[STATUTES AT LARGE, VOL. 28 (CHAP. 23), P. 601.]

AN ACT Providing for the public printing and binding and the distribution of public documents.

SEC. 73. Extra copies of documents and reports shall be printed promptly when the same shall be ready for publication, and shall be bound in paper or cloth as directed by the Joint Committee on Printing, and shall be the number following in addition to the usual number:

Of the report of the Bureau of Animal Industry, 30,000 copies, of which 7,000 shall be for the Senate, 14,000 for the House, and 9,000 for distribution by the Agricultural Department.

Approved, January 12, 1895.

LETTER OF TRANSMITTAL.

United States Department of Agriculture,
Bureau of Animal Industry,
Washington, D. C., June 8, 1910.

Sir: I have the honor to transmit herewith the Twenty-sixth Annual Report of the Bureau of Animal Industry for the year 1909, and recommend that it be published, as provided by section 73 of the act of Congress approved January 12, 1895.

Respectfully,

A. D. Melvin,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

ORGANIZATION OF THE BUREAU OF ANIMAL INDUSTRY.

Chief: A. D. MELVIN.
Assistant Chief: A. M. FARRINGTON.
Chief Clerk: CHARLES C. CARROLL.
Animal Husbandry Division: GEORGE M. ROMMEL, chief.
Biochemic Division: M. DORSET, chief.
Dairy Division: B. H. RAWL, chief.
Inspection Division: RICE P. STEDDOM, chief; MORRIS WOODEN, R. A. RAMSAY, and ALBERT E. BEHNKE, associate chiefs.
Pathological Division: JOHN R. MOHLER, chief.
Quarantine Division: RICHARD W. HICKMAN, chief.
Zoological Division: B. H. RANSOM, chief.
Experiment Station: E. C. SCHROEDER, superintendent.
Editor: JAMES M. PICKENS.

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REPORT OF THE CHIEF OF THE BUREAU FOR THE FISCAL YEAR ENDED JUNE 30, 1909.

By A. D. MELVIN.

ORGANIZATION AND ADMINISTRATION.

The lines of work carried on by the Bureau of Animal Industry during the fiscal year ended June 30, 1909, have been practically the same as in previous recent years, consisting of the meat inspection, the inspection of animals for export, the inspection and quarantine of imported animals, the eradication of diseases of live stock, the scientific investigation of such diseases, investigations in animal breeding and feeding, and work in the interest of the dairy industry and for the improvement of the milk supply.

The number of employees on the rolls of the Bureau July 1, 1909, was 3,268, an increase of 132 over the number a year before. Of these, 2,499 were engaged in meat inspection, an increase of 296.

While the work of the Bureau deals mainly with the live-stock industry, much of it operates at the same time for the protection of human health. Especially is this true of the meat inspection, the work for a more wholesome milk supply, and the study of animal diseases that may also affect man. The work is not and can not well be divided, however, according to the human and animal phases, as these are often intimately involved in a single problem or line of work. Even in the branches of the Bureau's work of which the protection of human health is an important object the problems must be attacked from the animal side.

The advantage and economy of the present organization of the Bureau in permitting the use of the same men in different lines of work and their transfer from time to time to meet the needs of the service was very strikingly shown in the work of the past year. In the emergency caused by an outbreak of contagious foot-and-mouth disease it was possible to draw immediately on a trained force of veterinarians and scientists already engaged in the regular work.

Had the work been organized differently this would have been impracticable or impossible, and while a force was being organized the contagion would very probably have spread widely and have reached the great stock-raising regions of the West, where it would have caused tremendous damage and loss and where its eradication would have been exceedingly difficult and expensive. The regular field work in eradicating diseases of animals is mostly done during the summer, while the work of slaughterhouses is heaviest during the winter, and the same men can be utilized for field work in the summer and for meat inspection in the winter, thus effecting an economy which would not be possible if these lines of work were not under the same management. There is also a great advantage in the wide experience and training which the members of the force receive when their work is varied in this way.

After a general discussion of some of the more important subjects the work of the various divisions of the Bureau's organization will be presented in order and more in detail.

FOOT-AND-MOUTH DISEASE.

The principal event of the year, aside from the regular work of the Bureau, was the appearance of an outbreak of contagious foot-and-mouth disease and its eradication. The disease was first observed early in November, 1908, in a herd of cattle near Danville, Pa. The owner of the cattle had in his possession a report of the Bureau of Animal Industry containing an account of the outbreak of this disease in New England in 1902–3, including a description of the disease, and on comparing the symptoms in his cattle with this description he suspected the nature of the affection and called in a veterinarian. The cases were reported to the state veterinarian of Pennsylvania, who, after an examination, made a positive diagnosis and notified the United States Department of Agriculture on November 10. This diagnosis was confirmed a few days later by the Chief of this Bureau and by other members of the bureau staff.

A quarantine was declared by the Secretary of Agriculture, effective November 13, against the interstate movement of animals from four counties in Pennsylvania in which the disease was reported. Within a few days cases were also found in several other counties in Pennsylvania and in the vicinity of Akron, N. Y., and on November 19 the quarantine was extended to include the entire territory of those two States.

On investigation it appeared that the disease was carried into Pennsylvania by cattle which came through the stock yards at Buffalo, N. Y., and that Buffalo was infected from Detroit, Mich. The State of Michigan was quarantined, effective November 25, and as the disease was also found a few days later near Lineboro, Carroll

County, Md., just over the Pennsylvania border, a quarantine was placed on the State of Maryland on November 27.

The federal quarantine prohibited the interstate movement or the exportation of cattle, sheep, and other ruminants and swine from any of the States named. The shipment of hides, skins, hoofs, hay, straw, etc., was forbidden unless such material had been disinfected under the supervision of the Bureau.

The areas in which the disease was found are as follows: In Pennsylvania, the counties of Chester, Clinton, Dauphin, Delaware, Juniata, Lancaster, Lehigh, Lycoming, Montgomery, Montour, Northumberland, Philadelphia, Snyder, Union, and York; in New York, the counties of Erie, Genesee, Monroe, Niagara, and Orleans; in Michigan, the counties of Oakland and Wayne; in Maryland, Carroll County.

Promptly after the discovery of the disease in Pennsylvania an arrangement was made for cooperative work by the federal and state authorities for its eradication, and similar arrangements were later made with the authorities of the other affected States. The plan followed for stamping out the disease was practically the same as that which had been successful in the case of the New England outbreak of 1902–3, namely, to enforce a strict quarantine, to discover all infected animals and localities, and to slaughter and bury all diseased and exposed animals and disinfect the premises occupied by them. The owners of condemned animals were reimbursed to the extent of the appraised value, the Federal Government paying two-thirds of this amount and the State one-third. The expenses of burial, disinfection, etc., were shared in the same proportion.

Dr. S. E. Bennett, who had charge of the force of the Bureau of Animal Industry in the eradication of the New England outbreak six years before, was placed in charge of the federal work in Pennsylvania and Maryland, and Dr. U. G. Houck was put in charge in New York, and Dr. P. H. Mullowney in Michigan. The state work in Pennsylvania was carried on under the direction of the state veterinarian, Dr. Leonard Pearson; in New York, under the direction of Commissioner of Agriculture R. A. Pearson; in Michigan, under the direction of the state live-stock sanitary board, of which Mr. H. H. Hinds was chairman; and in Maryland, under the direction of Dr. F. H. Mackie, state veterinarian.

Besides the work of slaughter, burial, and disinfection, veterinary inspectors were sent to trace all rumors of foot-and-mouth disease and to locate any probable centers of infection. A large force was maintained in the infected regions, and thorough and systematic inspections and reinspections were made of all animals from farm to farm. The Bureau of Animal Industry had engaged in the work of inspection and eradication a total of 572 employees, of whom 159 were veterinarians. These inspectors made 108,683 visits to premises in 12 States, and the total number of animals inspected, including reinspections, was 1,565,699.

Slaughter of the diseased herds was begun just as soon as the necessary preliminary arrangements could be made, and the work of slaughter and disinfection was carried forward as rapidly as possible. The slaughtered animals were buried in deep trenches, the rule being to have the carcasses covered with at least 5 feet of earth. The work of disinfecting premises was difficult and tedious, but every effort was made to have it thorough and complete. So rapidly was the work prosecuted that by December 19, or within six weeks from the beginning, all diseased and exposed animals, so far as known up to that time, had been slaughtered and buried. The disinfection was done as promptly as possible after slaughter. A few additional infected herds were found later. The number of animals slaughtered, their appraised value, etc., are given in detail in the portion of this report dealing with the work of the Inspection Division.

The federal quarantine was modified and partly released from time to time as conditions warranted, and was entirely removed on April 24, 1909. In view of the experience with the New England outbreak, when additional cases of the disease were found several weeks after it was supposed that eradication was complete, it was considered wise to keep the quarantine in force until sufficient time had elapsed to make it practically certain that none of the infection remained.

The origin of the outbreak was at first a mystery. As the Bureau of Animal Industry maintained a strict quarantine on imported live stock, and as the importation of ruminants from countries where foot-and-mouth disease existed was prohibited entirely, it was considered highly improbable that the infection was brought into the country with imported animals, and various other ways in which it might have gained entrance were suggested. It soon became apparent, however, that the outbreak started near Detroit, and when the disease was traced by inspectors of the Bureau of Animal Industry to calves that had been used in propagating smallpox vaccine by a Detroit establishment it was considered highly probable that the vaccine was contaminated with the virus of foot-and-mouth disease and that this caused the outbreak. It was therefore decided to make a thorough investigation by scientific methods to determine whether or not contaminated vaccine virus was really the cause. As the United States Public Health and Marine-Hospital Service of the Treasury Department is charged by law with the supervision of biological products used in human medicine, that service was requested to join this Bureau in making the proposed investigation, and the work was confided to Dr. John R. Mohler, chief of the Pathological Division of the Bureau of Animal Industry, and Dr. Milton J. Rosenau, director of the Hygienic Laboratory of the Public Health and Marine-Hospital Service. A full report of their investigation has been published as Circular 147 of the Bureau of Animal Industry.

By careful scientific methods Doctors Mohler and Rosenau were able to demonstrate that the smallpox vaccine virus of the Detroit establishment was in fact contaminated with the virus of foot-and-mouth disease. It appeared that this firm had obtained this particular strain of vaccine in May, 1908, from a firm in Pennsylvania, and tests with the vaccine of the latter firm showed that it was likewise contaminated. While it is not positively known just how long the contamination had existed at the Pennsylvania establishment, it seems probable that it was introduced with vaccine virus imported from Japan in 1902 and that the New England outbreak of that year originated from the same source.

The manner in which the disease was spread from the Detroit establishment was as follows: Certain calves, after having been used for the propagation of vaccine, were sent to the Detroit stock yards, where they remained two hours before being taken to a farm near the city. Four days later a shipment of healthy cattle from points in Michigan reached Detroit and was placed in the same pens that had been occupied by the vaccine calves. Some of these cattle were reshipped three days later to Buffalo and carried the contagion to the Buffalo yards. These animals, with others, were reshipped to Danville and Watsontown, Pa., where the disease was later discovered.

As soon as the facts as to the contamination of the vaccine became known, immediate and effectual steps were taken by Surg. Gen. Walter Wyman, of the Public Health and Marine-Hospital Service, to eradicate all this contaminated vaccine virus in America. After examining every strain of vaccine virus upon the market that Service has given assurance that there does not remain upon the market any vaccine virus contaminated with the virus of foot-and-mouth disease.

The cost to the Department of eradicating the outbreak was kept just within the appropriation of $300,000 made by Congress for that purpose, and if the disease had not been so promptly suppressed and if further cases had been found it would have been necessary to go to Congress for additional funds in order to continue the fight against the contagion. The authorities of the four affected States expended in their part of the work about $112,000. The loss to the dairy and stock-raising industries and to commerce was heavy. Not only was interstate traffic in live stock, hides, hay, straw, etc., interfered with, but exports to foreign countries, especially to Great Britain, were seriously curtailed.

The results have shown the wisdom of the rigorous slaughtering policy adopted in dealing with this outbreak. Such methods might be impracticable if the disease became so widespread that slaughter would involve the destruction of too large a part of the country's supply of live stock; but so long as the infection is restricted to a comparatively small part of the country's area there is no question that the slaughter policy is the best. To temporize with a restricted outbreak and rely entirely upon quarantine and treatment would very probably allow the infection to spread beyond control with disastrous results.

THE MEAT INSPECTION.

The meat inspection has continued to grow in volume and has reached the point where further extension is impossible without an increase in the appropriation by Congress. The expenditures on account of this work during the fiscal year amounted to about $2,884,000 out of the appropriation of $3,000,000. At the close of the year the rate of expenditure was higher than at the beginning, and it is now only by the strictest economy that the service can be maintained on its present basis without additional funds.

During the year there were inspected at the time of slaughter 55,672,075 animals, and of these there were condemned because of disease and other conditions 141,057 entire carcasses and 899,628 parts of carcasses, making a total of over 1,000,000 animals condemned in whole or in part. In addition there were condemned on reinspection nearly 25,000,000 pounds of meat and meat products which had become unwholesome since inspection at the time of slaughter. More detailed figures relating to the meat inspection appear in the portion of this report dealing with the work of the Inspection Division.

With the additional authority given by the new law the Bureau has been able to bring about a steady improvement with respect to sanitation. New packing houses have been built so as to embody the best modern sanitary construction, and great improvement has been made in the sanitary condition of the older plants. The latter are being gradually abandoned for the erection of modern plants which may be kept at a proper standard of cleanliness with less labor and expense. As a result of this improvement there has been a considerable decrease in the amount of meat condemned because of insanitary conditions. It has also been found that where cleanly methods are employed there is much less reason for the use of preservatives than under the old conditions.

A constant effort has been made to keep the service at a high standard of efficiency and to make improvements wherever possible. Notwithstanding the efforts to give the public a reliable inspection, however, the service has been made the object of unjust attacks. Serious charges made against the service at East St. Louis by a former employee were carefully and thoroughly investigated and were found to be without any real foundation, but to have their origin in personal animosity. A full report of this investigation was published by the Department. In other cases the attacks have proved to be due to ignorance or misconception of the facts, a failure to understand the system of inspection, or a desire to cause sensation.

Thorough investigation of a number of reported cases of ptomaine poisoning attributed to inspected meat has failed to disclose a single instance in which the trouble could reasonably be ascribed to that cause. These investigations were undertaken largely because of assertions by manufacturers of preservatives to the effect that the enforced discontinuance of preservatives is responsible for a great increase in the number of cases of ptomaine poisoning. The Bureau has failed to find any justification for such arguments. In three cases of extensive outbreaks of illness in schools it was found that the trouble was really typhoid fever, and in one of these instances it appeared that the report of ptomaine poisoning was circulated with a view to concealing the real cause. Another report of a death from ptomaine poisoning from eating canned meat proved to have originated in the imagination of a newspaper correspondent, who acknowledged that it was untrue. The family had in fact eaten no canned meat, and the attending physician denied that there was any evidence of ptomaine poisoning.

There have been cases in which meat bearing the federal inspection marks was alleged to have been condemned as unwholesome by city or local authorities. The fact is that the meat was sound at the time of being inspected and marked by the federal inspectors and that the unwholesome condition arose afterwards. Everybody knows that meat is liable to spoil, and no inspection can guarantee that it will remain wholesome until consumed.

These instances are sufficient to show that credence should not be placed in published reports reflecting upon the meat inspection. The regulations are based not only upon the knowledge and experience of the bureau staff, but upon the advice of high scientific authorities outside of the Department. The persons making up the inspection force are carefully selected through civil-service examination, and their work is closely supervised. One class of employees consists of veterinarians who are graduates of certain recognized colleges and who have a thorough knowledge of animal diseases and their relation to human health. Other employees are chosen because of their expert knowledge of live stock, meats, sanitation, packing-house processes, etc. There are seven supervisory traveling inspectors who visit the various stations from time to time, unannounced, and investigate the methods of carrying on the work. In this way it is extremely unlikely that inefficiency or corruption could remain undetected very long. In a work of such magnitude carried on by so many people, however, it is too much to expect absolute perfection. All men are liable to occasional errors of judgment, and in a force of 2,500 people there may even be a few who are incapable or unworthy. But even if it should happen on rare occasions that meat which should be condemned is passed, the amount is such an infinitesimal part of the entire quantity that it does not affect the value and integrity of the service as a whole. The large amount of meat actually condemned is good evidence of the care and thoroughness of the inspection.

There is, however, a real and serious danger to the public from uninspected meat, and almost half of the meat consumed in this country comes within that class. The federal authority does not reach the business done entirely within a State, and the people must look to their state and local authorities to protect them against the danger from that source. One result of the federal inspection is to cause the diversion of diseased and suspicious-looking animals to the uninspected establishments, where they are slaughtered for the local market. Many cities have an inspection service, but very few have a sufficient force of inspectors, and the inspection often consists merely in the examination of meat as offered for sale in the markets, when it is usually impossible to detect disease, the evidence of which may have been removed with the viscera or organs. As a rule sanitary conditions are very bad at uninspected slaughterhouses. In order to provide real protection against diseased and unwholesome meat a competent veterinary and sanitary inspection at the time of slaughter is essential. The great need for supplementing the federal inspection with state and municipal inspection was forcibly pointed out in a paper by Dr. A. M. Farrington, assistant chief of this Bureau, read at a convention of the Association of State and National Food and Dairy Departments and included in the Twenty-fifth Annual Report of the Bureau.

ERADICATION OF CATTLE TICKS.

The work of exterminating the ticks which spread so-called Texas fever of cattle in the South has been in progress for more than three years, and it is now possible to realize some of the benefits of this work. During the fiscal year there were released from quarantine as a result of the eradication of these ticks 13,544 square miles of territory, and since the beginning of the work in the summer of 1906 there have been released areas aggregating 71,336 square miles.

An investigation recently made by the Bureau in this territory shows that great improvement has already resulted from this work. More cattle are being raised, and a better grade of breeding stock is being introduced; calves grow faster, and cattle put on flesh more rapidly during the grazing season and go into the winter in better condition because of the absence of the ticks; they can be marketed without quarantine restrictions, and higher prices are being obtained; dairy cows give a larger yield of milk; and values of farm lands are enhanced. Aside from its own observations the Bureau has received from persons in the released territory numerous letters and other expressions confirming the foregoing facts and testifying to the great benefits following the extermination of the ticks.

The difference between the prices realized for cattle from the tick-infested region and the prices of cattle of similar grades from above the quarantine line ranges from $2.25 to $5 a head at the principal northern live-stock markets, without taking into account the improvement in quality and weight of cattle because of the eradication of the ticks. As more than 1,000,000 cattle from the quarantined area are annually sold in these markets, it can easily be seen that the extermination of the ticks means an annual increase of at least $3,000,000 in the prices obtained for southern cattle sold in northern markets. In addition to this, the increase in prices of cattle sold locally in the South would represent a large sum. This local increase has already been found to amount to from $3 to $15 a head in the territory recently freed from ticks. An agricultural official of one of the Southern States reports that calves in the tick-free area bring just double the price that can be obtained for similar calves in the tick-infested region.

Heretofore it has been impracticable to improve the quality of southern cattle by introducing fine breeding animals from other sections, because such animals were liable to contract Texas fever and die unless protected by inoculation. Furthermore, it is impossible for animals to attain good growth and to thrive when they are heavily infested with ticks. With the eradication of the ticks, however, the southern farmers are enabled to introduce good breeding animals and to improve the grade of their stock.

There is no longer any doubt that it is entirely practicable to exterminate the ticks throughout the entire region now infested by them, and the accomplishment of this result will be of tremendous economic advantage not only to the South but to the whole country. The rate of progress depends mainly on two factors—the amounts appropriated by the federal and state governments, and the cooperation of the people.

The work so far done by the Bureau has been in coöperation with state authorities, and the policy has been to work only in States and localities where the state and local authorities were prepared to assist and where public sentiment was favorable. Opposition has been encountered in some localities, but as the objects and benefits of the work are better understood this condition is being gradually overcome. In other sections there is a very cordial sentiment favorable to the work, and it is in such places that best results have been obtained. In sections where enough has been accomplished to demonstrate the advantages of tick eradication the people recognize the benefits, and in many instances hostility has given way to cordial approval. The Bureau is endeavoring to disseminate correct information as to the ticks, the disease which they spread, the damage which they cause, and the advantages of getting rid of them, by the distribution of publications, by lectures and addresses at farmers' institutes and other meetings, and by furnishing material to newspapers.

TUBERCULOSIS.

The Bureau has continued giving attention to the tuberculosis problem in its various aspects as it affects the live-stock industry and as the disease in animals affects the public health. Under authority contained in the agricultural appropriation act investigations have been continued to determine the prevalence and extent of this disease among dairy cattle in the United States. The tuberculin test was applied to numbers of cattle in several sections of the country by arrangement with the state and local authorities. Cattle were tested for interstate shipment to States requiring the tuberculin test as a condition of admitting dairy and breeding cattle, and assistance was also given to the authorities of many cities in testing cows furnishing milk to those cities. Out of 8,809 cattle tested with tuberculin during the year, 744, or 8.45 per cent, reacted as tuberculous. A much higher proportion of disease was found among dairy cows supplying milk to cities than among animals offered for interstate shipment, the proportion in the former class being about 14 per cent. Details of this work are given in the report of the Quarantine Division.

The Bureau has also continued its policy of reporting to state live-stock sanitary officers the names and addresses of owners and breeders of cattle and hogs found tuberculous in the meat inspection, and such reports were made to the authorities of 28 States during the fiscal year. By this means the state officials are enabled to locate centers of tuberculous infection and to take steps for stamping out the disease and preventing its spread.

It will be necessary to collect further information covering a much larger number of animals and a greater number of localities before the prevalence and extent of the disease in the United States can be accurately determined, but enough is known to show that tuberculosis exists to an alarming extent among the cattle and hogs of the country, especially among dairy cows, and that active steps should be taken to suppress it, both for the financial good of the stock owner and for the protection of the health of the people. A general campaign of eradication should, perhaps, be undertaken sooner or later, but this would be a task of great magnitude and would require heavy expenditures. In the meantime effective work can be done in a preliminary way to prevent the spread of disease and to eradicate it from certain herds and localities.

It should be remembered that tuberculosis is a contagious disease and must be considered and dealt with as such. With a proper understanding of its nature, each farmer and stock raiser can do much to prevent or eradicate the disease. In order to determine whether or not tuberculosis is present in a herd all the cattle should be tested with tuberculin, and if diseased animals are found they should be removed from the herd and the premises thoroughly disinfected. In case disease is found the herd should be again tested in about six months, in order to detect any new cases which may have been in the incubative stage at the time of the first test. If new cases are found on the second test, the premises should be again disinfected. All new cattle should be tested and if possible kept isolated for several months and again tested before being added to the herd.

Fairs and live-stock shows as at present conducted afford favorable conditions for the spread of tuberculosis. Cattle are brought together from various places, and there is frequently a considerable proportion of tuberculous animals among those exhibited. As a rule nothing is done by the management to determine whether or not animals offered for exhibition are healthy, and prizes are given indiscriminately to animals presenting the best appearance without regard to whether or not they are affected with tuberculosis. In my judgment the time has arrived when prizes should be given only to animals that are in a healthy condition, and the presence of tuberculosis or other contagious disease should constitute a disqualification. In fact, animals should not be admitted to such exhibitions at all unless their health is assured. An instance of the danger of the spread of tuberculosis through live-stock shows is afforded by the manner in which this disease is reported to have been introduced into the island of Guernsey. It seems that cattle from Guernsey that were exhibited in England, where the disease is prevalent, contracted the disease there, and after their return to Guernsey spread it among other animals.

The Bureau's scientific investigations relating to tuberculosis during the year are reviewed under the headings of the Pathological Division and the Experiment Station.

LIP-AND-LEG ULCERATION OF SHEEP IN THE NORTHWEST.

For many years a disease known to veterinarians as necrobacillosis has existed in a mild form in the United States, but until recently it has not threatened serious injury to the live-stock industry. During the past year, however, this disease has assumed a malignant form, known as lip-and-leg ulceration, in Wyoming and other Western States. The Bureau had a careful investigation made of the situation, and in order to check the spread of this virulent form of the disease and avoid serious injury to the sheep industry it was considered necessary to place a quarantine on the sheep in certain portions of Wyoming, which was done by the Secretary of Agriculture soon after the close of the fiscal year. The Bureau has studied methods of treatment of the diseased animals and has published a circular giving information on this subject. The milder forms of the disease yield readily to treatment, and it is believed that by the combined means of treatment and quarantine the infection may be suppressed.

PROPOSED PLAN FOR REPORTING DISEASES.

It is very important that the Bureau should keep constantly informed as to the appearance and prevalence of contagious diseases of live stock throughout the country, so as to deal with them promptly and effectively. At present such information is derived to some extent through bureau employees, state officials, and general correspondence, but there is no regular and comprehensive plan of reporting. It is proposed to organize a system by which state live-stock authorities will be asked to cooperate with the Bureau by reporting promptly any outbreaks of contagious diseases and by forwarding regular monthly reports as to the existence and prevalence of such diseases in their respective States.

VETERINARY EDUCATION.

More than 800 veterinarians are engaged in the service of the Bureau, in connection with the meat inspection and the investigation and eradication of animal diseases, and it is of great importance that such men be well educated for this work. In the spring of 1908 a committee was appointed by the Secretary of Agriculture to investigate the courses of instruction at the various veterinary colleges in the United States and to make recommendations as to the instruction necessary to qualify graduates for admission to the civil-service examination for veterinary positions in the Bureau. This committee consisted of Dr. Richard P. Lyman, secretary of the American Veterinary Medical Association; Dr. Joseph Hughes, president of the Chicago Veterinary College; Dr. Tait Butler, secretary of the Association of Veterinary Faculties and Examining Boards of North America; Dr. Paul Fischer, state veterinarian of Ohio; and Dr. A. M. Farrington, Assistant Chief of the Bureau of Animal Industry.

After visiting the various veterinary colleges in the United States and one in Canada and collecting full information, the committee made a report with certain recommendations for the classification of the colleges and requirements for admission to the civil-service examinations. Following this report, another committee of members of the Bureau's staff, with Doctor Farrington as chairman, was appointed to continue the consideration of the subject and to formulate regulations governing entrance to the civil-service examination for veterinary positions in the Bureau. The latter committee recommended certain regulations, which were approved by the Secretary of Agriculture and the United States Civil Service Commission, under date of July 31, 1909, to take effect September 1.

While the Department claims no authority to regulate the affairs of the veterinary colleges, it is very much concerned in seeing that men are suitably educated for its service, and in conjunction with the Civil Service Commission it has a right to prescribe the requirements for admission to the civil-service examinations for such positions. As a rule the colleges have been disposed to meet the requirements of the regulations, and as a result it is believed that the standard of veterinary education in the United States will be considerably raised. In accordance with these regulations only persons who are graduates of colleges having a satisfactory course of instruction will be permitted to take the civil-service examination.

SUPERVISION OF VACCINES, SERUMS, ETC.

In accordance with the provisions of the act of Congress making appropriations for the Department of Agriculture for the past fiscal year, the Bureau has made tests of a number of serums, vaccines, tuberculins, and other preparations sold for the detection, prevention, or treatment of dieases of animals.

Tests made of a certain brand of imported hog-cholera vaccine and hog-cholera and swine-plague serum indicated that neither of these preparations is a reliable agent for protecting hogs from hog cholera. A domestic preparation, widely advertised and sold as a serum for the prevention of abortion in cows, was found on examination not to be a serum at all but to consist of a weak solution of carbolic acid. The results of the tests of these three preparations were published in Circulars 27 and 29 of the Secretary's Office.

An investigation was also made to test the potency of tetanus antitoxin prepared for veterinary use, it having become known in the veterinary profession that this antitoxin as prepared and sold by commercial firms was in many cases unreliable and far below the standard of strength. After examining quite a number of antitoxins prepared by various firms it was found that there is a great lack of uniform potency, the variation amounting in some instances to about two-thirds less than the strength which the antitoxin should possess. The results of this investigation have been published as Bulletin 121 of the Bureau. In strong contrast with the conditions regarding tetanus antitoxin for veterinary use, it appears that tetanus antitoxin for human use is reliable and accurately standardized in consequence of the stringent supervision exercised by the Public Health and Marine-Hospital Service in accordance with law.

The foregoing facts, together with the circumstances as to the introduction of foot-and-mouth disease through contaminated smallpox vaccine virus, show the urgent need for legislation by Congress giving to the Secretary of Agriculture adequate power to supervise and control biological products intended for the treatment of domestic animals, similar to the authority already conferred on the Public Health and Marine-Hospital Service with regard to such products used in human medicine. Under existing law the Secretary of Agriculture can only have tests made of such products as are found on the market and publish the results. There is constant danger that contagious diseases may be introduced from abroad and spread in this country through vaccines and serums for the control and treatment of animal diseases, and this danger increases with the growing use of such remedies in veterinary medicine. Such preparations as anthrax and blackleg vaccine, tetanus antitoxin, hog-cholera serum and vaccine, virus for the destruction of rats, besides tuberculin and mallein, are imported to a considerable extent and are liable to be contaminated with the contagion of some destructive animal disease prevailing in foreign countries. In order to protect our live-stock interests against the introduction of contagious diseases in this way, as well as to protect our farmers, stock raisers, and veterinarians against fraudulent and unreliable preparations, the Secretary of Agriculture should have the power to control the importation of such products and to supervise the preparation of those manufactured in this country for interstate commerce.

THE DAIRY INDUSTRY.

A valuable and important work for the dairy industry of the country is being done by the Bureau through its Dairy Division, and as a tangible economic result of this work there is effected a financial saving of many thousands of dollars annually, amounting to many times the cost of the service.

The average production of dairy cows in this country is far below what it should be, and there is no doubt that by systematic work in keeping records of individual cows, eliminating unprofitable ones, improving the quality of dairy stock, and the introduction of better methods, the average yield of the dairy cows in the country can be enormously increased. One important agency in accomplishing this is what are known as the cow-testing associations, and during the year the Bureau has been active in promoting the formation of these associations. The keeping of records of dairy cows is advocated not only for the purpose of determining the value of each cow as a milk producer, but in order that the calves of the best cows may be kept and reared, as otherwise many animals that would be of great value in the dairy would be lost.

As a part of the general movement for more wholesome food the Bureau has continued to assist in bringing about the improvement of city milk supplies. This work has been done largely in cooperation with local health officers and through the use of the score-card system of dairy inspection, which affords an excellent means of determining actual conditions under which milk is produced and marketed, and in bringing about and measuring the improvement. On the basis of the score-card system an improvement of over 20 per cent in the sanitary condition of dairies has been observed during the past year as compared with the previous year in the work done in ten cities.

For three years work has been carried on in cooperation with state authorities for the development and improvement of the dairy industry in the South, and this work is already showing valuable practical results. The South consumes a much larger quantity of dairy products than it produces, yet it has fine natural advantages for a profitable dairy industry and should be able to produce a surplus. While much is needed in the way of a better class of cattle, improved methods, and more home-grown feed, the development of the dairy industry in the South is largely dependent upon the eradication of the cattle ticks, for which the Bureau is also working.

NEED FOR INSPECTION OF DAIRY ANIMALS AND PRODUCTS.

Investigations made by the Bureau show that in order to protect the health of consumers there is great need for the supervision and inspection of dairy products and of the animals from which they are obtained. The danger of contracting disease from such products is much greater than from meat, since milk, cream, and butter are almost universally used and are usually consumed in the raw state. Scientific experiments by the Bureau and by other investigators have demonstrated that the germs of tuberculosis and typhoid fever are frequently conveyed through dairy products, and that these germs may remain alive and virulent in milk beyond the time within which it is usually consumed, and in butter for several months.

Aside from the danger from contagious diseases, the sanitary conditions under which milk and butter are produced are often very bad and result in unwholesome products. While many creameries are in excellent sanitary condition, others are more or less filthy, and much of the cream that is made up into butter is shipped long distances in all kinds of weather and when received by the creamery is in a state of decomposition which renders it utterly unfit to go into a food product. Factories making renovated or "process" butter are now inspected by the Bureau under the requirement of an act of Congress, but there is no federal law giving authority for inspecting the creamery butter factories.

It is impossible to guard against unwholesome butter simply by an inspection of the finished product. Any inspection to be effective must deal with the milk and cream from which the butter is made, the health of the animals from which the milk is derived, the sanitary condition of the creamery, and the process of manufacture. It therefore seems highly desirable that legislation should be enacted by Congress providing for an adequate and efficient system of inspection at all plants where butter is manufactured for interstate shipment, for the control of interstate shipments of milk and cream, and for the inspection of animals and dairy establishments producing milk for interstate commerce.

PUBLICATIONS.

The large and increasing demand for the Bureau's publications gives evidence of the value and usefulness of this literature. During the fiscal year there were issued by the Bureau 111 new publications, aggregating 2,953 printed pages, besides numerous reprints of earlier publications. The new publications consisted of the Twenty-fourth Annual Report of the Bureau (for 1907), a revised edition of the Special Report on Diseases of Cattle, the annual report of the Chief of the Bureau for the previous fiscal year, 11 bulletins, 18 circulars, 8 Farmers' Bulletins, 5 reprints from annual reports of the Bureau, 2 Yearbook articles, 45 orders and amendments, and 19 miscellaneous publications. In addition the Twenty-fifth Annual Report of the Bureau (for 1908) has been prepared for publication.

THE INSPECTION DIVISION.

This division is under the direction of Dr. R. P. Steddom. The work consists of two main lines: (1) The meat inspection, and (2) the control and eradication of contagious diseases of animals.

THE MEAT INSPECTION.

A comparison of the meat-inspection work of the Bureau for the fiscal years 1908 and 1909 shows a steady growth. The only amendment to the regulations made during the fiscal year 1909 was that permitting the use of benzoate of soda as a preservative of meat or meat food product in conformity with the Department's ruling under the food and drugs act.

Four additional veterinary inspectors were assigned to travel and investigate the meat-inspection service at the various stations, making a total of seven inspectors so engaged.

Inspection was conducted during the year at 876 establishments located in 240 cities and towns, an increase of 89 establishments and 29 cities and towns as compared with the previous year. Inspection was inaugurated during the past year at 180 establishments and was withdrawn from 77 establishments, as compared with 137 establishments and 95 establishments, respectively, during the previous year. The cause of withdrawal in the majority of cases was that the establishment discontinued slaughtering or interstate business. Inspection was withdrawn from 5 establishments because of violation of the regulations and from 10 because of failure or inability to meet the sanitary or other requirements.

Below are shown the number of establishments and the number of cities and towns where inspection of meat and meat food products was conducted in each fiscal year since 1891.

Number of establishments and number of cities and towns where meat inspection has been conducted, fiscal years 1891 to 1909.

Year.	Establishments.	Cities and towns.	Year.	Establishments.	Cities and towns.
1891	9	6	1901	157	52
1892	23	12	1902	155	50
1893	37	16	1903	156	50
1894	46	17	1904	152	51
1895	55	19	1905	151	52
1896	102	26	1906	163	58
1897	128	33	1907	708	186
1898	135	35	1908	787	211
1899	139	42	1909	876	240
1900	149	46			

During the fiscal year market inspection was extended to 4 more cities, making a total of 37 cities at whose public markets federal meat inspection is conducted in order that interstate deliveries may be made without violating the meat-inspection law and regulations.

ANTE-MORTEM INSPECTIONS.

The number of animals of each species inspected before slaughter is shown in the following statement, and indicates an increase of 4.6 per cent over the previous year:

Ante-mortem inspections of animals, fiscal year 1909.

Kind of animals.	Passed.	Suspected.[a]	Total.
Cattle	7,547,969	40,175	7,588,144
Calves	2,059,529	4,050	2,063,579
Sheep	10,990,274	2,305	10,992,579
Goats	69,882	1	69,883
Swine	35,808,887	22,665	35,831,552
Total	56,476,541	69,196	56,545,737

[a] This term is used to designate animals found diseased or suspected of being unfit for food on ante-mortem inspection, most of which are afterwards slaughtered under special supervision, the final disposition being determined on post-mortem inspection.

POST-MORTEM INSPECTION.

The inspections made at time of slaughter are shown in the following statement, which indicates an increase of 3.15 per cent over the post-mortem inspections made during the previous fiscal year:

Post-mortem inspections, fiscal year 1909.

Kind of animals.	Passed for food.	Passed for lard and tallow only.	Condemned.	Total.
Cattle	7,287,793	2,441	35,103	7,325,337
Calves	2,038,494	4	8,213	2,046,711
Sheep	10,792,078	78	10,747	10,802,903
Goats	69,111		82	69,193
Swine	35,244,005	97,014	86,912	35,427,931
Total	55,431,481	99,537	141,057	55,672,075

Included in the foregoing table are the post-mortem inspections of the carcasses of animals "suspected" on ante-mortem inspection, the final inspection of carcasses that were retained [a] at time of slaughter, and the carcasses of animals slaughtered without ante-mortem inspection and presented to official establishments with the head and viscera attached as required by Regulation 20.

The various diseases and conditions for which fresh carcasses and parts were condemned and tanked are shown in the following table:

Diseases and conditions for which condemnations were made on post-mortem inspection, fiscal year 1909.

Cause of condemnation.	Cattle.		Calves.		Swine.		Sheep.		Goats.	
	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.
Tuberculosis	24,525	40,148	177	151	45,113	791,735	21	1		
Actinomycosis	589	44,440		69						
Hog cholera					20,789					
Septicemia, pyemia, and uremia	845		523		7,173		676		3	
Pneumonia, pleurisy, enteritis, hepatitis, nephritis, metritis, etc.	1,418		295		6,329		1,479		8	
Icterus	60		45		1,623		862		18	
Texas fever	427		775							
Caseous lymphadenitis							1,023	7	8	
Tumors and abscesses	107	5,989	28	43	1,178	1,609	102	37		
Pregnancy and recent parturition	254				89		107			
Injuries, bruises, etc	2,261	1,941	341	132	372	3,842	763	129	4	1
Immaturity			4,376							
Sexual odor					1,031					
Miscellaneous	4,617	7,221	1,653	14	3,215	2,114	5,714	5	41	
Total	35,103	99,739	8,213	409	86,912	799,300	10,747	179	82	1

[a] This term is applied to carcasses held on suspicion on first post-mortem examination, to be subjected later to more thorough examination for determining final disposition.

SUPERVISION OF PREPARATION OF MEATS AND PRODUCTS.

The amount of meats and meat food products prepared and processed under the supervision of the Bureau is given in the following statement, which shows an increase of 14 per cent over the previous year:

Meat and meat food products prepared and "processed" under Bureau supervision, fiscal year 1909.

Kind of product.	Weight.	Kind of product.	Weight.
	Pounds.		*Pounds.*
Beef placed in cure	223,248,347	Lard stearin	8,694,928
Pork placed in cure	2,686,051,091	Lard compound	16,029,644
All other classes placed in cure	3,459,072	Lard substitute	471,602,070
Sausage chopped	457,094,587	Bakers' compound	617,221
Canned beef	97,825,337	Oleo stock and edible tallow	51,742,603
Canned pork	23,725,342	Oleo oil	165,222,055
All other canned meats	2,259,506	Oleo stearin	78,924,616
Meat extract	445,921	Oleomargarin and butterine	91,068,350
Steam and kettle rendered lard	1,166,029,011	Miscellaneous products	1,095,075,749
Leaf lard	29,278,294		
Neutral lard	113,678,977	Total	6,791,437,032
Lard oil	9,364,111		

The following amounts of meat and meat food products were condemned on reinspection during the fiscal year: Beef, 13,216,568 pounds; pork, 11,285,323 pounds; mutton, 124,687 pounds; veal, 52,794 pounds; goat meat, 382 pounds; total, 24,679,754 pounds. The principal causes for condemnation were that the meat or product was found to be sour, tainted, putrid, unclean, or, in the case of fats, rancid. These condemnations show a decrease of 43 per cent from those of the previous fiscal year, which indicates improvement in methods of handling the products and in sanitary conditions.

INTERCHANGE OF MEATS BETWEEN OFFICIAL ESTABLISHMENTS.

Considerable quantities of meats and meat food products that have been inspected and passed are transferred between official establishments, this traffic being closely supervised and the meats and products identified by means of marks and seals. During the fiscal year there were transferred in this manner the following amounts of meats and meat food products, part of which was contained in 22,616 sealed cars: Beef, 1,017,240,838 pounds; veal, 27,762,369 pounds; pork, 1,715,035,048 pounds; mutton, 43,637,107 pounds; goat meat, 54,609 pounds; total, 2,803,729,971 pounds.

MEATS AND PRODUCTS CERTIFIED FOR EXPORT.

The amounts of meat and meat food products certified by the Bureau for export are shown in the following table, being a decrease of 23.5 per cent as compared with the previous fiscal year:

Inspection certificates issued for export of meat and meat food products, fiscal year 1909.

Kind.	Number.	Beef.	Mutton.	Pork.	Total.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Regular	62,488	206,053,486	4,336,172	618,562,772	828,952,430
Preservative	41,744	3,147,964	....	349,709,256	352,857,220
Total	104,232	209,201,450	4,336,172	968,272,028	1,181,809,650

There were also issued 2,066 "inedible product" certificates covering the exportation of 19,307,140 pounds of such inedible products as hoofs, horns, casings, bladders, bungs, etc.

IMPORTED OLEOSTEARIN.

During the fiscal year 23,486,072 pounds of compound were manufactured from imported oleostearin under the Bureau's supervision at five establishments located at three seaport cities (Jersey City, New Orleans, and New York). This imported product is kept under lock while in official establishments, and no domestic meat food product is permitted to be mixed with it. The finished product is also kept under lock and is promptly loaded into vessels and exported without certificates or marks of federal inspection.

EXEMPTION FROM INSPECTION.

The provisions of the meat-inspection law requiring inspection do not apply to animals slaughtered by farmers on the farm nor to retail butchers and dealers. The Department requires that such butchers and dealers, in order to ship meats and meat food products in interstate commerce, shall first obtain certificates of exemption, but no such requirement is made of farmers. The number of certificates of exemption outstanding at the close of the fiscal year was 2,114, as against 2,477 at the close of the previous fiscal year, a net reduction of 363 certificates. During the greater part of the year five veterinarians have been kept on the road inspecting the plants and investigating the business of the holders of certificates. They made reports upon approximately 2,000 places, and as a result it was found necessary to call in and cancel 871 certificates of exemption. In the majority of these cases, however, the certificates were reissued later when business was resumed or required it, or when the insanitary conditions had been corrected.

During the year 120,088 shipments were made under certificates of exemption, covering 20,455,870 pounds of meat and meat food product. Over 90 per cent of the carcasses were veal.

INSPECTIONS FOR THE NAVY.

Upon request of the Navy Department, occasional inspections of meats and meat food products were made for the navy during the year. These inspections were made at Baltimore, Boston, Brooklyn, Jersey City, New Orleans, Newport, Newport News, New York, Philadelphia, San Diego, San Francisco, and Washington. The meats and products inspected aggregated 3,288,163 pounds, of which 68,242 pounds were rejected. Rejections were made on account of the slimy, tainted condition of the product; also for underweight or overweight as required by the specifications and for the substitution of buck, heifer, or cow meat for the meat of wethers and steers, as specified.

CONTROL OF CONTAGIOUS DISEASES.

TEXAS OR SPLENETIC FEVER OF CATTLE.

The number of cattle shipped during the quarantine season of 1908 to northern markets from the area quarantined on account of Texas or splenetic fever of cattle was 1,141,804. These were carried in 39,994 cars, 38,085 of which were reported as being cleaned and disinfected under bureau supervision. The number of cattle moved interstate from the provisionally quarantined area under certificates of inspection issued by bureau inspectors was 215,867.

During the fiscal year 256,112 head of southern cattle were dipped in crude petroleum or otherwise treated under bureau supervision for unrestricted movement, as provided in the regulations.

TICK ERADICATION.

The work of exterminating the ticks which spread the contagion of Texas fever of cattle has been continued, in cooperation with the various States interested. During the fiscal year areas were released from quarantine as follows:

State.	Square miles.	State.	Square miles.
Virginia	986	Arkansas	683
North Carolina	1,544	California	8,000
Tennessee	2,271		
Oklahoma	60	Total	13,544

A great deal of preliminary work was also done in several other States, as a result of which substantial progress has been made and further areas have been so far freed of ticks as to indicate that they may be released within a few months.

During the year the total number of inspections made by the bureau employees was 3,202,871, of which 1,857,569 were reinspections.

SCABIES IN SHEEP.

The area quarantined for scabies in sheep was reduced during the fiscal year by releasing from quarantine the States of Kansas, Nebraska, Montana, North Dakota, and South Dakota. The number of inspections made by bureau employees during the year was 59,762,512, a very slight increase over the number in the previous year. The number of dippings supervised by the Bureau during the year was 15,597,823, a decrease of 11.3 per cent.

The inspections and dippings of sheep for scabies and the number of cars cleaned and disinfected on account of that disease since 1900 are shown in the following table:

Inspections and dippings of sheep, and cars cleaned and disinfected, fiscal years 1900–1909.

Fiscal year.	Inspections.	Dippings.	Cars cleaned and disinfected.	Fiscal year.	Inspections.	Dippings.	Cars cleaned and disinfected.
1900	1,801,392	626,838	....	1905	53,680,786	16,873,659	7,965
1901	7,912,724	1,034,368	....	1906	59,246,288	12,396,976	8,625
1902	11,186,661	1,017,162	791	1907	62,625,831	12,133,466	6,275
1903	16,444,370	2,167,002	752	1908	59,471,141	17,589,578	9,338
1904	40,967,961	9,578,476	2,732	1909	59,762,512	15,597,823	4,981

SCABIES IN CATTLE.

The area quarantined for scabies in cattle was reduced during the fiscal year by releasing from quarantine areas of more than 60,000 square miles, comprising 12 counties in North Dakota, 6 counties and parts of 7 other counties in Colorado, 1 county and parts of 2 other counties in Oklahoma, 3 counties in New Mexico, and 10 counties in Kansas. The number of inspections made during the year was 17,656,934, an increase of 4.4 per cent over the previous year. The number of dippings supervised was 1,559,477, an increase of 2.1 per cent over the previous year.

The inspections and dippings of cattle for scabies and the number of cars disinfected on account of this disease since 1904 are shown in the following table:

Inspections and dippings of cattle for scabies, and cars disinfected, 1904–1909.

Fiscal year.	Inspections.	Dippings.	Cars cleaned and disinfected.	Fiscal year.	Inspections.	Dippings.	Cars cleaned and disinfected.
1904	1,124,321	162,554	532	1907	15,243,323	466,623	15,009
1905	14,085,267	563,394	29,897	1908	16,920,100	1,527,280	17,601
1906	14,983,260	243,826	19,992	1909	17,656,934	1,559,477	11,607

SCABIES IN HORSES.

The number of horses and mules inspected for scabies during the year was 4,178, and the number dipped was 689.

FOOT-AND-MOUTH DISEASE.

The appearance of foot-and-mouth disease in Pennsylvania in the fall of 1908 required the quarantine of the counties of Columbia, Montour, Northumberland, and Union, effective November 13. This was followed by the quarantine, effective November 19, of the entire States of Pennsylvania and New York. The State of Michigan was quarantined effective November 25, and Maryland effective November 27. As soon as the infected area of each State was ascertained the remainder of the State was released from quarantine. In this way the uninfected portion of Maryland was released on December 19, of Michigan December 24, of New York December 29, and of Pennsylvania January 5.

All quarantine was raised from these States as follows: Maryland and Michigan, March 15; New York, March 26; Pennsylvania, April 24.

Following is a summary of the inspections made by bureau employees in the work of eradicating this disease:

Inspections made by the Bureau of Animal Industry in the eradication of foot-and-mouth disease.

	Maryland.	Michigan.	New York.	Pennsylvania.	Miscellaneous.	Total.
Original inspections:						
Visits	3,754	7,304	14,784	44,869	238	70,949
Cattle	32,112	61,859	72,534	338,945	1,865	507,315
Hogs	27,407	38,722	46,736	256,126	....	369,001
Sheep	2,259	27,839	114,472	18,996	....	163,566
Goats	22	70	245	795	....	1,132
Total	61,800	128,490	233,987	614,872	1,865	1,041,014
Reinspections:						
Visits	1,130	1,089	9,964	24,967	584	37,734
Cattle	6,749	11,829	47,444	191,318	10,495	267,835
Hogs	6,181	5,102	29,801	119,395	1,769	162,248
Sheep	646	13,188	62,506	12,629	5,139	94,108
Goats	1	43	157	293	....	494
Total	13,577	30,162	139,908	323,635	17,403	524,685
Total visits	4,884	8,393	24,748	69,836	822	108,683
Total inspections	75,377	158,652	373,895	938,507	19,268	1,565,699

The extent of the infection found and the appraised value of the animals slaughtered are shown in the following summary:

Premises infected with foot-and-mouth disease, and number and appraised value of animals slaughtered.

	Maryland.	Michigan.	New York.	Pennsylvania.	Total.
Infected premises	2	9	45	101	157
Cattle:					
Number	31	242	520	1,232	2,025
Value	$1,066.20	$5,103.00	$20,622.25	$49,993.94	$76,785.39
Hogs.					
Number	60	23	246	1,000	1,329
Value	$562.63	$202.00	$2,388.38	$8,317.78	$11,470.79
Sheep:					
Number		9	214	52	275
Value		$45.00	$1,367.50	$346.50	$1,759.00
Goats:					
Number		3		4	7
Value		$9.00		$9.00	$18.00
Total animals	91	277	980	2,288	3,636
Total appraised value	$1,628.83	$5,359.00	$24,378.13	58,667.22	$90,033.18

Two-thirds of the appraised value of the animals slaughtered was paid by the Federal Government and the remaining one-third by the respective States.

REPORTS OF VIOLATIONS OF LIVE-STOCK TRANSPORTATION LAW AND REGULATIONS.

During the fiscal year employees of the Bureau reported 300 cases of alleged violations of the twenty-eight-hour law. Alleged violations of the act of March 3, 1905, and of the regulations based thereon, were reported by bureau employees during the year to the number of 243 cases. The information thus obtained was placed before the department solicitor, who in turn presented to the Department of Justice for prosecution such cases as were supported by sufficient evidence.

Many of the cases tried during the past year required special investigations and the collection of evidence by employees of the Bureau, who have cooperated with the United States district attorneys in charge of the cases in the federal courts.

THE QUARANTINE DIVISION.

The Quarantine Division is under the direction of Dr. R. W. Hickman. The work mainly relates to the imports and exports of live stock and the management of the federal quarantine stations at the various ports of entry for imported animals.

INSPECTION OF VESSELS AND EXPORT ANIMALS.

Exports of cattle and sheep during the fiscal year show a considerable falling off, chiefly owing to the outbreak of foot-and-mouth disease. Because of this outbreak and the quarantine incident thereto, neither cattle nor sheep were exported from the ports of New York, Philadelphia, or Baltimore for several months.

During the fiscal year 473 inspections of vessels carrying live stock were made before clearance, in order to see that the regulations were complied with as to fittings, equipment, ventilation, feed, water, attendants, etc., and 818 certificates of inspection were issued for American cattle. The following table gives statistics of inspection of live animals for export during the year:

Inspections of American and Canadian animals for export, number tagged and rejected, and number exported, fiscal year 1909.

Kind of animals.	American.				Canadian.		
	Number of inspections.	Number rejected.	Number tagged.	Number exported.	Number inspected.	Number rejected.	Number exported.
Cattle	341,826	173	83,105	186,472	36,545	21	36,524
Sheep	36,628	5		21,000	14,398	11	14,387
Swine	1,718			1,718			
Horses	2,254	1		2,367			
Mules	816			816			
Asses	2			2			
Total	383,244	179	83,105	212,375	50,943	32	50,911

Most of the animals, exclusive of swine, included in the above statement were shipped to Great Britain, namely, of American animals, 184,159 cattle, 19,868 sheep, and 1,308 horses, and of Canadian animals, 36,459 cattle and 14,387 sheep.

The inspection of vessels carrying export animals and the enforcement of the regulations referred to continue to result in an exceedingly low percentage of losses of animals in transit. Statistics of animals landed at three principal British ports show that only 0.10 per cent of the cattle, 0.38 per cent of the horses, and 0.62 per cent of the sheep were lost at sea.

During the fiscal year 9,755 horses were inspected by bureau veterinarians for shipment to Canada, 52 of which were rejected on account of reacting to the mallein test.

There were also inspected for exportation to Canada 4,914 cattle, 11 hogs, and 1 goat. Of the cattle there were tested with tuberculin 317, of which 5 reacted and were rejected.

INSPECTION AND QUARANTINE OF IMPORTED ANIMALS.

In order to protect the live stock of the United States from contagion that is liable to be introduced with animals from other countries, the regulations require that all horses, cattle, sheep, and other ruminants, and swine imported into the United States must be inspected before they are admitted, and, in addition, that all ruminants and swine from any part of the world except North America shall be quarantined. For the importation of animals for which quarantine is required, a permit (in duplicate) must be procured from the Secretary of Agriculture prior to shipment. Importations are not permitted at all from some parts of the world where destructive diseases of animals prevail.

The following tables show the number of imported animals inspected and quarantined and the number inspected but not quarantined during the fiscal year:

Number of imported animals inspected and quarantined, fiscal year 1909.

Ports of entry.	Cattle.	Sheep.	Swine.	Goats.	Other animals.
New York	494	157	1	3	94
Boston	81	12			
Baltimore	9	19	7		
Canadian border ports	156	3,721	5		1
Total	740	3,909	13	3	95

Number of imported animals inspected but not quarantined, fiscal year 1909.

Ports of entry.	Cattle.	Sheep.	Swine.	Horses.	Mules and asses.	Goats.	Other animals.
New York				3,685	59		2
Boston				223	4		
Philadelphia				33	1		
Baltimore				93			
New Orleans				1,293	1,287		
Portland, Me				80			
Mexican border ports	129,539	5,232	850	830	830	147	20
Canadian border ports	5,337	79,496	126	3,767	85	7	18
Total	134,876	84,728	976	10,004	2,266	154	40

TUBERCULIN TEST IN GREAT BRITAIN.

The regulations governing the importation of animals subject to inspection and quarantine provide that all cattle 6 months old or over imported from Great Britain, Ireland, and the Channel Islands shall be tested with tuberculin by an inspector of the Bureau of Animal Industry before being exported or after arrival at the animal quarantine station at the port of entry. The following table shows the results of such tests made in Great Britain during the fiscal year:

Results of tuberculin tests in Great Britain of cattle for importation, fiscal year 1909.

Breed.	Passed.	Failed.
Aberdeen-Angus	53	4
Ayrshire	[a] 32	4
Dexter-Kerry	33	3
Guernsey	334	3
Jersey	[b] 229	
Shorthorn	14	4
Total	695	18

[a] Seventeen of these were for shipment to the United States via Canada.
[b] Seventy-seven of these were for shipment to the United States via Canada.

PREVALENCE AND EXTENT OF TUBERCULOSIS.

In accordance with a provision in the act of Congress making appropriations for the Department of Agriculture for the past fiscal year by which the Secretary of Agriculture was authorized "to investigate the prevalence and extent of tuberculosis among dairy cattle in the United States," steps were taken to collect such information by applying the tuberculin test to cattle in various parts of the country. The outbreak of foot-and-mouth disease interfered somewhat with this work, it being found necessary to transfer a number of men temporarily from the work of tuberculin testing to that of eradicating foot-and-mouth disease.

Many States require the tuberculin test as a prerequisite for the admittance of dairy and breeding cattle from other States, and ten additional States adopted this requirement during the fiscal year. Cooperative arrangements were made with the authorities of a number of States for the application of the tuberculin test to cattle for interstate shipment. This work was carried on during the fiscal year at the places and with the results shown in the following table:

Results of tuberculin testing of dairy and breeding cattle offered for interstate shipment during the fiscal year 1909.

Place.	Number of cattle tested.	Number passed.	Number reacting.	Number of suspects.	Percentage of reactors and suspects.
Denver, Colo	57	55	2	0	3.50
Lancaster, Pa	1,696	1,629	41	26	3.95
Minnesota Transfer, Minn	1,322	1,299	23	0	1.74
Portland, Oreg	135	127	8	0	5.92
Salt Lake City, Utah	161	137	16	8	14.91
Sioux City, Iowa	78	78	0	0	.00
South Omaha, Nebr	69	65	3	1	4.35
South St. Paul, Minn	114	114	0	0	.00
Total	3,632	3,504	93	35	3.53

The testing is being continued at nearly all of these points.

The tuberculin testing of cattle in Virginia, Maryland, and the District of Columbia, in connection with the cooperative work with the authorities of the District of Columbia for the improvement of the milk supply of the city of Washington, was continued, but was suspended from November, 1908, until April, 1909, owing to the outbreak of foot-and-mouth disease, already referred to. The results of this work for the fiscal year 1909, and also from its beginning in 1907, are shown in the table following.

Results of tuberculin testing of dairy cattle in Virginia, Maryland, and the District of Columbia supplying milk to the city of Washington.

Period and items.	Number of cattle tested.	Number passed.	Number reacting.	Number of suspects.	Percentage of reactors and suspects.
From July 1, 1908, to June 30, 1909:					
Cattle not previously tested	378	324	47	7	14.28
Annual retests	1,467	1,331	125	11	9.27
Total	1,845	1,655	172	18	10.29
From the beginning of the work in 1907 to June 30, 1909:					
Cattle not previously tested	2,471	2,094	350	27	15.25
Annual retests	1,729	1,563	153	13	9.60
Total	4,200	3,657	503	40	12.93

The Bureau has also applied the tuberculin test to dairy cattle in various parts of Nebraska in cooperation with the state authorities, and especially to assist the city of Omaha in obtaining a milk supply free from tuberculosis, with the following results:

Number of cattle tested	2,652
Number apparently free from tuberculosis	2,317
Number which reacted to the tests	335
Percentage of reactors	12.63

The city of Waterloo, Iowa, having passed an ordinance requiring that all milk sold in the city must be obtained from cattle which are free from tuberculosis, and the assistance of the Bureau having been requested, the Bureau is cooperating with the city and state authorities in testing dairy cattle. From the inception of the work, May 24, 1909, to the close of the fiscal year the results have been as follows:

Number of cattle tested	680
Number apparently free from tuberculosis	589
Number which reacted to the tests	91
Percentage of reactors	13.38

The following is a summary of all the tests made by the Bureau during the fiscal year in connection with this work at various places throughout the country as above set forth:

Number of cattle tested	8,809
Number found free from tuberculosis	8,065
Number of reactors and suspects	744
Percentage of reactors and suspects	8.45

An investigation of the milk supply of the various United States Government Indian schools from the standpoint of tuberculosis and sanitary conditions is also in progress. During the year investigations have been made at the Indian schools at Carlisle, Pa.; Stewart, Nev.; Chamberlain, S. Dak.; Green Bay, Wis.; Lawrence, Kans.; Hayward, Wis.; Lac du Flambeau, Wis.; Lapwai, Idaho; Phoenix, Ariz.; Rapid City, N. Dak.; and at the Canton (S. Dak.) Indian insane asylum.

An effort has also been made to locate centers of tuberculosis infection by tracing the origin of cattle and hogs that are found affected with tuberculosis, through the meat inspection. The names and addresses of the former owners or feeders of such animals are obtained when possible, and notification of the finding of tuberculosis is sent to those persons and to the state live-stock sanitary officers. This has been a means of enabling the state authorities to locate centers of tuberculous infection and to undertake measures in cooperation with the owners for the eradication of the disease from the remaining animals.

During the fiscal year the Bureau reported in this way cases of tuberculosis in 1,243 cattle from 342 premises and in 4,348 hogs from 630 premises in 28 States in various parts of the country.

ANTHRAX IN SOUTH DAKOTA.

Early in the fiscal year anthrax in domestic animals was reported in the southwestern portion of South Dakota. Investigation revealed a serious outbreak, and cooperation with the state live-stock authorities was immediately established. Incineration of the carcasses was quite generally carried out, and in some sections commercial vaccines were used with the object of assisting the quarantine and sanitary measures in preventing a further spread of the disease. The outbreak continued for about four months, and the deaths of cattle numbered about 1,200 and of hogs about 250. The losses of horses and sheep were slight.

LIVE-STOCK DISEASES AND CONDITIONS IN PORTO RICO.

Dr. Thomas A. Allen, bureau inspector in Porto Rico, made a tour of investigation of the diseases of animals in that island, and confirmed the report previously made by Dr. William Thompson to the effect that the cattle all over the island are more or less infested with ticks. The majority of stockmen interviewed expressed the opinion that in so far as native cattle are concerned the ticks do not cause many deaths, although in the case of animals that are in low condition, hard worked, and on poor pastures, they cause fever and death in many instances. It is the general opinion that ticks do more or less harm in all cases, especially so in reducing the flesh and the milk secretion of cows and in the loss of flesh and strength in work animals. There are very few American cattle on the island, nearly all those that have been brought there having died of tick fever. Many stock owners recognize the harmful effects of the ticks and are using various kinds of treatment. The Bureau is endeavoring to encourage systematic work in tick eradication by advising the stockmen.

Twenty-one head of tuberculin-tested Jersey cattle were purchased in the vicinity of San Antonio, Tex., and shipped to Porto Rico from New Orleans in April, for the agricultural farm of the University of Porto Rico at Mayaguez. All of the cattle arrived in good health. They were more or less infested with ticks of various sizes, but measures were taken to free them from ticks. These animals are believed to be immune to tick fever, and it seems that only such animals—that is, cattle from the tick-infested area of the United States—can be safely taken to Porto Rico.

THE PATHOLOGICAL DIVISION.

The pathological work of the Bureau is under the direction of Dr. John R. Mohler. It consists mainly in the scientific investigation of animal diseases, and during the past year the principal routine work was, as formerly, in connection with tuberculosis, blackleg, glanders, and rabies.

The preparation of an exhibition of tuberculous specimens by the Bureau for the International Congress on Tuberculosis, which was held in Washington in September, 1908, and the appearance of foot-and-mouth disease in Michigan, New York, Pennsylvania, and Maryland, entailed upon this division a large amount of work during the past year in addition to its regular operations. Notwithstanding the extra work required in these two instances, numerous investigations were made of several infectious diseases, brief outlines of which follow.

INFECTIOUS OPHTHALMIA IN CATTLE.

This affection was observed in the Cincinnati stock yards in a carload of cattle, and after their slaughter the eyes were forwarded to the pathological laboratory for confirmation of the diagnosis. In all of the 18 eyes which were received an opacity of the cornea was noted, accompanied by erosions. In two cases perforations were present. The bacterioscopic examination of the ulcers and aqueous humor showed the presence of a diplococcus which was also obtained in the growths upon various culture media. In all instances where the inoculation was made from the aqueous humor a pure culture of the organism was obtained from the growth. Experimental inoculations were made with the pure cultures of this organism on rabbits and calves, but it was not possible to transmit the disease in all instances. A rabbit in which the conjunctiva was slightly scarified received one drop of the bouillon culture into the eye, and as a result a conjunctivitis with a slight opacity of the cornea developed, which, however, disappeared after a few days without any further interference. A calf was given an intraocular inoculation of one drop of the bouillon culture, which caused a severe conjunctivitis and keratitis, with extensive ulceration of the cornea, resulting in the loss of the sight. Into the other eye of the same calf two loopfuls of the bouillon culture were smeared over the inside of the eyelids, producing only a slight conjunctivitis and photophobia, without any other complications. Other calves were also inoculated with older cultures of the same organism in different ways, but no typical lesions of the affection were obtained. Further work upon this disease will be conducted as soon as fresh material is available.

PARALYSIS OF PREGNANT EWES IN THE SOUTHWEST.

Numerous reports having been sent to the Bureau from New Mexico and Arizona of trouble with sheep just before lambing, an investigation was made during the winter of 1908 in an effort to determine the cause. It was found that the ewes were attacked from a few days to two weeks prior to lambing. They are first affected with tremors and disordered vision. The disease progresses rapidly. Staggering gait and lack of coordination are followed by inability to rise and a condition of more or less complete coma. The paralysis becomes gradually more complete, and after the animal has lingered five to ten days in this helpless state death ensues. The ewes show no tendency to abort, in spite of the severity of the symptoms. Only the fattest and thriftiest members of the flock are affected.

Since the disease closely simulates parturient apoplexy in cows, the inflation of the udder with air seems indicated. This treatment can not be unconditionally recommended at present, however, because of the small number of ewes upon which any form of treatment could be applied during this investigation.

CHRONIC BACTERIAL DYSENTERY.

During the past year the Pathological Division received several specimens showing the characteristic lesions of chronic bacterial dysentery or Johne's disease. The specimens originated in the States of California and Oregon, and the veterinary inspector who investigated the outbreak in Oregon could trace the origin of the infection to a cow imported from the Island of Jersey, where the disease is quite prevalent. The specimens from the outbreak in Oregon arrived in excellent condition for investigation purposes, and afforded a good opportunity to study the pathology of the disease and also to try to grow on various culture media the acid-fast organism causing the disease. No growths were obtained on the ordinary media, but on egg strata a luxuriant growth developed of the acid-fast organism in the form of a raised colony, while the entire surface of the medium was grown over with a saprophytic organism (*Bacillus prodigiosus*). It was then attempted to isolate the organism on egg plates. This, however, was not successful, as before any of the colonies of the acid-fast organism would develop the entire plates were covered with the saprophytic organism. Several such attempts at isolation remained fruitless. It was then deemed advisable to obtain additional fresh specimens for further investigations, and accordingly inspectors in the field were requested to forward specimens of this disease to the laboratory whenever it should come under their observation.

IMMATURE CALVES (BOB VEAL).

The enforcement of the meat-inspection law resulted in the prosecution, and finally the conviction, of several persons shipping, receiving, and offering for sale immature calves, commonly known as "bob veal." Several members of the Pathological Division were detailed to furnish expert testimony before the United States courts and federal juries as to the physiological and pathological conditions of immature veal and the deleterious effect which the consumption of this obnoxious food would exert upon the human system.

AN AFFECTION OF THE LIVER IN CATTLE.

The condition known as telangiectasis of the liver in cattle has been referred to as hemorrhagic spotting and angioma and is quite frequently met with on the killing floors of the various slaughtering establishments in this country, in some instances affecting as many as 25 per cent of the livers.

In cases where the liver is only slightly affected it is normal in size and color, with a few hemorrhagic areas scattered here and there throughout its substance. These areas are readily seen through the capsule, ranging in size from one-sixteenth to one-fourth of an inch in diameter. In more extensive cases the areas are from one-fourth to one-half inch in diameter or even larger. They vary from dark red to purple and some may be bluish black in color; in the latter cases there is usually a moderate hypertrophy of the organ. Where the areas are superficial, Glisson's capsule seems to be depressed, and on passing the hand over the surface of the organ the affected spots seem softer than the surrounding liver tissue.

On section the hemorrhagic areas are usually more numerous in the central and right portion of the organ, but occasionally the hemorrhages are uniformly scattered in a somewhat even manner throughout the entire organ, having apparently no relation to the blood vessels or hepatic ducts. The contents of the incised areas are soft in consistency, resembling splenic pulp. Blood, mixed with a little of the pulp, exudes slowly if pressure be applied, and some of the broken-down tissue and bloody fluid is forced out, leaving a depression with irregular margins. In some cases the hemorrhagic areas become confluent, resulting in the complete destruction of large areas of the hepatic tissue, 1 or 2 inches in diameter. In such cases the degree of hypertrophy is usually great; such livers are often three or four times their normal size and may weigh as much as 40 pounds.

PSEUDO-LEUKEMIA IN HOGS.

Many specimens of enlarged lymphatic glands of hogs have been received at the laboratory of the Pathological Division during the past year which have been diagnosed as pseudo-leukemia or Hodgkin's disease. On post-mortem examination the disease manifests itself by enlarged soft or hard lymph glands, often showing hemorrhagic areas. The glands in this affection do not all become involved at the same time; generally the cervical and other body glands are first to become enlarged, followed by the visceral glands. The spleen, liver, and kidneys may then become attacked and in extensive affections the submucosa and serosa are affected, the lungs remaining free. The post-mortem notes forwarded by inspectors with the specimens show that in the greater number of cases macroscopic lesions were found in body glands only. Histologically such glands showed a hyperplasia of the connective-tissue structures, hemorrhages, and in most cases a marked diminution of leucocytes and small lymphoid cells due in these cases to fatty infiltration of the liver and other organs. There were present, however, an abundance of epithelioid and eosiniphilic cells. When the spleen is involved it also shows an intense increase of the connective-tissue formations. If portions of the body are involved where the lymphoid elements are normally not conspicuous, the abundance of lymphoid structures is the principal manifestation.

This disease in hogs is especially important, since it resembles tuberculosis of the lymph glands to a certain degree, and has often been diagnosed as such, but in no instance could the tubercle bacillus be demonstrated in smears, nor did any of the experimental animals show lesions of tuberculosis upon inoculation. The fact that body glands are affected when visceral glands and organs remain normal, and the absence of any caseation or calcification in the diseased glands, should be of aid in differentiating Hodgkin's disease from tuberculosis.

INVESTIGATIONS OF COTTON-SEED MEAL.

Investigations are being made to determine the cause of injury to live stock by the feeding of cotton-seed meal. The physiological work has shown that cotton-seed meal owes its injurious action to a definite chemical substance, and this substance when fed artificially will produce chronic emaciation in laboratory animals. This active principle has been found to exist in two forms, one harmless and inactive, and the second a poisonous variety.

Cotton seeds of this country are known to be of two main varieties. One of these, when fed in the laboratory, seemed to be harmless, while the other induced death, the same as the meal of commerce. The harmless variety of seeds could be rendered poisonous by the same simple chemical procedure which converts the harmless variety of the active principle of the meal into the poisonous form. A meal apparently harmless to animals can be made in the laboratory, but factory conditions have not yet been tried. The prospects for making harmless meal of the less toxic variety of seeds are very promising, but as yet no method has been developed for converting the poisonous seeds into a harmless meal. This is a problem in plant physiology.

The study of cotton-seed meal would lead to the study of the action of pressed cakes, such as those made from peanuts, which are believed to cause poisoning in stock. The important problem which logically follows from this work is the study of the supposed poisonous action on animals of diseased corn, also of its relation to pellagra and to so-called forage poisoning of horses as well as of the relation of fagopyrismus to buckwheat poisoning.

DISEASES OF POULTRY AND OTHER BIRDS.

The importance of protozoa as causative factors in the production of enteritis in poultry is becoming more apparent, both coccidia and cercomonads being responsible for this condition. Several outbreaks of intestinal cercomoniasis have been studied, and points of differentiation at autopsy between this and intestinal coccidiosis have been recognized. There have also been an unusually large number of cases of death caused by the presence of the air-sac mite, some of the cases having gone on to the development of a typical acarian pneumonia, the lungs revealing scattered foci of inflammation, each of which contained at its center the mite *Cytodites nudus*. A diseased condition in golden pheasants, which has hitherto been described only by Galli-Valerio in 1897 and by Letulle and Marotel in 1901, was found. This affection is a parasitic nodular disease caused by the encystment of the larvæ of *Heterakis papillosa* in the submucosa of the walls of the ceca.

AUTOPSIES ON ANIMALS FROM NATIONAL ZOOLOGICAL PARK.

During the past fiscal year autopsies have been held on 126 cases of wild animals, including mammals, birds, and reptiles from the National Zoological Park. The principal diseases found on post-mortem and the species affected were as follows: Gastro-enteritis, 23 cases, affecting deer, fox, beaver, monkey, seal, parrot, owl, toucan, tinamou, and jaguarondi; pneumonia, 21 cases, affecting elk, deer, fox, kangaroo, otter, beaver, lynx, baboon, aoudad, armadillo, heron, parrot, and toucan; tuberculosis, 16 cases, in monkey, baboon, mountain goat, kangaroo, crane, owl, capybara, and cacomistle; pulmonary congestion, 7 cases, in American bison, deer, antelope, crocodile, and bobwhite; intestinal parasites, 7 cases, in lynx, monkey, jaguarondi, rattlesnake, and cormorant; traumatisms or injuries, 7 cases, in tiger, monkey, owl, stork, macaw, and curassow; aspergillosis, 6 cases, affecting flamingo, pigeon, duck, tinamou, and toucan; bacillary infection, 5 cases, in snakes; mechanical obstruction of the intestine, 5 cases, in snake, crested screamer, and cariama; nephritis, 5 cases, in monkey, deer, and fishing cat; peritonitis, 4 cases, in water buffalo, snake, duck, and leopard; pericarditis, 1 case, in a deer; rabies, 3 cases, all occurring in dingo dogs.

LEUCOCYTES IN MILK.

The number of leucocytes in milk and their significance are receiving the serious attention of those bacteriologists who are striving for a pure milk supply. The question as to what number of leucocytes should be regarded as abnormal is still the subject of investigation. The opinions of contemporary workers are becoming more uniform as the methods for the determination of these leucocytes are reaching greater efficiency. Previously it was considered that but few leucocytes were contained in the milk of healthy cows and that when a certain increased number of leucocytes were observed it was suggestive of inflammation of the udder. However, with the technique usually employed in the numerical determination of leucocytes there is too narrow a margin between the number of leucocytes found in the milk of healthy cows and in that of diseased cows to make this form of diagnosis satisfactory and practicable. With a view of obtaining more uniform results which would aid in establishing a standard, this Bureau, in cooperation with the Pennsylvania live-stock sanitary board, undertook some experiments in accordance with the improved technique recommended by Russell and Hoffman for the determination of the leucocyte content of milk. These experiments, reported in Bulletin 117 of this Bureau by Dr. H. C. Campbell, have opened up an interesting line of investigation, and the limits of lactic leucocytosis which have been adopted by some States based upon the old standards should be modified accordingly.

NECROBACILLOSIS IN SHEEP.

During the past year outbreaks of necrobacillosis among sheep have been so frequently reported to exist in alarming forms in portions of Wyoming and Montana that on several occasions members of the Pathological Division have been dispatched to the infected districts to study the various forms of the disease and to advise the stockmen as to the best means of combating it. It has long been established by this Bureau that necrobacillosis is caused by the *Bacillus necrophorus*. The disease manifests itself in various parts of the body by inflammation, tumefaction, ulceration, and necrosis with scab formation. The extent and size of the pathological changes vary from a papule to an extensive necrotic area. This disease assumes various manifestations, although the lesions are most often located on the lips, face, and skin of the legs; hence the names of lip-and-leg ulceration and necrotic dermatitis have been applied. Less often the affection spreads into the mouth, producing necrotic stomatitis. In some cases the necrosis extends over the nose and between the eyes, at times producing a muco-purulent discharge. The venereal form was found prevalent in the southeastern portion of Montana and in nine counties in Wyoming.

The treatment of this disease is very satisfactory if begun during the early stages and thoroughly applied. Separation of the uninfected sheep from the affected ones, treating the apparently uninfected sheep as exposed and dipping them prior to their being turned upon uninfected pastures or premises, the dipping of affected sheep after having received local treatment and recovered, cleansing and disinfecting contaminated pens, sheds, corrals, etc., have been found necessary in order to rid an infected section of this malady. Several applications of a 30 per cent solution of hydrogen peroxid after removing the scabs, or emollient dressings, such as 5 per cent of one of the cresol or coal-tar creosote sheep dips in vaseline or lard, have given good results if energetically applied. Advanced and aggravated cases require a more penetrating and caustic preparation. For this purpose 1 part of nitric acid to 7 parts of water applied to necrotic and fungoid appearing areas has been found very efficacious.

ERRONEOUS REPORTS OF FOOT-AND-MOUTH DISEASE.

During the recent outbreak of foot-and-mouth disease in this country many reports of the existence of the disease in various States were received which proved to be erroneous. Members of the Pathological Division who were detailed to ascertain the condition of the animals in these localities found stomatitis of various degrees, due to mycotic and bacillary infection, eruption of teeth, coarse feeding, and traumatisms, but in no instance did the trouble prove to be foot-and-mouth disease.

The alarm regarding foot-and-mouth disease even extended to neighboring island provinces, and a report reached the Bureau that it had appeared in Jamaica. Because of its commercial importance this reported outbreak demanded immediate investigation, and a member of the pathological force was dispatched to the scene of the trouble. On arrival he made some inoculations of sound animals for diagnostic purposes. None of these inoculations proving positive, it became evident that the outbreak was not of an infectious character and could not therefore have any effect upon international commerce.

RABIES.

During the fiscal year 153 animals suspected of being affected with rabies were sent to the pathological laboratory, in order that a definite diagnosis might be made. Of this number it was found that 104 were rabid and 49 were not affected with rabies. This large number of rabid animals, mainly originating in the District of Columbia or its immediate vicinity, offers conclusive evidence of the imperative need which has existed during the past year in this region for legal enactment providing for the better control of dogs and for the destruction of all that are not subjected to such control. The number of rabid dogs in the District is now somewhat less than it was a year ago, but the disease will undoubtedly remain until suitable requirements for the muzzling of dogs are rigidly enforced.

The positive cases of rabies diagnosed by the Pathological Division during the fiscal year are set forth in the following table. It will be seen that at least 48 persons, besides a much larger number of animals, were bitten by the rabid animals. Prompt notice of diagnosis was given so that preventive treatment might be taken, consequently no deaths are known to have occurred among the bitten persons, although they and their families were nevertheless subjected to great anxiety and considerable expense.

Positive cases of rabies diagnosed by the Bureau of Animal Industry during the fiscal year 1909.

Date.	Record No.	Kind of animal.	Source.	Method of diagnosis.	Persons or animals bitten.
1908.					
July 2	1715	Cat	District of Columbia	Negri bodies	1 girl.
July 3	1719	Dog	do	do	2 dogs.
July 10	1730	do	do	do	1 dog.
July 11	1731	do	Norfolk, Va	do	1 child, several dogs.
July 13	1735	do	Maryland	do	None reported.
Do	1736	do	West Virginia	do	Do.
Do	1737	do	do	do	Do.
July 14	1741	do	District of Columbia	do	Do.
July 18	1749	do	do	do	Do.
July 22	1757	do	do	do	1 man.
July 24	1760	do	Virginia	do	None reported.
July 27	1766	do	District of Columbia	do	Do.
July 28	1767	do	do	do	1 man.
Aug. 3	1781	do	do	do	1 dog.
Aug. 5	1788	do	do	do	1 boy.
Aug. 10	1796	do	do	do	None reported.
Aug. 28	1827	do	do	do	Do.
Aug. 29	1829	Cat	do	do	1 boy.
Aug. 31	1830	Dog	Virginia	do	Several dogs.
Do	1831	do	District of Columbia	do	1 man.
Sept. 8	1842	do	do	do	None reported.
Do	1843	do	do	do	Several dogs.
Do	1844	do	do	do	2 boys, 1 dog.
Sept. 9	1848	Cat	do	do	1 man.
Sept. 10	1850	Dog	Virginia	do	1 child.
Sept. 14	1855	do	District of Columbia	do	3 adults.
Sept. 16	1859	do	do	do	None reported.
Do	1861	do	do	do	Do.
Do	1862	do	do	do	Do.
Sept. 21	1868	Horse	do	do	Do.

Positive cases of rabies diagnosed by the Bureau of Animal Industry during the fiscal year 1909—Continued.

Date.	Record No.	Kind of animal.	Source.	Method of diagnosis.	Persons or animals bitten.
1908.					
Sept. 24	1872	Dog	District of Columbia	Negri bodies	None reported.
Sept. 25	1876	Cow	Maryland	do	Do.
Sept. 30	1880	Dog	Virginia	do	Do.
Oct. 2	1884	do	do	Inoculation of rabbits	Do.
Oct. 5	1888	do	District of Columbia	Negri bodies	3 adults exposed.
Oct. 12	1897	do	do	do	None reported.
Oct. 19	1908	do	Maryland	do	Do.
Oct. 20	1910	do	District of Columbia	do	Do.
Do	1911	do	do	do	Do.
Do	1913	do	Virginia	do	Do.
Oct. 21	1915	do	District of Columbia	do	Do.
Oct. 22	1918	do	do	do	Do.
Oct. 23	1919	do	do	do	Do.
Do	1923	do	do	do	Man and boy.
Oct. 27	1925	do	Virginia	do	None reported.
Oct. 29	1930	do	District of Columbia	do	1 horse.
Nov. 2	1934	do	do	do	None reported.
Do	1935	do	do	do	1 woman.
Nov. 4	1944	do	Virginia	do	2 cows, 2 dogs.
Nov. 6	1947	do	District of Columbia	do	1 boy.
Do	1950	do	do	do	Do.
Nov. 7	1952	do	do	do	None reported.
Nov. 12	1962	do	do	do	1 boy.
Nov. 20	1972	do	do	do	1 dog.
Nov. 23	1980	do	do	do	2 boys.
Nov. 27	1984	do	do	do	None reported.
Dec. 3	1988	do	do	do	Do.
Do	1989	do	do	Inoculation of rabbits.	1 boy.
Dec. 4	1992	do	do	Negri bodies	None reported.
Dec. 8	1995	do	Virginia	do	Do.
Dec. 12	2001	do	do	do	3 persons exposed.
Dec. 14	2003	do	do	do	1 boy, 1 dog.
Dec. 19	2009	Cow	West Virginia	do	None reported.
Dec. 22	2014	Dog	Virginia	do	Do.
Dec. 24	2015	do	District of Columbia	do	3 dogs.
Dec. 28	2019	do	Virginia	do	2 persons.
1909.					
Jan. 2–9	2023	do	District of Columbia	do	1 girl.
Jan. 11	2032	do	Virginia	do	None reported.
Jan. 20	2050	do	do	do	Do.
Jan. 28	2059	do	District of Columbia	do	Do.
Feb. 5	2068	do	do	do	1 dog.
Do	2069	Cow	do	do	None reported.
Mar. 17	3030	Dog	Virginia	Inoculation of rabbits.	Do.
Mar. 20	3035	do	West Virginia	Negri bodies	Do.
Mar. 22	3036	do	Virginia	do	4 dogs.
Apr. 5	3058	do	District of Columbia	do	3 children.
Do	3059	Cat	do	do	2 children.
April 5	3061	Horse.	West Virginia	Negri bodies	None reported.
April 18	3082	Dog	South Carolina	do	4 people.
April 21	3086	do	District of Columbia	do	1 man.
April 26	3096	do	do	do	None reported.
Do	3098	do	do	do	1 man.
Do	3099	do	do	do	None reported.
April 29	3103	do	do	do	1 child.
May 17	3124	do	do	do	Hens.
Do	3125	do	do	do	2 adults exposed.
May 19	3129	do	Maryland	do	1 child.
Do	3130	do	West Virginia	do	1 man.
Do	3131	do	District of Columbia	do	None reported.
May 21	3133	do	do	do	1 boy.
May 24	3136	do	do	do	Do.
May 25	3142	do	Virginia	do	None reported.
June 6	3156	do	District of Columbia	do	Do.
June 12	3172	do	do	do	1 boy.
June 14	3177	do	do	do	None reported.
June 15	3178	do	do	do	1 child.
Do	3179	do	do	do	None reported.
June 16	3180	do	do	do	1 child.
Do	3181	do	do	do	None reported.
Do	3182	do	do	do	1 dog.
June 17	3183	do	do	do	None reported.
June 21	3190	do	do	do	1 man.
June 24	3195	do	do	do	1 boy.
June 28	3200	do	do	do	None reported.

TUBERCULOSIS INVESTIGATIONS.

An exhibition of tuberculous specimens and cultures was made by the Pathological Division at the International Congress on Tuberculosis held in Washington in September, 1908, and much time was necessarily devoted to the preparation of this display. At this congress a demonstration was made by a European physician who claimed to be able to tell by a certain procedure whether any case of tuberculosis in the human subject owed its origin to human or to bovine material. Two patients by his examination were pronounced affected with tuberculosis from a bovine source. Sputum was obtained from each of them and tubercle bacilli recovered therefrom and thoroughly examined. One of these cultures disclosed characters which in the preliminary tests appear to be typical of tubercle bacilli of the bovine type, while the other apparently belongs to the human type.

An interesting investigation has also been made of tuberculosis which simultaneously affected the swine and the poultry of an Oregon ranch, causing great losses among both kinds of stock. Experiments showed that transmission of tuberculosis from fowls to swine readily occurs, and it seems most probable that the infected swine on this ranch obtained their infectious material from the tuberculous fowls which were kept near them.

Examinations were also made of cultures from two tuberculous cattle which were received from the Bureau Experiment Station, to determine the character of the tubercle bacilli which were present in the affected tissues and which must therefore be looked upon as the causative agents. One of these cases presented numerous cavities or vomicæ where the oldest of the lesions had existed. The bacilli recovered here have conformed in our preliminary experiments to the human type of tubercle bacilli. The other case was congenital tuberculosis in a calf, and the organisms recovered in this instance were found to belong to the bovine type.

The tests of the duration of life of tubercle bacilli in cheese and butter under the usual market conditions, undertaken in cooperation with the Dairy Division and which were in progress at the beginning of the year, have been continued throughout the fiscal year and are still being extended, as are various investigations in the immunization of cattle against tuberculosis in cooperation with the Experiment Station of the Bureau.

ANTHRAX.

Veterinarians from the Pathological Division have been sent to the South during the past year to assist in checking the spread of anthrax among the animals on the sugar and cotton plantations.

Many owners appear indifferent as to the fate of their cattle and are not disposed to take suitable measures for protecting them from infection. They have greater confidence in the powers of the " hoodoo bag" than in the efficacy of anthrax vaccines, and on many of the places visited these bags were observed tied about the necks of the animals, and because of the alleged protection thus afforded the owners considered that any further steps in the matter were quite unnecessary.

Owners of animals in infected districts were advised—

1. To remove all healthy stock from infected pastures and vaccinate them; to supply them with pure water and feed; to sponge them over with some disinfectant solution, thus reducing the chances of infection from the bites of insects.
2. To clean out all infected stables, finally washing the walls and woodwork with lime wash to each gallon of which 5 ounces of carbolic acid or commercial formalin have been added.
3. That all dead animals be incinerated.
4. That in the future all animals upon these infected places should be vaccinated each spring.

EFFECTS OF SMELTER FUMES ON LIVE STOCK.

Reports of heavy losses to the live-stock industry in the Deer Lodge Valley of Montana, alleged to be caused by smelter fumes, led the Bureau to make an investigation in 1905–6, and during the past fiscal year the results have been prepared for publication.

In the operation of a smelter, fumes laden with highly dynamized mineral elements are generated which are distributed over the surrounding country to a greater or less extent and are finally deposited on the grasses, crops, and forests. The region traversed by smelter smoke shows a steadily growing diminution in the quantity and quality of crops and vegetation of all kinds. Analyses of grasses, hay, soil, and animal tissues by the Bureau of Chemistry of the Department of Agriculture and by other authorities have demonstrated the presence of toxic quantities of arsenic. Animals subsisting on blighted feed soon show unthriftiness, and large numbers of horses and cattle as well as other stock die, while those that continue to live manifest lowered vitality, depraved nutrition, derangement of breeding functions, and sterility. The clinical symptoms of animals thus affected coincide with those known to science as symptoms of arsenical poisoning. Post-mortem findings in animals that have died and in affected animals purposely killed, as well as microscopic examination of the tissues of such animals, establish the accuracy of this diagnosis. Feeding experiments with known quantities of arsenic and the experimental local application of arsenic resulted in the production of symptoms and lesions identical with those found in affected animals.

INFECTIOUS ANEMIA OF HORSES.

The important feature of the year's work on infectious anemia, or swamp fever, of horses is the apparently successful immunization of a horse against this disease.

The results of the experiments of the year may be summarized as follows:

1. The virus of infectious anemia as contained in the blood serum of infected horses can pass through the finest porcelain filter bougie, and the serum thus filtered can reproduce the disease when injected into healthy horses. Microscopic examination of hanging-drop and stained cover-glass preparations of filtered serum and also culture tests made with such serum have failed to reveal any organisms, thus indicating not only that the causative factor of the disease is ultramicroscopic, but also that it is difficult if not impossible to discover it by the ordinary methods of bacteriological examination.

2. An experiment now under way indicates that artificial immunity may be produced.

3. Examination of the blood and urine proves that the corpuscles of the former decrease and that albumen appears in the latter during the advanced stages of the disease.

For the ensuing year, besides continuing experiments with urine and feces and with the feeding of virulent material, which are already under way, efforts will be concentrated on the study of artificial immunity and the methods of clinical diagnosis.

MILK SICKNESS IN TENNESSEE.

The peculiar disease known as milk sickness, so common in the mountains of the eastern part of the United States in the pioneer days, has, with the advancement of civilization and the consequent clearing of timbered lands, almost entirely disappeared. However, many localities in the Kentucky and Tennessee mountains are still considered to be dangerous by the mountaineers, and if cattle get into these localities by accident these people will not partake of their flesh or dairy products.

The discovery of the causative organism of this disease by Jordan and Harris in an outbreak in the Pecos Valley, New Mexico, in 1907, gave new interest to the malady, and during the past year under the direction of the Pathological Division some experimental animals were placed in the affected country in the region of Smithville, Dekalb County, Tenn., in the hope of developing a case of milk sickness, or trembles. Six animals, including one fresh cow and calf, one dry cow, and two yearlings, were used. They were placed in several heavily wooded mountainous regions about Smithville, which is considered one of the worst localities for the disease in Tennessee. The animals remained in these places for about four weeks. During this time the dry cow and the fresh one died with what the farmers considered well-marked cases of milk sickness. On post-mortem the cause of death of the fresh cow was found to be pneumonia. The necropsy on the dry cow was negative and all evidence pointed to her having died as a result of being entangled and thrown by the retaining rope with which it was necessary to restrain her, as the range was very large and unfenced. Cultures were made from the blood of this animal, a rabbit was inoculated with its blood, and a dog was fed exclusively on its meat for three days, but with negative results.

One human case was seen, but cultures made from the blood of the ear lobe remained sterile, and a dog drenched with vomitus from the patient showed no ill effects. Winslow and Orme, Tenn., were also visited, but no history of recent cases could be obtained. It would therefore seem that at the present day milk sickness is rare. Many animals reported by the farmers in these localities as dying of milk sickness in reality die from other causes. From a careful study of the history of the human case it appears that the disease may be contracted in other ways than from the ingestion of milk and dairy products.

SAND-BURN IN TEXAS.

Under the local term "sand-burn" there exists in Nueces, Starr, Hidalgo, Cameron, and Duval counties, Tex., a skin disease, principally of horses, which is very prevalent during the hot summer months, and an investigation of this disease was undertaken by the Pathological Division.

The disease occurs especially on hot, sunny days after a rain. Certain areas of land seem to be particularly dangerous, and stockmen fence such areas on their ranges to keep stock out. These areas are usually low-lying, with water collecting in them after a rain.

Horses are by far the most frequent animals affected, but mild cases occur in mules, and cattle may develop the disease. Its manifestations occur suddenly and consist of an extreme itching or burning sensation. The affected areas become tumefied, edematous, and a clear serum oozes through the skin. The horse makes frantic efforts to bite the affected parts and finally the skin becomes broken, leaving a raw ulcer, which the animal, unless restricted, continues to make larger by its constant biting at the locality to relieve the itching. The eyes sometimes show the effects of an attack. White horses are particularly susceptible, and dark-colored horses with white noses and feet are also frequently affected. The eruption after healing frequently leaves a scar, and in some cases there are very unsightly permanent blemishes. At the time of the investigation in November no acute cases were available, but several bad cases in the process of healing were found. From one of these, a gray horse showing a large lesion on the flank, cultures and smears were made, but no organism which could be considered as the etiological factor developed on them.

The species of plants in the inclosed areas in the Lasater range country were found not to differ from those on the open range.

The disease is very closely allied to trifoliosis, resulting from eating alsike, bastard, and Swedish clover, and thought to be due to a fungus growing on these plants. Should this disease prove to be identical with trifoliosis, however, there must be some other plant which harbors the fungus, as none of these three varieties of clover are grown in that part of Texas.

BLACKLEG INVESTIGATIONS.

The Pathological Division has continued the preparation and free distribution of blackleg vaccine. During the fiscal year ending June 30, 1909, about 1,150,000 doses were prepared in the laboratory and distributed among cattle raisers. With greatly improved facilities for the manufacture of vaccine the Bureau has been enabled to send out a much larger supply of vaccine of uniform quality and on shorter notice than heretofore.

The results of vaccinations for the fiscal year ending June 30, 1908, as reported to the Bureau by stock raisers who have used the vaccine, are as follows:

Report on the distribution and use of blackleg vaccine for year ending June 30, 1908.

States.	Number of reports.	Number of cattle vaccinated.	Deaths same season previous to vaccination.		Died after vaccination.					
			Number.	Per cent.	Within 48 hours.	From 2 to 7 days after.	Within one year.	Total number.	Per cent of deaths after vaccination.	Number of cases due to mistakes.
Arizona	87	3,673	153	4.16		7	30	37	1.00	
Arkansas	11	447	11	2.46			2	2	.44	
California	385	53,294	476	.89	6	17	149	172	.32	
Colorado	427	57,764	655	1.11	12	53	244	309	.53	
Idaho	24	2,588	73	2.82		1	1	2	.07	
Illinois	50	1,303	57	4.37		2	3	5	.38	
Indiana	2	42	3	7.14		2		2	4.76	
Iowa	148	8,443	118	1.39	2	1	10	13	.15	
Kansas	362	28,936	359	1.24	4	23	85	112	.38	
Kentucky	15	346	5	1.44		2		2	.57	
Maryland	1	12	1	8.33			1	1	8.33	
Michigan	2	50								
Minnesota	25	897	42	4.68						
Mississippi	1	242	15	6.15		3		3	1.24	
Missouri	279	12,347	189	1.53	4	2	33	39	.31	
Montana	173	34,909	651	1.86	14	17	124	155	.44	
Nebraska	1,106	96,129	1,492	1.55	30	92	220	342	.35	1
Nevada	5	1,873	25	1.33						
New Hampshire	2	22					2	2	9.09	
New Mexico	82	16,185	484	2.99	2	5	48	55	.33	
New York	14	328	15	4.57					.603	
North Carolina	49	2,486	65	2.61		2	13	15	.29	
North Dakota	300	25,431	477	1.87	4	5	65	74	.43	
Oklahoma	57	6,972	190	2.72	1	12	17	30	.08	
Oregon	78	31,702	206	1.50	2	2	7	11		
Pennsylvania	2	30	1	3.33						
Porto Rico	3	1,844					2	2	.108	
South Dakota	432	41,317	898	2.17	18	33	180	231	.55	
Tennessee	47	1,914	89	4.65	2		10	12	.62	
Texas	535	107,311	1,247	1.16	25	60	854	939	.87	4
Utah	40	6,415	307	4.78	7	4	38	49	.76	
Vermont	3	25	1	4.00						
Virginia	355	12,720	338	2.65	4	17	73	94	.73	
Washington	22	1,964	486	2.47	1		25	26	1.32	
West Virginia	143	4,689	100	2.11	2	3	15	20	.42	
Wisconsin	9	222	3	1.35						
Wyoming	354	59,048	702	1.18	17	30	186	233	.39	
Total and average	5,630	605,920	9,934	1.639	157	395	2,437	2,989	.49	5

A comparison of this report with reports of previous years shows a material decrease in the losses from this disease before vaccination and also a decrease in the percentage of losses after vaccination. Deducting the number of animals dying within forty-eight hours after vaccination as a result of previous infection, the percentage of losses after vaccination is reduced to 0.46 per cent.

THE BIOCHEMIC DIVISION.

This division, of which Dr. M. Dorset is chief, has been engaged during the year chiefly in the laboratory inspection of meat products, investigations concerning hog cholera, and tests of stock dips, besides continuing the preparation and distribution of tuberculin and mallein.

LABORATORY MEAT INSPECTION.

The laboratory meat inspection as carried out during the past year has consisted in the examination of samples submitted to the laboratories by the inspectors in charge of stations. During the fiscal year more than 17,000 samples of meat food products and substances used as ingredients in these products have been examined in the laboratories. Of these samples approximately 16,000 were from establishments where inspection is maintained; the remainder, somewhat more than 1,000 samples, being secured from establishments which operate under certificates of exemption from inspection.

About 5 per cent of the samples from establishments having inspection were found to conflict in some way with the meat-inspection regulations, but the greatest number of these cases were due not to unwholesomeness, but to incorrect labeling, such as the use of cereal in sausages without this being suitably shown on the labels, or the contamination of lards with very small amounts of cotton-seed oil resulting from lack of facilities in the packing houses, which necessitated the use of the same equipment for pure lards and for compounds made of cotton-seed oil and other fats. It is apparently very difficult to remove all traces of cotton-seed oil from the pipes and mixing machinery in lard refineries, and this difficulty accounts for a considerable proportion of the samples found below standard. In houses where inspection is maintained the use of prohibited preservatives seems to have been almost completely discontinued, and in the few instances where preservatives were found this occurred for the most part from inadvertence on the part of the packer and not through intentional violation of the regulations.

It should not be understood from the foregoing that 5 per cent of all meat food products which reach the market are in conflict with the regulations, for in a great many cases the products are held by the inspectors pending the results of the laboratory inspection. The great majority of products that are found to be misbranded, adulterated, or to contain prohibited preservatives or coloring matters, therefore, never reach the market, but are either destroyed for food purposes if unwholesome, or properly labeled if the case is one of misbranding. In general, the meat food products examined in the laboratories during the fiscal year from inspected houses have been found to be in excellent condition.

Of the samples from exempted establishments about 8 per cent were found to violate the regulations. The proportion of samples from these houses which contained prohibited preservatives was considerably larger than in the case of the samples taken from inspected establishments. The laboratory inspection resulted in the withdrawal of certificates of exemption from a number of establishments.

PACKING-HOUSE WATER SUPPLIES.

Whenever there has been reason to doubt the wholesomeness of water supplies used on meats, samples of the water have been taken and subjected to chemical and bacteriological examination, which has been supplemented by a sanitary survey of the surroundings. In all, 124 samples of water from a large number of establishments located in different parts of the country have been examined, and when the water has been found unwholesome its use has been stopped or the insanitary conditions remedied. The Bureau insists that water used for washing or preparing meats shall be as clean and wholesome as would be required for drinking purposes.

RESEARCH AND MISCELLANEOUS WORK.

The study of the changes which take place in meats during the process of curing has been continued and a large amount of data have been collected. The first portion of the work, dealing with the changes which occur in the curing salts and in the coloring matter of meats, has been completed and is reported in a paper by Mr. Ralph Hoagland in the Twenty-fifth Annual Report of the Bureau.

The study of the causes which lead to the souring of meats during curing has been continued on a large scale, and it is believed that at least one of the causes of this condition has been detected in the form of a bacterium which has been isolated from sour meats. Extensive practical experiments with this organism are under way, the object being to determine definitely its relation to the souring of meats and to devise means of combating it.

An extensive study has been made of the water content of the various kinds of sausage meats, including fresh, frozen, and cured meats taken from different parts of carcasses, all being meats actually employed in sausage making. It is intended to compare these results with a similar study of sausages prepared from such meats and with commercial brands of sausages as found on the market. It is hoped that as a result of this work it will be possible to decide upon the desirability of definite standards for the water content of sausages.

The investigation regarding the composition of commercial meat extracts has been carried on extensively during the past year, but owing to the great amount of time required for the preparation of typical samples under commercial conditions it has been impossible to complete the work. Some firms engaged in the manufacture of meat extracts have placed their factories at the disposal of the Department and have cooperated with us in attempting to reach a decision regarding standards for these substances.

In carrying out the laboratory meat inspection it has been found that certain methods of analysis were not entirely satisfactory when applied to the varying conditions in practice, and efforts have been made to improve these methods where possible. It has been found that potassium nitrate does not, as is generally supposed, interfere with the turmeric test for boric acid, but the nitrites on the other hand do interfere materially with this test. This interference can be counteracted by the use of urea. A method whereby the various colors permitted to be used in connection with the preparation of meats may be separated and identified has been worked out. The results of both of these investigations will be prepared for publication. The effects of various bacteria in the curing of meats have been studied, and considerable attention has also been given to methods for detecting adulteration in fats and oils.

BRANDING INK.

During the fiscal year 2,858 gallons of branding ink were furnished to the inspectors in charge of meat inspection. This ink, which was sufficient to do all of the branding required by the Department, cost, together with the necessary containers for shipment, approximately $1,750. An improvement in the form of brass brands, suggested by the Chief of the Bureau, has added greatly to the efficiency of the ink. Experiments are being carried out to improve the form of ink and to secure inks adapted for special purposes.

HOG CHOLERA.

During the past year no effort has been made by the Bureau to prepare anti-hog-cholera serum on a large scale, nor have any extensive practical experiments except those previously reported been carried out. In a few cases practical tests for demonstration purposes have been conducted in Nebraska, Texas, Missouri, Iowa, and Maryland, and the results secured were in entire agreement with those previously reported. The greater part of the work of the Bureau during the past year has been devoted to efforts to improve the present system of immunization and to a study of the biology of the filterable virus which is responsible for hog cholera. It has been found that the process of hyperimmunization, which is necessary in the production of the serum, and which was first carried out by injecting diseased blood subcutaneously into the immune hog, can be accomplished quite as well by intravenous injection, the particular advantage in the latter being that the highly potent protective serum is produced by using only half the quantity of diseased blood which would be required if subcutaneous injections were given. In the case of immunes treated intravenously the carcasses of the hogs killed for serum are in excellent condition and appear to be entirely suitable for food. As the cost of hogs is one of the chief items of expense in serum production, this intravenous injection of immunes is regarded as a very valuable improvement, tending to reduce the cost of the serum very materially.

One other fact has been established by the work during the past year—that carbolic acid in the presence of albuminous substances is not a satisfactory disinfectant for hog cholera, as the virus is frequently found alive after twenty-four hours' contact with a $3\frac{1}{3}$ per cent solution of carbolic acid, and the same was found to be true of bichlorid of mercury, the latter disinfectant failing to destroy the virus after one hour's exposure to a strength of bichlorid equivalent to 1 part in 1,000. It has been found, however, that the disinfectant described in the last edition of the United States Pharmacopœia under the name "liquor cresolis compositus" is very effective for destroying hog-cholera virus and may be depended upon even in the presence of albuminous substances if used in a 3 per cent solution.

It is gratifying to report also that scientific workers in Germany and in Hungary have confirmed the work of the Bureau of Animal Industry regarding the efficacy of hyperimmune serum for combating hog cholera, and this serum is now on sale in Germany.

In my last annual report it was stated that the attention of certain state authorities had been called to the serum developed by the Bureau as a preventive of hog cholera. Since that report was written representatives of the States of Alabama, Colorado, Kentucky, Pennsylvania, Louisiana, North Dakota, South Dakota, Tennessee, Virginia, Delaware, Montana, Mississippi, Illinois, Wyoming, and Oklahoma have visited the experimental farm of the Bureau near Ames, Iowa, and have had explained to them the methods used. These conferences have resulted in a number of these States taking up the manufacture of this serum, and recent information shows that at least 20 States have undertaken the preparation of the serum to a greater or less extent. Eleven States have each appropriated sums of money exceeding $1,500 per annum for starting the serum production for the benefit of hog raisers. Considerable serum has been prepared by state representatives, and in all 25,000 hogs have been treated with serum so prepared. The results of the inoculations have been in the main quite satisfactory. The work is being broadened in States which have already begun, and it is expected that a number of other States in which the hog-raising industry is of sufficient importance will begin serum production in the near future.

In looking over the work of the past year we find no reason for believing that the previously reported successful results in protecting hogs against hog cholera have been based upon error, but are rather more confident than ever that a properly prepared serum can be depended upon to afford such protection. It is furthermore believed that this serum should serve as the basis for an energetic campaign looking to the eradication of hog cholera, or at least the elimination of this disease as a serious menace to the hog-raising interests. Such a plan is presented in a paper in the Twenty-fifth Annual Report of the Bureau.

During the year a technical paper by Dr. C. N. McBryde entitled "Filtration Experiments with *Bacillus choleræ suis*" has been published as Bulletin 113 of the Bureau, and a paper entitled "Recent Work of the Bureau of Animal Industry Concerning the Cause and Prevention of Hog Cholera," by Dr. M. Dorset, has been published in the Yearbook of the Department for 1908.

ANIMAL DIPS AND DISINFECTANTS.

The routine analytical work on animal dips and disinfectants has consisted in the examination of samples of dips submitted by manufacturers with the object of having their use permitted in official dipping, the examination of samples of various dips forwarded by field inspectors, and the examination of samples of petroleum oils and various substances used in the field for experimental purposes. A number of samples of disinfectants were also examined. Some of these were products used by the Bureau in combating outbreaks of disease among animals, and a large proportion were samples of disinfectants submitted for test by the general supply committee for the government departments. Of 66 dips submitted by manufacturers with the object of having their use permitted in official dipping, 35 were found to be unsuitable and their use was not allowed. The examination of samples of dips sent in by inspectors disclosed the fact that some manufacturers were not maintaining their dips at the standard required and agreed upon, and the use of such preparations in official dipping was stopped.

During the outbreak of foot-and-mouth disease the manufacture of a large quantity of a cresol disinfectant to be used in the work of eradicating that disease was supervised by a member of the laboratory force. In addition 200 gallons of coal-tar creosote and cresol dips, intended for experimental use in cooperation with the Zoological Division, were prepared in the laboratory and shipped.

The laboratory has also undertaken a thorough investigation of phenolic disinfectants in order to ascertain accurately the factors which influence the efficiency of such preparations, particularly under conditions of practical use. A very large amount of chemical and bacteriological work has been carried out in investigating this question.

Examinations of a number of samples of crude carbolic acid submitted by inspectors of the Bureau have shown that many of these samples were of poor grade and not equal to the claims made for them.

The effect of sodium chlorid on the bactericidal action of bichlorid of mercury has been given some attention, the preliminary results indicating that a saturated solution of sodium chlorid does not materially affect the action of solutions of the bichlorid of moderate strength.

A paper entitled "Some Common Disinfectants" was prepared by the chief of the Biochemic Division and issued as Farmers' Bulletin 345. This paper gives information concerning the nature of commonly used disinfectants and advice as to the best methods of employing them.

EXPERIMENTS WITH RAT VIRUSES.

During the past year a considerable amount of cooperative work with the Bureau of Biological Survey of the Department has been carried out in testing rat viruses. These are represented to be cultures of bacteria which, when fed to rats, produce a disease which not only kills the animal to which the culture is fed, but spreads to others. Several of these viruses were tested, but none of the germs which they contained were found to be reliable agents for killing rats, and none of them produced in the infected rats a disease which was transmissible to others. One case was of particular interest, it being shown that a product on the market and advertised as a virus contained no pathogenic bacteria, but depended for its efficacy upon the presence of a poison.

TUBERCULIN AND MALLEIN.

The distribution to state, county, and city health officers of tuberculin for official use in the diagnosis of tuberculosis in cattle has been continued, and during the fiscal year 251,213 doses were prepared and sent out. Mallein to the amount of 55,564 doses, for the diagnosis of glanders in horses, was also prepared and distributed.

THE ZOOLOGICAL DIVISION.

The Zoological Division, under the direction of Dr. B. H. Ransom, is chiefly concerned in investigating animal diseases of parasitic origin and in collecting and determining animal parasites.

ROUNDWORMS IN SHEEP.

In experiments relative to the prevention of parasitic infection in lambs, it was found that infection with nodular worms was entirely avoided by keeping the lambs and ewes separate in adjacent pastures, with a bare earth pen between into which the lambs until weaned were frequently turned with the ewes for sucking, the animals being returned to their proper pastures after each suckling period. At the age of 12 months the weight of the lambs averaged 82 pounds, which was 12 pounds more than the average weight of other lambs at 13 months which had occupied the same pasture as their mothers. The former, when killed at the age of about 1 year, were found to be very slightly infested with stomach worms and hookworms and entirely free from infection with nodular worms as already stated, while of the latter some died at the age of 6 to 8 months heavily infested with stomach worms, and the survivors, when killed at the age of about 1 year, were all infested in a moderate degree with stomach worms, hookworms, and nodular worms.

In another experiment lambs and their mothers were kept together but changed at intervals to different pastures, and the lambs when weaned were placed finally in a pasture separate from the ewes. At the age of 1 year these lambs showed a slight infection with stomach worms, hookworms, and nodular worms. Their weight averaged 78 pounds, or 8 pounds more than that of the lambs mentioned above which were kept with their mothers in one pasture without change.

These experiments have shown that the degree of parasitic infection in lambs can be reduced by changing the flock at intervals to fresh pasture, and that the suckling-pen method gives almost perfect protection from infection with internal parasites.

Experiments in which tobacco was fed to lambs during a period of several months indicated that this remedy, which has been more or less highly recommended in live-stock journals during the last two or three years, is inefficient against stomach worms. At the close of the experiment there was no appreciable difference in the condition of lambs which were fed tobacco and of those which were not, stomach worms being fully as common in the former as in the latter.

GID IN SHEEP.

The investigations concerning this disease and the parasite which causes it have been continued. A remedy (repeated doses of male fern), which has been employed in Europe with reported success in a number of cases of somatic tæniasis in human subjects, has been tried in several cases of gid with no resulting benefit.

EXPERIMENTS WITH COAL-TAR DIPS FOR CATTLE MANGE.

In cooperation with the Biochemic Division of this Bureau and the South Dakota Agricultural Experiment Station, seven lots of cattle affected with scabies were dipped experimentally during an investigation to determine the percentage of the different constituents of coal-tar dips which should be present to render them effective in the treatment of this disease. On account of the slight infection at the time of dipping the favorable results obtained in the case of four of these lots of cattle are not considered trustworthy. These four lots were dipped in dips containing when diluted the following percentages of phenols and coal-tar oils: (1) Phenols, 0.1 per cent; coal-tar oils, 1.2 per cent; (2) phenols, 0.4 per cent; coal-tar oils, 1 per cent; (3) phenols, 0.2 per cent; coal-tar oils, 1 per cent; (4*a*) phenols, 0.5 per cent; coal-tar oils, none. These four lots of cattle remained free from mange for one year after dipping. The lice with which the animals were infested were not eradicated by the dipping. Three lots dipped in the following dips remained scabby after dipping: (4*b*) Phenols, 0.75 per cent; coal-tar oils, none; (5) phenols, 1 per cent; kerosene, 1.2 per cent; (6) phenols, 1 per cent; crude petroleum, 1.2 per cent. The lice with which the cattle were infested when dipped were not destroyed by dip 4*b*. The effect of dip 6 on the lice was not noted. The cattle dipped in dip 5 were free from lice when examined six months after dipping.

Three lots of scabby cattle were dipped near Merriman, Nebr., in dips of the following composition: (10) Phenols, 0.75 per cent; coal-tar oils, none; (11) phenols, 0.1 per cent; coal-tar oils, 1.2 per cent; (12) phenols, 0.2 per cent; coal-tar oils, 1 per cent. All of these dips failed to cure.

A proprietary coal-tar creosote dip tried experimentally on scabby cattle near Pine Ridge, S. Dak., injured the skin so seriously that the second dipping was omitted and the experiment terminated.

From the experiments with coal-tar dips it may be concluded that these dips, when diluted to a degree which has been found effective in the case of sheep scab, are inefficient in the treatment of cattle mange. Whether they can be used sufficiently strong to cure cattle mange without unduly injuring the animals remains to be determined.

INVESTIGATIONS RELATIVE TO TICK ERADICATION.

It was found in experiments with arsenical dips that when tick-infested cattle were dipped once in a solution containing an equivalent of about 0.2 per cent arsenic trioxid by weight in the form of sodium metarsenite, and about 0.2 per cent of pine tar by volume, less than 5 per cent of the female ticks survived to deposit eggs. It was also determined that only about 1 per cent of the eggs deposited by ticks surviving the dipping hatched, as compared with a fertility of about 50 per cent among eggs of ticks from undipped cattle, kept under similar conditions. In other words, the number of the next generation resulting from ticks present on cattle at the time of dipping in the arsenical solution in question was less than one one-thousandth of the number which would have resulted if the cattle had not been dipped, other conditions being equal.

The investigations relative to tick eradication conducted in cooperation with the veterinary department of the Alabama Polytechnic Institute at Auburn, Ala., have been continued.

INVESTIGATIONS CONCERNING PARASITIC PROTOZOA.

Considerable time has been spent in an attempt to clear up that portion of the life history of the Texas-fever organism which occurs in the tick, but as yet little progress has been made in the solution of this difficult problem.

The discovery has been made that apparently healthy American cattle commonly harbor a trypanosome in their blood. Direct microscopical examination of the blood does not reveal the presence of this parasite. In cultures made from bovine blood, however, it appears in large numbers after three to four days' incubation at a temperature of 20° to 25° C. This trypanosome appears to be nonpathogenic to cattle. Attempts to transmit it to other animals have failed. A similar trypanosome found in cultures of bovine blood by a Japanese investigator was considered by him to represent a stage in the life history of a species of *Piroplasma* which occurs in cattle in Japan. Our investigations have shown with certainty that the trypanosome found in the blood of American cattle has no genetic connection with the parasite of Texas fever.

OTHER WORK.

Parts 21, 22, and 23 of the Index-Catalogue of Medical and Veterinary Zoology have been issued during the year.

Three hundred and sixteen new entries have been made in the catalogue of the collection of parasites during the past year. The total number of specimens now in the collection is 5,640.

Eighty-one autopsies on various animals, wild and domesticated, were performed during the year with reference to the presence or absence of parasitic infestation.

THE EXPERIMENT STATION.

The Bureau Experiment Station is located at Bethesda, Md., and is in charge of Dr. E. C. Schroeder. The general character of the work consists of independent original investigations, investigations in cooperation with other divisions of the Bureau, and the provision of facilities for other divisions of the Bureau to make investigations of a kind that require farm and field conditions not obtainable within the city's limits.

TUBERCULOSIS INVESTIGATIONS.

The most important investigations made during the past year concern the disease known as tuberculosis. An experiment to determine the value of the method of immunizing cattle against tuberculosis developed by Pearson in the United States and by Von Behring in Europe is nearing completion. In a general way our work has shown that this method of immunization actually protects cattle fairly well against tuberculosis, but as it requires the introduction into their tissues of living tubercle bacilli of the morphologic type more commonly associated with the tuberculous lesions of persons, it is questionable whether its extensive practice should be advocated. This is especially true in the light of the work reported by various investigators relative to the elimination of tubercle bacilli from the bodies of cattle after injection in various ways. It is claimed by some of these investigators, for example, that tubercle bacilli injected under the skin or into the circulation of a cow are to some extent eliminated through the udder with milk. If this claim is true, no system to protect cattle against tuberculosis that requires the introduction of living tubercle bacilli into their bodies can be characterized as anything better than a means to protect live stock at danger to public health.

Another method of immunization against tuberculosis is also being tested. This is known, named after its inventor, as the Heymans method. It is simply the introduction of virulent tubercle bacilli, enveloped in a sack of vegetable fiber, which in turn is inclosed in a gelatin capsule, under the skin of the animal. It is too early to say much about this method, though some of our observations tend to discourage great expectations either as to safety or efficiency. The Heymans capsules are claimed by their inventor to confine tubercle bacilli so that they can not actually pass into the tissues of a treated animal. Anthrax bacilli, which are much larger than tubercle germs, introduced in Heymans capsules under the skin of sheep have been found to pass rapidly through the walls of the capsules and cause fatal disease accompanied by the usual presence of innumerable anthrax bacilli in the blood.

Considerable attention was given to hog tuberculosis, with special reference to the sources from which the bacilli that cause it are more commonly derived. More work is necessary before a complete report can be written on this subject, but it is interesting to know that among three lots of hogs exposed respectively to milk from tuberculous cows, feces from tuberculous cows, and to hogs affected with tuberculosis, those exposed to feces contracted tuberculosis much more frequently than the other lots. This bears out our former conclusion that the feces of tuberculous cows are probably the commonest cause for the propagation of tuberculosis among hogs. As far as our work has gone the exposure of hogs to the feces of tuberculous cows has infected them with fully ten times the certainty that followed their exposure to tuberculous hogs or from feeding them the whole milk of tuberculous cows. Examinations made by the Bureau have shown, however, that tubercle bacilli are present in a very large percentage of the samples of centrifuge slime from public creameries. In view of the danger from these two sources hog breeders are urged to protect their hogs from contact with the feces of cows that have not been proven by the tuberculin test to be free from tuberculosis, and to boil the skim milk which is obtained from public creameries and used as hog feed. It is gratifying that the work of the Experiment Station demonstrating that apparently healthy but tuberculous cattle intermittently expel tubercle bacilli with their feces now has the confirmation of the British Royal Commission on Human and Animal Tuberculosis (see Third Interim Report of the Commission, issued at London early in 1909).

During the year an article that pronounced tuberculosis in all its forms to be a bacteriemia, and that received unusually wide attention, was published by an American investigator. As this view, which stamps the disease as being constantly associated with the presence of numerous tubercle bacilli in the blood, had an important bearing on the meat-inspection regulations of the Bureau with regard to tuberculosis, an investigation was immediately undertaken to prove definitely to what extent the blood of tuberculous subjects actually contains tubercle bacilli. Numerous microscopic examinations and inoculation tests were made with the blood of tuberculous cattle. Some of the cattle were long-standing cases of generalized tuberculosis and were expelling numerous tubercle bacilli in their feces. In no instance were tubercle bacilli found in the blood, and hence we are justified in concluding that, in animals at least, tuberculosis is not a disease that can be characterized as a bacteriemia in any sense of the word, though in some forms of tuberculosis the bacilli may in rare instances be present in the blood, probably for short periods of time.

A number of tuberculous cattle were kept at the station to test the potency of the tuberculin sold by different manufacturers in this country. The tuberculins tested during the year were all found to be satisfactory.

It is of some importance to record in connection with the various tuberculous cattle kept under close observation at the station that the frequency with which udder tuberculosis developed among them is surprising. The development of the disease in the udder in one or two instances was so insidious that the milk of the cows was found to be infected with tubercle bacilli by guinea-pig injections long before the slightest lesion of local disease could be detected by a physical examination. In one instance it was determined, after weeks of inoculation tests, that infected milk was produced by one quarter of the udder of a seemingly healthy but actually tuberculous cow, while the remaining three quarters produced noninfected milk.

One case of udder tuberculosis observed in a cow is particularly instructive. The disease extended to and developed in the udder with great suddenness and violence. In the course of a few days an apparently healthy udder, including the associated lymph glands, became affected with a diffuse tuberculosis that wholly destroyed its normal function. Half of the udder became so swollen that its size was at least three times as great as normal. On post-mortem examination no real typical lesions of tuberculosis could be found, but the entire affected region was saturated with unusually virulent tubercle germs. This case shows how great the danger may be from a tuberculous cow, even when it can not be proven that her milk contains tubercle bacilli, and that tuberculosis of the udder may develop without warning at any time in a tuberculous cow.

An investigation has been planned to determine whether the use of pasteurized milk containing dead tubercle bacilli is injurious to the health of those who drink it, either because the dead bacilli may cause pathological conditions or because swallowing dead tubercle bacilli may lower the normal resistance of the body to living tubercle bacilli, a few of which, under existing conditions, are almost certain to find their way, sooner or later, into the body.

An investigation is also in progress relative to the percentage of healthy calves that can be raised from a herd of tuberculous cattle. The object of this investigation is to obtain additional and much-needed data regarding the economic eradication of tuberculosis from among cattle. This investigation is also of special interest because it may throw some light on the possible development of tuberculosis during later stages of life from tubercle bacilli that were swallowed during the true milk-drinking period.

RABIES.

During the year a number of dogs that had been bitten by rabid dogs were kept in quarantine, and one horse that had been bitten by a rabid dog was treated under the direction of, and with material received from, the Hygienic Laboratory of the United States Public Health and Marine-Hospital Service. The horse was discharged in perfect health ninety days after the treatment was completed, and as nothing has since been heard from the case the treatment was undoubtedly effective in preventing the development of rabies.

If the frequency with which the attention of the station has been called to rabid dogs has any value as a guide to the prevalence of the disease, we may conclude that it is still markedly in evidence in and about the District of Columbia.

OTHER DISEASES.

Some time and attention were given to special investigations concerning foot-and-mouth disease of cattle in cooperation with the Pathological Division, but as this subject has been treated at length in a bureau publication (Circular 147), it need only be referred to here.

The subjects of hog diseases, Texas fever, cattle ticks, cattle-tick dips, anthrax, blackleg, glanders, swamp fever, cattle mange, infectious abortion, the internal and external parasites of sheep, the marking and branding of sheep, etc., have also received more or less attention at the Experiment Station.

OTHER WORK.

The breeding investigations conducted in cooperation with the Animal Husbandry Office have given some interesting results. This work is presented in the part of this report which relates to the Animal Husbandry Office.

As in former years, large numbers of small experiment animals and a large quantity of green forage were raised at the station. Several needed buildings of small size were constructed, and the second and completing story was added to the new laboratory.

THE ANIMAL HUSBANDRY OFFICE.

Mr. George M. Rommel, Animal Husbandman of the Bureau, directs the work of this office, which relates to the breeding and feeding of live stock and poultry, the supervision of pedigree record associations, etc.

HORSE BREEDING.

COLORADO WORK.

The stallion to follow Carmon in the cooperative horse-breeding experiments with the Colorado Experiment Station at Fort Collins has not yet been purchased, although a number of horses have been inspected, which have not proved sufficiently desirable to be used. It is hoped that a suitable stallion will be found in time for the 1910 season.

The purchasing board, acting as a board of survey, in August, 1908, condemned 19 animals in the stud, three of which were mares purchased in 1905, which have proved to be unsatisfactory breeders. With the exception of one filly owned by the experiment station, which was injured just before the sale, the condemned animals were sold or turned over to the Colorado Agricultural College for work purposes. The filly mentioned will be sold in the near future. Annual inspections for similar purposes are arranged for.

The high mortality of foals throughout the State was felt at Fort Collins, and serious losses occurred for no apparent reason, unless it was adverse climatic conditions.

VERMONT WORK.

The work at the Morgan Horse Farm, near Middlebury, Vt., in cooperation with the Vermont Experiment Station, is progressing satisfactorily, and the farm has been much more fortunate in the foals of 1909 than was the case in the Colorado work. Ten foals were dropped out of twelve mares bred. The new sheds are proving satisfactory, but the accommodations will soon be crowded, and additional stable room will be needed. It is possible that the present facilities will suffice during the coming winter, but provision should be made in the near future for a total of 25 brood mares in addition to stallions and young stock.

The most important improvement during the year has been the installation of a first-class water system. It is the well-known pneumatic system, with a 15,000-gallon underground tank. The pump is run by an electric motor, which is equipped with an automatic starting and stopping device. Very little attention is needed, and the pressure in the mains is practically constant. The system not only makes it possible to supply water to any part of the farm, but gives adequate fire protection as well.

IOWA WORK.

The Shire and Clydesdale mares used in the experiments in cooperation with the Iowa Experiment Station are proving to have excellent endurance, especially in hot weather. They are noticeably fast walkers. Only one mare foaled during the fiscal year.

The station has added to the stud the Shire mares Wrydelands Starlight (37804), Wrydelands May (43904), and Stow Silver Streak (52348). They have had excellent show records in both England

and America. All these mares have been reduced in flesh and have been bred to the Clydesdale stallion Kuroki (13214).

CLASSIFICATION FOR AMERICAN CARRIAGE HORSES.

The classification for American carriage horses which was offered at twelve state fairs in 1908 at the Department's suggestion, resulted in very interesting and instructive exhibits. The animals shown were not all one could wish in every case, but they were all one could expect. That the fair managers believe that the classification is a useful one is shown by the fact that, with very few exceptions, the classification is being offered by the same fairs for 1909, although no assistance is rendered by the Department except furnishing judges when requested. Besides the fairs which offered the classification last year, the Missouri State Fair offers the complete classification for 1909, whereas only a partial one was offered in 1908, and the classification is offered by three additional fairs, including the live-stock show of the Alaska-Yukon-Pacific Exposition. Fourteen fairs of state or national importance have provided the classification for 1909. No change has been made in requirements and the classification stands as published in the revised edition of Bureau of Animal Industry Circular 113. Representatives of the Bureau attended each state fair offering the classification in 1908, and it is planned to continue this custom.

SHEEP BREEDING.

During the past year the range sheep-breeding work in cooperation with the Wyoming Experiment Station has been fairly satisfactory. During the lambing season in the spring some lambs were lost on account of the severe storms which continued for several days at a time, but the number lost was much less than it would have been if the new lambing sheds had not been available. The use of these sheds has proved to be a very good investment.

The flock was sheared earlier than in 1908, and owing to the heavy rains during the spring the wool was much cleaner and the percentage of shrinkage in scouring will probably be considerably less. The number of sheep shorn was 307, of which 291 were ewes, 7 mature rams, and 9 yearling rams.

The total number of lambs dropped in 1909 and living on July 15 was 137; ewe lambs, 62; ram lambs, 73; sex not reported, 2. It is proposed to reserve three of the yearling rams for breeding purposes and to sell the remainder.

CATTLE BREEDING.

MILKING SHORTHORNS.

The experiment in breeding milking Shorthorn cattle, carried on in cooperation with the Minnesota Experiment Station and individual breeders, has been continued, and the circuit now includes five herds, each of which is visited by the circuit superintendent for two days each month, when weights of milk and samples for butter-fat determinations are taken from four milkings. The cooperating breeders have been fitted out with milk sheets and spring balances, and are keeping records of the daily milk production of each cow. From these milk sheets, combined with the monthly check weights and butter-fat tests, annual semiofficial records will be made. A statement of milk and butter-fat production, feed consumed, and breeding record for each animal is sent to the owner by the station at the end of each month.

Thus far the results indicate an annual yield of 3,000 to 6,000 pounds of milk and 125 to 250 pounds of butter fat in three herds owned by private individuals, complete records not being available for the fourth. In the station herd, where the animals are fed and handled more carefully for dairy production, the yearly records are now complete, or nearly so, and show yields of from 4,000 to 8,000 pounds of milk and from 125 to 325 pounds of butter fat per annum.

BREEDING HOLSTEIN CATTLE.

A cooperative Holstein cattle-breeding experiment, similar to the work with milking Shorthorns in Minnesota, was begun during the year in North Dakota, in cooperation with the State Experiment Station. A circuit of 18 members has been formed within a radius of 12 miles of New Salem. There are 18 herd bulls and 47 cows in the circuit.

GENERAL ANIMAL-BREEDING INVESTIGATIONS.

The breeding experiments which are in progress at the Bureau Experiment Station at Bethesda, Md., are giving satisfactory results. During the past year six zebra-ass hybrids have been foaled. The first three of these were very weak and died shortly after they were born. The remaining three are vigorous, promising individuals.

Numerous attempts have been made at artificial impregnation to produce zebra-horse hybrids, but so far without success. We have also failed in getting direct service between a zebra and a mare.

Breeds of sheep having decidedly different characters have been crossed, and observations are being made of the characters inherited from either parent.

Breeding experiments in which small mammals (guinea pigs and rats) are used are in progress, and interesting data are being collected. This is true particularly of the inbreeding, in which nearly 4,000 animals have been under observation and all important data recorded. At present there are about 1,500 breeders in the experiment. The closest form of inbreeding is being practiced with these animals. Individuals of the same litter have been mated together, many of them for seven generations. Others have been bred to their parents for four generations.

Several small animals are being used in experiments in which the breeders are selected for some particular character, as the fixing of coat color and pattern or the fixing of some slight variation from the normal type. Results thus far obtained seem to indicate that Mendel's law applies to the breeding of animals so far as the inheritance of coat color and color pattern are concerned.

POULTRY INVESTIGATIONS.

MAINE WORK.

The cooperative work in breeding for increased egg production at the Maine Experiment Station has been continued, but the basis of selection has been changed, and individuals of both sexes are now chosen by reason of their centgener power, or ability to produce offspring which are uniformly good producers. As previously planned, the experiment of trying the introduction of new blood in the flock was tried, but without any significant result in increased egg production.

In accordance with the plan of testing various other breeds besides the Barred Plymouth Rock, a trap-nest test of Cornish Indian Game pullets from some of the best strains in America is being carried out, and a large number of promising hybrid chickens from the two breeds have been raised.

Part I of a biometrical study of egg production in the domestic fowl, based on the trap-nest records of the Barred Plymouth Rock stock of the station for the last ten years, has been completed and published as Bulletin 110 of this Bureau, entitled "Variation in Annual Egg Production." Part II, dealing with the seasonal distribution of egg production through the year, is practically complete, and will soon be ready for publication. Farmers' Bulletin 357, describing the methods of poultry management employed at the Maine Experiment Station, was issued during the fiscal year.

Future work will be continued along the same lines, namely, study of the accumulated records and breeding for increased egg production, with the associated problems which may arise, and the testing of other breeds and of the hybrids secured.

INDEPENDENT INVESTIGATIONS.

During the year the comparison of the wet and moist mash and the hopper systems of feeding laying hens, which has been under way for over two years, has been continued at the Bureau Experiment Station at Bethesda, Md., and this work is nearing completion.

A form of coccidiosis appeared in the spring in both the mature stock and the young stock raised. As a result, a high mortality of the chicks was occasioned. While the mortality was checked, those surviving have been so badly stunted that they are not considered worth saving for breeding purposes.

The trap-nest records of all laying hens have been carefully kept; but it has been impossible to begin the proposed inbreeding work because of lack of suitable facilities. Pens of such a size that a single cock bird could be used in each would be necessary for this purpose.

The preliminary field study of the conditions surrounding the production and marketing of eggs has been completed and a report has been issued as Circular 140 of this Bureau.

The cold-storage evaporimeter devised by the assistant in charge of the egg-market investigations and mentioned in last year's report has been patented by the Department. A circular (No. 149) of this Bureau describing the device and the manner of using it has been published.

A number of desirable projects for future poultry work present themselves. An effort could well be made to encourage the keeping of better poultry in the Southern States, where natural conditions are favorable, by the introduction and sale in certain localities of good utility cock birds of a general-purpose breed. By cooperation with a number of large poultry farms valuable data could be obtained on the cost and efficiency of various large-scale operations. The ostrich industry is rapidly growing in this country and is demanding work in its behalf. Investigations with the view of increasing fertility of eggs and decreasing loss of quality of feathers due to barring would be timely.

ANIMAL-NUTRITION INVESTIGATIONS.

The investigations in animal nutrition in cooperation with the Institute of Animal Nutrition of the Pennsylvania State College have been continued. The work of the past year has been substantially a continuation of that described in the report for the fiscal year 1908.

A bulletin is in course of preparation reporting the results of three years' work on the influence of age and type of cattle upon the utilization of their feed, and it is proposed to make further studies of the energy values of typical feeding stuffs with a view to securing more accurate data as to their real nutritive value. A general discussion of the energy values of feeding stuffs has been prepared and published as Farmers' Bulletin 346. The data of that bulletin, however, are not in all respects satisfactory, either as to the factors used for the energy values or as to the average composition of American feeding stuffs. It is hoped that the investigations now in progress will add to our knowledge upon the former point. Work on the latter will be commenced by an assistant to the Animal Husbandman, who will undertake a thorough compilation of recent American analyses and digestion experiments, which should lead to the construction of more satisfactory tables than now exist.

SOUTHERN BEEF PRODUCTION.

The work in studying the production of beef cattle in the South has been carried on during the past year along practically the same lines as outlined in the previous report. Satisfactory results are being obtained and the work will be enlarged during the year. Among the other projects which will be taken up will be the study of the economy of silage as a winter feed for beef cattle. A report of the work of the past three years is being prepared for publication.

SUPERVISION OF PEDIGREE RECORD ASSOCIATIONS.

The time and assistance available during the past year for the work of supervising pedigree record associations under the tariff law have been very largely occupied in a thorough study of the records of one of the most prominent draft-horse associations in the country. This investigation is still pending. It has become evident that close supervision by this Department of the business of recording animal pedigrees is of vital importance to the live-stock industry of the country. Clean studbooks can not be expected when they are managed by men whose interests may be served by loose or questionable methods. Canada has taken a long step forward in the solution of this problem by having all pedigree recording of useful domestic animals done by the Dominion government. It may be to the interest of the United States to follow Canada's example in the near future. There is a growing sentiment in favor of such a step.

There were on the certified list at the close of the fiscal year 133 books of record, of which 66 were American and 67 foreign.

THE DAIRY DIVISION.

The work of the Dairy Division, under the direction of Mr. B. H. Rawl, chief, is organized in five branches, as follows: (1) Dairy farming investigations, (2) dairy products investigations, (3) dairy manufacturing investigations, (4) market milk investigations, and (5) renovated butter inspection. A large part of the work of the division is educational in character and is being carried out in cooperation with state and local authorities and through organizations such as city boards of health, state dairy associations, and the like. These institutions are expected to reach the individual farmers and dairymen in their respective regions, and thus the greatest good to the greatest number is accomplished. During the past fiscal year 264 dairy meetings and farmers' institutes, in 37 States, were attended by employees of the Dairy Division, and assistance was given in conducting 4 dairy schools.

DAIRY FARMING INVESTIGATIONS.

SOUTHERN DAIRYING.

The work for the development and improvement of the dairy industry in the South has been continued along the same lines as in the previous fiscal year, namely, herd improvement and economical feeding; building of barns, silos, dairy houses, etc.; creating an interest in such organizations as dairy associations; improvement of city milk supplies, etc. Ten men have been regularly employed in this work, which is in progress in the States of Alabama, Georgia, Mississippi, North Carolina, South Carolina, Tennessee, and Texas.

Dairy farmers are advised to keep records of their herds so as to show the cost of feed, the yield of each cow, etc. During the year records of 73 herds, containing 1,642 cows, were kept by dairymen under the supervision of the Dairy Division. The value of keeping records was demonstrated by the fact that 138 cows were removed from the herds because their records showed them to be unprofitable. Some dairymen with whom the division has done work in the past have this year been carrying on systematic records by themselves, and others have begun to make records because of the good results from this practice which they have seen on the farms of their neighbors. The use of purebred bulls comes as an immediate result of keeping records.

Sixty-six silos have been built in the Southern States during the past year as a result of the work of this division. Seventeen were concrete, 3 brick, 7 modified Wisconsin, and 39 stave. Including some built in previous years, 13 concrete silos cost on an average $2.17 per ton capacity; 46 stave silos cost on an average $1.50 per ton capacity, and 9 modified Wisconsin silos cost on an average $1.36 per ton capacity. On account of the permanency of concrete construction, that type of silo is built wherever the conditions will permit. As a rule, in the Southern States good lumber is available and is cheap; hence it is often considered best for the beginner to build a silo of wood. Applications have been received in the last few months for assistance with 103 silos. One of the most gratifying features of the work in the South is that wherever a barn or silo is built one year there are sure to be others built in that locality the succeeding year.

There were 25 dairy barns built during the past year, and 10 old barns were remodeled. In addition 31 applications were on file for assistance in building. There were also 20 dairy houses built during the year and 5 remodeled, while 6 applications for assistance in building were still unacted on.

Assistance has been given in improving the milk supplies of 20 cities. In 18 of these the score-card system of inspection has been used. This work has been the means not only of much improvement in the sanitary conditions of the farms and premises, but of increasing profit to many of the producers.

Some assistance has been given in organizing a few creameries in Virginia and one in Texas. On the other hand, the building of creameries is discouraged where it appears that local conditions are such as to make their success impossible.

A new feature of the work in the South was the holding of two dairy schools (one-week session), one at Newton and the other at Dana, N. C. At Newton there was an average daily attendance of 50 persons, at Dana of 30 persons. These schools were conducted on the following plan: A small building or a portion of a building was secured, in which was placed enough hand machinery to conduct the entire work of a farm dairy. Separating, churning, and testing were performed during the forenoon of each day, beginning at 8 o'clock. The afternoons and evenings were devoted to lectures, and these were so planned as to cover the most important questions that the beginner in dairying in these localities needs to understand. These schools have not been conducted for a sufficient length of time to warrant definite conclusions as to their merits, but from the results so far obtained they seem to offer an effective means for teaching dairying, particularly in communities where it is undeveloped and where farm butter making must to a large extent be practiced. Plans are being made to conduct fifteen more such schools during the coming year. As an outcome of these two schools a farm dairy butter contest was organized. Each competitor sends to the agricultural college 1 pound of butter on a certain day in each month for twelve consecutive months. This butter is scored by the dairyman at the college, and letters of criticism are sent to the maker of each sample. Prizes are provided by the state department of agriculture.

Assistance was given by the field men at nine fairs. At each of them a butter contest was held, and at seven of them model dairies were operated. A small exhibit was made of plans of farm dairy buildings, and publications on various dairy subjects were distributed.

All the work in the Southern States has been done with the hearty cooperation of the state institutions, and these institutions are showing their approval of the work by increasing assistance. In North Carolina the state department of agriculture has provided

$2,850 to supplement the work for the present fiscal year. The State of Georgia has provided $600 for the work, Mississippi has provided about $800 or $1,000, South Carolina has provided $600, and Tennessee is expected to provide funds for the work in the near future.

COW-TEST ASSOCIATION WORK.

One employee has been engaged during the year in giving assistance to state officials in organizing and conducting cow-test associations. These are organized and operated along the following general plan: Approximately 26 members constitute an association. A tester is employed who makes a monthly visit to each farm, arriving one afternoon and remaining until the following afternoon. While at the farm he makes a record for each animal of the milk produced and the feed consumed, and on this basis he balances the account of each animal for the period of which the day of his visit is the center. The tester is paid by the association $1 a year for each cow owned by the members. He also receives his board and transportation from one farm to another free of cost. At the end of the year the tester determines what each animal has made. In addition to this very valuable information, the monthly visits to the farm enable him to give much assistance relative to various phases of the dairy work in progress.

Monthly meetings are held by the association, at which subjects of interest to the members are discussed. The association has, therefore, features of education and cooperation that extend considerably beyond the scope of dairying. There are now 27 of these associations organized, with 741 members, owning 11,686 cows, in nine States, as follows: Wisconsin, 10; Michigan, 5; Maine and Vermont, 3 each; Iowa, 2; California, Pennsylvania, Ohio, and New Hampshire, 1 each. All but five of these associations were organized during the past fiscal year.

No assistance is given in this work unless some state or local institution will take the immediate control of it. While the plan of operation makes the association self-sustaining, a certain amount of supervision by some state official will always be necessary. The institution taking active charge of the work agrees to furnish this necessary supervision. It is very important that the first associations organized in a State be closely watched so as to make sure of their success; but after two or three are operated for a year or two others can be handled much more easily. By that time other farmers understand something of the work and the officials in charge also have become familiar with handling the various difficulties that arise. It is the object of the Dairy Division to provide when possible the assistance necessary to enable the official in charge to give the proper supervision.

Much interest is being shown in the movement. The State of Wisconsin is employing two men for the work. Vermont has provided the sum of $5,000, a large part of which is to be used for test association work, and Iowa has appropriated $10,000, a large part of which will be similarly used. Ohio has also provided some funds that can be used in the same manner.

The fact that the average dairy cow of this country is producing only about half of what is within easy reach of the ordinary farmer of average intelligence indicates the enormous opportunity for systematic record work. We consider, therefore, that this is a very important work, and it is planned now to increase it as much as the funds available for the ensuing year will permit. It is not the policy to organize too many of these associations, but rather to organize a smaller number in the best localities so as to be sure that they will succeed. The state institutions are asked to make an annual report, showing the results produced by all the associations in each State.

SILO AND VENTILATION EXPERIMENTS.

Two cement-and-metal silos have been built and used, and have proved entirely satisfactory. A report showing the details of the experiment will soon be ready for publication.

Two experimental silos that will make it possible to determine the exact pressure of silage have been built, and special dynamometers have been designed for use in determining the pressure. These experiments will probably have to be continued another year.

An experiment in stable ventilation has been in progress two years at the barn of Mr. H. McK. Twombley, Madison, N. J. The object is, first, to determine the effectiveness of the various systems of ventilation now in use, and, second, to determine whether or not it is possible to improve further the one that seems most effective. The results of the work are being compiled and will be prepared for publication as soon as they are sufficiently complete.

JERSEY CATTLE FOR PORTO RICO.

Twenty-one head of Jersey cattle were purchased for the University of Porto Rico and shipped April 17 last. An employee of the Dairy Division proceeded to Porto Rico with the cattle and will remain long enough to develop the dairy farm in connection with the university. The cattle are doing well and the indications are that the project will be successful.

DAIRY ARCHITECTURE AND ENGINEERING.

The architectural and engineering work has become a very essential part of the work of the Dairy Division. During the past year plans have been prepared for two dairy houses, two silos, one dairy-school building, one dairy barn, and laboratories for the Dairy Division in Washington and at Albert Lea, Minn. Drawings have been prepared for several Farmers' Bulletins, and two applications have been made for patents on dairy apparatus. There have been sent out during the year 2,086 blueprints of barns and other dairy buildings. For several months past it has been impossible to supply all of the demands in this line.

Some of the problems to be handled during the coming year are concerned with creamery refrigerators, brine cooling systems, incubators, and other apparatus for laboratory use; also some work in connection with septic tanks and sewage-disposal systems for creameries and farms.

DAIRY PRODUCTS INVESTIGATIONS.

This section is in charge of L. A. Rogers, and includes technical investigations relating to butter, milk, and cheese. A considerable part of the work is carried on in cooperation with state experiment stations, because of lack of proper facilities to do the work in or near Washington.

BUTTER INVESTIGATIONS.

The work in progress relating to butter includes:

1. A study of the morphology and physiology of the bacteria concerned in the souring of milk, to determine methods of separating them into groups, etc. This work will be completed and ready for publication in a short time.

2. The production of a dry starter for use in butter making. Such starters now on the market contain few lactic-acid bacteria and are frequently badly contaminated. Results indicate that this undertaking will be successful, and that it will be possible to dispense entirely with the mother starter. This work will also be completed and the results ready for publication in a short time.

3. The study of factors influencing changes in storage butter. It has been found that acid in the cream causes great changes in the flavor of such butter, and also that overworking tends to increase the air content and to develop bad flavors. Fishy flavor is found to occur only in highly acid butter, and sometimes then only when it was overworked. Experiments proved that butter with excellent keeping quality can be made of pasteurized sweet cream without the use of a starter. These findings are published in Bulletin 114 of the Bureau of Animal Industry. The chemical changes which cause such marked changes in flavor have not as yet been accurately determined. Specific attention is being paid to changes produced by overworking and by proteolysis.

4. A study of the digesting-acid-forming bacteria and their influence on the flavor of butter. On account of their ability to form acid these bacteria persist in milk after other liquefying bacteria are suppressed, hence they frequently develop in large numbers in ripening cream. Such bacteria injure the keeping quality of butter.

5. A determination of the best temperature for pasteurizing cream for butter making, as indicated by the destruction of bacteria and the various enzyms of the milk and by the keeping quality of the butter.

6. Work under factory conditions to determine the relative cost and profit of pasteurization in butter making. The operations in this experiment involve pasteurizing the entire output of the factory for one week and manufacturing the cream raw the next week.

7. A systematic study of butter making under farm conditions, with the object of determining methods of making the best quality of farm butter.

The work projected includes:

1. A study of the chemical nature of the substances causing flavors in butter. An attempt will be made to collect the specific substances in sufficient quantities to make a study of their origin.

2. Determining the relative rate of changes in the flavor of butter stored at different temperatures.

3. A study of the factors causing loss of fat in butter making.

MILK INVESTIGATIONS.

A study of commercially pasteurized milk as found in Washington, D. C., Albert Lea, Minn., Boston, and New York, made to determine the correctness of the hypothesis that commercial pasteurization destroys the lactic-acid bacteria and permits the unchecked development of harmful bacteria, shows that such is not the case. A part of this work will be ready for publication in the near future.

It is planned to undertake a morphological and physiological study of gas-forming bacteria which grow in milk. It is desired also to study from a chemical standpoint the by-products of these bacteria.

It is proposed to investigate also the nonliquefying alkali-forming bacteria which are common in milk, especially when held at a low temperature. The origin of the bacteria and the by-products of their growth are important problems for study.

Investigations in milk secretion are being continued in cooperation with the Missouri Experiment Station. The principal problem to be studied is the effect of feed upon the chemical composition of milk. Before this main question could be investigated, however, there were numerous other questions which it was necessary to understand.

Those portions of the work already completed may be summarized as follows:

1. The influence of breed, individuality, and period of lactation upon the composition of milk. Twelve animals of four breeds were used in this work—Jerseys, Ayrshires, Holstein-Friesians, and Shorthorns. They were fed a uniform ration throughout the entire period of lactation in order that any variation in the composition of the milk due to feed would be eliminated. Some of them were fed throughout two periods of lactation. This made it possible to study the changes that took place due to advancement in the lactation period, to breed, and to individuality.

2. The use of formula in testing total solids. To determine whether or not a reasonably accurate result could be obtained by other means than chemical analysis, data from the main work were used in studying this problem simply as a side issue. A new lactometer was devised, whereby a more accurate reading can be made. This work is now ready for publication.

3. A chemical and physical study of the fat globules in cow's milk. Bulletin 111 has been issued, showing the results of this study.

4. For more than a year investigations have been conducted with human milk. Samples were taken from 12 subjects, mostly colored, of different ages, with nursing children from 2 weeks to 1 year of age. In some cases samples were taken each week for an entire year. About 250 samples of this milk were analyzed. Some very valuable information has been obtained from this study, particularly in comparison with the exhaustive study that is being made along the same line with cow's milk.

The work in progress under this head includes:

1. Effect of gain or loss of fat in the animal upon the composition of the fat secreted in the milk. In studying the effect of feed on milk production it will be necessary to know whether or not the composition of the milk is affected by a gain or loss in body weight; hence the necessity of this experiment.

2. Period of abnormality of milk at the time of parturition. A chemical study is being made to determine more definitely just when the milk is unfit for human food.

3. A comparison of the leucocytes contained in cow's milk and in human milk.

4. A study of the chemical and physical changes in milk from one milking to the next. Information on this subject is particularly important in infant feeding. Five different animals have been studied in this manner so far.

5. A study of the fat and ash in human milk. Very little has been published relative to the chemical composition of human milk fat. It is known, however, to vary materially from the fat in cow's milk. This work is being done when other work is not pressing.

6. A study of the action of rennet on milk. A method has been devised for determining accurately the coagulation period when milk is acted upon by rennet. This determination is being made regularly, and when sufficient data have been accumulated it is possible that some general laws may be deduced.

When the work now in progress is completed, it is proposed to take up the work on the main problem of the effect of feed on the composition of milk. It is planned to begin with cotton-seed meal, since this is known to have a very marked effect on the composition of milk, and will therefore possibly throw some light upon the methods to be followed in continuing such tests.

CHEESE INVESTIGATIONS.

Swiss cheese.—Two men at Albert Lea, Minn., have worked continuously the past year on various problems involved in the manufacture of the Swiss type of cheese, particular attention being given to the use of pasteurized milk. The work has been done without the assistance of a chemist or bacteriologist, and while the results are good, they are as yet not uniform. It is planned to continue the work, going thoroughly into an investigation of the question of starters, also into the chemistry and bacteriology of the whole subject.

Cheddar cheese.—Three men have been engaged in this work, which is done in cooperation with the Wisconsin Experiment Station at Madison. A study is being made of the influence of acid in Cheddar cheese making, to determine the effect of using commercial acid in the milk. The necessity of solving two main questions is apparent: First, how to develop a process of bringing milk to a uniform condition as to acidity and bacterial content, and thus render possible the production of a uniform product; second, to find accurately the factors influencing flavor. A study has been made of the influence of acidity and other conditions on the removal of the moisture content of curd in the vat, and a report of this particular phase of the investigation has been prepared. While the work has so far thrown but little light on the main problems, it has developed a great deal of important information relative to the whole subject of Cheddar cheese manufacture.

Whey butter.—Investigations conducted during the past year show that where a cheese plant handles 10,000 pounds or more of milk as a maximum daily run, whey butter can be made profitably. These results are important alike to the cheese maker and to the farmer who supplies the milk. A report on this subject has been prepared for publication.

Soft cheese investigations.—This work is being done in cooperation with the Storrs Experiment Station, at Storrs, Conn. These investigations have thus far been restricted to the Camembert and

Roquefort types. Three employees of the Dairy Division are engaged in this work—a chemist, a mycologist, and a practical cheese maker. The cheese maker manufactures the cheese and the chemist and mycologist study the exact chemical and biological properties and changes that occur during the process of ripening. Many difficulties have been encountered in this work, some of which have been overcome. There are some problems yet to be solved, but the results so far achieved seem to indicate that eventually it will be possible to manufacture successfully both the Camembert and Roquefort types of cheese in the United States. A report on "Camembert Cheese Problems in the United States" has been published as Bulletin 115 of the Bureau.

DAIRY MANUFACTURES.

This section is in charge of B. D. White. The work deals largely with the operations of creameries, cheese factories, etc., and includes a supervision of some of the principal dairy markets. It is aimed to assist the manufacturers of dairy products in the use of better and more economical methods of production, in overcoming difficulties and losses, and in improving the quality of their product.

MARKET INSPECTION.

Inspections of butter in the market have been made during the year as follows: Chicago, 1,250 lots; New York, 1,600 lots; San Francisco, 70 lots.

This inspection is made at the request of the dealer or the producer, and the defects of the butter are pointed out in a letter which in all cases is sent to the producer, giving suggestions as to methods of overcoming them. This work has accomplished sufficient results to warrant its continuation in the cities where it has been tried and to justify its inauguration in a few more of the other more important butter markets.

CREAMERY INVESTIGATIONS.

Assistance is rendered to the creameries throughout the country by a card system of reports and by visits from inspectors. The cards are sent out to the various creameries, upon which the manager or butter maker is requested to fill in certain information and in return is promised that this office will review the card and advise him whether or not the creamery is being handled in the most economical manner. In compiling this information for the Dairy Division the creamery manager incidentally gets hold of the exact information that he needs for his own use. One hundred and forty-six creameries have been helped in this way during the past year, and it is estimated that at least $80,000 have been saved to these creameries.

The returns received periodically from the creameries show that there is a great lack of uniformity in the results produced by the small creameries. For example, one creamery will sell more butter in proportion to the butter fat received than another creamery. Many creameries do not keep accurate records of the amount of butter fat bought and the amount of butter sold, or make tests to determine the losses in the different processes of manufacture. This lack of systematic business method in some cases causes a loss to the creamery of thousands of dollars every year. In order to assist more thoroughly in overcoming these defects five men have been employed during the past year in the States of Iowa, Minnesota, Wisconsin, North and South Dakota, Nebraska, Kansas, Oklahoma, Montana, and California. As a result assistance has been given to 159 different creameries. The inspector, when asked to do so, visits a creamery, studies thoroughly the conditions under which it is operated, and when the difficulties are located helps to correct them, if they can be corrected. It has been estimated that the amount saved to the 159 creameries where this work was done during the past year was $245,000, or an average of approximately $1,500 for each creamery.

An investigation has shown that where the creameries ship their butter only once a week it scores on reaching the market an average of two points lower than similar butter shipped more frequently. Such creameries have been advised, therefore, to adopt a system of shipping much more frequently.

Some of the cooperative creameries are built by promoters, who charge approximately $2,000 more for a creamery than it should cost if built by the creamery company. The Dairy Division has undertaken, therefore, to supply new companies with articles of incorporation, by-laws, a list of machinery needed, blueprints for buildings, etc., and in this way has done considerable good, not only in saving the creameries this $2,000 in money but often by advising against the erection of creameries in localities where it is impossible for them to succeed.

It is important that this work should be continued and increased, as a great deal of money is lost through the ignorance with which a very great part of the creamery business is conducted.

INSPECTION OF BUTTER FOR THE NAVY.

During the latter part of 1908 there was inspected on request of the Navy Department 350,000 pounds of butter for the navy. During the spring of 1909 the manufacture of 800,000 pounds was begun, at five different points, and this butter was inspected in the usual manner.

NEW WORK.

The extensive use of farm separators at present makes the loss of fat in skim milk through their use an important consideration.

Some work has been done to determine the amount of such loss on the average farm, but this work has not progressed far enough to warrant definite conclusions.

Other subjects under consideration for future study are the consumption of fuel in creameries, the manufacture of casein, the manufacture of condensed milk, proper business methods in the operation of cheese factories, and the manufacture of ice cream at creameries.

MARKET MILK INVESTIGATIONS.

The work of this section, which deals mainly with the improvement of milk supplies, is done very largely in cooperation with state and city health departments. A representative of the division, on visiting a city that has requested assistance, first familiarizes himself thoroughly with all the local conditions that affect the handling of milk. He discusses the various phases of the situation with the city authorities. Public meetings are arranged for producers, consumers, physicians, etc., in order that all may take a part in the discussion of the work that is being planned. The division representative frequently spends several days with the dairy inspectors, giving them assistance in scoring dairies, that they may become familiar with the use of the score-card system. This system of dairy inspection has been adopted in 64 cities where Dairy Division employees have worked during the year. The number using the score card previously was 61, making a total of 125 cities that have now adopted the system. In addition, 165 other cities have been given assistance through correspondence or visits, making a total of 290 cities, located in 39 States, that have been assisted by the Dairy Division. A summary of the score-card work shows that to date 29,970 dairies have been rated by means of the card, the average score being 52 per cent.

A few facts that indicate the advantage of the score card are here given:

At Syracuse, N. Y., 312 dairies during 1907–8 averaged a score of 51.4. During the following year, 380 dairies averaged 68, an increase of 32 per cent in the rating.

At Cleveland, Ohio, 3,758 dairies supplying milk to that city during 1907–8 scored an average of 47.9, while 5,000 dairies supplying the city in 1908–9 made an average score of 58, showing an improvement of 21 per cent.

The 250 dairies supplying milk to Memphis, Tenn., averaged 50 in 1907–8, and in 1909 they scored 60, an increase of 20 per cent.

Of the dairies supplying milk to Nashville, Tenn., 160 in 1907–8 scored an average of 62.5, and 183 in 1908–9 scored an average of 70.9, an increase of 13 per cent.

In Richmond, Va., 108 dairies supplying that city made an average score in 1907 of 41.5; in 1908 they averaged 74; a gain of 78 per cent.

Ten cities, containing over 5,000 dairies, that have been scoring these dairies for the past two years and furnishing the results to this office reported an average score for 1907–8 of 49.03. The average score one year later, 1908–9, was 59.20. This shows an average gain of 10.17 points, or 20.7 per cent.

These data bring out two very important facts: First, that the average score of dairies is very low, and, second, that this low standing can be quickly raised by the use of the score-card system. This system is very highly commended by health officers who have used it.

During the year 110 public lectures have been made by the workers in the market-milk section, and it has been necessary to refuse a number of applications owing to lack of sufficient help. Assistance has been given in 3 city, 8 state, and 2 national milk exhibitions, in which there were a total number of 438 entries, and in 3 dairy-farm contests with 145 entries.

Investigations have been in progress at Round Hill, Va., during the past year with regard to the following subjects: Contamination caused by dust in the air of the dairy house; the number of bacteria in milk cans when returned from dealer; the effect of sunning milk cans; the efficiency of cooling by means of the cooling vat, tubular cooler, and conical cooler; a bacteriological comparison of the open-pail method of milking with that of the adjustable can. The results of this work indicate the advantage of milking directly into the milk can by means of a funnel attachment. A combination milk pail, shipping can, strainer, and stool was devised by Dr. Lee H. Maynard, of the Dairy Division, and used in these experiments. This device has been described in an article appearing in the Twenty-fifth Annual Report of the Bureau. The Department has applied for a patent so that the apparatus may be used by any person in the United States free of royalty.

RENOVATED-BUTTER INSPECTION.

The work of inspecting renovated or "process" butter and the factories where it is produced is in charge of Maj. M. W. Lang, with headquarters in Chicago. The supervision of this product is carried on in accordance with the act of Congress of May 9, 1902. During the past fiscal year 43 renovated-butter factories were in operation, located in 13 States, practically all, however, being in the Middle West. The total volume of this trade for the past fiscal year showed some diminution when compared with the previous year. The total quantity manufactured last year was 47,432,276 pounds, a decrease of 3,225,882 pounds. There was a corresponding falling off in the export trade also, the total of which was 1,115,288 pounds, a decrease of 156,322 pounds. The total number of inspections of factories for the year was 144. The number of samples tested for moisture was 228, of which 193 were found below the standard of 16 per cent.

A STUDY OF SURRA FOUND IN AN IMPORTATION OF CATTLE, FOLLOWED BY PROMPT ERADICATION.

By JOHN R. MOHLER, V. M. D., *Chief of the Pathological Division*,

AND

WILLIAM THOMPSON, M. D. C., *Veterinary Inspector*.

PRELIMINARY REMARKS.

About thirty years ago a number of the so-called Brahman cattle of India were introduced into southern Texas by A. H. Pierce, a stockman of Pierce, Tex. These animals were crossed with our domestic cattle, and the resulting influence on the herds was markedly apparent. One of the most interesting observations was that their progeny remained relatively free from ticks while other stock in the same pastures would be literally covered with these pests. The cattle ticks are present in such enormous quantities in this section of Texas as to make cattle raising much less profitable than it should be. This is due not so much to the fact that these ticks carry the Texas-fever micro-organism as to their great blood-sucking powers as external parasites. The Brahman grade cattle appear likewise to be less affected by other parasites and pestiferous insects such as mosquitoes, hornflies, gadflies, etc., and to withstand better the warm, dry climate and other semitropical conditions present in the gulf coast section of the United States than do the native cattle. Since this first importation by Mr. Pierce the Indian strain of blood has gradually deteriorated, and after his death one of the executors of the estate, Mr. A. P. Borden, requested a permit from this Department to make a further importation of Indian cattle for the Pierce ranch with the view of restoring this strain of blood.

It was claimed that the cattle on the ranch which had some Brahman blood in them were as a rule in good flesh, while the native cattle were in poor flesh and had to be fed in winter. They were likewise found to be less subject to the prevalent diseases of this section. However, while it is evident that Brahman cattle have their usefulness in semiarid localities, it is not believed that they will ever be considered important factors in our live-stock industry, for reasons that will appear elsewhere in this article.

In consequence of Mr. Borden's representations and his desire to introduce other cattle from India in order that the breed might be replenished and continued in Texas, the Secretary of Agriculture consented to allow him to make an importation from that country.

HISTORY OF THE IMPORTATION.

Appreciating the great danger to our live stock connected with the bringing of animals from India, on account of the very dangerous contagious diseases which prevail there and their general dissemination, the Department required the strictest possible precautions to prevent the introduction of any of these contagions. Dr. William Thompson, a veterinary inspector of this Bureau, who had served two years in the veterinary service of the Philippine Islands, was detailed to go to India to inspect the animals before purchase, to inquire into the history of the cattle as far as possible, and to accompany them on the steamer to the United States, his expenses being paid by Mr. Borden. Full and complete instructions were given both for microscopic examinations and for animal inoculations of the blood of these cattle, and strict orders were furnished to use the utmost vigilance in making inspections, and to accept no animals from any infected locality. Furthermore, it was stipulated that in case any infectious disease should be discovered after the animals had been collected for shipment the entire number should be considered as exposed and rejected. On this side a special isolated place for their quarantine was provided, and arrangements were made to transfer the cattle on arrival from the steamer to a barge by which they were to be transported to Simonsons Island, adjoining Staten Island, where they were to be kept in special quarantine for an indefinite period. This island is located on the Fresh Kills, a tributary of Staten Island Sound, about a mile from New Jersey, and separated from Staten Island by wide salt marshes subject to tidal overflow, so that the cattle would not touch the mainland until released from quarantine.

On March 31, 1906, Doctor Thompson and Mr. Borden met at Bombay and proceeded to Miraji, where 22 very fine bulls of the Krishna Valley breed were purchased. This section was reported to be free from rinderpest, surra, contagious pleuro-pneumonia, foot-and-mouth disease, and all other contagions. These cattle, in order to prevent their exposure on the way, were shipped in clean and disinfected cars to the government agricultural farm at Poona, where arrangements had been made to isolate the animals until ready for shipment from Bombay. Other purchases were made at Ahmadabad, where 9 head of range bulls of the Gugjurat breed were obtained, while 6 others of the Nellore breed were secured from Madras. The remainder of the importation, which altogether included 46 bulls, 2 cows, 1 heifer, and 2 calves, of seven different breeds, were selected in lots of one and two at various points along the route and then shipped to the Poona agricultural farm.

At Poona microscopic examinations of the blood for trypanosoma were made on two different occasions, as it was impossible to do so prior to purchase owing to the prejudice of the Hindus. On account of the reported existence of rinderpest in other parts of West India it was considered advisable to inoculate all the animals with anti-rinderpest serum, and this work was carried out in order to guard against any unforeseen exposure during loading or detention in Bombay, or from feed and forage. From Poona the cattle were shipped in disinfected cars to Bombay, where they were conveyed by means of a loading chute directly from the cars to the steamer. Unfortunately, it was impossible to obtain rabbits for inoculation purposes in Bombay, nor could nose rings be purchased, and for these reasons no animal inoculations were made until the cattle reached the United States.

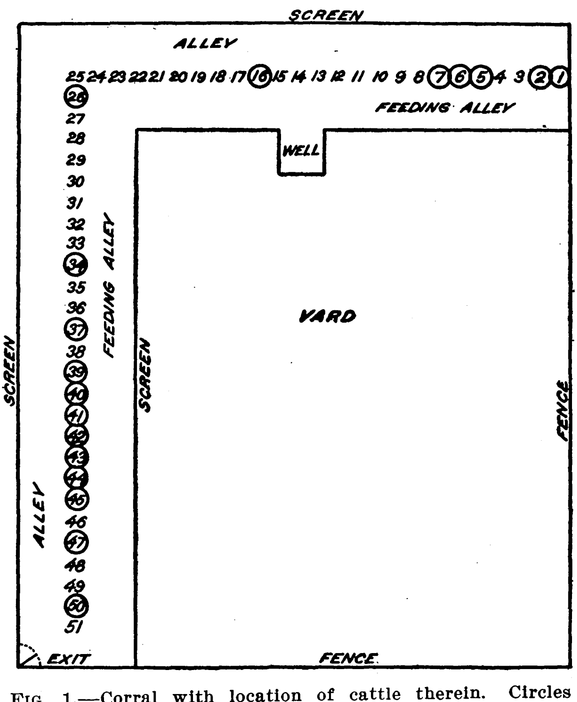


Fig. 1.—Corral with location of cattle therein. Circles around numbers indicate those animals which harbored the surra trypanosome.

No indication of any disease being apparent in the cattle, and the history regarding the presence of any infectious disease in their places of origin being negative, the animals were shipped from Bombay on April 27 for Hamburg, where they were transshipped on June 2, arriving in port at New York on June 16, 1906, seven weeks after their departure from Bombay. They were transferred from the Hamburg-American steamer directly to a large barge by means of a cage and derrick, being hoisted from the steamer and lowered directly to the barge deck. The barge was then towed to Simonsons Island, which had already been prepared for the purposes of quarantine. A corral 100 feet square, constructed with 6 by 6 inch posts and 2 by 6 inch rails, had been erected with uprights joined to support a tarpaulin, which was used as a shelter from the sun and the rain. The 51 head of cattle were placed side by side on the east and south sides of this inclosure, as shown in figure 1. The cattle were stabled without accident, and appeared to be in very good condition on physical examination. As the regulations of the Department provided for the tuberculin testing of all bovines imported into the United States, the cattle were subjected to this test as soon as they had thoroughly recovered from their sea voyage (June 29 and 30), but in no instance was any reaction obtained.

PREVIOUS IMPORTATIONS.

Brahman cattle were probably first introduced into the United States in 1849 by Dr. J. B. Davis, of South Carolina. Some additional importations for agricultural purposes followed, but such shipments were stopped in 1884 on the promulgation of an order of the Department of Agriculture issued under the act of Congress prohibiting importations of cattle from abroad without first obtaining a permit from the Department. After that time, until the Borden importation of 1906, no permits were granted to import Brahman cattle except for zoological gardens and menageries.

THE CHARACTERISTICS OF INDIAN CATTLE.

It will probably be of interest to mention briefly a few characteristics of this breed of cattle (*Bos indicus*), described in works on natural history as zebus and popularly known as Brahmans, or the sacred cattle of India. It is not uncommon to observe these animals in zoological gardens and circuses, but the majority of the sacred cattle on exhibition are of the smaller breeds, weighing about 250 pounds and standing not higher than 3 feet. On the other hand, the types of Indian cattle selected for this importation were of the larger breeds, standing as high as 6 feet and weighing up to 1,860 pounds. They are distinguished from our native cattle principally by the loose fold of skin at the navel, an immense hump on the withers, long, pendulous ears, large and loosely hanging dewlap, and an excessive fullness of the throttle. There is a more lengthened form of the head, with a concave line of profile, a mild, sleepy eye with a look of latent power frequently displayed, arched neck, and long, tapering legs. The horns are dark, short, but thick at the base, and point upward and backward; the hips are narrow, and the rump slopes rapidly from the sacrum to the tail. (See Pl. I.)

The sebum secreted by the sebaceous glands of the skin has a peculiar odor which seems to be repugnant to insect life. The hide, while it may be as thin as in our domestic animals, still appears to be much tougher and is more difficult to penetrate with a hypodermic needle. The hair is quite short and does not provide favorable shelter for the development of ticks. These three factors are probably responsible for the slight amount of tick molestation which these animals experience.

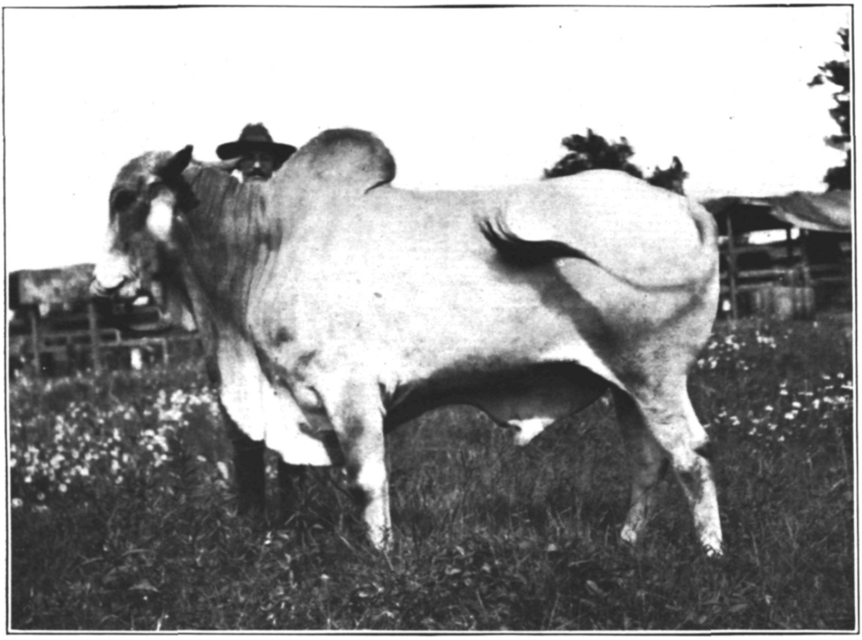


FIG. 1.—A ZEBU BULL OF THE BORDEN IMPORTATION, IN QUARANTINE.

FIG. 2.—TWO ZEBU CALVES OF THE BORDEN IMPORTATION, IN QUARANTINE.

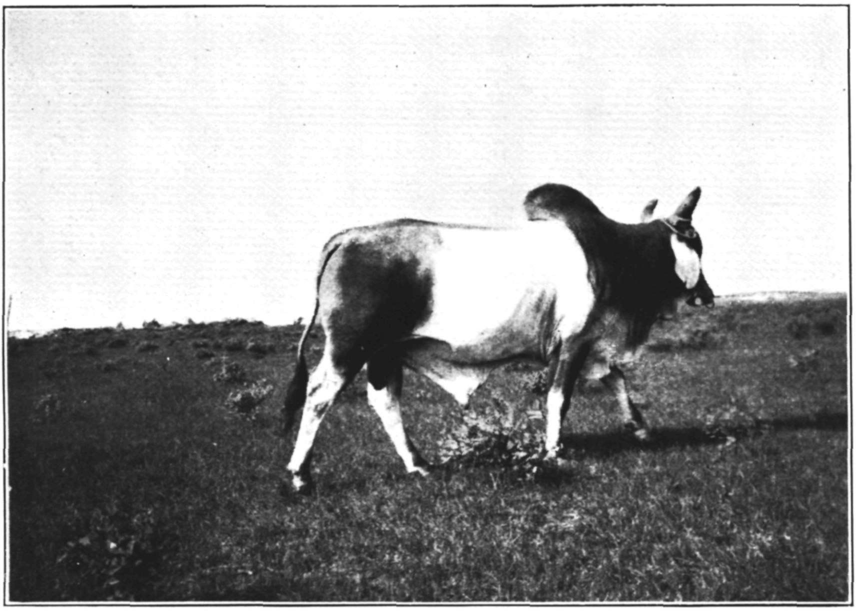


FIG. 1.—A ZEBU BULL OF THE BORDEN IMPORTATION, ON THE RANCH IN TEXAS.

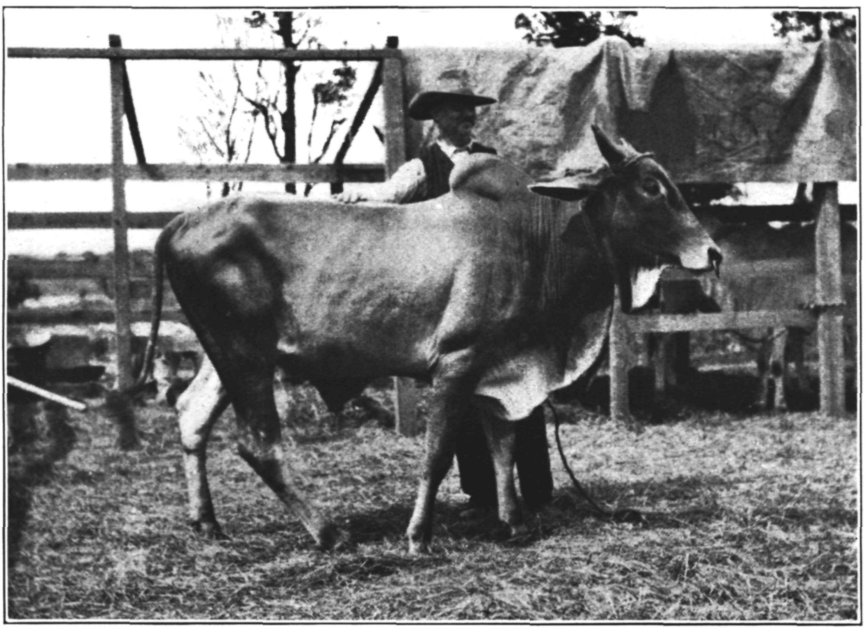
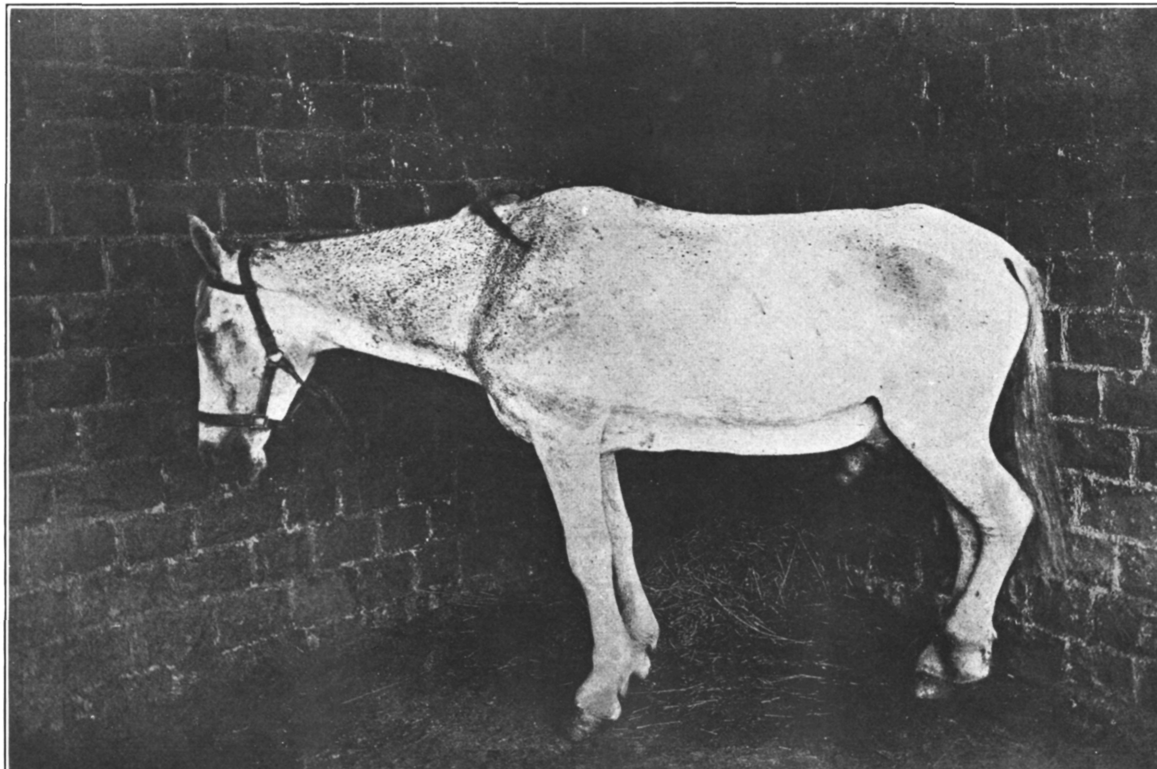


FIG. 2.—A ZEBU BULL WHOSE BLOOD WAS FOUND TO BE INFECTED WITH THE TRYPANOSOME OF SURRA.



Horse, Showing Swollen and Edematous Condition of Extremities, Sheath, and Under Surface of Abdomen, on Nineteenth Day of the Disease. (After Lingard.)

The color of the Brahman cattle is chiefly light silver gray, with dark shadings of the fore and hind quarters. (See Pl. II, fig. 1.) However, the color varies much according to the breed, some being red, while others are white, and the albino bulls constitute the so-called sacred bulls of India, which play a very important part in certain religious festivals. Among the Hindus the zebu is believed to have a charmed life. They venerate this animal and hold its slaughter to be a sin, though they have no scruples about working it. While the Brahmans are classed as a distinct species, they cross readily with our domestic animals. In India these animals are not only reared for milk and flesh, but are also extensively employed as beasts of burden. They are likewise used for both riding and driving, having great powers of endurance. The hump is considered the most delicate part of the carcass for food, and is usually prepared in pickle, like tongue. The cows sometimes yield a fair amount of milk, but it is low in butterfat.

APPEARANCE OF SURRA IN THE UNITED STATES.

Despite the fact that the blood of all the Indian cattle in the Borden importation had been examined microscopically on two occasions at Poona, and twice again during the ocean voyage en route to New York, with negative results, it was deemed advisable and a necessary precaution to make the more exacting test of rabbit inoculations before accepting the cattle as free from the surra parasite.

With this end in view a sufficient number of rabbits were taken to Simonsons Island and one rabbit was inoculated with the blood from each animal. Cover-glass preparations were likewise made at the same time for examination of the fresh, unstained specimens. These blood inoculations were commenced on July 5 and 6 by the inoculation of 49 rabbits with the blood of adult cattle, the two calves not being tested at this time.

The method of taking the blood and injecting the rabbits for this and all subsequent tests was as follows: Each zebu was secured by a nose ring or halter to a head rail, the hair on the margin of the left ear clipped, and the tissue toward the tip of the lower margin washed and disinfected with carbolized water, dried, and the ear then whipped by the hand to render the blood vessels turgid. A small vessel near the margin was then nicked with the point of a knife and 5 to 8 c. c. of blood obtained in sterile bottles, each containing a sufficient quantity of potassium citrate solution to prevent clotting. When necessary the hemorrhage was arrested by the use of a figure-8 suture after sufficient blood had been obtained. After each operation the knife and hands of the operator were washed in a 5 per cent solution of carbolic acid. Identification cards were made out for each rabbit, to which a number was given corresponding to the number of the animal from which the blood was taken, and 2 c. c. of this blood was injected subcutaneously into the rabbit on the inner side of the thigh. The syringe used for this purpose was disinfected after each injection with 5 per cent carbolic acid and then rinsed with sterile water.

A few days later the temperatures of the rabbits were taken. Following the first inoculation tests, rabbits Nos. 16, 39, and 42 showed a marked rise. The blood of each rabbit was then examined microscopically, and the *Trypanosoma evansi*, the causative agent of surra, was demonstrated on the ninth day in rabbit No. 16, and on the tenth day in rabbits Nos. 39 and 42. (See fig. 2.)

It is our opinion, which appears to be confirmed by the following notes, that in all probability there were only these three infected zebus at the time of the arrival of the cattle in quarantine, and that the others became subsequently infected by means of the plague of flies present that summer in the vicinity of Staten Island.

The seriousness of the appearance of surra in the United States being apparent to all interested parties, the question of preventing the landing of any of the cattle was carefully considered, with the result that it was finally decided to kill and burn all the infected cattle and to make repeated blood tests of the remaining animals under proper precautions until it was absolutely proven that the infection had been entirely eradicated. As the importer, Mr. Borden, was at that time in Texas, a delay of several days was occasioned awaiting his arrival, but the killing and burning of the three infected cattle was accomplished on July 20.

THE CAUSATIVE AGENT OF SURRA.

It has been definitely shown by numerous experimental observations that surra is caused by the presence of the *Trypanosoma evansi* in the blood. This fact was first reported by Dr. Griffith Evans in 1880, and since then has been confirmed by many other investigators. The parasite is a flagellate protozoan 20 to 30 μ long, 1 to 2 μ broad, and approximately spindle-shaped in outline. (See fig. 2.) Each organism has a somewhat pointed posterior extremity, while the anterior extremity narrows into a long, wavy flagellum. The organism moves, as a rule, with the flagellum end forward, owing to the rapid lashing of this whip-like extremity and by the contractions and relaxations of the body. The micronucleus or blepharoplast or centrosome is prominently located near the posterior end and is connected with the flagellum by a distinct line passing along the free border of the undulating membrane, which is along one side of the parasite like a fin. The nucleus is near the anterior end. Multiplication takes place by longitudinal division only, the centrosome being the first to begin dividing. The division of the nucleus follows, as a rule, the flagellum remaining attached to one of the resulting halves, while a new flagellum develops on the other half.

The parasite is transmissible from infected to healthy animals by biting flies, and perhaps by other agencies. Owing to its large size and active motility it is readily detected in a film of fresh unstained blood with the low-power lens of the microscope. At first there is noticed an intermittent and characteristic agitation of some of the red cells, and upon focusing in the vicinity of this motion there will soon emerge to view a minute, eel-like organism two or three times as long as the diameter of the red cell, actively moving between the blood cells. It appears in the blood in swarms, so that the examination of the blood at one time may give negative results, while a similar examination made earlier or later may give positive results. The organism, however, is invariably found during the paroxysms of the disease in both experimentally and naturally acquired surra. When such blood is filtered through bougies the filtrate is not pathogenic, proving that the trypanosome is withheld by the filter.

FIG. 2.—*Trypanosoma evansi,* the cause of surra. (From Zebu No. 44.)

The disease may likewise be transmitted from one susceptible animal to another through a long series, and in each instance the trypanosome may be observed during the febrile attack by microscopic examination. Even during the intermission when the blood appears to be entirely free of the trypanosomes the inoculation of rabbits will, as a rule, result in the production of the disease. All attempts that have been made in the laboratory of the Pathological Division to cultivate the organism on the blood-agar medium of Novy, as well as by other methods, have been without result, although the cultivation of certain other species of trypanosome (*T. lewisi* and *T. equiperdum*) has been accomplished.

The exact method by which these parasites interfere with the health of the infected animals has not as yet been established.

NATURE OF THE DISEASE.

The term " surra " was given to this disease by the natives of India, and was adopted by Evans, Lingard, and others on account of its appropriateness. The word " surra," by which the disease has since been universally known, was used by the natives to describe anything withered or rotten, such as a decayed carcass. They applied the term loosely to all those chronic ailments of a devitalizing character which had no specific designations. The name was thus very comprehensive, and was applied to this specific disease of animals because there is a marked withering or falling off in condition without sufficient post-mortem lesions to account for it. It is a disease of the Far East, and has prevailed in certain sections of India for generations. It has been reported from the Persian Gulf, Korea, Egypt, Syria, Algeria, Zululand, Java, Borneo, Madagascar, Mauritius, Burma, China, the Philippine Islands, and other places.

Surra is a specific, communicable febrile disease occurring in horses, mules, asses, camels, elephants, dogs, and rats, and capable of being transmitted by inoculation to cattle, buffalo, sheep, goats, rabbits, guinea pigs, and monkeys. It is due to the presence of a specific flagellate parasite in the blood, the *Trypanosoma evansi*, named after its discoverer. The fever is of an intermittent, remittent, and sometimes relapsing type, and continues for varying periods from a few days to months, depending upon the animal attacked and its physical condition at the time. In solipeds the disease generally assumes an acute type and causes death in a relatively short time, while in camels the disease is of a chronic type and the animal may live for months or even years, frequently recovering if the disease lasts for three years. The blood of cattle may swarm with the trypanosome without apparent harm, although the animals may become very thin and anemic for a time, after which they, as a rule, recover, though they occasionally die. The great danger from infected cattle, however, is in the possibility of the infection being carried from the apparently healthy cattle to the highly susceptible horse, mule, or ass by flies or otherwise. The period of incubation is usually about six to eight days after the exposure, although the disease may develop in from two to seventy-five days.

All available evidence seems to indicate that the most common method of transferring the trypanosome of surra from infected to uninfected animals is by means of insects, particularly the biting flies. Infection may likewise take place through an abraded wound on the body becoming contaminated with infectious blood. Thus dogs and cats with abrasions of the mucous membrane of the digestive tract may contract the disease by eating the flesh of horses which have died of surra. Saddle galls, summer sores, and similar lesions on otherwise healthy horses may likewise become infected by birds and insects which peck or feed on them after having previously soiled their beaks or probosces on infected animals or carcasses. Drinking stagnant water and eating grass or other forage grown on recently inundated land are popularly regarded as being methods of infection with surra, but the experimental proof to support such opinions is lacking. Stiles has probably given the correct interpretation of this theory by drawing attention to the fact that biting flies are generally numerous around inundated pastures and stagnant water, and therefore a great number of possible transmitting agents of the disease are in these localities.

In the outbreak of surra here recorded it was quite definitely proved that the infectious principle was carried from animal to animal by the large breeze fly, *Tabanus atratus*, and by no other species of fly or other kind of insect; nor did contact exposure, the use of the same drinking buckets, etc., play any part in the spread of the infection.

According to Lingard,[a] the chief symptoms in the horse are an intermittent, remittent, and sometimes a relapsing type of fever which continues for a varying period from a few days to several months. Closely following the first rise in temperature there is the occasional appearance of urticarial eruption, which may make its appearance at any time during the course of the disease. Then follows the presence of petechiæ on the mucous membranes, chiefly those covering the membrana nictitans; also nasal, ophthalmic, vaginal, and other mucous discharges, and the exudation of a yellow semigelatinous material in the subcutaneous and other connective tissues, especially of the legs, breast, and abdomen. (See Pl. III.) There is rapidly advancing anemia, emaciation, and great debility, although in the large majority of cases the appetite remains good throughout, no matter how high the fever may be. There is extreme pallor of the visible mucous membranes, followed at a later period by a yellow tinge. From first to last there is a progressive wasting.

The blood at first presents a normal character, but after a varying period of time undergoes marked changes. The white corpuscles are increased in number, while the red cells usually cease to form normal rouleaus, lose their individuality, and run together, forming irregular masses which are first of a dark appearance but gradually become pale owing to the loss of coloring matter as the disease advances.

The presence of the flagellate is not continuous during the whole course of the disease. At first it is usually found in small numbers in the blood, but it increases with greater or less rapidity until, having attained a maximum, it disappears either gradually or suddenly, to

[a] Lingard, Alfred. Report on horse surra. Bombay, 1893.

reappear after an interval. The periods during which it may be observed in the blood by microscopic examination are marked by extreme irregularity, varying from one to six days, though the latter number is very unusual.

The disease is invariably fatal in horses, death usually being due to exhaustion, but sometimes to concurrent complications. After death no specific lesion is present, but as a rule there are small subpleural, subendocardial, and subperitoneal extravasations, together with enlargement of the liver and spleen. If death takes place during a paroxysm the hematozoan will be found for a certain time in the blood. (See Lingard, 1893, pp. 1–2.) There is also an edematous exudate into the cellular tissues of the legs and abdomen, and the lymph glands are edematous and enlarged. The kidneys are congested and edematous or the seat of blood extravasation. Gastric ulcers have been noted preceded by capillary embolism and congestion.

In cattle affected with this disease the trypanosomes are frequently found in the blood before the animals show outward symptoms. (See Pl. II, fig. 2.) During this time, however, they serve as a means of spreading the disease. It is interesting to notice that in cattle the affection, unlike the affection in solipeds, is relatively benign, and many cattle, after having the disease for a time, recover. The first noticeable symptom is dullness followed by progressive emaciation with slight temperature variations. Under the breast and abdomen may be noted occasional areas of edema, accompanied by mucopurulent inflammation of the conjunctiva, cornea, and nasal mucosa. Lingard has stated that, although during the paroxysms of the disease the blood of the bovine species teems with the hematozoan, and their bodies become extremely emaciated, nevertheless the cattle usually recover from an attack and in time put on flesh and appear in robust health.[a]

However, cattle seem to vary in susceptibility to the fatal effects of surra in different countries. For instance, when surra was introduced into the Island of Mauritius in 1901 by an importation of Indian cattle, 70 to 80 per cent of the native cattle, it is said, later succumbed to the disease. It must be remembered that in tropical countries the transmitting agencies are present to some extent all the year round, the disease being spread more actively during the rainy season, owing to the larger number of flies present and to the humid state of the atmosphere, which favors greater dissemination.

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[a] For a detailed account of surra the reader is referred to Bureau of Animal Industry Bulletin 42, or to the same article in the Eighteenth Annual Report of the Bureau, entitled "An emergency report on surra."

PROMPT ERADICATION OF THE DISEASE.

As the decision had been made to destroy only those cattle of the Borden importation which harbored the trypanosome of surra, the first step taken after the killing and burning of the three infected zebus was to protect the remaining cattle from the biting flies and mosquitoes which swarmed around the corral in countless numbers. Therefore on July 24 was commenced the flooring and screening of that portion of the corral occupied by the cattle, and this work was accomplished July 27.

While the inclosure was being screened the cattle were necessarily removed from their original positions and placed temporarily in the open along the north and west sides of the corral. On completion of the screening of the south and east sides of the corral an abundant supply of sticky and poisonous fly paper was spread about within the inclosure, and very shortly all the *Tabanus atratus* were caught or destroyed, along with large numbers of the other Tabanidæ and *Stomoxys calcitrans*, one of the Muscidæ. However, a considerable number of the latter species and a few *T. lineola* and *T. costalis* still remained, and it seemed impossible to eliminate them by this temporary screening.

The second series of inoculations was made on July 31, the results of which were anxiously awaited, as upon the outcome depended the fate of the entire herd. The hope was entertained that if the Tabanidæ were solely responsible for the spread of the infection (which dissemination was expected under the circumstances), there were prospects of saving some of these valuable animals brought at great risk and expense 10,000 miles over the seas. On the other hand, should the other species of flies, which were far more numerous and very difficult to eliminate, be found to be active disseminators of the disease, the hopes of saving even one animal would have to be abandoned. On the expiration of this test, which gave seven reactions (Nos. 48, 1, 2, 50, 34, 41, and 44), it was decided that it was possible eventually to save part of the herd by placing each animal in an individual fly-proof stall, and by eliminating the infected cattle by blood inoculations of rabbits. After this second test it seemed plausible to consider that only the Tabanidæ—and probably only the *Tabanus atratus*—were responsible for the spread of the infection, and that the disease would be eradicated with the elimination of those animals which had been infected by these flies previous to July 27, when this *Tabanus* was effectually excluded as a factor in the conveyance of the infection.

A specially constructed fly-proof stable containing individual fly-proof box stalls was therefore erected for the purpose of eliminating all kinds of flies, and especially the stable fly, *Stomoxys calcitrans*, considered by some authorities as being capable of transmitting trypanosomal infections. This stable was completed on August 15, by working three shifts of carpenters, and during its construction the third (August 6) and fourth (August 11) tests had been made, resulting in the reaction of four animals in each test.

The appended table shows the positive results of the blood inoculations.

Positive reactions of rabbits to surra, following inoculations with blood of zebus.

Date of inoculation.	No. of animal.	Date of diagnosis.	Period of incubation.
First test, July 5 and 6	39	July 15	Ninth day.
	42	July 16	Tenth day.
	16	...do....	Do.
Second test, July 31	43	Aug. 6	Sixth day.
	1	Aug. 7	Seventh day.
	2	...do....	Do.
	50	...do....	Do.
	34	Aug. 9	Ninth day.
	41	...do....	Do.
	44	...do....	Do.
Third test, August 6[a]	26	Aug. 11	Fifth day.
	40	Aug. 12	Sixth day.
	6	...do....	Do.
	47	Aug. 15	Ninth day.
Fourth test, August 11[b]	45	...do....	Fourth day.
	5	Aug. 16	Fifth day.
	37	Aug. 18	Seventh day.
	7	Aug. 20	Ninth day.

[a] In addition to those recorded in this test, Nos. 1, 43, and 44 repeated their reactions of the second test, while rabbit No. 50 died before trypanosomes were found. Nos 2, 34, and 41 did not repeat in the third test.

[b] Besides these original reactions in the fourth test, Nos. 6, 26, and 47 of the preceding test repeated, while rabbit No. 40 died on August 22 without showing any trypanosomes. These unintentional retests occurred in the third and fourth series owing to the inoculations being made so close together that the rabbits in the preceding test had not time to react before the next series was injected.

The cattle shown to be infected with surra by these reactions in the inoculated rabbits were destroyed immediately upon the recognition of the trypanosome in the rabbits' blood. Owing to heavy rains several of the cattle were buried instead of burned, their bodies being destroyed by covering with unslaked lime and pure sulphuric acid, but in no instance was a post-mortem examination permitted, on account of the danger of disseminating the infection.

On August 15 the remaining cattle were removed from the screened corral and placed in the individual fly-proof box stalls within the fly-proof stable already mentioned. No further inoculations were made until August 31; a test made then, and subsequent inoculations made September 7, 13, and 20, and October 10, 19, and 24, proved negative in every case. On September 7 rabbit No. 48 exhibited a pseudo reaction, due, as was demonstrated later, to an intercurrent disease.

In the inoculations confirmatory tests were not made prior to August 15, owing to the danger involved in keeping the infected cattle alive; but it was noted that several cattle—for instance Nos. 2, 34, and 41—failed to repeat in giving reactions on the subsequent unintentional retest. These retests occurred in several instances where two series of inoculations were made so close together that the rabbits in the first test had not time to react before the next series was injected.

During the quarantine no reliance was placed upon the microscopic examination of blood smears made direct from the cattle, but it will be interesting to note that in two cattle numerous trypanosomes were observed by this method of examination. As the disease spread, the average period of incubation in the rabbits was shortened, and those rabbits which were not immediately killed upon reacting soon succumbed to the infection. Guinea pigs were also used in some of the tests, but proved unsatisfactory as compared to rabbits.

In view of the fact that the last seven series of tests were successively negative, and as killing frosts had already occurred, resulting in the disappearance of all flies and mosquitoes, it was recommended that the remaining cattle, 33 in number, be released from quarantine. On November 14, 1906, the Secretary of Agriculture issued a permit to that end, and the cattle proceeded directly to their destination in Texas.

RABBIT EXPERIMENTS WITH INFECTED BLOOD.

From this importation of surra much was learned of the character of the disease and of the remarkable periodical development of the living parasite within the blood of the affected animal. Virulent blood drawn from the affected animal and injected into a test rabbit will cause a sharp elevation of temperature after a period usually varying from four to nine days, occasionally extending to ten or eleven days, but averaging seven and a half days in our experiments. If an examination of the blood of the inoculated animal is made at the time of the acme of the fever attack, numerous wriggling and squirming organisms will be seen moving about rapidly among the blood corpuscles and manifesting their presence by an active disturbance of all corpuscles with which they come in contact. If the blood is examined daily these moving hematozoa may be found present for two, three, or four days, when they suddenly disappear, while the temperature returns to normal. Now follows a latent or quiescent period lasting for five or six days, during which the temperature of the animal remains at or near the normal point, and the animal eats as usual, only showing the effects of the parasitic invasion by a staring coat and by a slight loss of flesh and energy. At the end of the latent period the same course is repeated, and again an elevation of temperature and a return of the parasites occur, only to disappear more or less suddenly at the termination of the attack. These recurring periods of disease gradually undermine the strength and vitality of the animal until it succumbs.

Post-mortem examination of such an animal shows, first, general emaciation, together with bare denuded patches about the eyes, mouth, and nose, from which the hair has fallen. The external genitals are swollen and edematous, and more or less bare of hair. On opening the carcass it will be seen that the skin is firmly adherent to the tissues underneath; that considerable clear serous fluid has entered the peritoneal cavity; that the abdominal viscera have formed numerous fibrous attachments to the peritoneal walls; and that similar little fibers unite the various visceral organs into a more or less compact mass. The spleen will be found greatly enlarged, even to six or eight times its normal size. The liver and all of the thoracic organs will usually be found unchanged. Variously scattered over the surfaces of the abdominal walls, both internal and external, may be found small collections of the débris of degenerated red blood corpuscles, and the outer surfaces of the digestive organs within the peritoneal cavity may exhibit scattered remains of similar hemorrhages.

For experimental purposes healthy rabbits were placed in cages with rabbits that had been infected through injections of virulent blood, but no infection followed, even though they remained in close contact for thirty days, eating and drinking from the vessels used by the diseased animals.

THE RÔLE OF THE TABANIDÆ IN THE TRANSMISSION OF SURRA.

According to Lingard,[a] it appears that the cattle of India, particularly plains cattle, like the camel and water buffalo, are relatively immune to the harmful or fatal effects due to trypanosomal infection, especially to *Trypanosoma evansi.* Unlike the camel and water buffalo, however, the parasites appear less frequently in the blood of Indian cattle, and sometimes at rather long intervals, accompanied by a slight rise of temperature. Practically all authorities agree that the blood of infected animals is as a rule infectious even during the incubation period. Accepting the general applicability of the above statement, the first test on July 5 and 6 shows that there existed at that time three centers of infection, and the writers are strongly inclined to believe that on arrival of the cattle on June 18 there were not more than these three infected animals in the herd. These animals may have been infected in India prior to their purchase, or on leaving Bombay, or while the vessel was moored to the dock at Kurachi from April 29 to May 5, inclusive, where a number of camel

[a] Journal of Tropical Veterinary Science, Vol. 1, No. 1, April, 1906.

trains were in close proximity and *Tabanus tropicus* were present on the cattle while in port.

It is the consensus of opinion of practically all authorities on surra that the several species of flies implicated in the transmission of the various forms of trypanosomiasis act only as mechanical transmitters or accidental carriers of the infection, and that no part of the life cycle takes place in the body of the fly. A review of the literature on the subject tends to prove that all forms of these diseases in domestic animals, which are disseminated by flies (with possibly the sole exception of nagana), are spread chiefly if not entirely by some species of the Tabanidæ.

From the time the Indian cattle landed on Simonsons Island until the corral was screened several species of flies were present.[a] Among these the *Tabanus atratus* deserves special mention, although the *T. lineola*, *T. costalis*, and the muscid *Stomoxys calcitrans* were also noted. The former is commonly known as the black horsefly, gadfly, or breeze fly, and is widely distributed throughout the United States. As the eggs are deposited in damp or marshy places and the larvæ are semiaquatic, the vicinity of the quarantine pen was very favorable for the presence and propagation of this species.

Tabanus atratus[b] emerge as adult flies as early as May and persist until September. These large black flies were numerous and very vicious in their assaults upon the cattle, which they attacked at their most vulnerable parts, principally the hump and over the spine. As many as seven of these flies could be seen on one hump. They were most active during the late afternoon on bright days and during the entire day on dark days. The mouth parts of the female are well adapted for deep piercing, and when in the act of drawing blood they appeared to stand on their heads. When dislodged by the efforts of the animals they passed directly to the next animal, leaving, when successful, a trickling flow of blood to follow the bite. While these flies were always in evidence about the cattle up to the time of screening the corral on July 27, they were entirely excluded after that date.

The green-headed horseflies, *T. lineola* and *T. costalis*, were more numerous than *T. atratus*, but less dreaded by the cattle, and were inclined to stay upon one host, attacking any part of the body, and less frequently causing blood to flow from their bites, and then only in small quantities as compared with the *T. atratus*. These flies were not entirely eliminated from among the cattle until August 15, when the fly-proof stable was completed.

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[a] The determinations of the species were made by the authors.

[b] For notes on the habits of this and certain other North American species of Tabanidæ see Technical Series No. 12, Part II, Bureau of Entomology, U. S. Department of Agriculture, 1906, "Habits and life histories of some flies of the family Tabanidæ," by James S. Hine.

The stable fly, *Stomoxys calcitrans*, was present in swarms, biting any part of the body, more particularly the thin skin below the knee and hock joints. They left a drop or so of blood following the bites. The swampy surroundings and decaying vegetation in close proximity to the corral furnished appropriate conditions for the rapid and numerous multiplication of these stable flies. Like the two previously mentioned species, these flies were only excluded after August 15, on the completion of the new stable.

After the second series of blood inoculations it was firmly believed that the Tabanidæ, more particularly *T. atratus*, were solely responsible for the spread of the infection, and that the disease would be eradicated with the elimination of those animals which had been infected by these flies previous to July 27, when this species was effectively excluded as a factor in the conveyance of the infection. The results of the tests of August 11, which were followed by negative results in all later tests, proved this belief to be well founded. Allowing for the period of fifteen days elapsing between July 27 (when the *T. atratus* was excluded by screening the corral) and August 11 (when the last series of injections was made which gave positive results) as the longest period for the incubation of surra in the cattle after the exposure to this *Tabanus*, and for the fact that large numbers of *S. calcitrans* and a few *T. lineola* and *T. costalis* were present in the inclosure from July 27 to August 15, a period of nineteen days, it will be admitted that the last three species played a small, if any, part in the transmission of the infection. Had these flies been capable in this instance of conveying the parasite to any extent it is evident that hardly one animal would have escaped becoming infected. Final results based on the theory that *T. atratus* was solely responsible favors the opinion that the cloth screening of the corral would have been sufficient if the presence of this *Tabanus* could have been prevented. Figure 1 shows location and total number of cattle that became infected in this interesting experiment.

The evidence herein submitted indicates that the transmission of surra in this outbreak was made possible by (1) the close proximity of the infected and exposed animals, (2) the presence of a species of the Tabanidæ, acting as an intermediary bearer, and (3) the warm and humid climate which prevailed at that time.

That the season was warm and humid during the period under discussion is borne out by the meteorological summary of the New York station of the United States Weather Bureau for the days between June 18 and July 31. During this period there were but six clear days, the maximum temperature averaging 81.6° Fahrenheit, and the relative humidity being above 80 on at least twenty-four of these days. By reason of this large number of cloudy and humid days prevalent during that time, the climatic conditions were very favorable for the activity of all species of flies, and the facility with which the trypanosomal infection could be conveyed from infected to exposed animals without drying on the proboscis of the transmitting agent.

Fortunately, there was no spread of the infection outside of the original herd, because of the prompt screening and thorough isolation of the infected cattle, there being no other animals in the locality with the exception of one domestic cow and a calf kept on the premises. The latter, however, did not become infected, although they had grazed just outside of the corral and within 100 yards during the period from June 18 to July 20.

CONCLUSIONS.

1. In July, 1906, the first outbreak of surra in the United States was observed in an importation of zebus from India, and the disease was promptly eradicated by slaughtering and destroying the infected animals.

2. The causative agent of the disease is the protozoan *Trypanosoma evansi*, an eel-like organism which appears in the blood periodically in swarms. This parasite is transmissible from infected to healthy animals by biting flies, and possibly by other agencies.

3. Surra is a strictly infectious disease occurring in horses, cattle, sheep, and other animals, the transmission of which in this particular outbreak was dependent upon an intermediary agent, most probably a fly, the *Tabanus atratus*.

4. Contrary to some authorities, there exist in the United States, and probably in other temperate climes, species of Tabanidæ capable of transmitting trypanosomiasis, and which need not be the identical species implicated in the transmission of these diseases in countries where these infections are enzootic.

5. It has been definitely shown that in surra as well as in other trypanosomal infections microscopical examination of either stained or unstained blood films will not suffice in making a diagnosis, and that the only satisfactory results are obtained by animal, particularly rabbit, inoculations.

6. Relative to further importations into the United States of any class of susceptible animals from surra-infected countries for agricultural purposes or for menageries or zoological gardens, the experience gained in this outbreak indicates that it would be imprudent to import such possibly infected animals without testing each individual, either before or after arrival, by blood inoculations of susceptible small animals, preferably rabbits.

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7. It will at once be evident that the spread of such a disease as surra over the country would quickly lead to great destruction of live stock and to great financial loss. To prevent these losses the best efforts of this Bureau have been exerted and the disease has been rigidly controlled and promptly eradicated.

COW-TESTING ASSOCIATIONS.

By HELMER RABILD,
In charge of Dairy Farming Investigations, Dairy Division.

COW-TESTING ASSOCIATIONS IN EUROPE.

ORIGIN.

The cow-testing movement in connection with dairying originated in Denmark and was a direct result of necessity. That little country during the latter part of the nineteenth century passed through a financial crisis, the result of which was a reorganization of agricultural activity. Destructive and expensive wars had drained the resources of the country and increased the national debt, and the farmer, upon whom fell the burden of taxation, was forced to follow that system of agriculture which promised the highest possible returns. Beef production had become unprofitable by reason of increased land values and discrimination in foreign markets. The good standing of Danish butter and the prices paid for it on the English market gave promise that dairying, if properly developed, might furnish a good source of revenue, and this industry, which previously had been carried on in an indifferent way, began to assume greater importance. It received a great stimulus by the organization of a few cooperative creameries, the first of which was organized in the year 1882. The cows on the farms had not been selected for dairy purposes, the average production of butter per cow in 1884 being only 112 pounds a year, and the farmer soon learned that more productive cows were an absolute necessity if he would derive any profit from the business. Some importations of dairy cattle of foreign breeds were made. These importations, however, brought in many cases disappointment and loss and were soon discontinued, and the farmers began, by studying the individuality of their native cows, to breed a strain of cattle which were especially suited for dairy purposes.

The cow-testing movement began in 1892, when State Counselor B. Bøggild, at a meeting of the Kildebrønd Creamery patrons in July of that year, explained how records of the individual performances of the cows could be obtained, and the result was that 14 farmers agreed to weigh the milk from each cow and send samples of it to the creamery. The creamery manager, Mr. Hansen, determined its richness by the Fjord centrifugal cream tester and published the record of the milk and butter yield from each cow, as well as the feed consumed. Shortly thereafter, and as a result of this, those men who had kept records formed the Kildebrønd Bull Association, with the object of improving their herds.

State Counselor Frederik Hansen, a dairy expert employed by the Government and the owner of a dairy farm, had for several years studied the richness of the milk of individual cows by occasionally taking samples to the creamery for testing, and he had begun weeding out the animals in his herd which gave poor milk, thereby increasing the richness of the herd's milk. His neighbors who sent milk to the same creamery, noticing the increase in richness of the milk from his herd, began to inquire into the cause of it, and when sufficient interest had developed Mrs. Hansen, his wife, suggested that an association be formed in the neighborhood for the purpose of investigating the richness of the milk of individual cows and the economy of their production, so that each member of this association might obtain the same benefit that Mr. Hansen had derived from such investigations.

A meeting was called for this purpose January 23, 1895, on the farm of Søren Peter Knudsen, at Lille Skovgaard, Vejen, and the first cooperative cow-testing association was organized. A dairy expert was employed to make examination of the richness of the milk with the Gerber butyrometer and keep the milk and feed records. Active operations began May 1, 1895, with 13 members, and so satisfactory have been the results that the association now numbers 24 members, with 522 cows, and employs 2 men as cow testers.

GROWTH OF THE MOVEMENT.

Another association was organized later during the same year, and since then the movement has grown wonderfully. From Denmark it has spread to other European countries.

The following table shows the growth of the cow-testing movement in Europe. The figures given show the number of associations in the various countries, by years:

Number of cow-testing associations annually in operation in European countries, 1895 to 1909.

Year.	Denmark.	Germany.	Sweden.	Norway.	Finland.	Holland.	Russia.	Scotland.
1895	2							
1896	15							
1897	30	1						
1898	88	2	1	2				
1899	170	3	8	6	1			
1900	219	4	28	19	2			
1901	260	9	71	60	3			
1902	307	18	136	108	4			
1903	362	29	188	137	7		[a] 1	4
1904	415	63	270	145	11	[b] 36	(a)	1
1905	448	63	333	139	17		(a)	2
1906	479	63	413	142	38		(a)	5
1907	479	63	486	145	64	86	(a)	7
1908	508	207	593	146	83	(c)	(a)	13
1909	530	207	662	146	99	(c)	[d] 52	13

[a] Organization in Russia began in 1903; number of associations organized subsequently is not known.
[b] Number organized up to 1904.
[c] The development of these associations has continued, but figures are not available.
[d] Approximate number in existence.

PURPOSE AND PLAN OF THE ASSOCIATIONS.

The primary purpose of the cow-testing movement was to obtain records of the yearly production of milk and butter from each individual cow in the herds of the members, and with these data as a basis, by the selection of the best producing cows for breeding purposes, to develop a strain of cows which would produce a large quantity of rich milk in butterfat. Later it was found that to judge the quality of the individuals it was necessary in addition to keep account of the amount of feed consumed by each cow, in order to learn which of them utilized the feed to the best advantage. Many of these associations do not take into consideration the cost of the feed nor the price of products, but use the feed-unit system for this determination. By the feed-unit system the nutritive values of all feeds are reduced to a common basis, and that cow is considered best which combines the greatest yield of milk per 100 feed units with the largest production of butterfat.

It was not long before the work was extended to include also the cost of feeding and raising calves and young stock, of producing pork, and of keeping horses. It has even been extended to the keeping of records of yields of different fields with different crops, and much good has thus been accomplished, as the records furnish a good basis for comparing different systems of farm management, cultivation, crop rotation, etc.

The cow-testing associations of Denmark have on an average 22 members each and 390 cows. Each association employs an expert dairyman to make periodical visits to the farms of the members. At each visit he remains twenty-four hours, and obtains records, by actual weighing and testing, of the amount of feed consumed by each animal and the amount of milk and butterfat each cow yields during the twenty-four hours he is at the farm. With these data as a basis, he calculates the amount of feed each cow consumes for the entire year, as well as the amount of milk and butter she produces.

In case the association keeps records of other animal production, the cow tester obtains from the farmer information with reference to the amount of feed consumed by each animal, thus ascertaining the feed cost of keeping the animal; and by making occasional weighings of the animal the cost of producing 1 pound of gain is determined. Where records are kept of the growing of crops the cow tester ascertains from the farmer the total yield of a crop, as well as the total acreage, and calculates the yield per acre. If the grain has been sold, receipts must be shown for its delivery. By applying the total sum of expense in connection with the growing of the crop the cost of producing 1 bushel is calculated.

IMPROVEMENT AS SHOWN BY RECORDS.

Records of the first year's work of the cow-testing associations are not obtainable, but the method soon grew so much in importance and popularity that it was recognized by the Government and appropriations were made for promoting it. This assistance made it possible to collect the records of the various associations. Many of these records show very decided increases in average yield, and they furnish interesting material for study.

The following table shows the improvement in a herd owned by Mr. August Kinch at Beltaberga, Sweden:

Record of a dairy herd in Sweden.

Testing period (365 days).	Average number of cows in herd.	Average milk yield per cow.	Average fat test of herd.	Average butter yield per cow.	Average feed units consumed per cow.[a]	100 feed units gave—		Cost to produce 100 pounds of milk.	Cost to produce 1 pound of butter.
						Milk.	Butter.		
		Pounds.	*Per cent.*	*Pounds.*		*Lbs.*	*Lbs.*	*Cents.*	*Cents.*
1899-1900	70	7,320	3.05	245	2,421	302	10.1	86.0	25.7
1900-1901	28	7,905	3.13	272	2,695	293	10.1	88.6	25.7
1901-2	46	9,003	3.20	317	2,566	350	12.3	74.1	21.1
1902-3	55	9,984	3.18	350	2,507	398	13.9	65.3	18.6
1903-4	61	10,584	3.22	376	2,587	407	14.5	63.5	17.9
1904-5	64	11,236	3.22	399	2,743	409	14.5	63.5	17.9
1905-6	71	11,333	3.21	401	3,035	372	13.2	69.6	19.7
1906-7	79	11,486	3.18	403	3,111	369	13.0	70.4	20.1
1907-8	77	11,023	3.17	385	3,075	358	12.5	72.5	20.8
1908-9	79	11,399	3.34	421	3,051	374	13.8	69.6	18.8
Increase(+)or decrease(−)	....	+4,079	+0.29	+176	+630	+72	+3.7	−16.4	−6.9

[a] One Swedish feed-unit equals—1 kilogram (2.2 pounds) mixed grain; 1.2 kilogram (2.6 pounds) dried beet pulp; 1 kilogram (2.2 pounds) gluten feed; 2.5 kilograms (5.5 pounds) hay; 1.1 kilograms (2.4 pounds) wheat bran; 4 to 6 kilograms (9 to 13 pounds) straw; 0.9 kilogram (2 pounds) linseed cake; 6 to 10 kilograms (13 to 22 pounds) green clover; 0.8 kilogram (1.8 pounds) cotton-seed cake; 11 to 15 kilograms (24 to 33 pounds) turnips.

Mr. Kinch joined the cow-testing association in 1899. It will be noticed that he had 70 cows. The first year's testing revealed the fact that only 28 of them possessed sufficient merit to be deemed fit for breeding purposes, and the remainder of the herd was disposed of. The heifers of these 28 cows were raised and added to the herd, which kept increasing in numbers until in the seventh year it contained one more cow than in the first year. The increased yields shown in this table were accomplished by the selection of cows of large and economical production, and their progeny, combined with the use of improved sires. Naturally, with increasing production, the cows consumed more feed, something an owner can look at with satisfaction when he sees, as in this case, a gradual increase in yield per 100 feed units and a correspondingly satisfactory decrease in the cost of production. Assuming a cost of 2.6 cents for each feed unit and a price of 30 cents a pound for butter, the extra clear profit from 70 cows the last year was $2,549.40 more than it was the first year, when

Mr. Kinch joined the cow-testing association. The cost of obtaining these records was less than $1 per cow, or less than $70 a year; and, assuming that the cost of purchasing good sires was offset by the increased commercial value of the herd, it means that an outlay of less than $70 a year brought an income of $2,549.40.

Assuming that the profit from the cows could be applied to pay off the mortgage on a farm, a man with a herd of 70 cows like those owned by Mr. Kinch in 1900 could pay off a mortgage of $10,000 in 29 years; while the profits from 70 cows such as those owned by Mr. Kinch in 1909 would pay this mortgage in less than four years.

The following table shows the result of ten years' testing in the Lundatrakten Cow-Testing Association in Sweden:

Record of a Swedish cow-testing association for ten years.

Year.	Average milk yield per cow.	Average fat test.	Average butter yield per cow.	Average number of feed units per cow.	100 feed units gave—	
					Milk.	Butter.
	Pounds.	*Per cent.*	*Pounds.*		*Pounds.*	*Pounds.*
First year	6,890	3.11	236	2,586	266	9.1
Second year	6,582	3.11	225	2,458	268	9.1
Third year	7,357	3.16	256	2,501	294	10.2
Fourth year	7,692	3.17	268	2,418	319	11.1
Fifth year	7,653	3.04	256	2,281	336	11.2
Sixth year	8,268	3.04	277	2,443	338	11.3
Seventh year	9,155	3.05	307	2,603	352	11.8
Eighth year	9,338	3.15	324	2,648	353	12.3
Ninth year	9,183	3.15	319	2,585	355	12.3
Tenth year	10,064	3.12	345	2,751	366	12.6
Increase	3,174	....	109	165	100	3.5

This association had in the tenth year 639 cows. Giving the butter a value of 30 cents a pound and the feed units a cost of 2.6 cents a unit, these 639 cows returned during the tenth year $18,153.99 more than the same number would have returned during the first year, or nine times as much net profit. The cost of this splendid added income is less than $1 per cow, or less than $639 a year.

The cow-testing records in Denmark and Sweden show other instances where equally great improvements have been accomplished by profiting by the lessons the records teach. To duplicate the improvement shown in the foregoing table is indeed a worthy object for any cow-testing association.

THE COW TESTERS.

The cow testers (the men who collect the data and make the calculations) are young men who have been trained for this purpose. The agricultural schools have organized courses for the education of these men. One of the conditions for entrance to the schools is that the young men must have been raised on the farm and have had practical experience in the feeding and care of live stock. At the conclusion of this training, followed by one or two years' work in a cow-testing association, these men are greatly sought after for positions of trust and skill in connection with the dairy business. They can be found as managers and owners of dairies and operators of creameries, and so well recognized is the effect of this training that many creameries and dairies specify in their advertisements for men to fill these positions that the men must have had such training.

GENERAL RESULTS IN EUROPE.

Reports from Denmark show that the average production per cow in 1908 had increased to 224 pounds of butter. This average is exactly twice as much as it was in 1884. Much of this improvement has been accomplished as a result of the cow-testing movement. Reports from Sweden show an equal improvement. The more indirect results are seen in better system for all farm work, a livelier interest in the business of the farm, and a better understanding of the technical problems connected with its management. On the whole, the cow-testing associations have had a powerful influence in interesting the young people in farm life and keeping the population in the rural districts, and during the later years large farms are being cut up into smaller farms, in order that they may furnish homes for all the people desiring to engage in agricultural pursuits.

ASSOCIATIONS IN THE UNITED STATES.

OPPORTUNITY AND NEED.

According to the Twelfth Census the average production of butterfat per cow in the United States in 1900 was 145 pounds, which compared with the average production of 224 pounds of butter per cow in Denmark is entirely too low. The Bureau of Statistics of the Department of Agriculture reports that on January 1, 1910, there were 21,801,000 milch cows in the United States, and if it were possible to inaugurate a system whereby the average production per cow might be increased even 1 pound of butterfat in a year, this increase would amount to 21,801,000 pounds, which at the price of 30 cents a pound would be worth $6,540,300. If such an increase could be brought about by better selection of cows and feeding stuffs, the sum mentioned could be figured practically as clear profit. Investigations by experiment stations and breeding associations show that there are a large number of cows which yield greatly in excess of this average, some reaching an amount as high as 800 or 900 pounds of butterfat in a year—one cow even 998 pounds. This being the case, there must be a large number of cows which yield less than 145 pounds of butterfat in a year.

Many reports of cow census investigations conducted by Hoard's Dairyman have been published during the last decade. These investigations have been made in representative sections of many dairy States, and show an average production but very little above that reported in the Twelfth Census. More than one-fourth of the herds reported failed to produce enough milk or butterfat to pay for their feed at market prices.

THE PRACTICAL DIFFICULTY.

The difficulty has been to devise a system whereby the unprofitable cows might be detected. It is a common belief among farmers that the man who does the milking knows the best cows in the herd, as well as the poorest; but numerous experiments have demonstrated clearly that this belief is not warranted. Many factors enter to lead the judgment astray. The cow which gives a generous flow of milk during the first few weeks of her period of lactation is usually regarded as the best cow. She may soon go down in her flow of milk, and perhaps goes dry for four or five months of the year, but this is not observed, and only the memory of the large flow she gave when fresh lingers in the mind of the owner.

Another cow may give only a fair flow of milk when she first comes in, and may not be regarded highly by her owner; but she may continue at the same rate of yield for a long period, and will in the end prove a great deal more valuable than the other cow. No milker can tell, without weighing the milk regularly, whether a cow gives 6,000 or 8,000 pounds of milk in a year; still the difference may prove the difference between profit and loss on that particular cow.

When the milk is valued according to its butterfat content unsupported estimates of the cow's performance are still more uncertain. It requires frequent testing to ascertain the average percentage of fat in the milk a cow yields; the test may vary greatly from milking to milking and from day to day. There may also be a great variation in the richness of the milk yielded by a cow when she is fresh as compared with a time later in the period of lactation.

And last, but not least, different cows show different feed requirements for the same production of milk or fat—a fact which is not generally thought of, and it is impossible for the feeder to estimate accurately the difference in cost of feeding the various cows for a year unless records of the feed are kept systematically.

An expression often heard among members of cow-testing associations during the first year is, "The cow I thought was my best cow is actually the poorest," which shows that impressions of the relative profitableness of the different cows in the herd, if formed without actual records, may be exactly contrary to the truth.

It is possible for the farmer, by weighing, to ascertain the amount of milk that each cow in the herd produces, and ever since the invention of the Babcock test he has had an easy means of knowing the fat content of the individual cow's milk. Very few farmers, however, have taken advantage of this opportunity; not because it would not pay them to do so, but largely because testing is tedious work, and requires care, regularity, and time to make it accurate. Many farmers have bought Babcock testers and have started in to do this work, but have given it up for the above reasons. It has the nature of an extra chore, and is apt to be neglected under the pressure of other work. To be successful, a system for obtaining these data must be independent of other work on the farm.

THE ELEMENTS OF ECONOMY.

In order to be able to decide intelligently which cows produce milk and butter economically and which do not, it is necessary to know three things about the individual cows in the herd. First, how much milk they give; and this must be known for a year, because a cow has to be fed for three hundred and sixty-five days. Second, how much butter fat there is in each cow's milk, for upon this depends the market value of the milk. And third, in order to form a correct idea as to the economical utilization of the feed, it is necessary to know the amount of feed consumed by the cow.

The cow's ability to convert feed into dairy products economically can not always be judged by net profit in dollars and cents, as this profit is dependent also upon the skill of the feeder and the sagacity with which he selects low-priced and at the same time suitable feeding stuffs. In other words, the same cow might yield very different results with different owners; therefore, in judging of net profits, the man as well as the cow should be considered. For this reason, cows in one herd should not be compared on this basis alone with cows in another herd, nor should the summaries of whole herds be thus compared. The product must be compared with the feed consumed in order to form an accurate opinion, and that cow is a good dairy cow which has the ability to convert a large amount of feed into a correspondingly large amount of valuable dairy products with the least waste. In the absence of any such system as the feed-unit system, whereby all feeds are brought to a common basis regardless of their cost, it is perhaps not practicable to express absolutely the exact degree of economy in the production of dairy products.

The dairyman usually fixes a certain quantity of butterfat as a minimum, and if a cow does not reach that production she is deemed undesirable and disposed of. The cow tester's duty is to study the individuality of each cow in the herd and teach the farmer to feed her so that she will reach her maximum production consistent with an economical utilization of the feed.

THE FIRST AMERICAN ASSOCIATION.

The cow-testing movement in the United States was inaugurated by the writer, working under the direction of the state dairy and food department of Michigan, and the first association was organized at Fremont, Mich., September 26, 1905, under the name of the Newaygo County Dairy Testing Association. The general purpose for which it was formed was " to promote the dairy interests of its members, and particularly to provide means and methods for testing the milk of the cows of the members periodically." It consisted of 31 members, and 239 cows completed the first year's test. The officers of the association consisted of a president, a vice-president, a secretary and treasurer, and a board of nine directors. This board had the management of the business of the association and employed a cow tester, who made monthly visits to each herd, and as there are only twenty-six working days in a month, it was necessary for him in some cases to test two herds in one day.

METHODS OF OPERATION.

The cow tester arrives at the farm in the afternoon and remains there for twenty-four hours, when he is carried by the farmer to the farm of the next member in the association.

On his arrival at the stable the cow tester enters in a book which he carries for this purpose the name and number of each cow in the herd, whether she gives milk or not. As it is the purpose of the work to ascertain the actual status of the whole herd, as well as of the individual, every cow in the stable should be entered on this list. It is obvious that if only cows with large yields were entered on the list, at the end of the year the herd would show a higher average than the truth would warrant. For this reason, and in hope of obtaining commercial advantages from such high records, some dairymen have preferred not to have the whole herd tested; but it is a rule of the cow-testing association to obtain records of every animal in the herd which has had one calf, and no records are published where such is not the case.

The cow tester takes part in the feeding of the cows, and while doing so he weighs the amount of roughage and grain each cow receives and records these data in a book which he carries with him at all times. The milk yielded by each cow is weighed and samples of it are obtained for testing. Records of the feed and the yield for each individual are again obtained and recorded the next morning, and after breakfast the fat determination is made. During the forenoon the calculations are made and entered in the record book, which at all times remains in the possession of the farmer.

The milking is done at the usual milking time, in order that the average yield may be obtained as accurately as possible. In case of competition between the herds, there may be a tendency to milk early in the morning on the day the tester is expected to arrive. In this way the yield for the testing day might be somewhat increased. To guard against this it is customary in some associations for the cow tester not to follow a regular route, so that it will be impossible for the dairyman to know the exact day on which to expect him.

In weighing the milk a "shotgun" can—a can 8 inches in diameter and 20 inches high—is used. It holds 35 pounds and has straight sides, with a handle near the bottom so that it may be easily emptied. The empty can should weigh even pounds so that mistakes in subtraction may be avoided. It has straight sides so that accurate samples may be obtained by the use of an instrument known as a "milk thief," as with an ordinary milk pail with a flaring top an accurate sample might not always be obtained, owing to the greater area of the milk at the surface than at the bottom. If the herd is large it is desirable to have two of these cans with straight sides so that the milker may pour the milk into them and proceed to milk the next cow without waiting for the tester to weigh and sample the milk. In this way time is saved in the stable.

For weighing the milk a special spring balance is used, weighing to 30 pounds and having two indicators, one of which is adjustable and should be set at zero when the weigh can is on the scales. The balance is graduated in tenths of pounds and is frequently tested so that any stretching of the spring may be immediately detected. The milk is poured from pail to pail two or three times and the sample for testing is taken immediately after such pouring is completed.

The fat determinations are invariably made at the farm. The reason for this is the difficulty in transporting the samples to the creamery without leakage, churning of the milk in hot weather, etc., any of which renders correct determination difficult. Another and equally important reason is that the dairyman becomes more interested in the work if it is done on the farm. He usually assists the expert with the testing and in this way acquires an understanding of the principles and the use of the Babcock test which he would not otherwise get.

If a cow is in heat or temporarily out of condition on the testing day, no sample of her milk is taken, as there is usually an abnormal fluctuation in the fat content at such times, and the calculations based upon tests taken then may be several pounds too high or too low.

The fact of such temporary abnormal condition is recorded in the herd book, and the average of the preceding and the following months' tests is used in the calculations.

Milk from fresh cows for the first three days can not be considered normal, and calculations based upon a test at that time may be very erroneous. It is the rule not to use the test of a cow's milk for calculations until she has attained a normal condition. If she has not reached this condition on testing day the following month's test is used as a basis for calculation. The yield for the first three days is omitted from the record, and the cow is considered as being dry when nearing the end of the lactation period.

The day upon which the test is made is called the testing day, and the records obtained on that day are used as a unit for each day in the period extending equal lengths of time on both sides of the testing day. This period is called the testing period, and is so marked off as to end exactly in the middle of the time between two testing days. Observance of this rule is very important, as it materially affects the accuracy of the work. The number of days in the testing period is understood to include both the dates mentioned as beginning and end of the period; thus, if the testing period begins March 15 and ends April 14, there will be thirty-one days in the testing period. The yields of milk and butterfat for the testing period are found by multiplying the yield on the testing day by the number of days in the period. The daily yield of milk is recorded in tenths and the monthly yield in whole pounds, while the yield of butterfat is recorded in tenths of a pound. If 12 tests are made in the year, 12 testing periods will result, and the sum of the records thus obtained will furnish a total summary of the various items for one year.

It is always advisable that the dairyman should make daily weighings of each cow's milk. By doing this he will discover at once any sudden fluctuation in the milk yield, and may in many cases be able to locate and remedy the cause. He should also note when each cow goes dry, when she is bred, the date of calving, and any changes in feed during the testing period, so that he may be able to give the cow tester this information when he arrives.

A MICHIGAN ASSOCIATION'S RECORD FOR THE FIRST FOUR YEARS.

The Newaygo County Dairy Testing Association, the first cow-testing association organized in the United States, has now been in operation for more than four years, and four whole years' records have been obtained. At the end of the first year a number of members withdrew from the association, but new members were readily found, and the association is now able to get more members than it can take care of. The summaries for the first four years of the association's existence are given in the following table:

Yearly averages per cow of Newaygo County (Mich.) Dairy Testing Association.

Year.	Number of cows.	Milk.	Fat test.	Total butterfat.	Value of fat per pound.	Total value of fat.	Cost of roughage.	Cost of grain.	Total cost of feed.	Profit.	Returns for $1 expended in feed.	Feed cost of 1 pound butterfat.	Feed cost of 100 pounds milk.
		Lbs.	*P. ct.*	*Lbs.*	*Cts.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Cts.*	*Cts.*
1906	239	5,336	4.04	215.0	23.3	50.27	20.92	8.36	29.38	20.89	1.72	13.6	55
1907	287	5,467	4.02	219.7	29.1	63.85	24.88	11.54	36.42	27.43	1.75	16.6	67
1908	254	6,007	4.21	252.8	27.3	68.99	25.60	14.07	39.66	29.33	1.74	15.7	66
1909	272	6,170	4.28	264.5	31.2	82.43	27.04	14.95	41.99	40.44	1.96	15.9	68

The following table gives the yearly averages of nine herds which were in the association from the beginning:

Yearly averages per cow of nine herds for four years.

Year.	Number of cows.	Milk.	Fat test.	Total butterfat.	Value of fat per pound.	Total value of fat.	Cost of roughage.	Cost of grain.	Total cost of feed.	Profit.	Returns for $1 expended.	Feed cost of 1 pound butterfat.	Feed cost of 100 pounds milk.
		Lbs.	*Per ct.*	*Lbs.*	*Cents.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Cents.*	*Cents.*
1906	70	5,802	4.01	232.7	23.5	54.66	21.52	11.71	33.23	21.43	1.64	14.3	57.2
1907	85	5,987	4.03	241.4	29.4	71.02	25.59	13.70	39.29	31.73	1.81	16.3	65.6
1908	86	6,011	4.29	258.2	27.4	70.70	24.97	15.64	40.61	30.09	1.74	15.7	67.6
1909	89	6,426	4.32	277.6	31.2	86.52	27.26	16.44	43.70	42.82	1.98	15.7	68.0

These tables show a continuous increase in the average production. The richness of the milk has also increased. The average profit per cow has been doubled. Some of this increase in profit is partly accounted for by the increase in the price of butterfat, although feed prices show an almost corresponding increase. In these calculations it has been assumed that the value of the calf, skim milk, and manure from each cow would offset the cost of stabling, labor, and caring for her.

METHOD OF ORGANIZING.

The usual way of organizing an association has been to ascertain the extent of the interest in dairying in a community, and to call a meeting and explain the merits of the cow-testing association as an institution. If enough interest is exhibited to warrant going on with the work, a temporary organization is effected, and the neighborhood is thoroughly canvassed during the following few days in search of additional members for the association. When enough have been secured a second meeting is called, at which the organization is perfected, officers elected, and by-laws adopted.

In order to support a cow-testing association it is necessary that there should be 26 herds, conveniently located, and a sufficient number of cows so that the tester can get a reasonably good salary. As it is each member's duty to furnish the tester's conveyance to his next place of work, it is necessary that the farms of the members be located near enough together so he can be conveyed without inconvenience. A distance of 2 miles is not too great to give satisfaction, and the conveyance is often furnished by some passer-by. If the cow tester keeps his own horse and buggy, as is the case in some associations, a larger territory is usually accommodated. In such cases the members must furnish feed and stabling for his horse. The charge to the farmer is usually $1 a year for each cow. This money constitutes the pay of the tester; and it is desirable that there should be not less than 400 cows in an association, in which case the tester gets $400 a year. In addition he gets his board and lodging free of charge at the farm where he is working. There being only twenty-six working days in a month, it is not possible to have more than 26 members, except in cases where two men with small herds live very close together so that it is possible to test both herds in one day. On such farms the regular milking time is fixed so that the tester can attend to the weighing and testing in the first herd and still have plenty of time to get to the second herd by the regular milking hour. In addition to the $1 a cow, the farmer pays a membership fee of 25 cents yearly. This money, which for 26 members amounts to $6.50, is used for paying incidental expenses, postage, cost of sulphuric acid, etc.

THE TESTING OUTFIT.

A testing outfit consists of a 12-bottle Babcock tester with glassware, two "shotgun" cans in which to weigh the milk, a spring balance, a "milk thief," and the necessary books and record blanks. The outfit, with the Babcock tester, is usually furnished by the state authorities, but in case it must be purchased by the association assessments have to be levied for this purpose unless the number of cows is great enough so that it can be paid for out of the fund collected at the rate of $1 a cow. The necessary books and blanks have in some cases been provided by the United States Department of Agriculture until such time as the States have appropriations from which to supply these. The States of Michigan, Wisconsin, Vermont, Ohio, Iowa, and Maine now have provision for supplying this material to associations within their own borders.

QUALIFICATIONS OF THE TESTER.

The cow tester has much to do with the successful working of an association. He should be well fitted temperamentally and should have had special training for the work. Punctuality, regularity, and accuracy are of great importance, for unless he has these qualities the records may not be a true indication of the value of the respective cows. The tester should also have the ability to advise and teach the farmers, and for this reason it is necessary that he be constituted temperamentally to give advice in such a manner that it will be accepted and followed.

The work of a cow-testing association depends largely for its success upon the capability, reliability, and conscientiousness of the tester; but, on the other hand, the result of this work depends also upon the members. They should be willing to profit by the lessons which the cow testing teaches and ready to put into effect such changes in feed, stabling, and operation of the dairy as the records show will be profitable.

In this country, as well as in Europe, the position of cow tester offers excellent opportunities for dairy students to gain practical experience and is the best kind of school to fit them for responsible positions in connection with dairy work.

ACCURACY OF RESULTS OBTAINED BY VARIOUS TESTING METHODS.

Through the kindness of Prof. T. L. Haecker, access was had to the records kept of the production of the herd at the Minnesota State Experiment Station, St. Paul, Minn., where weights and Babcock tests of every milking of each cow in the herd have been recorded for nearly twenty years. The accuracy of the method used by the cow-testing associations was determined by comparing the yields as estimated by them and outlined in this publication with the actual yields as determined by weighing and testing each milking.

The accuracy was also determined of the estimated yearly yields as calculated by each of the following methods: (1) Taking the weights and a test of the composite sample of eight milkings in the middle of each month; (2) taking the same for four milkings in the middle of each month; (3) taking the product of one day in the middle of each three-week period; (4) taking the product of one day in the middle of each two-week period. In each of these methods the yields for each period were estimated and the sum of the periods was taken as the total for the year.

The following table shows the variations from the actual yields obtained by each of these five methods, the percentages of difference above or below the actual yields being shown in each case. The maximum variation by the cow-testing association method was not over 5.1 per cent for any one year, and this method compares favorably for accuracy with any of the others. The table shows the maximum per cent of variation for any one year and the per cent of total difference from the actual yield for nine years for each of the methods.

Variations from actual yield of estimated yield of milk and butterfat as determined by various methods.

	Milk.					Butterfat.				
	Cow-testing association method.	Eight milkings; composite.	Four milkings; composite.	One day in three weeks.	One day in two weeks (five years).	Cow-testing association method.	Eight milkings; composite.	Four milkings; composite.	One day in three weeks.	One day in two weeks (five years).
Cow 1:	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Maximum variation	−3.3	−2.5	+3.1	−2.7	−1.6	+2.8	+3.2	+3.6	−4.6	−1.9
Total difference	− .9	− .6	− .8	− .5	− .6	+ .3	− .8	− .7	− .8	−1.2
Cow 2:										
Maximum variation	+2.1	−2.3	−2.3	−2.9	−1.7	+2.9	+3.5	+3.9	+5.6	−3.1
Total difference	− .8	− .9	− .8	−1.0	− .8	− .8	± .0	+ .6	+ .3	−1.8
Cow 3:										
Maximum variation	−4.9	−3.2	−3.8	−2.3	−2.7	+2.9	−3.8	−3.9	+5.7	−3.9
Total difference	− .8	− .9	− .8	− .3	−1.5	−1.1	−1.4	− .6	− .4	−2.7
Cow 4:										
Maximum variation	+2.6	−1.9	−2.6	−2.6	−3.3	−4.2	−4.3	−5.3	+4.4	−4.8
Total difference	− .1	− .4	− .5	− .5	−1.9	− .2	− .5	− .7	+ .7	−2.7
Cow 5:										
Maximum variation	−3.7	− .9	−2.8	−3.8	−5.2	−5.1	+2.9	+4.4	−3.2	−3.0
Total difference	−1.2	− .3	−1.0	−1.3	−1.6	± .0	− .4	−1.1	− .4	−1.2
Cow 6:										
Maximum variation	−3.9	−3.3	−3.8	−4.5	−1.8	−4.8	+3.5	−3.9	+4.3	−1.6
Total difference	−1.1	− .9	−1.1	± .0	− .3	− .6	− .5	− .5	+1.2	− .4
Cow 7:										
Maximum variation	−4.3	−4.0	−4.5	−3.8	−2.0	−4.5	−3.3	−6.1	−5.1	−2.7
Total difference	−2.0	−1.2	−1.8	− .6	−1.3	−1.7	− .9	−1.3	− .7	−1.5

In the method used by the cow-testing associations the total difference for a nine-year period is in no case over 2 per cent from the actual yield.

When we consider that the cow-testing association method means the weighing and testing of the milk just one day a month, and that the results are as close to the actual as above stated, we must conclude that the records of performance as found by the cow-testing association method are sufficiently accurate to enable the dairyman to weed out his unprofitable cows.

MEETINGS.

The associations hold monthly meetings for the discussion of topics of interest to dairymen. A programme committee selects from the members one or two to lead in the discussion, and occasionally outside speakers are invited. The meetings are usually held at the homes of the members and often take the form of a picnic. On such occasions there is free discussion and many valuable ideas are exchanged. After lunch a tour is made of the farm, and the crops as well as live stock and buildings are inspected.

GROWTH IN THE UNITED STATES.

The following table shows the growth of the movement in the United States:

Number of cow-testing associations in the United States, 1905 to 1910.

States.	Number of associations in operation.					
	1905.	1906.	1907.	1908.	1909.	1910 (5 mos.).
Michigan	1	2	4	3	5	6
Maine				3	5	6
Wisconsin				3	10	12
Vermont				3	5	9
California					2	3
Iowa					2	3
Pennsylvania					1	2
Ohio					1	3
Washington					1	1
Colorado						1
Connecticut						1
Nebraska						1
New Hampshire						1
Oregon						1
New York						1
Maryland						1
Total in United States	1	2	4	12	32	52

RESULTS.

Perhaps the most important result of the cow-testing associations is the increased interest which members take in their work. Farm work, consisting as it does in large part of manual labor, is apt to become monotonous unless there is an intelligent interest in the operations and unless the farmer has something special in view. The monthly visit of the cow tester stimulates this interest; and while the primary object for which the association was organized is the selection and rejection of individual animals, the results, direct and indirect, cover a very broad field.

The tester, being an expert dairyman, not only studies the individual animals in the herd as to their capacity for utilizing feed economically, but he also assists the farmer in selecting those feeds which contain the greatest amount of food nutrients at the lowest price, thereby creating a larger net return per cow, per acre, per dollar's worth of feed, and, last but not least, per man. This larger net return per cow is brought about not only by the increased yield of the cows, but by improved economy in the conversion of feed into finished product.

One of the direct results is improved breeding. Many testing associations have proved to be forerunners of breeding associations, or bull associations, for the development of purebred cattle of breeds particularly adapted to the local conditions.

The cow-testing movement, being an organized effort for improvement, is conducive to better community spirit. At the monthly meetings problems of interest to dairymen are discussed, and this discussion often stimulates a friendly rivalry for attainment of the best results. The systematic and cooperative effort creates an interest in the growing of better forage crops and in better feeding; in more sanitary stabling and better care of the milk; it opens the eyes of the farmers to the value of system in their work, and leads to the application of better business methods.

Cooperative buying of feeding stuffs is a feature in nearly all cow-testing associations. At the monthly meetings the members place in the hands of the board of directors an order for the amount of feed stuffs they wish to buy. The aggregate of these orders often amounts to several carloads, and by buying in carload lots and for cash lower prices and freight rates are obtained. The officers of the associations study the markets for feed stuffs and are often able to take advantage of a low market. In this way business judgment is stimulated and the individual member is enabled to reap the benefit of the business judgment of his more experienced coworkers.

The work, broad as it is, has value not only for the farmer, but also for the creamery and the cheese factory, since it encourages better dairy methods at the same time that it procures larger remuneration for the dairymen. One of the causes of dissatisfaction with creameries and cheese factories has been the low average production of dairy commodities. The farmer has not had any systematic performance record of the production of his individual cows, and it is natural for him to think that some one else besides himself is responsible for the low return, and the creamery or cheese-factory manager, being the one who purchases his milk or cream, has received the blame. Many farmers have had only a half-hearted interest in dairying, because the average production of their herds has been so low that they could make but a small profit therefrom. The experience already gained in places where associations have been organized shows that with the elimination of the poor cows in the herd comes an interest in better cows and better care of the cows, and a tendency to make greater discrimination in price between good and poor animals. The introduction of better cows on the farms creates a desire for more of them, and a larger number of cows renders it possible for creameries and cheese factories to collect more milk or cream in a given territory, thus reducing the cost of collection.

The increased interest in dairying stimulates interest in dairy and kindred associations, and creates an interest in purebred stock. In the Newaygo County Dairy Testing Association, where during the first year only one man owned a purebred dairy bull, 22 such bulls were found among the herds during the second year; and while no purebred cows at all were owned in the first year, 21 were bought during the second year. This interest has steadily increased, and during the third year a breeding association was organized. Such increased interest in purebred stock naturally affects the market for such stock, and entitles the movement to the hearty support of the breeders' associations of the different dairy breeds.

The consumer is interested not only in greater economy in the production of dairy commodities, but in improvement of their quality, which is promoted by sanitary stabling and better care of milk on the farm. These results follow from cow-testing associations wherever tried, and the consumer should for this reason give encouragement to such organizations.

RELATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE TO THE WORK.

The United States Department of Agriculture, through the Dairy Division of the Bureau of Animal Industry, has been largely instrumental in encouraging the inauguration of cow-testing associations in the various dairy States, and has always worked in cooperation with the state authorities. In many States no funds have been available for conducting the work, and the Department has furnished the services of an organizer and has supplied blanks and record books free of charge, in the hope that when the value of the work has been demonstrated the States would appropriate sufficient funds to carry it on.

Such appropriations should cover the expenses of organizing, such as salary and traveling expenses of an organizer; they should also provide for the printing of books and blanks for compilation of the records, and for publication of the same.

It is advisable that some state authority should supervise the work, and that occasional visits should be made to the associations, so that difficulties may be straigtened out should they arise. It is also desirable that the supervisor of the work should attend the meetings held by the associations and give advice to the tester and check up his work, in order to get the highest degree of accuracy. Many of the States have already provided for such supervision, and for furnishing the material as well as for compiling the records, and it has been the policy of this Department to encourage the assumption of state control of the work.

In the promotion of this movement the Dairy Division has sought to forestall some of the defects under which the work in the older countries suffered during its earlier years. By furnishing the blank forms for the first few associations in each State, the aim has been to establish uniformity of methods, and by studying the work in the various States and keeping in close touch with it, to be able at all times to suggest to those interested the latest improvements in the system.

Contract Used in the Organization of a Cow-Testing Association.

Whereas the ——— Dairy Testing Association has been organized for the principal purpose of providing means for the cooperation of its members in testing the milk of their cows periodically and for otherwise improving their dairy interests; and whereas it is proposed by said association to engage a suitable person as soon as enough subscriptions are obtained to warrant said association in engaging such person, we, the undersigned members of said association, each for himself and not one for the other, agree to pay the sum of ——— for each cow set opposite our respective names to said association for that purpose. Said fees to be paid in quarterly installments in advance, the first payment to be made as soon as such person is engaged by said association. Each one of us also agrees to furnish board and lodging for said person for at least one day each month, and convey him to his next place of work. Said person shall not work Sundays, but shall have board and lodging over Sunday at the place where he is working Saturday.

Constitution and By-Laws for a Cow-Testing Association.

ARTICLES OF ASSOCIATION.

We the undersigned, desiring to become incorporated under the provisions of act No. —— (of the public acts of ———), entitled ———, and the acts amendatory thereof and supplementary thereto, do hereby make, execute, and adopt the following articles of association, to wit:

Article I. The name by which this association shall be known in law is ——— Dairy Testing Association.

Article II. The purpose for which it is formed is generally to promote the dairy interests of its members, and particularly to provide means and methods for improvement of the dairy qualities of cows and for the testing of the cows of its members periodically.

Article III. Its principal office and place of business shall be at ———.

Article IV. The number of its directors shall be ——.

Article V. The names of the directors for the first year of its existence are as follows: ———, ———.

Article VI. Any person may become a member of this association and be entitled to its benefits and privileges upon being accepted by the board of directors and upon complying with the requirements of the by-laws.

BY-LAWS.

Article I. *Meetings.*—An annual meeting of this association shall be held at a place to be designated by the board of directors, in ———, on the —— day of ——— in each year, at 2 o'clock p. m., for the purpose of electing a board of directors, and for the transaction of such other business as may lawfully come before said meeting.

The president shall call one meeting each month for the purpose of discussing topics of interest to dairymen and shall at each meeting appoint a committee of three members who shall prepare a programme for the next meeting. No member shall be obliged to serve two months in succession on this committee.

Special meetings may be called by the board of directors or by the president, and notice thereof shall be given by the secretary, by mailing to each member a written or printed notice thereof at least five days prior to such meeting. Such notice shall state the object of the meeting, and no other business shall be transacted thereat.

Article II. *Board of directors.*—Section 1. The board of directors shall be elected at the annual meeting, the first election to be held on the —— day of ———, A. D. ——.

Section 2. The board of directors shall have the management and control of the business of the association, and shall employ such agents as they may deem advisable, and fix the rates of compensation of all agents and employees.

Section 3. Whenever any vacancies occur in the board of directors by death, resignation, or otherwise, the same shall be filled without undue delay by the majority vote of the remaining members of the board. The person so chosen shall hold office until the next annual meeting or until his successor is elected and qualified.

Section 4. The board of directors shall meet on the first ——— of each month, at such hours and in such places as they may by resolution determine.

Section 5. A majority of the board of directors shall constitute a quorum at all meetings of the board.

Article III. *Officers.*—Section 1. The officers of the association shall consist of president, vice-president, secretary, and treasurer. The offices of secretary and treasurer may be held by the same person. The officers shall be elected by the board of directors from their own number by a majority vote of the whole number of directors. The first election shall be held immediately after the election of the board. Subsequent elections shall be held annually on the day of the regular meeting of the board next ensuing after the annual election, the day to be fixed by resolution of the board of directors.

Section 2. In case of death, resignation, or removal of any officer, the board shall elect his successor, who shall hold office for the unexpired term.

Article IV. *Membership.*—Any person acceptable to the board of directors may become a member upon paying a membership fee of 25 cents.

Article V. *Dues.*—Each member shall pay a fee of 25 cents annually on or before the —— day of ———; and in addition thereto shall pay quarterly dues to cover his share of the expense of cow testing, in proportion to the number of cows he has to be tested, the amount of such quarterly dues to be fixed by the board of directors, and paid as specified in a contract to be made for this purpose between the members.

No member shall be allowed to participate in the election of the board of directors who shall not have paid his annual dues in advance.

Article VI. *Amendments.*—These by-laws may be amended or added to by a majority vote of all the members present at the annual meeting or at a special meeting called for the purpose.

THE EXTRA COST OF PRODUCING CLEAN MILK.

By George M. Whitaker,
In Charge of Work relating to Market Milk, Dairy Division.

INTRODUCTION.

New methods are always more or less unpopular. Every business and profession has its conservative element which looks with suspicion at new ideas, especially those which threaten to jolt one out of well-established ruts. For instance, many of the old-school surgeons were skeptical about bacteriology and the aseptic methods of operating, which are now in vogue with such wonderful results. Milk producers have the same traits of human nature as other people, and many of them have been skeptical as to the utility of the newer ideas about sanitary milk which have caused them some inconvenience and expense.

Unfortunately, the movement for cleaner milk happened to be coincident with a marked increase in the cost of production, due to feed and labor problems, and a failure to get a corresponding increase in price. The feeling of dissatisfaction with prevailing economic conditions has had a tendency to develop hostility to the latest phases of milk production.

This natural feeling of irritation has been intensified in some instances by dairy inspectors who have lacked tact and good judgment; their arbitrary bearing, their ignorance, or their lack of sympathy have done much to make the movement unpopular. In some instances, also, this feeling has been increased by persons who from various motives have misrepresented modern requirements by exaggeration, ridicule, misleading half truths, or plausible generalities.

In view of this situation there seems to be need of accurate statements as to precisely what modern sanitary milk means and what extra cost it imposes on the dairyman. In considering the added cost of production due to this agitation we make the dairy score card the basis of our discussion, because it includes in convenient tabular form practically all of the points which need to be considered. This score card is in common use and is indorsed by many leading dairy and health authorities.

The card is as follows:

DAIRY SCORE CARD.

Score for equipment__________ + Score for methods______ = ________Final score.

Equipment.	Score. Perfect.	Score. Allowed.
COWS.		
Health	6	
Apparently in good health 1		
If tested with tuberculin once a year and no tuberculosis is found, or if tested once in six months and all reacting animals removed .. 5		
(If tested only once a year and reacting animals found and removed, 2.)		
Comfort	2	
Bedding 1		
Temperature of stable ... 1		
Food (clean and wholesome	2	
Water	2	
Clean and fresh 1		
Convenient and abundant 1		
STABLES.		
Location of stable	2	
Well drained 1		
Free from contaminating surroundings 1		
Construction of stable	4	
Tight, sound floor and proper gutter 2		
Smooth, tight walls and ceiling 1		
Proper stall, tie, and manger 1		
Light: Four sq. ft. of glass per cow	4	
(Three sq. ft., 3; 2 sq. ft., 2; 1 sq. ft., 1. Deduct for uneven distribution.)		
Ventilation: Automatic system	3	
(Adjustable window, 1.)		
Cubic feet of space for cow: 500 to 1,000 feet	3	
(Less than 500 feet, 2; less than 400 feet, 1; less than 300 feet, 0; over 1,000 feet, 0.)		
UTENSILS.		
Construction and condition of utensils	1	
Water for cleaning	1	
(Clean, convenient, and abundant.)		
Small-top milking pail	3	
Facilities for hot water or steam	1	
(Should be in milk house, not in kitchen.)		
Milk cooler	1	
Clean milking suits	1	
MILK ROOM.		
Location of milk room	2	
Free from contaminating surroundings 1		
Convenient 1		
Construction of milk room	2	
Floor, walls, and ceiling. 1		
Light, ventilation, screens 1		
Total	40	

Methods.	Score. Perfect.	Score. Allowed.
COWS.		
Cleanliness of cows	8	
STABLES.		
Cleanliness of stables	6	
Floor 2		
Walls 1		
Ceiling and ledges 1		
Mangers and partitions. 1		
Window 1		
Stable air at milking time	6	
Barnyard clean and well drained	2	
Removal of manure daily to field or proper pit	2	
(To 50 feet from stable, 1.)		
MILK ROOM.		
Cleanliness of milk room	3	
UTENSILS AND MILKING.		
Care and cleanliness of utensils	8	
Thoroughly washed and sterilized in live steam for 30 minutes 5		
(Thoroughly washed and placed over steam jet, 4; thoroughly washed and scalded with boiling water, 3; thoroughly washed, not scalded, 2.)		
Inverted in pure air 3		
Cleanliness of milking	9	
Clean, dry hands 3		
Udders washed and dried 6		
(Udders cleaned with moist cloth, 4; cleaned with dry cloth at least 15 minutes before milking, 1.)		
HANDLING THE MILK.		
Cleanliness of attendants	1	
Milk removed immediately from stable	2	
Prompt cooling (cooled immediately after milking each cow)	2	
Efficient cooling; below 50° F.	5	
(51° to 55°, 4; 56° to 60°, 2.)		
Storage; below 50° F.	3	
(51° to 55°, 2; 56° to 60°, 1.)		
Transportation; iced in summer	3	
(For jacket or wet blanket allow 2; dry blanket or covered wagon, 1.)		
Total	60	

The different items on the score card are not requirements, but things that must be considered in the production of milk; and the producer whose dairy is inspected is rated on each item according to the relation which its condition bears to perfect conditions. An advantage of the score-card system of inspection is that its statements are made in mathematical terms rather than by the vague, indefinite words "excellent," "good," "fair," "medium," and "bad." Such words mean very little, and each one may include a wide variety of conditions. The perfect dairy would score 100, and one superlatively excellent would come very close to that, say, 97 to 99. Some dairies run by wealthy gentlemen for pleasure rather than profit, just as they indulge in yachting or automobiling, will reach a score in the nineties—possibly as high as 99. Some certified-milk dairies can be given a similar score. The better class of what may be called common dairies are usually found in the seventies, and such dairies can, as a rule, be called reasonably satisfactory from the sanitary standpoint. In other words, it is not asked or expected that anyone will reach perfection; a dairy may be rated 25 to 30 points below perfect and yet have reasonably safe and satisfactory conditions. Barring a few exceptions, modern sanitary requirements are practically met by a score of 70 or thereabouts, although it is hoped that the ambitious dairyman will strive to get into the eighties or above, and that he will find appreciative consumers who will be willing to pay an extra price for milk produced under such superior circumstances.

THE REQUIREMENTS OF MODERN HEALTH REGULATIONS.

What added burdens do modern health regulations impose on the market milk producer? The answer to this question will vary much with different individuals and different conditions. Where the latter are so bad as to be rated as low as 20 the cost of reaching a score of 70 will, of course, be more than where one can start with respectable mediocrity, represented by 50, for instance; in other words, the longer the journey the greater the expense. But it should be remembered that in the change from a score of 20 to one of 70 much of the expense should be charged to ordinary decency and not to modern ideas regarding clean milk. We presume that no one, no matter how much of a skeptic he may be concerning milk bacteriology, would openly defend a condition so bad as to deserve a rating no better than 20. In such a case only an insignificant minority not worth considering would criticise a peremptory demand for radical and even expensive changes. If the expense should prove to be beyond the means of the producer there might be sympathy for him, but no criticism of the health officer who put him out of business. Indeed, conditions below 35 are so bad as to call for and justify a peremptory order for improvement.

Scores ranging from about 35 to 60 represent conditions that demand improvement. In such cases modern official milk inspection may properly interfere, although these conditions may have been hitherto regarded as satisfactory.

Upon those milk producers who already have conditions which may be expressed by about 70 or above, the newer milk ordinances impose no additional burden. Such producers are, however, voluntarily assuming an expense which is not incurred by the slovenly producer.

THE STANDARD OF PRODUCTION WHICH EVERY DAIRYMAN SHOULD REACH.

At the outset let us consider what every milk producer ought to do as a matter of decency or as an unquestioned incident of his business. It must be recognized that a certain amount of equipment is essential. There must be healthy cows, wholesome feed, plenty of clean and fresh water, and comfortable quarters. This gives 12 points on the score card to start with.

THE COWS.

In cleanliness the cows vary widely, ranging from the neglected animal with manure-plastered flanks and udders to the cow carefully groomed every day. Grooming costs money, and is not required, though there is more reason for the daily grooming of an animal that produces human food than of one that hauls a manure spreader or garbage wagon. Custom, however, demands that a horse be kept clean, whether it performs menial tasks or hauls the carriage of some person of wealth.

To raise the score for cleanliness of cattle from zero to 6.5 or 7 requires expense for bedding, for prompt removal of manure, for daily brushing the cows when they are housed, for clipping the long hairs about the udder, and for shortening the switch of the tail if it drags in the manure. But no one would defend the manure-coated cow, and an animal should be at least half clean before the modern health officer can be charged with adding to the expense of maintaining the dairy. This partial cleaning allows 4 points, which, added to the 12 noted above, gives us 16.

THE STABLE.

A proper stable is a subject that is much misunderstood and greatly misrepresented. The stable must be so located, constructed, and maintained as to promote the health of the animals and the cleanliness of the product. Many poorly constructed stables are fairly satisfactory when kept clean, and much good milk is being produced in such places by the use of proper methods. But for the present we will consider only light and ventilation. If the stable is poorly lighted the expense of sawing a few holes and putting in sash is so infinitesimal (except in basement stables) as to deserve no consideration. The King system of ventilation—which is the system now most prominently before the public—gives good results when properly installed. This adds to the expense, but a good substitute can be found in windows swinging in so that the fresh air is admitted at the top of the sash, over the cows' bodies. This arrangement will cause no appreciable expense. Estimating light at three-fourths of perfect and ventilation at two-thirds of perfect adds (3 plus 2) 5 points to our previous estimate of 16, giving 21 in all so far.

For cleanliness of stable and purity of stable air at milking time 12 points are allowed on the score card. The most vigorous critic of modern sanitary requirements would not defend a place so bad as to deserve no credit for cleanliness. Two whitewashings a year will add so little to the expense as to be unnoticeable at the end of the year. Feeding hay or ensilage after milking instead of before adds nothing to the expense of production, but results in better milk and may add to the score. We may safely assume that ordinary decency should call for at least half-way cleanliness—6 points, which brings the score to 27.

The daily removal of manure to a field or proper pit may add somewhat to the expense, but more than the added cost will be returned in the saving of plant food. The 2 points possible to gain here is no added burden on milk production, but an actual economy. Our hypothetical score is now 29.

CLEANLINESS OF MILKER, UTENSILS, ETC.

Clean milking suits are a bugbear in some localities and have been ridiculed as an unnecessary and faddish item of outlay. The writer found a New England dairyman who while milking wore clean, though not white, overalls and jumper. When they became somewhat soiled they were used for ordinary farm work and clean ones were taken to wear when milking. Thus clean suits were always in use when milking, with no extra expense except the time required to make the changes. This allows 1 point on the score card.

Inverting the utensils in pure air so that they may drain, dry, and be aired, without opportunity for dust to fall into them or probability of contact with flies, gives the producer 3 points and can not add a penny to the cost of production. (Frequently one sees cans and pails containing a few spoonfuls of milky water standing upright and gathering dust and flies.) Total score at present, 33.

The thorough washing of utensils even when they are not scalded gives 2 points on the score card, which should not be charged to the added cost of production. The thorough washing of all utensils ought to be considered an unquestioned and necessary incident to milk production.

Milking with clean, dry hands costs nothing and is deemed so good dairy practice as to be given 3 points. This brings the score to 38.

At least 1 point can be secured without added expense for fairly prompt removal of milk from barn, and one more for covering the cans in transit. Promptness of cooling (2 points) is not an expense, for if the milk is cooled at all the expense is the same at one time as another.

Here, then, is a score of 42, which can be considered a natural and necessary incident of milk production, with nothing allowed as yet for construction of barn and milk room, for utensils, for cooling milk, and for cleaning the cows' udders. Nearly all producers are entitled to some credit for these items, a credit which they would regard as no added burden incident to the newer requirements.

SOME "HORRIBLE EXAMPLES" OF DAIRIES.

A score of at least 42 to 45 should therefore be the lowest rating of very ordinary dairies and a prerequisite for selling milk. Let us compare this with a few actual figures. The first scoring of the dairies supplying the District of Columbia with milk averaged 43.44; 89 were in the twenties, and 224 in the thirties. The condition of dairies supplying a southern city inspected in 1910 is shown by scores ranging from 25 to 30. An investigation of the Chicago supply showed 12 per cent of the dairies in the twenties and 35 per cent in the thirties, with an average of 40.20. The score of the dairies of a Colorado city averaged about 40, and of a New Hampshire city 35 to 40.

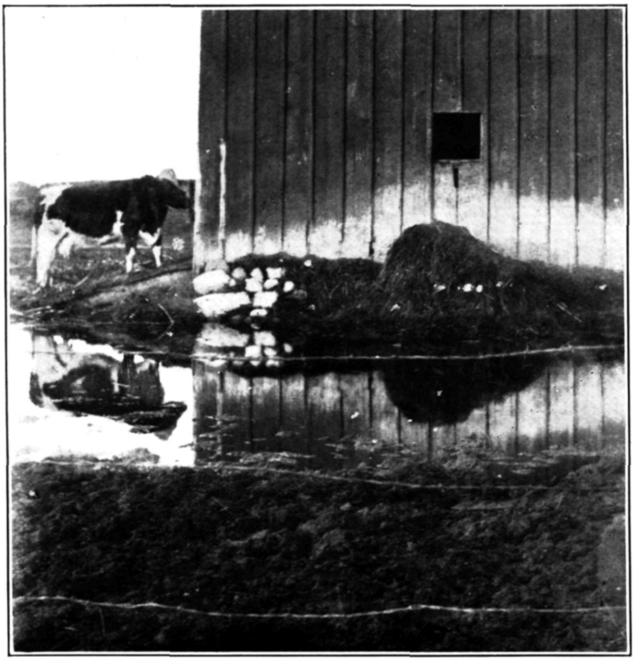
IMPROVEMENTS INVOLVING ADDED EXPENSE TO THE DAIRYMAN.

Let us now turn back to the score card to consider items passed over or receiving a low estimate, where added expense would unquestionably be incurred in effecting improvement.

CLEAN COWS AND SANITARY STABLE.

For cleanliness of cattle an allowance of 4 points was previously made—too low for a good score; five minutes per cow per day would raise the score from 4 to 7.

In regard to the stable, much criticism and misunderstanding has arisen. Some critics intimate that modern milk inspection is only a cement-floor propaganda. One newspaper writer says: "A short time since I heard a hard-working farmer say in all seriousness, 'I can't afford a sanitary barn, and if pushed shall have to go out of the milk



DIRTY BARNYARDS, WASTEFUL OF MANURE AND INCREASING EXPENSE OF KEEPING COWS CLEAN.

FIG. 1.—STABLE WITH INSUFFICIENT LIGHT AND VENTILATION.

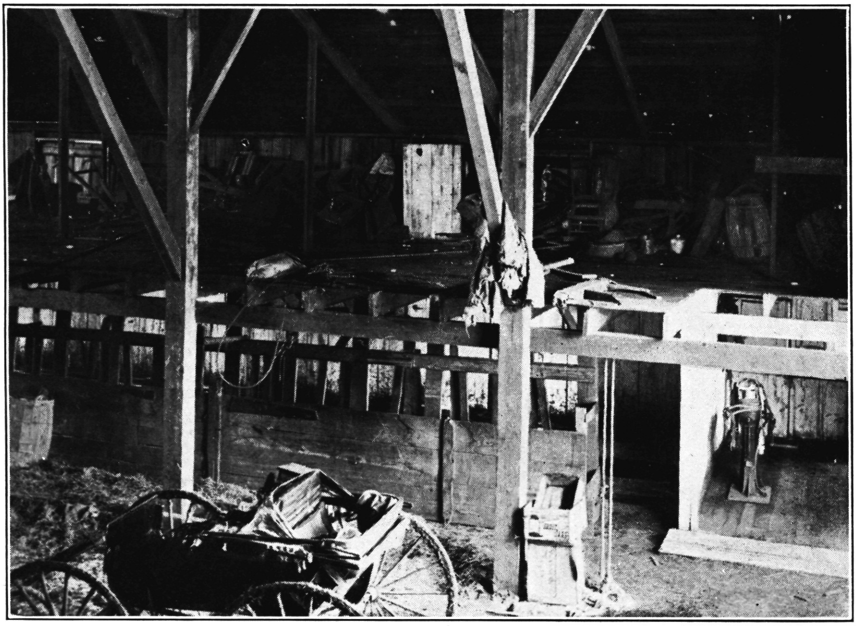


FIG. 2.—A STABLE THAT IS DIFFICULT AND EXPENSIVE TO KEEP CLEAN.

business.' " Says another writer: "In most cases more depends on the individual than upon the score of the barn." His statement is literally true, though liable to be misleading. The object of good barn conditions is not merely to get a creditable score simply for the score's sake, but to help the individual in his efforts to produce clean milk and to have a healthy herd. A man who is exceptionally pains-taking in his methods can get a good total score even when allowed nothing for the barn, but its poor condition would be a handicap and would increase the cost of cleanliness and caring for the herd. In this case a better barn would be an economy.

To secure a properly drained site where the country is level and the buildings already constructed may require expensive grading and other changes, but this counts only 1 point, and in such cases it may be well to see if the expenditure can not be laid out more profitably in other directions. When the site of a barn is poorly drained a clean, well-drained yard is almost impossible, and will doubtless require some expense for cement or cinders, but the result will reduce the expense of keeping the cattle clean.

To secure freedom from contaminating surroundings will frequently add nothing to the expense account, though sometimes it may mean a new place for the swine so that the incident odors and flies may not injure the milk.

A tight and sound floor, smooth and tight walls and ceiling, a wide and deep gutter, a stanchion of the "swing" type simply supported, a simple partition for stalls, and a manger which is merely a concave depression in a cement floor, are recommended as a perfect form of stable construction, carrying 4 points. These recommendations are based on the fact that a stable so constructed has a minimum of dirt-catching possibilities, and saves labor if one is to produce clean milk. Still, as has been stated, a good total score can be made by extra care when the equipment is inferior. But when the floor becomes rotten and urine-saturated, nothing can be done except to incur the expense of a new floor, preferably of cement. To offset this a tight floor will frequently pay a liberal profit on the investment in the saving of fertilizer, and hence be no burden on the producer.

A well-drained site for the barn, free from contaminating surroundings, with enough space for the cows, and proper floor, walls, ceiling, stanchions, etc., counts 9 points. But proper conditions in these respects will also help the score under the heading of cleanliness. A location poorly drained will usually have a dirty barnyard (2 points), which may be so bad as to contaminate the stable air, causing the loss of a point or two more; and this may also mean dirty cows. A rotten, soaked floor may be so filthy as to cause the loss of 2 points for cleanliness of floor and 2 more for stable air. Contaminating surroundings, such as pig pens or horses, may pollute the stable air, causing a loss of several points. Expense in rectifying these troubles may be necessary to get satisfactory conditions, but will help both the barn score and the score for methods.

As regards cleanliness of stable and air, we have already assumed that half-good conditions should be charged to the mere fact of doing business. In some cases there will be slight expense for changes, so that horses may not be kept in the same room with the cows. With a stable so built as to facilitate economy of labor, three-quarters of an hour a day will accomplish much in cleaning up and keeping clean. This is an average of three minutes for each cow in a 15-cow dairy. An average of even two minutes more a cow—thirty minutes a day—will keep the milk house reasonably clean.

THE MILK ROOM.

In the matter of the milk room some expense may be necessary. It has been the practice at some dairies where milk is sold by the can to have no milk room or milk house. The milk is strained from pail to carrier can in the barn and allowed to stand there in winter until the time to take it to the railroad station. In summer the can is set in the tank of water in the barnyard. The dairy utensils are washed with the domestic utensils in the kitchen. Where such a condition exists there will necessarily be expense for constructing a milk house. It need not be costly. Circular No. 158 of this Bureau gives plans for such a building, to cost from $200 to $400. The writer found a small cement milk house in Kansas which had cost the proprietor only $50 for material, the labor having been performed by himself.

A milk room or milk house should have smooth and tight floor, walls, and ceilings, with ample light and ventilation, and be thoroughly screened against flies and other insects. It should be used only for milk purposes and in no case for storage, especially of clothing, horse blankets, harness, or anything of such nature. The expense of the best modern practice, so far as the milk house goes, will be very slight outside of the necessities of the construction of the building itself. Four points are allowed for construction and 3 for cleanliness.

UTENSILS, EQUIPMENT, ETC.

The score card calls for facilities for washing and sterilizing the utensils in the milk house itself, not in the kitchen, and the practice of bringing hot water from the kitchen stove is not satisfactory. In some instances there must be an expense of from $10 to $50 for a heater to furnish the necessary hot water or steam.

A small-top milk pail will cost from $1.50 to $3, according to the pattern used; in some places a small-top cover for ordinary milk pails can be secured as low as 75 cents. If three or four pails are used, the added expense will range from $3 to $12.

A milk cooler is desirable for the best work, and will cost in the neighborhood of $15, though where milk is sold by the can, fairly satisfactory results are obtained by setting the cans in a tank of cold water.

The added expense to each producer for new construction and equipment can not be estimated on account of varying conditions. In many cases it will be nothing, and in others it may vary from 75 cents for a small-top pail cover to $2,000 or even more for a new stable and milk house. Where the barn is old and in bad condition,

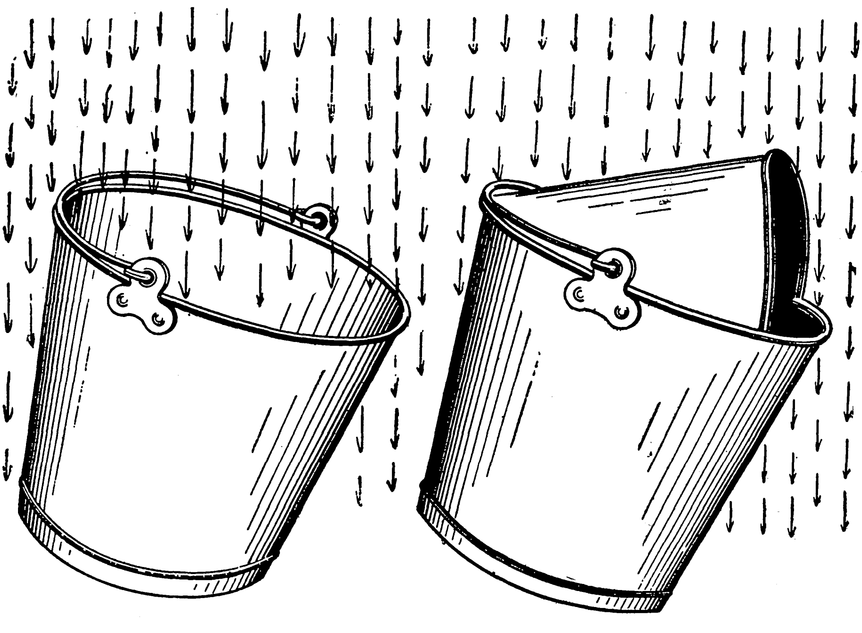


FIG. 3.—Open and hooded milk pails. A hooded pail will keep much dirt out of the milk. The hood can be put on by any competent tinsmith for a small price.

but well located, to make repairs upon it may be extravagance. To let it stand to be used for storage and to build a one-story cow stable as a wing may be advisable. If we assume the extreme of $2,000 on construction account, 10 per cent a year for depreciation and 5 per cent a year for interest on investment will make an annual expense of $300. This is $20 per cow per year in a 15-cow dairy, and less where more are kept. The number of farmers who ought to make a $2,000 investment is comparatively small; for the average producer this figure would be excessive.

The cost of scalding utensils is chiefly caused by the investment for a heating apparatus. There may be a little additional expense for fuel. Scalding the utensils will add 2 points to the score already allowed, and will frequently cause a saving in losses from sour milk.

Wiping the udders with a dry cloth a few minutes before milking gives 1 point. Many producers waste time here. After sitting down to milk they wipe the udders with a dry cloth or with bare hands, raising a dust which settles into the milk and increases the contamination. Time has been wasted and the product is worse for the misdirected energy. The udders should be wiped long enough before milking to allow dust to settle. Wiping the udders with a moist cloth gives 4 points, while the added trouble of washing and drying the udders adds 2 points more. Two minutes per cow will gain the 4 points.

Two points are allowed for removing the milk immediately from the stable as fast as each cow is milked. There is no excuse for allowing milk to stand in the stable, absorbing odors, until all the milking is done, and 1 point has already been allowed for part-way commendable methods. To remove the milk of each cow in the milking pail to a milk house or milk room may take a little extra time. Estimate this labor at two minutes per day per cow to gain the 1 point.

SUMMARY OF CONDITIONS INVOLVING ADDED EXPENSE.

We have now assumed fifteen minutes per cow daily as the additional time necessary to raise ordinary conditions, 16 points, as below:

Item.	Minutes per day per animal.	Additional points gained.
Cleanliness of cows	5	3
Cleanliness of stable and air	3	4
Cleanliness of milk house	2	2
Scalding utensils	1	2
Wiping udders	2	4
Removal of milk	2	1
Total	15	16

We have assumed in the first part of this article that any dairyman should secure at least 42 points as the lowest score that could be considered as a necessary incident of doing business, and none of the expense of reaching this standing should be charged to the advanced teaching of modern bacteriology. A dairyman really ought to do much better than that before anything is said about the added burden of meeting up-to-date sanitary requirements. But let the figure stand at 42 for the sake of moderation and conservatism. We have now shown how an expenditure of fifteen minutes per day per cow in a 15-cow dairy will add 16 points to the score, bringing it up to 58. Estimating labor at 20 cents an hour, 5 cents a day per cow, in addition to the expense of ordinary conditions, will give a rating

FIG. 1.—SEDIMENT IN BOTTOM OF BOTTLE OF MILK.

Such milk should not be regarded as merchantable.

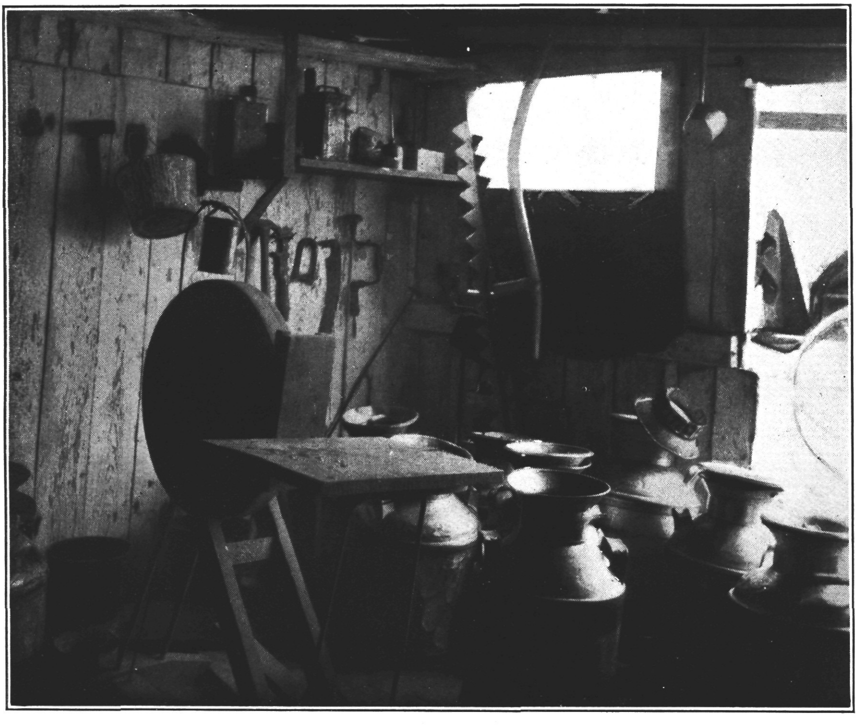


FIG. 2.—A MILK HOUSE FAVORABLE FOR DIRT AND ODORS.

To find a place somewhere else for a tool and paint room and for storage would not involve great expense.

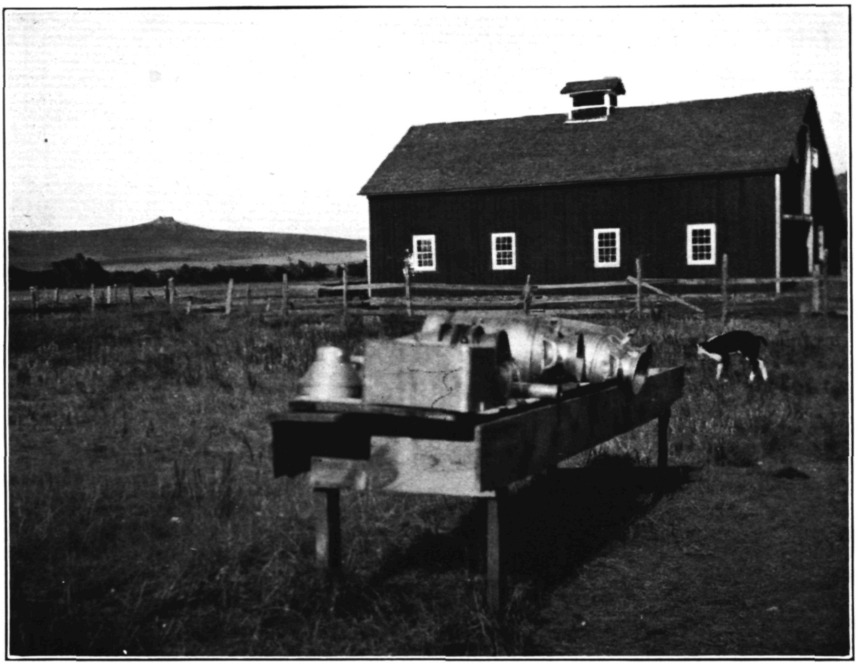


FIG. 1.—MILK CANS EXPOSED TO DIRT AND FLIES.

It costs nothing to invert cans so that dirt will not settle in them and to keep out flies. This dairy loses 3 points for improper care of cans.

FIG. 2.—AN INEXPENSIVE CEMENT MILK HOUSE.

This house is not wholly completed. Observe milk cans inverted to dry.

of 58. This includes nothing for cooling and storing milk and nothing for stable and milk room.

Milk must be cooled to 50° F. or below to secure a perfect score for efficient cooling, and when evening's milk is held for morning delivery it must be held at the same temperature to score perfect for storage. These 8 points, and 2 more for perfection in transportation, necessitate the use of ice. Spring water which would cool the milk below 60° F. would raise the score from 58 to 61, and would in most cases add nothing to the cost of production.

Should the use of ice be charged against the expense of modern bacteriology? In some parts of the South dairymen who retail their own product and have not been accustomed to use ice make two deliveries a day. Under such conditions the use of ice for the efficient cooling and proper storage of milk would be an economy instead of an added expense, for ice would be less expensive than the second delivery. In New England, New York, and some other States ice is regularly stored by the farmers and is regarded as necessary as the hay crop. In those States the use of ice adds nothing to existing expenses. It seems to the writer hardly reasonable to include the expense of ice in the "burden" of up-to-date milk production; but compromising on this by considering cooling to and storing at 55° F., which carry 6 points instead of 8, and the score is raised from 58 to 64. This has caused an added expense of 5 cents per cow per day, with as yet no allowance or estimate for construction of stable and milk house, small-top pails, cooler, etc., which give 18 points in all. If a producer gets one-third of this, or 6, his total score will be 64 plus 6, or 70. The added expense of these 6 points will vary from nothing to the extreme expense of about 5½ cents per cow per day in a herd of 15 for new construction, repairs, and equipment.

One other item of added expense has never been noticed in the discussion of this subject. In the production of reasonably clean milk constant care is required—eternal vigilance is needed. It is only reasonable that the dairyman should have some compensation for this. As his product improves he is more and more of a careful, skilled workman, and he should therefore be better remunerated. There may be a wide variation of opinion as to the amount of this added compensation, but for the purpose of making an estimate we will place it at 5 cents per cow per day in a herd of 15.

GENERAL SUMMARY.

To sum up: To increase the score of a dairy from 42 to approximately 70 points there may be in 15-cow dairies an added expense of 5 cents per cow per day for labor, plus, in extreme cases, 5½ cents for new or additional equipment; and if we add 5 cents more to remunerate the proprietor for his extra care and vigilance there will be an extreme increase of 15½ cents per cow per day. The product of a cow ranges from 4,000 to 10,000 pounds of milk a year, or from 5 to 12 quarts a day. The added expense for labor would therefore amount to about half a cent to 1 cent a quart, and in the rare instances where great additional expense is required for repairs, new construction, and new equipment, this might raise the increase 1 to 2 cents a quart more. The allowance for extra remuneration to the dairyman for added care, which is usually not included in estimates of this kind, but which is considered in the business world in estimating what is reasonable as to salaries, would bring the total added expense per quart from 1½ cents when cows give large amounts of milk to 3 cents when the cows are of low production. The added actual labor and the remuneration for the proprietor—without any new construction or equipment—would increase the expense from 1 to 2 cents a quart. This added expense of improved methods and equipment, however, would no doubt be partly offset by increased production and increased economy of feed, so that the net extra expense of producing clean milk would probably be somewhat less than the figures given.

The writer has made no attempt to discuss, in a dogmatic way, the added expense of producing sanitary milk, but rather to offset the exaggerations and vague generalities which have been published about oppressive and unreasonable demands by specific statements concerning the various details of the dairy industry. In other words, the purpose of this paper is to show that while modern sanitary requirements are not as burdensome as has been represented in some quarters, yet high-grade milk does necessarily cost more than a mediocre product. We have not discussed the difference in actual cost between dirty and reasonably clean milk; that question, indeed, admits of no discussion. Dirty milk ought not to be considered a merchantable article at any price, no matter how low. Any mention of cost or selling price ought to presuppose milk that is at least half-way clean—say, such as would be produced in a dairy scoring in the vicinity of 50.

The fact that there have been exaggerations of the demands and added expense of modern inspection is no argument against the consumer recognizing that the word "quality" as applied to milk means more than chemical composition, that there may be milks of widely varying quality even where the amount of milk solids is the same. A reasonably clean milk is worth 2 cents more than common slovenly milk. The former is safer and therefore cheaper at the increased price.

There has been too much indifference on the part of consumers regarding clean milk, too much of a tendency to regard all milk as the same, and too much of a desire to buy it at a low price, regardless of quality. Merely as a matter of sentiment and refinement, clean and fresh fruit and vegetables command a premium, while dirty food is frequently unsalable at any price. Milk, however, is often regarded with less discrimination. A little sediment meets with no emphatic disapproval. Consumers on seeing side-by-side pictures of bad and of sanitary stables comment favorably on the latter and express disapproval of a food produced in the former, but they haggle over the price and when it comes to paying the bills fail to recognize more value in one kind of milk than the other. Milk in most instances is consumed raw, and is exposed to the direct contamination of all the bad conditions with which it comes in contact. Furthermore, it is the exclusive diet of many invalids and infants, and is an almost perfect medium for the development and spread of germ diseases. Aside from any refined prejudices in favor of clean food, dirty milk may prove expensive even as a gift, while clean milk may be an economy at several cents above the ordinary price. The cheapest article is often the most extravagant. A few additional cents a quart for milk is cheap insurance against some forms of sickness. At the higher price the food material in the milk is cheaper than in many kinds of meat.

The propaganda for the production of cleaner milk must be accompanied by an educational campaign among consumers for a realization of the superior safety of the better article and an appreciation of its greater value, expressed in dollars and cents.

FERMENTED MILKS.

By L. A. Rogers,
Bacteriologist in charge of Research Laboratories, Dairy Division.

INTRODUCTION.

Within recent years there has been a rapidly growing interest in the therapeutic value of buttermilk and other fermented milks, such as kefir, kumiss, and yoghurt. This is seen in the increasing sale of buttermilk, in the large number of special preparations now offered for sale, and in the frequent discussion of this subject in popular and scientific publications. Buttermilk is not only consumed in large quantities as a beverage, but is recommended by physicians as a therapeutic agent in the treatment of intestinal disorders, and is in constant use in many hospitals.

It is the aim of this paper to give the reader a brief résumé of our present knowledge of this subject. The literature relating to fermented milks is already voluminous, and few persons, not even physicians, are so situated that this can be brought together and assimilated. It will be necessary for the benefit of those having a professional interest in the subject to include information of a somewhat technical nature.

All of the more familiar fermented milks are the result of an acid fermentation in which the sugar of the milk is split up into lactic acid. This may be brought about by the presence in the milk of varieties of the common lactic-acid group of bacteria, or, as in the case of yoghurt, by special organisms; or a yeast may be present, adding an alcoholic to the ordinary acid fermentation.

In many large cities special fermented milk preparations can be obtained under various trade names—zoulak, vitallac, yoghurt, matzoon, bacillac, kefir, kumiss, and lacto-bacilline. These are all soured milks which have been introduced from southern Russia, Turkey, and neighboring countries. They are sold as freshly prepared milk, or in the form of tablets or powders in capsules which may be taken directly or used to ferment milk. These preparations have been widely advertised and are the subject of very positive statements in regard to the benefits derived from their use.

Before discussing the various types of fermented milk it will be well to consider briefly the claims made for fermented milks in general, and the actual information on which such assertions are based.

FOOD VALUE OF FERMENTED MILK.

The high food value of milk is too generally recognized to need discussion here; fermented milks also have a high food value, except that in some cases the fat is partially or entirely removed. Otherwise the food value of the fermented milk differs little from that of the fresh milk from which it is made. Any increased digestibility of the fermented milk is due not so much to change in the chemical nature as to the fact that the casein is furnished in a precipitated and finely divided condition. In none of the fermented milks is there any material cleavage of the casein resembling the digestion in the stomach. The fat is almost unchanged, and a part only of the sugar is converted into acid, alcohol, or gas. In certain gastric troubles in which it is difficult to find any food that can be retained by the patient, fermented milks are frequently used with good results. Kefir and kumiss especially are used under such circumstances, as the stimulating action of the carbon dioxid which they contain is believed to aid in their digestion. The value to the physician of a highly nutritious food which can be digested when other foods are rejected is obvious.

THERAPEUTIC VALUE OF FERMENTED MILK.

Fermented milks have been used since very early times, and it is probable that their value in treating intestinal disorders has been known in an indefinite way for centuries, but it is only in recent years that their therapeutic possibilities have been recognized by physicians. The development of bacteriology was necessary to supply the information on which the rational use of this therapeutic agent is based. For the past fifteen or twenty years medical journals have contained occasional papers on fermented milks of various kinds, and at one time the use of kumiss in the treatment of tuberculosis and other diseases was much discussed. The present interest in the subject is largely due to the work of Metchnikoff and his students.

Metchnikoff's views are set forth in a popular way in Chapter V, "Lactic acid as inhibiting intestinal putrefactions," of his book entitled "The Prolongation of Life."[54] [a] He relates many marvelous incidents as to the therapeutic and prophylactic value of fermented milk. The narrative of the sailor who was cared for by Arabs who sometimes reached the advanced age of 200 or 300 years on a diet of soured camel's milk is admittedly somewhat exaggerated, but many cases are cited of exceptional longevity presumably through the use of fermented milks. It should be remembered that the peoples who habitually use fermented milks are hardy races living and working in the open air, and while their good health may be due in

[a] Figures refer to bibliography at end of paper.

part to their simple milk diet, it by no means proves that sour milk is the elixir of life as some writers would have us believe.

Fermented milks are now recommended when a nutritious and digestible food is essential, but it is in the treatment of disorders resulting from autointoxication that their chief value is supposed to lie. Autointoxication may be caused by the undue accumulation of poisonous substances which are promptly removed in health. Toxic substances usually found in small quantities may be produced in excess, or, what is more common, toxins may be formed by bacteria in the intestines in amounts too great to be disposed of through the usual channels. These toxic substances are absorbed into the system and produce symptoms which may be merely an uncomfortable feeling of indigestion and headache, or which may assume the more acute form frequently and erroneously spoken of as ptomaine poisoning. This form of autointoxication is usually accompanied by intestinal gas and foul-smelling stools. One symptom of great value to the physician is the excretion in the urine of abnormal quantities of indican and ethereal sulphates.

The phase of autointoxication which the advocates of the use of fermented milk hope to reach is caused by the decomposition of the partly digested food by bacteria. The digestive tract of the human being is normally free from bacteria at birth. In a short time, however, bacteria gain an entrance, and from that time the intestines are never free from micro-organisms. If an infant is breast fed the variety of bacteria is limited, but if it receives cow's milk the number increases more rapidly and the variety is correspondingly greater. Many persons have erroneous ideas in regard to the contamination of foods by bacteria, and statements are sometimes made which have no basis in fact. It is true, however, that any food may act as a carrier of bacteria, although in properly prepared food the number is usually small. There are some exceptions, as, for instance, milk, and there is no difficulty in explaining the presence of bacteria in the digestive tract. The acidity of the stomach is so high and the food is retained so short a time that under normal conditions bacteria do not multiply appreciably there, but are carried into the intestines, where conditions of temperature, chemical reaction, and nutriment are favorable to the rapid development of many kinds of bacteria. Certain kinds of bacteria establish themselves in the intestines, especially in the lower or large intestine, and are found so constantly there that they may be considered as normal inhabitants of the digestive tract. Among those most familiar to bacteriologists are the *Bacillus coli communis* and members of the *Bacterium aerogenes* group. Other varieties may be present constantly or may appear for a short time only, this depending largely on the nature of the food consumed. Most of the bacteria occurring in the intestines are probably harmless, at least under ordinary conditions. It is not improbable that some of them aid digestion in some way, and may be looked upon as beneficial. On the other hand, unusual varieties may appear, or varieties normally present may be influenced by unusual circumstances to produce changes detrimental to their host. Our knowledge of the bacteriology of the intestines is not yet sufficient to connect intestinal autointoxication with any particular species or group of bacteria, but recent work has indicated that while the normal bacteria of the intestines are of the class growing equally well in the presence or absence of air, autointoxication is coincident with the appearance in the intestines of bacteria growing only under conditions that exclude air. *Bacillus aerogenes capsulatus* is a typical member of this group.

It is not advisable in this paper to consider in any detail the chemical changes that result in the production of toxic substances. It is sufficient to note that it is not necessary to assume the presence of any specific toxin in the ordinary sense of the word. Many products of metabolism which are harmless in small amounts become toxic in excess. The carbohydrates of the partly digested food may be broken up by bacteria into gases, alcohols, and organic acids which are irritating to the delicate mucous membrane. From the proteins may be formed products toxic in their nature. The work of Vaughan and his associates shows that certain of the normal products of digestion may under some combinations of circumstances be split into two substances, one of which is harmless while the other is highly poisonous. Thus slight changes in the course of the decomposition which food undergoes in the intestine may have far-reaching effects on the system.

The use of fermented milk in combating autointoxication is based on the theory that the introduction of lactic-acid bacteria produces conditions unfavorable to the growth of the toxin-producing bacteria. The inhibiting action is believed to be due partly to the acid formed in the milk before it is ingested and partly to the introduction into the digestive system of large numbers of lactic-acid bacteria which become established there and tend to suppress the activities of the bacteria which produce undesirable decompositions.

Turning to the scientific demonstration of the value of sour-milk therapy, we find that most of the evidence is clinical, based on the observation by physicians of the effect of sour milk in various pathological conditions. Numerous instances could be cited of marked improvement of intestinal troubles following the use of sour milk. As has been noted, this action may be due—

(*a*) To the action of the lactic acid contained in the milk at the time it is taken in inhibiting the activities of undesirable bacteria in the digestive tract;

(*b*) To the growth in the intestines of the bacteria taken with the milk which suppress other forms either by the acid produced or through means not identified with acid formation.

Considering the possible action of the acid of the milk in suppressing undesirable bacterial fermentations, we find that it is well known that the growth of some bacteria can be prevented by acids and that different species of bacteria show marked differences in their tolerance to an acid reaction. Many bacteria fail to grow in a medium only slightly acid. As milk sours the many varieties of bacteria usually present in the fresh milk are eliminated one by one until in the curdled milk one or two forms only are found in appreciable numbers. Some peculiar species, as the vinegar organism, are able to stand comparatively high acidity, but these are exceptional, and vinegar is sometimes used as a preservative, especially in the manufacture of many kinds of pickles. The intestinal flora, however, always includes some bacteria capable of growing in a distinctly acid medium. Moro [57] isolated from the stools of breast-fed infants a bacillus able to grow in whey acidified to 0.9 per cent. *Bacillus coli communis* and members of the aerogenes group, which are almost invariably found in the digestive tract, thrive in a moderately acid medium. These two groups ferment sugars, forming organic acids, large quantities of gas, and sometimes small amounts of alcohol. The ingestion of soured milk would be very unlikely to overcome the natural alkalinity of the intestines sufficiently to inhibit bacteria of this class. Moreover, an increase in the milk used would increase the supply of sugar from which gases could be formed. This condition would be exaggerated by the practice frequently recommended of adding to the diet foods rich in sugar to furnish food for the lactic-acid bacteria.

An acid condition of the intestines is carefully guarded against by the provision for the neutralization of the acid juices of the stomach as they enter the intestine. It is probable that this action is largely automatic and that an increased acidity in the food coming into the intestine would be followed by a corresponding increased flow of alkaline secretion. If it were possible to render the contents of the intestines so acid that bacterial growth would be checked even slightly, the action of the digestive enzyms of this region would be almost or completely stopped and serious consequences would result. It is possible that the intestines may contain bacteria whose growth could be checked by a decrease in the alkaline reaction. There is some clinical evidence favoring the use of lactic acid in cases of intestinal autointoxication, but this is not very conclusive. It seems improbable that the acid contained in any form of fermented milk would be great enough to affect the activities of intestinal bacteria.

However, the efficacy of fermented milk is supposed to depend mainly not on the acid contained in the milk, but on the heavy inoculation of acid-forming bacteria into the intestines and their continued growth there to the exclusion of other forms. The evidence that such a condition can be induced is not altogether conclusive. The advocates of the use of sour milk have used for the most part in their experimental work a peculiar bacterium which forms an exceptionally high percentage of acid and which is said to be particularly adapted to acclimatization in the intestines. This micro-organism is generally known as the Metchnikoff bacillus, the bacillus of Massol, or *Bacillus bulgaricus* (see fig. 4, *a*). Cohendy,[12] who fed four patients for extended periods on milk curdled with *B. bulgaricus*, concluded that this organism became readily established in the intestine and that it persisted there for a considerable time after the subject had ceased to take fermented milk. This was said to be especially true if a diet were adopted containing suitable nourishment for the ingested organism. It is stated that the multiplication of these bacteria took place in the upper two-thirds of the colon. The stools were acid or neutral. The same writer in another paper[14] shows that intestinal putrefaction as indicated by the excretion of ethereal sulphates in the urine was materially reduced by the addition of a sour milk to the diet, and that this reduction, which may reasonably be attributed to a disinfection of the large intestine, continued after the ingestion of sour milk was discontinued. This may be taken as an indication that the growth of the bacteria continued after their introduction ceased. This disinfecting action of the lactic-acid culture was not appreciably influenced by variations in the amount of sugar eaten, indicating that the ordinary diet contains sufficient sugar to support the growth in the intestines of the lactic bacteria.

Belonovsky[3] studied the effect of the *Bacillus bulgaricus* on the intestinal flora of mice. In his experiment several lots of mice were fed on a basic ration of sterilized grain and water, and to the ration of two of these lots were added milk cultures of the *B. bulgaricus*. Mice fed on this ration one and one-half months showed this organism in the droppings fifteen days after the last feeding; with animals fed the culture for four months it was present for four weeks after the last feeding.

On the other hand, Herter[39] found that in the digestive tract of a monkey killed after feeding for two weeks on milk soured with *B. bulgaricus* this organism was abundant in the upper part of the small intestine only. In the lower part of the small intestine and in the large intestine *B. bulgaricus* was present in only moderate numbers as compared with other bacteria.

Heinemann and Hefferan[34] found an organism answering to the description of *B. bulgaricus* in ordinary milk, in feces of cows, horses, and man, and in soil, grains, and pickles. They consider that it is normally present in small numbers in the digestive tract and even suggest that it may cause pathological conditions under certain circumstances. The inference may be drawn from their work that since this organism is so widely distributed it must be taken into the digestive system almost continuously, and if it were adapted to growth in the intestines it would become established there in the natural course of events. The small amount of acid formed by their cultures in milk at 37° C. (98.6° F.) shows that they were much less active than the cultures used in making fermented milks. The most active of their cultures formed in three days only a little more than 1 per cent of lactic acid. A typical culture forms in this time at 37° C. nearly or quite 3 per cent.

It must be admitted that up to the present time the investigations have not conclusively demonstrated that it is possible to establish the lactic-acid bacteria in the intestines with any permanency.

From the cases cited or from the numerous clinical observations in which distinct benefit has resulted from the use of fermented milk it does not seem necessary to assume that the multiplication of this class of bacteria in the intestine is essential to the success of this treatment. It is very well known that bacteria excrete substances having a retarding influence on the growth of other bacteria and that in some cases at least this result is not due to acids. It is possible to explain the disinfecting action of fermented milk by assuming the existence of substances of this kind which are formed in the milk and introduced into the digestive system in amounts sufficient to have an appreciable effect on the bacteria of the intestines.

Belonovsky in the work already cited found that while there was no reduction in the intestinal bacteria in mice fed with sterilized milk or with sterilized milk curdled with lactic acid, the two lots fed milk cultures of *B. bulgaricus* showed a distinct reduction in the number of bacteria in the droppings. This was also true of the lot fed with similar cultures sterilized by heat. The diminution was especially evident in the bacteria forming gas and bringing about putrefactive changes. The evidence of the bacterial examination of the stools was confirmed by the changes in weight of the animals while under experimentation. In the two check lots receiving sterilized grain and water, in the lot receiving milk soured with acid, and in that fed sterile milk there were losses in weight; in the two lots fed with milk culture there was a decided gain; and in the lot receiving the sterile culture there was no change in weight. These observations would indicate, although they by no means prove, that the disinfecting effect is due not to the lactic acid, but to the presence in the fermented milk of some by-product having an antiseptic action on certain kinds of bacteria.

The conclusion of Belonovsky that products other than lactic acid play an important rôle are in accordance with the numerous clinical observations of North.[61] His paper on this subject covers observations on many cases of rhinitis, ethmoiditis, and other pathological conditions involving the formation of pus, which were treated with cultures of *B. bulgaricus* used as a spray or wash. In a high percentage of cases this treatment resulted in improvement and frequently in a complete cure. While this work was not controlled by checks to determine the part played by lactic acid or other factors, it is much easier to explain effects of this kind on the basis of a specific antiseptic body than by attributing it to the action of a dilute acid. Conradi and Kurpjuweit[16] have demonstrated that bacteria of the *Bacillus coli* group excrete substances which are antiseptic not only to other bacteria but, when they accumulate in sufficient quantities, to the bacteria secreting them. It is very probable that this is also true of lactic-acid bacteria. It should be stated, however, that the work of Conradi and Kurpjuweit has not been accepted as entirely correct. Kern[43] claims to have separated from cultures of *B. bulgaricus* a substance having a distinct inhibiting action on *B. coli communis*.

While there is no doubt that the benefits to be derived from the use of fermented milk have been greatly exaggerated, especially by those financially interested in an increased use of these preparations, there can be no question that in some cases, at least, much good has resulted from their use. To whatever action of the milk this effect is due, there is abundant evidence to show that putrefactive changes in the colon, with their accompanying symptoms, have in many cases been checked by the addition to the diet of some form of soured milk. Herter[38] found that an increase of ethereal sulphates and indican followed the ingestion with the food of cultures of the colon bacillus and *B. proteus vulgaris*. These indicators of intestinal putrefaction were diminshed by a diet of bread and milk, and cultures of lactic-acid bacteria usually produced a marked decrease. Results of a similar nature have been obtained by others, notably by the associates of Metchnikoff. To this could be added many observations by physicians cited in the medical journals.

It is probable that in many cases an improvement in health following the use of fermented milk may be due not so much to the action of the acid-forming bacteria as to a marked change in the dietary incidental to the use of the milk. Herter and Kendall[40a] found that the nature of the bacterial flora of the intestines could be promptly and distinctly changed by a radical change from a diet high in protein to one in which carbohydrates predominated, or vice versa. A high protein diet caused symptoms of intestinal putrefaction. A change to a carbohydrate diet resulted in a reduction of the putrefactive bacteria, an increase in the acid-forming bacteria, and the disappearance of the indications of autointoxication.

There are many questions that should be very carefully considered before a fermented milk is introduced as an important part of one's diet. As Herter[39] has pointed out in the admirable paper already cited, the addition of fermented milk to the diet may change very materially the ratio of protein to other classes of food. If the milk is taken in place of other food, the daily protein ration may be so reduced that intestinal putrefaction, which is dependent on the protein part of the food, is diminished. On the other hand, if milk is added to the usual food, the protein ratio will be increased rather than diminished. In many cases the condition of the mucous membranes will not permit the presence of organic acid, and soured milk can not be retained. It is also possible that symptoms of autointoxication are due not to unusual bacterial activity in the intestine, but to functional failure of certain organs. This point could be determined only by a physician. It would be very unsafe to consume large quantities of milk, fermented or unfermented, under certain pathological conditions. In any case an important change in one's diet should be made only upon the advice of a physician.

THE VARIOUS FORMS OF FERMENTED MILK.

If it is considered advisable to use cultures of acid-forming bacteria, the form in which these are taken becomes an important question. In large cities one usually has a choice of lactic-acid bacteria from several sources. Buttermilk is usually available, although it is not always of good quality. Sometimes kumiss or kefir can be obtained, and at the present time milk coagulated with the so-called Metchnikoff bacillus is sold as yoghurt or matzoon and under various trade names.

CULTURES IN TABLET AND CAPSULE FORM.

In addition to these freshly prepared preparations several tablets or capsules purporting to be pure and active cultures of the *Bacillus bulgaricus* are now offered for sale. These are for use in fermenting milk or are to be taken directly in place of buttermilk or yoghurt. Herschell[37] in his little book on the therapeutic uses of soured milks recommends the use of these preparations in preference to fermented milk, but it should be noted that he is very explicit in his statement that great care should be taken to determine the abundance and purity of the desired organism. Three brands of these tablets purchased at drug stores in Washington have been examined in the Dairy Division laboratory. It was found that while some of them sometimes contained the Metchnikoff bacillus it was present in such very small numbers that it could be detected only with difficulty. When these tablets were added to sterile milk they never, even under the most favorable temperature conditions, produced a clean acid curd. The milk was curdled, but with a rennet curd, and showed every evidence of the presence of peptonizing and gas-forming bacteria and yeasts. One tablet which was advertised to contain "5,000,000 active Metchnikoff units" was found to contain something over one million bacteria, nearly all of which were of the class usually considered as undesirable inhabitants of the digestive tract.

It is very easy to test the purity and activity of these dried cultures. Thoroughly pasteurize a small quantity (about half a pint) of milk by holding it, in a bottle plugged with cotton, at or near the boiling point for an hour or more. When this has cooled add two or three of the tablets and keep in a very warm place overnight. It should not be below and may be a few degrees above blood heat. If in this time the milk has not curdled with a sharp acid taste and without gas bubbles and whey there can be no reason for using these tablets except the possibility that they contain the active element of the culture which retards the growth of other bacteria. The evidence on this point is so inconclusive that it need not be considered in this connection.

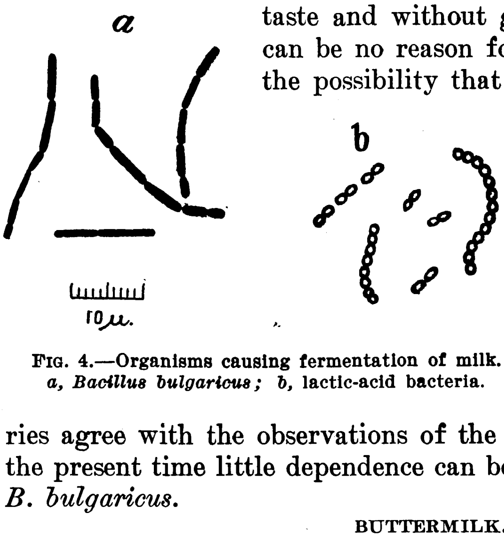


FIG. 4.—Organisms causing fermentation of milk. *a, Bacillus bulgaricus; b,* lactic-acid bacteria.

The results of examinations of these and similar tablets and powders reported by other laboratories agree with the observations of the writer in indicating that at the present time little dependence can be placed on dried cultures of *B. bulgaricus.*

BUTTERMILK.

Buttermilk, properly speaking, is the by-product resulting when milk or cream is churned for butter making. It is the milk remaining after the fat has been collected in globules and removed. If cream is churned when sweet the buttermilk does not differ from ordinary skimmed milk, but if it is churned when sour—the usual practice—the acidity is sufficient to coagulate the casein in the cream. In the churning process this curd is broken up into very fine particles. These curd particles settle very slowly, and if the buttermilk is agitated occasionally it will retain its milky appearance. When the buttermilk is allowed to stand undisturbed for several hours the curd particles sink to the bottom leaving an opalescent whey at the top. At the present time a large part of the buttermilk sold in cities is not made by churning cream, but is simply soured skimmed milk which has been churned or stirred in order to break up the curd. The same product is sold also under the name of ripened milk.

The souring of milk or cream is brought about by the activity of certain bacteria which form lactic acid by decomposing the milk sugar (lactose). The ability to form acid from lactose and other sugars is possessed by many kinds of bacteria, but is so characteristic of a certain group that they are commonly spoken of as the lactic-acid bacteria (see fig. 4, *b*). These bacteria have been described as distinct species or varieties under many names. Among these may be mentioned *Bacterium guntheri*, *Bacillus acidi lactici*, *Streptococcus lacticus*, and many others. In spite of the confusion in nomenclature it is evident that the term "lactic-acid bacteria" includes a fairly well-defined group of closely related varieties possessing in common several definite characters. Variations from the type in minor characters produce an almost infinite number of varieties. These variations may be in the ability to ferment different sugars, in the tendency to grow in chains, in the kind of flavor formed in milk, in the intensity of acid formation, and in the ability to produce pathological conditions in animals.

In many creameries the cream is allowed to sour spontaneously. In this case many bacteria other than the true lactic bacteria will take part in the acid formation, and in addition to lactic acid the buttermilk may contain in small quantities acetic, succinic, and formic acids, and sometimes traces of alcohol. The lactic bacteria form lactic acid, with only slight traces of other organic acids, no alcohol, and no gas. In well-managed creameries the acid fermentation is assisted and controlled to some extent by the use of a starter. This may be good milk allowed to sour spontaneously, or buttermilk from the previous day's churning, but careful butter makers build up starters from commercial cultures. These cultures are sold in the form of powders, tablets, or fluid cultures, as varieties of lactic-acid bacteria selected with special reference to the production of a desirable flavor in butter. The butter maker puts this culture in about a quart of milk which has been steamed for an hour or more to reduce the bacteria to the lowest possible number. After standing overnight this milk will usually be curdled, but gas bubbles and other evidences of contamination may be observed. A small portion of this milk is transferred to another bottle of milk prepared as before, and this process is continued until the acid fermentation has become sufficiently active to eliminate the contaminating bacteria, and the milk curdles with a clean acid taste and without signs of gas or "wheying off." This small starter, or "mother starter," is carried along indefinitely by daily transfers to freshly steamed milk. If reasonable precautions are taken to prevent contamination and to insure the thorough heating of the milk, this culture will remain pure and vigorous for an indefinite time.

To prepare the starter actually used in ripening the cream, a larger lot of milk—25 to 50 gallons or more, according to the amount of cream—is heated for an hour or more. This is usually done in a special apparatus (sold by creamery supply houses) which consists of a large can inclosed on the sides and bottom by a steam jacket and fitted with a belt-driven stirrer. Milk either skimmed or unskimmed is heated by turning steam into the jacket; during the heating the milk is stirred constantly. After the pasteurization is completed cold water is run into the jacket and the milk cooled to about 24–27° C. (75.2–80.6° F.). A bottle of the mother starter is added and the can is covered and allowed to stand overnight. This gives a large and active pure culture of lactic-acid bacteria to start the acid formation in the cream. More uniform results are obtained if the cream is first pasteurized.

When lactic-acid bacteria grow in milk the lactose is converted into lactic acid with slight traces of certain other organic acids. This acid breaks up the combination of calcium phosphate and casein which holds the casein in solution, and the casein is precipitated as a firm jelly-like mass. When this occurs in cream the fat globules are entangled in the precipitated casein. In the process of churning the casein is broken into fine particles and the fat globules are collected into large granules that float on the top of the buttermilk. Buttermilk, then, is the water of the milk holding the sugar, acids, ash, and other soluble constituents in solution and the finely divided particles of precipitated casein in suspension. The amount of fat in the buttermilk depends on the thoroughness with which the fat is collected in the churning. Even with the best methods a little of the fat in the form of very small globules remains in the buttermilk. On standing, the suspended casein settles slowly to the bottom.

The composition of an average buttermilk is about as follows: [a]

	Per cent.
Fat	0.5
Casein	2.4
Albumen	.6
Lactose	5.3
Ash	.7
Total solids	9.5

Chemically, buttermilk differs but little from milk. Only a slight rearrangement is necessary to bring about the physical change in the casein. If the milk has been pasteurized at a high temperature, the albumen is precipitated and the larger part lost. A small part—less than one-fifth—of the milk sugar is converted into acid. This acid combines with the ash constituents, probably converting the tri-

[a] Vermont Agricultural Experiment Station. Annual Report, 1891, p. 119.

phosphates to di-phosphates and mono-phosphates and the di-phosphate to mono-phosphate. It is obviously not necessary to make butter in order to secure a perfect substitute for buttermilk. Soured skim milk has all the chemical properties of buttermilk, and if it is thoroughly agitated in order to break up the curd it agrees in appearance and flavor with buttermilk obtained by churning cream.

In making buttermilk from milk the same procedure should be followed as in making a starter for cream ripening. A good, clean-flavored "mother starter" should be carried along with every possible precaution to prevent contamination. Good commercial cultures can be obtained, but if it is not convenient to use one of these a natural starter can be secured. For this purpose select milk from several sources, put it into steamed bottles or glass jars, and allow these samples to stand in a warm place until they have soured. Prepare milk for inoculation by steaming or holding a sufficient number of bottles of clean, fresh milk in boiling water for about an hour. When these are cool add to each one from 5 to 10 per cent of milk from those samples that have given the curd with the least evidence of contamination and the most agreeable acid taste. The first sample should contain a high percentage of lactic-acid bacteria. In the second transfer these develop quickly and other varieties are soon suppressed by the acid formed. If there is no added contamination, extraneous forms should soon be entirely eliminated.

After three or four transfers one of these at least should sour in twelve or fifteen hours at room temperature with a clean-flavored acid curd. Gas bubbles or the separation from the curd of a milky or straw-colored whey show that the lactic-acid bacteria are still mixed with other kinds. Considerable variation in flavor can be found in different cultures, and care should be exercised to select one that gives a clean and sharp taste.

Milk to be used for making buttermilk should be fresh and clean flavored. Good buttermilk can not be made from milk that is tainted or too old to be used for other purposes. Skimmed, partly skimmed, or whole milk, as desired, may be used. More uniform and satisfactory results can be secured by destroying the bacteria as completely as possible. If a continuous pasteurizer is used for this purpose the milk should be heated to 82° C. (180° F.) or 85° C. (185° F.). If cans or other holding devices are used—and this method is to be preferred—the milk may be heated to 82° C. (180° F.) or more and held for thirty minutes to an hour. The scorched taste which results from pasteurization at this temperature is not objectionable, as it is obscured by the acidity of the soured milk. The time of the inoculation may be arranged to suit the convenience of the maker and can be determined by experience in each individual case. Using the same culture and holding the temperature uniform, the amount of the starter can be adjusted to bring the acidity to the curdling point at any definite time within narrow limits. The temperature of the milk should be between 21° and 24° C. (70° and 75° F.). More rapid development of acid can be obtained at higher temperatures, but at the lower temperatures the lactic-acid bacteria are more successful in checking the growth of digesting and gas-forming bacteria. At lower temperatures and with a slower development of acid the casein is precipitated in a finer and more friable curd than at temperatures inducing a more rapid acid production. As soon as a fine curd has been formed the milk should be cooled promptly to below 50° F. to prevent the contraction and toughening of the curd. The curd should be thoroughly broken up by churning as soon as the milk has cooled to the proper temperature. The buttermilk is then ready for bottling, and should be smooth, free from lumps, and show a separation of whey and curd only on long standing.

A more uniform product can be obtained if it is made on a large scale, and if good buttermilk can be purchased from a reliable milk dealer at a reasonable price it is not advisable to attempt to make it on a small scale. However, it is possible to make buttermilk in the home by following in a small way the directions for making buttermilk on a commercial scale. It is necessary first to secure a culture or starter, which is merely milk containing the lactic-acid or sour-milk bacteria free or very nearly free from other kinds. These bacteria are present in any normal milk, and it is only necessary to provide conditions favoring their growth to obtain them in a state of purity. To secure this starter or culture the following procedure should be followed: Steam or boil a bottle holding 4 to 8 ounces for half an hour; fill it two-thirds full of fresh milk and put in a plug of cotton or cover with an inverted glass. Hold this at the ordinary room temperature until the following day, when a second bottle should be prepared in the same way. Put this bottle of milk in water, bring the water to a boil, and hold in this way for about an hour. After cooling to below blood heat add a teaspoonful of the milk from the first bottle. On the following day a third bottle of milk should be heated and inoculated from the second bottle. If the third bottle does not give a curd with a clean acid taste free from gas and whey it should be discarded and the entire process repeated. After the culture is obtained it is not necessary to maintain a small starter to inoculate the milk to be soured for use. Start the buttermilk by heating a quart bottle or jar of milk in boiling water at least a half hour. Cool to below blood heat and add a tablespoonful of the soured milk from the small bottle. When this has soured cool the milk by setting the jar on ice or in cold water, and break up the curd by shaking. Start the buttermilk for the following day with a tablespoonful of this buttermilk, or pour the buttermilk from the bottle in which it is made, and without washing fill the bottle with heated and cooled milk to sour for the following day. Sufficient sour milk will cling to the sides of the bottle to inoculate each succeeding quantity. One of the vacuum jacketed bottles will be found very convenient for this purpose because the milk can be held at a nearly constant temperature favorable to the growth of the lactic-acid bacteria.

Butter makers in the Northwest make a very refreshing and nutritious drink by adding sugar and lemons to buttermilk. As the casein is already precipitated, the acid juice of the lemon has no effect. Slightly more sugar and lemon juice are necessary than in making ordinary lemonade, and the mixture should be well iced.

KEFIR.

Fermented milks have evidently been extensively used by the people of southern Russia, Turkey, the Balkan countries, and their neighbors for many centuries. The natives have no records and few traditions of the origin of the milks they use, and it is probable that their preparation and use developed gradually by accident and cumulative experience. One of the first of the fermented milks known to Europeans was the kefir, made in the Caucasus Mountains and neighboring regions from the milk of sheep, goats, and cows. Kefir differs from most of the fermented milks of the Mediterranean countries in that it is made from a dried preparation and contains considerable quantities of alcohol and gas. Kefir is made by many tribes under varying names, as "hippe," "kepi," "khapon," "kephir," "kiaphir," and "kaphir," all of which are said to come from a common root signifying a pleasant or agreeable taste.

The mountaineers of the Caucasus depend for a large part of their food on kefir, which they prepare in leather bottles made from the skins of goats. In the summer the skins are hung out of doors either in the sun or in the shade according to the weather, but in winter they are kept in the house. The bags are usually hung near a doorway, where they may be frequently shaken or kicked by each passer-by. Fresh milk is added as the kefir is taken out, and the fermentation continues. Made and propagated in this way, foreign bacteria become mingled with the essential bacteria of the grains, and abnormal and frequently disagreeable flavors result. When the milk is drawn off, in order to prevent the escape of gas, a string is first tied around the neck of the leather bottle, so that the small part wanted for use is held between the stricture and the opening. In the villages and the low country kefir is made in open earthen or wooden vessels and most of the gas escapes.

Small yellowish, convoluted masses are observed in kefir, which are called seeds or "grains." These grains consist of a central filament of two parts, of which the outer spreads out, forming the convoluted polyp-like exterior. These parts are built up one upon another, giving the large grains a coral-like appearance. The central part is made up of a mass of bacterial threads. In the exterior, yeast cells are found mingled with the bacteria. When the grains are added to milk they swell and increase in size by forming new grains. At the beginning of the fermentation they settle to the bottom, but in a short time they are carried to the surface by attached bubbles of gas. If the fermentation is active, a thick layer will be formed on the surface, but on shaking or stirring this layer settles again to the bottom.

The biology of kefir was studied by Kern [42] in 1881; but, owing to the faulty technique of that day, his descriptions are evidently erroneous.

Freudenreich [23] describes four organisms that he isolated from kefir grains. One of these was a yeast which he designated *Saccharomyces kefir;* this he found to grow best at 22° C. (72° F.), but not at all at 35° C. (95° F.). It ferments maltose and cane sugar, but not lactose. It gives a peculiar flavor to milk, but causes no fermentation. The cells are oval, 3 to 5 microns by 2 to 3 microns. It is not identical with the ordinary beer yeasts. Two of the organisms were of the lactic-acid bacteria type, but differed from them in forming gas in lactose media. The most interesting of the organisms described is a long, slender bacillus corresponding to one described by Kern as *Dispora caucasica* and to which Freudenreich gave the name *Bacillus caucasicus.* In morphology, failure to grow on ordinary laboratory media, and in high acid production in milk, this bacillus resembles very closely the bacillus mentioned later in connection with yoghurt as *Bacillus bulgaricus.* If Freudenreich's description is accurate, *B. caucasicus* differs from *B. bulgaricus* by forming gas from lactose and in being feebly motile. At 35° C. (95° F.) it produced 0.2025 per cent of acid in nine days. Gas was formed slowly at this temperature and still more slowly at 22° C. (72° F.). No one of these organisms alone produced kefir, but when the four together were grown in milk typical kefir was produced on the first or second transfer.

According to the investigations of Nikolaiewa,[60] three organisms are always present in the fermented milk. One of these, *Bacterium caucasicum,* which forms the filament of the grain, is evidently identical with Freudenreich's *Bacillus caucasicus.* This investigator considers this bacterium, with a torula yeast fermenting lactose, dextrose, and cane sugar, as essential to the production of kefir. Other bacteria and yeasts are found in the grains and the fermented milk, but they are looked upon as contamination.

It is probable that kefir is produced under different circumstances by different organisms. Any combination of bacteria or of bacteria and yeasts that will produce a lactic-acid and a mild alcoholic fermentation in milk will make kefir, although to secure the most desirable flavor certain organisms may be essential.

Hammarsten [29] shows the changes brought about in cow's milk by this fermentation in the following table:

Chemical analysis of kefir.

	Two days old.	Four days old.	Six days old.
Casein	2.570	2.586	2.564
Lactalbumen	.425	.405	.390
Peptones	.071	.089	.120
Lactose	3.700	2.238	1.670
Fat	3.619	3.630	3.626
Ash	.641	.624	.630
Lactic acid	.665	.832	.900
Alcohol	.230	.810	1.100

It will be observed that the changes were confined almost entirely to the lactose and its by-products. The casein remained unchanged and the increase in the peptones was insignificant. The lactalbumen decreased slightly. The casein of kefir is, according to this chemist, not especially soluble, but may be more easily digestible because of its finely divided condition. The lactose diminished appreciably, and there was a corresponding augmentation of alcohol and lactic acid. A certain part of the lactose is consumed in the formation of carbon dioxid gas not included in this analysis.

The following directions are given for making kefir when the grains are available: The dry grains are softened by soaking in warm water, which should be changed several times. When the grains rise to the surface and become white and gelatinous they are ready for use. One part of these grains is used to three parts of milk which has been thoroughly heated to destroy the bacteria already present. The bottles in which the milk and grains are placed should not be stoppered but should be protected from the dust by cloths, inverted cups, or plugs of cotton. They are held at a temperature at or near 14° to 16° C. (57° to 60° F.), and stirred or shaken frequently. After eight to ten hours the milk is strained through cloth and put in tightly stoppered bottles at the same temperature as before. The bottles should be shaken every few hours to prevent the formation of lumps of precipitated casein. The kefir is ready for use at the end of twenty-four hours. If it is held longer than this it is advisable to keep it on ice to check the fermentation. The temperature at which the milk is fermented is important in controlling the relative amounts of alcohol and lactic acid. At higher temperatures the percentage of alcohol is increased, while as the temperature is lowered the alcoholic fermentation diminishes and the quantity of lactic acid formed is greater. After the fermentation is once started the grains may be discarded and new kefir made by adding one part of the fermented milk to three or four parts of fresh milk. In order to remove the grains the kefir should be strained through cheese cloth, and after thorough washing to remove the curd the grains may be dried by exposure to the sun on pieces of blotting paper. In this condition they are said to retain their vitality for several years, although many of the yeasts in the outer part of the grain are killed by the desiccation. It may be necessary to break up the grains with the fingers. They should not be larger than a walnut when in the wet stage.

Kefir grains can not ordinarily be obtained in this country, but a good imitation of kefir can be made by carrying on simultaneously in sealed bottles an alcoholic and a lactic fermentation. Better results can be obtained by inducing the alcoholic fermentation in buttermilk. In this way it is possible to avoid much of the trouble from the formation of lumps of curd. If buttermilk is made for this purpose from whole or skimmed milk, careful attention should be given to the time of curdling and the breaking up of the curd. This is essential to a smooth, creamy kefir. Ordinary bread yeast may be used for the alcoholic fermentation, but as this yeast does not ferment lactose it is necessary to add cane sugar to the milk. Prepare the yeast on the day before the buttermilk is ready by adding a half teaspoonful of sugar to a 6 or 8 ounce bottle of boiled and cooled water. Add half of a yeast cake to this sugar solution and set in a warm place overnight. This will give an active culture of the yeast and obviates the necessity of adding the yeast cake directly to the milk.

On the quantity of sugar added to the buttermilk will depend the extent of the alcoholic fermentation. Theoretically about one-half of the sugar fermented may be converted to alcohol; that is, milk to which 1 per cent of cane sugar has been added may contain after the fermentation one-half of 1 per cent of alcohol. The quantity of sugar added should be governed by the amount of carbon dioxid it is desired to have in the finished product. This should be sufficient to make the kefir distinctly effervescent and impart to it the peculiar sharp taste of charged water, but should not be developed enough to blow the fluid out of the bottles when the stoppers are removed. Experience shows that 1 to 1½ per cent of sugar will give the right amount of gas. This may be approximated by adding sugar in the proportion of 2 even teaspoonfuls of sugar to each pint of milk.

Having the buttermilk and the yeast culture ready, dissolve the sugar in the buttermilk and add the yeast culture in the proportion of 1 teaspoonful to a quart of buttermilk. Mix thoroughly and bottle. The bottles should be very strong, as sufficient gas pressure is sometimes generated to break ordinary bottles. The heavy bottles used for ginger ale or other carbonated drinks answer this purpose very well. The bottles should be carefully cleaned and boiled or steamed before filling. Fill them full and stopper tightly, wiring or tying the stoppers securely in place.

The alcoholic fermentation should be carried on at a comparatively low temperature. If the fermentation is too active the kefir will have a yeasty taste and the curd is likely to become lumpy and filled with large gas bubbles. A temperature of 18° C. (65° F.) to 21° C. (70° F.) will be found satisfactory for kefir which is to be used on the third or fourth day. The floor of a cool cellar is a convenient place to ferment kefir made in the home. The bottles should be shaken as often as may be necessary to keep the curd in a finely divided condition. The finished product should be smooth and creamy, effervesce rapidly when poured from the bottle, and have the pleasant acid taste of buttermilk with the added sharpness due to the gas and the trace of alcohol. Kefir 2 or 3 days old may have a yeasty taste, but if it has been properly made this will disappear as the fermentation of the sugar nears completion. Kefir made under these conditions should be used when 3 to 5 days old, but if it is put on ice it may be held for a week or even longer.

KUMISS.

The missionary monks and other wanderers who first penetrated the undulating, treeless plains of European Russia and central and southwestern Asia brought back descriptions of a fermented drink which in the light of more recent investigations is easily recognized as kumiss. These vast prairies are inhabited by tribes of nomads who live in squalid huts or tents in the winter and wander during the summer, seeking pasture for their horses, their herds of cattle, or flocks of sheep. They are all horsemen, and by a process of selection in which they have probably played only a passive part have developed an exceptionally hardy race of horses. The mares give much more than the ordinary amount of milk, which constitutes almost the entire food of the people during the summer. This is never used in the fresh condition, but is fermented to make kumiss. Unlike kefir, there is no dried "ferment," "seeds," or "grains" with which the fermentation of the mare's milk is started. It is the practice of the natives, when it becomes necessary to establish the fermentation anew, to add to milk some fermenting or decaying matter, such as a piece of flesh, tendon, or vegetable matter. Whatever the material used to supply the essential organisms, it is evident that the milk is so cared for that a combination of an acid and an alcoholic fermentation is favored and the necessary bacteria and yeasts are soon established.

No doubt the change in the milk is produced under different circumstances by different combinations of bacteria and yeasts, and there are usually present various contaminating organisms which are detrimental or at least are not essential to the production of the kumiss. Native kumiss makers lay great stress on the quality of the milk, the breed of the mares, and the condition of the pastures; but it is probable that their troubles ascribed to variations in these conditions are more likely due to imperfectly controlled bacteriological factors.

There was at one time much interest in kumiss as a therapeutic agent in the treatment of tuberculosis, and sanatoria were established in Russia where invalids could be given this treatment. It is probable that the benefits, real or imaginary, derived from this treatment came more from the general methods, which corresponded somewhat to present practices, than to the action of kumiss.

Mare's milk is lower in nutritive value than cow's milk, as the following table, taken from Richmond's Dairy Chemistry, shows:

Average composition of cow's milk and mare's milk.

	Water.	Fat.	Sugar.	Casein.	Albumen.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Cow	87.10	3.90	4.75	3.00	0.40	0.75
Mare	90.06	1.09	6.65	1.89		.31

The composition of kumiss varies somewhat with the age, the rapidity of the fermentation, and the nature and extent of contamination with extraneous organisms. The following analysis is taken from Richmond's Dairy Chemistry (p. 241):

Composition of kumiss made from mare's milk.

	1 day old.	8 days old.	22 days old.
	Per cent.	*Per cent.*	*Per cent.*
Water	91.43	92.12	92.07
Alcohol	2.67	2.93	2.98
Lactic acid	.77	1.08	1.27
Sugar	1.63	.50	.23
Casein	.77	.85	.83
Albumen	.25	.27	.24
Albumose	.98	.76	.77
Fat	1.16	1.12	1.30
Ash	.35	.35	.35

It will be observed that this fermentation produces no changes that could be expected to increase appreciably the digestibility of the nitrogenous part of the milk except the possible advantage of a finely divided curd. Mare's milk differs from cow's milk in giving with rennet a softer, more friable curd, but it is not certain that this property would increase the value of kumiss.

Kumiss is often made and offered for sale in this country, but as this is usually made from cow's milk, it is, more correctly, kefir.

YOGHURT, ETC.

In passing to a consideration of the fermented milks used by the people of the countries bordering on the eastern end of the Mediterranean we find a preparation very distinct from that of the Caucasus and the Russian steppes. Kefir and kumiss are limpid, mildly acid, and distinctly alcoholic; but the yoghurt, yahourth, or jugurt of the Turks, the kissélo mléko of the Balkan people, the mazun of Armenia, the gioddu of Sardinia, the dadhi of India, and the leben or leben raib of Egypt are all thick curdled milks, decidedly acid, and with very little or no alcohol. The method of preparation is also quite different. Goat's, buffalo's, or cow's milk may be used. This is usually boiled and sometimes is reduced by evaporation to one-half its original volume. In the latter case it is not used as a drink, but is eaten, frequently with the addition of bread, dates, or other food.

A portion of the previously fermented milk is used to ferment the fresh milk. Unlike kefir, there are no "seeds" through which the fermentation can be transmitted, but the essential organism is sometimes preserved by drying the fermented milk and reducing the dry material to a powder. This constitutes the "podkwassa," or "maya." The organism giving these milks their distinctive character is evidently identical in all of them, or, more properly speaking, may be any one of the several varieties of a distinct and closely related group. On account of its peculiarities, some of which are exceptional and striking, and the importance recently attached to it by the discussions both in the scientific and the popular press, a brief résumé of its characteristics is given:

This bacterium was probably first observed by Kern,[42] who incorrectly designated it *Dispora caucasicum.* His description, however, is so limited that it is impossible to attach the name he proposes to any particular organism. Later Beyerinck,[6] under the name *Bacterium caucasium*, and Freudenreich,[23] as *Bacillus caucasicus*, described organisms isolated from kefir which agree in their essential features with those obtained from yoghurt. More recently Rist and Khoury[66] isolated from Egyptian leben two bacilli to which they gave the names *Strepto-bacillus lebenis* and *Bacillus lebenis.* Grigoroff[27] and Cohendy[13] isolated similar organisms from Bulgarian fermented milk. These various bacteria are undoubtedly nearly or quite identical and are all included under the name *Bacillus bulgaricus*, now generally adopted. More strict adherence to the commonly accepted rules of bacteriological nomenclature would retain the name *Bacterium caucasicum* proposed by Beyerinck. Recent work by Hastings[30] and by Heinemann and Hefferan[34] indicates that this bacterium is not peculiar to the eastern fermented milks, but is widely distributed, having been isolated from milk, soil, saliva, feces, and various soured foods. White and Avery [76] believe that this bacterium is the representative of a group of closely related bacteria which they divide into two types on the basis of their activity in milk and the nature of the lactic acid formed. The characteristics of the typical culture may be summarized as follows:

Morphology.—Slender rods 2 microns to 6 or 8 microns in length, breadth usually about 1 micron, flagella and spores absent. Long chains frequently occur and apparently vary with different strains and conditions; pseudobranching has been observed. Very long threads without apparent division are frequently observed in old cultures. Living cells are gram positive, dead cells are gram negative.

Growth on artificial media.—One of the most striking features is its inability to grow on ordinary media. It grows on whey, malt, and slowly on whey agar and certain specially prepared media. The colonies on whey agar are masses of tangled threads resembling colonies of the anthrax bacillus. Gelatin is not liquefied.

Relation to oxygen.—Most varieties grow equally well in the presence or absence of oxygen.

Temperature relations.—The maximum temperature is near 45° C. (113° F.). The minimum growth temperature varies with different members of the group, but it is always comparatively high. Most varieties grow very slowly at 25° C. (77° F.), but some grow at 20° C. (68° F.). Hastings and Hammer[31] state that at 20° C. (68° F.) it forms 4 per cent acid in milk as compared with a maximum of 3 per cent at 37° C. (98° F.). According to White and Avery [76] it is killed by an exposure of fifteen minutes at 60° C. (140° F.).

Fermentation of sugars.—Many of the sugars are fermented, but statements of different workers are conflicting. It is probable that this property varies in different varieties.

Milk.—The action of this organism on milk distinguishes it from all other known bacteria. At the optimum temperature milk is curdled in a few hours with a rather soft curd, frequently somewhat slimy, which does not separate from the whey even on long standing. In twenty-four hours the milk may show acidity equivalent to nearly 2 per cent of lactic acid, and on standing several days this may become about 3 per cent. The most active of the ordinary lactic-acid bacteria seldom exceed 1 per cent lactic acid. The more active type of *Bacterium caucasicum* forms the inactive lactic acid, while the levorotatory acid is produced by the type forming acid more slowly. Small amounts of other organic acids are formed, and traces of alcohol.

This bacterium is evidently the essential organism of yoghurt, matzoon, ceiddu, leben, and similar fermented milks. Other bacteria are always present, some of them habitually and others only occasionally. Some of these may have an influence on the flavor while others are inert. It is probable that there are none, with the exception of *Bact. caucasicum*, that could not be replaced by other species without appreciably affecting the results. Different localities have doubtless developed slightly different varieties of fermented milk due to different combinations of bacteria or of bacteria and yeasts. The Egyptian leben is reported to contain alcohol, but not in sufficient quantities to produce an effervescence such as is observed in kefir or kumiss. One of the ordinary lactic-acid bacteria seems always to be present with the *Bact. caucasicum*, and it is probable that if it is not essential it is of some assistance in starting the lactic fermentation and, especially if the temperature is low, in suppressing contamination before the *Bact. caucasicum* has time to develop sufficient acid to check extraneous bacteria.

Hastings and Hammer [31] could not detect evidences of proteolytic enzyms by the usual tests, but found in old milk cultures a distinct peptonization of the casein which was not due to the action of the acid. This change is so slow and so small that it can not be considered as having any influence on the digestibility of the milk. Otherwise the only changes in the milk constituents are in the conversion of the sugar to lactic acid and very small amounts of volatile acids and traces of alcohol.

" Yoghurt buttermilk " is now sold in several cities, and the growing demand will doubtless soon extend its manufacture more generally. In making yoghurt in this country better results are secured by using with the *Bact. caucasicum* a culture of an ordinary lactic-acid organism such as is used in making buttermilk. *Bact. caucasicum* growing alone in milk forms usually a rather slimy tenacious curd which can not be broken up into the smooth creamy condition essential to a good buttermilk. If this organism is grown in combination with the ordinary lactic-acid organism, a more friable curd is obtained and the sliminess is not so evident. The two organisms can be carried in mixed culture only with great difficulty, as the high acid soon suppresses the ordinary form. The most satisfactory results can be obtained by making buttermilk in the ordinary way and churning it with an equal quantity of milk curdled with the yoghurt organism. This procedure gives the desirable texture of buttermilk and a distinctive flavor.

If a culture can be obtained, yoghurt can be made in the home with little difficulty. Heat the milk—for example, one quart—by holding the bottle submerged to the level of the milk in boiling water for a half hour. Cool the milk, slowly at first, by displacing the hot water with cold water. When the milk is cooled to about 40° C. (104° F.) add one teaspoonful of the culture. The milk should be held at a temperature as near 40° C. (104° F.) as possible. If the temperature is higher the curd is likely to be lumpy and tough; if the temperature is lower than 37° C. (98° F.) the fermentation is slower and the danger of the development of contaminating organisms is greater. The proper temperature is easily maintained by the use of one of the vacuum jacketed bottles now in general use. When these are available the procedure may be varied slightly from that given above. It may be more convenient to heat the milk in a double boiler ordinarily used for cooking cereals. Keep the water boiling for a half hour. It may be cooled by filling the outer receptacle with cold water. Cool the milk to 40° (104° F.), transfer to the insulated bottle, and add a teaspoonful of the culture. After about eighteen hours the milk is curdled and ready for use. It should be transferred to a clean milk bottle, capped or covered with an inverted glass, and put on ice to cool. If the yoghurt is not kept cold the acidity will continue to develop until it becomes unpalatable. The insulated bottle should be thoroughly washed and rinsed with boiling water and the cork stoppers should be boiled frequently. The process is then repeated, using for a culture a teaspoonful of the freshly curdled milk. The yoghurt may be made more palatable by adding to two parts of the yoghurt one part of cold water, or, better still, cold charged water, which can be bought in siphons at drug stores. Sugar and lemon juice or other fruit flavors or chocolate sirup may also be used for this purpose. The sugar should be added in the form of a sirup, as granulated sugar dissolves very slowly in the cold yoghurt. If the yoghurt has gas bubbles or a yeasty or a bitter flavor it has become contaminated with foreign organisms. The contamination may be removed by fermenting the milk at a higher temperature for three or four days, thus producing conditions unfavorable to the growth of the foreign organisms. The milk should be put into the insulated bottle at 49° C. (120° F.). This will give a high acid and a lumpy curd, but the contamination should be eliminated in three or four days.

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TUBERCLE BACILLI IN MARKET MILK IN PHILADELPHIA.[a]

By H. C. Campbell, V. M. D., M. D.,
Expert in Milk Hygiene, Pathological Division.

INTRODUCTION.

That milk and its products may contain tubercle bacilli is a well-established fact. How tubercle bacilli may contaminate milk is no longer problematic, but has been definitely proven to occur in one of the following ways: Either before the milk is drawn from the udder, by direct passage of tubercle bacilli from lesions in the animal,[b] or by contamination of the milk after it has been drawn from the udder by air, feces,[c] or particles of foreign matter laden with tubercle bacilli.

It is generally accepted that there are several varieties of tubercle bacilli. As a rule, the one commonly found in milk is the bovine type, but the human type has been found in a few instances, which are regarded as examples or illustrations of the contamination of milk by a consumptive dairyman.

As milk is a universal food product, the question arises whether man can be infected with tubercle bacilli of the bovine variety. Different authorities hold different views upon this question. Many scientists are of the opinion that a large percentage of the cases of tuberculosis in children are of the bovine type.

Among the first to demonstrate that tubercle bacilli of a bovine type may be proven to be present in the lesions of children suffering from tuberculosis were Theobald Smith and Ravenel. Recent experiments conducted by the German commission, the British commission, and Fibiger and Jensen on tuberculosis show that in tuberculosis of children respectively 10 to 23 per cent of the cases are due to the tubercle

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[a] The investigation reported in this paper was conducted in cooperation with the Pennsylvania State live-stock sanitary board.

[b] Mohler, John R. Infectiveness of milk of cows which have reacted to the tuberculin test. U. S. Department of Agriculture, Bureau of Animal Industry, Bulletin 44.

[c] Schroeder, E. C., and Cotton, W. E. The danger from tubercle bacilli in the environment of tuberculous cattle. U. S. Department of Agriculture, Bureau of Animal Industry, Bulletin 99.

bacilli peculiar to cattle, thus locating the origin of 10 to 23 per cent of children's tuberculosis in milk. Park, of New York City, has recently confirmed these results, having found bovine tubercle bacilli in 26 per cent of the cases of tuberculosis in children under 5 years of age and 18 per cent of bovine tubercle bacilli in tuberculous children between 5 and 16 years old.

The percentage of tubercle bacilli found in the milk supply of large cities has been accurately determined in only a few instances. The results of eighteen to twenty investigations in European cities showed that 9 per cent of the milk samples contained active germs of tuberculosis. Anderson has shown that in Washington, D. C., approximately 11 per cent of the dairies supplied milk containing virulent tubercle bacilli. Hess has found 16 per cent of the milk supply of New York City to contain virulent tubercle bacilli.

METHOD OF COLLECTING THE SAMPLES.

It is difficult to determine accurately the presence of tubercle bacilli in the milk supply of a city, because of the fact that market milk may contain large numbers of other bacteria, and only a very small portion of any one sample can be used for animal inoculation, which seems to be the only trustworthy method of determining the presence of tubercle bacilli in milk. After noting the high percentages in other cities, it was thought desirable to make a careful study of the Philadelphia milk supply for the presence of tubercle bacilli. This work was begun on January 7, 1909, in the following manner:

The samples were collected in a systematic manner so as to cover approximately the entire city. The collecting of the samples as well as the other work was done by the writer, so as to avoid any danger of outside contamination. In collecting the samples pint glass bottles were used which had been previously washed, plugged with cotton, and sterilized. The various milk stores were visited and a sample as sold over the counter to the public was placed in the sterile bottles. This method included not only tubercle bacilli that might have gained entrance at the dairy, but also any that might have gained entrance through the handling of milk by dealers suffering with tuberculosis. After collecting the samples they were brought immediately to the laboratory for examination.

METHODS OF ANALYSIS.

It was thought advisable to make an examination and estimate the percentages of fat, acid, total solids, and leucocyte and bacterial contents of the milk, in addition to determining the presence of streptococci and tubercle bacilli, as these data indicate approximately the quality of the milk and the care taken in its production.

The percentage of fat was determined by the Babcock method.

The percentage of acid was determined by a one-tenth normal solution of sodium hydrate.

The percentage of total solids was estimated by the use of the following formula: $\frac{1}{4}$ lactometer$+1.2\times$fat$=$per cent of total solids.

The specific gravity was determined by using Quevenne's lactometer.

The number of leucocytes was estimated by the Doane-Buckley method.

Agar-agar plates were used in determining the number of bacteria per cubic centimeter. The plates were placed in the incubator for twenty-four hours at 37° C. and at room temperature (26° C.) for twenty-four hours before the counts were made.

TECHNIC USED IN DETERMINING THE PRESENCE OF STREPTOCOCCI AND TUBERCLE BACILLI.

In brief, the technic used in determining the presence of streptococci and tubercle bacilli in the milk was as follows: Ten cubic centimeters of a thoroughly mixed sample was placed in each of three centrifuge tubes by means of a sterile pipette. These were placed in an ordinary electric centrifuge and run for thirty minutes at approximately 1,200 revolutions a minute. The tubes were then taken from the centrifuge and by means of a sterile wire loop the cream was removed and placed in a sterile crucible. Sterile water was added to the cream to bring the volume up to 3 c. c. and to make a suitable emulsion for inoculation. The milk remaining in the centrifuge was then drawn off with a sterile pipette down to the 1 c. c. mark. The 1 c. c. of sediment in each of the three tubes was placed in another sterile crucible. Several slides from both the cream and the sediment were examined carefully under the microscope for the presence of streptococci and tubercle bacilli.

For the first 16 samples only 2 guinea pigs were inoculated, one receiving the 3 c. c. of cream emulsion, the other the 3 c. c. of sediment. For the remaining samples 3 guinea pigs were used; one received 2 c. c. of the cream emulsion, one 2 c. c. of the sediment, and another a mixture of 1 c. c. of the cream emulsion and 1 c. c. of the sediment. Thus in every instance each guinea pig was inoculated with a volume of 2 c. c., except in the first 16 samples, where a volume of 3 c. c. was used.

The guinea pigs were all inoculated subcutaneously, as this is considered the best method where milk is suspected of containing tubercle bacilli. The reason for this is that when guinea pigs are inoculated intraperitoneally a large percentage usually die of septic peritonitis before tuberculosis has time to develop. When inoculated subcutaneously other infection is less liable to kill the animal, and the tubercle bacilli, if present in the sample, may manifest themselves in the lymph nodes.

EXAMINATION OF ORDINARY MARKET MILK.

The results of the estimations of the percentages of fat, acid, total solids, the specific gravity, and the leucocyte and bacterial contents are tabulated in Table 1. The data in this table show that in many instances the milk was of a poor quality. The bacterial count indicates that very little care had been taken in the production and handling of the milk. The wide variation in the bacterial content may be partially explained by the fact that the age of the milk varied.

TABLE 1.—*Results of examination of samples of ordinary market milk obtained from dealers in Philadelphia.*

Sample No.	Fat.	Acid.	Total solids.	Specific gravity.	Leucocytes per cubic centimeter.	Bacteria per cubic centimeter.
	Per cent.	*Per cent.*	*Per cent.*		*Number.*	*Number.*
1	3.4	0.15	11.40	1029.0	52,000	33,500
2	2.8	.19	11.50	1032.8	15,000	27,000
3	3.0	.18	11.50	1031.9	74,000	376,000
4	3.6	.20	12.00	1031.0	42,000	14,000
5	3.8	.20	12.20	1031.0	46,000	86,000
6	2.6	.20	13.30	1032.7	56,000	102,000
7	3.6	.28	12.10	1031.3	29,000	154,000
8	3.2	.23	11.30	1030.2	54,000	163,000
9	4.6	.33	13.50	1032.0	102,000	484,000
10	4.2	.36	12.90	1031.5	97,000	1,024,000
11	2.0	.24	10.60	1033.0	36,000	14,000
12	3.4	.22	11.80	1031.1	43,000	86,000
13	3.8	.24	12.10	1030.4	65,000	203,000
14	3.8	.22	11.80	1029.0	92,000	152,000
15	3.8	.24	12.20	1030.5	148,000	54,000
16	3.4	.27	12.10	1032.0	110,000	1,920,000
17	4.0	.198	12.60	1031.5	48,000	62,000
18	4.0	.195	12.20	1030.1	85,000	5,400
19	3.6	.197	11.40	1028.5	56,000	72,000
20	4.4	.216	12.60	1029.3	42,000	132,000
21	5.0	.22	13.07	1028.3	48,000	172,000
22	4.4	.20	12.88	1030.4	55,000	640,000
23	3.2	.22	11.09	1029.0	117,000	768,000
24	2.0	.216	10.00	1030.4	38,000	1,408,000
25	3.8	.216	12.30	1031.0	112,000	107,000
26	3.6	.198	11.79	1029.9	32,000	700,000
27	3.4	.20	11.75	1030.7	60,000	146,000
28	3.4	.198	11.85	1030.9	143,000	79,000
29	4.2	.198	12.04	1028.0	66,000	1,920,000
30	3.2	.216	10.86	1028.1	29,000	4,860
31	3.4	.20	11.83	1031.5	113,000	68,000
32	6.2	.234	14.44	1028.0	63,000	55,600
33	5.0	.197	13.25	1029.1	59,000	130,000
34	5.4	.19	13.18	1026.8	36,000	36,000
35	5.2	.192	13.34	1028.4	39,000	41,000
36	2.6	.23	10.62	1030.0	248,000	2,688,000
37	3.0	.198	10.90	1029.2	60,000	160,000
38	3.6	.216	11.67	1029.4	37,000	160,000
39	7.4	.20	15.65	1027.0	244,000	16,000
40	4.6	.216	12.64	1028.5	72,000	1,930,000
41	3.8	.189	12.06	1030.2	78,000	75,000
42	3.6	.18	11.54	1029.0	36,000	320,000
43	2.4	.234	10.63	1031.0	41,000	188,000
44	4.2	.198	12.59	1030.2	38,000	410,000
45	3.0	.206	11.60	1032.0	26,000	500,000
46	2.8	.198	10.38	1028.1	44,000	316,000
47	6.8	.197	15.96	1031.3	37,000	13,500,000
48	2.2	.225	10.17	1030.0	88,000	40,000
49	2.0	.216	9.45	1029.0	76,000	4,800,000
50	3.8	.215	11.96	1029.6	42,000	400,000
51	2.6	.24	10.87	1031.0	57,000	900,000
52	4.0	.22	12.30	1030.0	36,000	320,000
53	5.0	.263	13.80	1031.2	74,000	15,000
54	5.0	.253	13.00	1028.0	114,000	8,000

TABLE 1.—*Results of examination of samples of ordinary market milk obtained from dealers in Philadelphia*—Continued.

Sample No.	Fat.	Acid.	Total solids.	Specific gravity.	Leucocytes per cubic centimeter.	Bacteria per cubic centimeter.
	Per cent.	*Per cent.*	*Per cent.*		*Number.*	*Number.*
55	2.6	.234	10.63	1030.5	58,000	750,000
56	3.6	.216	11.82	1030.0	104,000	430,000
57	3.6	.20	11.34	1028.1	122,000	394,000
58	4.2	.198	12.64	1030.4	22,000	26,000
59	3.4	.189	11.63	1029.0	140,000	235,000
60	4.0	.216	12.05	1029.0	104,000	400,000
61	2.8	.225	10.46	1028.6	86,000	1,200,000
62	3.0	.189	10.85	1029.0	72,000	425,000
63	5.2	.18	13.74	1030.0	37,000	395,000
64	3.6	.23	11.94	1030.5	61,000	19,500,000
65	4.0	.198	12.67	1031.5	144,000	....
66	3.6	.198	12.69	1029.5	48,000	9,500,000
67	4.0	.19	11.90	1028.5	63,000	30,300
68	8.2	.18	16.60	1027.2	138,000	333,000
69	4.4	.198	12.45	1027.9	192.000	3,600,000
70	2.8	.27	11.23	1031.5	142,000	1,248,000
71	3.8	.226	12.26	1030.8	72,000	15,160
72	2.6	.196	10.62	1030.0	86,000	132,000
73	3.6	.243	11.60	1029.5	41,000	8,600,000
74	3.2	.288	11.94	1032.5	55,000	11,900,000
75	3.8	.258	11.88	1029.3	83,000	28,700,000
76	3.4	.225	11.65	1030.3	78,000	158,000
77	5.8	.261	14.01	1028.2	84,000	10,600,000
78	3.0	.216	11.20	1030.4	97,000	2,900,000
79	4.0	.27	12.55	1031.0	104,000	8,660,000
80	3.8	.216	11.63	1028.3	196,000	520
81	3.2	.205	10.79	1027.4	118,000	5,300,000
82	2.8	.198	9.94	1026.3	132,000	34,100,000
83	3.4	.189	11.63	1030.2	38,000	1,700,000
84	2.6	.225	10.89	1031.1	92,000	32,000
85	1.8	.24	9.53	1029.5	102,000	17,270,000
86	16.4	.207	23.48	1015.6	1,340,000	1,400,000
87	2.6	.217	10.62	1030.0	117,000	325,000
88	3.4	.23	11.40	1029.3	96,000	2,100,000
89	3.6	.216	11.82	1030.0	78,000	1,200,000
90	3.8	.234	11.66	1028.5	64,000	43,000
91	3.4	.216	11.40	1029.3	124,000	130,000
92	2.4	.27	10.78	1031.6	32,000	4,400,000
93	3.4	.216	11.20	1028.5	112,000	88,000
94	3.2	.23	11.01	1028.7	101,000	1,500,000
95	3.8	.21	11.48	1027.7	40,000	1,100,000
96	5.4	.214	12.73	1025.0	72,000	630,000
97	3.2	.245	11.29	1029.8	76,000	2,400,000
98	2.6	.253	10.62	1030.0	68,000	10,300,000
99	2.6	.293	10.62	1030.0	79,000	4,400,000
100	1.0	.32	8.87	1030.7	62,000	9,300,000
101	3.0	.189	10.55	1027.8	122,000	4,200,000
102	2.0	.207	9.32	1027.7	48,000	8,300,000
103	2.1	.189	10.52	1032.0	135,000	1,533,000
104	3.6	.207	11.67	1029.4	41,000	2,800,000
105	2.8	.243	10.73	1030.3	78,000	8,400,000
106	4.0	.207	12.30	1030.0	131,000	3,800,000
107	3.0	.316	10.97	1029.5	38,000	17,330,000
108	4.4	.171	12.40	1028.5	70,000	32,800,000
109	3.8	.198	11.93	1029.5	116,000	300,000
110	3.8	.207	11.81	1029.0	210,000	620,000
111	4.4	.252	12.48	1028.8	92,000	1,900,000
112	2.8	.306	10.36	1028.0	380,000	3,375,000
113	4.0	.18	11.95	1028.6	89,000	32,500,000
114	1.6	.185	9.79	1031.5	104,000	2,700,000
115	2.0	.21	9.65	1029.0	41,000	185,600,000
116	3.2	.225	11.46	1030.5	104,000	2,700,000
117	1.6	.18	10.29	1033.5	96,000	7,100,000
118	4.0	.216	12.29	1029.6	276,000	4,960,000
119	3.2	.216	11.31	1029.5	140,000	7,300,000
120	2.8	.18	10.98	1030.5	74,000	5,930,000
121	3.2	.23	11.66	1031.3	80,000	56,000
122	4.0	.21	12.05	1030.0	120,000	1,200
123	3.6	.207	12.07	1031.0	404,000	620
124	4.0	.21	12.42	1029.8	92,000	9,300
125	25.0	.23	37.1	1020.0	34,000	1,916
126	4.0	.243	12.72	1031.7	123,000	4,370
127	4.0	.21	12.3	1030.0	240,000	1,250
128	16.0	.22	24.95	1023.0	208,000	2,250
129	4.0	.189	12.8	1032.0	96,000	6,400
130	16.0	.205	25.2	1024.0	536,000	3,800

The results of the examination of the milk for the presence of streptococci and tubercle bacilli are shown in Table 2.

TABLE 2.—*Results of inoculating guinea pigs for the presence of streptococci and tubercle bacilli in market milk in Philadelphia.*

Sample No.	Streptococci in smears and plates.	Tubercle bacilli in smears.	Guinea-pig inoculations.				
			Number inoculated.	Material inoculated.	Days alive.	Died or killed.	Autopsy.
1	Absent	Absent	2	Cream	26	Died	Septic peritonitis.
				Sediment	64	Killed	No lesions.
2	...do...	...do...	2	Cream	34	Died	Generalized tuberculosis.
				Sediment	42	...do...	Do.
3	Present	...do...	2	Cream	63	Killed	No lesions.
				Sediment	63	...do...	Do.
4	Absent	...do...	2	Cream	63	...do...	Do.
				Sediment	63	...do...	Do.
5	...do...	...do...	2	Cream	2	Died	Septic peritonitis.
				Sediment	62	Killed	No lesions.
6	...do...	...do...	2	Cream	3	Died	Septic peritonitis.
				Sediment	62	Killed	Moderate tuberculosis.
7	...do...	...do...	2	Cream	62	...do...	No lesions.
				Sediment	62	...do...	Tuberculosis.
8	...do...	...do...	2	Cream	63	...do...	No lesions.
				Sediment	63	...do...	Do.
9	Present	...do...	2	Cream	4	Died	Septic peritonitis.
				Sediment	62	Killed	No lesions.
10	...do...	...do...	2	Cream	5	Died	Septic peritonitis.
				Sediment	60	Killed	No lesions.
11	Absent	...do...	2	Cream	60	...do...	Do.
				Sediment	60	...do...	Do.
12	Present	Present	2	Cream	5	Died	Septic peritonitis.
				Sediment	60	Killed	No lesions.
13	...do...	Absent	2	Cream	62	...do...	Do.
				Sediment	62	...do...	Do.
14	...do...	...do...	2	Cream	6	Died	Septic peritonitis.
				Sediment	62	Killed	No lesions.
15	Absent	...do...	2	Cream	60	...do...	Do.
				Sediment	60	...do...	Do.
16	...do...	...do...	2	Cream	60	...do...	Do.
				Sediment	60	...do...	Do.
17	...do...	...do...	3	Mixture	37	Died	Generalized tuberculosis.
				Cream	32	...do...	Do.
				Sediment	37	...do...	Do.
18	Present	...do...	3	Cream	63	Killed	No lesions.
				Mixture	63	...do...	Do.
				Sediment	62	...do...	Do.
19	Absent	...do...	3	Cream	62	...do...	Do.
				Mixture	62	...do...	Do.
				Sediment	62	...do...	Do.
20	...do...	...do...	3	Cream	65	...do...	Do.
				Mixture	65	...do...	Do.
				Sediment	65	...do...	Do.
21	...do...	...do...	3	Cream	65	...do...	Do.
				Mixture	65	...do...	Do.
				Sediment	65	...do...	Do.
22	...do...	...do...	3	Cream	61	...do...	Do.
				Mixture	61	...do...	Do.
				Sediment	61	...do...	Do.
23	Present	...do...	3	Cream	63	...do...	Do.
				Mixture	63	...do...	Do.
				Sediment	63	...do...	Do.
24	Absent	...do...	3	Cream	60	...do...	Do.
				Mixture	60	...do...	Do.
				Sediment	60	...do...	Do.
25	...do...	...do...	3	Cream	60	...do...	Do.
				Mixture	60	...do...	Do.
				Sediment	60	...do...	Do.
26	...do...	...do...	3	Cream	60	...do...	Do.
				Mixture	60	...do...	Do.
				Sediment	60	...do...	Do.
27	...do...	...do...	3	Cream	60	...do...	Do.
				Mixture	60	...do...	Do.
				Sediment	60	...do...	Do.
28	...do...	...do...	3	Cream	60	...do...	Do.
				Mixture	60	...do...	Do.
				Sediment	60	...do...	Do.
29	Present	...do...	3	Cream	60	...do...	Generalized tuberculosis.
				Mixture	60	...do...	Do.
				Sediment	60	...do...	No lesions.

TABLE 2.—*Results of inoculating guinea pigs for the presence of streptococci and tubercle bacilli in market milk in Philadelphia*—Continued.

Sample No.	Streptococci in smears and plates.	Tubercle bacilli in smears.	Guinea-pig inoculations. Number inoculated.	Material inoculated.	Days alive.	Died or killed.	Autopsy.
30	Absent	Absent	3	Cream	60	Killed	No lesions.
				Mixture	7	Died	Pneumonia.
				Sediment	60	Killed	No lesions.
31	Present	...do...	3	Cream	60	...do...	Do.
				Mixture	60	...do...	Do.
				Sediment	60	...do...	Do.
32	Absent	...do...	3	Cream	60	...do...	Do.
				Mixture	60	...do...	Do.
				Sediment	60	...do...	Do.
33	...do...	...do...	3	Cream	60	...do...	Do.
				Mixture	60	...do...	Do.
				Sediment	60	...do...	Do.
34	...do...	...do...	3	Cream	62	...do...	Do.
				Mixture	62	...do...	Do.
				Sediment	62	...do...	Do.
35	...do...	...do...	3	Cream	62	...do...	Do.
				Mixture	62	...do...	Do.
				Sediment	62	...do...	Do.
36	Present	...do...	3	Cream	60	...do...	Do.
				Mixture	60	...do...	Do.
				Sediment	60	...do...	Do.
37	Absent	...do...	3	Cream	62	...do...	Moderate tuberculosis.
				Mixture	16	Died	Septic peritonitis.
				Sediment	62	Killed	No lesions.
38	...do...	...do...	3	Cream	61	...do...	Do.
				Mixture	61	...do...	Do.
				Sediment	61	...do...	Do.
39	...do...	...do...	3	Cream	61	...do...	Do.
				Mixture	61	...do...	Do.
				Sediment	61	...do...	Do.
40	...do...	...do...	3	Cream	61	...do...	Do.
				Mixture	61	...do...	Do.
				Sediment	61	...do...	Do.
41	...do...	...do...	3	Cream	7	Died	Septic peritonitis.
				Mixture	60	Killed	No lesions.
				Sediment	60	...do...	Do.
42	...do...	...do...	3	Cream	9	Died	Septic peritonitis.
				Mixture	60	Killed	No lesions.
				Sediment	60	...do...	Do.
43	Present	...do...	3	Cream	7	Died	Septic peritonitis.
				Mixture	64	Killed	No lesions.
				Sediment	64	...do...	Do.
44	Absent	...do...	3	Cream	64	...do...	Do.
				Mixture	4	Died	Septic peritonitis.
				Sediment	64	Killed	No lesions.
45	Present	...do...	3	Cream	3	Died	Septic peritonitis.
				Mixture	66	Killed	No lesions.
				Sediment	66	...do...	Do.
46	Absent	...do...	3	Cream	7	Died	Septic peritonitis.
				Mixture	64	Killed	No lesions.
				Sediment	64	...do...	Do.
47	Present	...do...	3	Cream	9	Died	Septic peritonitis.
				Mixture	64	Killed	No lesions.
				Sediment	64	...do...	Do.
48	...do...	...do...	3	Cream	64	...do...	Do.
				Mixture	17	Died	Septic peritonitis.
				Sediment	64	Killed	No lesions.
49	Absent	...do...	3	Cream	64	...do...	Do.
				Mixture	64	...do...	Do.
				Sediment	64	...do...	Do.
50	...do...	...do...	3	Cream	64	...do...	Do.
				Mixture	64	...do...	Do.
				Sediment	64	...do...	Do.
51	Present	...do...	3	Cream	8	Died	Septic peritonitis.
				Mixture	62	Killed	No lesions.
				Sediment	62	...do...	Do.
52	...do...	...do...	3	Cream	63	...do...	Do.
				Mixture	6	Died	Septic peritonitis.
				Sediment	63	Killed	No lesions.
53	Absent	...do...	3	Cream	64	...do...	Generalized tuberculosis.
				Mixture	64	...do...	No lesions.
				Sediment	64	...do...	Do.
54	...do...	...do...	3	Cream	64	...do...	Do.
				Mixture	64	...do...	Do.
				Sediment	64	...do...	Do.

TABLE 2.—*Results of inoculating guinea pigs for the presence of streptococci and tubercle bacilli in market milk in Philadelphia*—Continued.

Sample No.	Streptococci in smears and plates.	Tubercle bacilli in smears.	Guinea-pig inoculations.				
			Number inoculated.	Material inoculated.	Days alive.	Died or killed.	Autopsy.
55	Present	Absent	3	Cream	60	Killed	Slightly affected.
				Mixture	60	...do	Moderate tuberculosis.
				Sediment	60	...do	No lesions.
56	...do	...do	3	Cream	60	...do	Do.
				Mixture	60	...do	Do.
				Sediment	60	...do	Do.
57	Absent	...do	3	Cream	60	...do	Do.
				Mixture	60	...do	Slightly affected.
				Sediment	60	...do	No lesions.
58	...do	...do	3	Cream	62	...do	Do.
				Mixture	62	...do	Tuberculous.
				Sediment	6	Died	Pneumonia.
59	...do	...do	3	Cream	10	...do	Do.
				Mixture	8	...do	Do.
				Sediment	2	...do	Do.
60	...do	...do	3	Cream	7	...do	Do.
				Mixture	10	...do	Do.
				Sediment	62	Killed	No lesions.
61	...do	...do	3	Cream	3	Died	Pneumonia.
				Mixture	5	...do	Do.
				Sediment	4	...do	Do.
62	...do	...do	3	Cream	60	Killed	Generalized tuberculosis.
				Mixture	60	...do	Do.
				Sediment	60	...do	No lesions.
63	...do	...do	3	Cream	61	...do	Do.
				Mixture	61	...do	Do.
				Sediment	61	...do	Do.
64	Present	...do	3	Cream	62	...do	Moderate tuberculosis.
				Mixture	62	...do	Do.
				Sediment	62	...do	No lesions.
65	Absent	...do	3	Cream	60	...do	Do.
				Mixture	60	...do	Do.
				Sediment	60	...do	Do.
66	...do	...do	3	Cream	4	Died	Septic peritonitis.
				Mixture	4	...do	Do.
				Sediment	60	Killed	No lesions.
67	...do	...do	3	Cream	75	...do	Do.
				Mixture	75	...do	Do.
				Sediment	75	...do	Do.
68	Present	...do	3	Cream	75	Died	Septic peritonitis.
				Mixture	75	Killed	No lesions.
				Sediment	75	...do	Do.
69	Absent	...do	3	Cream	74	...do	Do.
				Mixture	74	...do	Do.
				Sediment	74	Died	Dystokia.
70	...do	...do	3	Cream	70	Killed	No lesions.
				Mixture	70	...do	Do.
				Sediment	70	...do	Do.
71	...do	...do	3	Cream	69	...do	Do.
				Mixture	69	...do	Do.
				Sediment	69	...do	Do.
72	...do	...do	3	Cream	68	...do	Do.
				Mixture	68	...do	Do.
				Sediment	59	Died	Unknown cause.
73	...do	...do	3	Cream	57	...do	Do.
				Mixture	67	Killed	No lesions
				Sediment	67	...do	Do.
74	...do	...do	3	Cream	8	Died	Septic peritonitis.
				Mixture	64	Killed	No lesions.
				Sediment	64	...do	Do.
75	...do	...do	3	Cream	7	Died	Septic peritonitis.
				Mixture	3	...do	Do.
				Sediment	11	...do	Do.
76	...do	...do	3	Cream	36	...do	Do.
				Mixture	53	...do	Unknown cause.
				Sediment	60	Killed	No lesions.
77	...do	...do	3	Cream	56	Died	Generalized tuberculosis.
				Mixture	63	Killed	No lesions.
				Sediment	63	...do	Do.
78	...do	...do	3	Cream	5	Died	Septic peritonitis.
				Mixture	63	Killed	No lesions.
				Sediment	63	...do	Do.
79	Present	...do	3	Cream	7	Died	Septic peritonitis.
				Mixture	8	...do	Do.
				Sediment	60	Killed	No lesions.

Table 2.—*Results of inoculating guinea pigs for the presence of streptococci and tubercle bacilli in market milk in Philadelphia*—Continued.

Sample No.	Streptococci in smears and plates.	Tubercle bacilli in smears.	Guinea-pig inoculations. Number inoculated.	Material inoculated.	Days alive.	Died or killed.	Autopsy
80	Present.	Absent.	3	Cream	8	Died	Septic peritonitis.
				Mixture	65	Killed	No lesions.
				Sediment	65	...do	Do.
81	Absent	...do	3	Cream	6	Died	Septic peritonitis.
				Mixture	65	Killed	No lesions.
				Sediment	65	...do	Do.
82	...do	...do	3	Cream	2	Died	Unknown cause.
				Mixture	2	...do	Do.
				Sediment	12	...do	Septic peritonitis.
83	...do	...do	3	Cream	1	...do	Do.
				Mixture	8	...do	Do.
				Sediment	2	...do	Do.
84	...do	...do	3	Cream	3	...do	Do.
				Mixture	8	...do	Do.
				Sediment	3	...do	Do.
85	Present.	...do	3	Cream	62	Killed	No lesions.
				Mixture	62	...do	Do.
				Sediment	62	...do	Do.
86	...do	...do	3	Cream	9	Died	Septic peritonitis.
				Mixture	62	Killed	No lesions.
				Sediment	62	...do	Do.
87	...do	...do	3	Cream	3	Died	Septic peritonitis.
				Mixture	3	...do	Do.
				Sediment	62	Killed	No lesions.
88	...do	...do	3	Cream	63	...do	Do.
				Mixture	10	Died	Septic peritonitis.
				Sediment	7	...do	Do.
89	...do	...do	3	Cream	5	...do	Do.
				Mixture	3	...do	Do.
				Sediment	63	Killed	No lesions.
90	Absent	...do	3	Cream	64	...do	Do.
				Mixture	64	...do	Do.
				Sediment	64	...do	Do.
91	Present.	...do	3	Cream	10	Died	Septic peritonitis.
				Mixture	64	Killed	No lesions.
				Sediment	6	Died	Septic peritonitis.
92	Absent	...do	3	Cream	63	Killed	No lesions.
				Mixture	4	Died	Septic peritonitis.
				Sediment	63	Killed	No lesions.
93	...do	...do	3	Cream	2	Died	Septic peritonitis.
				Mixture	2	...do	Do.
				Sediment	11	...do	Do.
94	...do	...do	3	Cream	62	Killed	No lesions.
				Mixture	62	...do	Do.
				Sediment	62	...do	Do.
95	...do	...do	3	Cream	65	...do	Do.
				Mixture	6	Died	Septic peritonitis.
				Sediment	2	...do	Do.
96	...do	...do	3	Cream	64	Killed	No lesions.
				Mixture	64	...do	Do.
				Sediment	64	...do	Do.
97	...do	...do	3	Cream	65	...do	Tuberculosis.
				Mixture	3	Died	Septic peritonitis.
				Sediment	4	...do	Do.
98	Present	...do	3	Cream	10	...do	Do.
				Mixture	10	...do	Do.
				Sediment	65	Killed	No lesions.
99	Absent	...do	3	Cream	9	Died	Septic peritonitis.
				Mixture	16	...do	Do.
				Sediment	62	Killed	No lesions.
100	...do	...do	3	Cream	62	...do	Do.
				Mixture	62	...do	Do.
				Sediment	62	...do	Do.
101	...do	...do	3	Cream	63	...do	Do.
				Mixture	63	...do	Do.
				Sediment	63	...do	Do.
102	...do	...do	3	Cream	66	...do	Do.
				Mixture	11	Died	Septic peritonitis.
				Sediment	66	Killed	No lesions.
103	...do	...do	3	Cream	65	...do	Do.
				Mixture	65	...do	Do.
				Sediment	65	...do	Do.
104	...do	...do	3	Cream	15	Died	Septic peritonitis.
				Mixture	64	Killed	Slightly affected.
				Sediment	64	...do	No lesions.

TABLE 2.—*Results of inoculating guinea pigs for the presence of streptococci and tubercle bacilli in market milk in Philadelphia*—Continued.

Sample No.	Streptococci in smears and plates.	Tubercle bacilli in smears.	Guinea-pig inoculations.				
			Number inoculated.	Material inoculated.	Days alive.	Died or killed.	Autopsy.
105	Present	Absent	3	Cream	6	Died	Septic peritonitis.
				Mixture	2	do	Do.
				Sediment	67	Killed	No lesions.
106	Absent	do	3	Cream	4	Died	Septic peritonitis.
				Mixture	8	do	Do.
				Sediment	64	Killed	No lesions.
107	do	do	3	Cream	3	Died	Septic peritonitis.
				Mixture	64	Killed	No lesions.
				Sediment	64	do	Do.
108	do	do	3	Cream	10	Died	Generalized tuberculosis.
				Mixture	11	do	Do.
				Sediment	12	do	Do.
109	do	do	3	Cream	13	do	Septic peritonitis.
				Mixture	63	Killed	No lesions.
				Sediment	63	do	Do.
110	do	do	3	Cream	1	Died	Septic peritonitis.
				Mixture	64	Killed	No lesions.
				Sediment	64	do	Do.
111	do	do	3	Cream	65	do	Do.
				Mixture	65	do	Do.
				Sediment	65	do	Do.
112	do	do	3	Cream	4	Died	Septic peritonitis.
				Mixture	4	do	Do.
				Sediment	5	do	Do.
113	do	do	3	Cream	66	Killed	No lesions.
				Mixture	5	Died	Septic peritonitis.
				Sediment	66	Killed	No lesions.
114	do	do	3	Cream	4	Died	Septic peritonitis.
				Mixture	65	Killed	No lesions.
				Sediment	65	do	Do.
115	Present	do	3	Cream	2	Died	Septic peritonitis.
				Mixture	3	do	Do.
				Sediment	4	do	Do.
116	Absent	do	3	Cream	64	Killed	No lesions.
				Mixture	64	do	Do.
				Sediment	64	do	Do.
117	do	do	3	Cream	3	Died	Septic peritonitis.
				Mixture	66	Killed	No lesions.
				Sediment	66	do	Do.
118	do	do	3	Cream	5	Died	Septic peritonitis.
				Mixture	64	Killed	No lesions.
				Sediment	64	do	Do.
119	do	do	3	Cream	2	Died	Septic peritonitis.
				Mixture	5	do	Do.
				Sediment	65	Killed	No lesions.
120	do	do	3	Cream	66	do	Do
				Mixture	66	do	Do.
				Sediment	66	do	Do.
121	do	do	3	Cream	3	Died	Septic peritonitis.
				Mixture	61	Killed	No lesions.
				Sediment	61	do	Do.
122	do	do	3	Cream	62	do	Moderate tuberculosis.
				Mixture	62	do	Do.
				Sediment	62	do	No lesions.
123	do	do	3	Cream	64	do	Do.
				Mixture	64	do	Do.
				Sediment	64	do	Do.
124	do	do	3	Cream	5	Died	Septic peritonitis.
				Mixture	9	do	Do.
				Sediment	64	Killed	No lesions.
125	do	do	3	Cream	62	do	Do.
				Mixture	62	do	Do.
				Sediment	62	do	Do.
126	do	do	3	Cream	62	do	Do.
				Mixture	62	do	Do.
				Sediment	62	do	Do.
127	do	do	3	Cream	5	Died	Septic peritonitis.
				Mixture	63	Killed	No lesions.
				Sediment	15	Died	Septic peritonitis.
128	do	do	3	Cream	63	Killed	No lesions.
				Mixture	63	do	Do.
				Sediment	63	do	Do.
129	do	do	3	Cream	58	Died	Accidental.
				Mixture	64	Killed	Moderate tuberculosis.
				Sediment	64	do	Do.
130	do	do	3	Cream	63	do	No lesions.
				Mixture	63	do	Do.
				Sediment	63	do	Do.

The guinea pigs were kept under observation for two months. At the expiration of this time those alive were chloroformed, and a careful autopsy was made for the presence of tuberculosis. In a few instances all of the guinea pigs used in testing a sample of milk died before the expiration of the two months, and in many instances one or two of the guinea pigs died before the expiration of two months. When this occurred a careful autopsy was made, and if any organs showed signs of tuberculosis, smears and sections were examined microscopically for the presence of tubercle bacilli.

In many cases where the pigs died of septic peritonitis a microscopic examination revealed the presence of streptococci, as is shown in Table 2. In all, 130 samples of market milk were examined, and 18 of these were found to contain tubercle bacilli. In other words, 13.8 per cent of the milk was found to be tuberculous. In 7 samples out of the 130 all the guinea pigs died before the lesions of tuberculosis had time to develop. Deducting these, 123 samples were actually examined for tuberculosis. Thus, figuring on 123 samples instead of 130, the percentage of tuberculosis would be 14.6.

It was found in a number of instances that only one of the three guinea pigs used in testing a sample of milk lived a sufficient length of time to develop lesions of tuberculosis. So if all the animals in each sample had lived for two months, no doubt the percentage of tuberculous milk would have been much higher.

The percentage of tuberculosis actually found in any city milk supply is thought to be a very low indication of the extent to which the milk is really infected. It is claimed that it requires at least a small number of tubercle bacilli to develop tuberculosis in a healthy guinea pig,[a] so even with milk known to be supplied from a tuberculous herd, the small sample used for examination may not contain a sufficient number of tubercle bacilli to detect their presence by ordinary laboratory methods.

EXAMINATION OF PASTEURIZED MILK.

After examining the market milk for the presence of streptococci and tubercle bacilli, twelve samples of pasteurized milk were examined in the same manner to determine the effect of pasteurization, as practiced by the ordinary dealers, upon the number of bacteria, and to see whether such milk contained virulent tubercle bacilli. These samples were obtained from the large dealers who were known to have pasteurizing machines in their establishments, but the pasteurization of the milk was not under official supervision.

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[a] Webb, Gerald Bertram; Williams, William Whitridge, and Barber, M. A. "Immunity production by inoculation of increasing numbers of bacteria beginning with one living organism." Transactions of the Sixth International Congress on Tuberculosis, Washington, D. C., September 28 to October 5, 1908, vol. 1, pt. 1, pp. 194–212. Philadelphia, 1908. Also in Journal of Medical Research, vol. 20 (n. s., vol. 15), No. 1, pp. 1–24. Boston, January, 1909.

The results of the estimations of the percentages of fat, acid, and total solids, and the specific gravity, leucocyte and bacterial content of the milk, are shown in Table 3.

TABLE 3.—*Results of examination of samples of pasteurized milk obtained from dealers in Philadelphia.*

Sample No.	Fat.	Acid.	Total solids.	Specific gravity.	Leucocytes per cubic centimeter.	Bacteria per cubic centimeter.
	Per cent.	*Per cent.*	*Per cent.*		*Number.*	*Number.*
1	3.8	0.22	12.31	1031.0	188,000	605
2	3.2	.24	11.71	1031.5	106,000	110,000
3	4.0	.23	12.62	1031.3	92,000	244,000
4	3.8	.207	12.56	1032.0	96,000	1,205,000
5	3.8	.234	12.38	1031.3	146,000	292,000
6	4.0	.22	12.50	1030.8	142,000	22,000
7	4.0	.207	12.42	1030.5	144,000	820,000
8	3.6	.219	12.14	1031.3	404,000	193,000
9	4.0	.198	12.80	1032.0	2,250	136,000
10	3.6	.20	12.32	1032.0	1,040	128,000
11	4.0	.20	12.55	1031.0	1,200	97,000
12	4.0	.19	12.67	1031.5	1,500	6,400

The number of bacteria present in most of the samples indicated either that the milk was not properly pasteurized or that it was placed under bad conditions after the process was completed. The former bespeaks municipal control of all pasteurization; the latter, the education of the housewife and servant relative to the handling of milk in the home.

The results of the examinations of the pasteurized milk for the presence of streptococci and tubercle bacilli are shown in Table 4.

TABLE 4.—*Results of inoculating guinea pigs for the presence of streptococci and tubercle bacilli in pasteurized milk in Philadelphia.*

Sample No.	Streptococci in smears and plates.	Tubercle bacilli in smears.	Guinea-pig inoculations.				
			Number inoculated.	Material inoculated.	Days alive.	Died or killed.	Autopsy.
1	Absent	Absent	3	Cream	61	Killed	No lesions.
				Mixture	61	...do	Do.
				Sediment	58	Died	Malformation of the mouth.
2	...do	...do	3	Cream	5	...do	Septic peritonitis.
				Mixture	9	...do	Do.
				Sediment	62	Killed	No lesions.
3	...do	...do	3	Cream	63	...do	Do.
				Mixture	63	...do	Do.
				Sediment	63	...do	Do.
4	...do	...do	3	Cream	62	...do	Do.
				Mixture	62	...do	Do.
				Sediment	62	...do	Do.
5	...do	...do	3	Cream	12	Died	Septic peritonitis.
				Mixture	62	Killed	Moderate tuberculosis.
				Sediment	62	...do	No lesions.
6	...do	...do	3	Cream	62	...do	Do.
				Mixture	42	Died	Pneumonia.
				Sediment	6	...do	Accident.
7	...do	...do	3	Cream	64	Killed	No lesions.
				Mixture	64	...do	Do.
				Sediment	64	...do	Do.
8	...do	...do	3	Cream	66	...do	Do.
				Mixture	66	...do	Do.
				Sediment	66	...do	Do.
9	...do	...do	3	Cream	60	...do	Do.
				Mixture	60	...do	Do.
				Sediment	60	...do	Do.
10	...do	...do	3	Cream	56	...do	Do.
				Mixture	56	...do	Do.
				Sediment	56	...do	Do.
11	...do	...do	3	Cream	60	...do	Do.
				Mixture	60	...do	Do.
				Sediment	60	...do	Do.
12	...do	...do	3	Cream	60	...do	Do.
				Mixture	60	...do	Do.
				Sediment	60	...do	Do.

The results show that one sample out of twelve contained virulent tubercle bacilli, making 8.3 per cent of the pasteurized milk tuberculous. The results of Tables 3 and 4 show plainly that ordinary commercial pasteurization can not be relied upon as a means of destroying bacteria in milk.

EXAMINATION OF SUPPOSEDLY PASTEURIZED MILK.

Twelve samples of supposedly pasteurized milk were examined in the same manner as in the case of the market and pasteurized milk. These samples were obtained throughout the city, among the smaller dealers who claimed to sell pasteurized milk, but there was some doubt as to whether the milk was actually pasteurized.

The results of the estimations of the percentages of fat, acid, and total solids, and the specific gravity, leucocyte and bacterial content of supposedly pasteurized milk are shown in Table 5.

TABLE 5.—*Results of examination of samples of supposedly pasteurized milk obtained from dealers in Philadelphia.*

Sample No.	Fat.	Acid.	Total solids.	Specific gravity.	Leucocytes per cubic centimeter (unheated).	Leucocytes per cubic centimeter (heated to 60° C.).	Bacteria per cubic centimeter.
	Per cent.	*Per cent.*	*Per cent.*		*Number.*	*Number.*	*Number.*
1	4.0	0.207	12.80	1032.0	94,000	840,000	1,500,000
2	4.2	.198	12.91	1031.5	116,000	304,000	48,000
3	4.0	.21	12.80	1032.0	112,000	141,000	56,000
4	4.4	.207	13.25	1032.0	156,000	820,000	133,000
5	3.8	.238	12.16	1030.4	176,000	480,000	1,430,000
6	3.8	.216	12.31	1031.0	212,000	384,000	3,600,000
7	4.8	.198	13.46	1030.8	96,000	552,000	430,000
8	4.4	.225	13.15	1031.5	143,000	493,000	660,000
9	4.2	.207	12.87	1031.4	120,000	181,000	1,131,000
10	4.0	.197	12.67	1031.5	88,000	280,000	23,100
11	4.2	.21	13.04	1032.0	172,000	364,000	605,000
12	3.6	.198	11.94	1030.5	76,000	392,000	1,900,000

Here, as in pasteurized milk, a large number of bacteria were found, indicating either that the milk was not properly pasteurized or that it was placed under bad conditions after the process was completed. Furthermore, the great increase in the number of leucocytes after heating to 60° C. suggests that pasteurization had not been practiced in the majority of the milk samples. This is particularly true in the case of sample 1, in which tubercle bacilli were subsequently found to be present.

The results of the examinations of the supposedly pasteurized milk for the presence of streptococci and tubercle bacilli are shown in Table 6.

TABLE 6.—*Results of inoculations of guinea pigs for the presence of streptococci and tubercle bacilli in supposedly pasteurized milk in Philadelphia.*

Sample No.	Streptococci in smears and plates.	Tubercle bacilli in smears.	Guinea-pig inoculations.				
			Number inoculated.	Material inoculated.	Days alive.	Died or killed.	Autopsy.
1	Present.	Absent.	3	Cream	62	Killed	Generalized tuberculous.
				Mixture	13	Died	Septic peritonitis.
				Sediment	13	do	Do.
2	Absent.	do	3	Cream	62	Killed	No lesions.
				Mixture	62	do	Do.
				Sediment	62	do	Do.
3	do	do	3	Cream	61	do	Do.
				Mixture	61	do	Do.
				Sediment	61	do	Do.
4	do	do	3	Cream	67	do	Do.
				Mixture	67	do	Do.
				Sediment	67	do	Do.
5	do	do	3	Cream	66	do	Do.
				Mixture	66	do	Do.
				Sediment	66	do	Do.
6	do	do	3	Cream	63	do	Do.
				Mixture	63	do	Do.
				Sediment	63	Died	Pneumonia.
7	do	do	3	Cream	60	Killed	No lesions.
				Mixture	60	do	Do.
				Sediment	60	do	Do.
8	do	do	3	Cream	62	do	Do.
				Mixture	62	do	Do.
				Sediment	62	do	Do.
9	do	do	3	Cream	5	Died	Septic peritonitis.
				Mixture	61	Killed	No lesions.
				Sediment	61	do	Do.
10	do	do	3	Cream	60	do	Do.
				Mixture	11	Died	Septic peritonitis.
				Sediment	60	Killed	No lesions.
11	do	do	3	Cream	14	Died	Septic peritonitis.
				Mixture	61	Killed	No lesions.
				Sediment	61	do	Do.
12	do	do	3	Cream	3	Died	Septic peritonitis.
				Mixture	64	Killed	No lesions.
				Sediment	64	do	Do.

The results of this examination show that one sample out of twelve contained virulent tubercle bacilli, making 8.3 per cent of the supposedly pasteurized milk tuberculous.

It is generally believed that in the majority of instances tubercle bacilli gain entrance into the milk at the point of production. The fact that pasteurized and the supposedly pasteurized milk not only contained large numbers of bacteria, but also virulent tubercle bacilli, is very good evidence that pasteurization as practiced by some of the commercial dealers in Philadelphia is inadequate.

A number of bacterial counts were made for several firms in Philadelphia who used a form of the so-called "holder" process of pasteurization, by which the milk is held at a certain temperature for a certain time, and the number of bacteria was found to be very low. The majority of the dealers in Philadelphia use the continuous pasteurization process.

A portion of each sample of the supposedly pasteurized milk was heated momentarily to 60° C., and a second examination made for the number of leucocytes per cubic centimeter. These results are given in the next to the last column of Table 5.

It can readily be seen that in each instance there was a marked increase in the number of leucocytes. This is also fairly good evidence that the milk never reached a temperature of 60° C. in the process of pasteurization.

TYPE OF BACILLI.

Throughout this work very little effort was made to identify the type of tubercle bacilli found except in one sample of the market milk where two rabbits were inoculated with a culture obtained from the milk. Both rabbits developed generalized tuberculosis in two months, which is considered strong evidence in favor of the culture being of the bovine type.

INOCULATION SUPERIOR TO MICROSCOPIC EXAMINATON.

With every sample of milk examined several smears were made from both the cream and the sediment. Each smear was examined carefully for the presence of tubercle bacilli, and kept until the death of the guinea pigs, when they could be reexamined in case the pigs developed tuberculosis. In no instance could tubercle bacilli be demonstrated in the milk by a microscopic examination of the smears. In 8 samples out of the 150 examined the smears were at the time of inoculation marked as being suspicious of containing tubercle bacilli, but the animals inoculated with the same milk on post-mortem examination showed no signs of tuberculosis.

The writer attaches very little importance to a microscopic examination of milk for determining the presence of tubercle bacilli unless it be from a well advanced case of udder tuberculosis where pus can be obtained in the milk.

CONCLUSIONS.

1. One hundred and thirty samples of Philadelphia's market milk were examined, and of these 13.8 per cent were found to contain tubercle bacilli.
2. The method of commercial pasteurization used in the trade can not be relied upon as a means of destroying disease-producing bacteria.
3. If pasteurization is to be used as a means of purifying milk, it should be done under legal regulation and official supervision.
4. A microscopic examination for determining the presence of tubercle bacilli in milk is of little value.

ACKNOWLEDGMENT.

The writer wishes to thank Dr. John R. Mohler, Chief of the Pathological Division of the Bureau of Animal Industry, Washington, D. C., and Dr. John Reichel, of the state live-stock sanitary board of Pennsylvania, for many valuable suggestions in this work.

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THE VIABILITY OF TUBERCLE BACILLI IN BUTTER.

By John R. Mohler, Henry J. Washburn, and Lore A. Rogers.

Since it has been shown that milk may frequently contain tubercle bacilli, it is evident that butter and other products manufactured from milk so contaminated must also contain these organisms, and unless they have been attenuated during the manufacturing process the products must offer to the persons consuming them the same danger of tuberculous infection that was possessed by the raw contaminated milk.

The claim having been made that tubercle bacilli, if mixed into butter at the time of manufacture, would gradually lose their virulence when the butter was placed in cold storage, it seemed desirable to prepare some butter by introducing a definite number of tubercle bacilli at the time of manufacture, and to then watch the effect of cold storage upon them while embedded in the fatty product. The length of time that tubercle bacilli would continue to live and retain their virulence while in butter under usual market conditions was therefore made a subject of cooperative investigation between the Dairy and Pathological divisions.

CREAMERY METHODS OF HANDLING CREAM AND BUTTER.

In the ordinary creamery practice the cream, when separated at the creamery from milk received in the morning or on the farms with hand separators, is allowed to ripen until it reaches an acidity equivalent to 0.4 to 0.6 per cent of lactic acid. This ripening is completed in the afternoon of the day on which the cream is received and is checked by cooling with iced water or by adding ice directly to the cream. In many of the larger creameries the ripening is preceded by pasteurization in a continuous machine, but this is not yet a common practice. The cream is churned on the following morning. The acidity of the cream will increase slightly during the night and may be at the time of churning 0.6 or 0.7 per cent. Shipments of butter from the smaller creameries are usually made once a week. The butter is held at the creamery in an ice-cooled refrigerator. The shipment is always in refrigerator cars and may be from two to six or seven days on the road, the time depending on the distance of the creamery from the market. In the larger plants, which receive only cream separated on the farm and frequently shipped long distances, the practice necessarily differs somewhat from that followed in the smaller creameries.

All butter not sold for immediate consumption is placed in storage at temperatures rarely above 20° F. and usually near zero. In the best warehouses the temperature for butter is from zero to —10° F.

BACTERIAL CHANGES IN RIPENING CREAM AND IN BUTTER.

The ripening of the cream is essentially the development of acidity through the growth of lactic-acid bacteria. This fermentation is usually hastened by the addition of a pure culture of bacteria in the form of a soured milk. These bacteria soon produce in the cream conditions unfavorable to the growth of other bacteria, and properly ripened cream contains lactic-acid bacteria almost exclusively. This is illustrated in Table 1, which is typical of the ripening of unpasteurized cream, excepting that the lactic-acid bacteria did not reach the usual number.

TABLE 1.—*Bacterial changes in unpasteurized cream during ripening.*

Period.	Acidity, in per cent of lactic acid.	Bacteria per c. c.	
		Total.	Liquefying type.
Fresh from separator	0.18	43,800,000	1,750,000
Starter added	.32	226,000,000	540,000
Time of churning	.54	258,500,000	75,000

At the time of churning, the bacteria have reached, or nearly reached, their maximum development. These bacteria are in the milk serum of the cream, which may be considered as a homogeneous fluid holding the globules of fat in an imperfect emulsion. When the cream is made into butter the small part of the milk serum which is retained in the butter becomes a nearly saturated salt solution.

The decided acidity and the high concentration of the salt of the milk contained in the average creamery butter make unfavorable conditions for the existence of bacteria, and there is usually a decrease in the number of bacteria of all kinds. The rapidity of this decrease is dependent on various factors, but chiefly on the temperature at which the butter is held. The decrease is more rapid at the higher temperatures and is retarded as the storage temperature is lowered. This is illustrated in the accompanying diagram (fig. 5), which shows the number of bacteria at three intervals (0, 6, and 9 months) in butter stored at —10, 10, and 32° F. The weaker bacteria, among which are the lactic-acid group, succumb first, and the butter finally contains only spores and a few of the most resistant bacteria.

In consideration of these facts it would be expected that the bacillus of tuberculosis or other pathogenic bacteria would not survive long in butter made by the usual creamery methods.

DESCRIPTION OF EXPERIMENTS.

This point was tested in making butter under conditions approximating as closely as possible to creamery conditions. The milk used in making this butter was inoculated in various ways with *Bacillus tuberculosis*, as later described. The cream was separated in a hand separator and about 12 per cent of pure culture starter added. The cream was ripened at 70 to 75° F. and cooled late in the afternoon of the day of churning or on the following morning. The acidity at time of churning varied from 0.5 to 0.7 per cent of lactic acid. Churning was done in a small barrel churn and the working on a hand worker.

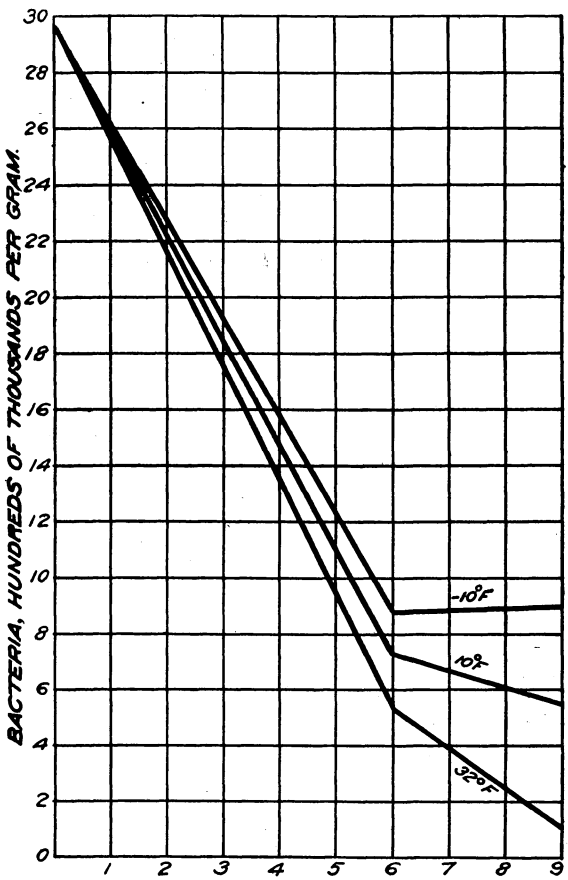

FIG. 5.—Diagram showing decrease in bacterial content of butter stored at different temperatures.

The butter was packed in glass jars and sent by express to the storage rooms in Chicago. These rooms were arranged for experimental work and held very constantly at the indicated temperature. One jar at a time was sent to Washington for experimental tests as required.

Five samples of butter were prepared in the Dairy Division. The first sample, which will be referred to as Lot I, was inoculated with an artificial culture of tubercle bacilli just previous to its passage through the cream separator. This butter was tested in the salted condition, having received one ounce of salt to the pound of butter.

Another sample of butter (Lot II) was made from milk produced by a cow that had tuberculosis of the udder, but not to an advanced extent. Tubercle bacilli were present in this product, however, so numerously that guinea pigs readily contracted fatal cases of tuberculosis when fed upon it or inoculated with it.

The third sample (Lot III) was inoculated by the addition of tubercle bacilli from a bouillon culture, which were thoroughly mixed with physiological salt solution before being added to the milk.

Lot IV was made with milk from an udder that was very badly affected with tuberculosis, and in consequence the milk when placed in the separator was heavily loaded with tubercle bacilli. This milk was of unusual virulence. Guinea pigs inoculated with 1 c. c. of the mixed milk quickly succumbed to generalized tuberculosis as a result. Lots III and IV also received the customary amount of salt.

Lot V was made of the same material used in making Lot II, but it was left unsalted.

In making examinations of these samples of butter for the determination of the presence of living tubercle bacilli, 12 guinea pigs were used for each sample at each of the different ages at which it was tested. Six guinea pigs were inoculated subcutaneously with 2 c. c. of the melted butter from each lot, the butter having been liquefied in an incubator at a temperature of 37.5° C. (99.5° F.). The remaining 6 guinea pigs were fed for a period of ten days upon oats, with which some of the liquefied butter had been thoroughly mixed. During this feeding of the butter, all other foods were denied the animals, as they were not fond of the addition to their customary fare, and would only eat the preparation when nothing else was available.

These tests were made from time to time after the butter had been kept in cold storage for various periods, namely, ten days, thirty days, three months, and six months.

RESULTS OF EXPERIMENTS.

The results of feeding and inoculating guinea pigs with these lots of butter, together with the character and age of the butter tested, are recorded in the accompanying table.

TABLE 2.—*Results of feeding and inoculating guinea pigs with butter infected with tubercle bacilli.*

LOT I (SALTED).

Infected by the addition of 10 c. c. physiological salt solution emulsion of culture of tubercle bacilli to 10 gallons of milk. Storage temperature, —10° F.

Number of guinea pigs used for each sample and method of test.	Number of animals contracting tuberculosis from each sample. Butter stored for—				
	10 days.	30 days.	3 months.	6 months.	9 months.
6 fed	1	0	0	0	0
6 inoculated	2	0	5	1	0

LOT II (SALTED).

Infected by the addition of night and morning milk from tuberculous udder of cow to 10 gallons of milk. Storage temperature, —10° F.

6 fed	0	0	0	0	0
6 inoculated	5	0	0	5	0

LOT III (SALTED).

Infected by the addition of 10 c. c. bouillon culture of tubercle bacilli to 20 gallons of milk. Storage temperature, 10° F.

6 fed	1	0	0	0	0
6 inoculated	0	0	0	0	0

LOT IV (SALTED).

Infected by the addition of 2 gallons of milk from tuberculous udder of cow to 20 gallons normal milk. Storage temperature, 10° F.

6 fed	2	0	2	1	0
6 inoculated	0	1	3	1	0

LOT V (UNSALTED).

Same origin as Lot II, except that butter was not salted.

6 fed	0	0	2	0	0
6 inoculated	4	0	0	1	0

The results of these tests show that the storage of butter at the temperature of a large storage ice chest during a period approximating the length of time that market butter is usually held previous to its consumption will not destroy the vitality of tubercle bacilli within the product. Furthermore, the results of these experiments indicate that the tubercle bacilli in infected butter are not distributed equally or uniformly throughout the product. For instance, certain samples failed to cause tuberculosis in the experiment animals when the butter was ten days old, while other samples from the same lot of butter ninety days old produced marked tuberculosis. In fact, the bacilli were evidently irregularly distributed in the one sample referred to, as is indicated by the death of only a certain number of the total guinea pigs exposed. The most highly infectious lot of butter was Lot IV, which was made from the milk secreted by a tuberculous udder of a cow.

These experiments further show that the inoculation of guinea pigs with products suspected of being tuberculous is a far more delicate test for tubercle bacilli than feeding experiments. Such an investigation should be carried over a considerable time and include a number of individual tests, since negative results such as are recorded for butter 30 days old might lead to erroneous conclusions if not properly controlled by subsequent experiments.

REVIEW OF PREVIOUS EXPERIMENTAL WORK.

There have been many investigations of market butter in the past by qualified investigators who were searching for tubercle bacilli. The results of their work show most conclusively that tubercle bacilli may be present in butter that is sold on the open market. The following table taken from Swinthinbank and Newman's Bacteriology of Milk, page 221, gives a fair estimate of the results of investigations along this line.

TABLE 3.—*Results of various investigations to determine presence of tubercle bacilli in market butter.*

Investigator.	Number of samples tested.	Number in which tubercle bacilli were found.	Percentage.	Remarks.
Brusaffero	9	1	11	
Roth	20	2	10	
Schuchardt	42	0	0	
Obermüller	14	14	100	Obtained from one source.
Groening	17	8	47	
Petri	102	33	32	From Berlin and Munchen.
Rabinowitsch	80	0	0	Thirty samples from Berlin; fifty samples from Philadelphia.
Hormann and Morgenroth	10	3	30	
Rabinowitsch	15	2	13.3	Obtained from 14 shops.
Korn	17	4	23	
Ascher	27	2	7	Obtained from 22 shops.
Weisenfeld	32	3	9	
Hellsträu	12	1	8	
Bonhoff	39	0	0	
Markl	45	0	0	
Augeszky	17	3	17	From different sources in Budapest.
Total	498	76	15.2	

The more recent experiments of Schroeder and Cotton [a] have shown that living tubercle bacilli will retain their infective properties for at least one hundred and sixty days in salted butter when kept without ice in a house cellar.

CONCLUSIONS.

The work recorded in our investigation, as well as that by contemporaneous writers, proves that constant storage in an icy temperature does not destroy the virulence of butter which contains dangerous tubercle bacilli. It should therefore be evident to all that the most satisfactory way of obviating this danger would be to manufacture butter only from cream that is free from tubercle bacilli. The application of the tuberculin test to all cows that supply milk for butter-making purposes, with the subsequent removal of all tuberculous animals from these dairy herds, is desirable, but where this can not be done recourse may be had to pasteurization, as it has been found that subjecting cream to a temperature of 140° F. (60° C.) for a period of twenty minutes, or of 176° F. (80° C.) momentarily, will effectually destroy all of the tubercle bacilli that may have found lodgment in it. Moreover, the manufacture of butter out of pasteurized cream has other advantages, as set forth in Bureau of Animal Industry Circular 146.

No dependence should be placed upon the action of the salt that is added to butter as an agent in the destruction of tubercle bacilli. It has been shown that the effect of salt as commonly used in the manufacture of butter is very slight at best. Most of the samples of butter used in the present experiments were salted with the usual amount, yet the butter retained its virulence for six months, as already noted.

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[a] Schroeder, E. C. The relation of the tuberculous cow to public health, Bureau of Animal Industry Circular 153, p. 38.

THE VIABILITY OF TUBERCLE BACILLI IN CHEESE.

By John R. Mohler, Henry J. Washburn, and C. F. Doane.

Dairy products, if made from the milk of tuberculous cows, may support living tubercle bacilli for a considerable period of time. Since cheese forms a very important article of food in all civilized countries, it becomes desirable to know, if possible, how long the tubercle bacilli which may be contained within common market cheese will retain sufficient virulence to cause the development of tuberculosis. Furthermore, it is of interest to determine the length of time that living tubercle bacilli will continue to retain their capability for growth if removed from the cheese and placed under suitable conditions for their reproduction and extension. That they are sufficiently resistant to live through the souring and other processes necessary in the manufacture of milk into butter and cheese has been proved by a comparatively large number of tests, but the results showed the extremes to be so far apart that additional work on the subject was considered desirable.

Investigation was therefore extended to a number of specially prepared cheeses, in order to determine to what extent the virulence and vitality of tubercle bacilli were retained after the bacilli had been thoroughly mixed into the product during the manufacturing process.

METHOD OF EXPERIMENTAL WORK.

The cheese was made at the laboratory which the Dairy Division maintains at Albert Lea, Minn. Milk for the purpose was taken from the regular supply delivered daily at the creamery, 300 pounds being used. Tubercle bacilli removed from a bouillon culture in the Pathological Division at Washington were shipped to Albert Lea and there thoroughly mixed with 2 quarts of water at 70° F., which mixture was later stirred into the milk previous to the heating of the latter. On reaching 88° F. the milk was set with rennet extract and allowed to coagulate to the usual firmness. The mass was then cut and cooked at 100° F. Whey with acidity of 0.18 per cent was drawn when the curd had reached medium firmness. The curd was allowed to mellow on the rack, milled with acidity of 0.6 per cent at two hours from drawing the whey, salted, and put to press. The presses used were specially prepared, and produced cheeses weighing about 2 pounds each.

After pressing, the cheeses were allowed to remain in a curing room with a temperature of approximately 65° F. for seven days. They were then put into tin cans that were made just large enough to hold them, and placed in cold storage until required for bacteriological examination, when they were shipped one at a time as needed. The temperature of the storeroom was held at 33° F.

The entire process as here outlined corresponds with the regular process of making cheese in this country at the present time. Cheese is now customarily made somewhat softer than it was a few years ago, and as a consequence it ripens faster. Storage when one week old is the rule, and 33° F. is the usual storage temperature. Cheese is usually coated with paraffin before being placed in cold storage, which coating makes it practically air-tight. For various reasons the cheeses used in this experiment were sealed up in tin cans instead of being coated with paraffin, but the effects upon the ripening and the quality of the product would be unaltered by this substitution.

When the cheese had reached an age of about 23 days the first one was cut up, part of it being fed to six guinea pigs, mixed with their oats, while six other guinea pigs were inoculated subcutaneously with an emulsion made from portions of the central part of the cheese rubbed up in a mortar with physiological salt solution. After being well ground the liquid was removed from the mortar, strained through a layer of absorbent cotton, and the equivalent of 2 grams of cheese was then injected beneath the skin, back of the shoulder, of each guinea pig. The pigs that were fed with the cheese each received 10 grams daily for ten consecutive days. They ate it very readily, seeming to regard it as a relish that had been added to their supply of oats.

RESULTS OF EXPERIMENTS.

None of the animals used in testing the first lot of cheese developed tuberculosis, either of those inoculated or those fed. One of the animals died five days after its inoculation. The remaining guinea pigs were chloroformed after a period of six weeks had elapsed, and all were subjected to a careful autopsy, but without revealing any lesions of tuberculosis.

Ten days after the feeding of the first lot, Lot II was tested under similar conditions, the result being that four of the six guinea pigs that were inoculated developed generalized tuberculosis. The lots that followed were all found to contain living tubercle bacilli until Lot XII was reached. This lot, as well as Lots XIII and XIV, failed to cause tuberculous lesions in any of the test animals receiving portions of them.

As above intimated, the latest test in which tubercle bacilli were demonstrated was made with Lot XI. In this case the cheese was

261 days old, and it was found that even at this age the tubercle bacilli still retained sufficient vitality to cause slight tuberculous lesions in one of the fed and four of the inoculated test animals.

The detailed results of the experiment are shown in the following table:

Results of feeding and inoculating guinea pigs with cheese infected with tubercle bacilli.

Lot No.	Age of cheese when tested.	Results of feeding and inoculation.	
		Number of fed guinea pigs showing tuberculous lesions.	Number of inoculated guinea pigs contracting tuberculosis.
	Days.		
I	23		
II	33		4 (generalized).
III	55		3 (generalized).
IV	79	1 (generalized)	2 (generalized).
V	108	do	3 (generalized).
VI	138		6 (generalized).
VII	165	1 (generalized)	
VIII	184		1 (generalized).
IX	200	1 (generalized)	3 (generalized).
X	220		6 (5 generalized, 1 slight).
XI	261	1 (slight)	4 (slight).
XII	297		
XIII	356		
XIV	383		

From this table it will be seen that advancing cases of generalized tuberculosis were developed by means of inoculations of cheese 220 days old, and that slight tubercular lesions were caused by the injection of an emulsion of cheese when 261 days old. The statements made on page 184 with reference to the irregular distribution of tubercle bacilli in the different samples of butter and the greater delicacy of the animal-inoculation tests when compared with feeding experiments apply with equal force to the above experiments with tuberculous cheese.

REVIEW OF PREVIOUS WORK.

Very few experiments have been recorded with reference to the presence of tubercle bacilli in market cheese. Hormann and Morgenroth [a] found in 15 samples of cottage cheese purchased upon the market 3 cases of true tubercle bacilli, while Rabinowitsch [b] obtained 3 positive results out of 5 such samples examined. Harrison [c] tested 5 samples of soft cheese which he bought in the open

[a] Hormann and Morgenroth. Weitere Mittheilungen über Tuberkelbacillenbefunde in Butter und Käse. Hygienische Rundschau, vol. 8, no. 22, pp. 1081–1084. Berlin, Nov. 15, 1898.

[b] Rabinowitsch. Verbreitung der Tuberkelbazillen durch Milch und Fleisch. In G. Cornet's Die Tuberkulose, second edition, part 1, p. 123. Vienna, 1907.

[c] Harrison, F. C. La durée de la vie du bacille de la tuberculose dans le fromage. Annuaire Agricole de la Suisse, vol. 1, no. 9, pp. 321–326. Berne, 1900. Translation of above: The duration of the life of the tubercle bacillus in cheese. U. S. Department of Agriculture, Bureau of Animal Industry, 19th Annual Report, 1902, pp. 217–233.

market at Berne. The ages of the cheeses were unknown, but they were probably made within a short period before the test. Three of these samples conveyed tuberculosis to guinea pigs by inoculation and two did not. Heim [a] and Galtier,[b] in their investigations relative to the duration of life of tubercle bacilli in cheese, purposely added tubercle bacilli to normal milk from which the cheese was made. The former found that the bacilli remained alive in the curd prepared from such milk for at least fourteen days, but none survived after four weeks.

As a result of Galtier's experiments conducted with cheese both salted and not salted, it was found that tubercle bacilli retained their virulence in cheese which was 2 months and 10 days old. He concluded that coagulated milk, cheese, and salted cheese made from the milk of tuberculous cows may infect man and that the by-products fed to swine and chickens may infect these animals. The difference between the results of these last two investigations may be accounted for in part by the variation in virulence of the bacilli used and in part by the different methods of preparing the cheese and conducting the experiments.

In further experiments made by Harrison [c] in Switzerland, it was demonstrated that tubercle bacilli died between the thirty-third and fortieth day in cheese made after the Emmental method, but considerably later in cheese made approximately after the Cheddar method. An emulsion of tubercle bacilli was added to milk at the same time as rennet, and cheese was made from the milk in the manner required to obtain Cheddar cheese. From the time of manufacture average samples of the cheese were taken weekly, macerated in sterile water, and filtered. Guinea pigs were inoculated with portions of the filtrate, and it was found that the pathogenic power of the tubercle bacilli was still apparent even after one hundred and four days. The actual limit of the duration of life of tubercle bacilli in this experiment was not demonstrated, since the guinea pigs injected with cheese older than 104 days were killed by mistake before the experiment was completed. Harrison concluded that these experiments justify the statement that Emmental (or Swiss) cheese may be eaten with safety, as the period of ripening is much longer than the period during which the bacilli become innocuous. Cheddar cheese, he states, is seldom eaten under four months from time of manufacture,

[a] Heim, L. Ueber das verhalten der Krankheitserreger der Cholera, des Unterleibstyphus und der Tuberkulose in Milch, Butter, Molken, und Käse. Arbeiten aus dem Kaiserlichen Gesundheitsamte, Band 5, Heft 2, pp. 294–311. Berlin, 1889.

[b] Galtier, V. Dangers de l'utilisation des produits tel que le petit-lait te le fromage, obtenus avec le lait de vaches tuberculeuses. Comptes Rendus de l'Académie des Sciences, tome 104, pp. 1333–1335. Paris, 1887.

[c] See reference on page 189.

and during this period the tubercle bacilli lose their vitality. Notwithstanding this, however, Harrison recommended the pasteurization of the milk in order to make the cheese absolutely safe. In another series of experiments upon Cheddar cheese made in the approved manner, Harrison found that the tubercle bacilli which had been added to the milk, as in the above test, died out somewhere between the sixty-second and seventieth days, both guinea pigs inoculated with sixty-two-day-old cheese showing tuberculosis.

CONCLUSION.

As a result of these various experiments it is evident that the bacillus of tuberculosis not only retains its life but also its virulence in cheese for a considerable period of time, and that cheese made from raw, unpasteurized milk should therefore be considered as a possible carrier of tubercle bacilli.

Knowing that there are many tuberculous cows among the dairy herds which furnish milk for the manufacture of cheese in this country, it is evident that some steps should be taken to prevent the introduction of living, virulent tubercle bacilli into this important food product. The best possible means to this end would be the removal of all tuberculous cattle from the dairy herds of the country. This, however, is a proposition of such magnitude that its early accomplishment is a practical impossibility, and some other and more feasible method of rendering the products of our cheese factories more wholesome must therefore be found. If it be possible to use pasteurized milk in the manufacture of cheese without injuring the product, a simple solution of the problem is offered to the cheese manufacturer in the process known as pasteurization. Abundant proof has been furnished to establish the fact that whenever milk is heated to 140° F. (60° C.) and held at that temperature for twenty minutes, or heated to 176° F. (80° C.) momentarily, all of the tubercle bacilli which it may contain are destroyed and the product obtained from it is rendered safe and wholesome.

MEDICAL MILK COMMISSIONS AND BOVINE TUBERCULOSIS.[a]

By E. C. SCHROEDER,
Superintendent of Experiment Station.

INTRODUCTION.

The primary object of a medical milk commission, unless I am in error, is to discover and to define the conditions that must govern the production and the distribution of milk to insure that it shall reach the consumer, not occasionally or even generally, but constantly, as a fresh, clean, and wholesome article of food, and, above all else, as an article of food certainly free from any virus that may injure human health. In accordance with this view it is really unnecessary for a milk commission to know the precise significance of bovine tuberculosis with regard to public health, or to determine whether tuberculosis of persons and cattle is caused by identical or by dissimilar types of bacilli. What a milk commission must know is whether tuberculous cattle expel tubercle bacilli that can injure human health, and whether such bacilli occur in milk obtained from tuberculous dairy herds. The title of this paper therefore requires the consideration of two subjects: First, the susceptibility of persons to bovine types of tubercle bacilli; and, second, the occurrence of tubercle bacilli in milk.

THE SUSCEPTIBILITY OF PERSONS TO BOVINE TUBERCLE BACILLI.

No valid reason existed for doubting that the introduction of tubercle bacilli into the human body, equally from the human and the bovine source, was dangerous until Theobald Smith demonstrated that the bacilli more commonly found in human tuberculous lesions are not exactly like those commonly found in bovine tuberculous lesions. The importance of Smith's work was not fully recognized until Koch used it, together with a number of unsuccessful attempts, made in conjunction with Schütz, to infect cattle with tubercle bacilli from the human source, as the foundation for the broad generalization that "human and bovine tuberculosis are not alike and that the latter is of negligible importance for public health."

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[a] This paper was presented before the American Association of Medical Milk Commissions at St. Louis, Mo., June 6, 1910.

If we take into consideration that Smith discovered the difference between the types of tubercle bacilli designated as human and bovine, and that Koch is the first and most authoritative among those investigators who have used the discovery as the basis for the assertion that persons are practically immune against tubercle bacilli of the bovine type, then, if it can be shown that Smith supplies evidence of the kind demanded by Koch to prove that persons are susceptible, and fatally susceptible, to tubercle bacilli of the bovine type, we may feel assured that we will not go astray if we conclude that bovine tubercle bacilli from the bovine source must be looked upon as a virus to which public health can not be exposed with impunity.

Koch has stated repeatedly that the isolation of tubercle bacilli of the bovine type from human tuberculous lesions, under strict conditions that exclude errors, is acceptable proof that the source of infection was bovine; and Smith, whose ability to distinguish without error between different types of tubercle bacilli no one can question, isolated bovine types of tubercle bacilli from human lesions with sufficient frequency to lead him to make the following statement in Washington during the International Congress on Tuberculosis in 1908:

> A rough and liberal estimate would make from one-fourth to half the cases of tuberculosis starting in the cervical and mesenteric lymph nodes bovine in origin. This estimate, to which many have contributed, has placed our knowledge concerning the infection of man from cattle on a firm basis.

Strictly speaking, there is no need to go beyond this to prove that a medical milk commission must regard the presence of bovine tubercle bacilli in milk as a positively objectionable and seriously dangerous condition, but it may nevertheless be well to give the subject a little more attention.

Woodhead, of the British Royal Commission on Human and Animal Tuberculosis, apparently holds views similar to those of Smith on the relationship between primary lesions of tuberculosis and the proportion of tuberculous infections chargeable to the bovine source. In a lecture, recently published in the Medical Record, he called attention to the fact that observers, including those working on the German Imperial Tuberculosis Commission, seem to agree that we have a definite and frequent tuberculous affection of the alimentary canal among children, and that of these cases a certain proportion is undoubtedly of bovine origin. He further called attention to the fact that, of the fatal cases of tuberculosis among children investigated by the German and British tuberculosis commissions, about one-third were found to be due to the bovine type of bacillus. Taking these facts into account with the frequency of tuberculosis of the alimentary canal among children under 5 years of age, as shown by autopsy records in Great Britain, Woodhead concluded that a little less than 7 per cent of the total deaths from tuberculosis in Great Britain are due to the bovine source of tubercle bacilli.

Primary tuberculosis of the alimentary canal is seemingly commoner in Great Britain than in America, hence an estimate for our country similar to that of Woodhead, but corrected to conform with the frequency of alimentary tuberculosis in America, will charge a much lower proportion of tuberculous deaths to bovine infection, approximately 1½ to 2 per cent of the total number. This proportion is very well supported by the evidence obtained from American investigators who have made special studies of the types of bacilli currently found in human tuberculous lesions, and also by the general statistics on fatal tuberculosis in the United States. The latter show with a fair degree of constancy that about 87 per cent of all deaths from tuberculosis are due to the pulmonary form, and about 13 per cent to other forms of the disease. Of the 13 per cent about one-quarter, that is, 3¼ per cent of the total deaths, are true cases of abdominal tuberculosis.

This estimate is the lowest that can reasonably be entertained, in the light of the facts as we know them to-day, of the harm done to public health by the bovine source of tuberculosis; it is an estimate that can not be lowered without trying to outstrip Koch in his attempts to belittle the significance of bovine tuberculosis as a source of human disease, and yet it is an estimate which means that from 2,400 to 3,200 deaths are caused annually in this country, principally among children, by bovine tubercle bacilli.

To remove all possible doubt about the lowness of the estimate, and to show that it is probably much too low—though it is large enough to justify the condemnation of all raw dairy products not above the suspicion that they may contain bovine tubercle bacilli—I wish specially to emphasize that it is based wholly on data characterized as satisfactory by those investigators whose authority, more truly than substantial and convincing proof, originated the controversy regarding the identity of human and bovine tuberculosis, and who have tried most diligently to prove that the bovine source of tuberculosis has no terrors for mankind.

Attention should also be called to the fact that the estimate wholly ignores the excellent investigations that give us reasons to believe that strains of tubercle bacilli are not constant in their types and virulence; that it makes no allowance for the actual discovery in tuberculous lesions of tubercle bacilli that are intermediate and possible transition forms between the human and the bovine; that it does not take into consideration that even fatal cases of pulmonary tuberculosis may be due to infection through the alimentary canal; and that it does not magnify itself by borrowing strength from significant data like the following: That tubercle bacilli may remain latent in animal tissues for long periods of time; that bovine types of bacilli are isolated with an enormously greater frequency from the tuberculous lesions of children than from those of adults, and that the latency of tubercle bacilli on one hand, and the greater frequency of bovine types in the lesions of children on the other hand, are conditions which, when taken together with the type mutability of tubercle bacilli and the occurrence of intermediate types in human lesions, strongly suggest that the occurrence of human types of tubercle bacilli in the tuberculous lesions of adults does not give us an unimpeachable argument to reject tuberculous cattle as the source from which the infecting agent was originally derived, particularly when we deal with chronic tuberculosis, pulmonary cases included.

Furthermore, the estimate deals only with fatal cases of tuberculosis, and this is of the utmost importance, because a medical milk commission, as a matter of plain duty, must fight against milk-borne diseases irrespective of their probable end in recovery or death.

If the human body is more resistant to bovine than to human types of tubercle bacilli, or if bovine types have a lower pathogenic virulence than human types for the human body, which is practically the same thing, and deaths occur among persons who are infected with bovine types of tubercle bacilli and recoveries among those who are infected with human types, both of which we know to be the case, we may logically conclude that the number of recoveries in proportion to the number of deaths will be greater among the persons who are infected from the bovine than among those who are infected from the human source of tuberculosis. I believe that I simply state a truism when I say that the ratio between the recoveries and deaths from an infectious disease is in close harmony, other things being equal, with the immediate pathogenic virulence of the infecting agent. From this point of view, if bovine types of tubercle bacilli are, contrary to their virulence for all other species of animals, of lower virulence for the human species than human types, they must be charged with causing a large amount of disease that does not reach a fatal climax, and hence, with being common handicapping factors in the physical and mental development of children. It is well to bear in mind when we think of this that tuberculosis, though it causes more than 10 per cent of all deaths, is a disease that has been proven by modern methods of diagnosis and careful post-mortem examinations to be greatly more prevalent than we formerly believed it to be, and that cases of arrested and spontaneously healed tuberculosis are much more numerous than those that die.

Enough has been said to show conclusively that we should make a strong and unremitting fight against the exposure of public health to bovine tuberculosis, especially for the protection of children. Enough has also been said to show that we need not use insufficiently confirmed experimental evidence, of a kind we can not afford to ignore altogether and which justifies the belief that bovine tuberculosis is a very serious public health danger, to prove that it is imperatively necessary for every milk commission to demand that milk shall be produced under conditions which will exclude all types of tubercle bacilli from it, or that it shall be subjected to some treatment which will make tubercle bacilli harmless before it is used as food. Hence, the second part of the subject will be taken up.

THE OCCURRENCE OF TUBERCLE BACILLI IN MILK.

Many tests have been made during the last three or four years concerning the occurrence of active, virulent tubercle bacilli in milk. These tests have shown (1) that a large quantity of milk infected with tubercle bacilli is distributed by dealers to their customers; (2) that the occurrence of tubercle bacilli in the milk distributed by different dealers who sell infected milk is more commonly intermittent than continuous; and (3) that it is not only ordinary market milk that contains live tubercle bacilli, but that they also occur in some of the so-called commercially pasteurized milk.

That much of the ordinary milk of commerce contains live, virulent tubercle bacilli (more than 5 per cent of all the samples recently examined of which the writer has been able to get the records) must be looked upon as a regrettable and serious condition, not alone because we know that it is the real, responsible cause for much disease and the destruction of several thousand or more children every year in our country, but also because many investigators and observers are strongly of the opinion that infection with tuberculosis depends in the great majority of instances on frequently repeated introductions of tubercle bacilli into the body, and rarely on a single or an occasional exposure to tubercle bacilli; and because some investigators of the highest order have supplied us with reasons to believe that the introduction of tubercle bacilli into the body, even though they are of a kind or type that is incapable of causing a progressive or fatal tuberculosis, is responsible for a negative state of resistance, of longer or shorter duration, to infection with subsequently introduced tubercle bacilli. In other words, each successive exposure to tubercle bacilli seems to be more dangerous than previous exposures, and this as a direct result of the previous exposures. While this view is admittedly hypothetical, it is worth while to keep it in mind when we study the possible influence the numerous tubercle bacilli from the bovine source that are swallowed with raw dairy products may have in preparing our bodies for the growth within it of tubercle bacilli of any type or kind.

The intermittent occurrence of tubercle bacilli in the milk distributed by individual dealers signifies that the extent to which the public is exposed to infection through the use of raw dairy products can not be measured by knowing only the percentage of milk that contains tubercle bacilli, because the proportion of dealers who distribute infected milk more or less intermittently has an important bearing on the number of persons who are exposed to infected milk. For example, Professor Eber, of the University of Leipzig, in Germany, examined the milk sold by 70 dealers at three different times. Among the 210 samples of milk examined, 3 from each dealer, 22 were found to contain tubercle bacilli. When the infected milk was charged to the dealers who sold it, Professor Eber found that one dealer sold 3 samples, another 2, and that the remaining 17 samples were sold by 17 different dealers; hence, though only 10.47 per cent of the total number of milk samples examined were found to be infected, the persons who were buying milk from 19, or 27.1 per cent, of the milk dealers were exposed to tuberculous milk.

The conditions in our country relative to the intermittently infected character of the milk sold by different dealers are similar to what Professor Eber found in Germany. This can be determined by analyzing the milk tests recorded by Anderson, of the United States Public Health and Marine-Hospital Service, in Bulletin 56 of the Hygienic Laboratory. In one of the writer's own series of tests 31 samples of milk were examined, each taken on a different day, from one and the same dealer, and it was found that 4, or 13 per cent, and not all the samples, contained tubercle bacilli. Had Eber continued to make series of tests with the milk sold by the 70 dealers included in his investigation of the milk supply of Leipzig, it is probable that he would have found no great variation in the percentage of infected samples, but that the percentage of dealers selling infected milk would have climbed rapidly upward to a very high maximum.

The manner in which tubercle bacilli are expelled from the bodies of tuberculous cows, frequently long before symptoms of disease can be detected, the frequent occurrence of tuberculosis among dairy cattle, the percentage of milk that contains tubercle bacilli, and the intermittent character of the infected condition of the milk sold by dealers, are facts that should convince us that we can not expect milk to be constantly free from tubercle bacilli unless it is obtained from healthy cows in an environment that is free from tuberculous infection.

The question may present itself here, Why does not the common occurrence of tubercle bacilli in milk cause the infection of the entire human race? In this connection it is well to remember that the human race is actually rather badly infected with tuberculosis, if the information derived from tuberculin tests and autopsy records is not grossly misleading, and that infection with tuberculosis does not always manifest itself in the form of physically determinable and observably progressive disease. Fortunately in most cases various incidents must fall together with the presence of tubercle bacilli in the body to cause an actively progressive tuberculosis, and a great danger from infected milk is that children are so persistently and helplessly exposed to it that many of them can hardly escape swallowing tubercle bacilli at times when the germs will meet those conditions in their bodies with which they can form more or less injurious and at times fatally destructive combinations.

The occurrence of living tubercle bacilli in so-called commercially pasteurized milk must not be charged against the efficiency of pasteurization as a method for destroying disease germs in milk. It is merely evidence to prove that pasteurization as sometimes practiced for commercial purposes is not safe, and that, to be thoroughly reliable, the pasteurization of milk, if it is done before the milk is delivered to the consumer, should be conducted under strict official supervision.

The following may be interesting to show how reliable pasteurization is when it is properly done in a simple, economical way that can be practiced in any kitchen. In a special investigation at the Experiment Station of the Bureau of Animal Industry the writer gave an employee—not a trained scientist, but an intelligent laborer—instructions to divide the milk of a cow affected with tuberculosis of the udder into two lots each day, and to pasteurize one lot and to leave the other lot in its raw, untreated condition. This work was repeated with the milk of the cow daily for more than a month, and on each day guinea pigs were injected, some with the pasteurized and some with the raw milk. The method of pasteurization used was simply to place the milk in cotton-stoppered bottles, in which it was rapidly brought to a temperature of 60° C. (140° F.) by immersing the bottles in hot water. The elevated temperature was maintained twenty minutes, and the milk was then rapidly cooled by immersing the bottles in cold water. The special investigation in hand required that I should know that I was dealing with the nearest possible article to raw, fresh milk naturally contaminated with tubercle bacilli that had been killed; hence the guinea pigs were injected, those with raw milk to show that the milk certainly contained tubercle bacilli, and those with pasteurized milk to show that the tubercle bacilli had certainly been killed. The total number of guinea pigs injected with each kind of milk was over 100. The injections were made into the peritoneal cavities, this method being one of the most delicate tests that we have for tubercle bacilli. Among the guinea pigs injected with the raw milk 98 per cent contracted generalized tuberculosis; among those injected with the pasteurized milk not one showed a single lesion of disease.

A more conclusive demonstration of the efficiency of low temperature pasteurization (60° C. or 140° F.) maintained for twenty minutes seems almost impossible. The temperature is 72° F. below the boiling point of water and only 41.5° F. above the normal temperature of the human body, which latter has a temperature several degrees lower than the body of a healthy milch cow.

CONCLUSIONS.

The evidence we have to prove that tubercle bacilli derived from cattle cause tuberculosis—and fatal tuberculosis—among human beings is direct and irrefutable. The evidence we have to prove that the milk from tuberculous dairy herds frequently contains living virulent tubercle bacilli is equally direct and irrefutable. Hence, no medical milk commission should consent to the certification of milk unless it is obtained from cows that are free from tuberculosis and that are kept in an environment free from tuberculous infection.

As medical milk commissions can not reasonably restrict their good work to a rare article, such as certified milk is and must remain for a long time to come, they should recommend some measures for the immediate protection of the milk-using public generally. The simplest, the least expensive, and the most efficient available expedient through which the public can be protected against bovine tubercle bacilli and other viruses that may be disseminated with milk is pasteurization. Hence, pasteurization should be recommended for all milk that is not certainly free from the germs of tuberculosis or those of other diseases.

As ordinary commercially pasteurized milk has been proven to be unreliable, by the discovery of live tubercle bacilli in it, medical milk commissions should insist on strict official supervision for all pasteurization of milk that is practiced elsewhere than in the home of the consumer. Until official supervision is established, we should teach that home pasteurization rather than commercial pasteurization is a true protection against milk-borne agents of disease.

It is not meant by this that all commercial pasteurization is unsatisfactory, because the contrary is known to be true. But for the general consumer of milk to distinguish between properly pasteurized milk and milk pasteurized only for commercial purposes is not far from impossible; and therefore, until commercial pasteurization has been placed under official supervision, home pasteurization seems to be the best solution.

The availability, efficiency, and low cost of pasteurization should not be regarded as reasons for relaxing the efforts that have been made, and that are being made, through inspection, education, and otherwise, to improve the general milk supply.

Finally, it may be added that the low estimate of the harm done by bovine tubercle bacilli given in this paper is far below what the writer and many others believe to be true. I hold the opinion now, and have always held it, that the human source of tubercle bacilli is responsible for a much larger proportion of human tuberculosis than the bovine source; but I am thoroughly convinced that there is no equal number of cases of tuberculosis, among all those that are caused by the infection of persons with tubercle bacilli expelled by persons, that can be prevented as easily, as cheaply, and as certainly as the numerous cases that are due to the infection of persons with tubercle bacilli derived from the bodies of tuberculous cattle.

THE NATURE, CAUSE, AND PREVALENCE OF RABIES.

By John R. Mohler, V. M. D.,
Chief of the Pathological Division.

NATURE AND CHARACTERISTICS OF THE DISEASE.

Skepticism with reference to the existence and prevalence of rabies in animals, or hydrophobia in man, strange as it may seem, is still entertained by a few prominent professional men. Their contention shows an unwillingness to accept the work of reputable investigators with regard to this particular disease, although other results obtained by the same investigators upon allied subjects are accepted and advocated. There is no greater galaxy of names associated with the study of any of the infectious diseases than is connected with the experimental investigation of rabies. The ablest scientists who have adorned the medical and veterinary professions, and to whom we owe the greatest deference for having advanced our knowledge of contagious diseases, have repeatedly shown by their experiments that rabies is a specific, communicable disease, preeminently affecting the canine race, although all warm-blooded animals, including man, are susceptible to it.

Many years of patient scientific research have been required to lead these investigators to a clear comprehension of the nature and characteristics of this disease. It was known and described several centuries prior to the beginning of the Christian era, and from the dawn of history the disease has been feared and dreaded. But it has been only in comparatively recent years that we have arrived at a tolerably clear understanding of the facts concerning this disease, which have to a certain degree displaced many of the fallacies and superstitions that have had a strong hold upon the public mind for many years. Indeed, it is still a widely prevalent belief that if persons or animals are bitten by a dog they are liable to become rabid if the dog should contract the disease at any future time. There is no foundation for this impression, and it would be a great comfort to many people who are now and then bitten by animals if the fallacy of this idea were appreciated. All experience, both scientific and practical, goes to show that rabies is transmitted only by animals that are actually diseased at the time the bite is inflicted. Under natural conditions this is the sole method by which the disease is transmitted, and therefore the old idea of spontaneous generation of the malady is absolutely fallacious. Artificially, it may be readily produced by inoculating susceptible animals with an emulsion of the brain or spinal cord or with the saliva, milk, and other secretions of the affected animal. The blood, on the other hand, seems to be free from the infectious principle. The saliva contains the virus which under natural conditions is introduced into or under the skin on the tooth of the rabid animal.

Following the canine race, cattle seem to be the most frequently affected, probably because rabid dogs, next to their morbid desire to attack members of their own race, have a better opportunity to bite grazing cattle than any other species of animals.[a] The relative frequency of rabies in these two species of animals is indicated by the carefully compiled statistics of the German Empire, which show that 560 dogs and 78 cows died of rabies in 1901, while in 1902 there were 516 cases in dogs and 77 in cattle..

Every animal or person bitten does not necessarily develop the disease, and the percentage of fatalities has been variously estimated. According to Hogyes the proportion of persons who contract the disease after being bitten by rabid dogs and not treated is conservatively estimated at 15 per cent. The percentage is considerably higher in man following bites by the wolf. From 35 to 45 per cent of the dogs, 40 per cent of the horses, 36 per cent of the hogs, and from 25 to 30 per cent of the cattle bitten by rabid animals contract the disease, making a general average of about 30 per cent. This, however, depends on the location and size of the wound, as well as the amount of hemorrhage produced, and various other conditions. In general, the nearer the bite is located to the central nervous system and the deeper the wound is inflicted, the greater is the danger of a fatal result. In cases where the hemorrhage resulting from the bite is profuse, there is a possibility that the virus will be washed out of the wound and thus obviate the danger of subsequent appearance of the disease.

The virus after being deposited in the wound remains latent for an extremely variable period of time, which also depends on the size and depth of the wound as well as its location and the amount of virulent saliva introduced. Experiments have proved that the virus follows the course of the nerves to the spinal cord and along the latter to the brain before the symptoms appear. Gerlach, having collected statistics from a large number of cases, has found the period of incubation to vary from fourteen to two hundred and eighty-five days. The great majority of cases, however, contract the disease in from

[a] For a description of the symptoms manifested in rabies the reader is referred to Circular 129 of the Bureau of Animal Industry, by George H. Hart.

three weeks to three months after the bite has been inflicted. It has been clearly demonstrated by the experiments of Roux and Nocard that the bite of a dog is infectious at least three days before it manifests symptoms of rabies, while at the Athens (Greece) Pasteur Institute infection was noted in the saliva eight days before the dog showed signs of the disease.

ETIOLOGY.

Rabies is a specific infectious disease involving the nervous system and characterized by extreme excitability and other disorders, practically always terminating in death. The contagion of this disease has never been isolated, but the fact that the disease is caused by a specific organism principally found in the nervous system is indisputable. For instance, if an emulsion of the brain of a rabid animal is rapidly filtered through a fine Pasteur-Chamberland filter, the filtrate will be harmless. On the other hand, if a similar emulsion is filtered through the more porous Berkfeld filter, the virus will be found in the filtrate. This fact indicates that the infectious principle is not in solution, but is an organism of such size as to be withheld from the filtrate by a very fine filter. Further proof of the organic nature of the virus is furnished by the fact that heating at 50° C. for one hour will render the virulent emulsion inert, while similar results follow its exposure to light for fourteen hours, to the usual antiseptic solutions for a short period, or to the action of the gastric juice.

This contagion can be propagated only in the body of an animal, and despite numerous attempts to cultivate it artificially upon various culture media only negative results have followed.

There is no doubt that between rabies and other well-known infectious diseases there are analogies at many points, the most striking being the protective immunization which constitutes the great work of Pasteur. Moreover, the disease is transmitted from one animal to another through a long series, which indicates the presence of a living organism capable of multiplication, rather than a mere toxin which would naturally become greatly diluted and innocuous by passage through such a series. In addition, the behavior of the disease makes us certain that it is caused by a specific micro-organism which, after introduction into the body, undergoes a period of incubation, during which it multiplies and subsequently produces certain definite symptoms and lesions which terminate in death.

Innumerable attempts have been made to discover the causative agent, and investigators have announced the finding of many of the lower forms of animal and vegetable life as the pathogenic factor. Among the recently described causes certain protozoan-like bodies, found in 1903 by Negri in the ganglionic cells and termed Negri bodies, are of a very suggestive nature. Negri claims that these bodies are not only specific for rabies but that they are protozoa and the cause of the disease. His work has been corroborated by investigators in all parts of the scientific world, but there have been so many claims presented in the past regarding the specific cause of rabies that a number of contemporaneous workers, while admitting the diagnostic value of these bodies, refrain from stating that they are the causative agents. Some of these observers consider the Negri bodies as "involution forms" of the tissue cells which have been invaded by the true parasite, or as encapsulated parasites undergoing degeneration.

Personally, it is the writer's belief that these bodies are the specific cause of rabies. They are from 0.5 to 25 microns in size, oval, round, or pear-shaped, and strongly eosinophilic. They possess a homogeneous substance resembling coagulated albumen in appearance. Within are clear hyaline bodies which show one or more points of deep color on high magnification. An examination of their viability will show a striking resemblance to the viability of an emulsion of the virulent tissue. Thus, Negri bodies have been found to be quite resistant to external agencies such as putrefaction, desiccation, etc., and are about the last portion of the nerve cell to survive the advance of decomposition. They are also found in over 96 per cent of the cases of rabies examined, but have not been proved to exist in other diseases.

Valenti states as his strongest evidence of the protozoan nature of the bodies that the virus of rabies is neutralized in test tubes by quinin, while no other alkaloid has this property. As a result of the work performed in the New York City board of health laboratory, Park states that Negri bodies are found in animals before the beginning of visible symptoms, and evidence is given that they may be found early enough to account for the infectiousness of the central nervous system. Williams's reasons for considering these bodies organisms belonging to the protozoan class are:

(*a*) They have a definite, characteristic morphology.

(*b*) This morphology is constantly cyclic, i. e., certain forms always predominate in certain stages of the disease, and a definite series of forms indicating growth and multiplication can be demonstrated.

(*c*) The structure and staining qualities, as shown especially by the smear method of examination, resemble those of certain known protozoa, notably of the rhizopoda.

These bodies are now almost universally considered as diagnostic of rabies, and in the pathological laboratory of the Bureau of Animal Industry their detection in the ganglionic nerve cells suffices for a diagnosis of rabies without animal inoculations. In case these granular bodies are not found in a suspected animal, the plexiform ganglion is next examined, and should negative results still be obtained the inoculation of rabbits is then made as a last resort. It is indeed rare that positive results are obtained from the latter method after the first two methods have been negative, but it has occurred occasionally in cases where the animal had been killed in the early stages of the disease.

TRANSMISSION OF THE DISEASE BY MILK AND MEAT.

While the virus of rabies is most frequently found in the central nervous system and the salivary glands, it may also be found in other glands and secretions, including the mammary glands and the milk. That rabies may at times be excreted with the milk has been proved by Nocard, Perroncito, Bardach, and the writer. In these latter experiments the milk of a rabid bitch having a litter of puppies was inoculated intramuscularly into rabbits and guinea pigs, and produced typical rabies; but the puppies, removed from the mother when the first symptoms developed, were kept under observation for eighteen months without developing the disease. The reason for these negative results in the puppies may be explained (1) by not having been bitten by the mother before she was removed, and (2) the absence of any abrasion in the alimentary tract through which the virus could have entered the circulation.

It is a generally accepted fact that rabies can not be transmitted to normal animals through food containing the virus of the disease unless lesions are present in the alimentary canal; but the conclusion that there is no danger to the consumer from the meat or milk of animals that are rabid is not tenable, since abrasions of the lips, mouth, and pharynx are all too frequent to permit of such risks. These products must therefore be considered as dangerous to health.

One case is on record where a baby in Cuba developed rabies from nursing its mother while the latter was in the early stages of hydrophobia. In this case, however, the virus in the milk may have entered the circulation through abrasions of the gums during teething. Similar cases have been reported in veterinary practice where the virus of rabies was observed to have been passed to the offspring through the mother's milk, but in these cases it is impossible to eliminate an obscure bite from the bitch or lesions of the gums during this early age. While it is not probable that cattle would be milked after the symptoms of rabies developed, it is nevertheless important to realize the danger of using such milk and the necessity for preventing calves from sucking such diseased cows.

All attempts to convey the disease to healthy dogs by feeding them upon meat from infected animals have given negative results.[a]

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[a] Claudio Fermi has recently produced rabies in rats and mice by feeding them rabietic material with their food. About 60 per cent of the 70 animals so fed died of paralytic rabies.

Nevertheless the meat of rabid animals must be considered as unfit for food, and the meat-inspection regulations enforced by the various countries having such inspection provide for the total condemnation of the carcasses of these animals.

Infection has occurred in man from making autopsies on rabid dogs, and it is likewise possible to result if inoculation occurs while handling the meat of rabid cattle, hogs, or sheep. Ostertag reports the case of a veterinary student at Copenhagen who infected a wound on his finger while making an autopsy on a dog dead of rabies and died of the disease. Another somewhat similar case occurred in a veterinary student at Dresden in consequence of an injury received while holding a post-mortem on a rabid dog.

Wyrsykowski, in an attempt to discover the reason for the fact that no illness followed the eating of the meat and even the brain of rabid animals, tested the action of the gastric juice upon infectious material in vitro. Twenty-one rabbits were inoculated with this artificially digested virus, but not one animal contracted the disease, while all the 17 check rabbits which were inoculated with undigested rabies virus developed the disease and died. It is evident, therefore, that the gastric juice has a pronounced deleterious effect upon the virus of rabies.

DIFFERENTIAL DIAGNOSIS.

The present advocates of the assumption that rabies is a disease of the imagination should be better fortified in both their facts and their theory. Little children certainly do not die after a dog bite from the effects on the imagination, nor do horses, cattle, sheep, hogs, dogs, rabbits, and monkeys die from an imaginary disease. It must be more than a mere coincidence that ever since the recognition of this disease in the days of Aristotle this peculiar mode of death has occurred only after infection by a rabid animal. The daily newspapers may add to the sensational details of these occurrences, but there is no doubt of the real danger involved.

Anyone who has seen the suffering of one human being affected with this fatal disease will readily concede that no amount of inconvenience caused animals by muzzling or other protective arrangement can ever be considered too much to prevent such suffering, nor should it prove difficult to differentiate between hydrophobia and the pseudo form, which has been termed lyssophobia, if all the cases of these diseases were as typical as the two which were brought to the writer's attention.

Through the courtesy of Dr. William C. Woodward, health officer of the District of Columbia, I was invited to visit Freedmen's Hospital for the purpose of seeing a patient whose case had been diagnosed by the resident surgeon as suspected hydrophobia. The woman, 28 years of age, had been fiercely attacked and severely bitten on the right forearm and about the face by a stray collie dog. Eighteen days later she complained of a general malaise and pains in the cicatrized wounds of the head, which rapidly grew more severe, necessitating the services of a physician, upon whose advice the patient was removed to the hospital on the following day. My visit occurred on the afternoon of the succeeding day, at which time the patient was found in an extremely nervous condition, having an excessive feeling of fear and uneasiness. The eyes were staring, and a general expression of anxiety pervaded her countenance. Her mind was clear, and no efforts at violence were made. When interviewed as to the scars on her head and forearm she lightly replied, "Oh, a dog bit me there some weeks ago, but they are all right now."

From time to time reflex spasms involving the muscles of deglutition were noticed, causing a clutching at the throat and difficult breathing during the attack. These rapidly became more generalized and soon involved the respiratory muscles, causing dyspnea. Attempts at vomiting would then occur, but no evacuations followed. Contrary to the views of our skeptical friends, the patient accredited these symptoms to indigestion, and had not the slightest suspicion of the true nature of her condition, thus disproving the idea that the nervousness and fear usually seen in the early stages of rabies in the human subject are due to the natural dread of the disease and apprehension of the consequences rather than to organic changes in the central nervous system. During the night these symptoms became more aggravated and spasms followed one another more rapidly, causing grave delirium. The patient finally became violent, requiring the adoption of forcible measures to keep her under control. Death occurred on the following morning, twenty-one days after the bites had been inflicted. On post-mortem examination no pathological lesions were found which could be held accountable for the symptoms which resulted in death, but histological examinations of the plexiform ganglia and the medulla, as well as the inoculation of rabbits both subdurally and intramuscularly with an emulsion of the brain, resulted in the confirmation of the diagnosis of hydrophobia.

That the appearance of a disease like rabies in a community seems peculiarly and in an extraordinary degree to be associated with an atmosphere of hysterical simulation and to inspire states of auto-suggestion must be admitted. One case of this character recently came to my attention through the kindness of a local physician which is in direct contrast to the instance cited above.

A young man, 24 years of age, employed as a clerk in a dry goods store, was bitten on a Saturday morning by a watchdog belonging to the proprietor. The bite, which was slight, had been immediately cauterized, and no further attention was given to the incident until Wednesday morning, when the young man fainted at the counter. Upon reviving he stated that he had been reading about rabies and the symptoms which would develop in man from the bite of a rabid dog, and insisted that he was developing hydrophobia as a result of having been bitten by the watchdog. He was immediately sent to his home and the dog brought to the Bureau to be kept under observation. Two days later the young man was in a very hysterical state and kept insisting that the dog that bit him was rabid. During this time the patient had been in bed, and seemed to have had marked paroxysms. He would roll himself over and over in bed, snarling, growling, and snapping at the bed clothes. He would catch the pillow or sheet with his teeth and shake it like a terrier shaking a rat, and in numerous other ways would show more imitative accuracy than in the genuine disease. At first it was impossible to attract his attention, although he would mutter and talk to himself. When he was informed that the dog that bit him did not have rabies, that it was alive and well, and that even if it did develop rabies several weeks later it would have no bearing on his case, as the saliva would not be virulent such a long period before the development of the symptoms in the dog, and furthermore that he had developed symptoms entirely too soon after the bite had been inflicted, as a longer period of incubation had to intervene for the virus to multiply and produce its effects, he commenced to realize that he had been making himself a victim of autosuggestion, and rapid recovery followed.

Here was a typical case of lyssophobia or pseudo-rabies, a figment of an overworked imagination, and, as in all cases of this class, recovery took place instead of death, which is always the termination of the true disease.

It has been stated by certain physicians that tetanus is undoubtedly the true cause of death in the majority of instances where rabies has been diagnosed. It is not my purpose to give a differential diagnosis between these two diseases in man, but there is such a marked difference between a horse affected with tetanus and one with rabies, or a cow affected with tetanus and one with rabies, or a dog affected with tetanus and one with rabies, that a few brief words on differential characteristics will be given.

Tetanus may be readily differentiated from rabies by the persistence of muscular cramps, especially of the neck and abdomen, which cause these muscles to become set and hard as wood. In tetanus there is also an absence of a depraved appetite or of a willful propensity to hurt other animals or damage the surroundings. The general muscular contraction gives the animal a rigid appearance, and there is an absence of paralysis which marks the advanced stage of rabies. The dumb form of rabies in dogs is characterized by a paralysis and pendency of the lower jaw, while in tetanus the jaws are locked. This locking of the jaws in horses is very characteristic, and in cattle or dogs it renders the animals incapable of bellowing or barking as in rabies. Finally, tetanus may be distinguished from rabies by the fact that the central nervous system does not contain the infectious principle, while in rabies the inoculation of test animals with the brain or cord of a rabid animal will produce the disease with characteristic symptoms after an interval of fifteen to twenty days. This period of incubation is much longer than in tetanus, since the inoculation of rabbits with tetanus bacilli invariably results in death after a short period, usually within three or four days.

DISTRIBUTION AND PREVALENCE.

There is no intention of assuming the part of an alarmist with reference to the increasing prevalence of rabies. It can not be denied, however, that there is at present unusual occasion for alarm in certain parts of this country. It may be true that many newspaper stories have been exaggerated or entirely false, but it is not true that all are fabrications. This is shown by a number of cases traced by the writer where the diagnosis had been made in reputable laboratories by recognized scientists. Kerr and Stimson in their investigation of the prevalence of rabies used a number of press clippings, and in no instance did a press report lack official confirmation, which is quite contrary to the general opinion on this subject.

In looking over the proceedings of the American Veterinary Medical Association for the past twelve years it was observed that rabies is reported as existing in a certain number of States each year, although there has been no special endeavor on the part of the resident state secretaries to ascertain the extent of this particular disease in their sections. In 1897 the disease was reported in four States, in 1898 in five States, while in 1899 the statement of Huidekoper was cited by Parker to the effect that the disease was not west of the Rockies and was rare in the United States except in Pennsylvania and Massachusetts. However, in the 1900 report we find that the disease had appeared in Montana, Wyoming, and Colorado, in addition to certain Eastern and Central Western States. It is evident from the succeeding reports that the disease was becoming more widespread, and at the meeting of the American Veterinary Medical Association in Philadelphia in 1908, of the twenty resident state secretaries who reported, thirteen incidentally mentioned the existence of rabies in their States, and in Alabama, Connecticut, the District of Columbia, Minnesota, Mississippi, and Ohio the disease seemed to be on the increase. As there was no apparent reason for mentioning the presence or absence of this disease, the failure of the reports from the remaining seven States to refer to rabies should not be considered as indicative of its absence. In fact, the writer has corresponded with officials in these seven States, and replies have been received from five of them to the effect that rabies had prevailed in their localities during 1908, thus showing that the disease existed in eighteen of the twenty States mentioned in the 1908 report. We have gone even further in our correspondence and have endeavored to find out if there is any State or Territory in the United States where rabies is unknown. From the information at the writer's disposal it would appear that the disease occurs in almost every State in the Union, and the only places where it has been impossible to obtain positive information are Idaho, Utah, Nèvada, and Oregon, while in the State of Washington there has been but one outbreak, which was quickly suppressed seven years ago. It would be entirely impracticable without registration laws to ascertain the extent of the disease among animals in the various infected sections, but the disease appears at times in certain centers with all the vigor of an enzootic, and such outbreaks have occurred recently in Jacksonville, Fla.; El Paso, Tex.; Norfolk, Va.; Kansas City, Mo.; Boston, Mass.; Chicago, Ill.; Baltimore, Md.; Washington, D. C.; Cleveland, Ohio; Pasadena and Los Angeles, Cal.; and certain sections of New York, Pennsylvania, Minnesota, Ohio, Missouri, and Michigan. Not only is there a gradual increase in the number of outbreaks of rabies, but many new centers which appear to be more or less permanent are being established from year to year. The fiscal year 1909 is the first year when over 100 cases of rabies have been diagnosed in the Pathological Division of the Bureau of Animal Industry, and of the positive cases, 79 came from the District of Columbia and 33 were divided among Virginia, Maryland, West Virginia, and South Carolina.

The following table, prepared by Kerr and Stimson, of the United States Public Health and Marine-Hospital Service, gives a partial list of the number of laboratory diagonoses of rabies found in 1908 at the various institutions interested in the investigation of this disease. They call attention to the fact that these figures represent in many instances only a small proportion of the actual number of cases of rabies occurring in the various States. For example, while only 47 cases of rabies have been actually demonstrated in Wisconsin, the state veterinarian estimates that 584 animals died of this disease during 1908.

Positive findings of rabies in animals, 1908.

Diagnosis made by—	Number.
Delaware state board of health laboratory	7
Connecticut state board of health laboratory	14
Florida state board of health laboratory	20
Indiana University, Bloomington, Ind	12
Indiana state board of health laboratory	75
Baltimore (Md.) Pasteur Institute	74
Massachusetts cattle bureau	135
University of Michigan Pasteur Institute	101
New Hampshire state board of health	7
New Jersey state board of health	13
New York Pasteur Institute	60
North Carolina state laboratory of hygiene	21
Vermont state board of health	2
Wisconsin state hygienic laboratory	47
New York state veterinary college	188
Minnesota state live-stock board	15
Bureau of Animal Industry, Pathological Division, Washington, D. C	121
Cleveland health department, east side	49
Pennsylvania state live-stock sanitary board	103
Ohio state board of health laboratories	32
Virginia Pasteur Institute, Richmond	39
Biological laboratories, Brown University, Providence, R. I	32
Total	1,167

In a letter from former State Veterinarian Langley, he states that Texas probably has more rabies than any other State in the Union. Several years ago President Frank Wells, of the Michigan state board of health, made rabies largely the subject of his annual address and declared it was epidemic in Michigan. Vaughan, who reported as a special committee on rabies, intimated that it had gradually spread from New York, where it had prevailed for a number of years previously, into Ohio and thence to Michigan, having been diffused throughout the lower peninsula of Michigan. In fact the disease became so widespread and so many people were bitten that the State appropriated funds for the establishment of a Pasteur institute in connection with the medical department of the University of Michigan. A Pasteur institute was likewise established in April, 1908, in Washington, D. C., in connection with the Hygienic Laboratory of the United States Public Health and Marine-Hospital Service, owing to the continued outbreak of rabies in that vicinity and the large number of people bitten by rabid animals, 139 persons having been treated since its establishment. In addition, there are eighteen other Pasteur institutes in the United States, located at Atlanta, Ga.; Austin, Tex.; Baltimore, Md.; Chicago, Ill.; Iowa City, Iowa; Jacksonville, Fla.; Minneapolis, Minn.; Montgomery, Ala.; Newark, Del.; New Orleans, La.; Pittsburg, Pa.; Raleigh, N. C.; Richmond, Va.; St. Louis, Mo.; two in Indianapolis, Ind.; and two in New York City.

As an indication of both the distribution and the prevalence of rabies among animals may be considered the number of persons who have been treated at these institutes. The directors of these Pasteur institutes have been requested to furnish this information, and the majority have responded. From these reports it is evident that several thousand people have been subjected to the Pasteur treatment recently, and hundreds (nearly 1,500 persons in 1908) receive the treatment every year as a result of bites inflicted by rabid animals. At the Pittsburg institute 1,022 persons from Canada, Ohio, Pennsylvania, New York, West Virginia, and Colorado have received treatment as follows:

From December, 1900, to September, 1902, 76 cases.
From October, 1902, to October, 1904, 143 cases.
From October, 1904, to October, 1906, 185 cases.
From October, 1906, to October, 1908, 368 cases.
From October, 1908, to June, 1909, 250 cases.

The Texas institute, under state control, has been established less than five years, but the number of persons who have applied for treatment has gradually increased from 81 in 1905 to 254 in 1906, 310 in 1907, and 353 in 1908, these patients coming from 7 Southwestern States and old Mexico.

At the St. Louis institute 381 person have been treated, coming from 11 Southern and Central Western States and from Mexico.

Since 1890 the Chicago institute has treated 3.016 people, coming from 30 different States of the Union.

At the New York institute (Rambaud's) 1,367 cases were treated between 1890 and 1900; 237 cases in 1900 and 1901, and 486 cases from October, 1904, to October, 1906.

Brawner, of the Georgia institute, has treated 670 patients since 1900 with only 2 deaths. During this time all the people in Georgia bitten by rabid animals so far as could be learned, and who did not take the treatment, were recorded, and of the 120 bitten without subsequent treatment 29 have died. Rabies is said to be very much on the increase in that section, and it is not uncommon for farmers to lose many horses, cows, and hogs from the disease.

At the Baltimore institute 1,092 cases have been treated, 334 of which came from Maryland, 117 from North Carolina, 102 from Pennsylvania, 104 from Virginia, 112 from West Virginia, 57 from the District of Columbia, and the remainder from 13 other States.

Since 1901 the Richmond institute has treated 208 cases, coming from Virginia, North and South Carolina, and West Virginia.

As a further indication of the number of persons bitten but who did not take the Pasteur treatment are the census reports showing the mortality statistics from rabies. In the census of 1900, when only about 40 per cent of the population resided in districts where registration was observed, 123 deaths from rabies distributed in 20 States were reported. That this number was entirely too low was shown by Salmon in 1900, who corresponded with a number of health officers within and without the registration districts and collected 230 authentic cases of hydrophobia in man during this same interval in 73 cities.

That the increase of rabies in animals which has been demonstrated above bears a direct relation to the increase in the disease in man is shown by the vital statistics of the Census Bureau, as follows:

In 1903, 43 people died of rabies; in 1904, 38; in 1905, 44; in 1906, 85; in 1907, 75; in 1908, 82. These deaths occurred only in the registration area of the United States, which now includes about 51 per cent of the total population.

While the disease in certain foreign countries has at times appeared in the form of severe enzootics extending over considerable territory, in the course of the last decade the affection has decreased on the whole, and in some places has even disappeared entirely, owing to the rigid enforcement of muzzling and quarantine regulations. According to Hutyra and Marek the disease in France is widely distributed all over the country. Since 1899 more than 2,000 cases of rabies in animals have been reported each year, and in 1903 there were 2,391 rabid animals. In Germany during the years 1895 to 1898 the number of cases of rabies increased rapidly from 489 to 1,202. The number then decreased to 612 in 1902. These cases occurred mainly in the eastern and southern provinces bordering on the badly infected districts in Russia and Austria, while in the other parts of Germany only a few isolated outbreaks of the disease appeared. In Austria the disease has been on the increase since 1891, and in 1900 there were 1,187 cases reported. During this interval—from 1891 to 1900—4,974 people were bitten by rabid animals, 123, or 2.4 per cent, of whom died of hydrophobia. In 1903 the number of people bitten by mad dogs varied from 11 to 42 weekly. In Hungary there was a momentous decrease in rabies following the passage of the veterinary sanitary law of 1888, but since 1893, when there were 883 cases, outbreaks have been gradually increasing, and in 1903, 2,040 rabid animals were reported. The disease is most common in Russia, and it also appears very frequently in Roumania, Servia, and Bulgaria. In Turkey, despite the large number of dogs, the disease does not increase much, which is explained by Remlinger by the fact that the affection generally appears in the form of dumb rabies. In 1903 only 35 rabid animals were reported in Belgium, 25 in Holland, 18 in Switzerland, and 376 in Italy. Spain has had more frequent outbreaks of the disease, while Denmark, Sweden, and especially Norway and Great Britain, have been free from the contagion for several years owing to the wise provision that all dogs running at large shall be muzzled. The islands of Australia, Tasmania, New Zealand, St. Helena, and the Azores have never become infected with rabies, and the first three prevent its introduction by rigid inspection and quarantine. In 1905 Rutherford reported the disease to be spreading in Canada, and in 1908 Dudley made a similar statement for the Philippine Islands, where the malady had been found to exist in 39 provinces. The latter recommends the establishment of a Pasteur institute in the islands. That rabies is increasing in Mexico is shown by the report of the Pasteur institute in the City of Mexico. For the twenty years since this institute was established 8,680 patients from all the Federal States of Mexico have taken treatment, 4,579 of these people receiving the treatment during the last six years. The disease is also known to occur at infrequent intervals in certain sections of South America, Africa, and Asia.

PREVENTION AND ERADICATION.

Sanitary regulations which seek to control the disease effectively by exterminating it among dogs are most likely to prove successful. There is no communicable disease which is more easily prevented or eradicated than rabies. Since the infection is practically always transmitted by a bite, and since the animal which does the biting is almost always a dog, all sanitary measures must be directed to the control of these animals for a sufficient time to cover the incubation period of the disease. It seems inexcusable, therefore, to allow this contagion to be propagated indefinitely, causing untold suffering to the affected animals and menacing the lives of persons, particularly children, who go upon the streets.

The only measures necessary to obtain the desired result are (1) a tax or license for all dogs, with a fee of $2 for males and $5 for females, and the destruction of homeless or vagrant dogs; (2) restraint of all dogs which appear in public places, either by the use of a leash or an efficient muzzle.

There is no doubt that neglect has allowed the accumulation of ownerless dogs in this country to an extent that renders our large cities frequently liable to incursions of rabid animals. To even mention muzzling, however, is sufficient to bring tirades of abuse upon the head of the sanitarian, and dog sentimentalists are immediately up in arms, using time, influence, and money to prevent such an ordinance. In spite of the obloquy with which it is received by a certain mistaken class of the community, the results of muzzling amply justify its recommendation, and its rigid enforcement without any additional requirement will exterminate rabies in a district in a shorter time than any other known method. Even Dulles, the great controversialist on rabies, admits that he considers muzzling to be the most important measure for limiting the ravages of this disorder, no matter on what theory it may be accounted for. Excellent examples of its efficiency are shown by the well-known results obtained in eradicating the disease from England, Sweden, Denmark, Berlin, and in other communities.

The striking results obtained by England have caused many persons to propose and advocate a national dog muzzling law for the United States, enforced by the Department of Agriculture. These suggestions, however, do not take into consideration the discrimination between the functions of the federal and state governments and the differences between the laws of the United States and those of England. The power conferred is not in all cases sufficient to effect the eradication of a disease, for the reason that the Federal Government can not enforce measures within a State without the legislative consent of the State unless the animals affected are subjects of or endanger interstate commerce. Its work, therefore, without the cooperation of the States affected, is limited to interstate traffic, and quarantine lines are thus made to follow state lines. The Department is always willing to cooperate, so far as possible, with any State which requests assistance in eradicating an infectious disease. But such a State must necessarily have the proper laws by which the control of the disease is made possible. When a disease such as rabies is confined within a State it does not come under the jurisdiction of the Federal Government and can not be treated as the infectious diseases pleuro-pneumonia and foot-and-mouth disease, which spread from State to State and become a serious menace to interstate traffic. The Department of Agriculture could quarantine against States where the rabies exists, but it can readily be seen that owing to the great freedom of movement which dogs enjoy it would be impracticable to enforce such a quarantine further than to require all dogs to be muzzled which are being transported interstate by common carriers. Such a requirement would give an infinitesimal amount of protection, as these dogs would be beyond the federal jurisdiction after reaching the State for which they were destined.

If all States should enact muzzling laws, or if the state boards of health, state sanitary boards, and municipal authorities in the infected States should be empowered to issue and enforce regulations compelling the muzzling of all dogs in the infected area and the impounding or humane destruction of all dogs found running at large, the disease would soon be stamped out.

The necessity for a muzzling order having arisen in the District of Columbia, the Secretary of Agriculture notified the District Commissioners of the presence of this disease in an alarming degree among the canines of Washington, and requested the enactment of a muzzling order. Such an order was deemed advisable because the disease had suddenly jumped from 12 cases during the fiscal year of 1906–7 to 61 cases in 1907–8. The Commissioners, however, believing that the most effective manner of dealing with the matter was to impound and destroy stray dogs, started to increase the dog-catching service on February 1, 1908, and from this time to June 15, 1908, there were 2,762 dogs impounded as compared with 1,185 dogs impounded during the corresponding period for 1907. The President of the United States became interested in the subject, and the Commissioners issued a muzzling order to be effective for a period of six months. With the extra wagons and force employed the number of dogs captured during the period of the muzzling order was 4,355 as compared with 2,794 captured during the corresponding period of the preceding year. The cost of the service for the period of the muzzling order was $6,125 as compared with $2,243 for the corresponding period in the previous year. To further the execution of this order 146 arrests were made and 134 convictions secured besides what was accomplished by giving notice of a penalty for violation. In 1908, during the last six months of which the muzzling order was enforced, 8,225 dogs were impounded, while after the expiration of the muzzling order only 2,243 dogs were impounded during the first half of 1909. During the last six months of 1908, the period when muzzling was required, there were 46 cases of rabies, while in the first six months of 1909 there were only 28 cases. The results from the muzzling order were therefore becoming apparent, and an additional six months' quarantine was requested by the Secretary of Agriculture, but this request was not complied with by the District Commissioners.

In order to secure state and municipal legislation for the control of rabies it will require concerted action on the part of all interested parties, whether professional men or laymen, to prove to the public the need, value, and benefits of such a procedure. With such legislation properly enforced no dog would be seen running at large without a muzzle. Those contracting the disease would be unable to transfer the virus to other animals. Monetary loss, untold suffering, and death among both human beings and animals caused by the disease would rapidly decrease, and in a relatively short period rabies would be eradicated from our country. After reaching this desired goal the reappearance of the disease could be readily prevented by a six months' quarantine of all dogs imported into the United States from countries where rabies is prevalent.

ANTHRAX, WITH SPECIAL REFERENCE TO ITS SUPPRESSION.

By Henry J. Washburn,

Senior Pathologist, Pathological Division.

NATURE AND HISTORY OF THE DISEASE.

Anthrax may be defined as an infection due to specific bacilli which may attack every species of domestic mammal, and for this reason may become one of the greatest scourges of animal life. Man is by no means immune, although, fortunately, the malady as it appears in the human subject is usually less acute than the form seen in cattle and sheep. This is probably due to the fact that the lesions in man occur most frequently from infection of the surface of the hands or feet, while cattle and sheep are more likely to swallow the infectious germs with their food, thus giving the germs immediate entrance into the animal system, where they can exert their most harmful influence without check or control.

Historians record an outbreak of anthrax in the south of Europe in 1613 which started with the cattle and spread from them to the populace, ultimately becoming a veritable scourge and causing the death of more than 60,000 people. From this it is very evident that the disease was far more virulent and far more inclined to attack all species of mammals during these earlier centuries than it is at the present day. It is even recorded that many deer and other varieties of game animals were destroyed during these early periods.

At the present time cattle and sheep are the chief sufferers, and the outbreaks appear to be limited to animals that run upon low, moist lands of a more or less mucky character. In certain regions of the country, where the land is mainly hilly, it has been found that pastures exist in which there are wet, low places, and that anthrax appears every season among the cattle of these farms if they are allowed to pasture upon these damp areas, but when good fences are built around them and the stock is kept upon the dry portions of the pasture the disease quickly disappears. Should the fence become broken down, allowing cattle to invade the infected area at certain seasons of the year, they are very likely to contract anthrax. In fact, certain plats of ground of this description have been found to retain the germs of anthrax for several years, a circumstance which has led many investigators to declare that the anthrax organism has the capability of growing from year to year without any artificial aid or cultivation, if only planted upon suitable soil; that it will sprout and grow, producing the plant and later the seed, thus providing a perpetual source of infection for the stock that may chance to be allowed to linger on this area of growing anthrax plants.

Because of the remarkable tenacity with which certain plats of ground retained their infection, Pasteur in 1880 reached the conclusion that the carcasses of animals dying from anthrax, even though deeply buried, retained their many infectious organisms and supplied them with such an amount of nutriment that they continued to multiply for years, and in this way produced an immense underground supply of virulent anthrax organisms. He decided further that these living infectious germs might be brought to the surface at any time through the agency of earthworms, and that, having reached the surface, they offered a very serious menace to any live stock that might wander into that vicinity. These suggestions were very generally accepted by the medical fraternity and for some years were taught as illustrative of the manner in which anthrax lurks in certain localities for years at a time; but later investigations by Kitasato have shown that spore formation by anthrax bacilli is very incomplete at a depth of 18 to 20 inches below the surface of the ground, and at even greater depths must be greatly suppressed by the presence of the products of decomposition. Koch has further stated that earthworms are incapable of taking up anthrax spores and bringing them to the surface.

Nevertheless, the fact remains that certain circumscribed areas of ground remain dangerous to stock from year to year. It is still an unsettled question whether the anthrax germs grow and multiply each season upon infected lands when conditions of moisture and warmth become favorable or whether the ground becomes infected at some certain time with bacilli, from which spores develop, which remain near the surface of the ground for years or until taken up by some susceptible animal.

Careful experiments have proven that anthrax bacilli flourish and retain their virulent properties in stagnant water for at least twelve months, and certain authorities claim to have observed them multiplying with no other nourishment than that afforded them by muddy water.

A look at some of the most seriously infected localities in this country will help us to understand the conditions which tend to perpetuate the infection. Upon the rice plantations of the South, where the fields are annually submerged to favor the starting of the rice plants, many of the animals used in the cultivation of the crops contract anthrax and die as a result if driven over the infected lands after the water has subsided and a few days of hot weather have intervened.

Where tanneries are located upon or near to streams there is great danger that anthrax will be brought to them upon hides and then be scattered over the low lands lying downstream from the point where the tanning process is carried on. This state of affairs exists especially near to those tanneries which work upon goat or sheep pelts from foreign countries. Infection in the form of spores adheres to these hides so persistently that ordinary fumigation fails to destroy it, and repeated outbreaks of the disease occur wherever such skins are unpacked and manufactured into leather. In making mention of this danger Professor Law writes:

Since 1892 anthrax has prevailed along the banks of the Delaware River for a distance of 40 miles in New Jersey and Delaware, destroying from 70 to 80 per cent of the farm stock. The great morocco industry on this river draws infected hides from India, China, Russia, Africa, and South America, and the spores are carried and distributed by the hides.

Delafond studied the vitality of anthrax bacilli in 1860. He placed some blood from a sheep dead of anthrax in a glass container to which free access of air was granted. This was kept in a cool place at a temperature ranging variously from 45° to 60° F. (10° to 15° C.). When examined at the end of the fourth day it was found that the length of the filaments was increased, but that their diameter had remained unchanged. After eight to ten days their length was four or five times as great as when first brought under observation, thus proving that a veritable growth of the bacillus had taken place outside of the animal body and without the presence of animal heat.

In a letter from China to the London Lancet we read:

The disease which has been destroying cattle throughout this district continues its ravages, though with diminished virulence, probably because there is now a scarcity of susceptible cattle. The mortality has varied from 50 to 75 per cent of the infected animals. To determine the extent of the disease I made inquiry as to the number of hides exported during the first three months of this year. They say that more than 260,000 left Peking, and that half a million would not be too high an estimate for the whole district. As no cattle are being slaughtered, this represents, approximately, the loss of cattle from the plague.

The foreign firms that export hides, wool, bristles, and hair are in the hands of Chinese middlemen who roam about the interior buying here and there from the agricultural classes. I have been over some of the factories in Tientsin and have observed the steps they take to clean the stuff before its export. Bristles and hair are thoroughly well boiled in soda solution, wool is roughly carded and shaken free of as much dust as possible by machinery, and hides are sorted out and packed with naphthaline. The exporters claim that any further disinfection than is now given would spoil their goods and increase their expenses.

The real difficulty does not lie with the *Bacillus anthracis* but with its spores, whose natural resistance is increased by their being embedded in the grease and dirt of the material while it is being dealt with in wholesale bulk in China. There can be little doubt that the passage home through the Indian Ocean and the Red Sea in the warm hold of a ship is all-conducive to their propagation and preservation, so that when the time comes for bristles and hair being carded and separated out by workers at home these spores are liberated in an active condition, ready for human infection to a much greater extent than is the case in China.

Aside from the danger of direct infection to animals pasturing on infected areas, there exists the added danger of inoculation through the agency of hay or other crops that have been grown upon infected areas of land. The process of drying and curing the hay or forage does not lessen this danger, for drying favors the development of spores, and these, mingling with the dust and fragments of the dried forage, may be taken up by the wind and blown about, or may cause serious damage simply by being eaten by susceptible animals

FORMS OF THE DISEASE.

The disease may appear in one of three forms—apoplectic, acute, or subacute.

The apoplectic form is most frequently seen attacking cattle or sheep at the beginning of an outbreak before the animals of the vicinity have developed any degree of natural immunity to the infection. Here the animals present symptoms of cerebral apoplexy. They reel and fall, bloody liquid flows from the body openings, and death soon follows. If the body is opened and search is made for evidence of disease, it may be quite impossible to detect any definite lesions or any change in the tissues.

The acute form of the disease develops more slowly, but becomes well established in twelve to twenty-four hours after the premonitory symptoms are noticed. In these cases the fever is intense (104° to 107° F.). The animal is greatly prostrated. Cerebral congestion causes excitement, which is followed by drowsiness and staggering gait. There is frequent passage of bloody urine, followed by convulsions and death. In this type of the disease, as well as in the apoplectic form, post-mortem examination of the carcass may fail to reveal any definite lesions.

The third form of anthrax, the subacute, is the most common. The symptoms are like those of the acute form except that they are of slower development. Instead of becoming established in twelve to twenty-four hours, one to seven days may be required. The fever is very high. Serious colics are often present. Local anthrax tumors appear externally, first near the shoulders, neck, and head, and are usually due to local injury or bruising, which gives rise to a collection of bacilli within the blood vessels of the part, whose resulting inflammation gives rise to the swellings or carbuncles. These tumors are at first hard and circumscribed, but later become cold, insensible, diffuse, and fluctuating. An examination of the carcass of an animal dead of anthrax of the subacute form will probably show many lesions or alterations. Hemorrhages may be found in almost all parts of the body. Serous infiltrations may be present beneath mucous membranes and skin. There will be swelling of the spleen, the liver, and the kidneys, and the blood will be of a muddy or tarry appearance and incoagulable. The cavities of the body contain more or less bloody effusion, and the lymphatic glands are swollen and contain small hemorrhages. The red blood cells have become broken down in large numbers and the serum of the blood has been markedly reddened. The walls of the intestines may appear perfectly normal, but hemorrhages are frequently seen, especially in the walls of the duodenum.

The subacute form is the one most commonly met, and it is the only form which responds favorably to treatment. Death ensues so quickly in the other two forms that attempts at treatment are of but little use.

Isolated or sporadic cases are usually of the subacute form, and are frequently limited to the formation of a tumor or carbuncle at the point of the body at which the infective germs first gained their entrance.

THE ANTHRAX BACILLUS.

The anthrax bacillus is a straight rod with ends slightly concave. It can not grow without the presence of air, but will grow in temperatures ranging from 55° to 106° F. It is not capable of motion. It measures 4 to 6 μ in length and about 1 μ in breadth. The bacilli multiply by fission, or dividing into two, or they may multiply much as corn does by the formation of seeds or spores, which sprout and produce a new anthrax plant when placed under suitable conditions. This simile may be carried further, for, like a tender blade of corn, the anthrax plant or bacillus may be destroyed very easily by the application of heat or cold, but the seed or spore will resist considerable heat and is unaffected by freezing, still retaining its virulence in spite of being subjected to either temperature.

When cultivated artificially and grown in the laboratory, a luxuriant growth may be obtained by planting upon any of the culture media commonly used for bacterial growth. The organisms grow rapidly and produce dense, thick clumps on potato, gelatin, agar, or other solid material. They grow with equal readiness in fluid media such as beef broth, milk, etc., but will not produce spores while growing in media of this character, as spores can not develop except in the presence of free air or oxygen.

METHODS OF COMBATING INFECTIOUS DISEASES.

Whenever attempts are made to control or suppress an infectious disease a thorough study of its character must be made, as the measures to be applied will very largely depend upon the results of such investigation. Take foot-and-mouth disease, for instance. This has become so firmly established in the flocks and herds of certain European countries, especially in the southeastern portion, that it is considered almost an endemic, and while the stock owners are constantly trying to suppress the disease, they never go at it with the fixed purpose of obtaining its complete eradication. But in this country the circumstances are very different. Here the outbreaks have only occurred after long intervals, and in every instance, save one, have been traceable to some definite source. The number of animals attacked in each outbreak has been comparatively small. Hence, in view of the rapid transmission of the infection, not alone by sick animals, but by men, dogs, or chickens that may chance to come in contact with infected cattle or stables, any dallying, experimental measures must not be considered for a moment; and, taking this view of the matter, the immediate slaughter of all infected and exposed susceptible animals has been insisted upon each time that the disease has appeared within the borders of this country.

How very different is the method of dealing with Texas fever. But these differences of treatment are only such as are demanded by the differences in the characters of the two infections. Texas fever is known to be dependent for its origin upon the bite of an infected cattle tick, by means of which the minute parasite which destroys the blood cells of its victims gains entrance to the circulatory system, and multiplying rapidly breaks down so many blood corpuscles that fatal fever quickly results. To obviate this disease, all that is necessary is to keep the cattle free from contact with infectious ticks or to immunize them by the careful application of blood or ticks under proper precautions. Present endeavors of the Bureau of Animal Industry toward the suppression of Texas fever are being extended along these very lines. By establishing and maintaining the Texas fever quarantine line, it is preventing southern cattle from bringing dangerous ticks into northern pastures where their presence would quickly act as a scourge. The Bureau is also doing an immense amount of work in removing all infectious ticks from certain regions of the South, not with a view to saving the cattle of these regions from death from Texas fever, because they have become immune to that disease, but for the purpose of making these cattle more valuable than they are at present, as they may be given free bills of health for shipment to northern points and northern markets just as soon as it can be shown that they originate in tick-free districts.

There are a number of serious contagious diseases which terminate fatally in almost every case of attack. For these no treatment is attempted, but preventive measures may be applied with the greatest assurance that further spread may be stopped. Such is rabies. Once the disease develops, no known treatment will avail to save the patient's life; but if inoculative treatment is applied soon after the victim is bitten by the rabid dog the chances for recovery are excellent.

In studies of the various infectious diseases it has been found that one of the most desirable means of preventing their extension is to furnish the susceptible and exposed animals with artificial immunity. This is the case with tuberculosis, blackleg, anthrax, rabies, hog cholera, Texas fever, and the like. Many animals prove to be naturally immune to these diseases, while others must be made immune by inoculation with suitably prepared materials before they are able successfully to withstand attacks from the specific organisms which cause the several maladies.

Educated investigators the world over have expended a vast amount of effort and study in attempts to discover and perfect the most effective and at the same time the most practicable means of immunizing animals against the more destructive of the infectious diseases. Immense amounts of money have been appropriated for the advancement of these researches, both from governmental sources and from gifts of private wealth. The goal sought by these searchers along lines of agricultural interest is the discovery of some means by which immunity may be conveyed to a large number of animals readily and at slight expense.

VACCINATION AS A PREVENTIVE.

Satisfactory immunity is readily granted to cattle at the present time against the ravages of blackleg or symptomatic anthrax, through the injection beneath the skin of the susceptible animal of some material containing the living but weakened germ of the disease. The amount of this material is so graduated that it causes the prompt development of the very disease that is being guarded against, but only in a mild and comparatively harmless degree. There is considerable elevation of temperature, and there may even be limited tumor formation, but only in the rarest cases does this type of blackleg, that has been intentionally produced by inoculation, progress so far that the animal is seriously injured. The value of artificially produced immunity in the struggle against this disease is shown by the fact that the losses of young cattle which reached from 15 to 20 per cent in certain infected localities previous to the discovery of vaccine treatment, have been reduced to one-half of 1 per cent at the present time where vaccines are used.

It is at once apparent that hard and fast conclusions can not be drawn favoring vaccination against anthrax from results obtained in the suppression of blackleg by the use of blackleg vaccine. But there are a sufficient number of points of similarity between the two diseases to justify considering the two together. They are so similar that for many years no distinction was made between the two maladies, but all cases were called anthrax.

The successful vaccination of cattle against either of these two troubles must consist in giving the animal that is to be safeguarded a sufficiently severe attack of the disease that is feared to provide the body tissues with such a degree of resistance that no germs can be taken into the system in fatal numbers and remain to find lodgment and nurture there. After such vaccination the animal is safely protected and can go with perfect safety into fields that would have proven deadly before the vaccination was performed.

Just how this immunity is obtained is still an open question, but it is very manifest that the attenuated organism is able by its growth to affect the tissues (some say the animal cells, others the fluid tissues) in such a manner that virulent organisms of the variety presented in the vaccine can not possibly thrive, and without the rapid multiplication of virulent organisms within the animal tissues there can be no disease.

Blackleg vaccine is prepared from the affected muscle of an animal dead of that disease. Anthrax vaccine is produced by the cultivation in beef broth of pure cultures of anthrax bacilli, hence may be manufactured in unlimited quantities without having recourse to any animal suffering from the disease.

Starting with a thrifty culture of anthrax bacilli growing in a flask of bouillon, Pasteur, in 1881, by a series of experiments found that subjecting it to a temperature of 108.5° F. for twelve days would so lower the virulence of the organisms that they would only exceptionally cause death when injected into rabbits. Continuing the attenuation by subjecting the bacilli to the same degree of heat for twelve days longer, or twenty-four days in all, he discovered that he had in his possession a living culture of anthrax bacilli that had lost its power for killing cattle, sheep, rabbits, or guinea pigs, although still capable of killing white mice. This was the beginning of the practical preparation of anthrax vaccine, for he soon found that cattle or sheep when inoculated with the culture of twenty-four days' attenuation would survive the treatment and would gain a very material power in resisting infection from inoculations with bacilli of a high degree of virulence. This power of resistance is needed to enable them to withstand the injection of the second and stronger vaccine, which, having been subjected to attenuating heat for only twelve days, is possessed of considerable virulence.

In his early investigations he made experiments upon a flock of 50 sheep. Half of these were vaccinated with his attenuated culture of anthrax bacilli. Twelve days later they received an inoculation with stronger vaccine, and forty days after this the whole flock was inoculated with a virulent anthrax culture. Two days later the vaccinated animals were all sound, while the checks were all dead.

Following this striking demonstration by Pasteur, 60,000 sheep and 6,000 cattle were at once treated in France. The following year the same form of treatment was applied to 270,000 sheep and to 55,000 cattle. Since that time this method of vaccinating against anthrax has found very general application in France whenever losses have occurred, making it evident that certain fields or pastures have become infected with anthrax bacilli. As a result, Nocard and Leclainche state that anthrax has disappeared from many sections in which it formerly decimated the live stock and that the medical doctors at the same time reported a disappearance of malignant pustules from among their human patients.

Soon after this method of immunization by the use of attenuated cultures had become suitably tested and perfected in France, steps were taken to supply vaccinating material to other countries, and reports of its successful application were soon received from Russia, South America, Australia, and other lands.

Other investigators, fearing to use the living anthrax bacillus, even though greatly attenuated, have turned their attention to the production of a serum that should possess immunizing powers equal to those of the attenuated organism. The immunity granted by serum inoculations becomes effective very quickly, but does not last long unless reinforced by the addition of virulent material at about the time that the serum is injected. At first the virulent material was injected a few days after the serum had been applied, but the latest recommendations are that they should be given simultaneously; wherefore it is now customary to inject immunizing serum into one side of the animal's neck and virulent serum into the other side before releasing it.

Very interesting facts have been disclosed through the efforts of various investigators to perfect sera for immunizing in outbreaks of anthrax. It is well known that a very small amount of virulent blood will serve to convey the disease from an anthrax carcass to a healthy animal. A fly can easily carry enough on his proboscis to kill a horse. It may safely be admitted that a single drop is sufficient to cause the death of a horse; yet Sobernheim has, by means of repeated injections, using cultures gradually increasing in virulence, produced such a high degree of immunity in a horse that it withstood the injection into its veins of 500 c. c. (about 17 fluid ounces, or more than a pint) of the most virulent anthrax culture obtainable. This is a good illustration of the word "immunity." It is something that this horse in question has received into his system through the several inoculations of sera that enables him to receive unharmed an injection of living anthrax fully ten thousand times as large as the amount that would have sufficed to kill him previous to his immunization.

Another peculiarity discovered by investigators along these lines is that a culture of anthrax bacilli that has once been attenuated can then be cultivated indefinitely without necessarily causing any alteration in the degree of its virulence. If we let 100 represent the virulence of an active, fresh culture, and 10 the degrees of virulence in one that has been greatly attenuated, it has been repeatedly shown that one can cultivate the attenuated germs for many generations without causing any observable alteration from this virulence rating of 10; yet it only requires the single passage of this material through a white mouse to restore its virulence at once to approximately 100.

In this country the Delta lands of the Mississippi Valley are most thoroughly permeated with anthrax infection. The losses through anthrax have there been enormous, due in great measure to the large number of valuable mules owned and worked upon the sugar plantations. Dr. W. H. Dalrymple has for years been engaged in fighting this plague in Louisiana, and he reports as follows on the results of preventive inoculation:

> Perhaps the most convincing evidence of the beneficial effect of this method of prevention in Louisiana is the fact that those localities which suffered most from yearly, or at least periodic, epizootics of anthrax, before vaccination became so generally adopted, have experienced the past summer a wonderful degree of immunity from the disease which, I think, we must attribute to the fact that the use of the lymph is now almost general in these sections and that greater attention is being directed to the more careful disposal of the dead animal, our people more fully appreciating its being the chief source from which this most deadly disease is spread.
>
> I believe we are gradually solving the anthrax problem in the Pelican State, and the progress we have already made is, I think, considerable and fairly satisfactory when we take into account the erroneous and visionary ideas which prevailed up to ten or twelve years ago regarding the true nature of the disease and the most potent factors in causing its spread.
>
> I question very much if ten years ago a single dose of preventive vaccine was used or an anthrax carcass destroyed as a sanitary precaution against the spread of the disease in our State. To-day there are probably 40,000 or 50,000 doses of vaccine used, and carcasses are being much more carefully looked after, which I feel indicates some progress at least.

The material which Doctor Dalrymple used so successfully and which called forth the above encouraging report was manufactured in accordance with Pasteur's findings and consisted of a double inoculation with attenuated anthrax cultures.

In carrying out tests for the determination of the reliability of attenuated living cultures the Bureau of Animal Industry has succeeded in immunizing test animals to such a perfect degree that they were able to withstand subcutaneous injections of extremely virulent anthrax cultures. Cattle, sheep, goats, burros, and a mule were subjected to these fortifying inoculations, and were later proven to be immune to anthrax. The first injection caused but slight disturbance of the health of any animal, and only slight elevation of temperature. The second injection resulted in somewhat higher temperatures, and in a few cases in transient indifference to feed. The final test of their immunity was made with a pure culture of anthrax bacilli of the highest degree of virulence obtainable. The application of this severe test soon resulted in very high temperatures and in rather general refusal of feed for a day or two; but this test far exceeded in severity any chance for infection that the animals could have incurred by pasturing over infected lands. Pure anthrax bacilli were forced into the tissues in great numbers, and the ultimate survival and full recovery of the animals after this severe treatment offers the best possible argument in favor of preventive inoculation in all cases in which animals are positively known to be exposed to contact with anthrax bacilli in infected stables or pastures.

The material used in vaccinating against anthrax has many dangerous properties, since it contains living anthrax organisms; hence it should never be used except in regions in which the disease has already appeared, and it should be used only by qualified veterinarians, as careless handling might result in the serious extension of the very disease that it was desired to eradicate. Vaccines for this work should be obtained from reliable manufacturers, as the use of weakened or diluted material can only lead to disappointing results.

The season of the year in which the vaccination is undertaken makes considerable difference in results, for it has been shown that there is a natural tendency toward the suppression of the disease in the infected plats of ground during the winter months.

OTHER PREVENTIVE MEASURES.

In future attempts to eradicate anthrax from infected districts preventive inoculation will undoubtedly play a very important part. But there are many other steps which should be taken into consideration in addition to the vaccination. Infected areas should be thoroughly drained and kept under cultivation for some time before attempts are made to pasture stock upon them. Sunlight greatly hinders the development of anthrax bacilli, and the repeated stirring of the soil favors the action of the sun's rays.

The complete destruction of all anthrax carcasses is also a very important matter. This is best accomplished by burning, but as this method of disposal is impractical in many localities, deep burial may be practiced instead. Covering the carcasses within their graves with quicklime adds another valuable precaution against further dissemination of the infection. No animal dying from anthrax should ever be skinned or cut open, as the blood from such sources is one of the most dangerous means of spreading the infection, being charged while in the animal with great numbers of bacilli, which quickly turn into spores as soon as spread about upon the surface of the ground. All discharges from the body openings should also be burned or buried deeply, as these are frequently of a virulent character.

One of the most common obstacles to sanitary police control of outbreaks of anthrax is the opposition of the owners of the affected animals to any regulation which requires them to dispose in a safe and satisfactory manner the cadavers of animals dying from the disease. Many localities have failed to secure legal enactments demanding suitable destruction of infectious carcasses, and others which have laws upon their statute books have an opposing public opinion that largely nullifies the real intent and purpose of the law, with the result that carcasses filled with deadly material are allowed to lie about in the fields to be scattered by prowling dogs or birds; or they may be dragged to the nearest stream and thrown into the water, only to be floated along bearing their infection to neighboring properties. A little practical application of the golden rule by interested stockmen would, under these circumstances, not only prove beneficial to their neighbors, but the benefits would be felt upon their own properties in later seasons. It is imperative that all carcasses of animals dying from anthrax should be safely burned or buried if the eradication of the infection is ever to be reached.

There are some encouraging features to be noted in connection with outbreaks of anthrax. One of these is the limitation of the infection to certain restricted areas. Another is that the disease does not sweep across a whole State in a few days, as foot-and-mouth disease is inclined to do. A third is that drainage of the infected parcels of ground usually removes the danger. So let those who have suffered losses of stock from anthrax take courage and resolve to ward it off in the future by fencing, draining, and plowing infected plats, by burning or burying deeply all infected carcasses, and by the vaccination of the healthy animals that are unavoidably exposed. Such methods will lessen the losses and cause the gradual disappearance of the plague.

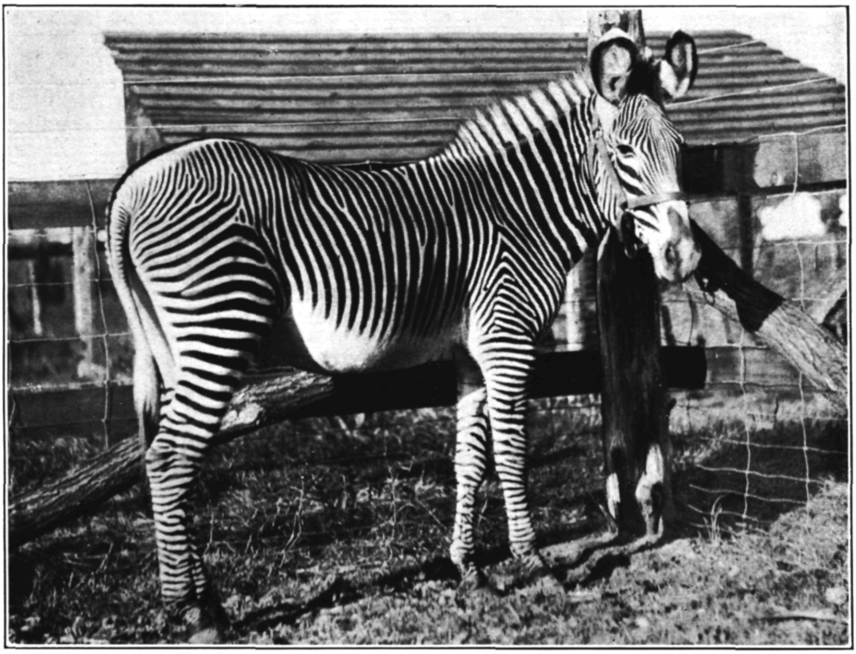


FIG. 1.—MALE ZEBRA "DAN." THE SIRE OF ALL HYBRIDS THUS FAR PRODUCED. HEIGHT, 13½ HANDS; WEIGHT, 800 POUNDS.

FIG. 2.—FEMALE DONKEY NO. 55. DAM OF THE OLDEST MALE HYBRID (NO. 1). HEIGHT, 12½ HANDS; WEIGHT, 560 POUNDS.

(Photograph taken April 27, 1909.)

FIG. 1.—FEMALE DONKEY NO. 58 AND FEMALE ZEBRA-ASS HYBRID NO. 2. HYBRID FOALED JANUARY 1, 1909.

(Photograph taken May 8, 1909.)

FIG. 2.—FEMALE DONKEY NO. 55 AND MALE ZEBRA-ASS HYBRID NO. 1 ON LEFT SIDE OF PICTURE. FEMALE DONKEY NO. 58 AND FEMALE ZEBRA-ASS HYBRID NO. 2 ON RIGHT. HYBRIDS FOALED, RESPECTIVELY, DECEMBER 2, 1908, AND JANUARY 1, 1909.

(Photograph taken May 8, 1909.)

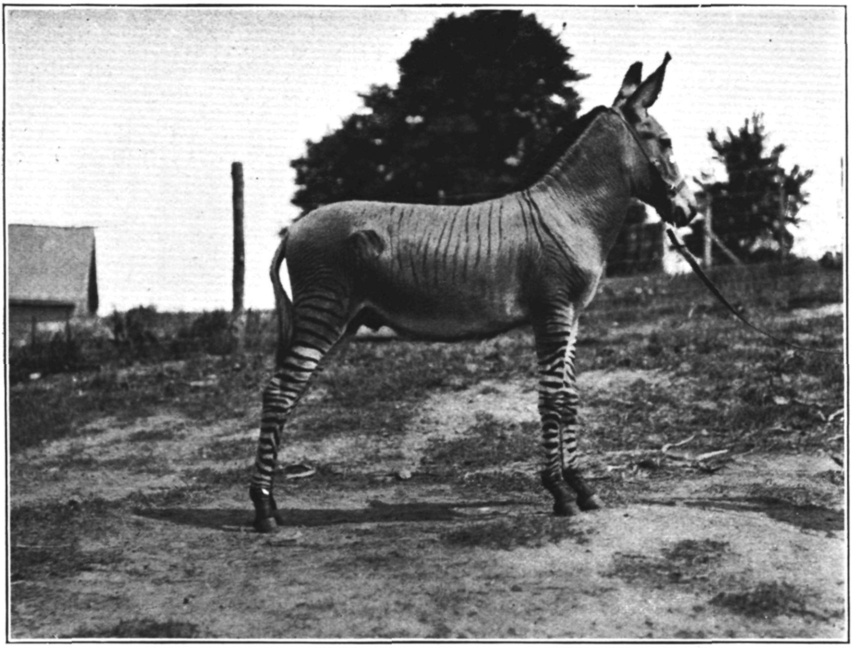


FIG. 1.—ZEBRA-ASS HYBRID NO. 1. FOALED DECEMBER 2, 1908. HEIGHT AT 1 YEAR, 12 HANDS; WEIGHT AT 1 YEAR, 500 POUNDS.

(Photograph taken August 19, 1909.)

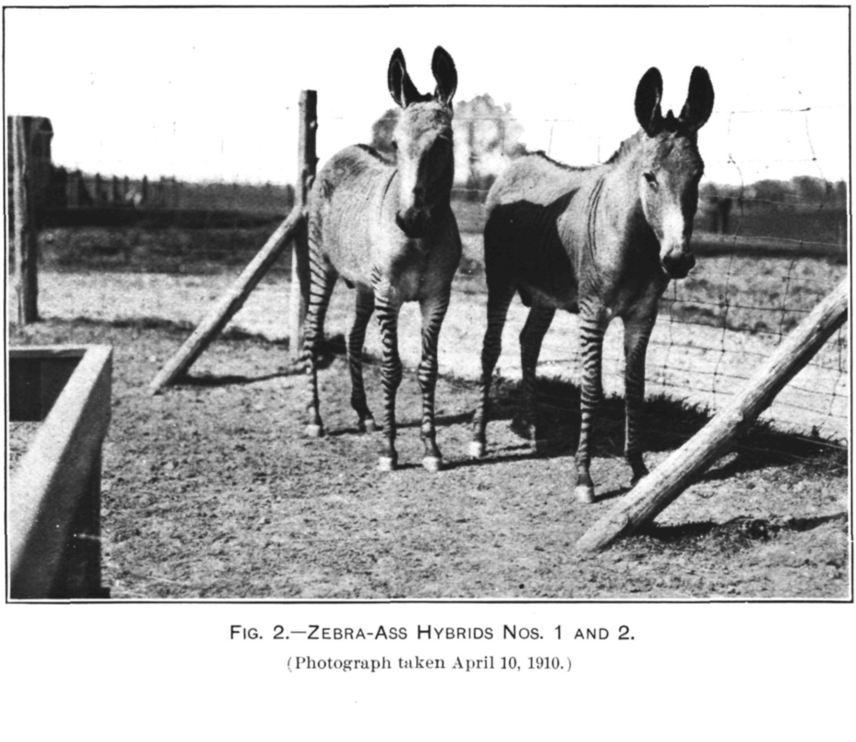


FIG. 2.—ZEBRA-ASS HYBRIDS NOS. 1 AND 2.

(Photograph taken April 10, 1910.)

A NOTE ON ZEBRA HYBRID BREEDING.

By E. H. RILEY,

Animal Husbandman in Animal Breeding Investigations, Animal Husbandry Division.

For several years investigations have been in progress at the Experiment Station of the Bureau of Animal Industry relative to the production of a new and useful hybrid of the mule type. The investigations have not progressed sufficiently to supply the necessary data for a report, but the popular interest they have aroused and the somewhat misleading statements that have appeared from time to time in newspapers and other popular journals seem to make it desirable that an authorized preliminary note be issued.

PREVIOUS EFFORTS AT ZEBRA HYBRID BREEDING.

Zebra hybrid breeding is not a wholly new proposition, as is shown by the following historical sketch from Zebra Hybrids, etc. (1900), by Prof. James Cossar Ewart, of the University of Edinburgh:

The first zebra hybrids bred were between the ass and the zebra mare, later came crosses between the zebra mare and the horse, and, later still, zebra mules—crosses between male zebras and ordinary mares.

Lord Clive seems to have bred the first zebra hybrid by crossing a female Mountain zebra (which he brought with him on returning from India) with a common ass. About a quarter of a century later (in 1801) a similar hybrid was bred in Italy, and soon after this (in 1806) the first of a series of zebra-ass crosses made its appearance in Paris. Later still, zebra-ass hybrids were bred at Windsor Park (in the time of His Majesty George the Fourth) and at Lord Derby's once famous menagerie at Knowsley. At least one of the Knowsley hybrids was a cross between an Asiatic ass (*E. hemionus*) and a Burchell zebra mare. A similar hybrid was bred in the Jardin des Plantes, Paris, in 1875, and in 1893 a hybrid between a Burchell zebra mare (Chapman variety) and a white ass was bred in the Zoological Gardens, Melbourne. There is no record of zebra mules having been bred in the Zoological Gardens, London, but it is reported an effort is now being made in this direction. Some of the zebra-ass hybrids bred in Paris found their way about three years ago to England. One of these—evidently out of a Burchell zebra mare—I had the opportunity of studying through the kindness of the Hon. Walter Rothschild.

When the first hybrid between a zebra mare and a horse was bred is uncertain. But for the untimely death of a zebra mare, F. Cuvier would have succeeded in obtaining a hybrid of this kind in 1808. In the Jardin d'Acclimatisation several horse-zebra crosses seem to have been obtained prior to 1880, and between 1880 and 1890 three were bred by Lady Meux at Theobalds Park, Hertfordshire.

In 1815 a hybrid of some historic interest was bred by Lord Morton by crossing the often-referred-to seven-eighths Arabian chestnut mare with a quagga. A similar hybrid, Darwin tells us, was bred by Lord Mostyn. Later (about 1870), it is said, a cross was obtained in the Jardin des Plantes between a pony mare and a male Mountain zebra.

In 1896, on the 12th of August, my oldest hybrid, Romulus (said to be the first hybrid between a pony mare and a Burchell zebra) made his appearance. A few months later a similar hybrid was born in Brazil—bred by Baron de Parana.

Since 1896 quite a number of hybrids have been bred at Penycuik, and several have been added to Baron de Parana's stud in Brazil.

During the past few years a number of more or less successful attempts have been made in Africa to cross small zebras with other members of the horse genus. Hagenbeck, of the trained animal show, succeeded in getting zebra-horse hybrids in this country from mating zebras of one of the Burchell varieties with ponies. He afterwards broke these hybrids to work and found them very satisfactory for that purpose.

THE WORK OF THE BUREAU OF ANIMAL INDUSTRY.

The work of the Bureau of Animal Industry differs from that done elsewhere in the fact that the largest type of zebra (*Equus grevyi*) is being used. It received its first incentive from the impression made by the splendid conformation, large size, and great beauty of a Grévy zebra at the National Zoological Park which had been presented to President Roosevelt by the King of Abyssinia.

This zebra was brought to the Bureau Experiment Station in the fall of 1906. Five mares were first selected to mate with him, four grade Percherons, the other of a rather heavy carriage type. These animals occupied adjoining stalls for a time where they became accustomed to one another, and later they were allowed to run together in a small paddock. The zebra took no special notice of the mares, and it was soon evident that they would not mate.

A large Kentucky jennet weighing 950 pounds and 14 hands high, bought for the purpose, and four burro jennets which were kept at the station, were substituted for the mares, the plan being to impregnate the mares artificially, in case the zebra served the jennets. He was much more attentive to his new companions, and after being with them almost daily for eight months, finally mated with one of the burros. Since then there has been no difficulty in getting a service, providing he sees no one, or nothing else attracts his attention. Considering the length of time which elapsed before the first mating, it was thought that possibly zebras had a rutting season, which is common to many other wild animals; but in this case it has not been a fact, as matings have since occurred during every month of the year.

From time to time, extending over a period of nearly two and one-half years, six or seven attempts have been made to impregnate each of the large mares artificially. All the attempts except one were failures, and the mare that was successfully impregnated aborted after being in foal four months. An equal number of similar attempts from stallion or jack services would have resulted in a high per cent of impregnations. Although this abortion was unfortunate, it proves that a hybrid between this large variety of zebra and the mare is possible, and renewed efforts are being made to obtain zebra-horse hybrids by this method of breeding, as well as by direct service.

In order to increase the number of zebras and thus expedite the work, others have been added to the stud. In 1905, through the efforts of Hon. R. P. Skinner, American consul-general at Marseilles, France, a pair of Grévy zebras were presented to the Department of Agriculture by Ras Makonnen, governor of Harrar, Abyssinia. The female of this pair died in transit before reaching the African coast. The male arrived here safely, but was injured accidentally in the National Zoological Park, where he had been sent on his arrival, and died shortly after.

In September, 1907, a young male and a female Grévy zebra were received direct from Abyssinia. The female became sick a day or two after arriving and died a month later.

In April, 1908, two young female Grévy zebras were imported from Abyssinia. These animals arrived in apparently good condition, but one of them died suddenly the following October. This importation, as well as the preceding one, was made possible through the courtesy of Consul-General Skinner. The remaining female foaled a dead filly sired by the older zebra, after a gestation period of three hundred and ninety days, which is said to be the usual period for zebras. She has since been bred to him again.

All of these zebras have been captured in their wild state. So far as known, Grévy zebras have never been domesticated, although they are easily handled.

The young male zebra and the remaining female are very gentle and have been ridden, and driven to a breaking cart. Two grade Thoroughbred mares, averaging 850 pounds, that is, nearly the size of the zebra, were turned into a paddock with this male, and other mares have been with him at intervals for about two years, but as yet they have not mated. These animals were together several months before the zebra paid any attention to them. No attempt has been made to breed this zebra to jennets.

The results with zebra-ass hybrids thus far have been successful. Eleven of these hybrids have been foaled, six colts and five fillies. Two colts out of the Kentucky jennet were born dead. Two other colts and one filly out of burro jennets were in such a weak condition when born that they died within one or two days. Two colts and four fillies are now alive and vigorous. They are apparently as hardy and endure the cold of this climate as well as the donkeys. A difference in degree of vigor was shown in these hybrids by a lopped-eared condition which existed in all the foals except the last two, which had erect ears. The ears of the other hybrids which lived assumed a natural position after a week or ten days. The two female zebras, the zebra foal, and all the hybrids which died were sent to the National Museum.

Considerable difficulty was experienced at first in getting the jennets with foal. Each of them was served from two to eight times, at different periods of heat, before they became pregnant. Those that had a second colt by the zebra required but one or two services. Each of these donkeys previously had foals sired by a jack, in which but one or two services were required for an impregnation. The period of gestation for the production of the zebra-ass hybrids averaged three hundred and seventy-eight days.

These hybrids show a decided improvement over either parent in action, conformation, and disposition. Their sire weighs 800 pounds and is 13½ hands high. The average weight of their dams is 550 pounds, and the average height 12 hands. The weight of the young at birth averaged 48 pounds. Two of these hybrids have reached the age of one year, at which time they weighed 500 pounds each and measured 12 hands in height. They have good action, a neat, clean-cut appearance, and are as easily handled as horse foals of the same age. These zebra-ass hybrids will be kept until they reach the breeding age, after which they will be tested as to fertility, among themselves, and also with horses, zebras, and asses. Considering the apparent similarity of the species to which zebras and asses belong, there may be a possibility of their hybrids being fertile.

THE OSTRICH INDUSTRY IN THE UNITED STATES.

By A. R. LEE,

Junior Animal Husbandman, Animal Husbandry Division.

HISTORY.

Ostrich farming is in its infancy in the United States, the first ostriches having been imported in 1882. Other importations followed, but it was some time before success was obtained in the reproduction of ostriches in this country. The first ostrich breeders in the United States learned through experience alone, as there was available very little information on ostrich breeding and management and no data concerning their care and management as adapted to climatic and soil conditions in this country.

DISTRIBUTION AND ADAPTATION.

From these importations the ostrich farms have been built up and breeders have located in various parts of the United States, so that to-day there are ostrich farms in Arizona, Arkansas, California, Florida, and Texas. Complete statistics of the number of ostriches in this country are not available, but reports received from all of the large and the majority of the smaller ostrich farms show that there were at least 6,100 breeding or feather-producing ostriches in the United States in January, 1910. These ostriches were distributed among the States approximately as follows: Arizona, 80 per cent; California, 17 per cent; Arkansas, 2 per cent; while Texas and Florida together reported less than 1 per cent of the total number in this country.

Ostriches apparently thrive best in a warm, dry climate, but they have not been tried extensively enough under other climatic conditions in the United States to see whether or not they may become adapted to a climate where the precipitation is greater. The precipitation during the year 1908 in the various States in which ostriches are raised was as follows: Arizona, 15.15 inches;[a] Arkansas, 48.88 inches; California, 18.78 inches; Florida, 47.33 inches; Texas, 32.91 inches.

[a] Figures furnished by the Weather Bureau.

The small number of ostriches raised in Florida and Texas is partly because it is only recently that ostriches have been introduced there, so that it is impossible either to draw any definite conclusions as to the future of the ostrich industry in these States or to tell how important a part precipitation has in determining the favorable location of ostrich farms.

The question of the nature of the country most favorable for ostriches is largely affected by the kind of vegetation peculiarly suited to the soil, which in turn is undoubtedly affected by the amount of rainfall. Alfalfa pasture makes an ideal run for the birds, furnishing a large percentage of their food; hence a soil which is or can be made suitable for alfalfa is one of the essentials to success in ostrich farming. A dry, sandy soil, made suitable by drainage and irrigation for raising alfalfa, has proven best adapted to successful ostrich farming. Such a soil is generally peculiarly adapted for raising large crops of alfalfa, and makes an ideal soil for an alfalfa pasture. Under such conditions it is essential to have some shade.

BREEDS AND MANAGEMENT.

There are two breeds of ostriches in this country—the so-called South African breed, which was originally imported from the southern part of Africa, and the Nubian, imported from northern Africa. The South African ostrich is the most popular breed in the United States, most of the ostriches being of this breed.

There is considerable variation in the color of the naked skin of ostriches in this country. The South African breed, both male and female, have blue, drab, gray, or grayish-blue skin on the neck and legs, most of these ostriches having a blue skin, while the skin of the Nubian male is red or pink and of the female a light yellow.

If allowed to sit, an ostrich female will lay from 12 to 15 eggs and then rear a brood of young. Different individuals vary greatly in their annual egg yield, which would naturally be expected from birds domesticated for only such a short time, as they have not been raised in large enough numbers to allow much selection. The value of ostrich eggs for hatching as compared with their value for human consumption has a tendency to make the owner use all the eggs for incubation. If eggs are removed from the nest as fast as they are laid, the ostrich female will lay more than one clutch of eggs. Records of egg yields of 100 eggs in a year have been recorded, but data regarding the average egg yield are very scarce and unsatisfactory. The average egg yield in this country where the eggs are hatched by artificial methods is much below this figure, probably not over 55 eggs a year. An ostrich egg weighs about 3½ pounds and would contain as much food as 2¼ dozen of hens' eggs of average size. As the female begins to lay when from 3 to 4 years of age, and will lay until she is 35 or more years old, the production of egg material during her life is enormous, provided she comes from a good producing strain.

Breeding birds may be paired off separately, run in trios, or run in flocks and allowed to breed promiscuously. In this country the first and third methods are in about equal favor, while only a few breeders use the second method. In most cases all the young birds are run in troops of from 20 to 50 birds until they are 1 year old, when they are separated according to sex. The birds are mated, either in pairs or trios (a cock and two hens), when about 3½ years old.

Ostriches are pastured on alfalfa runs inclosed by fences 5½ feet high. Partition fences may be 18 inches from the ground, but the outside fence must be tight to keep out animals. One acre of alfalfa will support 4 ostriches, but the common practice is to supplement the pasture by feeding more or less grain throughout the year, thus keeping more birds to the acre, and to feed grain and alfalfa hay during the winter. Alfalfa meal, wheat bran, barley, oats, and corn are fed in varying amounts, while bone, granite, and gravel are kept before the birds most of the time. Corn is fed only during the winter, and then in very small quantities. When there is no growing green food, a mature ostrich will consume about 3 pounds of alfalfa hay and 1 pound of grain daily.

Ostriches have not been experimented with to any large extent to find out either the best rations to feed or in what condition to keep the birds in order to produce the best quality and largest quantity of feathers. Undoubtedly the condition of the bird at quilling time has a very marked influence on the growth of the succeeding crop of feathers; the better the condition of the bird at quilling time the quicker will be the growth of a new crop. As the most critical time in the life of a feather is during the first few months of its growth, some breeders partially starve their birds for a short time while the quills are ripening and then give full rations at quilling time in order to have the birds in the best of condition, or improving in condition, when the new feathers begin to grow. In some instances it appears that it takes longer for a feather to mature on a highly nourished bird than on one less highly fed, but in such a case a longer feather is secured than would be obtained from a bird not fed so freely.

INCUBATION.

Both natural and artificial methods of incubation are used, but incubators have been adapted for hatching ostrich eggs and are used with good results by most ostrich breeders. An incubator provided with moisture pans and a system of ventilation to care for the moisture should prove very successful in the hatching of ostrich eggs. Incubators made for hatching ostrich eggs are constructed to hold from 30 to 50 eggs, which size is preferred by the ostrich breeders.

Eggs are turned from one to three times daily and are examined frequently to note the evaporation of the moisture and the development of the embryo. Water is placed in the incubator about the fourth week and left in until the chicks are about through hatching. The time to put in the water and the proper amount depend on local conditions. Each operator works out this problem for himself, carefully noting the size of the air cell in the egg. The period of incubation is forty-two days, and toward the end of this period, when the chick "peeps" in the shell, the operator cracks the shell, thus aiding the chick to escape.

Natural incubation is used and preferred by a few breeders. It would seem that if removing the eggs from an ostrich hen as fast as they are laid would increase the annual egg yield of each hen, it would be advisable to do this, and to use artificial methods of incubation entirely. On the other hand, it may be that better hatches and stronger chicks can be secured by natural methods of incubation. In some places nests out in the open proved unsatisfactory, as they were subject to floods caused by spring showers.

BROODING.

All ostrich chicks are raised artificially rather than by the ostrich hen. It is advisable to supply heat until the chick is about 1 week old, gradually reducing the amount of heat until, by the end of a week or ten days, depending on the weather, the source of heat is taken away. Chicks need close care and attention for some time. They should be fed the same kinds of grain, green feed, and grit that are supplied to the breeding stock, these feeds being adapted to the size of the birds.

Ostriches are called "chicks" until their first crop of feathers are removed, after which time they are known as "young birds" until they are 1 year old, when they are called "plucking birds" or "feather birds."

PARASITES AND DISEASES.

When kept under good conditions and properly fed, ostriches are very free from diseases and parasites. A few breeders report constipation among both the young birds and the breeding stock. This is probably caused by improper feeding. The following remedy has been used successfully in treating this trouble: Mix together 8 ounces of Socotran aloes, 1 ounce of calomel, 4 drams of powdered capsicum, and 1 ounce of oil of juniper, and divide the mass into eight parts. Give two doses at an interval of a few days, each dose to contain one

A Flock of Ostriches in California.

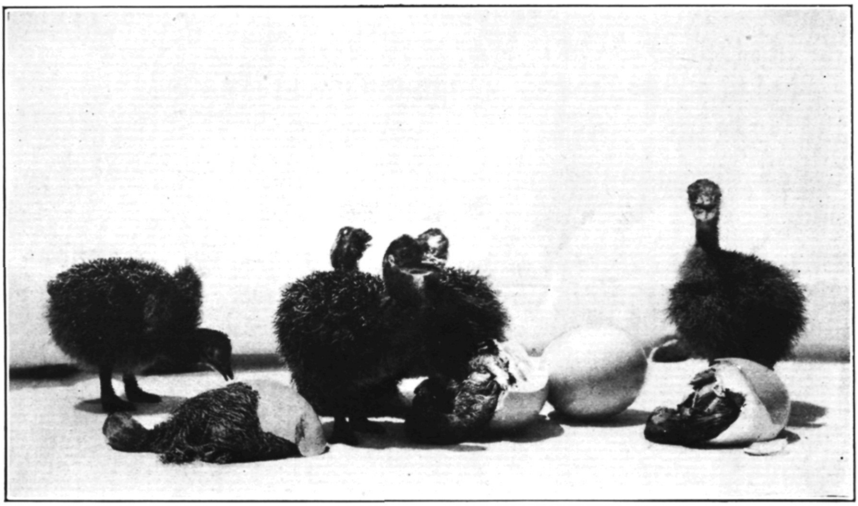


FIG. 1.—OSTRICH CHICKS HATCHING AND JUST HATCHED.

FIG. 2.—OSTRICH CHICKS HATCHING BY ARTIFICIAL INCUBATION.

FIG. 1.—PLUCKING AN OSTRICH.

FIG. 2.—YOUNG OSTRICHES.

pill or ball made of one of the parts mentioned above. This dose is recommended for an adult bird, and a smaller dose should be used for young birds, depending on their size. Epsom salts are also sometimes fed to aid the removal of any irritating matter in the bird's system. In any trouble of this kind the most essential thing is to remove the cause.

Ostriches are occasionally infested with a mite, but never in large enough numbers to injure the bird, although some breeders think that the presence of this mite may have some influence on the quality of the feathers produced. In South Africa much loss of vitality in young birds is caused by tapeworms and *Strongylus douglassi* or wireworms. These affect the young birds, and, by lowering the vitality, have a very detrimental effect on the growth of the feathers. Turpentine is used quite extensively in removing these wireworms from the intestines. Fortunately this country is very free from this scourge, as up to the present time no cases of this trouble have been noted here.

PLUCKING.

The young birds are plucked when they are 6 months old and then at intervals of from eight to eleven months. The majority of breeders allow a nine months' interval, which time appears to be best suited for the production of the best quality of feathers in this country. Still there is considerable variation in the length of the interval allowed between pluckings, and there is some difference of opinion, so that one can not state definitely that any fixed interval is best. The growth of the feathers, the condition of the bird, and the time of the year all affect the best time for quilling.

The wing feathers are cut and the "shorts" and "tails" are pulled either at the same time or a month or so later. In South Africa the quills of the coverts are drawn two months before the quills of the wings. The quill stumps are pulled from sixty to ninety days after clipping the wing feathers. Some farmers allow the stumps to fall out, but generally the growth of the succeeding feather is hastened by removing the quill stump by hand. The Yearbook of the Department of Agriculture for 1905 contains a detailed account of plucking and sorting ostrich feathers.

FUTURE OF THE OSTRICH INDUSTRY.

The demand for ostrich feathers in this country is constantly increasing, while the quantity produced here scarcely affects importations, which are steadily increasing. The Report of Commerce and Navigation for 1908, prepared by the Bureau of Statistics of the Department of Commerce and Labor, shows that $3,568,152 worth of raw and dressed feathers were imported into the United States during that year. Under the present tariff law there is a duty of 20 per cent ad valorem on raw and 60 per cent on dyed or prepared ostrich feathers. It has been demonstrated that various parts of the United States are adapted to ostrich raising, and now that the results of experience have shown some of the ways in which ostrich farms may be managed successfully, there is every reason to believe that there will be a steady but marked growth in the ostrich industry in the near future. The demand for literature and the number of inquiries received by the Bureau for information concerning ostriches indicate that the number of individuals who are interested in ostrich farming is rapidly increasing.

The profit to be derived from the business will depend on the management, on the success secured in the raising of the young birds, and on the production of feathers of good quality. The average yearly yield of feathers from an ostrich is 1¼ pounds. Birds produce from 12 to 20 ounces of feathers at each plucking, with an average of 16 ounces. The total weight of an average yield is divided about as follows: "Wings," 48 per cent; "short stuff," 25 per cent; and "tails," 27 per cent. The amount received from the feathers of each bird varies from $20 to $30, depending upon the yield and the price of the product. The average return during the year 1909 was $25.93 per bird. While both ostrich eggs and flesh may be used for human consumption, the amount to be derived from these products is hardly worth considering. As each pair of breeding birds is worth about $800, and chicks 6 months old are valued at $100, any deaths from accidents or any inability to raise chicks greatly lessen the profit to be derived from the business. Allowing for some loss in these ways, and charging a fair interest on the investment, the business can be operated to return a fair profit.

MARKETING EGGS THROUGH THE CREAMERY.

By Rob R. Slocum,

Animal Husbandman in Poultry Investigations, Animal Husbandry Division.

During the fall and winter months it is the current opinion among consumers of eggs, when they are compelled to pay high prices for such occasional dozens of strictly fresh eggs as they are able to procure, that the farmer or the poultryman, the original producer, is receiving a high price for his product as it leaves his hands. This is true in the main in so far as the producer is concerned who is so situated that he can either retail his eggs directly or place them in the hands of a dealer or retailer who can dispose of them within a short time while they are still fresh. In so far as the general farmers, who produce the great bulk of eggs, are concerned, this is not the case. The price received by the general farmers of the Middle West, of most of the South, and of many other localities, while varying with the season, is, during a considerable portion of the year, often much below and apparently out of proportion to the prices paid by the consumer.

The reasons for this lie in the lack of care given the eggs and in the methods of handling used in connection with the present system of marketing, and not, as a rule, in the realization of an undue or unreasonable profit by the egg handlers or dealers.

THE USUAL METHOD OF MARKETING EGGS.

At the present time the common method of marketing eggs in the Middle West is in brief as follows: The farmer gathers his eggs whenever convenient, sometimes each day, sometimes two or three times a week. The eggs are brought to the house and kept until there is a sufficient number to take to the village or until the farmer makes a trip to the village for some other purpose and takes the eggs along. No particular attention is given to the conditions under which the eggs are kept in the meantime. They may be put in a pantry or cupboard of the kitchen where the temperature is comparatively high and where the eggs are bound to undergo considerable deterioration in quality or to reach a more or less advanced stage of actual spoiling. Even in those cases where the importance of a low temperature may be realized and an effort made to secure this by placing the eggs in a cellar, there is likelihood that the cellar may be damp, and the eggs in consequence become moldy. Likewise no particular effort is made to obtain clean eggs by proper attention to the nests and by frequent gathering or to separate the clean from the soiled eggs when taking them to market. Whenever a nest of eggs is discovered in the weeds or about the barn they are usually added to the eggs in the market basket without question as to whether they are partly incubated.

As a result the farmer starts for town with a basket of eggs, part of which are perfectly fresh and wholesome, part of them dirty or smeared, and part of them shrunken or stale or even partly or wholly spoiled. These eggs the farmer takes to the village store and receives for them a certain price per dozen, which is usually given in trade. The village merchant is not a dealer in eggs from choice, but rather because he feels it necessary to take the eggs in order to keep the trade of the farmer. If he does not take the eggs he fears that the farmer will offer them to one of his competitors and will in consequence be likely to give that competitor the bulk of his trade. For the same reason the merchant believes that he must accept the eggs as they run, good or bad, fresh or stale, clean or dirty, for if he does not his competitors will.

The merchant holds the eggs until he has enough to make a shipment to some egg dealer or shipper from whom he gets regular quotations. The delay here may be anywhere from two days to a week, or even two weeks. Usually the conditions attendant upon the shipment of these eggs up to the time they reach the packing house are such as to cause a still further deterioration in the eggs. After they reach the packing house they are assembled in great enough numbers so that more attention and care is given their handling, and although the eggs go through one or more sets of hands from this point before they are placed in storage or reach the consumer, the deterioration which they undergo is usually not so great proportionately.

For more detailed information regarding the complex process of marketing eggs the reader is referred to Circular 140 of the Bureau of Animal Industry.

The result of this common and almost universal method of marketing eggs is that when the eggs leave the hands of the country merchant, and still more when they reach the packer, quite a large proportion, varying with the season and the weather, are either seriously deteriorated or are wholly bad. It is usual somewhere during the process of marketing, after the eggs have left the hands of the country merchant, for them to undergo a grading process, in the course of which the bad eggs are discarded and the deteriorated eggs are separated and eventually sold for a less price than they would bring were they of first quality. Obviously, the man who buys these eggs "case count," candles them, and sells the graded product must protect himself from loss as a result of the eggs thrown out, and this he does by paying a lower price per dozen for the eggs he buys than he would were the eggs all good or reasonably good. As a result this lower quotation must be passed back to the storekeeper and eventually to the farmer.

The average farmer through carelessness and lack of knowledge produces indifferent eggs; the method of buying in vogue places no premium on quality, and the farmer producing clean eggs and putting them in the hands of the storekeeper in a good, fresh condition realizes no more for them than does the careless farmer, one-quarter or one-third of whose eggs may be bad. The subsequent course of the eggs to the market and to the table of the consumer usually includes a grading process for the purpose of culling out the bad and deteriorated eggs, and this in turn makes necessary a reduction in the price which can be paid to the producer.

To correct this injustice to the careful farmer and to place a premium on the production of good eggs and their subsequent careful handling, a system of buying is necessary which bases payment on quality. It is not the purpose of the writer to enter into a discussion of the general problem of "loss-off" buying in its relation to the commercial egg, but simply to describe a system of marketing which is in successful operation and which seems to be accomplishing this result.

HOW EGGS ARE MARKETED THROUGH A MINNESOTA CREAMERY.

The marketing of eggs in this particular instance is accomplished through a creamery in the northern part of Minnesota. Because of the fact that farmers must take their milk or cream to the creamery at frequent and regular intervals, it is an agency especially well suited to obtaining the egg in a fresh condition from the farmer. As it seems that there must be other creameries so situated that they could readily put their eggs directly in the hands of a retailer in a fair-sized city with only a short shipment, it seems well to describe in detail the methods used in this case. The volume of eggs handled in this way would, of course, probably never become so great as to make them a factor in the mass of eggs now handled commercially.

As stated before, the eggs are brought by the farmer directly to the creamery when bringing his milk. While this particular creamery is privately owned, it is essentially cooperative, in that its owner and manager is a far-sighted business man with other interests in the village and who sees that the increased agricultural prosperity of the community will eventually be to his advantage. In consequence he is content to take a small profit for himself and to pay the farmers as liberally as possible for both their cream and eggs. Any patron of the creamery or any other person who will sign a required agreement may market his eggs in this way. At present about one hundred and thirty-five farmers are taking advantage of this method of disposing of their eggs. These egg patrons are scattered over quite a wide territory, one man finding it to his advantage to drive in 14 miles with his eggs.

The agreement reads as follows:

> For the privilege of selling eggs to the creamery company and getting a market established for guaranteed fresh eggs, I, the undersigned, hereby pledge myself to comply in every way with the following rules:
>
> I agree to deliver eggs at the creamery that will not be to exceed 8 days old and to be picked in (gathered) twice every day.
>
> Eggs to be of uniform size (no under size or over size eggs).
>
> Eggs to be clean and to be kept in a cool, dry cellar.
>
> Brown eggs to be put in one carton and white in another and so marked.
>
> Each egg to be stamped on the side and carton to be stamped on the top.
>
> I agree not to sell any eggs that I have marked with the creamery company's trade-mark to anyone else but the creamery company, and to return stamps and other supplies that have been furnished, in case I should decide to discontinue to sell eggs to the creamery company.

It is readily discernible from the provisions of this agreement that the aim is to get a grade of uniform, clean, dependable eggs, of reasonable freshness. It might seem that requiring delivery once in eight days would not be frequent enough, but the nights in Minnesota even in summer are said to be usually cool, and this condition, together with the gathering twice a day and the storage in dry, cool cellars, must account for the fact that no complaints have been received on the score of staleness.

The separation of the brown and the white eggs serves two purposes. First, it promotes uniformity and greater attractiveness of appearance, and second, it encourages the keeping of the breeds of hens which lay white eggs, because the owner of the creamery pays during the spring months 1 cent more for white eggs than for brown. The creamery owner justified this action by the statement that it was his belief that his markets would pay a premium for white eggs in the near future, and that he wished to stimulate the keeping of one class of chickens, so as to insure a more uniform product.

To every person signing the agreement quoted above a small rubber stamp is given for use in stamping the eggs and the container. This stamp plays an important part in the system of marketing. It contains the name of the creamery, the creamery brand, and a serial number for each producer. By means of the stamp which thus appears on each egg and on each package it is possible to trace the product back to the individual producer, and in consequence to place the blame for any carelessness or poor quality where it belongs. A repetition of any offense of this nature may be sufficient ground for refusing to handle the eggs of that particular producer.

When the creamery patron signs the agreement, and at such times thereafter as may be necessary, he is furnished with a supply of cartons or containers in addition to the rubber stamp. These cartons are the ordinary one-dozen size pasteboard egg boxes which are so shaped that they may be packed in a regular 30-dozen egg case. The following guaranty is printed on the top of the carton:

> This package contains
>
> ONE DOZEN GUARANTEED FRESH EGGS
>
> ——— Creamery Company,
>
> Manufacturers and Dealers
>
> EGGS, BUTTER, PASTEURIZED CREAM, AND ICE CREAM
>
> ——— Minnesota.
>
> NOTE.—Eggs in this package, if they have our trade-mark on them, are guaranteed to be strictly fresh, clean and full size, and if ever found otherwise, we wish you would do us the favor to report it, giving number found on the egg.
>
> ——— Creamery Company.

The farmer takes these cartons home, and as the eggs are gathered each day, the clean, good-sized eggs are stamped and placed in them. When a carton is filled it is stamped on its upper side just the same as the eggs.

When the farmer comes in to the creamery with his milk or cream he brings along as many cartons or dozens of eggs as he has. The man in charge of the creamery takes these eggs, examines the packages, and gives the farmer a check for the eggs delivered that day. The cartons are then packed in substantial returnable 30-dozen egg cases and shipped to market by express. The shipping charges are paid by the consignee. The labor and cost of handling the eggs at the creamery are thus reduced to a minimum. The eggs are never candled, reliance being placed on the farmer to bring in good eggs. The cost of handling the eggs, including the cost of the carton, which is about one-half cent, is estimated to be 1 cent a dozen. The farmer in turn feels bound to be particular, knowing that any carelessness can be traced back to him and realizing that he thus jeopardizes his chances of continuing to dispose of his eggs in this manner. This he can not well afford to do, as will be shown later by a comparison of the prices received for eggs marketed through the creamery and through the general store.

In this particular case the creamery happens to be located within easy shipping distance of Duluth, Minn., and this city was chosen as a market for the eggs. One of the best grocery stores was already handling butter made by the creamery and was in consequence glad to take the eggs. The eggs, therefore, pass through only one dealer between the creamery and the consumer. These eggs, because fresh, were soon in great demand by the customers of this store, and though sold for several cents a dozen more than other eggs handled, were always taken in preference. It is interesting to note that during the year and a half that this store has been handling the eggs, only two complaints have been made as to their quality. It is also significant of the recognition of their quality that the demand for them has greatly increased and that persons living on the opposite side of the city make special trips to this store by street car solely for the purpose of buying some of these eggs. The brand which is placed on the eggs and on the cartons has become strongly associated with quality in the minds of the consumers. This is illustrated by the statement of the storekeeper that two cases of these eggs which came in unbranded for some reason or other were disposed of as eggs from this particular creamery only after a good deal of difficulty and on the personal guaranty of the proprietor. The consumers noticed the absence of the brands and demanded eggs so stamped.

ADVANTAGES OF THE SYSTEM.

Previous to the inauguration of this method of handling the eggs by the creamery the farmers brought their eggs to the general store and traded them for merchandise in the usual manner. When the creamery first began to handle eggs this innovation was looked upon with disfavor by the merchants, who feared that they would lose some trade because of the fact that the farmers received cash for their product. Gradually, however, these merchants have come to realize that as this method brought a greater return to the community for its eggs, it helped to increase the general prosperity and that under these circumstances their trade improved rather than degenerated. In consequence they have come to favor the step heartily, to feel a pride in it, and finally to feel grateful for being relieved of the necessity of handling the eggs.

The advantage of this system of marketing, to the farmers or producers, has come about in two ways: First, it has increased the price paid to them by compelling an improvement in quality, by selling more directly to the consumer, and by establishing a reputation for the eggs sold under the creamery brand. Second, it has brought about the realization that poultry raising by the general farmer is profitable, that the income from this source is considerable, and that it is capable of increase by keeping better fowls and giving them better care.

The increase in price which the farmer is realizing for his eggs as a consequence of the introduction of the new method varies with the season. During the spring, when eggs are plentiful and quite uniformly good in quality, the difference is small and does not amount to over 1 or 2 cents. From this time on the difference increases until the following winter, when it reaches as high as 10 cents or more. During the month of December, 1909, when this creamery was visited, farmers were receiving 40 cents a dozen for their eggs and continued to do so during the entire month. At this very time, as determined by personal investigation, farmers in a village of a near-by portion of the State were receiving 25 cents a dozen. There was, moreover, absolutely no expense of marketing to come out of this 40 cents, as even the cartons in which the eggs were packed were furnished by the creamery. From the following table giving the average price paid by the creamery by months during 1909 it can be seen that the return to the farmer is very satisfactory, and far better than that received where eggs are marketed through the country store, where a bad egg is worth, or rather brings, as much as a good egg:

Average price paid by creamery for eggs in 1909.

Month.	Number marketed.	Average price paid farmer.
	Dozens.	*Cents.*
January	630	35.6
February	1,329	25.9
March	1,771	19.0
April	2,069	18.2
May	2,445	19.8
June	1,725	20.0
July	1,509	22.7
August	1,898	24.5
September	1,562	25.1
October	507	27.0
November	229	37.4
December	810	40.0

In this particular Minnesota village during the year 1907, which was just previous to marketing the eggs by the new method, the eggs received by the storekeepers hardly more than supplied the local demand. In fact, during the whole of that year only 15 cases, or 450 dozen eggs, were shipped out of the village. During the year 1909 nearly $4,000 was paid out by the creamery for eggs, all of which were shipped away. The impetus which has been given the poultry business during the short time this method of marketing has been practiced may be judged from the statement of the proprietor of the creamery that from present indications he expected the egg business to double or treble during the year 1910.

Along with this increase in the volume of egg receipts, which indicates a realization of the profitableness of the business and an increase in the number of fowls kept, has come an awakening to the value of better stock and improved methods. It is noticeable that purebred poultry is being introduced and is replacing the old flocks of mongrel fowls. Poultry papers are being subscribed for and publications on poultry raising are in demand. New and better hen houses are being built and systematic attention is being given to the care and feeding of the fowls. The great part of this awakening to the possibilities of poultry keeping is directly traceable to the method of marketing the eggs through the creamery which is used in this locality.

SIMILAR SYSTEMS IN OTHER LOCALITIES.

In at least one other locality in Minnesota a very similar system of egg marketing is in operation. In this village, however, a little settlement of Danes, the eggs are not marketed through a creamery, but through an association formed solely for the purpose of marketing eggs. The details of the process are practically identical, and it is planned to handle the eggs through a cooperative creamery which the settlers expect to start in the near future. At present the secretary of the association attends to the business of marketing the eggs without compensation.

In still another locality which boasts a strong cooperative creamery it is the intention to begin handling eggs on exactly the same plan, except probably to require somewhat more frequent delivery of eggs during the hot summer months. Still another locality intends to accomplish the same end by means of a man paid to handle the eggs and attend to the marketing. In this case, too, the details of the collection and delivery of the eggs by the farmers will be almost identical with the method described above, except that the eggs will not go through the creamery.

CONCLUSION.

It can not be denied that in the particular case described above, marketing eggs through the creamery has been a success. It has brought about carefulness on the part of the producer and a most decided improvement in the quality of the eggs. It has, moreover, provided the market with a grade of good, fresh eggs, which are always in good demand and which at present are almost unobtainable at certain seasons in the cities. It has, in doing this, prevented a considerable waste and loss in quality which is normally associated with the marketing of eggs in the Middle West, and has increased very materially the price which the producer receives. It would appear, in view of the fact that the creamery seems a logical and natural agency for the handling of eggs to good advantage, that this method, with modifications, is adaptable to a wide range of conditions, and that many creameries could well afford to make eggs as well as butter one of the products which they handle. Wherever this method is adopted it should mean a most acceptable increase in the price received by the farmer for his eggs, and this without any increase in cost to the consumer.

THE SANITARY CONSTRUCTION AND EQUIPMENT OF ABATTOIRS AND PACKING HOUSES.

By G. H. Parks,
Architect, Bureau of Animal Industry.

INTRODUCTION.

In this country previous to the last three or four years but little attention had been given to the sanitary character of the buildings designed for abattoirs, packing houses, and rendering plants, the dominating idea being to arrange and construct the buildings so that the products from the establishments could be finished and delivered with the least outlay of capital. The result generally has been that the principal laws of hygiene have been violated, unless it was found that the market value of the products decreased because of the insanitary conditions in which they were produced. The violation of the hygienic laws was, perhaps, due in part to the lack of knowledge of such laws and to a failure to appreciate properly the possible harmful results which might be caused to the community at large through the consumption of food products produced under insanitary conditions.

Prior to the passage of the meat-inspection law of 1906 the United States Department of Agriculture had no legal power to enforce sanitation at slaughtering and packing establishments. By that law, however, the Department was given such authority, and it now requires that such establishments shall be maintained in a sanitary condition, and great improvement has resulted. Sanitary principles have been applied in the construction of new buildings, and many old buildings have been practically reconstructed. In some old buildings it is difficult and expensive to secure and maintain cleanliness, and the total elimination of insanitary features has sometimes been found impossible; yet certain definite and decided improvements have been made, and a reasonably satisfactory state of sanitation is required as a prerequisite to doing business under federal inspection. As these older buildings are gradually replaced by new structures it will be possible to incorporate the best features of modern sanitary construction and thus obviate the difficulty of keeping buildings clean that were erected without regard to that object. The greatest need for sanitary reform is found in local establishments operating without inspection.

PRIME NECESSITY OF CLEANLINESS.

The first condition requisite in an abattoir or packing house is cleanliness throughout the establishment. Cleanliness signifies the absence of dirt, and dirt is defined as matter out of place. Odors are matter, and undesirable and noxious odors caused by decaying products should be removed, not alone by the aid of exhaust fans and natural ventilation, but by the elimination of dirt. It will not be practicable to maintain the degree of cleanliness required in an operating room of a hospital, but it is practicable and requisite that a high standard of cleanliness be maintained. A high standard can not be attained without proper construction and planning of the various departments of the buildings and of the equipment.

PRINCIPAL SANITARY FEATURES IN ABATTOIR CONSTRUCTION.

The term "sanitary" means that which is conducive to the preservation of health, and "sanitary construction" means such construction as will eliminate those factors of construction that tend to make the buildings insanitary.

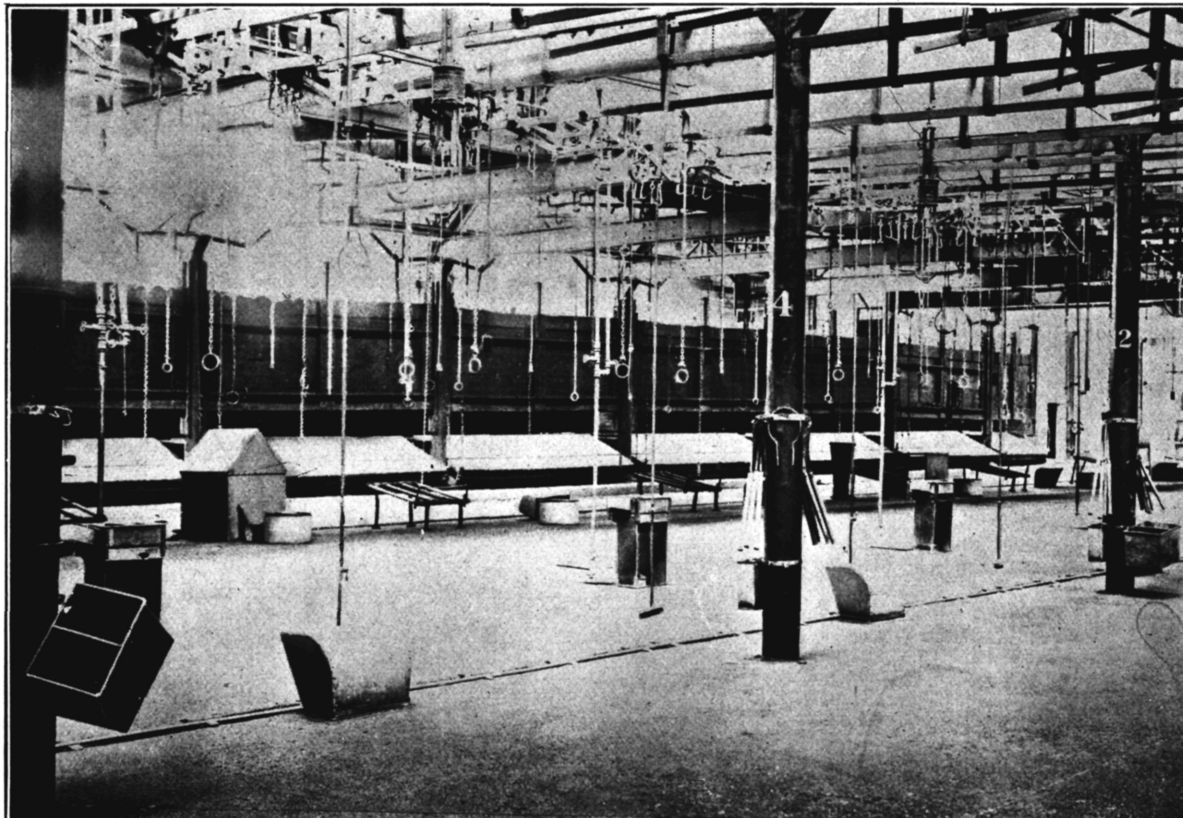
The features which are principally at fault in abattoirs may be summarized as follows: Location, plan, material, and construction of the buildings, lack of sunlight, ventilation, plumbing and drainage, materials and construction of the equipment, and water.

All buildings that are to be used for the purpose of slaughtering animals for the preparation of meat or meat food products should meet the following requirements:

1. A location on a site that is dry and with an aspect which gives an abundance of sunlight.
2. An abundant supply of pure water, by means of which perfect cleanliness of all parts of the building can be secured, and proper means for the removal of waste water.
3. A system of immediate and perfect sewage removal which renders it impossible that the air or water shall be contaminated.
4. A system of ventilation which carries off all impurities from the air of the rooms and supplies clean, pure air as required.
5. A condition of building construction which admits of perfect cleanliness of the ceilings, columns, walls, and floors.
6. Proper equipment.

LOCATION.

A large number of the present establishments have been located that direct connection may be had with the railroads, and as it is the custom for railroads to be on low grades, the establishments are in many instances situated on the banks of rivers. Such lands are almost always badly drained and are subject to overflow when the



INTERIOR OF ABATTOIR WITH SANITARY CONSTRUCTION AND EQUIPMENT.

rivers are flooded. The water backs up in the sewers and prevents proper drainage. When the sewers back up recourse is had to pumps, but the results are not satisfactory. The cellars where meats are stored become flooded, and after the subsidence of the water the walls and floors are covered with a deposit of sediment which renders the rooms, until cleaned, totally unfit for use for the storage or handling of meats. During the flooded condition of the cellars much of the meat is damaged, and this entails great loss, not alone to the producer, but also to the consumer.

There are other establishments so located that the surrounding premises are undrained and pools of stagnant water are seen on the surface of the ground.

Some few of the smaller factories have been found in rooms in the basements of dwelling houses. Generally in cases of this character the entire surroundings are in an undesirable condition, caused by the accumulation of refuse in the alleys, back yards, and courts. The windows of the basement generally open on the level of the ground outside or into areas closed with gratings, but there is usually to be found an accumulation of filth in the area, so that the air admitted to the rooms is not wholesome. Establishments of this character are to be found in the congested portions of cities, and as the alleys are under the control of the city authorities, the owners of the establishments depend entirely upon the officers of the health department to keep the alleys clean. This cleaning is usually done spasmodically and with very indifferent success.

Buildings with outside openings into alleys, back yards, or courts that are not kept clean should never be used for the preparation of meat or meat food products. It is imperative that no buildings where meat or meat food products are prepared or stored shall have any openings that will admit the outside air from surroundings that are not or can not be kept in a sanitary condition. An exception to this might be allowed if the establishment is furnished with a proper equipment to purify all the air admitted to the building and where the cleaned air is forced into the various rooms.

NATURAL LIGHT.

Sunlight in abundance should be admitted to all rooms where meat or meat food products are prepared, with the exception, perhaps, of the dry-salt and pickle cellars, oleo seeding rooms, and chill rooms. The admission of much sunlight to dry-salt cellars is objected to by some meat packers, as it is claimed that the light darkens the meat, but there are others who hold that the light is not objectionable in this respect. It is a fact, however, that much glass surface in the walls of chilled rooms does influence the refrigeration. There is apparently less need for direct sunlight in the dry-salt cellars than in any of the other rooms, for the floors are generally kept sterile to a degree by the salt and brine, and the temperature of the rooms is comparatively low. In all rooms where the normal temperature is relatively high it is imperative, from a sanitary standpoint, that sufficient windows and sash be supplied, so that the sunlight can penetrate the entire depth of the room and that practically the entire floor will have been covered during the day. This sunlight should be direct and not diffused light, such as comes through the wire glass generally employed for fire protection. The action of sunlight as a disinfectant or sterilizing agent is much diminished when the light is diffused. The windows in the outside walls should be numerous and should not have the sills more than 5 feet from the floor, and the tops of the windows should be as near the ceilings as practicable. The higher the tops of the windows are from the floor the farther the sunlight will penetrate the room. In rooms over 60 feet in width monitors or skylights are necessary, and these should be placed to run north and south.

WATER SUPPLY.

One of the principal requirements of a slaughterhouse is an abundant supply of both cold and hot water, and particular attention should be paid to the source from which the water is obtained in order that it may be pure. The supply may be obtained from driven wells, shallow wells, rivers, lakes, or if near a city from the water mains of the city.

Where water is required for washing, flushing, or use in the preparation of meat food products, all rooms should be supplied with a complete system of piping for hot and cold water, in order that either kind may be drawn as required.

ARRANGEMENT OF ROOMS AND COMPARTMENTS.

The rooms and compartments should be so constructed and located that the odors of one compartment or room will not penetrate the adjoining rooms. The rooms should be so planned that it will not be necessary to truck or convey any of the nonedible products of the carcasses through or into those rooms or compartments where edible meat products are handled, prepared, or stored; and it is also of importance that edible meat products shall not be conveyed through or stored in rooms that contain the inedible products of the carcasses.

IMPERVIOUS MATERIALS NECESSARY.

The materials used in the construction of the various rooms or compartments should be, as far as practicable, of an impervious character. The impression is erroneous that if a substance is fire resistant it is, because of this quality, impervious to air and water. Concrete, cement, and plaster are considered by some as presenting a sanitary surface, but this is far from being a fact unless some method is adopted to make them impervious. Concrete and cement plaster are rendered much less porous by an admixture of waterproofing compound, and the surfaces of these materials may be made practically impervious by covering with oil paints or similar substances. Wood, unless painted with oil paint, is not impervious, and the same is true of bricks unless they are painted or have an enameled surface. When the walls and posts of a room are of wood it becomes necessary to use a covering of metal. This metal covering need be but of such a height from the floor as to protect the walls and posts from injury. Above the metal wainscot the woodwork should be painted, preferably with an oil paint, and the surface of the wood should be dressed before the paint is applied.

If the walls are of common brick or terra-cotta blocks the joints should be filled to the face of the bricks or the blocks. The terra-cotta blocks should be covered with hard or cement plaster and troweled down to a smooth surface and then painted with oil paint. The brick walls should also be painted with oil paint. At least three coats of oil paint should be used on all plaster, cement, or brick surfaces. Stone walls should be pargeted with cement mortar to a true surface, and, if other than dry-salt or pickle cellars, should be painted with oil paint.

PAINT.

As all exposed surfaces of the compartments are required to be painted it is advisable to select such paints as are best suited to the character of the rooms. If there is much moisture in the rooms the paint must be nonabsorbent. This quality is possessed by those paints containing oil and by some of the varnishes, such as "spar varnish." Oil paints may be made from white lead or from white zinc and oil with the addition of coloring pigments.

In painting concrete surfaces, cover the surface to be painted with a solution of equal parts by weight of zinc sulphate (white vitriol) and water, applied with an ordinary bristle brush after the cement is dry. Allow from forty-eight to seventy-two hours for the solution to dry after it has been applied to the walls before applying the lead and oil paint finish.

In rooms containing much hydrogen sulphid, if it is desired to paint in light colors, it will be necessary to use pure white zinc and oil, because the white lead turns dark when acted upon by the hydrogen sulphid.

Cold or hot water paints may be used in compartments that are very dry, as paints of this character have but little resistance to moisture.

In selecting colors it is commendable to select those that will aid in the effort to keep the rooms clean, as the paint is not used to cover up the dirt, but to assist in maintaining cleanliness.

Metal work is well protected from rust when the paint used is oil paint, enamel paint, or aluminum paint. Aluminum paint, enamel paint, and elastic varnish are satisfactory for use on pipes subject to great fluctuation of temperature.

CEILINGS.

All ceilings should be so constructed as to present a flat surface. If wood joists are used, the bottoms of the joists should be covered with plain sheets of metal, or planed tongued-and-grooved flooring boards or with plastering. The use of beaded boards is not to be recommended. All ceilings of wood or plaster should be painted with oil paint. The oil paint may be either of lead and oil or zinc and oil. Metal ceilings should be plain and not stamped or embossed, as the smoother the ceilings the more readily they can be kept clean. In ceilings constructed on the mill principle the supporting floor beams and the under side of the floor planks should be planed and all surfaces painted with oil paint.

FLOORS.

There are two points to be considered in the construction of the floors The first point is that the floors shall be of a nonabsorbent material. This is especially important where during the time of operation there is a continual flow of water on the floors.

The second consideration is to drain the floors properly. Asphalt of the proper degree of hardness to suit the various temperatures of the compartments is probably the best flooring material in use at the present time. When a floor, such as the basement floor, can be constructed on a solid foundation, concrete may be used. The disadvantage of a cement floor is principally that the wearing surface soon wears out under continuous trucking, and as the tensile strength of concrete is not great the floor soon cracks. This is especially true where concrete and cement are overlaid on a wooden floor. The shrinkage of the wood will cause the concrete to settle and crack. The cracks can not be filled with cement with the assurance that the floor will be water-tight. Asphalt has been used to patch concrete and cement floors, and under favorable conditions the results have been satisfactory. The wearing surface of a concrete floor is much improved when a granolithic or granitoid surface is used.

The granolithic and granitoid surfaces are composed of hydraulic cement, crushed stone, sand, and gravel, with the addition of some indurating mineral substance, as baryta or litharge. When properly made and put down they give general satisfaction. They are generally manufactured under a patent.

The common practice of finishing a concrete floor is to add an inch of a mixture consisting of Portland cement 1 part, sand 1 or 2 parts. A particularly good cement will take 1 part of sand, but a poorer quality requires a greater proportion. From improper or faulty mixing of the parts and finishing or troweling down at the wrong stage of the set of the cement, the surface fails in wearing qualities. The practice of adding cement to the surface to temper the mortar ruins the finish, and consequently where the best results are to be obtained this practice should not be allowed.

Owing to the low temperature of the pickle or dry-salt cellar, the concrete and the cement or other finish must be given sufficient time to set and harden thoroughly before the floor is used. Cement sets much more slowly in a low temperature than when the temperature is high.

Floors of brick are not to be recommended, as they are not sanitary even under the best conditions. The brick is too absorbent and the floors are uneven with numerous joints. The bricks are uneven in hardness of burning and require frequent replacing.

Wooden floors to be satisfactory should be made of good material and constructed so as to be water-tight. Alternate wetting and drying will cause decay. Trucking also wears the floor into splinters and prevents it from being thoroughly cleaned. The splintering of the wood can be partially prevented by selecting the rift-sawn or edge-grain flooring. Because of the short life, liability to splinter, and the difficulty of cleaning when splintered, flat or slash-grained wood should not be used.

USE OF ASPHALT FOR FLOORING.

The most important point in asphalt concrete is a good matrix, one that will not soften in the heat of the room or become brittle in the chilled atmosphere of the cold rooms. The aggregate should be as dense as possible, thoroughly coated with the matrix while hot, and closely compacted while cooling. The amount of the matrix should be just sufficient to fill the voids in the aggregate. Many floors of asphalt are unsatisfactory because too much of the matrix was used or because of poor quality, and also because the floors were put down by labor unskilled in the use of asphalt.

Asphalt for surface may be overlaid on a subbase of wood flooring in place of cement aggregate. The wood underfloor must be thoroughly dry and clean. The wood floor is first covered with a layer of waterproof building paper with overlapping joints. The paper is then covered with a coating of asphalt about one-half inch thick. This asphalt is made of mastic, flux, and sand. Next the one-half inch covering is covered by a coat of asphalt 1 inch thick of the same constituents as the first coat. On the top coat is sprinkled dry Portland cement, and the whole surface is troweled, rammed, or rolled to a true even surface. The life of the floor depends to a great extent on the evenness with which the floor is laid. Water will rot the surface if allowed to stand on it. Trucking will also wear out an asphalt floor if the floor is uneven.

Floors of cement or asphalt should be made with a pitch or fall of not less than one-fourth inch to the foot. This will allow for a little unevenness, consequent to imperfect workmanship.

At the junction of floors and walls the asphalt should be coved and carried up the face of the walls to a sufficient height to prevent the water from running down to the floor below.

FLOOR GUTTERS.

In cement or asphalt floors the gutters should be of metal or formed in the concrete or asphalt. The use of wood is unsatisfactory, as the wood soon decays and it is impossible to make a permanent watertight joint between wood and cement or asphalt.

TOILET AND DRESSING ROOMS.

Toilet rooms should be conveniently located, ample in size, and adequate in number. The fixtures should be simple in character and of such material as to be readily kept clean. There must be an ample water supply to flush the closets and urinals thoroughly. Automatic fixtures are to be preferred.

The rooms should be well lighted by an abundance of properly placed windows, and the light should be direct sunlight. The rooms should be thoroughly ventilated. When there is danger of the water freezing in the fixtures it will be advisable to install a system of mechanical ventilation in addition to the natural system.

The floors, walls, and ceilings should be of sanitary construction and material. The floor must be properly drained to facilitate cleaning. All walls and ceilings should be thoroughly painted with oil or other waterproof paint.

The rooms for holding the wearing apparel of the employees should be well lighted by natural light and should be thoroughly ventilated. When necessary the rooms should be thoroughly fumigated and sterilized. It is well to fumigate and sterilize both the working clothes and the street dress.

When lockers are used, separate compartments should be provided for the working clothes and the street clothes. There is a possibility that the street clothes worn to the establishment will bring infection to the dressing room, and if both the working clothes and street clothes are hung in the same compartment in the locker there is a chance for infection and spread of disease. The lockers of metal are best, and should be so constructed that the compartments are thoroughly ventilated.

The system of ventilation of the rooms should be of such a nature as to maintain an even temperature at all times, and should be so arranged that it can not be tampered with by those who are not immediately in charge. When the rooms are ventilated only by means of open windows or sash, the employees will close the windows or sash if the temperature of the room is too cold. The room then ceases to be ventilated, and the air and the garments become saturated with foul odors so that the primary object, that of keeping the clothes sanitary, is defeated.

There are various styles of closets that are satisfactory. Where there are but few employees the separate closet of standard manufacture is acceptable. For the men's toilet room not less than one closet to each 25 men is required. For the women's toilet room not less than one closet to each 20 women is required. Where there is a large number of employees to use one toilet room the best pattern of the range closet is satisfactory. There should be a partition between each two seats or spaces. The range closet with a front rail of hard wood is better than the closet with individual seats, as it is more easily kept in condition both as regards repairs and cleanliness. The closet should have a good depth of water in the trough and an ample flushing service. When closets of this kind are used, the urinal should be omitted in the toilet room, as it is desirable to eliminate all unnecessary urinals on account of the odor arising therefrom. Where the toilet room is far removed from the working rooms it is advisable that a urinal station be installed closer to the working room in order that the employees will not find it necessary to use sheep or cattle pens or dark corners. The ventilation of these rooms must be particularly efficient.

Wash basins or sinks should be adjacent to the toilet and urinal stations, in order that the employees may wash their hands after using the station.

PLUMBING AND DRAINAGE.

All floors must be properly drained by the use of gutters or other effective means to remove from the floors the waste water incident to the processes of preparing the products and from cleaning and washing the rooms and equipment. The proper pitch of the floors to the gutters should be not less than one-fourth inch to the foot, and the gutters should not have less pitch than the floors. The gutters should be trapped into the drainpipes or down spouts by proper water-sealed traps. The "bell" trap is efficient when given proper attention, but as it requires constant attention other traps may be used more advantageously. The removal of the bell from the under side of the strainer entirely defeats the purpose for which the trap is made. Where the bell trap is in use it is not unusual to find the entire top removed so that in effect no trap at all is supplied. Because of the ease with which this trap is made inefficient its use should not be recommended, but where it is used special attention should be paid to keep it clean and in working order.

The custom of draining from one story to the next story below by the use of an open down spout should not be permitted. The drainpipe should extend from the sewer in the lowest story up through the building to the highest fixture and from there should extend above the roof. Each separate story should be connected through a trapped

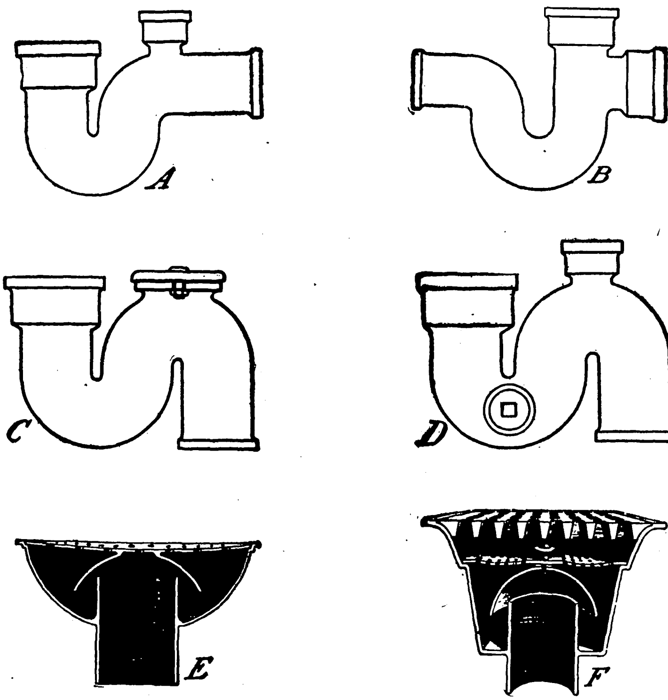


FIG. 6.—Types of traps for drainage in abattoirs. *A*, "P" trap with vent; *B*, running trap with vent; *C*, "S" trap with hand hole and cover; *D*, "S" trap with vent and brass trap screw on side; *E*, section of bell trap; *F*, section of cesspool bell trap.

pipe to the main vertical drainpipe. If S, half S, or P traps are used, the traps should be vented from the crown of the trap, and the vent pipe must be carried up through the building and through the roof.

When the floor drainage is emptied into catch basins instead of directly into the sewer the lowest end of the drain should be entirely submerged in water, so as to make a water seal to prevent the gases of the catch basin from permeating the various rooms by way of the drain. Catch basins and skimming tanks should be located entirely outside of any rooms where meat food products are prepared, handled, or stored.

The size of the drainpipes should not be too large nor too small, but of a size that will be completely flushed. All down spouts or conductors should be of cast iron or wrought iron and made continuous from the top story to the bottom, where they should be connected to the sewer pipe. All joints of the pipes should be made air and water tight. In the refrigerated rooms containing cooling pipes there should be supplied proper gutters below the pipes to receive the ice and water formed by condensation and subsequent thawing. The down spouts from the drip pans of the refrigerator coils should have cast-iron or wrought-iron sections at the lowest end of conductors so as to prevent the jamming and closing of the outlet. It has been the custom to make these down spouts of galvanized iron, and where they have not been protected by boxing the trucks have jammed the ends of the conductors so that they have become not only worthless as conductors but a source from which the air of the rooms has been fouled.

Every plumbing fixture should be separately trapped by a water-sealed trap placed as close to the fixture as possible, and if located within the building, vented, except in the case of the upper or only water-closet on a soil pipe extended full size through the roof, the closet having the center within 2 feet of the center of the stack, in which case no vent is required. Where three or more water-closets discharge immediately into a horizontal branch and thence into a vertical soil-pipe line carried through the roof as a vent, the vent may be omitted and an extension of the branch line substituted not less than 3 inches in diameter, to be reconnected to the main vent or carried through the roof independently.

A floor trap for a shower should be vented unless located in a cellar the paving of which renders the trap inaccessible. Every vent should be taken from the crown of the fixture trap except the water-closet trap. Each vent pipe should run independently above its fixture in order to prevent its use as a waste. Each vent may be connected above the highest fixture into the adjacent soil pipe if distant therefrom not more than 6 feet. If more than this distance from the soil pipe the vent must be independently extended above the roof. Main vent risers having a length of 15 feet or more should be connected at the foot into a main waste or soil line below the lowest vent outlet and with no greater angle or connection than 45 degrees.

The sinks in the lavatories should be of metal and prepared so as not to rust. Galvanized iron or enameled iron are most in use. The enameled iron is the more easily kept clean but is less durable. The waste pipes from sinks in the working rooms should be connected to the sewer system. The practice of allowing the waste water to run onto the floor should not be permitted. The waste pipe should be trapped immediately below the inlet and the trap should be furnished with a vent pipe which is to be extended into a common vent system up to the highest fixture. Above the highest fixture the vent pipe may be connected to the soil or drain pipe and the pipe extended above the roof.

VENTILATION.

By the term "ventilation" is understood the continuous introduction of pure air into a room or building in such a way as to mix it thoroughly with the air contained therein, and the simultaneous removal of a like quantity of the impure air. The ventilation of rooms and buildings is necessary in order to prevent the accumulation of the impurities of respiration, combustion, and putrefaction.

It is extremely difficult to give any definite rule for the amount of cubic space required, or for the rate of the change of air. It is obvious that in a small room containing many persons the air should be changed much oftener than in a large room containing but a few persons. In factories it may be stated that in general from 2,000 to 3,500 cubic feet per hour per person is required for good ventilation. This will allow only for a change of air twice an hour when each person has from 1,000 to 1,800 cubic feet. Where this cubic space per person is less the rate of change of air should be greater.

The incoming air must not have such a velocity as to make itself felt to any marked degree. The inlet openings should not be large and should be so placed that the current of incoming air does not immediately find its way to the exit or exhaust openings.

The quality of the incoming air is of equal importance with the quantity. Care should therefore be taken that the source from which the air supply is drawn shall be as free from impurities as possible. In some instances it will be necessary to wash or filter the air before it is introduced into the building.

The current of incoming air should be imperceptible, especially when, as is generally the case, the outside air is lower in temperature than that of the room to be ventilated. A current of air not to exceed 3 feet a second will generally be found to be unobjectionable, as the draft will be very slight. If the currents are entirely above the persons much greater speed may be maintained; the larger the areas of the inlet and the outlet openings the slower the velocity of the air current.

The fresh air must not only be supplied; it must also be diffused equally throughout the space so as not to pass directly from the point of entrance to the point of exit. Special attention should be paid to this matter, otherwise there will not be the proper displacement and renewal of the vitiated air.

Ventilation is effected either by natural means or by the aid of mechanical equipment. The former is called natural ventilation and the latter artificial ventilation.

NATURAL VENTILATION.

In all buildings there is a very slow interchange between the inside and outside air by diffusion through the substance of the walls and floors themselves. This diffusion takes place through almost all the substances used in building construction. The more porous the material the more rapid the diffusion, the diffusion being caused by unequal pressure. Because of the slowness with which this diffusion takes place it becomes necessary to provide additional means to supply the needed amount of fresh air. Thus openings in the walls, such as doors and windows, or special openings into ventilating shafts are employed.

The natural ventilation through the pores of the walls is but of little moment generally, but an unequal temperature in two adjacent rooms will cause the air of the rooms to equalize, so that it is necessary, if the air of adjoining rooms is to be kept separate, to make the dividing partitions, floors, and ceilings air-tight. This point is well illustrated by the construction of chill rooms. The partition, floor, and ceiling in these rooms are "insulated," which is only a method to reduce to a minimum the diffusion of the air.

When only natural ventilation is employed the action of the wind is depended upon to give the required ventilation. Open windows and doors allow the entrance of moving masses of air. When the openings are sufficient in number and properly placed this method gives acceptable results; but when the outside air becomes cold, as in winter, the windows are closed more or less and in consequence the rooms do not get the necessary ventilation. Another objection to the system of natural ventilation is that the air admitted in some instances is fully as foul as the air in the room, so that practically no ventilation takes place. The admitted air may be cooler, but not of better quality. When the carbon dioxid does not exceed 6 or 7 parts in 10,000 the air is good, and any system that will keep it down to this may be called good. But in order that the carbon dioxid may be kept as low as 6 or 7 parts by volume in 10,000 parts, it will usually be found necessary to install a system of artificial ventilation.

ARTIFICIAL VENTILATION.

Artificial ventilation is that form of ventilation in which the movement of air is produced by artificial contrivances. These may be of two kinds—heat and mechanical—and either of these may be arranged for extraction of the foul or vitiated air or propulsion of fresh air. The former is sometimes called the vacuum and the latter the plenum system.

In practice, heat is employed only as a means of ventilation by extraction, not by propulsion. The most common method is to introduce coils of hot water or steam pipes or gas burners in a ventilating shaft. Whatever the source of the heat, it is best to place it at the bottom of the shaft and not at the top, except when it is desired to extract the steam from a room through a vertical flue constructed of metal. In this case if the heating pipes are placed near the top they will warm the metal of the flue, thus preventing to a great extent the condensation of the steam. The great disadvantage of extraction by heat is its irregularity of action, as it is almost impossible to regulate the temperature of the column of heated air; consequently the upward current will sometimes be far more rapid than at other times. It is also expensive to maintain on a large scale.

The mechanical means used are chiefly fans. The fans are almost always rotary, and may be either centrifugal or axial. Axial fans are more suitable where a large volume at low pressure and velocity is required; centrifugal fans are better for the production of high velocity and high pressure. It should be noted, however, that a large fan worked at low pressure is more economical than a small one at high speed. The blades are best curved in centrifugal fans, and flat and inclined in axial fans.

Fans can be used either for extraction or propulsion, and may derive their motive power from engines or electric motors. The amount of air delivered can be calculated by taking the velocity of revolution of the extremities of the fan; three-fourths of this equals the velocity of the air, this allowance being necessary on account of friction. The sectional area of the conduit being known, the delivery per second can be calculated from these data.

Certain points require attention in all arrangements for artificial or mechanical ventilation:

1. The point of intake for the fresh air must be selected at such a location as will insure the air being pure, and, as a general rule, the purest air will be found at a height of 10 to 15 feet above the ground, unless influenced by local conditions such as the close proximity to slush boxes, fertilizer buildings, stables, cattle yards or pens, air vents of sewer, or similar conditions.

2. In the last-mentioned cases the air would require cleansing or filtering. This may be done by means of screens of coarse cloth or cotton, and the air may then be washed by passing it through a spray or through a wire screen over which a fine stream of water is running. This adds moisture to the air, and if it is to be forced into chill rooms it will require drying.

3. The temperature of the incoming air should be under control. It may be chilled by passing over and through refrigerating coils, or it may be heated by passing across steam coils.

4. The channels through which the air is conducted must be so arranged as to be easily cleansed. This is especially necessary in the propulsion method. Extraction shafts also require to be kept clean.

The extraction method is less costly than the propulsion method, but it has the disadvantage of not having the source of the incoming air under control, and consequently impure air may be admitted. In the propulsion method the inlets are entirely under control if properly arranged, and the purity of the air can be assured. A proper diffusion throughout the room is more easily effected as well. It is sometimes an advantage to combine the two methods.

EQUIPMENT.

All the equipment should be of a sanitary character. Stone, metal, and glass are three of the best materials to be used. Wood is acceptable only when in perfect condition. Wood when subjected to alternate treatments of wetting and drying soon becomes altered in condition and is subject to decay.

All machinery, tables, benches, and other equipment should be so constructed and located that all the parts may be readily cleaned.

TABLES.

Table tops of wood should be covered with metal. For this purpose iron heavily coated with tin is perhaps as lasting as any metal. Zinc is too soft and soon becomes filled with dents and holes, and as metallic zinc is soluble in the acids occurring normally in meats and meat products, zinc and galvanized metal should not be used where they come in contact with these products intended for food. Holes in metal tops should be immediately repaired. Wooden tables and trucks with cracks and with the wood splintered should not be used. Tables should not be fastened against walls or partitions unless the metal covering of the table is continued and carried up on the walls. The covering should be carried up on the walls to such a height that there is no possibility of meat shreds, chips, or pieces becoming lodged between the lining and the wall to which it is fastened. When the tables or benches are not covered they should be so constructed as to be removable from against the wall to facilitate cleaning. Tables of glass are satisfactory only so long as they are in perfect condition. Glass readily cracks through uneven strains caused by unequal expansion or contraction. The perfect table is made of a particularly hard nonabsorbent soapstone. Tables of cement manufacture are in use, but if the cement is not made nonabsorbent they are not sanitary. The frames and legs are preferably constructed of metal.

TRUCKS.

Trucks at the present time are made of wood, wood bodies lined with sheet metal, metal bodies, and cast-iron enameled bodies. The enameled iron trucks have not proved successful, as they are exceedingly heavy and the enameling does not stand rough handling. If the enamel is of the gray or blue variety it will be found more serviceable than the white. The trucks made of wood are satisfactory only when they can be kept clean. The process of cleaning by hand is not satisfactory. The best method to clean trucks is by immersion in a tank containing the cleansing fluid. By this method every part of the truck is reached, which result is not obtained when an attempt is made to clean by the use of brushes. When the truck body is made of sheet metal in such a manner that the inside surfaces are perfectly plain, the cleansing of the truck can be done by hand satisfactorily. Some of the sheet-metal trucks are so made that the reenforcing angles are placed in the inside corners, making the inside surfaces of the trucks uneven and difficult to clean. The angle reenforcement may be placed on the outside of the corners without decreasing the strength of the truck, and if the metal edge be soldered there will be no cracks or crevices to retain dirt, and the truck can therefore be more easily cleaned.

CONVEYORS.

Conveyors are of various kinds, the bucket and belt pattern being the most extensively used. From a sanitary standpoint neither kind is to be recommended, as the machines can not be kept clean.

CHUTES.

Long metal chutes should be so constructed that the inside of the chute will be as nearly free from unevenness as it is possible to make it. The overlapping joints should be so made that the upper sheets will overlay the lower sheets. Chutes are made preferably of cast iron heavily coated on the inside with block tin, or coated with porcelain enamel. Porcelain-enamel lined cast-iron pipes up to 15 inches inside diameter are now on the market. These pipes should have the joints made with litharge and glycerin cement. This cement is acid and waterproof and withstands well the expansion and contraction of the pipes. All chutes should have numerous hand holes to facilitate cleaning.

LAUNDRY.

A properly equipped laundry should be furnished, in order that the employees may be supplied with clean outer clothing.

PROTECTION FROM RATS, FLIES, AND OTHER VERMIN.

Since rats, flies, and other vermin are sources of filth and frequently transmit disease, they should be rigidly excluded from all compartments containing meat or meat food products. Besides the objections mentioned, extensive pecuniary losses are caused by the depredation of rats.

Rat-proof construction should be employed in building new abattoirs and packing houses. Much can be done by changes in existing houses toward getting rid of and keeping out rats. As is generally known, rats will burrow in the walls and floors of packing houses, and they are usually found in large numbers beneath the floors of cattle pens, alleyways, sheds, and platforms, especially if the floors of these are of wood laid directly on the ground. Wherever possible wooden floors should be replaced by brick or block pavements laid on cement, or by concrete construction. Platforms should be built open in front and paved below. The walls of chill rooms, both outer and inner, should be of rat-proof material, and the space between the walls should be guarded against rats by wire screens at the top and at each floor. All sewer openings, air flues, and windows through which rats might enter should be screened.

During the fly season all doors and windows should be fitted with efficient fly screens.

THE USE OF METALLIC CONTAINERS FOR EDIBLE FATS AND OILS.

By James A. Emery, M. D.,
Senior Biochemist, Biochemic Division.

INTRODUCTION.

The utilization of metals in the making of vessels for storing and transporting substances intended for human food originated with the ancients. In the earlier ages, before metals were known, skins and horns of animals, wood shaped by fire into the semblance of the interior of a bowl, pots made by hollowing out soapstone, and earthenware vessels were brought into use and served as containers for such substances as could be stored in them. The advance of civilization, however, with its ever-increasing knowledge of metallurgy, which brought about a large production and low cost of metals, presented possibilities, which were soon recognized, for their application in the manufacture of containers for foodstuffs of all kinds. As a consequence, metallic utensils of almost every shape and description may now be obtained on the market at a cost which in some instances seems remarkably low, when the construction of the well-made pail or can is considered.

At an early period it was discovered that certain of the then known metals were less subject to deterioration through the action of atmospheric oxygen, liquids, etc., than others. Chief among these was tin. Its brilliancy, malleability, and particularly the slowness with which it was attacked by the air and other external agents, together with its price as compared with other metals possessing these properties, rendered it especially adaptable to the manufacture of culinary articles and receptacles for foodstuffs. Utensils of brass, copper, and iron were therefore frequently tinned on the interior in order to protect them, the process consisting merely in melting a mixture of resin and tin in the previously scrubbed and brightened vessel, and then by means of rags or tow quickly wiping a thin layer of the molten metal over the heated inner surface. It is stated that a skilled workman by this process could apply a uniform coating so thin that 1 square inch of the thoroughly tinned surface was found to contain only 0.15 of a grain of tin.

The modern process of manufacturing tin plate was invented in Bohemia about the year 1620. Tin plate was first made in England about one hundred years later, and its manufacture was started, but not successfully, in the United States in 1872–73. It was not until 1892, however, that the industry was established in this country.

In 1810 Appert published his work on canning, and about the same time Durrand secured an English patent covering a process for "the preservation of fruits, vegetables, and meats in hermetically sealed containers of tin, glass, pottery, or other fit material." With the discovery of this new method of preserving foods, which has now become essentially American, the tin-plate industry received an impetus which caused the yearly production to increase enormously, until at the present time thousands of tons of plate are produced annually, of which a large proportion is used in the manufacture of containers for foodstuffs, a not inconsiderable quantity entering into the manufacture of containers for the storage and commercial distribution of fats and oils.

Various countries have enacted laws requiring that tin plate for the manufacture of food containers must be prepared from tin of the best quality and that the method of tinning be such as to yield a surface as free as possible from so-called "pin holes," scratches, and other imperfections. Even when the greatest precautions are observed in the manufacture of the plate, however, imperceptible abrasions or imperfections are at times found, these being indicated later by corrosion of the metal at the point where the coating is imperfect and discoloration of the product at this point, or in certain instances through the discoloration of the entire contents of the receptacle. An ingenious method for the demonstration of such "pin holes" or abrasions in plate of this character has been described by Walker.[a]

In 1837 a process for covering iron with a coating of zinc—so-called "galvanized iron"—was patented by Crawford, the object being, as in the tin plate, to protect the readily oxidized iron base from deterioration. The claim was made that zinc in this respect acted even more perfectly than tin, which is electro-negative to iron; and this, together with the reduced cost of the plate as compared with tin, caused many manufacturers to use it instead of tin plate in the manufacture of vessels intended for use as containers of foods. In the case of tin plate the protection is perfect only provided the surface of the iron is completely covered, for imperfections and damage to the tin covering cause the action on the iron to proceed more rapidly than if the tin were absent, while with a zinc coating the zinc, being electro-positive to iron, would alone suffer corrosion as long

[a] The Journal of Industrial and Engineering Chemistry, vol. 1, No. 5, p. 295. Easton, Pa.

as any of it remains. The process of galvanizing is generally not, as its name tends to imply, an electric one, but is carried in a manner similar to that employed in the manufacture of tin plate, the annealed iron base being covered by dipping, rolling, etc., yielding a coating of zinc instead of tin.

The bright surface of the zinc coating soon becomes covered with a thin layer of zinc oxid, which is highly resistant to air and water, and, if subject only to their influences in the pure state, is extremely durable. However, imperfections in the coating, impurities in the zinc, or the presence of acids or alkalies, even though in small amounts, in substances with which the metal comes in contact, hasten corrosion. In the case of galvanized iron, therefore, the deterioration of the coating is hastened by the presence of even the weaker vegetable or flesh acids.

The "spelter" used in the galvanizing process may contain small amounts of lead, and it has been stated that in some instances tin and lead are added in small quantities, that the formation of the crystalline structure of the coating may be accentuated. It is probable that any agent which would serve to dissolve the zinc would act in a similar manner on metallic impurities, such as lead, etc., with which the zinc might be contaminated.

THE CONTAMINATION OF FATS AND OILS BY METAL CONTAINERS.

With the adaptation of pails made of metal to the permanent storage of fats, the question naturally arose as to the possibility of the absorption of metals by the fats so stored. That fats and oils possess the quality of holding in solution small quantities of metallic soaps has long been recognized. In some of the "boiled oils" of commerce their presence as a result of treatment during the process of manufacture is so uniformly constant that they are regarded as normal constituents of the oil, while in other cases they are added to the oil by the refiners to meet the requirements of the trade. In view of the solubility of metallic soaps in fats and oils and the known fact that fatty acids react with metals to form such soaps, it is reasonable to suppose that edible oils and fats, containing more or less free fatty acid, will act on metallic containers and that the resulting metallic soap may dissolve in the fat.

In those fats and oils which at ordinary temperatures remain in a more or less solid condition the products of the action between the fat and the metallic surfaces exposed would naturally be confined to that portion of the fat or oil in intimate contact with the container or to a zone immediately adjacent to it. Provided the surrounding temperature does not rise sufficiently to cause melting, diffusion of the metal throughout the mass would be retarded, and the greater portion of the fat would therefore be free from metallic contamination.

REVIEW OF LITERATURE.

A search of the literature shows that while considerable work has been done concerning the action on metals of fatty oils used in conjunction with mineral oil as lubricants, comparatively little mention is made of the action of the edible fats and oils on metals with the view of determining the suitability of such metals as containers.

Redwood [a] in an investigation of this question concludes that the chemical examination of the oils after exposure appears to afford a most valuable guide in determining what metal is best adapted for the construction of storage tanks for the different oils used as lubricants, as in some cases a protective covering is formed by a fatty acid salt of the metal, which, being insoluble or difficultly soluble in the oil and adhering closely, prevents general absorption of the metal by the oil. In his results the percentage loss of the metal due to the action of the oil is given. The extent of surface exposed and the acidities of the oils employed are not considered.

Volney [b] investigated the effect of some of the vegetable and animal oils on brass with a view of determining their relative value as lubricants and as protectors of metals. He found that neat's-foot oil, crude cotton-seed oil, and lard oil all acted on the brass to a greater or less extent, but as he failed to record the acidity of the oils his figures are applicable only to the particular oils used in his tests.

Watson [c] in a paper "On the Action of Various Fatty Oils Upon Copper" finds that of the vegetable oils castor oil has the least action, while linseed oil has the greatest. The acidities of the oils used is not mentioned, and the results therefore apply only to the particular oils employed in his experiments. The loss of metal per unit area of metallic surface exposed is given.

Thompson [d] conducted a series of extended experiments on the action of different fatty oils upon strips of metallic copper, some fully immersed in, others ony half covered by the fat. He bases his conclusions as to the action of the oils on the relative proportion of copper dissolved by the oil and the appearance of the strip. The actual acidities of the oils employed was not determined, only a relative acidity of a watery extract of the oil being secured. It is interesting to note that whale oil, a sample of which was used by this investigator, did not dissolve even a trace of the metal. In this sample the oil through oxidation was solidified to about one-third of its depth from the surface.

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[a] Journal of the Society of Chemical Industry, vol. 5, p. 363. London, 1886.
[b] The Analyst, vol. 8, p. 68. London.
[c] The Chemical News, vol. 36, p. 200. London.
[d] Ibid., vol. 34, pp. 176, 200, 213.

Engler[a] referred to the feature of acidity as applied to the action of mineral oils, maintaining that metals are attacked by petroleum only under the joint influence of air or oxygen when acid compounds are formed, and shows that petroleum which has been freed from acid by washing with caustic alkali and then further purified by distillation in an atmosphere of carbon dioxid has no solvent action upon the metals.

Donath,[b] in an article on the action of lubricating fatty oils on metals, states that in his opinion neutral fats and fatty acids have no direct chemical action on metals, the action taking place between the oxid of the metal and the free fatty acid in the fat, the formation of the oxid being influenced by the presence of air and moisture with the fatty acid acting as a predisposing agent promoting more rapid and energetic oxidation.

INSIDE COATINGS AND PROTECTIVE COVERINGS.

Some of the factors which may in one way or another influence the extent of deterioration of metals when acted upon by fats have been already referred to, but other factors remain to be considered, and in this connection it will not be amiss to discuss briefly another phase of this question. In recent years the subject of corrosion has been extensively investigated along scientific lines, and descriptions of these investigations are to be found freely scattered throughout the literature.

In these investigations the protection afforded by the application of a coating or insulation, if the term may be used, to the surface of the metal has been the basis of many of the articles written. In so far as it applies to metallic containers, the protective covering has usually consisted of a thin film of varnish or lacquer applied to the inner surface. If this coating remains impervious to the contents of the container, the corrosive action is of course prevented.

While the work already published on this subject has been directed more particularly to the so-called "inside coating" for cans intended for the preservation of fruit and vegetables, the conditions obtaining would in a limited sense apply equally as well to containers used as receptacles for fats and oils, especially in certain instances, as, for example, butter and oleomargarin, in which the materials necessary to the formation of a voltaic cell are to be found. In a recent article Walker and Lewis[c] show that these inside coatings, under conditions favorable to the setting up of an electric current, accelerate instead of retard the corrosive action by the absorption and removal of the

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[a] The Chemical News, vol. 41, p. 284.

[b] Dingler's Polytechnisches Journal, Band 294, pp. 186–187. Stuttgart.

[c] The Journal of Industrial and Engineering Chemistry, vol. 1, No. 2. Easton, Pa., 1909.

thin film of depolarizing hydrogen which, evolved by this electrolytic action, in a degree protects the metal when no depolarizing agent is present. These investigators were unable to find a lacquer which was nonporous and nonabsorptive, or at least one which, when subjected to the various processes necessary to the construction of the container, was not rendered permeable through the destruction in some manner of its continuity of surface. By the addition of paraffin to the lacquer, they demonstrated that the resistance of the latter could be enormously increased, thereby practically elminating the corrosive action; but they found this procedure made the lacquer so brittle as to render its use in a practical way out of the question. In the application of these coatings as protective agents to containers in which fats and oils are to be stored, the soluble action of the oil, in conjunction with the softening effect produced by the oil, causing disintegration of the film and consequent exposure of the metal, compels consideration. The ready solubility of paraffin in fats and oils has been demonstrated, and the protection afforded by its use would therefore be but temporary.

The specifications for tinned butter as promulgated in the schedule of supplies for the United States Navy, in referring to the tin plate to be used and the method to be adopted for the construction of containers for butter, specify "prime coked tin plate, weighing 90 pounds box of 112 sheets 14 by 20 inches in size," to be used, the "outside tins, tops, bottoms, and sides to be lacquered but under no circumstances to be lacquered on inside."

The use of a parchment paper lining on the interior surface of the container was suggested as a protective agent. Tests conducted along this line in which galvanized-iron receptacles were used showed a diminution in the amount of metal absorbed by the fat as compared with the amount taken up when no such protective covering was used. The action, however, was sufficiently pronounced to demonstrate the inadequacy of parchment paper as a protective agent.

EXPERIMENTAL WORK.

In the experimental work carried out by the writer, which extended over a period of several months, the method of procedure was necessarily subjected to some variations. The investigation as originally planned was intended to apply only to the action of fats upon galvanized iron. As the investigation proceeded, however, it was considered advisable to extend the scope of the work to embrace vessels made of tin plate, and later the possibility of the presence of other metals as impurities through the use of lead solder, imperfections in the coating, or the use of other metallic utensils was recognized. In view of this a study of the action taking place between metals which might be present, as above indicated, and some of the more important edible fats and oils was considered essential.

When the tests here recorded were inaugurated copper, tin, lead, and zinc were the only metals immediately available in reasonably pure condition. At a later period, however, sheets of aluminum and iron were secured and they were also included. The iron sheet was obtained by treating tin plate with acid until the last traces of tin were removed. The iron thus represented, to an extent, the commercial product, an analysis showing only traces of impurities. In order, however, that this metal in a condition of extremely high purity might be included in the work, a sample of electrolytic iron was obtained through the courtesy of Dr. C. F. Burgess, of Wisconsin State University, to whom the writer desires to express his sincere appreciation. Early in the investigation it was noted that the degree of acidity of the fat or oil under investigation seemed to play an important rôle, while the influence of temperature and atmospheric oxygen or the presence of moisture or salt were factors which could not be neglected.

METHODS USED IN THE INVESTIGATION.

METHODS OF APPLYING THE FAT.

The method of applying the fat as first adopted consisted in placing 100 grams of the fat in each of several small cylindrical cups 6.25 centimeters in height, with a diameter of 7.5 centimeters. Some of these containers were made of galvanized iron and others of tin plate, a few of the latter being covered on the inner surface with a coating of ordinary solder. Owing to the lack of machinery for the proper construction of these containers, but chiefly because of the difficulties attendant upon the removal of the contents without the danger of introducing some of the metal mechanically, and in order also that the successive changes which might occur could be more readily observed and determined, the following method of procedure was substituted:

Twenty-five grams of the fat or oil of known acidity, which had been previously ascertained by titration of a small portion in hot alcohol solution with tenth normal sodium hydroxid, using phenolphthalein as the indicator, were introduced into a small wide-mouthed glass bottle of approximately 35 grams capacity. Fats solid at ordinary temperatures were heated sufficiently to render them fluid before being placed in the bottle. The metal in the form of a thin sheet 2.5 centimeters square, affording a surface of about 12.5 square centimeters, after having been thoroughly cleaned, washed with warm ether, dried, and carefully weighed, was bent in the shape of a dihedral angle of about 45 degrees and completely immersed in the fat with its edges resting on the bottom of the bottle. This receptacle with its contents was then allowed to remain at room temperature or was placed in a box maintained at a temperature of 37° C. When desired, an examination as to the action could readily be made by observing any physical change in either the fat or the metal. By removing the strip of metal, allowing the superfluous fat to drain (solid fats being previously melted), washing the strip with warm ether, drying, and weighing, it was possible to secure exact information as to the progress of the action between the fat and the metal. If the test was to be continued the metal was replaced in the fat and the above procedure repeated at the expiration of the desired period.

METHOD OF EXAMINING THE FAT.

Fresenius and Schattenfroh[a] have shown that three methods may be employed in obtaining, for its quantitative estimation, the metal which may be present in solution in an oil, namely: (1) A simple extraction of the oil by agitation with dilute acid and the subsequent determination of the metal in this aqueous solution of its salt; (2) solution of the oil in ether followed by a precipitation of the metal from the ethereal solution by means of a suitable precipitant; (3) combustion of the oil and estimation of the metal in the residual ash. The first method, which, as a check, was the one used in this investigation in all cases except in the estimation of tin, was found to yield the best general results and to be readily and rapidly executed. In the examination of the fat it is, when necessary, melted and separated from the metal by pouring off, allowing the last portions retained by the strip to drain. The strip is then washed with warm ether, and any adhering incrustation or deposit carefully removed by means of a pledget of cotton. The washings and cotton are then added to the main portion, and the whole is transferred by means of ether to a separatory funnel containing dilute mineral acid,[b] where it is vigorously agitated. The acidulated water extract containing the large part of the metal, if present, is then removed, and the residual ether layer, in order to remove any retained metal, is well washed by shaking with several portions of water, the washings being added to the first portion containing the bulk of the metal. The resulting solution is evaporated to dryness in a platinum dish, then taken up with acidulated water, the solution filtered, and the metals are estimated by a suitable method. Tin was found to be extracted from the fat with great difficulty by the above process, only a small proportion being removed by agitation with acid, and on attempting to wash the ether layer a separation in the form of a white powder occurred with the coincident formation of an obstinate emul-

[a] Zeitschrift für Analytische Chemie, Band 34, p. 382. Wiesbaden, 1895.

[b] Dilute hydrochloric acid, 10 per cent, was used in most cases. In the case of lead, however, dilute nitric acid, 10 per cent, was employed.

sion, which was only broken down by filtration. Only traces of the tin, however, were found in the filtrate, a large proportion remaining in the filter and a small amount being still retained by the ether layer. In the case of tin, therefore, the fusion method was substituted, the fat being ignited with a mixture of sodium carbonate and potassium nitrate until thoroughly oxidized, the tin then being estimated in the fused mass.

METHOD OF ESTIMATING METALS.

In the estimation of the metals in the solutions obtained by the extraction of the fat the method employed depended upon the amount of metal present as indicated by the extent of loss of the metallic strips. If considerable action was shown, gravimetric methods were used, while colorimetric or volumetric methods were applied to solutions in which the presence of only a small amount of the metal was indicated. The methods employed follow:

Zinc.—Gravimetric method. The acid solution containing the metal is rendered faintly alkaline with ammonia, then 1 cubic centimeter of acetic acid is added and hydrogen sulphid gas conducted into the heated solution. The precipitated zinc sulphid is collected on a small ashless filter, washed with hot water, and incinerated, first, at redness and then at white heat in a platinum crucible, the residue being weighed as zinc oxid. This result is then calculated to zinc.

Iron.—Colorimetric method. The sulphocyanid method, as described in Sutton's Volumetric Analysis, 1904, p. 227.

Lead.—Gravimetric method, described in Treadwell and Hall's Analytical Chemistry, vol. 2, p. 138.

Copper.—Colorimetric method. Ammoniacal solution of copper. See Sutton's Volumetric Analysis, 1904, p. 199.

Tin.—Gravimetric method. By precipitation as tin sulphid and conversion into stannic oxid, from which tin is calculated.

In the colorimetric and volumetric estimation of the metals standard stock solutions for comparison were made by dissolving 0.5 gram of the metal in the acid employed and diluting the resulting solution to 500 cubic centimeters. The stock solutions were further diluted when necessary for comparison with solutions containing minimal amounts of metal.

EXPERIMENT I.

In Experiment I the method of applying the fat in which it was placed in containers was employed. The following fats were used:

Lard A.—Neutral lard, to which oleic acid was added to increase the acidity to 13.5 per cent.

Lard B.—Rancid lard, with an acidity of 0.7 per cent calculated as oleic acid.

Lard C.—Neutral lard, to which oleic acid was added to bring the acidity to 12.7 per cent.

Lard D.—Commercial kettle-rendered lard.

Compounds.—Commercial products, consisting of mixtures of cotton-seed oil and oleo stearin.

Oleo stock.—Rendered beef fat, the source of oleo oil and oleo stearin.

The results secured are recorded in the following table:

TABLE 1.—*Effect of certain edible fats and mixtures of fats upon metallic containers.*

Fat.	Container.	Acidity.	Time of exposure.	Temperature.	Appearance of container.	Examination of fat.
		P. ct.		°*C.*		
Lard A	Galvanized iron.	13.5	6 weeks	22	Apparent selective action shown. Thin white film of combined zinc and fatty acid at surface line.	Zinc found in considerable quantities in portion next to container. No zinc found in central area. Melted fat, brownish, yellowish white, flaky deposit combined zinc and fatty acid.[a]
Lard B	Galvanized iron.	.7	6 weeks	22	Similar to that of Lard A. White film above and below surface line.	No zinc found in central area. Zinc in considerable amount in portion next to container.
Lard D	Galvanized iron.	.5	48 hours	22	Not noted	Zinc 0.005 per cent present.
Compound	Galvanized iron.	.3	6 weeks	22	No apparent effect	No evidence of metallic contamination.[b]
Compound	Galvanized iron.	.7	2 weeks	22	Thin white film over areas corresponding to points of contact with fat. This film proved to be a combination of zinc with a fatty acid.	Fat and film remaining on sides of container after main part of fat was removed contained 0.043 per cent zinc. No zinc in central area of fat container.
Compound	Galvanized iron.	.11	4 weeks	25	Apparently little change. No film noticeable.	Fat remaining on sides of container after removal of main part of contents contained 0.052 per cent zinc. No zinc found in central area.
Oleo stock	Galvanized iron.	1.30	4-5 days	30	Not noted	A small amount of water and salt present, which separated on heating the fat. Water portion contained 0.02 per cent zinc. Filtered fat contained 0.0015 per cent zinc.
Oleo stock	Galvanized iron.	1.0	4-5 days	30	do	Contained 0.004 per cent zinc.
Oleo stock	Galvanized iron.	(c)	4-5 days	30	do	Samples taken from fat next to sides and bottom of container each contained 0.002 per cent zinc.
Lard B	Tin, solder-lined.	.7	6 weeks	22	Few darkened areas on bottom; otherwise no effect apparent.	A portion from areas adjacent to surface of container showed traces of lead.
Lard C	Solder	12.7	6 weeks	22	Dark line around container at surface level of fat. Few darkened areas on sides below line. No film apparent.	No trace of contamination by metal in central portion, but in portions adjacent to container surfaces lead in traces was found.

[a] When the amounts of metal found are not indicated, qualitative results only were obtained.

[b] Only small amounts of the fat were taken for examination, which may account for the negative results obtained, for in similar experiments conducted on a much larger scale at a later period, no difficulty was experienced in demonstrating the presence of metal in the fat.

[c] Not noted.

TABLE 1.—*Effect of certain edible fats and mixtures of fats upon metallic containers*—Continued.

Fat.	Container.	Acidity.	Time of exposure.	Temperature.	Appearance of container.	Examination of fat.
		P. ct.		*°C.*		
Compound.	Solder	0.3	6 weeks	22	No apparent effect	No apparent effect.
Lard B	Solder	.7	6 weeks	37	Few darkened areas of irregular shape on exposed surface of metal. No film seen.	Greenish-yellow color and contained small amounts of lead.
Lard C	Solder	12.7	6 weeks	37	Thin white film just above surface level of fat, darkened in places.	Fat had acquired a greenish-yellow color; 0.13 per cent lead found.
Compound.	Tin, solder lined.	.3	6 weeks	37	No apparent effect	No metals found.
Lard A	Tin plate	13.5	6 weeks	37	Faint line noticed at surface level; no other apparent effect.	Trace of tin found.
Lard B	Tin plate	.7	6 weeks	37	No apparent effect	Slight trace of tin found.
Compound.	Tin plate	.3	6 weeks	37	do	No metals found.
Lard A	Galvanized iron.	13.5	6 weeks	37	Exposed surfaces largely covered with white film, and a dark line plainly noticeable at surface level. White film firmly adherent. Consisted of combined zinc and fatty acid.	Fat separated into liquid and solid portion. Traces of zinc found in liquid portion, and in solid portion adjacent to surfaces of container 0.23 per cent zinc found.
Lard B	Galvanized iron.	.7	6 weeks	37	No film on surfaces of container; surfaces exposed to fat show increased brilliancy and structure more clearly defined, as though selective action had taken place.	Fat also separated into solid and liquid portions. In this case the solid portion was collected only on bottom surface. It contained 0.18 per cent zinc. The fluid portion contained only traces of zinc.
Compound.	Galvanized iron.	.3	6 weeks	37	No apparent effect	Only traces of zinc found.

EXPERIMENT II.

In this experiment the fats, in order to insure purity, were examined for metals and then placed in small bottles in contact with the small strip of metal, 2.5 centimeters square, as described previously. The results secured are to be found in the following table:

TABLE 2.—*Results of the action of certain fats and oils upon metals.*

[Time of exposure, six weeks; temperature, 37° C.]

Metal.	Fat.	Acidity.	Loss of metal.[a]	Results.		
				Acidity of fat.	Appearance of fat.	Appearance of metal.
		P. ct.	*Mg.*	*P. ct.*		
Zinc	Lard	0.28	12.78	0.48	No apparent change	Bright; no visible effect.
Do	Oleo oil	1.69	3.48	1.63	White particles in suspension in fat; color unchanged.	White film on surface in places or hanging from metal. Surface is bright under the film.
Do	Corn oil	2.96	275.90	2.08	No apparent change	Heavy deposit on metal and on bottom of bottle.
Do	Corn oil[b]	.50	179.12	0.48	Slightly bleached; no other change.	No apparent change.
Do	Cotton-seed oil	.06	None.	0.08	No change	Do.

[a] Loss of metal in milligrams per 100 square centimeters of exposed surface.

[b] This corn oil was obtained by reducing the acidity of the highly acid corn oil used in the other tests. The latter was agitated with a solution of sodium carbonate and was then purified by separation and washing of the oily layer with water until free from traces of alkali. It was finally freed from moisture by filtration through several layers of filter paper.

TABLE 2.—*Results of the action of certain fats and oils upon metals*—Continued.

Metal.	Fat.	Acidity.	Loss of metal.	Results.		
				Acidity of fat.	Appearance of fat.	Appearance of metal.
		P. ct.	*Mg.*	*P. ct.*		
Zinc	Cotton-seed oil[a]	0.85	None.	2.31	No change noticed	No change.
Do	Butter[b]	.56	57.35	1.74	No change apparent	Metal bright; no change.
Do	Butter fat[c]	.39	None.	0.56	....do	Do.
Do	Oleomargarin[d]	.90	3.10	0.90	....do	Thin white film on surface of metal.
Tin	Lard	.28	1.55	0.51	No effect noticeable	Bright; no change.
Do	Oleo oil	1.69	None.	1.66	do	Do.
Do	Corn oil	2.96	None.	3.00	....do	Do.
Do	Corn oil[e]	.50	None.	0.59	....do	Do.
Do	Cotton-seed oil	.06	None.	0.08	....do	Do.
Do	Cotton-seed oil[a]	.85	None.	1.80	....do	Do.
Do	Butter[b]	.56	1.93	1.74	....do	Do.
Do	Butter fat[c]	.39	None.	.56	....do	Do.
Do	Oleomargarin[d]	.90	None.	(f)	....do	Do.
Lead	Lard	.28	14.72	.51	No change except small amount of white deposit.	Small white masses of substance adhering to metal; removed by ether and cotton with difficulty.
Do	Oleo oil	1.69	17.05	1.61	Small amount; white deposit.	White deposit on metal; removed by ether and cotton.
Do	Corn oil	2.96	611.47	2.48	Oil bleached; somewhat heavy deposit.	Lead corroded very badly, especially along all four edges.
Do	Corn oil[e]	.50	723.07	1.54	White flakes present in suspension in the oil, which is bleached nearly colorless.	Lead corroded and white flakes on surface; difficultly removable with ether and cotton.
Do	Cotton-seed oil	.06	None.	.08	No apparent change	No change.
Do	Cotton-seed oil.[a]	.85	4.65	2.25	Color of oil bleached	Do.
Do	Butter[b]	.56	251.87	1.52	Heavy white deposit in suspension and thrown down.	Heavy deposit on surface of metal.
Do	Butter fat[c]	.39	462.67	.79	Color bleached; heavy white deposit in oil.	White deposit on surface of metal.
Do	Oleomargarin[d]	......	13.17	(f)	No apparent change	No change apparent.
Copper	Lard	.28	12.78	.39	No appreciable change	No change noticeable.
Do	Oleo oil	1.69	17.43	1.24	No apparent change; color may be faintly darker.	Surface entirely covered with bright emerald-green coating, which, when removed by aid of cotton and ether, leaves bright metal.
Do	Corn oil	2.96	19.37	1.35	No noticeable effect	Bright; no visible change.
Do	Corn oil[e]	.50	2.32	.11	Oil is slightly bleached	Metal bright.
Do	Cotton-seed oil.	.06	None.	.23	No effect	Bright surface.
Do	Cotton-seed oil[a]	.85	.38	1.69	No change	No change.
Do	Butter[b]	.56	77.50	1.33	Green at surface near copper and at bottom.	Green deposit on parts of surface. When washed off the metal underneath looks like Cu_2O.
Do	Butter fat[c]	.39	6.2	.56	Color greenish and apparently bleached a little.	Copper dulled on one side. Lower side bright.
Do	Oleomargarin[d]	.90	7.75	(f)	No change	Green at bottom; surface stained.
Iron (commercial).	Butter[b]	.56	8.52	1.74	Color slightly darker.	Corroded badly, especially edges, red oxid, very difficult to remove this.
Do	Butter fat	.39	None.	.56	Few flakes, reddish in suspension.	Few flakes of red brown shown on surface of metal.
Do	Oleomargarin[d]	.90	4.65	(f)	No apparent effect	Few places showing corrosive action, may be little darker.
Aluminum.	Butter[b]	.56	None.	1.74	....do	No apparent effect.
Do	Butter fat[c]	.39	None.	.56	....do	Do.
Do	Oleomargarin.	.90	None.	(f)	....do	Do.

[a] This cotton-seed oil was secured from a supply that had been on the laboratory shelves for about a year and was decidedly rancid.

[b] and [d] The butter and oleomargarin used were secured on the market and represented the fresh commercial products. The tests here recorded were made at room temperature (23.5° C.), in order to avoid separation of the ingredients.

[c] Secured from whole butter, as referred to in [b], by separation and filtration of the melted fat from the accompanying casein and water.

[e] This corn oil was obtained by reducing the acidity of the highly acid corn oil used in the other tests. The latter was agitated with a solution of sodium carbonate and was then purified by separation and washing of the oily layer with water until free from traces of alkali. It was finally freed from moisture by filtration through several layers of filter paper.

[f] Not noted.

Experiment III.

The lard used in these tests was the same as that used in the tests recorded in the preceding table. Its acidity at the beginning of the experiment was 0.28 per cent and at the end of the six weeks' period 0.73 per cent. The investigation was conducted at room temperature (23 to 24° C.). The results will be found recorded in the table below.

The submerged metal consisted of a sheet 2.5 centimeters square. The metal one-half submerged was a strip 10 centimeters long and 1.25 centimeters wide, bent in the form of a semicircle and placed in a flat dish. The melted fat was then added until its surface corresponded with a line on the strip 6.25 millimeters from the lower edge, thereby exposing one half of the surface of the metal to the fat, the other half being exposed to the air.

Table 3.—*Effect of atmospheric air on the action of fat on metals.*

Condition.	Loss in milligrams per 100 square centimeters surface exposed.			
	Zinc.	Tin.	Lead.	Copper.
Metal entirely submerged	1.93	0.77	2.32	4.65
Metal one-half submerged	3.10	.38	5.42	5.42

EXPERIMENTS TO TEST THE ACTION OF OLEIC ACID ON METALS.

As indicated by the results already recorded, the action of the fats was apparently influenced to some extent by their degree of acidity. In view of this a study of this feature of the investigation was considered desirable, and oleic acid as a representative fatty acid was selected. The results obtained have led us to believe that some interesting data may be secured through a more extended research along these lines, and it is our purpose to apply other fatty acids in a future investigation of this subject. The oleic acid used in these tests was the commercial C. P. product and was not subjected to further purification.

One gram of the acid required 35.3 c. c. of tenth normal sodium-hydrate solution to render it neutral to phenolphthalein. Mineral acids were found to be absent, and an examination of an acidulated water extract of the fat acid in the manner previously described in this paper gave no evidence of the presence of metals, nor was any trace of tin found by examination of a fused portion.

The following tests of the action between the fatty acid and the metals were conducted.

Experiment IV.

The metals in the form of strips, as previously described, were completely immersed in the acid. Contact was maintained for a period of five days, when they were removed, washed, and weighed. They were then replaced in the same fatty acid and the above procedure repeated at five-day intervals up to five periods. The temperature during exposure was 37° C., and the amount of oleic acid employed was 20 grams in each case. The results obtained are recorded below.

TABLE 4.—*Effect of oleic acid upon certain metals.*

Metal.	Weight in grams.		Percentage loss of metal.	Loss of metal in mgs. per 100 sq. cm.
	Start.	End.		
Zinc	2.0806	2.0484	1.54	257.6
Copper	.3753	.3688	1.73	52.0
Tin	.1055	.5475	48.10	406.0
Lead	.2227	.0926	58.42	1,040.8
Aluminum	.8688	.8688	.00	.0
Iron (commercial)	.8678	.8676	.02	1.6
Iron (electrolytic)	1.23035	1.22947	.07	7.0

Metal.	Actual loss of metal (5-day periods).					Appearance of acid.	Appearance of metal.
	1st.	2d.	3d.	4th.	5th.		
	Mgs.	*Mgs.*	*Mgs.*	*Mgs.*	*Mgs.*		
Zinc	4.9	5.4	8.4	5.4	8.1	Bits of film in suspension and deposited.	Covered with film removed by ether and cotton; metal bright.
Copper	2.1	.9	1.3	1.0	1.2	Greenish-blue color; no cloudiness.	Metal bright.
Tin	.7	5.9	11.4	11.5	21.2	Remained clear	Metal perforated, but bright.
Lead	53.2	6.5	35.2	14.1	21.0	Heavy white deposit.	White deposit removed by ether.
Aluminum	.0	.0	.0	.0	.0	No change	No change.
Iron (commercial)	.1	.05	.05	.0	.0	do	Do.
Iron (electrolytic)	.8	.05	.03			do	Do.

Experiment V.

In this and the following tests the metal was in a finely divided condition instead of being cut into strips. Experiment V shows the influence of temperature.

Amount of oleic acid taken — 5 grams.
Weight of metals — 1 gram.
Time of exposure — 45 hours.

Loss of metal, in milligrams:

	At room temperature (20–21° C.).	At 37° C.
Zinc	41.4	75.1
Tin	7.3	7.5

Experiment VI.

This experiment also shows the influence of temperature.

Amount of oleic acid taken .... 5 grams.
Weight of metals .... 1 gram.
Time of exposure .... 5 days.

Loss of metal, in milligrams:

	At room temperature (20–21° C.).	At 37° C.
Copper	11.6	10.4
Lead	4.1	31.9

Experiment VII.

This experiment shows the influence exerted by change in ratio between acid and metal. Time of exposure, five days. Temperature, 37° C.

(*a*) Oleic acid taken .... 2 grams
Weight of lead .... 1.36 grams
Loss, in milligrams 97.5

(*b*) Oleic acid taken .... 5 grams
Weight of lead .... 1 gram
Loss, in millimeters 28.9

In view of the results obtained in the last test, it was thought advisable to make some further investigation along the same lines. Accordingly, the following tests were carried out:

Experiment VIII.

Test 1. Amount of oleic acid variable, with weight of lead filings constant.

(*a*) Oleic acid .... 1 gram
Lead .... 1 gram
Loss, in milligrams 79.1

(*b*) Oleic acid .... 2 grams
Lead .... 1 gram
Loss, in milligrams 82.9

(*c*) Oleic acid .... 3 grams
Lead .... 1 gram
Loss, in milligrams 51.7

(*d*) Oleic acid .... 4 grams
Lead .... 1 gram
Loss, in milligrams 26.2

(*e*) Oleic acid .... 5 grams
Lead .... 1 gram
Loss, in milligrams .... [a] 11.4

[a] The finely divided lead used in this experiment was from the same source as that used in Experiment VII. It was cut at a different time, however, and this may account for the slight difference in results as shown in *b* of the latter and in test 1, *e*, of the former.

Test 2. Weight of lead variable, with amount of oleic acid constant.

(*a*)	Oleic acid	1.0 gram	
	Lead	.3 gram	
	Loss, in milligrams		49.8
(*b*)	Oleic acid	1.0 gram	
	Lead	.6 gram	
	Loss, in milligrams		121.1
(*c*)	Oleic acid	1.0 gram	
	Lead	1.5 grams	
	Loss, in milligrams		130.8

Test 3. Weight of lead variable, with amount of oleic acid constant.

(*a*)	Oleic acid	3.0 grams	
	Lead	.3 gram	
	Loss, in milligrams		27.6
(*b*)	Oleic acid	3.0 grams	
	Lead	.6 gram	
	Loss, in milligrams		44.4
(*c*)	Oleic acid	3.0 grams	
	Lead	1.5 grams	
	Loss, in milligrams		119.0

SUMMARY.

While the scope of this investigation is not as extensive as would have been the case had the writer foreseen the various situations which were presented during its course, nevertheless it is hoped that the results have brought out a few features which may prove of general interest. A more complete study of the various factors which apparently have such an important bearing on the activity of the fats and oils toward metals is contemplated, with the view of securing further information which may prove of practical and scientific value.

In the enumeration of the principal points brought out in the experimental work, the factor which seems to play the most active part is to all appearances that presented by the degree of acidity of the fat. In the main it may be stated that with an increase in the free fatty-acid content of a fat or oil its solvent action toward metals is accelerated, and when other conditions such as heat, moisture, and exposure to atmosphere are presented at the same time this action is further stimulated. While this seems to hold true in the majority of the tests conducted, nevertheless exceptions may be noted, as, for example, in the action of cotton-seed oil (*a*) as recorded in Table II. This oil possessed a somewhat high acid value when first placed in contact with the metals, which was increased threefold during the course of exposure, and yet when compared with the corn oils referred to in the same table, the acidity of which was either lower or approximately the same, a marked difference in the degree of activity is easily seen, the cotton-seed oil causing little or no effect on the metals exposed, whereas in case of the corn oils the metals, with one exception, were vigorously attacked. No attempt has yet been made to investigate this condition, but it suggests an interesting line of research in this direction. In this same table attention is called to the marked increase of solvent action exhibited toward lead by the two samples of corn oil, indicating the action of a distinctive fatty acid or an increase in oxygen-absorbing power of the oil as compared with the cotton-seed oil.

That an elevation of temperature markedly accelerates the action of the fats and oils upon metals in some instances is shown by the experiments. In cases where the metal was not so susceptible to the action of the fatty acid and the resultant small amount of metallic soap formed was soluble in the medium, no coating was formed to act as a protection against continued action, and in those instances the solvent power seemed not to be interfered with, such metals showing approximately the same losses at different temperatures. In other cases, however, the coating formed apparently assumed a protective rôle, and this protection, based on the insolubility of the soap, restricted the action of the solvent in a marked degree. Increase in temperature evidently renders the coating more soluble, as it was shown that metals upon which such a coating was readily formed were less resistant to action as the temperature was increased. It is our purpose to continue the study of this feature, as, in view of the marked differences in the solubility, color, action, etc., of these metallic soaps, the possibility was suggested of variations sufficiently distinctive being found to permit of their application in the differentiation of fats and oils or to the identification of certain of them when in admixture.

That the action of the fat or oil may be further increased by the oxygen of the air is apparently demonstrated by the activity of the oleic acid in Experiments VII and VIII. It will be noticed that in those instances in which the ratio between the metal and the acid was such as to afford a thicker layer of the latter, the action on the metal was markedly decreased. In Table 3, Experiment III, the metals also showed increased losses when only partially submerged in the fat, although these losses were not so well marked as in the case of oleic acid above mentioned. It is proposed to further investigate this subject under conditions which will, it is hoped, yield more decided information upon this point.

The present investigation indicates that the use of metallic containers in the fat and oil industry should be restricted so that only such metals as have been shown to be resistant to the action of the fatty acids formed in the usual preparation of such products should be allowed to enter into their composition. It has been demonstrated that zinc, copper, and lead are somewhat readily acted upon, while aluminum, iron, and tin, in the order in which they are named, have offered evidences of higher resisting power and are the metals which would more satisfactorily meet the requirements of both manufacturer and consumer.

ERADICATING CATTLE TICKS IN CALIFORNIA.

By William M. MacKellar, *Veterinary Inspector in Charge,*
AND
George H. Hart, *Assistant in Pathology and Bacteriology.*

CONDITIONS PRIOR TO COMMENCEMENT OF ERADICATION WORK.

The history of the Texas-fever cattle tick in California covers scores of years. On account of its dating back long before the tick was known to be in any way connected with Texas fever, and at a time when differentiation of infectious diseases of bovine animals was little understood, resulting in anthrax, blackleg, and Texas fever being confused with each other and all classed under the lay term of "murrain," there is no way of ascertaining the exact origin of the tick in this State.

The common wood tick and castor-bean tick are very numerous in parts of California and are found on the cattle and horses in great numbers at certain seasons of the year. It is natural, therefore, that the invasion of the country by the deadly fever ticks attracted but little attention for a long time after their appearance and until they had secured a firm foothold.

Pioneer cattlemen of the State have different views as to the source from which the fever ticks were introduced. Thus it is held by some that they were brought across the Rocky Mountains on feeder cattle shipped into this country from Texas. As Mexico, however, has probably been infested since the early conquests of the Spanish, it is most plausible to consider that California received her first Texas-fever ticks from cattle driven across the line from Lower California.

Until recent years the entire country was open range and movements of cattle were not controlled. The ticks, therefore, having been seeded in this country, and attracting no suspicion from cattlemen, had ample opportunity to spread and involve more of the southern section of the State. In every infested locality some one cattleman, who on account of having carried on the cattle business on a large scale involving the shipping in of cattle from other sections of this State and from other States, is accredited by his neighbors with the responsibility for bringing the ticks into that particular section.

When the Texas-fever quarantine line was first placed across the United States in 1891 as a result of investigations by Dr. D. E. Salmon, the State of California was not included in the quarantined area. In 1894 outbreaks of Texas fever in Nevada, Kansas, and Missouri were reported as apparently caused by cattle originating in California. On account of these outbreaks of disease Mr. W. E. Hill, an inspector of the Bureau of Animal Industry, was directed to proceed to California and make an investigation. His investigation revealed that a large part of this State was permanently infested with Texas-fever ticks, and that great numbers of cattle had died of the disease in this State. The limits of the infested area not having been definitely determined, the entire State was subsequently placed below the federal quarantine line. Further investigation, however, having shown that the northern part of the State was free of ticks, the line was gradually moved south, so that in 1906 it crossed California at the northern limits of San Luis Obispo, Fresno, Madera, and San Bernardino counties, thus including the 13 southern counties of the State. All of the territory south of this line was not infested, on account of portions of the country being unfavorable to the propagation of the ticks. Although many of the counties in the quarantined territory had appointed live-stock inspectors, their duties involved attention to all infectious diseases, and movements of cattle within a county were without restriction. In this way all those sections favorable to the development of ticks became permanently ticky ranges, although in many instances they were separated by miles of mountainous desert, or extremely dry lands, where, on account of lack of feed, cattle could not remain the year round. Hence the ticks, even if well seeded on this land, failed to secure a permanent foothold.

Cattlemen learned, even before ticks were in any way connected with Texas fever, that certain ranges were dangerous for cattle, and thus in many instances after the loss of nonimmune cattle that had been placed on a ticky range this land was left free of cattle, and the starvation method of cleaning the land of ticks was thereby unconsciously accomplished. Thus areas within the State were constantly being cleaned, while others, on account of the early-day practice of driving a herd of cattle away from a range on which they were dying, became seeded. Such a condition of affairs existed when, in July, 1906, under the congressional appropriation for tick eradication, the Bureau of Animal Industry started the work of eradicating the ticks in California in cooperation with the State officials.

The work at first consisted in locating the ticky ranches and educating the owners of such land to the losses they were sustaining from the ticks and the benefits they would derive from eradicating them. This required careful and repeated inspections of all the cattle south of the quarantine line, and when completed showed San Luis

Obispo, Santa Barbara, San Diego, Orange, Fresno, and Ventura counties to be heavily infested, and Tulare, Kern, Kings, Los Angeles, Riverside, San Bernardino, and Madera counties to be infested to a lesser degree. These counties comprised 69,755 square miles of territory, and contained 660,027 head of cattle, of which 153,476 were on tick-infested ranges.

LOSSES FROM THE TICKS.

The loss to the cattle industry south of the quarantine line in California from ticks has been enormous. This has been especially the case in this State on account of the topography of the country. In all the quarantined counties there is high mountainous land, or dry land with very hot summers, where ticks do not thrive. As a result there was constantly being raised, even in some very ticky counties, thousands of head of cattle yearly that reached maturity without ever becoming infested with ticks, and hence were not immune to Texas fever. From adverse feed conditions, as cold in the mountains or drought in the dry lands, cattle would from time to time be brought to more favorable feeding places, usually along the coast, which in the majority of cases were tick infested, and almost immediately they would commence to die in wholesale numbers. The mountain cattleman called the disease "coast fever," and from bitter experience learned to leave their cattle in the mountains or dry lands during adverse years, sustaining more or less heavy losses from starvation, rather than bring them to the coast on good feed only to stand much heavier losses from Texas fever.

Also, in the driving of cattle to favorable feeding places 50 to 100 miles distant, they would frequently be driven through some valley in the mountains that was tick infested; and although perhaps only remaining there overnight, in a short time afterwards, when miles away from the ticky valley, the cattle would start to die, and losses of from 50 to 100 head in this manner were not uncommon.

With the breaking up of many of the large ranges in California the raising of cattle to the fattening stage early became cheaper in the more remote States, as Arizona, Utah, Nevada, New Mexico, and western Texas, which were free of ticks. Thus many feeders, all nonimmunes, were annually shipped from these States to California to be fattened on the native grasses. Such cattle, when brought to ticky ranges in this State, died in such large numbers that the practice, while very profitable in the absence of ticks, had to be abandoned in many localities. Single cattlemen have been known to lose an entire train load of such cattle in a short time.

Among the immune cattle raised on ticky ranges, toward the end of the dry season, when feed was poor and ticks were so numerous as to "shingle" the cattle, a yearly loss ranging from 3 to 10 per cent was sustained, while on all of these places since eradicating the ticks this loss is entirely obviated.

On the grossly infested ranges it was sometimes necessary for stock owners to get off their beef cattle before they were in prime condition, rather than keep them until later in the season, when, from the heavy infestation, they would fall off instead of gain.

In some of the quarantined counties the trading in cattle became so hazardous as to be almost abandoned, owners being afraid to buy or move stock on account of great losses sustained by neighbors on all sides from such a procedure.

In the counties where dairying is the main industry, the shrinkage in milk production among the grossly infested herds during the summer and fall, while hard to estimate accurately, would increase the economic loss from the ticks to a considerable extent.

A great saving to the railroads in car disinfection has also been accomplished, since a large part of the original area quarantined in the State has been released.

EARLY METHODS OF COMBATING GROSS INFESTATION.

Prior to the commencement of the eradication work many ranges containing fine feed were so heavily infested with ticks that raising and fattening cattle on them was a difficult problem. The cattlemen in many instances did not believe in the so-called tick theory of Texas fever, but they considered that from their enormous numbers the ticks were an injury on account of the parasitic existence they maintained on the cattle, which was constantly demonstrated by the large percentage of deaths among immunes during times when feed was short. It therefore was a general practice for ranchers in the summer and fall to resort to various methods to destroy the ticks. The time and labor expended in this procedure were great and their value slight and of a very temporary duration. On some of the ranches the range cattle were corraled, roped, and treated one at a time by hand, either by currying off the ticks or applying various solutions, as crude oil, coal-tar preparations, kerosene oil, or carbolic acid, which in all cases killed only a portion of the ticks and often injured the hides of the cattle more or less seriously. On the very large ranches, containing many thousand head, treating all the cattle individually was impossible, and after corraling a bunch only those most heavily infested were picked out for treatment. Even this absolutely ineffective method required weeks of labor.

In other cases, wild cattle would be crowded into chutes and sprayed through openings in the sides, by which method it was impossible to wet with the solution the parts of the animals where the ticks were most numerous. In the dairy herds spraying and swabbing were resorted to at irregular intervals. On some ranches chickens were accredited with assisting in retarding tick development by entering the corral and feeding on the adult ticks picked from the bodies of cattle in the recumbent position.

On one large grant of land comprising 17,000 acres along the ocean front, it was the custom to drive the cattle into the ocean and hold them against the bluffs where the waves could beat against them. This mechanical action of the waves had the effect of dislodging the large ticks, and they dropped into the ocean, where they perished. The measure, although very crude, was easy of accomplishment and resulted in some benefit.

Owners of some of the larger ranches in order to combat ticks built dipping vats. These they filled with water, on the surface of which a thin float of oil or distillate was placed, in some cases not over one-quarter to one-half inch thick. Cattle were rounded up and run through such vats when the ticks became too numerous, but the permanent good so derived was slight.

IMPORTANCE OF STATE LAW.

On account of actual tick-eradication work being in no way connected with the interstate movement of cattle, federal laws are inoperative with regard to cattle kept within a State. It is therefore essential that Bureau employees engaged in this work be deputized under the state law so that they may carry out all the various provisions of a practicable tick-eradication law.

While in all cases it expedites matters and is more pleasant for the cattle owners and inspectors to work harmoniously in the eradication of the ticks, a stringent state law is absolutely necessary, as there are always a few stockmen who refuse to see the advantage to themselves and the community in eradicating this pest. In order to compel such indifferent owners to disinfect their cattle properly a state law should be enacted giving the state authorities the power to enforce disinfection and making it a misdemeanor for the owners not to comply with such requirements.

Through the efforts of the state veterinarian, Dr. Charles Keane, the State of California, in March, 1907, enacted a law which makes it a misdemeanor to move or expose tick-infested cattle in such a manner as to infest other cattle or live stock not so infested. This law also provides for the disinfection of cattle as directed by the state veterinarian or his deputy, and provides that in case of failure on the part of the owner so to disinfect, the state veterinarian has the power to disinfect the cattle, the cost of the treatment becoming a lien on them. This law, while having weak points that should be corrected to cover certain special conditions, has been of inestimable value in the work of tick eradication in California.

METHODS USED IN TICK ERADICATION IN CALIFORNIA.

On account of the present high valuation of range lands, the absence of feed-lot methods of fattening, and the stocking of all sections to the full capacity with live stock, the practice of "resting" pastures to clean them is impracticable in the great majority of cases in California. This method, however, is one which gives rapid results with little work, and when the number of cattle on the ranch will permit of its use it is an easy method of accomplishing the desired results. In this State it is recommended that all cattle, horses, mules, and asses be excluded from the resting pasture for eight months, resting preferably to begin between May 1 and October 1, when all tick eggs that may be on the pasture are sure to hatch before the approach of cold weather.

From the lack of rains during the summer season and the excessive valuation of irrigable lands, where forage crops could be raised for use in the pasture-rotation method, this resource for ridding a ranch of ticks has also been impracticable.

Tick eradication therefore resolved itself into a problem of cleaning the ranges while the cattle were constantly grazing upon them. Under such conditions the first essential to success is the installation of a dipping vat. It has been our experience under usual conditions in this State that time used in spraying, smearing, currying, hand picking, or other means without the dipping vat is mostly wasted. These latter methods may be entirely successful with single cows, but when there are a dozen head or more such measures require two or three years, and before success is attained the owner is discouraged and disgusted. When the herd comprises over 50 head, it has, in our experience, proved to be practically impossible to clean without the vat.

After the vat is installed the owner must be thoroughly informed at the beginning what will be required of him to clean his ranch, and impressed with the possibility of freeing his land and cattle in one season. His cooperation is necessary, but even when this is given constant supervision by the inspector is necessary to prevent laxity and overlooking of details which are absolutely essential to success. Thus on a ranch containing infested cattle a single improper mixing of the dipping solution or the failure to get a few head to the vat at a dipping in the middle of the dipping season may destroy the opportunity of cleaning the ranch with that year's work.

Although the eradication work in one community has been very successful and cleaning of the ranches has proceeded without interruption, this fact when used as an argument for thorough and regular dipping in another section often has little effect on obstinate owners of tick-infested land.

During the process of cleaning, which entails time, labor, and expense on the part of the cattleman, he is almost sure to become discouraged; and when, after having dipped his cattle three or four times, they continue to come up to the vat for the fourth or fifth dipping showing ticks, he commences to feel that his efforts are going to be in vain. At this stage of eradication even the most enlightened cattlemen who appreciate the benefit of exterminating the ticks are liable to become so discouraged as to be disagreeable when approached by the inspector in regard to further dipping. At this time tact on the part of the inspector is very essential. Many cattlemen who have made irritating and even insulting remarks to the inspectors during the time of actual eradication work have, after this was completed and when they realized that their ranches were free of the pest, become strong in their praise of the work and the economic good it has done them personally and will do the country at large.

During the dipping season, when the ranches are heavily infested, horses, mules, and burros running on the range require attention, and should be dipped or otherwise freed from ticks. When there is slight infestation of the range, solipeds require little attention.

The dippings can be separated by intervals of thirty days under ordinary circumstances when the infestation is slight or moderate. When the range is very heavily infested it is better to dip at shorter intervals, twenty-one to twenty-eight days, for several months or until the ticks begin to show a reduction in numbers, when the intervals between dippings may be extended to thirty days. When infested cattle are to be moved to a tick-free pasture, two dippings must be required, separated by an interval of five to fourteen days.

The dipping season in California begins about April 1 and must continue at thirty-day intervals until eight or nine dippings have been made in order to clean the range in one season. During these eight or nine months it is necessary for the inspector to be present at each dipping and supervise the mixing of the dipping fluid in person. He should know the exact number of cattle on each infested ranch, and where possible should count the cattle at every dipping as they are let out of the draining pen, to be sure that the owner has made a clean roundup.

On the slight or moderately infested ranges after several dippings the cattle will often come to the vat apparently free from ticks, and the owner will therefore object to further dipping. In such cases the absolute necessity for continuing the disinfection throughout the season must be impressed upon him.

In many localities in California where infestation existed the country was divided up into small ranches, 40 to 120 acres. Such ranches were separated by a single line of barbed-wire fence, and all contained cattle. Upon ranch-to-ranch inspection of such localities, in many instances ranches would be found tick free when surrounding them on one or more sides ticky cattle were known to be grazing. Such ranches were kept under close observation throughout the eradication work, and remained clean. It is thus seen that it is quite practicable for a single line of good fence to prevent the spread of the Texas-fever tick. As a result of our observations in this matter it would seem to be unnecessary to augment the cost of eradication by insisting on double division fences.

In dividing large ranges by cross fences, for the purpose of tick eradication, as far as possible the single fence should be made to traverse rough, inaccessible land where feed is short and where cattle will consequently have little tendency to stray directly up to the fence.

INTERNATIONAL FENCE.

Tick eradication along the California-Mexico line is complicated by the fact that parts of Lower California, especially the coast section, is heavily infested with ticks. It being largely a range country, bady tick-infested live stock from that country were constantly drifting and straying across the international line and undoing any efforts of the American ranchers in this section to eradicate the ticks from their land. Consequently it became apparent that if the ticks were to be eradicated in this locality it would be necessary to control this movement of tick-infested Mexican live stock. Without such control ranchers in this section consider it a hardship to have to attempt to free their land of ticks, only to have it reinfested by stray Mexican animals, and, consequently, their cooperation in the work can not be secured.

The only feasible method of securing this control of live stock is the construction of a stock-proof fence on or near the international line. The necessity for such a fence has long been recognized by the ranchers in this section, and some, to protect their feed and to assist in freeing their cattle of ticks, have constructed fences of a more or less temporary character at irregular intervals along the line; but in most cases it has been necessary to abandon the eradication work in this section pending the construction of a proper fence. It was soon ascertained that such a fence could not be constructed without government assistance. The Bureau of Animal Industry has therefore undertaken to construct a first-class stock-proof fence along this line, wherever necessary, to prevent the entrance of infested Mexican live stock. With this fence installed, eradication in this section will soon be accomplished and future reinfestation prevented. Such a fence will also assist the customs officials in preventing illegal traffic between the two countries.

DIPPING SOLUTION, ITS PREPARATION AND USE.

At the commencement of the work by the Bureau in the summer and fall of 1906 the oil-float dip was used. This was prepared by filling the vat with water, after which 1 to 2 inches of oil was floated on the surface. The oil used was a California product, and while samples from several wells seemed to be nearly identical with Beaumont oil, injurious results to the cattle of a more or less serious nature followed in most instances. This probably was largely due to the extreme heat of California summers and the absence of shade on the ranges. While ticks on the cattle were killed by this measure when properly carried out, reinfestation soon occurred, and redippings at sufficiently short intervals to prevent reseeding of the ranges was impossible. The oil float having been found injurious, attempts to use crude petroleum alone after the methods followed in the Eastern States was abandoned. On account of the insurmountable opposition on the part of the cattlemen to the use of oil, it soon became apparent that tick eradication in this State would be impossible unless some other less injurious disinfecting solution could be obtained.

The following year the arsenical solution was tried in several vats with such satisfactory results to stock owners and inspectors that its general use was at once inaugurated and has been continued uninterruptedly to the present time. In this solution, properly prepared, cattle can be dipped nine or ten times in one season and remain in as good if not better condition than cattle on adjoining pastures with identical feed that have not been dipped.

The solution used in California is made after the following formula:

Arsenic trioxid (white arsenic)	pounds	8
Sodium carbonate (sal soda)	do	24
Soap (laundry or chipped)	do	24
Pine tar	gallons	2 or 3
Water	do	500

For mixing the preparation it is necessary to have at the vat one or two caldrons or tanks of a capacity of not less than 50 gallons in which to dissolve the ingredients. As the water in the caldron warms the sodium carbonate is added and dissolved by stirring, after which the arsenic is added and the fluid brought to the boiling point and stirred until all is in solution. To expedite matters, the soap may be cut up and heated at the same time in the second caldron or dissolved in the arsenic and soda solution when only one tank is available. These three ingredients being dissolved, the fire is then drawn, and the tar is slowly added, with constant stirring to make a homogeneous solution. This concentrated solution is then added to the water in the vat to make the proper proportion, as given in the preceding formula. When filling a large vat of a capacity of 3,000 or 4,000 gallons, several boilings have to be made, unless the cooking tank is quite large.

The soap, in our opinion, is a valuable ingredient of the preparation. It gives body to the dip and tends to make it adhere to the hides. This is important, as the solution acts as a gradual poison to the ticks, requiring several days to kill when the parasites are nearing maturity. It also cleans the hair of the cattle, thus improving their appearance after dipping, and may have a slight effect in preventing reinfestation for a longer time than when they are dipped in an arsenical solution without the soap. It also assists in emulsifying the tar and rendering the solution homogeneous. These advantages far outweigh the slight extra cost of its use. The addition of the larger quantity (3 gallons, instead of 1 gallon, as usually recommended) of pine tar is recommended, as it is also valuable in giving body to the mixture and increases its action as a parasiticide. In addition, it has been found that the greater the proportion of tar the longer cattle are free from annoyance by flies following dipping.

While the solution made after the above formula is most satisfactory for dairy and fine-bred cattle, more arsenic may be added, up to 9 or 10 pounds to the 500 gallons, in the disinfection of range cattle.

When once filled, the vat is ready for use at all times, unless rains should dilute its contents, when ingredients have to be added in the proper proportions for the amount of rain water which has fallen or drained into the tank. In exposed tanks the amount of evaporation is considerable during the hot summer months, reducing the fluid in the vats as much as 3 inches between dippings. In adding ingredients to keep the fluid at the proper depth for dipping, this evaporation does not have to be accounted for, and the medicinal ingredients should be added in full proportion for all water used. The same solution remains active as a tickicide indefinitely, but the number of times it should be used for redippings depends entirely on the number of cattle dipped each month. Dirt carried in on the hoofs; hair which comes off the animals in considerable quantities during the shedding season, and urine and feces evacuated by the cattle in the vat and draining pen tend to befoul the solution. When therefore the number of cattle dipped monthly reaches into the hundreds of head it is our practice to clean out the vat after each three dippings.

Following dipping in arsenical solution care must be used in driving cattle to prevent overheating, as injurious and even fatal results have followed forced driving, especially during hot weather.

While this solution is very poisonous, it has been used very extensively in this State with no bad results, and with ordinary precautions its poisonous nature is not a good reason against its use. It is our practice to place on each vat in which the solution is used a notice reading as follows:

> WARNING!
> The fluid in this vat is
> *POISONOUS*
> to man and all animals.
> Do not allow it to contaminate any feed or water supply.
> Cattle should be watered before dipping.

THE DIPPING VATS FOUND MOST PRACTICABLE.

Dipping being the most practicable method of disinfecting cattle for eradicating ticks, it is necessary for those engaged in eradication work to become familiar with the various kinds of vats, in order that the most suitable form may be recommended under the various conditions met, depending on the kind and number of cattle to be treated and the financial condition of the owner.

In communities where several small tick-infested ranches are located within a short distance of each other cooperative vats have been established. The several owners of the infested places would club together, select the most convenient location to build the vat, and subscribe the necessary money for its installation. One rancher is appointed treasurer, and it is his duty to collect all money for dipping, buy the dipping materials, and act as manager of the plant. A charge is made for dipping, usually not over 5 cents a head, and if at the end of the dipping season there is a surplus this is divided among the subscribers. In this way the several ranchers have the advantage of a dipping vat without each being put to the cost of installing one. A dipping day is set once each month, and all infested herds are dipped at this time, the owners assisting each other in the operation.

In other cases one rancher will install the vat and allow his neighbors to dip their cattle in it, charging a nominal fee for the service.

In California three styles of vats are used, namely, the swim vat, the cage vat, and the wade vat.

THE SWIM VAT.

The swim vat is by far the most practical for range stock and where large numbers of cattle are to be dipped. It has the advantage of speed and requires little labor in the operation of dipping. The longer such a vat can be constructed, up to 50 or 60 feet at the dip line, the better, as it has been found that the action of the arsenical solution is more potent if the cattle are submerged for at least twenty seconds, and such a length of time is recommended when mature ticks are present on the cattle. However, in this State successful results have followed the use of much shorter tanks. Such vats may be

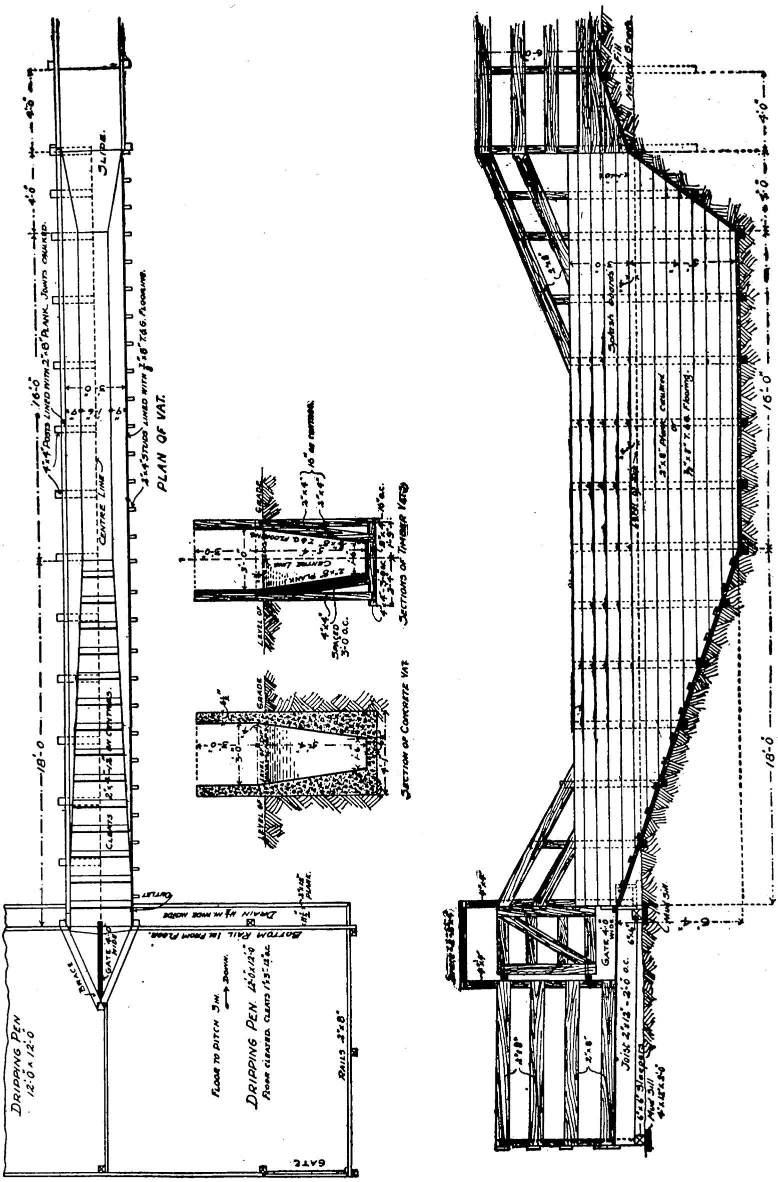


FIG. 7.—Plans for wood or concrete dipping vat.

constructed of lumber or cement. The latter is preferable, as it has not the disadvantage of leaking, which is common in wooden vats, and is more durable. A swim vat built after the plans shown in figure 7 will prove very satisfactory. This figure, as well as the following specifications and list of materials, is taken from Farmers' Bulletin 378, by H. W. Graybill. A vat constructed according to these plans will hold 2,088 gallons when filled to a depth of 5 feet. In our experience in the use of such vats in California it has been found advantageous to construct the vat with a somewhat steeper slope at the entrance end than is indicated in the plans. With this modification the cattle are plunged more quickly into the vat, and time can be saved in dipping a large number of animals.

Excavation.—Excavate for the vat, as shown by the drawings (fig. 7), to the proper depth. Level the bottom of the pit for the sills. After the vat is completed fill in around it, using the surplus earth to bring the grade at the sides of the vat a little above the natural grade and slope the surface away from the vat. Dig the holes required for all posts, etc.

Carpenter work.—The drawings show the vat constructed according to two methods. One method is to make the sides of 4 by 4 inch posts spaced about 3 feet apart and lined with 2 by 8 inch dressed, sized, and bevel-edged plank, using 20-penny spikes to fasten them to the posts and braces. All the joints are to be calked with oakum well driven in with a calking iron and pitched. The floor of the vat and the inclines are to be made of 2-inch plank with joints calked, the exit incline to have 2 by 4 inch cleats spiked to the plank flooring. The slide should have an angle of about 25° and should be covered with No. 16 galvanized iron.

The other method is to build the sides of the vat of 2 by 4 inch posts and 2 by 4 inch braces spaced about 16 inches on centers. The 2 by 4 inch posts and braces are to be lined with ⅞ by 8 inch tongued-and-grooved flooring, blind nailed at every bearing with 10-penny nails. All the joints are to be laid in white lead paste and the boards firmly driven up.

Lumber.—The lumber used in the construction of the vat must be thoroughly dried and seasoned stock, free from large and loose knots, straight grained, and free from sap.

Gutters.—The gutters for the dripping pens should be made of sound stock, the bottom plank housed into the sides and ends, and the ends housed into the sides. All the joints are to be laid in white lead paste and thoroughly nailed. Gutters are to have 3-inch fall in 11 feet.

Concrete vat.—The concrete vat should be made of concrete composed of 1 part by measure of good Portland cement, 3 parts of clean sharp sand, and 5 parts of broken rock, the broken rock to be not larger than will pass in any direction through a 2-inch ring. The rock should be washed free of dust. Concrete should be mixed wet and well tamped into place.

Bill of materials.—Lumber for vat when constructed of 2-inch material and 4 by 4 inch posts:

Sills	8 pieces 4 by 4 inches by 10 feet long.
Posts	1 piece 4 by 4 inches by 16 feet long. 1 piece 4 by 4 inches by 14 feet long. 6 pieces 4 by 4 inches by 12 feet long. 5 pieces 4 by 4 inches by 10 feet long.
Braces	1 piece 4 by 4 inches by 16 feet long. 6 pieces 4 by 4 inches by 12 feet long. 1 piece 4 by 4 inches by 10 feet long. 1 piece 4 by 4 inches by 6 feet long.

Guards	2 pieces 2 by 8 inches by 18 feet long. 1 piece 2 by 8 inches by 16 feet long. 2 pieces 2 by 8 inches by 12 feet long. 1 piece 2 by 8 inches by 10 feet long.
Sides	18 pieces 2 by 8 inches by 20 feet long. 25 pieces 2 by 8 inches by 18 feet long. 2 pieces 2 by 8 inches by 16 feet long. 2 pieces 2 by 6 inches by 18 feet long. Dressed one side and two edges. Edges beveled for calking.
Floor	3 pieces 2 by 10 inches by 20 feet long. 2 pieces 2 by 10 inches by 16 feet long. 1 piece 2 by 10 inches by 14 feet long. 1 piece 2 by 10 inches by 7 feet long. 1 piece 2 by 12 inches by 12 feet long. Dressed one side and two edges. Edges beveled for calking.
Cleats	4 pieces 2 by 4 inches by 12 feet long.

Lumber for vat when constructed of flooring and 2 by 4 inch posts:

Sills	7 pieces 2 by 4 inches by 14 feet long.
Posts	28 pieces 2 by 4 inches by 18 feet long. 4 pieces 4 by 4 inches by 11 feet long.
Braces	15 pieces 2 by 4 inches by 12 feet long. 2 pieces 2 by 4 inches by 10 feet long. 2 pieces 2 by 4 inches by 16 feet long.
Guards	Materials the same as specified above.
Sides	550 feet b. m. $\frac{7}{8}$ by 8 inches tongue-and-groove flooring.
Floor	Materials the same as specified above.
Cleats	Materials the same as specified above.

Lumber for draining pens:

Mud sills	10 pieces 4 by 12 inches by 2 feet long (cedar or cypress).
Sleepers	4 pieces 6 by 6 inches by 12 feet long.
Joists	13 pieces 2 by 12 inches by 12 feet long.
Floor	360 feet b. m. tongue-and-groove flooring $\frac{7}{8}$ by 8 inches—12-foot pieces.
Cleats	265 linear feet 1 by 3 inches.
Gutters	Sides: 4 pieces 2 by 12 inches by 11 feet long (dressed). Bottom and ends: 2 pieces 2 by 12 inches by 12 feet (dressed). Bottom housed into sides and ends. Ends housed into sides. All joints calked and white leaded or pitched.
Posts	11 pieces 4 by 4 inches by 7 feet long. 2 pieces 4 by 4 inches by 8 feet long. 2 pieces 4 by 4 inches by 9 feet long.
Rails	2 pieces 2 by 8 inches by 18 feet long. 5 pieces 2 by 8 inches by 16 feet long. 18 pieces 2 by 8 inches by 12 feet long.

Braces	2 pieces 2 by 4 inches by 10 feet long.
Gates	7 pieces 1 by 6 inches by 12 feet long. 6 pieces 1 by 6 inches by 10 feet long.

Hardware for vat and draining pens:
- 4 pair 12-inch heavy T hinges and screws.
- 4 wrought-iron hooks and staples.
- I pair wrought-iron hook hinges, 12-inch wood screw hooks, and screws.
- 50 pounds 20-penny wire nails.
- 15 pounds 10-penny wire nails.
- 12 square feet No. 16 galvanized iron.

When vat is constructed of flooring and 2 by 4 posts, the following additional hardware will be required:
- 19 pounds 20-penny wire nails.
- 12 pounds 10-penny wire nails.

Material for concrete vat:
- Concrete, 1 part Portland cement, 3 parts sand, 5 parts broken rock or gravel.
- 19 cubic yards broken rock or gravel.
- 18 cubic yards sand.
- 30 barrels Portland cement.

THE CAGE VAT.

The cage vat, when properly constructed, is very practical and is recommended for the disinfection of smaller herds and gentle cattle, especially dairy cows. It has the advantages of being economical in the amount of dipping solution necessary to charge the vat; animals may be held in the solution as long as desired, and the operation of dipping is almost entirely without rough handling or worry to the cattle. This last is an important factor in the disinfection of milch cows without causing shrinkage in the milk flow. Dairy herds should be dipped in the morning immediately after milking. They can then be turned out to pasture with very little time lost from feed. Plate XV and figures 8 and 9 show this form of vat as it has

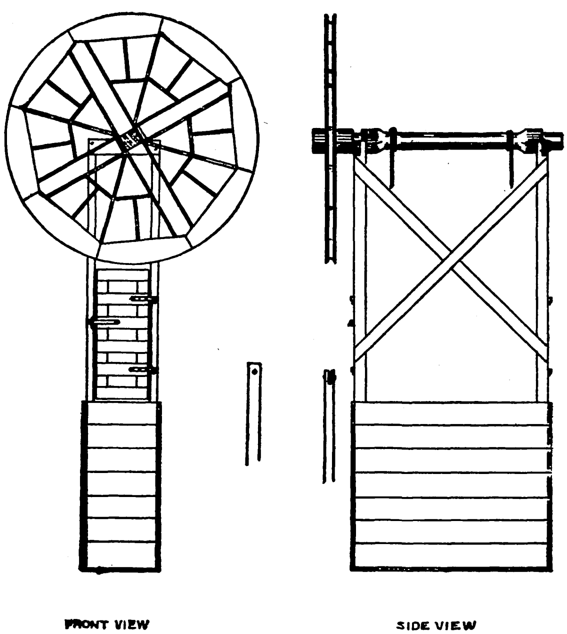


FIG. 8.—Plans for cage vat.

given most satisfactory results in California. The following specifications and bill of materials are given for its construction:

Tank.

The tank should be made 7 feet deep, 3 feet wide, and 8 feet long, inside measurements.

Four corner posts, 4 by 6 inches by 18 feet, must be planed on outer sides to join planks for sides and ends.

Sides, 7 planks 2 by 12 inches by 16 feet cut to 8 feet long.

Ends, 3 planks 2 by 12 inches by 12 feet cut to 3 feet long.

Ends, 1 plank 2 by 12 inches by 16 feet cut two pieces 3 feet long; left over, 2 by 12 inches by 10 feet.

Bottom, use left-over 2 by 12 inches by 10 feet cut to 3 feet 4 inches long.

Bottom, 2 planks 2 by 12 inches by 12 feet cut to 3 feet 4 inches long.

Braces, ends, and sides, five 1 by 6 inches by 12 feet.

Gates, two 1 by 6 inches by 14 feet.

Gates, two 1 by 6 inches by 12 feet.

Gates, four hinges and two hooks.

Cage.

Floor, two 2 by 6 inches by 16 feet cut to 7 feet 11 inches long.

Floor cleats, one 2 by 3 inches by 12 feet cut 28 inches long.

Sides, six 1 by 6 inches by 14 feet cut to 6 feet 11 inches long.

Top piece, one 4 by 6 inches by 6 feet.

Make hangers of ½ by 2-inch iron.

Wheel.

Shaft, one 8 by 8 inches by 10 feet, turned to set in bed pieces.

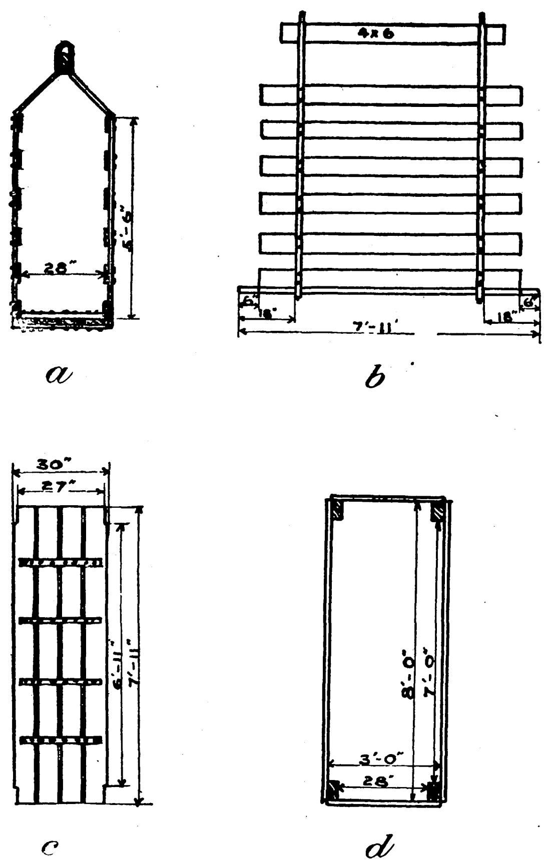


FIG. 9.—Detail plans for cage vat; *a*, Cross section of cage; *b*, side view of cage; *c*, floor of cage; *d*, cross section of tank.

Three-eighths-inch cable or chain attached to shaft to raise cage.

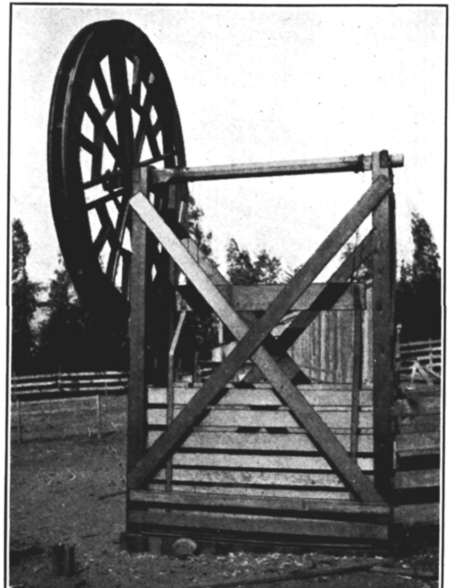
Bed pieces, make two 3 by 8 inches by 3 feet.

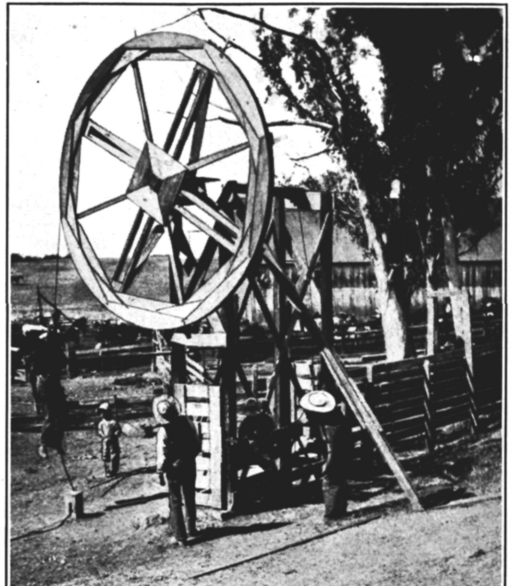
Spokes, twelve 1½ by 3 inches by 12 feet.

Flanges, four 1 by 12 inches by 16 feet.

Have flanges extend 3 inches over ends of spokes and run rope over free ends of spokes.

Use ¾-inch rope 140 feet long, have pulley in a block sunk in ground, and lift cage with saddle horse or horse and traces.





CAGE VAT FOR DIPPING CATTLE.

The first figure shows gross appearance of vat and apparatus. The second figure shows vat with cage down and attendant ducking animal. The third figure shows vat with cage raised and animal walking out.

Lumber and milling companies furnish these materials, sized and cut in proper manner, to the ranchers for from $55 to $65. The builder then has in addition the labor of excavating the pit and putting the tank together. Draining pens with such vats are not essential and are rarely used, as the animal drains while the cage is being raised.

This vat is installed near the corrals and requires only a short chute leading from the corral to the cage. In operating such a vat the animal is driven through the chute into the cage and the end gate closed. The hoist rope is released and the weight of the animal carries the cage down into the fluid. If the animal is not completely submerged, its head is forced under by the foot of an assistant wearing rubber boots. After remaining in the solution the proper length of time (twenty to thirty seconds) the cage is raised by attaching

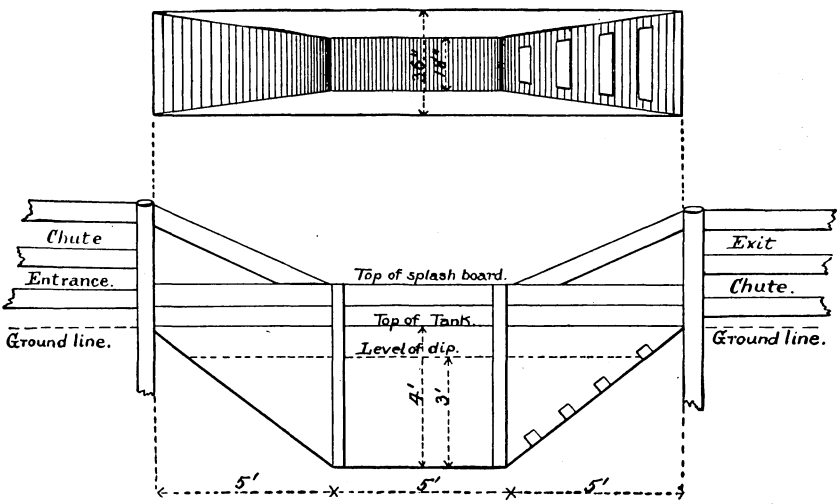


FIG. 10.—Plans for small "wade tank." Vertical section.

the end of the hoist rope to the saddle horn or the swingletree of a horse in harness. During the raising of the cage the animal drains, and after a short interval the opposite end gate is opened and the animal passes out. With this vat from 30 to 50 animals can be dipped per hour.

THE WADE TANK.

The wade tank is recommended only in the disinfection of very small herds. It can be constructed with an outlay of less than $10 for materials, thus being cheaper than a good spray pump. Figure 10 shows plans of such a vat, which can be made of either lumber or cement.

In the use of this tank the animal is led in by a rope or halter and cross-tied or held. The solution in the vat, being 36 inches deep, thoroughly saturates the lower parts of the body and sides, which are always most heavily infested and most difficult to reach with a spray pump or swab. The upper parts of the body are then thoroughly wet by pouring the dipping solution from a pail over the head and back. The animal is then led out at the opposite end of the vat and allowed to drain on the incline or in the chute. With this method less fluid is used than in spraying or swabbing, the operation is easier to perform, and it is efficacious.

PRESENT CONDITIONS IN CALIFORNIA.[a]

As a result of four years' work by the Bureau and state officials, California has only 9,315 square miles, instead of 69,755 square miles, of territory in quarantine for Texas-fever ticks. Of this area remaining in quarantine a large percentage is at present tick free and should soon be in a condition to be released.

Of the original 153,476 cattle infested there remain under local quarantine 41,906. This number includes all herds on which the slightest infestation has been found in 1910, and many of these will no doubt be free with the close of this season's work. Half of this number are on one large ranch where eradication work has been slow on account of its size, the roughness of the range, and lack of co-operation from the owner.

Prior to the inauguration of tick eradication in California condemnations for Texas fever were numerous in the abattoirs having federal inspection. During the past two years not a single condemnation for this disease has occurred in Los Angeles, where the majority of the cattle from the quarantined area are slaughtered. In the past year deaths from Texas fever on the ranges, where some years back losses annually reached into the thousands of head, have been so few as to be hardly worthy of notice. Our experience has proved that tick eradication is not only possible, but with stringent laws and proper methods is very practicable. When attained it returns to the individual owner and the cattle industry at large many times more than the cost of its accomplishment.

[a] Data brought down to summer of 1910.

MISCELLANEOUS INFORMATION CONCERNING THE LIVE-STOCK INDUSTRY.[a]

THE LIVE-STOCK MARKET IN 1909.

The most disturbing factor in the live-stock situation in 1909 was the hog. It may be recollected that in 1908 the hog market was over-abundantly supplied, in consequence of which values became depressed, the annual average price of hogs falling 45 cents a hundredweight below that of the previous year. This condition, coupled with the high prices of feed, naturally had a tendency to discourage hog raising, and as a result the pendulum swung hard the other way during 1909. Hogs became scarce and prices mounted higher and higher, until finally all records since the war were surpassed.

The Chicago stock yards reports state that 6,619,018 hogs were received during 1909, as against 8,131,465 in 1908. The receipts in 1909 were, in fact, the smallest since 1893, the year of the panic. The shortage, compared with 1908, was over a million and a half, or 19 per cent. As regards the prices, the average for the year, as compiled by the Chicago Farmers' and Drovers' Journal and by the Weekly Live Stock Report, was $7.35 a hundredweight, while the figure for 1908 was $5.70. Last year's price, therefore, advanced no less than $1.65, which is equivalent to 29 per cent.

The supply of cattle was scarce also, although to a far less extent than hogs. The total receipts at Chicago in 1909 were 2,929,805, which was 109,401, or 3½ per cent, less than in the previous year. Cattle prices, which have shown a steady upward tendency for six years, continued firm and high in 1909. The annual average for native steers is given at $6.35 a hundredweight, which is 25 cents, or 4 per cent, higher than in 1908. Range steers, with an average of $5.35 for the six months in which they are on the market gained considerably more, the advance in this case being 50 cents a hundredweight, or 10 per cent. The average for cows and heifers was $4.25, as against $4.10, which is a rise of 3⅔ per cent.

Compared with 1908 the situation for sheep raisers was much improved, although prices still averaged lower than in the three years from 1905 to 1907. The average price for 1909, at Chicago, was 30 cents a hundredweight higher than in 1908, notwithstanding the

[a] Compiled mainly by John Roberts, of the Editorial Office, Bureau of Animal Industry.

fact that more sheep were marketed. Lambs commanded very high prices throughout 1909. The top monthly average of $8 was recorded for May, and the average for the year was $7.30, which is no less than 95 cents higher than for 1908.

THE NATIONAL SUPPLY OF FARM ANIMALS.

It may be interesting to show here the estimated numbers and values of the various classes of farm animals in the United States, as given by the Bureau of Statistics, Department of Agriculture, for January 1 of each year for the past four years. They are as follows:

Estimated annual number of farm animals in the United States, 1907 to 1910, with valuation for 1910.

Farm animals.	Number January 1—				Valuation January 1, 1910.
	1907.	1908.	1909.	1910.	
Horses	19,747,000	19,992,000	20,640,000	21,040,000	$2,276,363,000
Mules	3,817,000	3,869,000	4,053,000	4,123,000	494,095,000
Milch cows	20,968,000	21,194,000	21,720,000	21,801,000	780,308,000
Other cattle	51,566,000	50,073,000	49,379,000	47,279,000	917,453,000
Sheep	53,240,000	54,631,000	56,084,000	57,216,000	233,664,000
Swine	54,794,000	56,084,000	54,147,000	47,782,000	436,603,000

The table shows an increase in the past year in the number of four of the six classes of animals estimated. The remaining two—"other cattle," meaning beef cattle, and swine—show considerable decreases, especially the latter. The percentage of beef cattle on hand January 1, 1910, compared with the same date in 1909 was 95.7, while the percentage of swine fell as low as 88.2.

As regards the value of the different animals, there was, compared with 1909, an increase all along the line. The valuations here recorded represent a conservative estimate of the farm value of the various animals. The average value per head of horses increased last year $12.55, mules increased $12, milch cows increased $3.43, beef cattle increased $1.92, sheep increased $0.65, and swine increased $2.59.

Some idea of the magnitude of our national live-stock interests may be inferred from the last column of the table. When added up, the total valuation amounts to upward of five billion dollars, the exact figures being $5,138,486,000.

MARKET PRICES OF LIVE STOCK.

The tables next following give the monthly and annual average prices of the various classes of farm stock at Chicago for a series of years. Only the first and last tables give average prices, the others showing the high and low range. In the case of the latter, it should be borne in mind that the mean between the high and low range does not necessarily give the true average.

Average prices, per hundredweight, of live stock at Chicago in 1909, by months, and annual average, 1898–1909.

[From the Weekly Live Stock Report.]

Month.	Cattle.			Hogs.	Sheep.	Lambs.
	Native steers.	Cows and heifers.	Range steers.			
January	$5.85	$4.10	....	$6.15	$4.80	$7.30
February	5.80	4.25	....	6.40	4.85	7.25
March	6.05	4.35	....	6.70	5.15	7.35
April	6.10	4.65	....	7.25	5.35	7.50
May	6.45	5.00	....	7.35	6.10	8.00
June	6.45	4.60	....	7.60	5.20	7.70
July	6.50	4.40	$5.30	7.80	4.85	7.65
August	6.65	4.10	5.55	7.80	4.65	7.50
September	6.70	3.90	5.20	8.25	4.60	6.70
October	6.75	3.85	5.35	7.85	4.35	6.50
November	6.65	4.00	5.50	8.00	4.55	7.00
December	6.40	4.00	5.25	8.30	4.90	7.40
Annual average:						
1909	6.35	4.25	5.35	7.35	4.95	7.30
1908	6.10	4.10	4.85	5.70	4.65	6.35
1907	5.80	3.85	4.50	6.15	5.25	7.05
1906	5.30	3.70	4.40	6.25	5.20	6.85
1905	5.05	3.65	3.80	5.25	5.00	6.80
1904	4.95	3.55	3.65	5.15	4.25	5.60
1903	4.80	3.95	3.65	6.00	4.00	5.45
1902	6.20	4.70	4.95	6.80	4.20	5.50
1901	5.25	4.05	4.55	5.85	3.80	4.80
1900	5.15	4.05	4.35	5.05	4.55	5.90
1899	5.30	3.55	4.60	4.05	4.35	5.50
1898	4.65	3.40	4.20	3.85	4.25	5.35

Range of prices, per hundredweight, of cattle at Chicago in 1909, by months, and annual range, 1898–1909.

[Compiled from report of Union Stock Yard and Transit Company.]

Month.	Native steers (1,500-1,800 pounds).	Native steers (1,200-1,500 pounds).	Poor to best cows and heifers.	Native stockers and feeders.	Texas and western steers.
January	$6.25-$7.50	$5.15-$7.40	$2.90-$6.65	$2.50-$5.75	$5.20-$6.00
February	6.20- 7.15	5.35- 7.05	3.00- 6.25	2.75- 5.60	4.75- 6.10
March	6.50- 7.40	5.50- 7.30	3.05- 6.50	2.85- 5.75	4.60- 5.80
April	6.40- 7.15	5.55- 7.00	3.15- 6.50	2.85- 5.85	5.50- 5.60
May	6.60- 7.30	6.00- 7.25	3.30- 7.05	3.00- 5.75	5.60- 6.55
June	6.55- 7.25	5.75- 7.25	3.15- 7.10	3.00- 5.60	3.60- 6.40
July	6.50- 7.45	5.40- 7.25	3.10- 7.50	2.60- 5.25	3.85- 6.45
August	6.80- 8.00	5.25- 5.75	3.00- 7.15	2.50- 5.20	4.15- 6.60
September	7.20- 8.50	5.15- 8.50	3.00- 7.00	2.60- 5.75	4.10- 7.15
October	7.65- 9.10	5.10- 9.00	3.05- 7.50	2.50- 5.70	3.90- 7.60
November	7.75- 9.25	4.90- 9.25	3.05- 6.90	2.50- 5.50	4.10- 7.50
December	7.50- 9.50	4.90- 9.25	3.00- 6.75	2.75- 5.40	4.00- 6.60
Annual range:					
1909	6.20- 9.50	4.90- 9.25	2.90- 7.50	2.50- 5.85	3.60- 7.60
1908	5.25- 8.40	4.00- 8.40	2.55- 7.50	2.00- 6.05	3.40- 7.50
1907	5.30- 8.00	3.95- 7.50	2.35- 6.25	2.00- 5.35	3.00- 6.75
1906	4.75- 7.45	3.90- 7.90	2.40- 6.60	1.75- 5.10	2.90- 6.35
1905	4.40- 6.80	3.00- 6.85	2.25- 6.80	1.50- 5.45	2.60- 5.25
1904	4.40- 7.65	3.35- 7.60	2.00- 7.50	1.50- 5.50	2.40- 5.65
1903	4.10- 6.75	3.35- 6.85	2.50- 5.50	1.50- 5.20	2.55- 5.10
1902	4.25- 9.00	3.60- 9.00	3.35- 8.25	1.90- 6.00	2.55- 7.65
1901	4.80- 9.00	3.60- 8.00	2.00- 8.00	1.65- 5.15	2.75- 5.75
1900	4.70- 7.50	3.90- 7.50	1.75- 6.00	2.10- 5.25	3.00- 5.90
1899	4.60- 8.25	4.00- 8.25	2.00- 6.85	2.50- 5.40	3.10- 6.75
1898	4.10- 6.25	3.80- 6.15	2.00- 5.40	2.50- 5.40	3.15- 5.40

Fifty-two loads of fat "show" steers sold in the auction Thursday, December 2, 1909, at $9.50 to $15, or an average of $11.44. The 52 loads averaged 1,331 pounds. A year before 49 loads of fat steers sold in the auction at an average of $9.13, the previous highest average on record.

Range of prices, per hundredweight, of hogs at Chicago in 1909, by months, and annual range, 1899–1909.

[Compiled from report of Union Stock Yard and Transit Company.]

Month.	Heavy packing (250–500 pounds).	Mixed packing (200–250 pounds).	Light bacon (150–200 pounds).
January	$5.60–$6.70	$5.50–$6.70	$5.20–$6.55
February	6.00– 6.95	5.90– 6.95	5.75– 6.85
March	6.15– 7.15	6.05– 7.12½	5.95– 7.00
April	6.70– 7.60	6.65– 7.60	6.50– 7.50
May	6.90– 7.55	6.85– 7.55	6.75– 7.40
June	7.00– 8.20	6.95– 8.15	6.80– 7.95
July	7.00– 8.45	7.10– 8.40	7.00– 8.25
August	6.95– 8.25	7.10– 8.25	7.25– 8.32½
September	7.20– 8.60	7.40– 8.60	7.50– 8.55
October	7.05– 8.40	7.10– 8.40	6.85– 8.25
November	7.35– 8.45	7.35– 8.40	7.20– 8.30
December	7.90– 8.75	7.80– 8–70	7.65– 8.60
Annual range:			
1909	5.60– 8.75	5.50– 8.70	5.20– 8.60
1908	4.00– 7.50	4.00– 7.50	3.95– 7.40
1907	3.75– 7.25	3.70– 7.22½	3.70– 7.17½
1906	5.00– 7.00	4.95– 7.10	4.90– 7.00
1905	4.35– 6.40	4.25– 6.42½	4.10– 6.45
1904	4.10– 6.30	4.15– 6.37½	4.00– 6.30
1903	3.85– 7.87½	3.90– 7.80	3.90– 7.70
1902	5.70– 8.25	5.65– 8.20	5.40– 7.95
1901	4.80– 7.37½	4.85– 7.30	4.75– 7.20
1900	4.15– 5.85	4.15– 5.82½	4.10– 5.75
1899	3.35– 4.95	3.40– 5.00	3.30– 5.00

Average weight of hogs, 1909, 219 pounds. Fifteen carloads of International Exposition "show" hogs sold in the auction Thursday, December 2, 1909, at $8.40 to $9, or an average of $8.60 per 100 pounds for the 15 loads. Only one load sold above $8.80.

Range of prices, per hundredweight, of sheep and lambs at Chicago in 1909, by months, and annual range, 1899–1909.

[Compiled from report of Union Stock Yard and Transit Company.]

Month.	Native sheep (60–140 pounds).	Native yearlings and lambs.	Western sheep (70–140 pounds).	Western and Mexican lambs.
January	$2.50–$5.75	$5.25–$8.10	$3.25–$5.85	$6.00–$8.10
February	2.50– 5.75	5.00– 7.95	3.15– 5.80	5.50– 7.95
March	3.00– 6.50	5.25– 8.00	3.00– 6.75	5.75– 8.30
April	3.25– 6.50	5.25– 8.10	3.25– 6.75	5.00– 8.80
May	3.50– 6.90	5.50– 8.50	3.85– 6.85	5.50– 9.80
June	3.00– 6.75	5.00– 8.50	3.50– 6.65	5.50– 9.90
July	2.75– 5.50	4.75– 8.80	2.75– 5.30	6.50– 8.90
August	2.25– 5.00	4.50– 8.15	3.00– 5.00	6.50– 8.15
September	2.25– 5.25	4.50– 7.75	3.00– 5.25	5.85– 7.75
October	2.25– 5.00	4.50– 7.50	2.75– 4.85	6.25– 7.30
November	2.50– 5.50	4.50– 7.85	2.75– 5.35	6.00– 7.60
December	2.50– 6.00	4.75– 8.75	3.00– 6.00	6.25– 8.85
Annual range:				
1909	2.25– 6.90	4.50– 8.80	2.75– 6.85	5.00– 9.90
1908	2.00– 7.00	3.25– 7.85	2.00– 7.00	3.75– 8.35
1907	2.00– 7.00	4.00– 8.60	2.00– 7.25	4.00– 9.25
1906	3.00– 6.50	5.00– 8.50	3.00– 7.00	4.75–11.25
1905	2.75– 6.35	4.00– 8.25	3.15– 6.35	4.50– 8.20
1904	1.50– 6.00	2.50– 7.75	2.00– 5.80	3.00– 7.50
1903	1.25– 7.00	2.50– 8.00	2.00– 7.00	2.50– 7.90
1902	1.25– 6.50	2.00– 7.25	1.25– 6.30	2.50– 7.60
1901	1.40– 5.25	2.00– 6.25	1.50– 5.25	2.75– 5.90
1900	2.00– 6.50	3.00– 7.60	3.00– 6.50	4.00– 7.60
1899	2.25– 5.65	3.50– 7.45	2.50– 5.55	4.00– 7.00

Nineteen loads of "show" sheep and lambs sold Thursday, December 2, 1909, at a general average of $8.67. Thirteen loads of lambs sold at $8 to $11, or an average of $9.18. Three loads of sheep went at $6 to $7.50, or an average of $6.66. Three loads of yearlings sold at $7.75 to $9.85, averaging $8.48.

Average prices of horses at Chicago in 1909, by months, and annual average, 1904–1909.

[Compiled from report of Union Stock Yard and Transit Company.]

Month.	Draft horses.	Carriage pairs.	Drivers.	General use.	Bussers and trammers.	Saddlers.	Southern chunks.
January	$187.00	$440.00	$160.00	$135.00	$147.00	$167.00	$77.00
February	195.00	500.00	162.00	140.00	155.00	175.00	85.00
March	197.00	510.00	167.00	145.00	160.00	185.00	87.00
April	197.00	515.00	170.00	147.00	165.00	187.00	87.00
May	192.00	510.00	170.00	145.00	160.00	185.00	85.00
June	190.00	495.00	165.00	140.00	155.00	180.00	82.00
July	190.00	490.00	160.00	140.00	155.00	175.00	80.00
August	190.00	490.00	160.00	140.00	155.00	175.00	80.00
September	180.00	475.00	155.00	135.00	150.00	165.00	70.00
October	175.00	460.00	150.00	130.00	145.00	160.00	67.00
November	170.00	450.00	145.00	125.00	140.00	155.00	65.00
December	170.00	450.00	145.00	125.00	140.00	155.00	65.00
Annual average:							
1909	194.00	482.00	165.00	137.00	152.00	172.00	77.00
1908	180.00	450.00	156.00	129.00	138.00	164.00	69.00
1907	194.00	482.00	165.00	137.00	152.00	172.00	77.50
1906	188.00	486.00	158.00	154.00	147.00	174.00	72.50
1905	186.00	486.00	156.00	132.00	145.00	172.00	70.00
1904	177.00	475.00	150.00	140.00	140.00	160.00	64.00

HOME AND FOREIGN MEAT PRICES.

The wholesale prices of meat at home and abroad given in the following tables are of somewhat special interest at this time because of the agitation throughout the country against the high prices of foodstuffs, especially of meat, which has prevailed more or less acutely for a considerable time. The tables show a comparison of the values of the several kinds of fresh meat—beef, veal, mutton, lamb, and pork—at the five largest American and European cities.

In order that this comparison may be as nearly accurate as possible, a representative high grade of each class of meat has been selected, the aim being to have each class as nearly similar in grade as practicable. The markets represented in the tables are Chicago, New York, London, Berlin, and Paris. The prices quoted are from well-known trade papers and are shown at monthly periods. The data for the European cities have been converted at the standard rates into the United States equivalents in pounds and cents.

BEEF.

Certain causes, among which may be mentioned the high prices of feed and the breaking up of the large ranges, have operated in recent years to reduce considerably our national supply of beef cattle. The actual extent of this reduction in the last three years, as shown by the estimates of the number of farm animals in the country, which are published annually by the Bureau of Statistics, was 4,287,000. When in conjunction with this we consider that the number of consumers has gone on increasing, it is inevitable that there should be a scarcity of beef in our markets and a corresponding rise in the price.

The table shows that the wholesale price of beef in Chicago began to rise in the latter half of 1907, the average rise at this period being fully 1 cent a pound above 1906. A further sharp rise occurred in the spring of 1908, after which there was little change until July and August, 1909, when there was a slight easing off. The prices stiffened again in October, when the highest point, 12 cents, was reached, and the same conditions prevailed to the end of the year. The total rise in three years, from December, 1906, to December, 1909, was $3\frac{1}{2}$ cents a pound. Expressed in terms of percentage this is a rise of 41 per cent.

It is interesting to note that New York prices were generally a shade lower than those of Chicago for the last two years.

English beef and port-killed American beef are now the same thing on the London market as regards price, which shows the high esteem in which our beef cattle are held. It may be stated, however, that there is one higher grade of beef in the British quotations, namely, Scotch, which averages about 1 cent a pound more. The London prices eased off a little toward the end of the year, and it may be remarked that for the last three months of 1909 the price in Chicago, New York, and London were practically even.

The Berlin prices for fat beef are considerably higher than any others in the table; they were, however, on the whole somewhat lower during 1909 than in the two previous years.

Paris prices are for hind quarters, which are usually rated about $1\frac{1}{2}$ cents higher than the price for the whole side. With this deduction from the French prices it is seen that the best grades are in most instances not much higher than those of London.

Wholesale prices, per pound, of fresh beef at stated home and foreign markets, 1907 to 1909, at monthly periods.

Date.	Chicago.	New York.	London.		Berlin.	Paris.
	Good native steers, carcass.	Choice native steers, heavy carcass.	English beef.	American (London killed).	Fat oxen.	Hind quarters.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January, 1909	10½–11½	10¾	12¼–12¾	11¾–13¼	16 –16½	9¾–15¾
1908	9¼	9¾	11 –11¼	10¼–11¼	17¾–18⅜	8¾–14
1907	7 – 8½	9¾	11⅛–11⅝	10⅛–11⅜	18 –18½	7 –14
February, 1909	10 –11½	10	10¾–11	10¾–11¾	15¼–16	9¾–14
1908	9¾	9¼	10¾–11¼	10½–11	16⅝–17¼	8 –13⅛
1907	7½– 8½	8¾– 9½	10⅝–10⅞	10⅞–11⅜	17 –18	9¾–14
March, 1909	10 –10½	10	11½–12¼	11¾–12¼	15 –15¾	8¾–14½
1908	9½	9	10½–10¾	10¼–11	15¾–16⅜	8 –13¾
1907	7½– 8½	9 – 9¼	11⅛–11⅜	10⅜–11⅛	16½–17¼	8 –13¾
April, 1909	10 –11	10¼	11½–12½	11¾–12½	15 –15¾	8¾–15½
1908	10	11½	11 –11½	10¾–11½	15½–16¼	8 –14
1907	7½– 8½	9	11⅛–11⅜	10⅝–11⅝	16½–17½	10½–15¾
May, 1909	10½–11	10	11¾–12¼	11¾–12¼	15 –16	10½–16¾
1908	11 –12½	11¾	10¾–11	10¾–11¼	15½–16¼	8 –14
1907	8 – 8½	8½– 9¼	10⅞–11⅜	10⅜–11⅛	16½–17	9¾–15¾
June, 1909	11	10 –10½	11¾–12½	11½–12½	14½–16¼	10½–16¾
1908	10 –10½	11¼	12½–12¾	12¼–12¾	14⅞–15¾	8¾–16⅝
1907	8 – 8½	9	11⅝–11⅞	11⅛–11⅝	16¼–16½	9¾–15¾
July, 1909	10½	9¾–10½	13 –13¾	12¾–13¾	15 –16½	8¾–15¾
1908	11½–12	12	11½–12¼	11½–12½	15¾–16⅞	9⅝–16⅝
1907	8½ –9	10	11⅝–12⅛	11⅛–12⅛	16½–17	8¾–15
August, 1909	10½	9¾–10½	11½–12	12¼–12¾	15¾–16¾	7 –15
1908	10½–11	11	11¼–12¼	11½–12¾	16⅝–17¾	9⅝–15¾
1907	8½– 9	10¾	11⅛–11⅜	10⅝–11⅝	17¼–18	8¾–15
September, 1909	11	9¾–11	11¾–12¾	11¾–12¾	16¼–17¼	8¾–15
1908	10 –11	10¾	10¾–11¼	10¾–12¼	17 –18⅛	10½–15¾
1907	9½	11	11⅛–11⅝	11⅛–12⅛	17¾–18½	8¾–13¼
October, 1909	11½–12	11 –11½	11¼–11¾	11¼–11¾	16 –17	7 –15
1908	10½–11½	10¾	10½–11¼	10 –11¼	17 –17⅞	8¾–14⅞
1907	9¾	10½–10¾	10⅞–11⅛	10⅝–11⅝	17¼–18	9¾–15
November, 1909	11½–12	11 –12	10¾–12	10¾–12	16½–17¾	7 –13¾
1908	10½–11	10½	10¼–11¼	10¼–11¼	16⅜–17¼	8 –14
1907	9¾	10¾–11	10⅝–11⅛	10⅛–11⅜	17 –17¾	8 –14
December, 1909	11 –12	11 –11½	11 –12¼	10¾–12¼	16¼–17½	8 –13¼
1908	10½–11	10¾	11½–12¼	10 –11¼	15¾–16⅝	8¾–14½
1907	9½	10½–10¾	10⅝–11⅛	10⅝–11⅝	17 –17¾	8 –13¾

VEAL.

There is a noticeable difference between the price of "prime" veal at New York and that of the highest market class at Chicago, which is called "good carcass." The price at New York is in many instances fully 3 cents a pound higher. Following the lead of beef, the rates were somewhat higher last year.

The price of London veal averages pretty close to that of New York. It showed a tendency to rise at the end of last year.

Berlin veal prices are the highest in the table. In the last two months of 1909 they rose sharply, the December quotations, 26½ cents a pound, being the highest price for any class of meat throughout the tables. It was more than double the price of Chicago veal at the same date. This class of Berlin veal is, however, no doubt a choice article. It is described as "choice whole-milk fed and best sucking calves."

The best Parisian veal is also an expensive class of meat, although large quantities are consumed, as is shown in another statement on page 315. The prices were high in the early part of 1909, but in the later months were considerably lower than for the corresponding period in 1908.

Wholesale prices, per pound, of fresh carcass veal at stated home and foreign markets, 1907 to 1909, at monthly periods.

Date.	Chicago.	New York.	London.	Berlin.	Paris.
	Good carcass.	Prime veal.	Best veal.	Choice whole-milk fed.	Extra.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January 1909	12	15 -16	12¾-14¼	20¾-22	19¾-21
1908	11	14 -14½	16 -16⅞	20½-22	19¼-21
1907	10 -11	14	15¼-16¼	22½-23¼	19¼-20¾
February 1909	11	14 -15	13¾-15¼	19¼-20½	18 -19¼
1908	11	14 -14½	13¾-15¼	19 -20⅛	18 -19¼
1907	11½-12	14½	13⅛-14⅛	19½-20	17½-19¼
March 1909	12	15 -16	13¾-15¼	19 -19¾	18 -18½
1908	11	14	14¼-16	17¾-18½	17½-19
1907	11½-12	14½	13⅝-15¼	19 -20	16¾-17½
April 1909	12	13½-14½	14¼-15¾	18¾-19¾	18 -19¼
1908	11	13	15¼-16	18⅜-19½	16⅝-18⅜
1907	11 -11½	14	14⅛-15¼	20¼-21¼	16¾-18½
May 1909	11½	11 -12½	13¼-14¼	20 -21	19 -20¼
1908	10½	12	13 -13¾	19½-20¼	16¼-17¼
1907	10 -11	12	13⅛-14⅛	20¼-21¼	19 -20¼
June 1909	11	12 -13½	14¾-15¾	20¼-21¼	16¾-18
1908	10	11	13¾-15¼	19 -20¼	18⅜-19¾
1907	9 -10	13	14⅛-15¼	20¼-21	17½-18½
July 1909	12	11 -13	12¾-14¼	19¼-20	14 -15
1908	10½	11 -12	13⅜-15¼	19 -20⅛	16⅝-17½
1907	9 -10	13	13⅛-14⅛	16¾-17¾	15 -16¾
August 1909	12½	12 -14	11¼-12¼	22½-24¾	12¼-13¼
1908	11	12 -13	13 -13¾	19⅞-21	16¼-17¼
1907	10 -11	13 -14	12⅛-13⅛	18 -18¾	15 -15¾
September 1909	13	12½-15	12¾-14¼	23½	16¼-17¼
1908	11½	14 -14½	15¼-16	19⅝-20¾	18⅜-19¼
1907	10 -11	13 -14	12⅝-13⅝	18¾-19½	16¼-17½
October 1909	13½	12½-15½	12¼-13¼	23	15¾-17¼
1908	12	14 -15	14¼-15⅝	19⅝-20¾	17½-19
1907	11 -12	14 -15	13⅛-14⅛	19 -19¾	18½-19¾
November 1909	12½	12 -15	13¼-14¼	26	16¾-18
1908	11½	14	13 -13¾	20¾-21⅝	17½-19
1907	12	14 -14½	13⅛-14⅛	20½-21½	19¼-20¼
December 1909	12	12 -15½	15¼-16¼	26½	16¾-18½
1908	10½	14 -15	13⅜-15¼	19⅞-21⅛	17¼-18⅜
1907	12	14 -14½	13⅝-14⅝	20½-21½	18½-20¼

MUTTON.

For the greater portion of 1909 mutton was at a lower price in our markets than beef. Formerly, before the scarcity in the past two years caused the rise in beef values, the reverse used to be the case. Mutton prices at New York were at a specially low ebb in the last four months of 1909.

London mutton was quite high from May to July, but declined rapidly thereafter. London prices average 2 to 3 cents higher than those at New York.

Berlin mutton is, in turn, about 4 cents higher than London. Prices were firm throughout the year and somewhat higher than in 1908.

Good mutton is very expensive in Paris. In some instances it is 100 per cent higher than in New York and Chicago. The price in July—22 cents a pound—is the highest of the year for any class of meat at the French capital, and it is only equaled in one other instance, namely, for lamb in January. In common with the other cities, except Berlin, the prices slackened toward the end of the year.

Wholesale prices per pound of fresh carcass mutton at stated home and foreign markets, 1907 to 1909, at monthly periods.

Date.		Chicago.	New York.	London.	Berlin.	Paris.
		Good sheep.	Choice sheep.	English.	Fat wethers.	First quality.
		Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	1909	9½	9	11¼–13¼	14 –15	19 –20¼
	1908	10	10	13 –14¼	15¾–16⅜	18⅜–20⅛
	1907	9	10	12⅝–13⅝	15¼–16	16¼–18
February	1909	10½	9½	9½–10¾	13¼–14	17¼–18½
	1908	10½	10 –10½	13 –15¼	14⅞–15½	18⅜–19¼
	1907	9	9	12⅛–13⅜	15¾–16½	17½–18½
March	1909	10½	8½– 9½	10¼–12¼	13½–14	17½–18½
	1908	10½	11¼	13 –15¼	14 –14¾	18⅜–19¾
	1907	9	9	12⅝–14⅛	15¾–16½	17½–18½
April	1909	10½	10 –11½	11¼–12¾	13¼–13¾	18½–19¾
	1908	13	14	13⅜–15¼	14⅛–14⅞	18⅜–20⅛
	1907	9	10	13⅛–14⅝	15 –15¾	18½–19¼
May	1909	10½	10 –11	13¼–14¾	14¼–14¾	18½–19¼
	1908	12	13	12¼–13¾	14⅛–14⅞	16⅝–17½
	1907	10	11	13⅜–15¾	15 –16	19 –19¾
June	1909	13½	11½–13	12¾–15¼	15¼–15¾	19¼–20¾
	1908	10½	11	13 –15⅝	14⅞–15½	18⅜–19¼
	1907	10	12½	14⅛–16¼	15 –16	17½–19
July	1909	11½	10 –11	11¾–14¼	15¾–16¼	19¼–22
	1908	9½	10	13 –14¼	14⅞–15½	18⅜–19¾
	1907	11	10	14¼–15¾	16 –16¾	17½–18½
August	1909	10½	10 –11	11¼–12¼	16¼–16¾	18½–19¼
	1908	9½–10	10	13 –15¼	16 –16⅞	18 –19¼
	1907	10	10½	13⅛–15¾	17¼–18¼	17½–19
September	1909	11	8½– 9½	11¼–12¾	16½–16¾	17½–19¼
	1908	9½	9½	12¼–13¾	15½–16¼	18⅜–19¼
	1907	9 – 9½	11	12⅝–14⅝	17¼–18¼	16¾–17½
October	1909	9½	8½– 9½	11¼–12¾	15½–16½	17½–18½
	1908	8½	9	10¾–13	15½–16¼	18⅜–19¼
	1907	10	11	13⅛–14⅝	16¼–16¾	18½–19¼
November	1909	9½	8 – 9	9 –11¼	15½–16½	17¼–18½
	1908	9	8½– 9	11¼–13	14¾–15½	17½–19
	1907	10	11	12⅛–14⅛	15¼–16	17½–19¼
December	1909	9½	8 – 9	9½–11¾	16 –17	16¾–18
	1908	9½	9	10¾–13	14⅛–15⅛	17¼–18⅜
	1907	10½	10½	12⅛–14⅛	15¾–16½	17½–19¼

LAMB.

The price of lamb was as a rule considerably higher throughout last year at Chicago and New York than in 1908. It may be noted that the high point was not reached until June, which also was the case two years ago, but this contrasts rather singularly with the maximum period of 1908, which occurred in April, and with the high point for early spring lamb in London, which invariably occurs in March.

The new season's lamb in England is a highly esteemed article of food and commands very high prices compared with the other classes of British meat. The price ruled steady from March to May, 1909, but the March quotation was 2 cents lower than it was in 1908. London values were unusually low for the last two months of 1909; the December quotation was, in fact, lower than those of New York and Chicago.

Choice lamb brings a high price in Paris throughout the year, although values are generally highest in fall and winter, rather than in spring. The highest figure for 1908 was in November, while the maximum for 1909 was in January.

Wholesale prices per pound of fresh carcass lamb at stated home and foreign markets, 1907 to 1909, at monthly periods.

Date.		Chicago.	New York.	London.	Berlin.	Paris.
		Round-dressed lambs.	Choice spring lambs.	Choice native.	Fat lambs.	Milk lambs, without head and pluck.
		Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	1909	12½	12 -13½	a 20¼-22¼	15¾-16¼	15¾-22
	1908	13	12½	a 19⅞-22⅞	18⅛-18½	17½-21⅞
	1907	12 -13	12 -13	....	16½-17¼	15 -19¼
February	1909	14	11½-12½	a 17¼-19¼	14 -14½	15¾-19¼
	1908	13½	12½-13	a 19 -21¼	17 -17¼	14⅞-18⅜
	1907	12 -13	12 -12½	....	16¾-17¾	14 -18½
March	1909	14	11½-13	a 19¼-22¼	14¼-14¾	15¾-19¼
	1908	13	13	a 19⅞-24¼	16¼-16½	14⅞-19¼
	1907	12 -13	12	a 20¼-23¼	16¾-17¾	14 -18½
April	1909	14	12½-14	a 19¼-22¼	14 -14¼	15¾-20¼
	1908	15½	15½	a 19⅞-22⅞	16⅜-16¾	14 -19¼
	1907	12 -13	14	a 19¼-22¼	16 -16¾	14 -19¼
May	1909	13½	13 -14½	a 19¼-22¼	14¾-15	15¾-20¼
	1908	14½	15	a 19 -22⅛	16⅜-16¾	14 -17½
	1907	13 -13½	14½	a 19¼-22¼	16½-17	14 -19¾
June	1909	16	15 -17	a 16¼-20¼	16 -16¼	15¾-21
	1908	12½	15 -16	a 16⅞-21¼	16¾-17¼	15¾-21
	1907	13½-14	16	a 18¼-20¼	16½-17	14 -19¼
July	1909	16	12½-15½	a 14¼-16¼	16½-16¾	15¾-21
	1908	12½	12½	16 -19	16¾-17¼	14 -19¾
	1907	13	13	16¼-19¼	17¼-18	15 -18½
August	1909	14½	10 -13	12¼-12½	17 -17½	15¾-20¼
	1908	12½	11½-12	15¼-18¼	17¾-17⅞	15¾-20⅛
	1907	13	12½	15¼-18¼	18¾-19½	14 -19
September	1909	14	11 -13½	12¼-14¼	17¼-18	15¾-20¼
	1908	12	12	13⅜-14¼	16¾-17¼	14⅞-20⅞
	1907	13	13½	14⅛-15¾	19 -19½	14 -18½
October	1909	13	11 -13	11¼-13¼	17¼-17¾	15¾-21
	1908	11	11	13 -13¾	16¾-17¼	14⅞-21
	1907	13½	13½	14⅛-15¼	18¼-18¾	15¾-20¼
November	1909	12	10 -12	10¼-12¼	17¼-17¾	15¾-21
	1908	11½	12	10¾-13	16⅜-16⅞	14⅞-23⅜
	1907	13½	12½	14⅛-15¼	18 -18¾	15 -22
December	1909	13	11 -13	10¼-12¼	18 -18½	15¾-21
	1908	12	12	12¼-13	16 -16⅜	15¾-21
	1907	13½	12	a 20¼-22¼	18 -18¾	15¾-22

a New season's lamb.

PORK.

An extraordinary rise in pork values took place in our markets during the past year, particularly in the latter half. The total rise for the year, both in Chicago and New York, was no less than 3 cents a pound. The highest price of the year at Chicago, 12 cents, was touched in October. The December quotation shows a range of 11 to 11½ cents at both markets.

London pork values reflected the conditions in our own markets. The London prices, however, usually average 3 to 4 cents a pound above ours.

German and French pork is comparatively cheap when considered with their other meats. The Berlin prices have run about on a par with those of London for the last two years.

It is rather surprising to note that the prices of pork in Paris have moved in a contrary direction to those of the other countries. They show a consistent decline when compared with the two previous years. For the last three months of 1909 the Paris figures, usually many cents higher, were only about 1 cent above those of Chicago, while they were fully 2 cents below the London quotations.

Wholesale prices per pound of fresh carcass pork at stated home and foreign markets, 1907 to 1909, at monthly periods.

Date.		Chicago.	New York.	London.	Berlin.	Paris.
		Dressed hogs.	Dressed hogs.	Best (small and medium).	Choice (medium weight).	Extra.
		Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	1909	7½- 8½	8¼	11¾-12¼	15 -15¼	13¼-15
	1908	9½- 9¾	7⅛	11¼-12½	12¾	14⅞-16⅛
	1907	9½- 9¾	9¼	12⅛-13⅛	13½	14½-15½
February	1909	7½- 8½	8⅞	11¾-12¾	15 -15¼	12¼-13¼
	1908	9½- 9¾	6⅝	12¼-13	12⅛	15½-16¼
	1907	9½- 9¾	9½- 9⅞	12⅛-13⅛	12¾	14½-15¾
March	1909	7½- 8½	9⅛	13¾-14¼	14¼-14½	12¼-13¼
	1908	6¼- 6¾	6¾	11¼-12½	11¾	14½-16⅝
	1907	9½- 9¾	9⅛- 9⅞	13⅛-14⅝	11¾	15 -16¼
April	1909	8½- 9½	9½	13¾-14¼	14	12 -12¾
	1908	6¾- 7¼	8½	12¼-13	11¾	14⅞-15¾
	1907	9½- 9¾	8¾- 9½	13⅛-14⅝	11½	15¼-16¾
May	1909	9½-10	10	12¼-13¼	13¼-13½	12¼-13¼
	1908	7½- 8	8¾	10¾-12¼	12⅛	14 -14⅞
	1907	9½- 9¾	8⅞- 9⅜	13⅛-14⅝	10½	16½-17½
June	1909	9½-10	10¼	13¾-14¾	13½	12¼-13¼
	1908	7 - 7½	7⅞- 8	10¼-11¼	12½	15½-16¼
	1907	9½- 9¾	8½- 9	11⅝-12⅝	10¾	16¾-17½
July	1909	10 -10¾	11	12¾-13¼	14 -14¼	12¼-13¼
	1908	8½- 9	9⅛- 9¼	10¼-11¼	12¾	14⅞-15¾
	1907	9½- 9¾	8⅜- 8⅞	11⅝-12⅝	12	16¼-17
August	1909	10¾-11¼	11¼	12¼-12¾	15½-15¾	13½-14½
	1908	9½-10	9⅝	10¼-10¾	13½	14-⅞16⅛
	1907	9½- 9¾	8⅝- 9¼	11⅝-12⅝	14¼	15¾-16¾
September	1909	10¾-11¼	11½	15¾-16¼	16¼-16½	13¼-14
	1908	9½-10	9⅜	13 -13¾	13¾	14⅜-15¼
	1907	9½- 9¾	8⅞- 9⅝	12⅛-13⅛	13¾	16¼-16¾
October	1909	11 -12	11¾	14¾-15¼	16½-16¾	12½-13½
	1908	10 -10½	9½- 9⅝	12¼-13	13¾	14 -14⅞
	1907	9½- 9¾	8⅞- 9¾	12⅛-13⅝	13	15 -15¾
November	1909	10½-11½	11¼	15¼-15¾	16¼-16½	12 -12¾
	1908	8 - 8¾	8¾	12¼-12½	14	13⅛-14⅜
	1907	9½- 9¾	8⅜- 9¼	12⅛-13⅛	12	15 -15¾
December	1909	11 -11½	11¼	15¼-15¾	15 -15½	11½-12½
	1908	8 - 8½	8¼- 8⅜	12¼-13	14 -14¼	12⅝-13½
	1907	9½- 9¾	6⅞- 7⅝	11⅛-12⅛	12	15 -16¼

MEAT CONSUMPTION IN PRINCIPAL COUNTRIES.

The four countries dealt with in the preceding chapter on meat prices, namely, the United States, the United Kingdom, Germany, and France, are the four principal meat-consuming countries of the world. It may therefore be of interest to note here the latest information concerning the consumption of meat per head of the population in each of them. A statement is added showing the proportion of the different kinds of meat consumed in each country.

In the case of the United States an estimate is made of the consumption in 1909; the British figures cover the triennial average from 1905 to 1908; the German estimate is for 1907, and that of France for 1900. Before presenting the tables a few salient points will be briefly mentioned.

THE UNITED STATES.

The United States both produces and consumes in the aggregate a far larger quantity of meat products than any other country in the world. Regarding the extent of this consumption, no previous details are available except for the last census year, 1900. Two separate estimates were made for the year named, the first appearing in the Twenty-second Annual Report of this Bureau (1905), in which the consumption per head of the population was placed at 179 pounds. A later estimate, which went into the whole question in great detail, was published in 1907 in Bulletin 55 of the Bureau of Statistics, Department of Agriculture. In this case the consumption per head was given as 186 pounds; but it should be said that lard was included with the other pork products, whereas the first-mentioned estimate was confined strictly to dressed meats.

The present estimate, which shows a consumption per head of 169 pounds, is based on the number of farm animals estimated by the Bureau of Statistics of this Department to be in the country on January 1, 1909, as quoted on page 302 of this volume. These figures indicate a scarcity, especially of cattle and hogs, which accounts for the decrease of about 5 per cent in the present estimated per capita consumption, as compared with the former figures.

THE UNITED KINGDOM.

Very full information regarding the production and consumption of meat in the United Kingdom has been published from time to time. The latest statistics, as given in a comprehensive paper published in 1909,[a] have brought the figures down to and including the year 1908. It is here shown that the annual consumption per head has averaged 120 pounds for the past fifteen years.

The British, as is well known, depend to a large extent on outside sources for their meat supply. The actual extent of this dependence is shown in the paper referred to as having increased from 34 per

[a] Hooker, R. H. "The meat supply of the United Kingdom." Journal of the Royal Statistical Society, June, 1909.

cent in 1890–91 to 1894–95 to 46 per cent in 1905–6 to 1907–8, so that the home supply seems likely soon to become less than half of what is required for consumption. However, this does not mean that the British supply is in itself decreasing—it has, in fact, been practically stationary for many years—it merely shows that the total consumption is increasing along with the population.

England now imports very close upon 2,500,000,000 pounds of foreign meat annually, and this comes from all quarters of the globe. The enormous development of the international meat trade in the last quarter of a century may be said to have caused the law of supply and demand regarding meat to become not merely a local but a world question. Hence, especially in those countries where the production is on a large scale, prices are in these days influenced to a large extent by the world's demand rather than by that of any particular country. The great improvements that have in recent years been effected in the methods of transporting perishable products, such as meats, have practically eliminated the question of distance between producer and consumer. The British market has therefore become attractive to foreign meat producers regardless of distance, provided the means and cost of transportation are not too great a handicap.

In this connection an interesting event of the past year may be alluded to. This was an importation of pork to London from Hankow, China. The consignment consisted of some 5,000 frozen carcasses, and the hogs were stated to have been specially fed on rice for this trade. The shipment created a good deal of comment in England, and considerable opposition, partly by trade interests and by individuals who had heard of the unsavory reputation of the native Chinese hog. The pork arrived in due course and was admitted, subject to a rigid governmental inspection. The carcasses were thawed out and examined when required for the trade, and information is at hand concerning the disposition of the first 1,182. Of these, 107, or 9 per cent, were condemned. The remainder were reported to have brought good prices, and the pork was rated as first class of its kind. It does not appear, however, that the experiment has resulted as yet in establishing a meat trade of any consequence between China and England.[a]

GERMANY.

The figures for Germany are taken from the official reports covering the total slaughterings (under inspection and otherwise) for the year 1907. One of these reports mentions 135,775 horses and 6,461

[a] There have been some consignments of Chinese pork to the United States also, by way of Pacific ports, but as this Bureau has no supervision over imported meats, we are unable to give any details of the shipments at the present time.

dogs as having been slaughtered under government inspection, in addition to the ordinary farm animals. So far as we know, Germany is the only country that officially recognizes the slaughter of dogs for food. There is a considerable consumption of horse meat in several of the continental European countries, and it is quite prevalent in many of the German cities. The total consumption of horse flesh in Germany is indicated by the above total to be about 1¼ pounds per head of the population yearly.

These facts, taken in conjunction with the high prices of fresh meats in Berlin (see preceding chapter on meat prices for details), show the difficulty experienced by Germany in maintaining her policy of excluding foreign meat from her markets.

FRANCE.

The estimates of meat consumption quoted for France are not as recent as those for the other countries. Abattoir statistics for 38 French cities covering the decennial period 1895–1904 have been published by De Loverdo,[a] but no estimate for the whole of France appears to have been made since the last census year, 1900. The average annual consumption in the cities for the period named is shown to have been approximately 136 pounds per head, while that of the entire country, according to the census, was stated by De Foville to have been 36.8 kilograms, or 81 pounds.

The use of horseflesh as a meat food product is quite general in French cities, although the consumption in the aggregate is somewhat less than that of Germany. However, De Loverdo's statistics show it to have increased considerably in the ten years covered by his figures, and the quantity of horse meat produced in the latest year of the period, 1904, indicates a consumption of a trifle over 1 pound per head of the population of France.

The table shows that the consumption of veal is much greater in France than in the other countries. This seemed to be especially the case in Paris. The sale of veal at the great distributing market at the French capital—the "Halles Centrales"—was observed to be so abnormally large in comparison with the other kinds of meat as to call for special comment. The daily arrivals at this market indicated that not far short of one-half of all the meat disposed of was veal. This is borne out by an article in a French statistical journal dealing with the meat consumption of Paris for 1907.[b] It is here stated that the total weight of the meat brought into the market during the year was 116,354,143 pounds, and that the percentage of distribution was

[a] De Loverdo, J. Les Abattoirs Publics. Paris, 1906.

[b] Cadoux, G. "Meat supply of Paris in 1907." Journal de la Société de Statistique de Paris, October, 1908.

as follows: Beef, 31.3 per cent; veal, 44.6 per cent; mutton (including lamb and goat), 16.8 per cent; pork, 7.3 per cent.

It should be mentioned that the greater part of the above meat was brought into the market from the surrounding country; only 23 per cent, it is stated, was supplied by the Parisian abattoirs, of which there are two under the direction of the municipality. The total yield of these in 1907 amounted to 403,420,493 pounds of meat, of which 323,707,485 pounds was destined for Paris and the remainder for outside. The different kinds of meat constituting the last total are not given, but the entire output of the two abattoirs gave percentages of 52 for beef, 11 for veal, 21 for mutton, and 16 for pork.

The quantities of the various kinds of meat consumed per head of the population in the countries named are as follows:

Per capita consumption of meat in the United States, the United Kingdom, Germany, and France.

Kind of meat.	United States (1909).	United Kingdom (annual average 1905–1908).	Germany [a] (1907).	France [a] (1900).
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Beef	70	56	32	39
Veal	6	4	6	8
Mutton and lamb	10	26	3	20
Pork	83	33	63	14
Total	169	119	104	81

[a] The consumption of horseflesh, which, as previously mentioned, amounts to about 1¼ pounds per head in Germany and 1 pound per head in France, is not included in this table.

The British are well known to be partial to beef in their meat dietary, and the Germans to pork, and this is amply borne out by the table; nevertheless it is seen that the people of the United States consume more beef than the English and more pork than the Germans. The British, however, consume more mutton per head than any other nationality, while the French come first with veal.

Below is a table showing the proportional consumption of the various kinds of meat in each country:

Proportional consumption of meat in the United States, the United Kingdom, Germany, and France.

Kind of meat.	United States (1909).	United Kingdom (annual average 1905–1908).	Germany (1907).	France (1900).
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Beef	41	47	31	48
Veal	4	3	6	10
Mutton and lamb	6	22	3	25
Pork	49	28	60	17
Total	100	100	100	100

The highest percentage in the table is that of pork for Germany. Six-tenths of all the meat consumed in Germany is pork. All the countries consume a fairly high proportion of beef, but the English and French appear to have a more balanced meat ration because of their large consumption of mutton and lamb. In this respect they far exceed the United States and Germany, the percentage of the latter country in this kind of meat being particularly small. France has considerably the highest percentage in veal consumption.

OUR FOREIGN TRADE IN ANIMALS AND ANIMAL PRODUCTS.

The tables of exports and imports of animals and animal products, showing the trade for the past four years of the United States, denote a continued decrease in the exports for last year and a very pronounced increase in the imports. The exports have, in fact, fallen off steadily year by year since 1906, chiefly on account of our rapidly diminishing surplus of meat products. In 1906 the total value of the exports of animals and animal products was $296,658,466; in 1909 it was $215,652,463. The decline in three years was therefore $81,006,003, which is a little over 27 per cent.

The extraordinary increase in the imports of 1909 was no doubt mostly due to the fact that the new tariff came into operation in the course of the year, consequently the manufacturing interests required largely increased quantities of raw materials to fill orders which had been held in abeyance until the new rates came into effect.

EXPORTS.

It may be seen from the table of exports that there was a decrease in round figures of $33,000,000 in the total for 1909 as compared with 1908. This is equivalent to 14 per cent. The items chiefly concerned in this deficit were: Live cattle, $8,000,000; fresh beef, $6,400,000; bacon and hams, $7,000,000; pickled pork, $4,000,000; and lard, $5,000,000. It is satisfactory to note, on the other hand, a slight increase in the horse trade and a considerable advance in the leather exports.

The large decline in butter shipments was caused by the stoppage of the trade with Great Britain. In 1908 we sent to the British islands 5,101,703 pounds; in 1909 only 1,295 pounds. The cheese trade diminished for similar reasons.

Exports of leather in 1909 show a general increase, especially upper leather, which advanced a little over $4,000,000, or 20 per cent.

Shipments of fresh beef continue to fall off, last year's trade being, as before mentioned, over $6,000,000, or about 40 per cent, less than 1908. The trade in pork products is still quite large, notwithstanding the previously noted deficiencies.

The statement following shows the value of the exports of animal origin, by articles, for the past four years.

Value of exports of animals and animal products, by articles, for calendar years 1906 to 1909.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Item.	1906.	1907.	1908.	1909.
Animals:				
Cattle	$38,273,132	$33,796,425	$24,034,193	$16,274,250
Hogs	341,232	304,464	256,938	76,515
Horses	4,914,999	3,608,119	2,893,344	3,334,455
Mules	914,839	907,304	823,952	561,870
Sheep	831,495	707,930	605,792	265,356
All other, including fowls	339,051	327,419	235,196	282,692
Bones, hoofs, etc	156,539	206,034	243,898	211,984
Dairy products:				
Butter	4,548,366	862,812	1,884,254	699,460
Cheese	2,628,134	1,260,480	1,270,557	486,855
Milk, condensed	1,889,795	2,548,435	1,997,689	1,012,629
Eggs	1,225,708	1,719,433	1,385,450	1,183,942
Feathers	301,980	335,137	451,267	383,773
Glue	311,173	322,939	260,956	259,205
Grease, and all soap stock	4,250,942	6,163,739	4,988,477	5,107,620
Hair, and manufactures	863,027	1,102,520	1,050,531	1,008,524
Hides and skins (other than furs)	1,877,388	1,293,380	1,437,202	1,047,030
Leather:				
Sole	8,062,649	6,757,306	6,398,377	6,979,545
Upper	22,586,643	19,158,010	19,902,133	23,995,188
Other	2,328,305	2,315,673	2,055,057	2,227,340
Meat products:				
Beef—				
Canned	3,492,189	2,352,226	1,884,940	1,843,205
Fresh	24,751,284	26,182,787	15,952,670	9,592,176
Salted, etc	4,452,362	3,293,932	3,340,964	3,308,947
Tallow	5,729,856	6,623,648	3,967,532	2,856,390
Bacon	35,886,152	22,344,365	27,829,273	23,318,162
Hams and shoulders	20,986,356	24,213,548	24,444,747	21,937,171
Pork—				
Canned	586,856	362,432	492,880	623,280
Fresh	1,216,770	1,224,355	1,770,019	238,553
Pickled, etc	12,907,344	15,465,072	8,630,497	4,494,038
Lard	57,984,829	55,518,079	53,659,222	48,770,370
Lard compounds and substitutes	4,801,078	6,849,445	6,061,233	6,146,922
Lard oil	162,786	145,034	173,854	137,458
Other animal oil	267,214	324,735	367,007	341,649
Mutton	60,445	104,994	138,183	162,929
Oleo oil and neutral lard	16,936,026	18,348,208	19,136,772	17,437,772
Oleomargarine	870,910	335,550	279,930	312,287
Poultry and game	1,401,784	1,161,789	794,533	827,324
Sausage and sausage meats	935,288	895,685	1,046,786	892,549
Sausage casings	2,920,703	3,799,904	3,602,807	4,357,133
All other meat products	3,595,750	3,886,604	3,306,666	2,645,885
Wool	67,087	20,667	34,554	10,030
Total	296,658,466	277,150,618	249,090,332	215,652,463

IMPORTS.

By far the greatest quantity of animal products ever imported in any single year in the history of our country was brought in during 1909. The total value of these imports last year was $200,407,539. Of the items that compose this large total, hides and skins and wool are the only really important ones. The combined value of the products mentioned amounted last year to $159,288,643, which is 80 per cent of the total.

Last year's increase covered practically every item on the list, the greatest proportional increase in any one item being in cattle hides, which advanced 134 per cent over 1908. The cause for this was the removal of the tariff duty.

Regarding some of the more important of the smaller items, it may be mentioned that the scarcity of our domestic supply of beef cattle is reflected in the increased imports of the animals on which duty is paid in the last two years, the actual figures being 63,129 in 1907 and 152,120 in 1909. It may be explained that cattle imported for breeding purposes are admitted free of duty, whereas those brought in for feeding, slaughter, etc., are subject to the tariff.

There is a large and increasing consumption in this country of fancy and other varieties of European cheese. Fully three-fourths of this supply comes from Italy and Switzerland, the former country supplying the larger share.

The annual values of the imports of animal products for the past four years are as follows:

Values of imports of animals and animal products, by articles, for calendar years 1906 to 1909.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Item.	1906.	1907.	1908.	1909.
Animals:				
Cattle	$525,266	$1,111,330	$1,599,037	$2,317,464
Horses	1,947,872	1,835,555	1,435,315	2,905,929
Sheep	1,132,539	1,034,213	547,954	701,250
All other, including fowls	670,149	649,662	494,539	712,756
Bones, hoofs, etc	953,138	810,863	631,967	945,028
Bristles	3,090,288	2,851,411	2,097,252	[a] 3,076,489
Dairy products:				
Butter	75,767	215,868	73,384	295,633
Cheese	4,874,559	5,957,972	5,627,894	6,398,907
Eggs	21,074	29,014	32,278	(b)
Feathers, crude	3,707,954	4,415,304	4,802,029	6,603,551
Glue	616,961	659,168	565,274	746,620
Grease and oils	1,351,080	1,255,573	1,267,857	1,345,613
Hair, animal, unmanufactured	3,297,308	3,126,236	3,056,131	3,627,565
Hides and skins:				
Goatskins	32,518,896	26,565,334	18,835,098	29,827,745
Cattle hides	21,149,829	18,120,638	16,318,195	38,161,362
All other	30,216,256	32,964,087	22,500,488	35,769,170
Hide cuttings	1,306,295	1,502,763	1,140,997	1,506,756
Leather:				
Morocco skins	3,146,516	2,907,468	1,515,783	1,813,356
Upper leather, etc	4,012,364	4,287,225	2,506,422	3,782,881
All other	70,685	57,168	196,968	1,171,601
Meat products:				
Sausage casings	987,566	1,950,224	2,151,618	2,388,738
All other	926,417	843,249	710,132	778,759
Wool	38,361,869	39,673,007	23,304,465	55,530,366
Total	154,960,648	152,823,332	111,411,077	200,407,539

[a] Does not include bristles, crude, not sorted, bunched, or prepared, in 1909.
[b] Not separately stated for 1909.

THE FEDERAL MEAT INSPECTION.

Below is presented a table showing the number of each class of food animals slaughtered under government inspection during the calendar year 1909 in each city where inspection is maintained. It may be stated that some of the larger cities have a number of separate establishments where slaughtering is conducted. On the other hand not a few contain establishments where no slaughtering takes place. In such cases the meat is brought from other places for the purpose of canning, etc., which processes are supervised by the inspectors as well as the actual slaughtering. Altogether the federal inspection was in operation during the year at 924 establishments in 248 cities. Slaughtering was conducted at 370 of these, and there was no slaughtering at 554.

The totals for 1909 in the table, when compared with those of the previous year, show an increase in all the classes of animals except swine. The decrease in swine was quite serious; no less, in fact, than 7,239,913, or 19 per cent. (It is worthy of note that this percentage exactly corresponds with that representing the decrease in the receipt of hogs at Chicago in 1909—see page 301.) This, of course, accounts for the extraordinary rise in the price of pork, which was in effect practically throughout the entire year and continued into 1910.

A detailed report of the meat inspection for the fiscal year 1909 will be found on pages 22–27 of this volume.

Number of food animals slaughtered under government inspection during calendar year 1909, by cities.

City and State.	Cattle.	Calves.	Hogs.	Sheep.	Goats.
Albert Lea, Minn	509	1,101	17,434	90	....
Allentown, Pa	11,772	322	63,517	1,040	....
Alton, Ill	3,209	555	51,611	420	....
Arkansas City, Kans	1,464	114	22,227	14	2
Auburn, Me	258	78	18,039	230	4
Augusta, Ga	8,988	4,083	10,544	1,205	50
Austin, Minn	1,127	836	199,517	413	....
Baltimore, Md	47,282	4,378	501,358	21,563	56
Bangor, Me	230	259	72	22,530	....
Billings, Mont	2,413	820	6,765	3,469	18
Binghamton, N. Y	7	75	5	133	....
Boston, Mass	59,580	84,466	1,161,141	294,202	773
Bridgeport, Conn	....	256	25	....	....
Bridgeport, Pa	899	66	18,915	3,132	....
Brightwood, Mass	2,299	2,364	131,331	157	....
Brooklyn, N. Y	15,060	41,385	....	193,064	6
Buffalo, N. Y	93,583	26,026	783,364	179,062	....
Burlington, Iowa	844	169	7,591	137	27
Burlington, Vt	1,331	20	95	3	....
Cairo, Ill	1,974	391	6,838	353	28
Cedar Rapids, Iowa	23,225	465	452,367	2,040	105
Charleston, Tenn	....	....	2,255	....	....
Chester, Pa	3,344	761	27,967	7,490	....
Cheyenne, Wyo	1,318	39	3,501	606	....
Chicago, Ill	1,659,688	357,974	5,359,825	3,442,044	21,089
Cincinnati, Ohio	136,968	68,112	524,641	114,499	235
Claremont, N. H	59	38	272	20	....
Cleveland, Ohio	62,624	45,950	703,479	113,242	106
Columbus, Ohio	4,437	319	53,818	290	....
Corning, N. Y	37	2,739	179	471	....
Cortland, N. Y	373	11,482	12,277	1,761	15
Corydon, Ind	31	2	695	1	....
Davenport, Iowa	234	188	45,673	4	....
Dayton, Ohio	9,675	4,793	116,737	3,735	....
Decatur, Ind	206	281	3,563	50	....
Denver, Colo	42,887	5,726	212,440	38,851	22
Des Moines, Iowa	27,545	682	143,135	43	1
Detroit, Mich	22,014	16,354	439,779	89,176	15
Dover, N. H	....	14	....	30	....
Dubuque, Iowa	7	20	17,628	....	....
Duluth, Minn	6,776	5,173	11,196	4,510	27
Eau Claire, Wis	152	44	39,026	341	....
Elmira, N. Y	....	599	9	121	....
El Paso, Tex	932	276	184	470	....
Evansville, Ind	9,515	2,316	34,697	1,331	15
Fergus Falls, Minn	528	83	6,726	208	....
Fort Atkinson, Wis	....	....	9,557	....	....
Fort Madison, Iowa	1,093	382	51,951	232	....
Fort Wayne, Ind	3,654	2,127	41,323	962	....
Fort Worth, Tex	531,044	224,648	834,397	81,465	191
Grand Rapids, Wis	137	4	1,386	16	....
Greenville, Tenn	....	....	840	....	....
Hallstead, Pa	217	4,414	55	132	....
Hamilton, Ohio	472	296	7,065	287	1
Harrisburg, Pa	3,372	1,184	40,121	353	....
Haverhill, Mass	800	2,162	2,552	38,963	11
Houston, Tex	26,395	7,869	42,574	1,229	1
Indianapolis, Ind	191,667	34,588	1,415,113	47,950	....
Jacksonville, Ill	1,856	155	21,229	7	....
Jefferson, Wis	164	512	4,239	5	....
Jefferson City, Tenn	....	....	875	....	....

Number of food animals slaughtered under government inspection during calendar year 1909, by cities—Continued.

City and State.	Cattle.	Calves.	Hogs.	Sheep.	Goats.
Jersey City, N. J.	15,077	51,155	716,126	222,079	150
Kansas City, Kans.	1,349,777	204,553	3,174,437	1,111,275	57,593
Keene, N. H.	68	1	5	28	....
Kennett Square, Pa.	139	367	748	15	....
Knoxville, Tenn.	3	....	152	....	....
La Crosse, Wis.	607	543	5,620	396	....
La Fayette, Ind.	4,764	3,046	45,341	1,031	....
Leavenworth, Kans.	345	66	621	12	....
Lewiston, Idaho.	504	181	1,136	359	....
Logansport, Ind.	659	273	26,600	90	....
Los Angeles, Cal.	80,954	12,922	105,102	224,353	302
Louisville, Ky.	11,016	1,675	184,421	2,070	42
Madison, Ind.	323	1,345	2,767	62	....
Mankato, Minn.	2,563	1,984	6,417	3,168	....
Marshalltown, Iowa.	1,518	154	90,280	8	....
Mason City, Iowa.	1,239	297	71,797	4	....
Meadville, Pa.	....	41	61	....	....
Milwaukee, Wis.	68,169	108,520	929,160	37,573	118
Morristown, Tenn.	....	....	2,374	....	....
Nashville, Tenn.	6,286	1,323	44,342	3,318	76
National Stock Yards, Ill.	531,511	131,573	1,356,092	532,467	7,888
Nebraska City, Nebr.	24	1	138,909	....	....
Newark, N. J.	16,865	15,057	463,545	58,750	2
New Haven, Conn.	....	....	135,883	....	....
New Orleans, La.	62,586	4,123	7,672	415	369
New York, N. Y.	486,216	320,458	782,907	1,526,820	67
Ogden, Utah.	5,708	1,127	7,727	8,999	....
Oklahoma City, Okla.	2,160	628	13,636	8	3
Olathe, Kans.	....	3	1,733	....	....
Ottumwa, Iowa.	15,538	2,977	570,245	4,318	....
Paris, Ill.	293	231	3,387	7	1
Paterson, N. J.	5,845	5,190	111,068	44,495	....
Peoria, Ill.	6,925	3,585	91,758	975	....
Philadelphia, Pa.	100,133	44,025	375,869	233,201	2
Pittsburg, Kans.	3,772	658	13,126	243	8
Pittsburg, Pa.	47,546	39,497	306,083	67,351	4
Portland, Oreg.	45,010	3,995	64,384	87,722	....
Pottsville, Pa.	689	253	55,842	41	....
Providence, R. I.	....	24	101,492	....	....
Pueblo, Col.	4,512	1,518	31,363	4,025	....
Quincy, Ill.	2,762	1,115	46,216	438	2
Reno, Nev.	4,771	2,564	4,991	16,158	....
Richmond, Ind.	2,888	2,027	7,702	491	....
Richmond, Va.	3,884	87	86,896	131	....
Rockford, Ill.	1,905	671	19,568	963	....
St. Louis, Mo.	172,490	20,395	777,751	43,472	936
Salt Lake City, Utah.	5,628	318	7,579	8,765	....
San Diego, Cal.	6,289	2,304	5,762	13,568	....
San Francisco, Cal.	83,152	24,309	45,353	286,946	1,401
Scranton, Pa.	1,138	103	20,385	2,304	....
Seattle, Wash.	46,834	....	99,720	100,576	....
Silver Mills, Me.	....	48	37	10,168	....
Sioux City, Iowa.	168,366	15,824	906,034	42,726	18
Sioux Falls, S. Dak.	....	....	22,467	....	....
South Bellingham, Mass.	....	17	121	....	....
South Omaha, Nebr.	676,779	49,832	1,857,557	1,180,613	4,761
South St. Joseph, Mo.	353,700	45,101	1,650,364	477,080	2,017
South St. Paul, Minn.	119,937	45,831	651,380	129,450	....
Spokane, Wash.	12,139	1,940	36,963	21,427	4
Springfield, Ohio.	211	21	2,961	9	....
Tacoma, Wash.	38,759	4,872	62,287	80,855	1,929
The Dalles, Oreg.	519	310	753	639	....
Toledo, Ohio.	3,160	466	124,938	747	2
Topeka, Kans.	6,884	1,275	115,564	644	43
Trenton, N. J.	....	733	....	19	....
Troy, N. Y.	4,425	249	6,153	16	....
Wallace, Idaho.	2,503	783	3,992	4,044	....
Walla Walla, Wash.	3,047	1,058	7,466	3,548	....
Washington, D. C.	14,599	13,077	102,471	35,406	4
Waterloo, Iowa.	1,483	416	57,442	143	....
West Newbury, Mass.	1,106	1,200	445	636	....
Wheeling, W. Va.	8,725	7,864	118,906	6,661	....
Whitesburg, Tenn.	....	....	854	....	....
Wichita, Kans.	40,668	5,246	655,543	873	3
Wilmington, Del.	7,236	1,055	9,767	3,599	4
Winona, Minn.	1,380	806	29,503	1,495	....
Worcester, Mass.	....	....	119,477	....	....
Youngstown, Ohio.	728	9	11,860	299	....
Total.	7,703,714	2,185,830	31,403,191	11,364,739	100,550

LIVE STOCK REGISTERED IN THE UNITED STATES.

The details given in the annexed statements have been furnished by the secretaries of the pedigree-record associations, to whom acknowledgment is hereby made for the courtesy. In connection with the table of registered animals is shown the number of living registered animals of each kind.

Live stock registered in the United States up to June 30, 1909.

[Compiled from statements furnished by secretaries of certified pedigree-record associations.]

Breed.	Animals registered.			Animals living.		
	Male.	Female.	Total.	Male.	Female.	Total.
HORSES.						
American Trotter	51,454	169,366	220,820	(a)	(a)	(a)
Belgian Draft	4,119	1,104	5,223	4,070	1,090	5,160
Cleveland Bay	1,284	536	1,820	1,050	400	1,450
Clydesdale			14,391	(a)	(a)	(a)
French Draft	11,372	7,145	18,517	7,000	6,500	13,500
French Coach Studbook of America	2,292	757	3,049	1,400	400	1,800
French Coach Horse Register	310	11	321	310	11	321
German Coach	2,524	362	2,886	(a)	(a)	(a)
Hackney	1,209	2,153	3,362	(a)	(a)	(a)
Morgan	1,932	5,709	7,641	2,100	2,100	4,200
Percheron Studbook of America	9,437	9,834	19,271	[b] 22,500	[b] 17,500	[b] 40,000
Percheron Register	1,478	863	2,341	1,500	800	2,300
American Breeders and Importers' Percheron Register	1,939	1,384	3,323	[c] 2,200	[c] 1,500	[c] 3,700
Saddle Horse	3,787	5,898	9,685	2,842	4,425	7,267
Shetland Pony	3,440	5,208	8,648	3,000	5,000	8,000
Shire	7,540	3,015	10,555	2,150	1,700	3,850
Suffolk	234	179	413	50	140	190
Thoroughbred			55,180	15,000	20,000	35,000
Welsh Pony	26	31	57	20	30	50
ASSES.						
Jacks and Jennets	2,225	1,285	3,510	1,500	1,000	2,500
CATTLE.						
Aberdeen-Angus	45,523	72,547	118,070	38,426	48,907	87,333
Ayrshire	11,416	24,254	35,670	3,000	13,000	16,000
Devon	8,506	14,497	23,003	4,300	7,500	11,800
Dutch Belted	759	1,611	2,370	250	625	875
Galloway	14,947	19,993	34,940			
Guernsey	14,805	27,446	42,251	9,000	18,000	27,000
Hereford			323,087	43,000	75,000	118,000
Holstein-Friesian [d]	63,576	128,266	191,842			
Jersey	85,463	228,259	313,722			
Polled Durham	8,009	9,961	17,970	5,500	9,000	14,500
Red Polled	18,927	30,297	49,224	11,616	18,360	29,976
Shorthorn	316,504	481,413	797,917	95,000	197,000	292,000
Sussex	91	228	319			
Brown Swiss	3,004	4,242	7,246	300	1,700	2,000
SHEEP.						
Cheviot			12,230			
Cotswold			47,490	5,000	15,000	20,000
Dorset Horn	2,599	6,380	8,979	1,500	3,000	4,500
Hampshire Down	8,597	19,117	27,714	4,000	10,000	14,000
Leicester	4,962	7,502	12,464	4,089	6,349	10,438
Lincoln	7,894	11,538	19,432	4,250	5,500	9,750

[a] No record.
[b] These estimates include animals registered by the Percheron Society of America, of which the Percheron Studbook of America is successor.
[c] These estimates include animals registered by the American Percheron Horse Breeders' Association, of which the American Breeders and Importers' Percheron Register is successor.
[d] Number registered up to May 15, 1909.

Live stock registered in the United States up to June 30, 1909—Continued.

Breed.	Animals registered.			Animals living.		
	Male.	Female.	Total.	Male.	Female.	Total.
SHEEP—continued.						
Merino (Delaine):						
Dickinson Spanish Merino Sheep Register	....	....	11,399	800	3,000	3,800
National Delaine Merino Register	7,283	12,435	19,718	500	2,000	2,500
American and Delaine Merino Record [a]	4,030	6,045	10,075	12,500	31,000	43,500
Merino (French)	....	....	52,381	10,000	25,000	35,000
Merino (German)	232	346	578	....	....	....
Merino (Spanish):						
Register of the Michigan Sheep Breeders' Association	12,635	37,955	50,590	....	....	....
Vermont, New York, and Ohio Merino Sheep Breeders' Association [a]	1,173	2,062	3,235	3,518	10,310	13,829
Oxford Down	....	....	45,473	....	....	....
Shropshire	132,000	184,000	316,000	80,000	120,000	200,000
Southdown	....	....	24,164	....	....	13,000
HOGS.						
Berkshire	....	....	120,590	....	....	75,000
Cheshire	1,361	2,854	4,215	60	150	210
Chester, Ohio Improved	....	....	23,389	2,500	8,000	10,500
Duroc-Jersey:						
American Duroc-Jersey Record	12,420	30,156	42,576	11,340	25,180	36,520
National Duroc-Jersey Record	43,300	109,250	152,550	10,000	50,000	60,000
Hampshire (Thin Rind)	2,064	4,270	6,334	....	....	....
Poland-China:						
American Poland-China Record	75,027	183,652	258,679	14,000	37,000	51,000
National Poland-China Record	38,000	84,000	122,000	....	....	....
Southwestern Poland-China Record	1,218	1,834	3,052	600	400	1,000
Standard Poland-China Record	52,849	127,278	180,127	9,000	21,000	30,000
Tamworth	....	....	5,576	....	....	....
Yorkshire	....	....	9,107	1,500	2,500	4,000

[a] These figures are but for one year, July 1, 1908, to June 30, 1909.

CERTIFIED PEDIGREE-RECORD ASSOCIATIONS.

Paragraph 492 of the tariff act of August 5, 1909, provides that—

Any animal imported by a citizen of the United States specially for breeding purposes shall be admitted free, whether intended to be so used by the importer himself or for sale for such purpose: *Provided*, That no such animal shall be admitted free unless purebred of a recognized breed, and duly registered in the book of record established for that breed: *And provided further*, That certificate of such record and of the pedigree of such animal shall be produced and submitted to the customs officer, duly authenticated by the proper custodian of such book of record, together with the affidavit of the owner, agent, or importer that such animal is the identical animal described in said certificate of record and pedigree: *And provided further*, That the Secretary of Agriculture shall determine and certify to the Secretary of the Treasury what are recognized breeds and purebred animals under the provisions of this paragraph.

Accordingly the Secretary of Agriculture has certified a large number of books of record of pedigrees and their publishing agencies and has prescribed regulations for them, which have been published in Bureau of Animal Industry Order 136. A list of the certified American records and associations follows:

American pedigree-record associations and books of record certified by the Secretary of Agriculture.

HORSES.

Name of breed.	Book of record.	By whom published.
American Trotter	American Trotting Register	American Trotting Register Association, William H. Knight, secretary, 355 Dearborn street, Chicago, Ill.
Arabian	Studbook of the Arabian Horse Club of America.	Arabian Horse Club of America, H. K. Bush-Brown, secretary, Newburgh, N. Y.
Belgian Draft	American Register of Belgian Draft Horses	American Association of Breeders and Importers of Belgian Draft Horses, J. D. Conner, jr., secretary, Wabash, Ind.
Cleveland Bay	American Cleveland Bay Studbook	Cleveland Bay Society of America, R. P. Stericker, secretary, Oconomowoc, Wis.
Clydesdale	American Clydesdale Studbook	American Clydesdale Association, R. B. Ogilvie, secretary, Union Stock Yards, Chicago, Ill.
French Coach	French Coach Studbook	French Coach Horse Society of America, Duncan E. Willet, secretary, Maple avenue and Harrison street, Oak Park, Ill.
Do	French Coach Horse Register	French Coach Horse Register Co., Chas. C. Glenn, secretary, 1319 Wesley avenue, Columbus, Ohio.
French Draft	National Register of French Draft Horses	National French Draft Horse Association of America, C. E. Stubbs, secretary, Fairfield, Iowa.
German Coach	German, Hanoverian, and Oldenburg Coach Horse Studbook.	German, Hanoverian, and Oldenburg Coach Horse Association of America, J. Crouch, secretary, Lafayette, Ind.
Hackney	American Hackney Studbook	American Hackney Horse Society, Gurney C. Gue, secretary, 308 West Ninety-seventh street, New York, N. Y.
Morgan	American Morgan Register	American Morgan Register Association, T. E. Boyce, secretary, Middlebury, Vt.
Percheron	Percheron Studbook of America	Percheron Society of America, George W. Stubblefield, secretary, Union Stock Yards, Chicago, Ill.
Do	Percheron Register	The Percheron Registry Co., Charles C. Glenn, secretary, Columbus, Ohio.
Do	The American Breeders and Importers' Percheron Register.	The American Breeders' and Importers' Percheron Registry Company, John A. Forney, secretary, Plainfield, Ohio.
Saddle Horse	American Saddle Horse Register	American Saddle Horse Breeders' Association, I. B. Nall, secretary, Louisville, Ky.
Shetland Pony	American Shetland Pony Club Studbook	American Shetland Pony Club, Miss Julia Wade, secretary, Lafayette, Ind.
Shire	American Shire Horse Studbook	American Shire Horse Association, Charles Burgess, sr., secretary, Wenona. Ill.
Suffolk	American Suffolk Horse Studbook	American Suffolk Horse Association, Alex Galbraith, secretary, De Kalb, Ill.
Thoroughbred	American Studbook	The Jockey Club, W. H. Rowe, registrar, 571 Fifth avenue, New York, N. Y.
Welsh Ponies and Cobs	Welsh Pony and Cob Studbook	Welsh Pony and Cob Society of America, John Alexander, secretary, Aurora, Ill.

ASSES.

Name of breed.	Book of record.	By whom published.
Jacks and Jennets	American Jack Stock Studbook	American Breeders' Association of Jacks and Jennets, J. W. Jones, secretary, Columbia, Tenn.

American pedigree-record associations and books of record certified by the Secretary of Agriculture—Continued.

CATTLE.

Name of breed.	Book of record.	By whom published.
Aberdeen-Angus	American Aberdeen-Angus Herdbook	American Aberdeen-Angus Breeders' Association, Charles Gray, secretary, Union Stock Yards, Chicago, Ill.
Ayshire	Ayshire Record	Ayshire Breeders' Association, C. M. Winslow, secretary, Brandon, Vt.
Brown Swiss	Swiss Record	Brown Swiss Cattle Breeders' Association, C. D. Nixon, secretary, Owego, N. Y.
Devon	American Devon Record	American Devon Cattle Club, L. P. Sisson, secretary, Newark, Ohio.
Dutch Belted	Dutch Belted Cattle Herdbook	Dutch Belted Cattle Association of America, G. G. Gibbs, secretary, Marksboro, N. J.
Galloway	American Galloway Herdbook	American Galloway Breeders' Association, Robert W. Brown, secretary, Union Stock Yards, Chicago, Ill.
Guernsey	Herd Register of the American Guernsey Cattle Club.	American Guernsey Cattle Club, William H. Caldwell, secretary, Peterboro, N. H.
Hereford	American Hereford Record	American Hereford Cattle Breeders' Association, C. R. Thomas, secretary, 225 West Twelfth street, Kansas City, Mo.
Holstein	Holstein-Friesian Herdbook	Holstein-Friesian Association of America, F. L. Houghton, secretary, Brattleboro, Vt.
Jersey	Herd Register of the American Jersey Cattle Club.	American Jersey Cattle Club, J. J. Hemingway, secretary, 8 West Seventeenth street, New York, N. Y.
Polled Durham	American Polled Durham Herdbook	Polled Durham Breeders' Association, J. H. Martz, secretary, Greenville, Ohio.
Red Polled	Red Polled Herdbook	Red Polled Cattle Club of America (Incorporated), H. A. Martin, secretary, Gotham, Wis.
Shorthorn	American Shorthorn Herdbook	American Shorthorn Breeders' Association, John W. Groves, secretary, Union Stock Yards, Chicago, Ill.
Sussex	American Sussex Register	American Sussex Association, Overton Lea, secretary, Nashville, Tenn.

SHEEP.

Name of breed.	Book of record.	By whom published.
Cheviot	American Cheviot Sheep Flock Book	American Cheviot Sheep Society, F. E. Dawley, secretary, Fayetteville, N. Y.
Cotswold	American Cotswold Record	American Cotswold Registry Association, F. W. Harding, secretary, Waukesha, Wis.
Dorset Horn	Continental Dorset Club Record	The Continental Dorset Club, Joseph E. Wing, secretary, Mechanicsburg, Ohio.
Hampshire Down	Hampshire Down Flock Record	American Hampshire Breeders' Association, C. A. Tyler, secretary, Coldwater, Mich.
Leicester	American Leicester Record	American Leicester Breeders' Association, A. J. Temple, secretary, Cameron, Ill.
Lincoln	National Lincoln Sheep Breeders' Record	National Lincoln Sheep Breeders' Association, Bert Smith, secretary, Charlotte, Mich.
Merino (Delaine)	Dickinson Spanish Merino Sheep Register	Dickinson Merino Sheep Record Co., Beulah McDowell Miller, secretary, New Berlin, Ohio.
Do	National Delaine Merino Register	National Delaine Merino Sheep Breeders' Association, J. B. Johnson, secretary, 248 West Pike street, Canonsburg, Pa.
Do	The American and Delaine Merino Record	American and Delaine Merino Record Association, S. M. Cleaver, secretary, Delaware, Ohio.
Merino (French)	American Rambouillet Record	American Rambouillet Sheep Breeders' Association, Dwight Lincoln, secretary, Milford Center, Ohio.
Merino (German)	International Von Homeyer Rambouillet Club Record.	International Von Homeyer Rambouillet Club, E. N. Ball, secretary, Ann Arbor, Mich.
Merino (Spanish)	Register of the Michigan Merino Sheep Breeders' Association.	Michigan Merino Sheep Breeders' Association, E. N. Ball, secretary, Ann Arbor, Mich.

Do.	Register of the Vermont, New York and Ohio Merino Sheep Breeders' Association.	Vermont, New York and Ohio Merino Sheep Breeders' Association, Wesley Bishop, secretary, R. F. D. No. 1, Delaware, Ohio.
Oxford Down	American Oxford Down Record	American Oxford Down Record Association, W. A. Shafor, secretary, Hamilton, Ohio.
Shropshire	American Shropshire Sheep Record	American Shropshire Registry Association, L. E. Troeger, secretary, Lafayette, Ind.
Southdown	American Southdown Record	American Southdown Breeders' Association, Frank S. Springer, secretary, 510 East Monroe street, Springfield, Ill.

HOGS.

Berkshire	American Berkshire Record	American Berkshire Association, Frank S. Springer, secretary, 510 East Monroe street, Springfield, Ill.
Cheshire	Cheshire Herdbook	Cheshire Swine Breeders' Association, Ed. S. Hill, secretary, Freeville, N. Y.
Chester, Ohio Improved	O. I. C. Record	O. I. C. Swine Breeders' Association, J. C. Hiles, secretary, Cleveland, Ohio.
Duroc-Jersey	National Duroc-Jersey Record	National Duroc-Jersey Record Association, J. R. Pfander, secretary, Peoria, Ill.
Do.	American Duroc-Jersey Record	American Duroc-Jersey Swine Breeders' Association, T. B. Pearson, secretary, Thorntown, Ind.
Hampshire (Thin-Rind)	American Hampshire Record	American Hampshire Swine Record Association, E. C. Stone, secretary, Armstrong, Ill.
Poland-China	American Poland-China Record	American Poland-China Record Association, W. M. McFadden, secretary, Union Stock Yards, Chicago, Ill.
Do.	National Poland-China Record	National Poland-China Record Company, A. M. Brown, secretary, drawer 16, Winchester, Ind.
Do.	Standard Poland-China Record	Standard Poland-China Record Association, George F. Woodworth, secretary, Maryville, Mo.
Do.	Southwestern Poland-China Record	Southwestern Poland-China Record Association H. P. Wilson, secretary, Gadsden, Tenn.
Tamworth	American Tamworth Swine Record	American Tamworth Swine Association Record, E. N. Ball, secretary, Ann Arbor, Mich.
Yorkshire	American Yorkshire Record	American Yorkshire Club, Harry G. Krum, secretary, Whitebear Lake, Minn.

DOGS.

Fifty-seven recognized breeds.	American Kennel Club Studbook	American Kennel Club, A. P. Vredenburgh, secretary, 1 Liberty street, New York, N. Y.

CATS.

Long-haired (Persian or Angora); short-haired (Russian, Siamese, Japanese, Mexican, Manx, Abyssinian, native).	Studbook of the American Cat Association	American Cat Association, Mrs. Anna L. Besse, secretary-treasurer, 5534 Union avenue, Chicago, Ill.
Long-haired (Persian or Angora); short-haired (Russian, Siamese, Japanese, Mexican, Manx, Abyssinian, native).	Studbook of the Cat Fanciers' Association	Cat Fanciers' Association, Miss Ethel B. Champion, recorder, Manor Road, Staten Island, New York.

NATIONAL AND STATE LIVE-STOCK BREEDERS' ASSOCIATIONS.

Name of organization.	Secretary.	Post-office.
Alabama Live Stock Association	Dan. T. Gray	Auburn, Ala.
Arizona Wool Growers' Association	F. W. Perkins	Flagstaff, Ariz.
California Live Stock Breeders' Association	E. W. Major	Berkeley, Cal.
California Wool Growers' Association	J. N. Blair	Sacramento, Cal.
American National Live Stock Association	T. W. Tomlinson	909 Seventeenth street, Denver, Colo.
Colorado Stockgrowers' Association	Fred. P. Johnson	Denver, Colo.
Connecticut Sheep Breeders' Association	F. H. Stadtmueller	Elmwood, Conn.
National Trotting Association	W. H. Gocher	Hartford, Conn.
Florida Wool Growers' Association	L. H. Cawthron	De Funiak Springs, Fla.
Southeastern Stock Growers' Association	Z. C. Chambliss	Ocala, Fla.
Georgia Dairy and Live Stock Association	M. P. Jarnigan	Athens, Ga.
Hawaiian Live Stock Breeders' Association	Albert F. Judd	Honolulu, Hawaii.
Idaho Wool Growers' Association	Sam. Ballantyne	Boise, Idaho.
American Association of Live Stock Herdbook Secretaries.	Charles F. Mills	Springfield, Ill.
Illinois Live Stock Breeders' Association	Fred. H. Rankin	Urbana, Ill.
Indiana Live Stock Breeders' Association	C. N. Arnett	Lafayette, Ind.
Indiana Swine Breeders' Association	Charles S. Hemenway.	Zionsville, Ind.
Indiana Wool Growers' Association	C. A. Kurtze	Indianapolis, Ind.
Corn Belt Meat Producers' Association	H. C. Wallace	Des Moines, Iowa.
Interstate Breeders' Association	F. L. Wirick	Sioux City, Iowa.
Iowa Improved Stock Breeders' Association	W. J. Kennedy	Ames, Iowa.
Iowa Sheep Breeders' Association	E. S. Leonard	Corning, Iowa.
Iowa Swine Breeders' Association	C. C. Carlin	715 Clinton avenue, Des Moines, Iowa.
Kansas Improved Stock Breeders' Association	I. D. Graham	Topeka, Kans.
Kansas Sheep and Wool Growers' Association	E. E. Hazen	Hiawatha, Kans.
Kansas Swine Breeders' Association	I. D. Graham	Topeka, Kans.
Kentucky Beef Cattle Breeders' Association	J. J. Hooper	Lexington, Ky.
Kentucky Live Stock Breeders' Association	Clarence Sale	23 Board of Trade Building, Louisville, Ky.
Kentucky Swine Breeders' Association	M. W. Neal	414 Third street, Louisville, Ky.
Kentucky Wool Growers' Association	Silas L. Stevens	Beaver Dam, Ky.
Louisiana Stockbreeders' Association	W. H. Dalrymple	Baton Rouge, La.
Louisiana Trotting Horse Breeders' Association	J. Stone Ware	White Castle, La.
Eastern Horse Breeders' Association	J. E. Osborne	Calais, Me.
Massachusetts Cattle Owners' Association	J. L. Harrington	Lunenburg, Mass.
Michigan Improved Live Stock Breeders' and Feeders' Association.	A. C. Anderson	East Lansing, Mich.
Minnesota Cattle Breeders' Association	J. B. Erwin	R. F. D., Minneapolis, Minn.
Minnesota State Horse Breeders' Association	G. W. Patterson	Worthington, Minn.
Minnesota Live Stock Breeders' Association	Andrew Boss	St. Paul, Minn.
Minnesota Sheep Breeders' Association	C. W. Glotfelter	Waterville, Minn.
Minnesota Swine Breeders' Association	D. A. Gaumnitz	St. Anthony Park, St. Paul, Minn.
Southern Live Stock Association	J. M. Aldrich	Michigan City, Miss.
Improved Live Stock Breeders' Association	George B. Ellis	Columbia, Mo.
Missouri State Sheep Breeders' Association	M. V. Carroll	Sedalia, Mo.
Central Montana Wool Growers' Association	A. C. Logan	Billings, Mont.
Montana Horse Breeders' Association	W. J. Taylor	Bozeman, Mont.
Montana Registered Cattle Breeders' Association	John W. Pace	Helena, Mont.
Montana Stock Growers' Association	E. K. Preuitt	Do.
North Montana Roundup Association	T. A. Cummings	Fort Benton, Mont.
Live Stock Improvers' Association	Robert Ashby	University Farm, Lincoln, Nebr.
Nebraska Stock Growers' Association	E. M. Searles, jr.	Ogallala, Nebr.
Swine Improvers' Association	Sam. McKelvie	Lincoln, Nebr.
National Mohair Growers' Association	S. O. Baker	Silver City, N. Mex.
New Mexico Cattle and Horse Growers' Association	W. C. Hoffman [a]	Cimarron, N. Mex.
Sheep Sanitary Board of the Territory of New Mexico	H. F. Lee	Albuquerque, N. Mex.
Northeastern New Mexico Stock Growers' Association	L. F. Wilson	Folsom, N. Mex.
New York State Breeders' Association	Albert E. Brown	Batavia, N. Y.
New York State Sheep Breeders' Association	B. W. Brace	Albion, N. Y.
North Dakota Live Stock Association	W. B. Richards	Agricultural College, N. Dak.
Ohio Horse Breeders' Association	Samuel Taylor	Grove City, Ohio.
Ohio Live Stock Association	C. S. Plumb	Columbus, Ohio.
Ohio Swine Breeders' Association	F. P. Hardin	Lima, Ohio.
Ohio Wool Growers' Association	W. N. Cowden	Quaker City, Ohio.
Oklahoma Improved Stock Breeders' Association	Charles M. Johnson	Waukomis, Okla.
Oklahoma Live Stock Association	W. E. Bolton	Woodward, Okla.
Northern Pacific Sheep Breeders and Wool Growers' Association.	James Withycombe	Hillsboro, Oreg.
Oregon Pure Bred Live Stock Association	N. C. Maris	373 Yamhill street, Portland, Oreg.
Oregon Wool Growers' Association	Dan P. Smythe	Pendleton, Oreg.

[a] Acting secretary.

National and State live-stock breeders' associations—Continued.

Name of organization.	Secretary.	Post-office.
Pennsylvania Live Stock Breeders' Association	E. S. Bayard	East End, Pittsburg, Pa.
Pennsylvania Wool Growers' Association	R. L. Munce	Canonsburg, Pa.
South Carolina Live Stock Association	J. M. Burgess	Clemson College, S. C.
South Dakota Improved Live Stock and Poultry Breeders' Association.	James W. Wilson	Brookings, S. Dak.
South Dakota Sheep Breeders' Association	John Manning	Booge, S. Dak.
Western South Dakota Stock Growers' Association	F. M. Stewart	Buffalo Gap, S. Dak.
Tennessee Live Stock Breeders' Association	May Overton [a]	42 Arcade, Nashville, Tenn.
Tennessee Sheep and Wool Growers' Association	Ed. Hicks	Bellevue, Tenn.
Cattle Raisers Association of Texas	E. B. Spiller	Fort Worth, Tex.
Texas Sheep and Goat Breeders' Association	Charles Schreiner [a]	Kerrville, Tex.
Texas Swine Breeders' Association	J. U. Lainhart	Bonham, Tex.
Utah Cattle Growers' Association	Wesley K. Walton	Woodruff, Utah.
Utah Cattlemen's Association	J. Wesley Walton	Salt Lake City, Utah.
Mount Pleasant Wool Growers' Association	Fred. C. Jensen	Mount Pleasant, Utah.
Utah Wool Growers' Association	C. B. Stewart	Salt Lake City, Utah.
Inland Empire Breeders' Association	S. B. Nelson	225 Indiana avenue, Spokane, Wash.
Washington Live Stock Association	do	Do.
Washington Wool Growers' Association	H. S. Coffin	North Yakima, Wash.
West Virginia Live Stock Breeders' Association	A. R. Thrasher	Romney, W. Va.
Tri-State Wool Growers' Association	J. R. Wells	Bens Run, W. Va.
West Virginia Sheep Breeders' and Wool Growers' Association.	J. B. Huyett	Charlestown, W. Va.
West Virginia Wool Growers' Association	James Beall	Wellsburg, W. Va.
Wisconsin Live Stock Breeders' Association	F. H. Scribner	Rosendale, Wis.
Wisconsin Sheep Breeders' Association	William F. Renk	Sun Prairie, Wis.
Snake River Live Stock Association	Harry L. Hays	Dixon, Wyo.
Wyoming Stock Growers' Association	Miss Alice R. Smith	Cheyenne, Wyo.
Wyoming Wool Growers' Association	George S. Walker	1614 Capitol avenue, Cheyenne, Wyo.

[a] President.

POULTRY SPECIALTY CLUBS.

Breed.	Club name and secretary's address.
	American Poultry Association, S. T. Campbell, secretary-treasurer, Mansfield, Ohio.
CHICKENS.	
Ancona	American Ancona Club, J. Henry Bennett, secretary, Viroqua, Wis.
Do	International Ancona Club, W. P. McNary, secretary-treasurer, Bannock, Ohio.
Blue Andalusian	Blue Andalusian Club of America, E. L. C. Morse, secretary, 9009 Escanaba avenue, Chicago, Ill.
Brahma	American Light Brahma Club, Frank P. Johnson, secretary-treasurer, Station A, Indianapolis, Ind.
Do	National Dark Brahma Club, J. H. Ladd, secretary-treasurer, Chillicothe, Ill.
Buckeye	National Red Feather Club, Edgar L. Andrews, secretary-treasurer, Ithaca, N. Y.
Butter-cup	American Butter-cup Club, John Aldrich, secretary-treasurer, Springfield, Mass.
Cochin	American Cochin Club, Arthur R. Sharp, secretary, Taunton, Mass.
Do	American Buff Cochin Club, C. W. Case, secretary-treasurer, Rochester Mich.
Cornish	American Cornish Club, H. C. Hayes, secretary-treasurer, Eureka, Ill.
Crested	International Crested Fowl Club, H. W. Schriver, secretary, Chester, N. Y.
Dominique	National American Dominique Breeders' Club, W. H. Davenport, secretary-treasurer, Colrain, Mass.
Dorking	American Dorking Club, Robert Officer, secretary-treasurer, North Grafton, Mass.
Faverolle	Faverolle Club of America, Charles S. Hanna, secretary, West Hebron, N. Y.
Game	National Exhibition Game and Game Bantam Club, E. J. W. Dietz, secretary-treasurer, Downers Grove, Ill.
Hamburg	Hamburg Fanciers' Club, Ralph E. Forbes, secretary, 89 State street, Boston, Mass.
Houdan	American Houdan Club, James Abernathy, secretary-treasurer, West Pembroke, Me.
Do	Houdan Club, E. P. McAvoy, secretary, Cambridge, N. Y.
Do	Western Houdan Club, W. H. Pipfin, secretary-treasurer, Newton, Ill.
Langshan	American Langshan Club, A. H. Asche, secretary-treasurer, Princeton, Ill.
Do	National Langshan Club, John Aldrich, secretary-treasurer, Springfield, Mass.
Do	National Black Langshan Club, M. S. Barker, secretary-treasurer, Thornton, Ind.

Poultry specialty clubs—Continued.

Breed.	Club name and secretary's address.
CHICKENS—continued.	
Langshan	White Langshan Club of America, O. E. Stewart, secretary-treasurer, Bridgeport, Ind.
Leghorn	American Leghorn Club, N. L. Kisling, secretary, Bel Air, Md.
Do	American Rose Comb Brown Leghorn Club, Mrs. W. W. Gale, secretary-treasurer, 64 Center street, New Haven, Conn.
Do	American Single Comb Brown Leghorn Club, E. W. Staebler, secretary-treasurer, West Park, Ohio.
Do	American Buff Leghorn Club, George S. Barnes, secretary-treasurer, Battle Creek, Mich.
Do	National Rose Comb White Leghorn Club, John J. Peters, secretary-treasurer, Lincoln, Ill.
Do	National Single Comb White Leghorn Club, F. O. Groesbeck, secretary-treasurer, Hartford, Conn.
Minorca	American Black Minorca Club, Frank McGrann, secretary-treasurer, Lancaster, Pa.
Do	American Rose Comb Black Minorca Club, S. T. Campbell, secretary-treasurer, Mansfield, Ohio.
Do	International Rose Comb Black Minorca Club, Lloyd C. Mishler, secretary-treasurer, North Manchester, Ind.
Do	American White Minorca Club, William Sapper, secretary, Erie, Pa.
Do	National Rose Comb White Minorca Club, Fred Alger, Secretary, Waukau, Wis.
Orpington	Southwestern Orpington Club, H. R. Barlow, secretary-treasurer, Hope, Ark.
Do	National Single Comb Black Orpington Club, Milton W. Brown, secretary, Station L, Cincinnati, Ohio.
Do	National Single Comb Buff Orpington Club, V. O. Hobbs, secretary-treasurer, Trenton, Mo.
Do	American White Orpington Club, Dr. F. S. Bullington, secretary, box 328, Richmond, Va.
Do	American Orpington Club, Frank W. Gaylor, secretary, P. O. box 72, Mount Vernon, N. Y.
Plymouth Rock	American Plymouth Rock Club, A. C. Smith, secretary-treasurer, Waltham, Mass.
Do	American Buff Plymouth Rock Club, William A. Stolts, secretary-treasurer, R. F. D. No. 19, Indianapolis, Ind.
Do	American Columbian Plymouth Rock Club, Dr. E. B. Kaple, secretary-treasurer, Elbridge, N. Y.
Do	Silver Penciled Rock Club, William F. Fotterall, secretary-treasurer, Oakford, Pa.
Do	White Plymouth Rock Club, Charles H. Ward, secretary-treasurer, R. F. D. No. 24, Bethel, Conn.
Polish	American Polish Club, George W. Trent, secretary-treasurer, Wilmette, Ill.
Rhode Island Red	Rhode Island Red Club of America, George P. Coffin, secretary-treasurer, Freeport, Me.
Do	National Rose Comb Rhode Island Red Club, W. F. Burleigh, secretary-treasurer, Larrabees Point, Vt.
Do	National Single Comb Rhode Island Red Club, J. H. Valliere, secretary-treasurer, Cedar Rapids, Iowa.
Wyandotte	American Black Wyandotte Club, Edwin H. Morris, secretary, Sparkill, N. Y.
Do	American Buff Wyandotte Club, Henry R. Ingalls, secretary, Greenville, N. Y.
Do	National Columbian Wyandotte Club, George F. Eastman, secretary-treasurer, Granby, Mass.
Do	National Golden Wyandotte Club of America, W. G. Smith, secretary-treasurer, Bannock, Ohio.
Do	National Partridge Wyandotte Club, William Erfurth, secretary-treasurer, 9235 Commercial avenue, South Chicago, Ill.
Do	Partridge Wyandotte Club of America, H. R. Hildreth, secretary, Worcester, Mass.
Do	Silver Laced Wyandotte Club of America, E. S. Tarbox, secretary-treasurer, Yorkville, Ill.
Do	Silver Penciled Wyandotte Club of America, G. S. Boller, secretary-treasurer, Little Valley, N. Y.
Do	Silver Wyandotte Club of America, Waldo H. Dunn, secretary, Wooster, Ohio.
Do	American White Wyandotte Club, George W. Dakin, secretary, P. O. box 44, Evergreen street, Roxbury Crossing, Mass.
Do	National White Wyandotte Club, F. S. Hawn, secretary-treasurer, box 164, Youngstown, Ohio.
Bantam	National Bantam Association, George L. Young, secretary, 349 Eleventh street, Brooklyn, N. Y.
TURKEYS.	
Bronze	National Bronze Turkey Club, E. F. Pullins, secretary-treasurer, R. F. D. No. 1, Rensselaer, Ind.
WATERFOWL.	
Waterfowl	Waterfowl Club of America, Edwin H. Morris, secretary-treasurer, Sparkill, N. Y.
Do	International Waterfowl Association, Theodore F. Jager, secretary, Pittsford, N. Y.

LEGAL STANDARDS FOR DAIRY PRODUCTS.

In the following statement, prepared in the Dairy Division, are given the standards for dairy products as established by law in the several States and Territories, so far as obtainable, and revised to July 1, 1910.

The percentages stated represent minimum standards in all cases unless otherwise expressed. States not named are understood to have no laws prescribing standards for dairy products or else to leave the subject to local ordinances.

Standards for ice cream are in force in a few of the States. A standard of 14 per cent milk fat for this product has been adopted by the States of Missouri, Kentucky, and Indiana. Idaho has a 12 per cent standard, and the city of Memphis, Tenn., by municipal ordinance, an 8 per cent standard.

Legal standards for dairy products, 1910.

State.	Milk.			Skim milk.	Cream.	Butter.	Whole-milk cheese.	Condensed milk.	
	Total solids.	Solids not fat.	Fat.	Total solids.	Fat.	Fat.	Total solids.	Total solids.	Fat.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Alabama	None; municipal control.								
California		8.5	3	9.25	18	80	a 30	24.5	7.7
Colorado		8.5	3.25	9.25	18	82.5	a 35	28	7.7
Connecticut	11.75	8.5	3.25						
Dist. Columbia		9	3.5	9.3	20	b 83			
Delaware	None; municipal control.								
Florida	None; municipal control.								
Georgia	12	8.5	3.25	9.25	18	82.5	50	28	7
Hawaii	11.5	8.5	3					28	7.7
Idaho	11	8	3	9.25	18	82.5	a 30	28	7.7
Illinois		8.5	3	9.25	18	82.5	50	28	7.7
Indiana		8.5	3.25	9.25	18	82.5	50	28	
Iowa	12.5		3		15	80			
Kansas			3.25						
Kentucky	12	8.5	3.25	9.25	18	82.5	50	28	7.7
Louisiana	13	9.5	3.5	9.25	18	82.5	c 50	28	7.7
Maine	11.75	8.5	3.25						
Maryland	12.5		3.5					(d)	
Massachusetts	12.15		3.35	9.3	15				
Michigan	c 12.5		3	Sp. gr. 32	15				
Minnesota	13		3.5		20	80	45		
Missouri		8.75	3.25	9.25	18	82.5	50	28	7.7
Montana	12	9	3		15				
Nebraska			3		18				
New Hampshire	13			9	18	80			
New Jersey	12		3		16				
New Mexico	None; municipal control.								
New York	11.5		3						(d)
North Carolina		8.5	3.25	9.25	18	82.5	c 50	28	7.7
North Dakota	12		3		15				
Ohio	12		3			80		(d)	

a Per cent of fat.
b Not over 12 per cent water or 5 per cent salt.
c Per cent of fat in total solids.
d Proportion of fat to total solids must be the same as in the crude milk.

Legal standards for dairy products—Continued.

State.	Milk.			Skim milk.	Cream.	Butter.	Whole-milk cheese.	Condensed milk.	
	Total solids.	Solids not fat.	Fat.	Total solids.	Fat.	Fat.	Total solids.	Total solids.	Fat.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Oklahoma	12.5		3		18			28	7
Oregon	12.2	9	3.2		20		[a] 30	22	4.5
Pennsylvania		None; municipal control.			15				
Porto Rico	12		3						
Rhode Island	12		2.5						
South Carolina	None; municipal control.								
South Dakota		8.5	3.25	9.25	18	80	[b] 50	28	7.7
Tennessee		8.5	3.25		18	82.5	[b] 50	28	7.7
Texas		8.5	3.25						
Utah	12	9	3.2		18	80		28	7
Vermont	[c] 12.5	9.25	4						
Virginia		8.5	3.25	9.25	18	82.5	[b] 50	28	7.7
Washington	12	8.75	3.25	9.3	18		[a] 30		
Wisconsin		8.5	3	9	18	82.5	50	28	8
Wyoming	12		2.4			80	[a] 20		([d])

[a] Per cent of fat.
[b] Per cent of fat in total solids.
[c] May and June, 12.
[d] Proportion of fat to total solids must be the same as in the crude milk.

CONTAGIOUS DISEASES OF ANIMALS IN FOREIGN COUNTRIES.

The series of tables next following show the condition of affairs in respect to contagious diseases of animals in those foreign countries which maintain sanitary supervision over their live stock and publish reports concerning the same. Such reports as are received and placed on file in the library of this Bureau are used in compiling the information set forth.

A review of the situation for 1909, as shown in the tables, indicates that a determined effort was made by the majority of the European governments to rid their countries of foot-and-mouth disease. It is satisfactory to note also that great success has attended the work, particularly in western and central Europe. The seaboard countries—France, Belgium, and the Netherlands—were entirely free from the disease about the middle of the year, and the central countries—Germany, Austria, and Hungary—were also in that fortunate condition at the close of the year. However, Italy and Switzerland are still heavily affected with the scourge, so that strict vigilance is necessary to prevent infection from these countries.

AUSTRIA.

There was practically no change in the animal-disease situation in Austria during 1909. Foot-and-mouth disease had been quite prevalent in the last three months of 1908, and although it was strictly under control throughout the past year, it was not entirely absent until the month of December. A number of other contagious diseases of animals were widely prevalent throughout the year.

Number of premises infected with contagious diseases of animals in Austria at monthly periods during 1909.

Disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Foot-and-mouth disease	19	16	1	8	2	40
Anthrax	9	11	10	20	14	18
Glanders and farcy	10	10	8	8	8	16
Scab:						
Horses	25	31	48	65	79	71
Sheep	......	......	......	7	6	5
Goats	3	3	7	11	16	51
Blackleg	......	2	1	3	2	5
Erysipelas of swine	45	27	22	20	44	107
Hog cholera and swine plague	268	288	362	267	253	396
Coital exanthema	35	83	95	113	132	184
Rabies	27	49	39	50	35	44

Disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Foot-and-mouth disease	13	20	17	40	23	......
Anthrax	19	31	61	23	25	14
Glanders and farcy	25	24	12	11	11	14
Scab:						
Horses	45	42	57	55	31	20
Sheep	15	4	8	4	3	1
Goats	47	44	44	38	5	3
Blackleg	15	9	10	12	11	9
Erysipelas of swine	165	327	446	284	313	121
Hog cholera and swine plague	454	532	468	458	367	463
Coital exanthema	141	83	76	68	65	31
Rabies	35	36	43	26	29	44

There were no cases of cattle plague, pleuro-pneumonia, sheep pox, or dourine.

BELGIUM.

After having been free from foot-and-mouth disease since April, 1908, Belgium was visited with a slight outbreak in March, 1909, reported to have come across the border from Holland. The visitation was promptly suppressed, and no new cases occurred after the early part of May. In all, 438 animals were affected. There was a considerable decrease of rabies as compared with 1908.

Cases of contagious diseases of animals in Belgium during 1909.

Disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Glanders and farcy	1	......	20	......	......	......
Foot-and-mouth disease:						
Cattle	......	......	250	39	18	......
Swine	......	......	117	6	1	......
Goats	......	......	5	......	......	......
Sheep	......	......	2	......	......	......
Rabies:						
Cases	2	3	4	5	5	2
Suspects	2	4	2	10	6	4
Anthrax	48	50	49	52	54	51
Blackleg	9	7	10	15	9	31
Sheep scab	4	......	[a] 271	[a] 8	......	65
Foot rot of sheep	......	......	17	1	[b] 9	......

[a] Of the cases of sheep scab 249 were found at abattoirs in March and 4 in April.
[b] The 9 cases of foot rot in May occurred at abattoirs.

Cases of contagious diseases of animals in Belgium during 1909—Continued.

Disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Glanders and farcy	.....	2	2	.....	.....	3	28
Foot-and-mouth disease:							
Cattle	.....	.....	.....	.....	.....	.....	307
Swine	.....	.....	.....	.....	.....	.....	124
Goats	.....	.....	.....	.....	.....	.....	5
Sheep	.....	.....	.....	.....	.....	.....	2
Rabies:							
Cases	1	3	7	4	3	.....	39
Suspects	4	11	7	3	3	3	59
Anthrax	39	40	42	51	42	50	568
Blackleg	31	23	25	40	31	15	246
Sheep scab	5	.....	.....	.....	.....	1	[a] 354
Foot rot of sheep	.....	.....	320	.....	.....	.....	[b] 347

[a] Of the cases of sheep scab 249 were found at abattoirs in March and 4 in April.
[b] The 9 cases of foot rot in May occurred at abattoirs.

DENMARK.

The only features of moment in the Danish reports for 1909 were the recurrence of glanders in August, after a lapse of ten months, and a slight increase in the swine diseases.

Outbreaks of contagious diseases of animals in Denmark during 1909.

Disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Anthrax	14	11	15	18	21	6
Spinal meningitis	2	4	3	2	5	2
Glanders	.....	.....	.....	.....	.....	.....
Malignant catarrhal fever	7	3	14	17	15	14
Hog cholera, chronic	1	1	4	3	7	14
Erysipelas of swine, acute	26	16	13	16	20	22

Disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Anthrax	6	6	5	11	18	11	142
Spinal meningitis	2	.....	1	6	1	4	32
Glanders	.....	3	3	4	3	4	17
Malignant catarrhal fever	12	13	9	7	5	2	118
Hog cholera, chronic	10	5	8	5	6	1	65
Erysipelas of swine, acute	49	32	56	65	43	27	385

Denmark was free during 1909 from the following diseases, which are listed in the reports: Foot-and-mouth disease, sheep pox, malignant foot rot of sheep, sheep scab, pleuro-pneumonia, cattle plague, and acute hog cholera.

FRANCE.

Compared with 1908, there was little change in 1909 in the condition of the contagious diseases of animals in France except in regard to foot-and-mouth disease. This disease, which had been present to a slight extent throughout 1908, was entirely eradicated in the early portion of last year. There were altogether but nine outbreaks during the year, and the last one of these occurred in May. There was an increase in the outbreaks of erysipelas of swine, particularly in the last six months, but there were fewer cases of hog cholera in every month except December.

Status of contagious diseases of animals in France during 1909.

Disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Foot-and-mouth disease (outbreaks)	2	4	2	.....	1	.....
Sheep scab (outbreaks)	29	14	6	7	23	6
Sheep pox (outbreaks)	12	10	4	2	2	1
Anthrax (outbreaks)	23	24	27	39	36	35
Blackleg (outbreaks)	55	41	53	55	78	55
Glanders and farcy:						
Number of outbreaks	16	14	17	23	27	25
Horses slaughtered	16	23	18	40	34	46
Rabies (cases)	107	123	147	138	135	140
Erysipelas of swine (outbreaks)	132	36	25	24	33	80
Hog cholera and swine plague	21	33	45	47	38	30

Disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Foot-and-mouth disease (outbreaks)	.....	.....	.....	.....	.....	.....	9
Sheep scab (outbreaks)	7	4	6	4	16	17	139
Sheep pox (outbreaks)	3	6	6	4	9	6	65
Anthrax (outbreaks)	31	58	31	21	44	34	403
Blackleg (outbreaks)	68	72	79	106	126	129	917
Glanders and farcy:							
Number of outbreaks	23	23	15	16	17	19	235
Horses slaughtered	26	29	15	19	22	25	313
Rabies (cases)	113	126	103	106	116	109	1,463
Erysipelas of swine (outbreaks)	85	62	145	185	125	82	1,014
Hog cholera and swine plague	25	33	36	31	36	74	438

There were no outbreaks of contagious pleuro-pneumonia or of dourine during 1909.

GERMANY.

Exceedingly satisfactory progress was made in Germany in the elimination of animal diseases. Foot-and-mouth disease, which had previously been persistently present, although generally not alarming, was eradicated in May, and no further cases were recorded up to the end of the year. Pleuro-pneumonia was stamped out in July. There remained only two diseases on the schedule list, namely, glanders and farcy, and hog cholera and swine plague. These were somewhat less prevalent than in 1908.

Number of localities and farms infected with contagious diseases of animals in Germany at monthly periods during 1909.

Disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Glanders and farcy:						
Localities	34	21	24	17	16	16
Farms	44	30	28	21	17	16
Pleuro-pneumonia:						
Localities	2	2	2	1	1	1
Farms	2	2	2	1	1	1
Foot-and-mouth disease:						
Localities	17	13	8	5	2	......
Farms	31	29	9	9	2	......
Hog cholera and swine plague:						
Localities	1,102	1,041	1,083	1,252	1,235	1,224
Farms	1,422	1,351	1,503	1,539	1,511	1,463

Number of localities and farms infected with contagious diseases of animals in Germany at monthly periods during 1909—Continued.

Disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Glanders and farcy:						
Localities	14	21	21	21	24	28
Farms	14	22	23	25	28	32
Pleuro-pneumonia:						
Localities	1					
Farms	1					
Foot-and-mouth disease:						
Localities						
Farms						
Hog cholera and swine plague:						
Localities	1,289	1,269	1,337	1,197	1,216	1,129
Farms	1,597	1,606	1,576	1,589	1,618	1,466

GREAT BRITAIN.

The status of contagious diseases of animals in Great Britain in 1909 was generally satisfactory. There was an increase in the outbreaks of anthrax, but the other diseases were less in evidence than before.

Annual status of contagious diseases of animals in Great Britain, 1902–1909.

Disease.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.
Foot-and-mouth disease:								
Outbreaks							3	
Cases							112	
Glanders and farcy:								
Outbreaks	1,155	1,456	1,529	1,214	1,070	850	785	536
Cases	2,040	2,499	2,658	2,068	2,012	1,934	2,421	1,761
Sheep scab:								
Outbreaks	1,632	1,792	1,418	918	534	751	849	685
Cases	21,523	24,431						
Anthrax:								
Outbreaks	678	767	1,049	970	939	1,089	1,108	1,316
Cases	1,032	1,143	1,589	1,317	1,325	1,466	1,426	1,700
Swine fever:								
Outbreaks	1,688	1,478	1,196	817	1,280	2,336	2,067	1,651
Swine slaughtered (diseased or exposed)	8,263	7,933	5,603	3,876	7,359	11,275	14,096	14,316

There have been no outbreaks of cattle plague, pleuro-pneumonia, or rabies during the above period.

HUNGARY.

The Hungarian reports include Croatia and Slavonia. Foot-and-mouth disease, which was quite prevalent in the first two months of the year, was brought strictly under control in March and succeeding months, and was entirely absent from October to the end of the year. There were no cases of dourine of horses after April. Of the other diseases those of swine were most prevalent.

Number of premises infected with contagious diseases of animals in Hungary at monthly periods during 1909.

Disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Anthrax	115	138	157	143	231	338
Rabies	270	288	357	369	362	370
Glanders and farcy	32	23	34	75	81	68
Foot-and-mouth disease	327	116	2	4	4	5
Sheep pox	69	82	73	61	32	27
Dourine of horses	10	10	12	12	......	......
Coital examthema:						
Solipeds	2	1	8	59	62	77
Cattle	9	8	19	56	80	116
Scab:						
Solipeds	33	119	180	487	548	507
Sheep	142	181	200	210	251	249
Barbone of buffalo	2	2	7	3	5	14
Erysipelas of swine	296	199	175	196	611	1,400
Hog cholera	1,441	995	761	707	781	1,545

Disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Anthrax	417	456	450	327	345	211
Rabies	378	358	355	213	295	244
Glanders and farcy	53	52	39	36	35	34
Foot-and-mouth disease	1	......	3	......	......	......
Sheep pox	58	77	116	170	200	208
Dourine of horses	......	......	......	......	......	......
Coital examthema:						
Solipeds	54	30	5	......	......	......
Cattle	153	116	66	25	25	15
Scab:						
Solipeds	337	249	175	132	103	82
Sheep	120	85	99	71	76	64
Barbone of Buffalo	22	23	12	28	23	12
Erysipelas of swine	3,621	3,716	2,367	1,320	825	487
Hog cholera	3,735	4,704	4,445	3,450	2,733	1,970

Hungary is declared free from cattle plague and pleuro-pneumonia.

INDIA (BRITISH).

The great difficulty of acquiring accurate statistics concerning the animal diseases in a country the size of India, especially with the limited force of men available for that purpose, is easily apparent. The reports are stated to be as complete as the circumstances permit. The table below indicates that the cattle industry suffers considerable loss, especially on account of cattle plague and foot-and-mouth disease.

Number of deaths from contagious diseases of animals in stated provinces of British India during the fiscal year 1908–9.

Disease.	United Provinces.	Punjab.	Bengal.	Eastern Bengal and Assam.	Total.
Cattle plague	6,662	8,935	8,490	44,126	68,213
Foot-and-mouth disease	1,957	1,830	3,769	11,852	19,408
Anthrax	1,015	904	373	2,990	5,282
Blackleg	62	830	227	565	1,692
Glanders	2	33	158	21	214
Surra	....	163	9	70	242
Dourine	....	....	14	....	14
Hemorrhagic septicemia	655	21,910	1,546	8,040	32,152
Other diseases	149	8,918	2,171	18,041	29,217

The official report for Ceylon supplies data regarding infectious diseases of cattle only. The report shows that the number of buffaloes on the island in 1908 was 589,888 and of "black" cattle 1,105,889, a total of 1,695,777. The number of deaths reported from all diseases was 11,925, or 0.7 per cent. The total number of buffaloes affected by diseases during the year was 13,733 and of cattle 15,974. Rinderpest and foot-and-mouth disease are the only diseases specifically mentioned in the report. In some instances the number of cases of these diseases is given, otherwise the data are grouped under "all diseases."

IRELAND.

Ireland is singularly free from animal diseases. The only disease that causes considerable loss is swine fever, and there was a notable diminution in the number of outbreaks of this malady in 1909.

Annual status of contagious diseases of animals in Ireland, 1902–1909.

Disease.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.
Anthrax:								
Outbreaks	....	4	4	4	4	3	8	8
Cases	....	11	7	4	8	5	11	8
Glanders and farcy:								
Outbreaks	10	5	11	30	8	7	....	....
Cases	43	7	34	107	16	12	....	....
Rabies, cases	....	2	....	....	....	....	....	....
Sheep scab:								
Outbreaks	613	655	486	339	256	333	384	424
Cases	7,818	8,306	6,433	4,253	3,513	5,198	6,182	(a)
Swine fever:								
Outbreaks	166	175	181	137	95	163	159	88
Cases	993	1,079	931	1,416	1,103	2,789	3,625	1,570
Epizootic lymphangitis:								
Outbreaks	....	....	1	10	1	....	....	....
Cases	....	....	1	25	1	....	....	....
Parasitic mange:								
Outbreaks	161	195	162	169	85	77	42	(a)
Cases	221	295	252	322	130	94	59	75

[a] Figures for 1909 not available.

In addition to the above the following diseases are scheduled in Ireland, but no cases were reported: Cattle plague, foot-and-mouth disease, pleuro-pneumonia, and sheep pox.

ITALY.

Although there were in the aggregate a great many less animals affected with foot-and-mouth disease in Italy during 1909 than in 1908, the total for which was 144,709, the situation at the close of 1909 was less satisfactory, as the heaviest monthly infection occurred in December, while October and November were the next heaviest months. Sixty per cent of all the cases in 1909 were reported in this last quarter.

On comparing the yearly totals of the other diseases in 1909 with those of 1908 there is seen to be an increase in anthrax, the infectious disease of swine, and contagious mammitis, while decreases are shown in sheep scab and blackleg. There was no change in regard to rabies and glanders and farcy.

Cases of contagious diseases of animals in Italy during 1909.

Disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Anthrax	221	160	81	1,178	302	249
Blackleg	15	5	4	29	14	28
Foot-and-mouth disease	2,747	3,171	2,123	2,131	1,159	930
Glanders and farcy	34	16	22	49	31	42
Pox:						
Horses						
Sheep	14					
Cattle					1	6
Barbone of buffalo		24				
Sheep scab	2,377	814	4,713	3,426	578	403
Rabies	24	22	60	62	47	52
Infectious disease of swine	1,042	793	788	1,372	1,410	2,696
Contagious mammitis	70	3,500	306	500	650	2,993

Disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.[a]	Total.
Anthrax	253	1,430	689	278	137	118	5,096
Blackleg	38	31	39	80	28	19	330
Foot-and-mouth disease	2,825	3,415	4,292	9,493	9,337	13,291	54,914
Glanders and farcy	47	67	90	102	30	11	541
Pox:							
Horses	54	1					55
Sheep		3					17
Cattle							7
Barbone of buffalo					13		37
Sheep scab	92	275	611	362	1,253	2,749	[b] 17,653
Rabies	58	60	44	41	33	51	564
Infectious disease of swine	2,601	2,222	2,009	3,307	2,565	1,177	21,983
Contagious mammitis	5,722	1,820	413	222	14	44	16,254

[a] Report for second week in December not received.
[b] This total includes 55 cases of goats and 25 cases of equines.

THE NETHERLANDS.

Foot-and-mouth disease was practically eradicated in April, 1909, only three outbreaks being reported afterwards—two in June and one in September. There had, however, been no serious visitation of the disease since May, 1908. Of the other diseases there were two remarkable deviations from the figures of 1908, namely, a large increase in the outbreaks of sheep scab and a considerable decrease in the outbreaks of erysipelas of swine.

Cases of contagious diseases of animals in the Netherlands during 1909.

Disease.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Anthrax	67	52	48	60	42	28	39	31	26	44	47	50	554
Rabies	3												3
Trichinosis of swine											2		2
Scab:													
Horses		1	1								5		7
Sheep	492	103	46	31	23	340	96	69	206	360	458	637	2,865
Erysipelas of swine	8	6	5	3	26	56	107	164	91	78	17	7	568
Foot rot	14	6	60	28	38	14	42	31	42	59	29	21	394
Glanders		2		1	2	5	6	1			1	2	20
Foot-and-mouth disease (outbreaks)	1	6	29	6		2			1				45

NORWAY.

Anthrax and malignant catarrhal fever were the only animal diseases in Norway of which there were more than 100 outbreaks during the past year. There were less cases of the former than in 1908, but malignant catarrhal fever increased from 505 to 562. Hog cholera and swine plague appeared in two months of 1908—May and October—but no outbreaks were recorded last year.

Outbreaks of contagious diseases of animals in Norway during 1909.

Disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Anthrax	25	29	35	24	29	30
Blackleg	3	2	2	4	2	11
Braxy of sheep	15	7	9	11	7	......
Malignant catarrhal fever	30	46	64	51	63	58

Disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Anthrax	27	14	19	24	29	25	293
Blackleg	6	10	7	6	5	4	62
Braxy of sheep	......	1	2	8	15	16	91
Malignant catarrhal fever	67	53	38	35	27	30	562

There were no outbreaks of cattle plague, pleuro-pneumonia, foot-and-mouth disease, rabies, glanders, sheep pox, sheep scab, foot rot, or hog cholera.

SOUTH AFRICA (BRITISH).

Number of outbreaks of contagious diseases of animals during 1908 and 1909.

Name of disease.	1908.	1909.
Anthrax	39	82
Sponsziekte (blackleg)	251	348
Epizootic lymphangitis	3	4
Glanders	50	45
Lung sickness	665	423
Redwater	69	85
Scabies (equine)	26	26

SWEDEN.

The only animal disease of much consequence in Sweden is anthrax. There were 224 outbreaks of this disease in 1909, as against 214 in 1908. Good work was done in the suppression of erysipelas of swine, there having been 26 outbreaks of this disease in 1908 and only 9 throughout the succeeding year.

Outbreaks of contagious diseases of animals in Sweden during 1909.

Disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Anthrax	16	22	17	13	31	22
Blackleg	2	......	4	1	1	3
Hog cholera	3	1	1	1	2	......
Erysipelas of swine	......	1	......	......	1	......

Disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Anthrax	30	13	11	15	19	25	224
Blackleg	13	7	12	7	2	2	54
Hog cholera	......	......	1	1	......	1	11
Erysipelas of swine	......	......	1	1	......	5	9

SWITZERLAND.

The situation in Switzerland in 1909 was on the whole rather worse than in 1908. Foot-and-mouth disease was especially rife during the summer months, but although the total number of cases for the year was a little over 5,000 more than in 1908, the number of outbreaks was less, there having been 512 premises infected in 1909, as against 592 the previous year. There were slight increases in the other diseases, except blackleg, of which there were 25 less cases.

Cases of contagious diseases of animals in Switzerland during 1909.

Disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Blackleg	9	7	9	23	33	99
Anthrax	16	22	25	14	22	14
Foot-and-mouth disease	86	59	30	85	143	775
Rabies	......	......	3	2	4	1
Glanders and farcy	7	10	6	......	......	......
Erysipelas of swine	477	1,121	523	606	808	978
Sheep scab	......	6	......	83	......	300

Disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Blackleg	165	177	120	61	43	20	758
Anthrax	20	22	19	9	21	41	245
Foot-and-mouth disease	665	11,377	4,096	1,456	611	242	19,625
Rabies	......	1	......	......	......	......	11
Glanders and farcy	1	......	1	......	1	1	27
Erysipelas of swine	1,023	1,888	1,820	1,441	1,581	1,270	13,540
Sheep scab	......	......	......	......	......	......	389

There were no cases of pleuro-pneumonia.

STATE LIVE-STOCK SANITARY OFFICERS.

United States Live Stock Sanitary Association: President, C. E. Cotton, 615 Fourth avenue south, Minneapolis, Minn.; vice-presidents, John R. Mohler, Washington, D. C.; P. S. Haner, Taylorville, Ill; Paul Juckniess, Lincoln, Nebr.; C. A. Cary, Auburn, Ala.; S. B. Nelson, Spokane, Wash.; secretary and treasurer, J. J. Ferguson, Union Stock Yards, Chicago, Ill.

Alabama.—State live-stock sanitary board: J. A. Wilkinson, chairman and commissioner of agriculture, Auburn; C. A. Cary, secretary and state veterinarian, Auburn; D. T. Gray, Auburn.

C. A. Cary, experiment station veterinarian, Auburn.

Arizona.—Live-stock sanitary board: George Pusch, chairman, Tucson; J. D. Carter, secretary, Phoenix; O. H. Christy, Phoenix; J. W. Stewart, Simmons.

Arkansas.—W. Lenton, state veterinarian, Fayetteville.

J. F. Stanford, experiment station veterinarian, Fayetteville.

California.—Charles Keane, state veterinarian, Sacramento; W. E. D. Morrison, assistant state veterinarian, Los Angeles.

A. R. Ward, experiment station veterinarian, Berkeley.

Colorado.—State board of stock inspection commissioners: A. K. Stevens, president, Iola; E. McCrillis, secretary, Denver; H. W. Potter, treasurer, La Junta; Charles G. Lamb, state veterinarian, Denver.

George H. Glover, experiment station veterinarian, Fort Collins.

Connecticut.—Heman O. Averill, commissioner on domestic animals, Hartford.

Delaware.—Abram E. Frantz, secretary state board of health, Wilmington. Board of veterinary examiners: James R. Mahafrey, Wilmington, and H. P. Eves, Wilmington.

Charles F. Dawson, experiment station veterinarian, Newark.

Florida.—Joseph Y. Porter, state health officer, Jacksonville; Thomas J. Mahaffy, veterinarian to state board of health, Jacksonville.

Georgia.—Thomas G. Hudson, commissioner of agriculture, Atlanta.

Hawaii.—V. A. Nörgaard, territorial veterinarian, Honolulu.

Idaho.—George E. Noble, state veterinarian, Boise.

Illinois.—State board of live-stock commissioners: Phil. S. Haner, chairman, Taylorville; Henry J. Beer, Blue Island; A. W. Sale, Springfield; J. M. Wright, state veterinarian, 1827 Wabash avenue, Chicago.

Donald McIntosh, experiment station veterinarian, Urbana.

A. T. Peters, assistant to experiment station veterinarian, Urbana.

Indiana.—W. E. Coover, state veterinarian, Indianapolis; G. H. Roberts, assistant state veterinarian, Indianapolis.

R. A. Craig, experiment station veterinarian, Lafayette.

Veterinary medical examiners: George C. Ferling, Richmond; Orville L. Boor, Muncie; John J. Herron, Tipton; A. H. McGlasson, Madison.

Iowa.—Paul O. Koto, state veterinarian, Des Moines.

C. H. Stange, experiment station veterinarian, Ames.

Kansas.—J. H. Mercer, live-stock sanitary commissioner, Topeka; F. S. Schoenleber, experiment station veterinarian, Manhattan.

Kentucky.—J. N. McCormack, secretary state board of health, Bowling Green. F. T. Eisenman, state veterinarian, Louisville. Hon. M. C. Rankin, chairman live stock sanitary board, Frankfort.

Louisiana.—State live-stock sanitary board: Charles Schuler, chairman, Baton Rouge; E. P. Flower, secretary and executive officer, Baton Rouge; W. H. Dalrymple, J. H. Thurmond, and George W. Sentell.

W. H. Dalrymple, experiment station veterinarian, Baton Rouge.

Maine.—State cattle commissioners: F. O. Beal, president, Bangor; John M. Deering, secretary, Saco; Frank S. Adams, Bowdoin.

State board of veterinary examiners: W. S. Lord, president, Portland; A. Joly, secretary and treasurer, Waterville; F. E. Freeman, Rockland.

Maryland.—Wade H. D. Warfield, secretary live-stock sanitary board, Cockeysville; F. H. Mackie, chief veterinary inspector, 1035 Cathedral street, Baltimore.

S. S. Buckley, experiment station veterinarian, College Park.

Massachusetts.—Austin Peters, chief of cattle bureau, state board of agriculture, State House, Boston.

J. B. Paige, experiment station veterinarian, Amherst.

Michigan.—State live-stock sanitary commission: H. H. Hinds, president, Stanton; C. A. Tyler, secretary, Coldwater; T. F. Marston, Bay City; W. M. Morris, state veterinarian, Cass City.

Charles E. Marshall, experiment station veterinarian, East Lansing.

Minnesota.—State live-stock sanitary board: C. E. Cotton, Minneapolis; Charles A. Nelson, Anoka; M. H. Reynolds, University Farm, St. Paul; P. H. Grogan; C. Sholin. S. H. Ward, veterinarian, secretary and executive officer, St. Paul.

M. H. Reynolds, experiment station veterinarian, University Farm, St. Paul.

Mississippi.—State live-stock sanitary board: H. E. Blakeslee, chairman and commissioner of agriculture and commerce, Jackson; W. L. Hutchinson, secretary, Agricultural College; James Lewis, state veterinarian, Agricultural College; J. M. Aldrich, Michigan City; John W. Day, Crystal Springs.

Missouri.—T. C. Wilson, secretary state board of agriculture, Columbia. D. F. Luckey, state veterinarian, Columbia.

J. W. Connoway, experiment station veterinarian, Columbia.

Montana.—State live-stock sanitary board: William Treacy, chairman; M. E. Knowles, secretary and state veterinarian; T. C. Power; all at Helena.

Nebraska.—Governor A. E. Shallenberger, ex officio state veterinarian, Lincoln; Paul Juckniess, deputy state veterinarian, Lincoln.

Nevada.—T. F. Richardson, state veterinarian, Goldfield.

New Hampshire.—N. J. Bachelder, secretary state board of cattle commissioners, Concord.

New Jersey.—State board of Agriculture: E. B. Voorhees, president, New Brunswick; Franklin Dye, secretary, Trenton.

Commission on tuberculosis in animals: E. B. Voorhees, president, New Brunswick; Joseph B. Ward, vice-president, Lyons Farms; Franklin Dye, secretary, Trenton; C. H. Cook, treasurer, Trenton; A. A. Cortelyou, Neshanic; William C. Parry, Hainesport; B. E. Tine, Stanton.

New Mexico.—Cattle sanitary board (having charge also of horses and mules): Charles L. Ballard, president, Roswell; W. J. Linwood, secretary, Albuquerque; W. C. McDonald, Carrizozo; W. H. Jack, Silver City; W. J. Linwood, Raton; B. F. Pankey, Lamy; W. W. Cox, Organ.

Sheep sanitary board (having charge also of goats): Harry F. Lee, secretary, Albuquerque; Solomon Lunas, Los Lunas; H. W. Kelly, Las Vegas; Charles Sleter, Clayton; A. D. Garrett, Roswell; and J. W. Akers, Santa Fe.

New York.—R. A. Pearson, commissioner of agriculture, Albany. J. F. De Vine, veterinarian, Albany.

North Carolina.—W. A. Graham, commissioner of agriculture, Raleigh. W. G. Chrisman, state veterinarian, Raleigh. E. P. Wood, assistant veterinarian, Raleigh.

G. A. Roberts, experiment station veterinarian, West Raleigh.

North Dakota.—State live-stock sanitary board: E. J. Walsh, president, Willow City; Andrew Veitch, Grand Forks; W. L. Richards, secretary, Dickinson; W. F. Crewe, veterinarian and executive officer, Devils Lake; J. W. Robinson, Garrison.

L. Van Es, experiment station veterinarian, Agricultural College.

Ohio.—Paul Fischer, state veterinarian, Columbus.

A. P. Sandles, secretary state live-stock commission, Columbus.

Oklahoma.—G. T. Bryan, superintendent live-stock inspection, Guthrie.

J. K. Callicotte, veterinarian to state board of agriculture, Guthrie.

A. J. Emery, chief dairy inspector, Guthrie.

L. L. Lewis, experiment station veterinarian.

Oregon.—W. H. Lytle, state veterinarian, Pendleton.

Pennsylvania.—State live-stock sanitary board: Gov. Edwin S. Stuart, president; S. H. Gilliland, state veterinarian; T. E. Munce, deputy state veterinarian; all at Harrisburg.

Porto Rico.—Thomas A. Allen, veterinary inspector, health office, San Juan.

Rhode Island.—State board of agriculture: John J. Dunn, secretary, Providence; John S. Pollard, veterinarian, Providence.

South Carolina.—M. Ray Powers, state veterinarian, Clemson College.

R. O. Feeley, assistant veterinarian, Clemson College.

South Dakota.—State live-stock sanitary board: Thomas H. Hicks, chairman and state veterinarian, Milbank; Frank M. Stewart, president, Buffalo Gap; Frank R. Cock, secretary, Belle Fourche; J. N. Long, Waubay; P. H. O'Neil, Faulkton; W. W. Davis, Mount Vernon.

E. L. Moore, experiment station veterinarian, Brookings.

Tennessee.—John Thompson, commissioner of agriculture, Nashville.

J. H. McDowell, state live-stock commissioner, Nashville.

Moses Jacob, experiment station veterinarian, Knoxville.

Texas.—State live-stock sanitary commission: R. H. Harris, chairman, San Angelo; A. S. Gage, secretary, San Antonio; A. F. McClure, Stamford.

E. R. Forbes, state veterinarian, Fort Worth.

M. Francis, experiment station veterinarian, College Station.

Utah.—A. Carrington Young, state veterinarian, 517 Judge Building, Salt Lake City.

State board of sheep commissioners: L. R. Anderson, president, Salt Lake City; Arthur A. Callister, secretary, Salt Lake City; Thomas W. Jones, Salt Lake City; J. S. Ostler, Nephi.

H. J. Frederick, experiment station veterinarian, Logan.

Vermont.—F. L. Davis, state cattle commissioner, White River Junction.

Virginia.—J. G. Ferneyhough, state veterinarian, Burkeville.

William D. Saunders, dairy and food commissioner, Richmond.

State board of veterinary examiners: H. S. Willis, Rapidan; Thomas Fraser, Richmond; S. C. Neff, Staunton; H. Bannister, Roanoke.

Washington.—S. B. Nelson, state veterinarian, Spokane.

West Virginia.—John M. Millan, secretary state board of agriculture, Charleston. Consulting veterinarians: W. C. Atkeson, Buffalo; J. C. Callander, Parkersburg; L. N. Reefer, Wheeling; W. M. Stanley, Charleston.

Wisconsin.—State live-stock sanitary board: Herbert Lothe, secretary, Madison; D. B. Clark, state veterinarian, Madison; M. P. Ravenel, bacteriologist, Madison; George McKerrow, Pewaukee; George Wylie, Morrisonville; Grant U. Fisher, Janesville.

H. L. Russell, dean, college of agriculture, University of Wisconsin, Madison.

A. S. Alexander, experiment station veterinarian, Madison.

Wyoming.—William F. Pflaeging, state veterinarian, Cheyenne.

State board of live-stock commissioners: George R. Eyken, Laramie; Fred G. S. Hesse, Buffalo; Addison A. Spaugh, Manville; Thomas Durbin, secretary, Cheyenne.

State board of sheep commissioners: William Daley, president, Rawlins; C. E. Very, secretary-treasurer, Cheyenne; W. D. McKeon, Newcastle; J. M. Wilson, Douglas.

C. L. Prien, experiment station veterinarian, Laramie.

PUBLICATIONS OF THE BUREAU IN 1909.

Following is a list of publications issued by the Bureau of Animal Industry during the year 1909, excepting regulations, which are to be found in the appendix to this report. A circular giving a list of the available publications of the Bureau and indicating how they may be obtained will be sent free upon request.

Publications in the following list for which no price is indicated will be sent free of charge to persons in the United States, so long as the editions permit, on application to the Secretary of Agriculture, Washington, D. C.

Applications for publications to which a price is affixed should be made to the Superintendent of Documents, Government Printing Office, Washington, D. C., the officer designated by law to sell government publications. All payments should be made to him and not to the Department of Agriculture, and should be sent by postal money order, express order, or New York draft. Currency may be sent at the sender's risk, but postage stamps, foreign money, and uncertified checks will not be accepted. No charge is made for postage on documents forwarded to points in the United States, Guam, Hawaii, the Philippine Islands, or Porto Rico, or to Canada, Cuba, or Mexico. To other countries the regular rate of postage is charged, and remittances must cover such postage. To residents of foreign countries the price of 6 cents a copy, including postage, has been fixed for publications for which no price is indicated in the list.

REPORTS.

Twenty-fourth Annual Report of the Bureau of Animal Industry for the year 1908. Pp. 486, pls. 6, figs. 62. Price, 85 cents.

Report of the Chief of the Bureau for [the fiscal year ended June 30] 1909. By A. D. Melvin. Pp. 69.

Special Report on Diseases of Cattle. (Revised edition, 1908.) By Doctors Atkinson, Dickson, Harbaugh, Hickman, Law, Lowe, Mohler, Murray, Pearson, Ransom, Salmon, Smith, and Trumbower. Pp. 551, pls. 52, figs. 27. Price, $1.

BULLETINS.

Bulletin 39. Index-Catalogue of Medical and Veterinary Zoology. By Ch. Wardell Stiles, Consulting Zoologist, and Albert Hassall, Assistant in Zoology. (Authors: P to Pfeilsticker.) Part 22. Pp. 1625–1718. Price, 15 cents.

Same, Part 23. (Authors: Pfender to Qvortrup.) Pp. 1719–1805. Price, 15 cents.

Same, Part 24. (Authors: R to Rizzo.) Pp. 1807–1893. Price, 15 cents.

Same, Part 25. (Authors: Roack to Rzewuski.) Pp. 1895–1979. Price, 15 cents.

Bulletin 110, Part 1. A Biometrical Study of Egg Production in the Domestic Fowl. I. Variation in Annual Egg Production. By Raymond Pearl and Frank M. Surface, of the Maine Agricultural Experiment Station. Pp. 80, figs. 17. Price, 15 cents.

Bulletin 111. A Chemical and Physical Study of the Large and Small Fat Globules in Milk. By R. H. Shaw, Assistant Dairyman, and C. H. Eckles, Professor of Dairy Husbandry, University of Missouri. Pp. 16. Price, 5 cents.

Bulletin 112. The Loco-Weed Disease of the Plains. By C. Dwight Marsh, Expert, Poisonous Plant Investigations, Bureau of Plant Industry. Pp. 130, pls. 11, figs. 18. Price, 35 cents.

Bulletin 113. Filtration Experiments with *Bacillus choleræ suis*. By C. N. McBryde, Senior Bacteriologist, Biochemic Division. Pp. 31, fig. 1. Price, 10 cents.

Bulletin 114. The Influence of Acidity of Cream on the Flavor of Butter. By L. A. Rogers, Bacteriologist, Dairy Division, and C. E. Gray, formerly Chemist, Dairy Division. Pp. 22. Price, 10 cents.

Bulletin 115. Camembert Cheese Problems in the United States. By Charles Thom, Mycologist in Cheese Investigations, Dairy Division. Pp. 54, figs. 6. Price, 10 cents.

Bulletin 116. Tests Concerning Tubercle Bacilli in the Circulating Blood. By E. C. Schroeder, Superintendent of Experiment Station, and W. E. Cotton, Expert Assistant at Experiment Station. Pp. 23. Price, 5 cents.

Bulletin 117. Leucocytes in Milk: Methods of Determination and the Effect of Heat upon their Number. By H. C. Campbell, Expert in Milk Hygiene, Pathological Division. Pp. 19. Price, 5 cents.

Bulletin 119. Studies on Blood and Blood Parasites. I. Observations on Mammalian Blood with Dark-Field Illumination. II. The Priority of *Cryptobia* Leidy, 1846, over *Trypanoplasma* Laveran and Mesnil, 1901. III. *Trypanoplasma americanum* n. sp., a Trypanosome which Appears in Cultures made from the Blood of American Cattle. By Howard Crawley, Expert in Protozoology, Zoological Division. Pp. 31, figs. 3. Price, 5 cents.

Bulletin 121. The Need of Controlling and Standardizing the Manufacture of Veterinary Tetanus Antitoxin. By John R. Mohler, Chief of the Pathological Division, and Adolph Eichhorn, Bacteriologist, Pathological Division. Pp. 22. Price, 5 cents.

CIRCULARS.

Circular 68 (revised). Diseases of the Stomach and Bowels of Cattle. Pp. 14. (Reprinted, with slight changes, from Special Report on Diseases of Cattle, revised edition of 1908.)

Circular 74 (revised). Legal Standards for Dairy Products. Pp. 2.

Circular 134. Classified List of Available Publications of the Bureau of Animal Industry. (Revised to September 1, 1909.) Pp. 8.

Circular 136. How to Build a Stave Silo. By B. H. Rawl and J. A. Conover, of the Dairy Division. Pp. 18, figs. 18.

Circular 138. Infectious Anemia or Swamp Fever of Horses. By John R. Mohler, Chief of the Pathological Division. Pp. 4.

Circular 139. The Score-Card System of Dairy Inspection. By Clarence B. Lane, Senior Dairyman, Dairy Division, and George M. Whitaker, Assistant Dairyman, Dairy Division. Pp. 32, figs. 3.

Circular 140. The Egg Trade of the United States. By Milo M. Hastings, Scientific Assistant, Animal Husbandry Office. Pp. 34, figs. 2.

Circular 142. Some Important Factors in the Production of Sanitary Milk. By Ed. H. Webster, Chief of the Dairy Division. Pp. 22, figs. 12. (Reprinted from the Twenty-fourth Annual Report of the Bureau of Animal Industry.)

Circular 143. Milk and Its Products as Carriers of Tuberculosis Infection. By E. C. Schroeder, Superintendent of Experiment Station. Pp. 21. (Reprinted from the Twenty-fourth Annual Report of the Bureau of Animal Industry.)

Circular 144. Tuberculosis of Hogs: Its Cause and Suppression. By John R. Mohler, Chief of the Pathological Division, and Henry J. Washburn, Assistant Chief of the Pathological Division. Pp. 215–246, pls. 4. (Reprinted from the Twenty-fourth Annual Report of the Bureau of Animal Industry.)

Circular 145. The Care and Testing of Camembert Cheese. By Charles Thom, Assistant Dairyman, Dairy Division. Pp. 5. (Reprinted from the Twenty-fourth Annual Report of the Bureau of Animal Industry.)

Circular 146. Fishy Flavor in Butter. By L. A. Rogers, Bacteriologist, Dairy Division. Pp. 20, figs. 2.

Circular 147. The Origin of the Recent Outbreak of Foot-and-Mouth Disease in the United States. By John R. Mohler, Chief of the Pathological Division, and Milton J. Rosenau, Director Hygienic Laboratory, United States Public Health and Marine-Hospital Service. Pp. 29, fig. 1.

Circular 148. A Practical Demonstration of a Method for Controlling the Cattle Tick. By W. D. Hunter and J. D. Mitchell, of the Bureau of Entomology. Pp. 4.

Circular 149. A Cold-Storage Evaporimeter. By Milo M. Hastings, Scientific Assistant, Animal Husbandry Office. Pp. 8, fig. 1.

Circular 150. Regulations Governing Entrance to the Veterinary Inspector Examination. Pp. 11.

Circular 151. Competitive Exhibitions of Milk and Cream, with Report of an Exhibition held at Pittsburg, Pa., in Cooperation with the Pittsburg Chamber of Commerce. By C. B. Lane and Ivan C. Weld, of the Dairy Division. Pp. 36.

Circular 152. Directions for the Home Pasteurization of Milk. By L. A. Rogers, Bacteriologist, Dairy Division. Pp. 2.

SEPARATES FROM TWENTY-FOURTH ANNUAL REPORT.

Embryonal Adenosarcoma of the Kidney of Swine. By L. Enos Day, Veterinary Inspector in Charge of Branch Pathological Laboratory, Chicago, Ill. Pp. 247–257, figs. 8.

Dermal Mycosis Associated with Sarcoptic Mange in Horses. By A. D. Melvin, Chief of the Bureau of Animal Industry, and John R. Mohler, Chief of the Pathological Division. Pp. 259–277, pl. 1, figs. 6.

A Study of the Methods of Canning Meats, with Reference to the Proper Disposal of Defective Cans. By C. N. McBryde, Bacteriologist, Biochemic Division. Pp. 279–296, fig. 1.

The Effect of Certain Diseases and Conditions of Cattle upon the Milk Supply. By John R. Mohler, Chief of the Pathological Division. Pp. 145–159.

Report of a Commission on Certain Features of the Federal Meat-Inspection Regulations. Pp. 361–373.

SEPARATES FROM THE DEPARTMENT YEARBOOK.

Some Facts About Tuberculous Cattle. By E. C. Schroeder, Superintendent of Experiment Station. Pp. 217–266, pls. 5.

Recent Work of the Bureau of Animal Industry Concerning the Cause and Prevention of Hog Cholera. By M. Dorset, Chief of the Biochemic Division. Pp. 321–331.

FARMERS' BULLETINS.

Farmers' Bulletin 346. The Computation of Rations for Farm Animals by the Use of Energy Values. By Henry Prentiss Armsby, Director of the Institute of Animal Nutrition of the Pennsylvania State College, and Expert in Animal Nutrition, Bureau of Animal Industry. Pp. 32.

Farmers' Bulletin 348. Bacteria in Milk. By L. A. Rogers, Bacteriologist, Dairy Division. Pp. 24, figs. 6. (Reprinted from the Department Yearbook for 1907.)

Farmers' Bulletin 349. The Dairy Industry in the South. By B. H. Rawl, Duncan Stuart, and George M. Whitaker, of the Dairy Division. Pp. 37, figs. 10. (Reprinted from the Twenty-fourth Annual Report of the Bureau of Animal Industry.)

Farmers' Bulletin 350. The Dehorning of Cattle. By Richard W. Hickman, Chief of the Quarantine Division. Pp. 14, figs. 6. (Reprint from the Twenty-fourth Annual Report of the Bureau of Animal Industry.)

Farmers' Bulletin 351. The Tuberculin Test of Cattle for Tuberculosis. By John R. Mohler, Chief of the Pathological Division. Pp. 8. (Reprinted from the Twenty-fourth Annual Report of the Bureau of Animal Industry.)

Farmers' Bulletin 357. Methods of Poultry Management at the Maine Agricultural Experiment Station. Compiled by Raymond Pearl, Expert in Poultry Breeding, Bureau of Animal Industry, and Biologist, Maine Agricultural Experiment Station. Pp. 39, figs. 10.

Farmers' Bulletin 378. Methods of Exterminating the Texas-Fever Tick. By H. W. Grabill, Scientific Assistant, Zoological Division. Pp. 30, figs. 15.

Farmers' Bulletin 379. Hog Cholera. By M. Dorset. Chief of the Biochemic Division. Pp. 23, figs. 3.

APPENDIX.

RULES AND REGULATIONS OF THE SECRETARY OF AGRICULTURE RELATING TO THE ANIMAL INDUSTRY ISSUED IN 1909.

AMENDMENT 3 TO B. A. I. ORDER 129.

Regulations Concerning the Importation of Hay and Straw from Continental Europe—Importation of Hay and Straw from Belgium and Denmark.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., November 15, 1909.

It is ordered, That the regulations concerning the importation of hay and straw from continental Europe as contained in B. A. I. Order 129, issued October 4, 1904, be, and they are hereby, modified so as to permit the importation of hay and straw from the countries of Belgium and Denmark when accompanied by a certificate issued by the proper government officer showing that such articles originated in Belgium or Denmark, or have been in the country from which exported for a period of six months; that no foot-and-mouth disease or rinderpest existed in that country at the time of their shipment, nor during the six months immediately preceding, and that no anthrax had existed within a radius of 5 miles of the section of country from which such hay or straw originated during the six months preceding the date of harvesting; also that the vessel upon which these articles have been shipped has been inspected and found free from infection, and does not carry any hay, straw, or animals which have recently come from a country infected with said diseases.

This amendment shall become and be effective on and after December 1, 1909.

JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 5 TO B. A. I. ORDER 136.

Regulations for the Certification of Associations of Breeders of Purebred Live Stock and Books of Record of Pedigrees—Withdrawal of Certification.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., January 6, 1909.

On account of failure to comply with the provisions of B. A. I. Order 136, the certification of the following association and book of record of pedigrees has been withdrawn and the Secretary of the Treasury informed to this effect:

American books of record.

SHEEP.

Name of breed.	Book of record.	By whom published.
Merino	Register of the Standard American Merino Sheep Breeders' Association.	Standard American Merino Sheep Breeders' Association, J. P. Ray, secretary, R. F. D. 3, East Bloomfield, N. Y.

JAMES WILSON, *Secretary.*

AMENDMENT 6 TO B. A. I. ORDER 136.

Regulations for the Certification of Associations of Breeders of Purebred Live Stock and Books of Record of Pedigrees—Certification of Associations.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., January 6, 1909.

The following associations and books of record have this day been certified to the Secretary of the Treasury:

American books of record.

SHEEP.

Name of breed.	Book of record.	By whom published.
Merino	The American and Delaine Merino Record.	American and Delaine Merino Record Association, S. M. Cleaver, secretary, Delaware, Ohio.

HOGS.

Name of breed.	Book of record.	By whom published.
Hampshire (Thin Rind).	American Hampshire Record.	American Hampshire Swine Record Association, E. C. Stone, secretary, Armstrong, Ill.

Foreign books of record.

CATTLE.

Name of breed.	Book of record.	By whom published.
Kerry and Dexter.	Royal Dublin Society Kerry and Dexter Herdbook.	Royal Dublin Society, Richard J. Moss, secretary, Leinster House, Dublin, Ireland.

JAMES WILSON, *Secretary.*

AMENDMENT 7 TO B. A. I. ORDER 136.

Regulations for the Certification of Associations of Breeders of Purebred Live Stock and Books of Record of Pedigrees—Amendment of Certification.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., February 24, 1909.

In view of the amalgamation of the Vermont, New York, and Ohio Merino Sheep Breeders' Associations, the Department has this day withdrawn the certification of the following associations and books of record, and the Secretary of the Treasury has been informed to this effect:

American books of record.

SHEEP.

Name of breed.	Book of record.	By whom published.
Merino (Spanish).	Register of the Vermont Merino Sheep Breeders' Association.	Vermont Sheep Breeders' Association, C. A. Chapman, secretary, Middlebury, Vt.
Do	Register of the New York State American Merino Sheep Breeders' Association.	New York State American Merino Sheep Breeders' Association, J. H. Earll, secretary, Skaneateles, N. Y.
Do	Register of the Ohio Merino Sheep Breeders' Association.	Ohio Merino Sheep Breeders' Association, Wesley Bishop, secretary, R. F. D. 1, Delaware, Ohio.

In place of the above the following association and book of record has been certified to the Secretary of the Treasury:

American book of record.

SHEEP.

Name of breed.	Book of record.	By whom published.
Merino (Spanish).	Register of the Vermont, New York, and Ohio Merino Sheep Breeders' Association.	Vermont, New York, and Ohio Merino Sheep Breeders' Association, Wesley Bishop, secretary, R. F. D. 1, Delaware, Ohio.

JAMES WILSON, *Secretary.*

AMENDMENT 8 TO B. A. I. ORDER 136.

Regulations for the Certification of Associations of Breeders of Purebred Live Stock and Books of Record of Pedigrees—Certification of Foreign Affiliated Associations.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., September 28, 1909.

The following foreign association and book of record is certified as being affiliated with the American Kennel Club:

DOGS.

Name of breed.	Book of record.	By whom published.
Harrier and beagle.	Harrier and Beagle Studbook.	Association of Masters of Harriers and Beagles, Arthur L. Mercer, secretary, Rodmersham House, Nr. Sittingbourne, Kent, England.

The following foreign association and book of record is certified as being affiliated with the German, Hanoverian, and Oldenburg Coach Horse Association of America:

HORSES.

Name of breed.	Book of record.	By whom published.
Holstein Coach...	Gestutbuch der Holsteinischen Marschen.	Verband der Pferdezüchter in den Holsteinischen Marschen, Johannes Cluver, secretary, Elmshorn, Holstein, Germany.

JAMES WILSON, *Secretary.*

AMENDMENT 9 TO B. A. I. ORDER 136.

Regulations for the Certification of Associations of Breeders of Purebred Live Stock and Books of Record of Pedigrees—Withdrawal of Certification.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., October 1, 1909.

On account of failure to comply with the provisions of B. A. I. Order 136, the certification of the following association and book of record of pedigrees has been withdrawn and the Secretary of the Treasury informed to this effect:

American books of record.

CATS.

Name of breed.	Book of record.	By whom published.
Longhaired (Angora or Persian); Shorthaired (Siamese, Manx, Mexican, Abyssinian, Indian, Russian, and Japanese).	United States Register and Studbook (except Appendix).	United States Official Register Association (Incorporated), Mrs. S. Hazen Bond, registrar, 310 First street SE., Washington, D. C.

JAMES WILSON, *Secretary.*

AMENDMENT 10 TO B. A. I. ORDER 136.

Regulations for the Certification of Associations of Breeders of Purebred Live Stock and Books of Record of Pedigrees—Certification of Association.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., October 2, 1909.

The following association and book of record has this day been certified to the Secretary of the Treasury:

American book of record.

HORSES.

Name of breed.	Book of record.	By whom published.
Arabian..........	Studbook of the Arabian Horse Club of America.	Arabian Horse Club of America, H. K. Bush-Brown, secretary, Newburgh, N. Y.

JAMES WILSON, *Secretary.*

AMENDMENT 11 TO B. A. I. ORDER 136.

Regulations for the Certification of Associations of Breeders of Purebred Live Stock and Books of Record of Pedigrees—Certification of Various Associations.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., October 21, 1909.

The following American association and its affiliated foreign association have this day been certified to the Secretary of the Treasury:

CATS.

American book of record.			Foreign book of record.	
Name of breed.	Book of record.	By whom published.	Book of record.	By whom published.
Longhaired (Persian or Angora), Shorthaired (Russian, Siamese, Japanese, Mexican, Manx, Abyssinian, Native).	Studbook of the Cat Fanciers' Association.	Cat Fanciers' Association, Miss Ethel B. Champion, recorder, Manor Road, Staten Island, N. Y.	National Cat Club Studbook and Register.	National Cat Club of England, Ed. T. Cox, secretary, 65 Chancery Lane, London, W. C., England.

The following foreign association and book of record has also been certified this day to the Secretary of the Treasury:

CATTLE.

Name of breed.	Book of record.	By whom published.
Alderney........	Royal Alderney Agricultural Society's Herd Book.	Royal Alderney Agricultural Society, N. W. Gaudion, secretary, Lower Victoria street, Alderney, Island of Alderney.

JAMES WILSON, *Secretary.*

AMENDMENT 5 TO B. A. I. ORDER 142.

Regulations for the Inspection and Quarantine of Horses, Cattle, Sheep, and Other Ruminants, and Swine Imported into the United States—Amendment to Regulation 1, Designating Campo, Cal. (Port of San Diego), as a Quarantine Station.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., July 22, 1909.

Regulation 1 of the regulations of the Secretary of Agriculture for the inspection and quarantine of horses, cattle, sheep, and other ruminants, and swine imported into the United States, B. A. I. Order 142, is hereby amended to include Campo, Cal. (port of San Diego, Cal.), as a port for the entry of animals which are subject to both inspection and quarantine.

This amendment shall become effective on and after August 2, 1909.

JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 6 TO B. A. I. ORDER 142.

Amendment to Regulation 9 of the Regulations for the Inspection and Quarantine of Horses, Cattle, Sheep, and Other Ruminants, and Swine Imported into the United States.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., September 28, 1909.

Regulation 9 of the regulations of the Secretary of Agriculture for the inspection and quarantine of horses, cattle, sheep, and other ruminants, and swine imported into the United States, B. A. I. Order 142, is hereby amended to read as follows:

Regulation 9.—All cattle imported into the United States from any part of the world except North America, Great Britain, Ireland, and the Channel Islands shall be subject to a quarantine of ninety days, counting from the date of shipment, this date of shipment to be the date of clearance of the vessel bringing the animals to the United States. Sheep and other ruminants and swine from any part of the world except North America shall be subject to a quarantine of fifteen days, counting from the date of arrival at the quarantine station: *Provided,* That cattle and sheep imported for immediate slaughter at the port of landing may be imported without quarantine, but shall be subject to such restrictions as the Chief of the Bureau of Animal Industry, after causing an inspection to be made, may consider necessary in each case for guarding the domestic animals of the United States from contagion: *Provided further,* That the period of quarantine for cattle imported from Great Britain, Ireland, and the Channel Islands shall be thirty days, counting from the date of arrival at the quarantine station.

The effect of this amendment is to shorten the period of quarantine for cattle imported from Great Britain, Ireland, and the Channel Islands to thirty days, counting from the date of arrival at the quarantine station.

This amendment shall become and be effective on and after October 1, 1909.

JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 7 TO B. A. I. ORDER 142.

Regulations for the Inspection and Quarantine of Horses, Cattle, Sheep, and Other Ruminants, and Swine Imported into the United States.—Amendment to Regulation 41, Providing for the Dipping or the Quarantine of Sheep Imported from Canada for Breeding, Grazing, or Feeding.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., October 18, 1909.

Regulation 41 of the Regulations of the Secretary of Agriculture for the inspection and quarantine of horses, cattle, sheep, and other ruminants, and swine imported into the United States, B. A. I. Order 142, is hereby amended to read as follows:

Regulation 41.—All sheep imported into the United States from Canada for breeding, grazing, or feeding must be inspected at the port of entry by an inspector of the Bureau of Animal Industry. They must also have been inspected by a veterinarian in the employ of and receiving a salary from the Canadian government, and be accompanied by a certificate signed by him stating that he has inspected the sheep and found them free from disease, and that no contagious disease affecting sheep has existed in the district in which the animals have been kept for six months preceding the date of importation; stating also that they have been twice carefully dipped under his personal supervision, or under the personal supervision of another veterinarian in the employ of and receiving a salary from the Canadian government, in one of the dips approved by the Secretary of Agriculture, as described in Regulation 33 of B. A. I. Order 143. The owner or importer shall present an affidavit that said certificate refers to the sheep in question: *It is provided further,* That any such sheep which are unaccompanied by the aforesaid certificate showing that they have been twice dipped, as herein prescribed, shall be subjected to a quarantine of thirty days.

This amendment shall become and be effective on and after October 20, 1909.

JAMES WILSON, *Secretary of Agriculture.*

Regulation 33 of B. A. I. Order 143, as amended, **which is referred to in the foregoing amendment, reads as follows:**

Regulation 33.—The dips now approved are:

(*a*) The tobacco-and-sulphur dip, made with sufficient extract of tobacco or nicotine solution to give a mixture containing not less than five one-hundredths of 1 per cent of nicotine and 2 per cent flowers of sulphur: *Provided,* That for the first dipping of infected sheep, in lieu of the sulphur herein prescribed, a sufficient additional amount of extract of tobacco or nicotine solution shall be used to give a mixture containing not less than seven one-hundredths of 1 per cent of nicotine.

(*b*) The lime-and-sulphur dip, made by mixing 8 pounds of unslaked lime and 24 pounds of flowers of sulphur and boiling with 30 gallons of water for not less than two hours. All sediment should be allowed to subside before the liquid is placed in the dipping vat. This liquid should be diluted sufficiently to make 100 gallons before use.

And pending further investigation, the following-described dips:

(*c*) The cresol dip, which consists of a mixture of cresylic acid [a] with soap. When diluted ready for use this dip should contain one-half of 1 per cent of cresylic acid.

(*d*) The coal-tar creosote dip, which is made by mixing coal-tar creosote or coal-tar oils and cresylic acid separately with resin soap in varying proportions. This dip should contain when diluted ready for use not less than 1 per cent by weight of coal-tar oils and cresylic acid. In no case should the diluted dip contain more than four-tenths of 1 per cent nor less than one-tenth of 1 per cent of cresylic acid; but when the proportion of cresylic acid falls below two-tenths of 1 per cent the coal-tar oils should be increased sufficiently to bring the total of the tar oils and the cresylic acid in the diluted dip up to 1.2 per cent by weight.

The cresol dip and the coal-tar creosote dip should always be tested on a small scale with the water and under the conditions to be employed in dipping in order to avoid possible injury to stock. The diluted sample should be allowed to stand for at least an hour. If after this length of time there is a separation of an oily layer the dip should not be used with that kind of water. Especial care in this connection is necessary where hard water is to be used.

In the undiluted coal-tar creosote dips there may be, in cold weather especially, a separation of naphthalene and other constituents of the dip. Care should therefore be taken to see that the concentrated dip is homogeneous in character before using any portion of it.

Manufacturers who desire the Department to approve their dips for official dipping should submit a sample of their product to the Bureau of Animal Industry in Washington and accompany this with the formula used in preparing the dip.

Before a proprietary substance is approved for use in official dipping the manufacturer must agree as follows:

(1) To recommend for sheep scab a dilution of the product, so as to conform to the requirements of the Department of Agriculture.

(2) To maintain said product at a uniform composition.

(3) To place on packages of dips which have been examined and found to conform to the requirements of the Department the following statement:

"A sample of this product has been submitted to the United States Department of Agriculture for examination. We guarantee the contents of this package to be of the same composition as the sample submitted to the Department, and that when diluted according to the directions printed thereon for the treatment of sheep scab, it will give a dipping fluid of the composition required of a ____________ [b] dip by the regulations of the Secretary of Agriculture governing sheep scab."

(4) To have on containers or advertising matter no reference to the United States Government or any of its Departments except as provided in the preceding paragraph, unless such reference has been submitted to and approved by the Department of Agriculture, and to have on containers or advertising matter no false or misleading statement.

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[a] By the term cresylic acid as used in these regulations is meant cresols and other phenols derived from coal tar, none of which boils below 185° C. nor above 250° C.

[b] There should be inserted here the name of the class of dips to which the product belongs, such as " cresol " or " lime and sulphur," etc.

AMENDMENT 8 TO B. A. I. ORDER 142.

Regulations for the Inspection and Quarantine of Horses, Cattle, Sheep, and Other Ruminants, and Swine Imported into the United States—Amendment to Regulation 49, Providing for the Dipping Twice of Sheep Imported from Mexico for Breeding, Grazing, or Feeding.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., October 23, 1909.

Regulation 49 of the Regulations of the Secretary of Agriculture for the inspection and quarantine of horses, cattle, sheep, and other ruminants, and swine imported into the United States, B. A. I. Order 142, is hereby amended to read as follows:

Regulation 49.—Sheep for breeding purposes, grazing, or feeding will be admitted if found upon inspection by an inspector of the United States Bureau of Animal Industry to be free from scabies or other contagious diseases and are accompanied by an affidavit made by the owner stating that they have been in the district from which shipped for six months next preceding the date of importation and that no contagious disease affecting sheep has existed among them nor among other animals of the kind with which they have come in contact for six months last past; also by an affidavit made by the importer or his agent supervising the shipment stating that they have not passed through any district infected with contagious diseases affecting sheep, and that they have not been exposed in any possible manner to the contagion of any contagious disease, and that the animals, if not driven, have been shipped in cleaned and disinfected cars and vessels direct from the farm or ranch where purchased. But such sheep shall, nevertheless, be dipped twice, ten days apart, at the expense of the owner, as prescribed by the rules and regulations of the Secretary of Agriculture, before being permitted to proceed to their destination in the United States or to mingle with other sheep.

This amendment shall become and be effective on and after November 1, 1909.

JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 9 TO B. A. I. ORDER 142.

Regulations for the Inspection and Quarantine of Horses, Cattle, Sheep, and Other Ruminants, and Swine Imported into the United States—Amendment to Regulation 1, Designating Rio Grande City and Edinburgh, Tex., as Ports for the Entry of Animals which are Subject to both Inspection and Quarantine.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., November 27, 1909.

Regulation 1 of the Regulations of the Secretary of Agriculture for the inspection and quarantine of horses, cattle, sheep, and other ruminants, and swine imported into the United States, B. A. I. Order 142, is hereby amended to include Rio Grande City and Edinburgh, Tex., as ports for the entry of animals which are subject to both inspection and quarantine.

This amendment shall become and be effective on and after December 1, 1909.

JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 4 TO B. A. I. ORDER 143.

Regulations of the Secretary of Agriculture Governing the Inspection, Disinfection, Certification, Treatment, Handling, and Method and Manner of Delivery and Shipment of Live Stock which is the Subject of Interstate Commerce—Modifying Regulations 11 to 18, inclusive, Relating to the Prevention of the Spread of Splenetic Fever of Cattle, and Revoking Amendment 3 to B. A. I. Order 143 (effective on and after April 1, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The regulations of the Secretary of Agriculture governing the inspection, disinfection, certification, treatment, handling, and method and manner of delivery and shipment of live stock which is the subject of interstate commerce, issued under date of March 22, 1907, effective on and after April 15, 1907, as amended by amendment 3 to B. A. I. Order 143, issued under date of March 17, 1908, and effective on and after April 1, 1908, are hereby modified by the revocation of Regulations 11 to 18, inclusive, and the substitution therefor of the following regulations, which revocation shall take effect on April 1, 1909, on and after which date the regulations given below shall become and be effective until otherwise ordered.

REGULATIONS TO PREVENT THE SPREAD OF SPLENETIC FEVER OF CATTLE.

Regulation 11.—Whenever any State or Territory located within an area quarantined by the Secretary of Agriculture for splenetic, southern, or Texas fever shall duly establish a state or territorial quarantine area different from the quarantined area established by the Secretary of Agriculture, and shall obtain the legislation requisite to enforce said state or territorial quarantine strictly and completely within the boundaries of said State or Territory, the Secretary of Agriculture will, if the said state or territorial quarantine be satisfactory, adopt by a rule [a] said state or territorial quarantine, and the state or territorial quarantine thus adopted shall define the limits of that portion of the federal quarantined area.

Regulation 12.—Whenever any State or Territory under authority of law shall establish a state or territorial quarantine for splenetic fever which differs from the quarantine established by the Secretary of Agriculture for the said disease, and shall desire a modification of the area quarantined by the Secretary of Agriculture, the proper officer of the said State or Territory shall forward to the Secretary of Agriculture a true map or description of such state or territorial quarantine and a duly authenticated copy of the laws and regulations relating to the establishment and enforcement of the quarantine.

Regulation 13.—Cattle of the quarantined area of any State or Territory shall not at any time be transported, driven, or allowed to drift therefrom to any portion of the quarantined area of any other State or Territory to which the intrastate movement of cattle of the quarantined area is prohibited by the state or territorial authorities thereof.

Regulation 14.—Interstate shipments of cattle from the quarantined area may be made at any time by rail or boat to recognized slaughtering centers for immediate slaughter, provided that in their movement the provisions contained in paragraphs (*a*) to (*m*), hereinafter set out in this regulation, are strictly observed and complied with; but cattle shall not be trailed or driven or hauled in private conveyances from the quarantined area in any State to any point in any other State or Territory not included in the quarantined area.

Interstate shipments of cattle from the quarantined area may be made during the months of January, November, and December of each year by rail or boat for any purpose into the District of Columbia, the States of Colorado, Connecticut, Delaware, Idaho, Illinois, Indiana, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming, and that portion of the State of Missouri north of the Missouri River under such restrictions as may be imposed by officials of the District of Columbia or State at destination, provided that in their movement the provisions contained in paragraphs (*a*) to (*m*), hereinafter set out in this regulation, are strictly observed and complied with.

The provisions referred to in the foregoing paragraphs of this regulation and which shall be strictly observed and complied with in all interstate movements of cattle of the quarantined area to points outside the quarantined area except only those movements authorized and accompanied by certificates of inspection issued by inspectors of the Bureau of Animal Industry are as follows:

(*a*) Cattle of the quarantined area when received at destinations outside the quarantined area, or which in course of interstate transportation from the quarantined area are unloaded at a point not within the quarantined area to be fed or watered or for other purposes, shall be handled over platforms, chutes, and alleyways, and placed in yards or portions of yards reserved for cattle of the quarantined area. Such yards or portions of yards, alleyways, chutes, and platforms shall be constructed and maintained in accordance with the specifications set out below:

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[a] A "Rule to prevent the spread of splenetic fever in cattle" is in effect throughout the entire year. This rule prescribes the quarantined area in the respective States and should be considered in connection with these regulations. Copies of the rule may be obtained from the Chief of the Bureau of Animal Industry, Washington, D. C.

SPECIFICATIONS FOR QUARANTINE YARDS AND APPROACHES.

(1) The outside fences inclosing such yards or portions of yards, and the fences on either side of the alleyways, chutes, and platforms leading thereto, shall be tight board fences not less than 6 feet high on the inside.

(2) If such yards or portions of yards, alleyways, chutes, and platforms are adjacent to yards or portions of yards, alleyways, chutes, and platforms for cattle not of the quarantined area, there shall be between them a space not less than 10 feet wide, which shall be inaccessible to cattle; this space shall be limited on one side by the 6-foot fence required by specification 1 and on the other side by a tight board fence not less than 5 feet high.

(3) If such yards or portions of yards, alleyways, chutes, and platforms are either isolated from or adjacent to other yards, portions of yards, alleyways, chutes, or platforms, there shall be built and maintained outside thereof on all sides to which cattle of the vicinity might otherwise approach a cattle-proof fence not less than 5 feet high and not less than 15 feet from the 6-foot fence required by specification 1.

(4) The only means of egress from yards and portions of yards for cattle of the quarantined area in transit shall be by way of the alleyways, chutes, and platforms inclosed by 6-foot fences, as required by specification 1, to cars for reforwarding, and under no circumstances shall there exist any connection between such yards or portions of yards and the yards or portions of yards for cattle not of the quarantined area or other adjacent premises.

(5) The yards or portions of yards reserved for cattle of the quarantined area shall be so located, or such drainage facilities shall be provided therefor, that water therefrom will not flow onto the adjacent property.

(6) The yards or portions of yards reserved for cattle of the quarantined area shall be marked by a conspicuous sign bearing the words "QUARANTINE YARDS" or "QUARANTINE PENS" in letters not less than 10 inches in height.

(*b*) If cattle not of the quarantined area be driven over platforms, chutes, or alleyways, or placed in the yards or portions of yards reserved for cattle of the quarantined area, such cattle shall thereafter be treated in all respects as if they were actually of the quarantined area.

(*c*) Cars or boats which have carried cattle of the quarantined area outside thereof shall be cleaned and disinfected as provided by paragraphs (*g*) and (*h*), respectively, of this regulation, as soon as possible after unloading and before the said cars or boats are again used in the interstate transportation of live stock or merchandise.

(*d*) If for any reason, such as delays or wrecks, it is necessary to unload cattle of the quarantined area which are being transported as "Southern Cattle" into pens or yards which have not been specially provided for that purpose as hereinbefore indicated, the transportation company shall immediately forward notice of such unloading and the reasons therefor to the Chief of the Bureau of Animal Industry at Washington, D. C., and the premises shall be disinfected as provided by paragraph (*i*) of this regulation.

(*e*) The proper officers of the transportation companies shall securely affix to both sides of all cars carrying interstate shipments of cattle from the quarantined area (except those accompanied by certificates of inspection issued by inspectors of the Bureau of Animal Industry, covering shipments of cattle dipped as provided in Regulation 17 hereof, and shipments of cattle from certain areas described in the "Rule to prevent the spread of splenetic fever in cattle," which rule should be construed in connection with these regulations) durable placards not less than 5½ by 8 inches in size, on which shall be printed with permanent black ink and in bold-face letters not less than 1½ inches in height the words "SOUTHERN CATTLE." These placards shall also show the name of the place from which the shipment was made, the date of the shipment (which must correspond with the date of the waybills and other papers), the name of the transportation company, and the name of the place of destination. Each of the waybills, conductors' manifests, memoranda, and bills of lading pertaining to such shipments by cars or boats shall have the words "SOUTHERN CATTLE" plainly written or stamped upon its face. Whenever such shipments are transferred to another transportation company or into other cars or boats, or are rebilled or reconsigned from any point not in the quarantined area to a point other than the original destination, the cars into which said cattle are transferred and the new waybills, conductors' manifests, memoranda, and bills of lading covering said shipments by cars or boats shall be marked as herein specified for cars carrying said cattle from the quarantined area, and for the billing, etc., covering the same. If for any reason the placards required by this regulation are removed from the car or are destroyed or rendered illegible they shall be immediately replaced by the transportation company or its agents, the intention being that legible placards designating the shipment as "Southern Cattle" shall be maintained on the car from the time such shipments leave the quarantined area until they are unloaded at final destination and the cars are treated as hereinafter specified.

(*f*) No car or boat containing an interstate shipment of cattle of the quarantined area shall receive on board cattle which are not of the quarantined area. Interstate shipments of cattle of the quarantined area shall not be made to points outside of said quarantined area where proper facilities have not been provided for transferring the said cattle from the cars or landing to the stock yards and slaughterhouses without passing them over public highways, unless permission for such passing is first had and obtained from the proper authorities at point of destination.

(*g*) Cars required by paragraph (*c*) of this regulation to be cleaned and disinfected shall be treated in the following manner: Remove all litter and manure from all portions of the cars, including the ledges and framework outside; wash the exterior and interior of the car until clean and saturate the entire interior surface, including the inner surface of the car doors, with the disinfecting material.

(*h*) Boats required by paragraph (*c*) of this regulation to be cleaned and disinfected shall be treated in the following manner: Remove all litter and manure from the decks, stalls, and all other parts of the boat occupied or traversed by such cattle, and from the portable chutes or other appliances or fixtures used in loading and unloading same, and wash them until clean, and saturate the entire surface of the decks, stalls, or other parts of the boat occupied or traversed by the cattle, or with which they may have come in contact or which have contained litter or manure, with the disinfecting material.

(*i*) Yards, pens, chutes, and alleyways required by paragraph (*d*) of this regulation to be disinfected shall be treated in the following manner: Empty all troughs, racks, or other feeding or watering facilities and wash them until clean; remove all litter and manure from the floors, posts, or other parts and wash them until clean, and saturate the entire surface of the fencing, troughs, chutes, floors, walls, and other parts with the disinfecting material.

(*j*) As materials for the disinfection of cars, boats, pens, chutes, and alleyways which have contained cattle of the quarantined area one of those indicated below shall be used: (1) A mixture made with not more than 1½ pounds of lime and ¼ pound of pure carbolic acid to each gallon of water. In lieu of the pure carbolic acid required to make this solution a proper quantity of so-called "crude carbolic acid" of known strength (but not less than 25 per cent pure) may be used, sufficient to make a disinfecting solution containing 5 per cent of the pure acid. (2) Any coal-tar creosote dip permitted in the official dipping of sheep for scabies, provided the same is used at one-fifth the maximum dilution (five times the minimum strength) specified for dipping sheep.

(*k*) The litter and manure removed from cars, boats, or other vehicles, and from pens, chutes, alleyways, or other premises or inclosures which have contained cattle of the quarantined area shall not be so located or stored that they come in contact with cattle in course of interstate transportation unless disinfected by one of the methods specified below: (1) It may be disinfected by saturating it with any disinfecting material specified in the preceding paragraph of the strength and composition indicated therein, except that the lime may be omitted. (2) It may be stored without disinfection during the period from February 1 to October 31, inclusive, of each year; when stored as above indicated, the storage space shall be tightly inclosed and so situated or so surrounded by cattle-proof fences or other structures that no cattle other than cattle of the quarantined area may approach closer to it than 15 feet.

(*l*) Cars which have carried cattle within the quarantined area of any State or Territory shall be cleaned and disinfected before being taken to any point in another State or Territory not in the quarantined area. This provision shall not apply to cars containing cattle in the course of interstate transportation for immediate slaughter in accordance with these regulations.

(*m*) The regulations relating to the movement of cattle of the quarantined area as prescribed by the proper state officers at destination shall be carefully observed.

Regulation 15.—(*a*) Cattle not of the quarantined area which are transported interstate by rail through the quarantined area may be unloaded therein for rest, feed, and water into properly equipped noninfectious pens, provided such pens and the platforms, chutes, and alleyways leading thereto are constructed and maintained in accordance with the specifications set out below.

SPECIFICATIONS FOR NONINFECTIOUS PREMISES.

(1) The outside fences inclosing such pens, and the fences on either side of the alleyways, chutes, and platforms leading thereto shall be tight board fences not less than 6 feet high on the inside.

(2) If such pens, alleyways, chutes, and platforms are adjacent to pens, alleyways, chutes, and platforms for cattle of the quarantined area, there shall be between them a space not less than 10 feet wide, which shall be inaccessible to cattle; this space shall

be limited on one side by the 6-foot fence required by specification 1, and on the other side by a tight board fence not less than 5 feet high.

(3) If such pens, alleyways, chutes, and platforms are either isolated from or adjacent to other pens, alleyways, chutes, or platforms there shall be built and maintained outside thereof on all sides to which cattle of the vicinity might otherwise approach, a cattle-proof fence not less than 5 feet high and not less than 15 feet from the 6-foot fence required by specification 1.

(4) The only means of egress from such pens shall be by way of the alleyways, chutes, and platforms inclosed by 6-foot fences as required by specification 1 to cars for reforwarding, and under no circumstances shall there exist any connection between such pens and the pens for cattle of the quarantined area or other adjacent premises.

(5) Such noninfectious premises shall be so located, or such drainage facilities shall be provided therefor, that water from the surrounding area will not flow onto or through them.

(6) Such pens shall be marked by a conspicuous sign bearing the words "NONINFECTIOUS PENS" in letters not less than 10 inches in height.

(*b*) Cattle infected with the *Margaropus annulatus*, or southern cattle tick, disseminate the contagion of splenetic, southern, or Texas fever; therefore cattle not of the quarantined area which are infested with the *Margaropus annulatus* ticks shall be considered as infected cattle and shall be subject to the regulations governing the interstate movement of cattle of the quarantined area.

Regulation 16.—Stock-yard companies receiving interstate shipments of cattle infected with the said ticks shall place the said cattle in the pens set aside for the use of cattle of the quarantined area, and transportation companies are required to clean and disinfect, in accordance with the requirements of these regulations, all cars and boats used in interstate transportation which have contained the infected cattle.

Regulation 17.—At any time of the year cattle of the quarantined area or other cattle exposed to or infected with ticks (*Margaropus annulatus*), which have been properly dipped in Beaumont crude petroleum or otherwise treated in a manner approved by the Secretary of Agriculture under the supervision of an inspector of the Bureau of Animal Industry and which have been examined and certified by the said inspector to be free of infection, may be shipped interstate subject only to such restrictions as may be imposed by State, Territorial, or District officers at points of destination: *Provided,* That when cattle are to be dipped, as specified herein, they shall, within six hours immediately prior to dipping, be given an opportunity to drink sufficient water to quench their thirst. Shipments of cattle that have been dipped or treated as herein provided shall be forwarded in clean, disinfected cars, shall be accompanied by the certificates of dipping or treatment issued by the inspector supervising the same, and shall not be driven through the quarantined area or be unloaded therein except at such points as may be designated in the rules of the Secretary of Agriculture.

The interstate movement of horses and mules infested with ticks (*Margaropus annulatus*) may be made only in accordance with the regulations and rule governing the interstate movement of tick-fested cattle.

Regulation 18.—Before accepting or moving an interstate shipment of cattle to a point not in the quarantined area from that portion of the quarantined area from which, under the rules of the Secretary of Agriculture, cattle may be shipped after inspection for purposes other than immediate slaughter, transportation companies shall secure a signed statement from each owner or consignor of said cattle showing the purpose for which the cattle are shipped. In every case this statement shall accompany the waybills.

Amendment 3 to B. A. I. Order 143 is hereby revoked, to take effect upon April 1, 1909.

Done at Washington this seventeenth day of March, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 3 TO B. A. I. ORDER 146.

Amendment 3 to Rule 3, Revision 1—To Prevent the Spread of Scabies in Sheep (amendment effective on and after April 1, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that the contagious and communicable disease known as scabies is not now known to exist, or exists to a slight extent only, among sheep in the State of Montana, that portion of North Dakota lying south and west of the Missouri River, and that portion of South Dakota lying west of the Missouri River, all of which areas are now quarantined by Rule 3, Revision 1, dated March 22, 1907, and effective April 15, 1907.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, do hereby remove and revoke the quarantine placed by Rule 3, Revision 1, upon the following area, to wit:

The State of Montana, that portion of North Dakota lying south and west of the Missouri River, and that portion of South Dakota lying west of the Missouri River.

Done at Washington this 11th day of March, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 4 TO B. A. I. ORDER 146.

Amendment 4 to Rule 3, Revision 1—To Prevent the Spread of Scabies in Sheep (effective on and after August 16, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that a contagious, communicable disease known as scabies exists among sheep in the State of Kentucky.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority conferred by section 1 of the act of Congress approved March 3, 1905 (33 Stat., 1264), do hereby quarantine the following area, to wit:

All territory situate within the boundaries of the State of Kentucky.

It is ordered by this Amendment 4 to Rule 3, Revision 1, under the authority and discretion conferred upon the Secretary of Agriculture by section 3 of the act of Congress approved March 3, 1905 (33 Stat., 1264), that sheep in the State of Kentucky shall be moved therefrom to any other State or Territory or District only in accordance with Regulations 31 to 37, inclusive, of the regulations of the Secretary of Agriculture designated as B. A. I. Order 143, promulgated March 22, 1907, and effective April 15, 1907, as amended, and that all inspections and dippings required under said Regulations 31 to 37, inclusive, shall be made at points where federal inspection is maintained.

Done at Washington this 5th day of August, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 5 TO B. A. I. ORDER 146.

Amendment 5 to Rule 3, Revision 1—To Prevent the Spread of Scabies in Sheep (effective on and after August 18, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

It is ordered that that portion of Rule 3, Revision 1, to prevent the spread of scabies in sheep, dated March 22, 1907, and effective on and after April 15, 1907, which provides for the interstate movement of sheep from the quarantined area, in so far as it relates to the interstate movement of sheep in the State of Texas, which State is quarantined by said Rule 3, Revision 1, is hereby revoked and superseded by the following:

It is ordered by this Amendment 5 to Rule 3, Revision 1, under the authority and discretion conferred upon the Secretary of Agriculture by section 3 of the act of Congress approved March 3, 1905 (33 Stat., 1264), that on and after August 18, 1909, sheep in the State of Texas shall be moved therefrom to any other State or Territory or District only in accordance with Regulations 31 to 37, inclusive, of the regulations of the Secretary of Agriculture designated as B. A. I. Order 143, promulgated March 22, 1907, and effective April 15, 1907, as amended, and that all inspections and dippings required by said Regulations 31 to 37, inclusive, shall be made at points where federal inspection is maintained.

The effect of this amendment is to require that scabby sheep may be dipped twice in accordance with the regulations and shipped interstate without further federal restrictions, or they may be so dipped once and shipped interstate for immediate slaughter. All other sheep may be shipped interstate, without dipping, for immediate slaughter as "exposed sheep for slaughter," or they may be dipped once in accordance with the regulations and shipped interstate without further federal restrictions.

Done at Washington this 7th day of August, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 6 TO B. A. I. ORDER 146.

Amendment 6 to Rule 3, Revision 1—To Prevent the Spread of Scabies in Sheep (amendment effective on and after August 20, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

It is ordered that the quarantine for scabies in sheep placed upon the State of Kentucky by Amendment 4 to Rule 3, Revision 1, dated August 5, 1909, and effective on and after August 16, 1909, be, and the same is hereby, modified to permit the interstate shipment of sheep of States not quarantined for scabies in sheep which are exhibited at the Kentucky State Fair to be held at Louisville September 13 to 18, 1909, inclusive, subject to the following restrictions:

(*a*) Such sheep shall be shipped by rail to Louisville and shall not be unloaded in the area quarantined for sheep scabies elsewhere than at Louisville.

(*b*) Separate cleaned and disinfected chutes and other facilities shall be provided for the exclusive unloading and loading of such sheep at Louisville.

(*c*) Such sheep shall be hauled in cleaned and disinfected wagons direct from the cars in which they arrive at Louisville to the fair grounds, and from the fair grounds direct to the cars in which they are to be reshipped.

(*d*) That portion of the fair grounds or other premises to be occupied exclusively by such sheep shall be cleaned and disinfected under the supervision of an employee of the Bureau of Animal Industry before said sheep are placed therein.

(*e*) Such sheep shall not be moved interstate from Louisville except in cleaned and disinfected cars, nor unless accompanied by a certificate issued by an inspector of the Bureau of Animal Industry showing that the sheep have had no opportunity to become infected with scabies.

It is also ordered that said Amendment 4 to Rule 3, Revision 1, be, and the same is hereby, modified to permit the reforwarding in interstate commerce of shipments from other States of sheep that are free from scabies and from exposure thereto and that in transit through Kentucky are unloaded at points in that State: *Provided,* Such unloading shall be into pens or yards which have been specially cleaned and disinfected for the purpose under the supervision of an employee of the Bureau of Animal Industry, and which have been specially designated and approved for that purpose by the Chief of the Bureau of Animal Industry.

Done at Washington this twentieth day of August, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] W. M. HAYS, *Acting Secretary of Agriculture.*

AMENDMENT 2 TO B. A. I. ORDER 150.

Regulations Governing the Meat Inspection of the United States Department of Agriculture—Amendment to Paragraph 1 of Section 2 of Regulation 22, Governing the Use of Preservatives in Establishments where Inspection is Maintained.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., March 12, 1909.

For the purpose of preventing the use in interstate or foreign commerce of meat and meat food products which are unsound, unhealthful, unwholesome, and otherwise unfit for human food, under the authority conferred on the Secretary of Agriculture by the provisions of the act of Congress approved June 30, 1906 (34 Stat., 674), Paragraph 1 of Section 2 of Regulation 22 is hereby amended to read as hereinafter set out.

This amendment, which for purposes of identification is designated as Amendment 2 to B. A. I. Order 150, shall become and be effective on and after March 15, 1909.

JAMES WILSON, *Secretary of Agriculture.*

Section 2, Paragraph 1. There may be added to meat or meat food products common salt, sugar, wood smoke, vinegar, pure spices, and saltpeter. Benzoate of soda may also be added to meat or meat food products which are placed in containers or packages to which are securely affixed officially approved labels plainly showing the presence and amount of benzoate of soda. Only such coloring matters as may be designated by the Secretary of Agriculture as being harmless may be used and these only in such manner as the Secretary of Agriculture may designate.

AMENDMENT 2 TO B. A. I. ORDER 152.

Amendment 2 to Rule 2, Revision 2—To Prevent the Spread of Scabies in Cattle (amendment effective on and after May 15, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that the contagious disease known as scabies is not now known to exist, or exists to a slight extent only, among cattle in the counties of Trego, Sheridan, and Thomas, in the State of Kansas, quarantined by Rule 2, Revision 2, dated September 5, 1908, and effective October 1, 1908, as amended by Amendment 1 thereto, dated September 23, 1908, and effective October 15, 1908.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority of law, do hereby amend said Rule 2, Revision 2, to prevent the spread of scabies in cattle, in the following particulars, to wit:

That part of Amendment 1 to said Rule 2, Revision 2, which specifies the quarantined portion of the State of Kansas is amended to read as follows:

"The counties of Cheyenne, Sherman, Wallace, Greeley, Hamilton, Stanton, Morton, Stevens, Grant, Kearney, Wichita, Logan, Rawlins, Gove, Scott, Lane, Finney, Gray, Haskell, Seward, Meade, Clark, Ford, Kiowa, and Comanche, in the State of Kansas."

The effect of this order is to release from quarantine on account of scabies in cattle the counties of Trego, Sheridan, and Thomas, in the State of Kansas.

Done at Washington this sixth day of May, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 3 TO B. A. I. ORDER 152.

Amendment 3 to Rule 2, Revision 2—To Prevent the Spread of Scabies in Cattle (amendment effective on and after September 1, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Acting Secretary of Agriculture, and notice is hereby given, that the contagious disease known as scabies is not now known to exist, or exists to a slight extent only, among cattle in that part of the State of North Dakota lying south and west of the Missouri River, quarantined by Rule 2, Revision 2, dated September 5, 1908, and effective October 1, 1908.

Now, therefore, I, WILLET M. HAYES, ACTING SECRETARY OF AGRICULTURE, under authority of law, do hereby amend said Rule 2, Revision 2, to prevent the spread of scabies in cattle, in the following particulars, to wit:

That part of said rule which specifies the quarantined portion of the State of North Dakota is hereby revoked, said revocation to become and be effective on and after September 1, 1909.

The effect of this order is to release from quarantine the State of North Dakota.

Done at Washington this 19th day of August, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] W. M. HAYS, *Acting Secretary of Agriculture.*

AMENDMENT 9 TO B. A. I. ORDER 156.

Amendment 9 to Rule 6, Revision 1—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, Other Ruminants, and Swine (effective on and after January 5, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

During the existence of the quarantine to prevent the spread of foot-and-mouth disease in cattle, sheep, other ruminants, and swine, as provided in Rule 6, Revision 1, and amendments thereto, cattle, calves, sheep, and swine may be shipped interstate by rail or boat or be trailed or driven under the restrictions hereinafter indicated from any point in the State of Pennsylvania except from the counties of Philadelphia, Delaware, Chester, Lancaster, Dauphin, Lebanon, Berks, Montgomery, Bucks, Lehigh, Northampton, Carbon, Schuylkill, Luzerne, Columbia, Montour, Northumberland, Lycoming, Clinton, Center, Union, Snyder, Mifflin, Juniata, and Perry, and that portion of York County which lies east and south of Conewago Creek, for immediate slaughter, to any point located in any other State or Territory or the District of Columbia, without inspection or certification, provided the authorities of the State, Territory, or the District of Columbia to which the animals are destined have previously signified their willingness to accept such animals. When such animals are received from points in Pennsylvania they shall be slaughtered immediately.

Animals moved under this amendment shall not be trailed into or driven through any one of the aforesaid counties or part of county in the State of Pennsylvania. No cattle, sheep, other ruminants, or swine shall be trailed or driven from the State of Pennsylvania until permission for such movement has first been obtained from the Chief of the Bureau of Animal Industry. When such animals are shipped by rail or boat they shall not be unloaded en route either at points within or without the area quarantined for foot-and-mouth disease except into pens designated for that purpose by the Chief of the Bureau of Animal Industry. Animals from the State of Pennsylvania shall not be unloaded into cleaned and disinfected pens specially designated by the Chief of the Bureau of Animal Industry under Rule 6, Revision 1, for the yarding of live stock passing through the quarantined area.

Railroad cars or boats, within that portion of Pennsylvania not included in the aforesaid counties and part of county, which have carried live stock may be moved interstate without being cleaned and disinfected.

Hay, straw, or similar fodder, including that used for packing merchandise, etc., may be moved interstate from the State of Pennsylvania except from the aforesaid counties and part of county without disinfection or certification, subject to the consent of the officials of the State, Territory, or District of Columbia to which such consignments are destined.

Hides, skins, and hoofs of cattle, sheep, other ruminants, and swine taken from animals slaughtered at any point in the State of Pennsylvania except points located in the aforesaid counties and part of county may be moved interstate without disinfection or certification, subject to the consent of the officials of the State, Territory, or District of Columbia to which such consignments are destined.

Amendment 8 to Rule 6, Revision 1, modifying the quarantine for the State of New York, is hereby amended to provide that live stock for immediate slaughter may be shipped interstate by rail or boat or be trailed or driven under the restrictions above indicated for the State of Pennsylvania from any point in the State of New York except from the counties of Erie, Niagara, Orleans, Genesee, and Monroe. When such animals are received from points in New York they shall be slaughtered immediately.

Railroad cars or boats, within that portion of New York not included in the counties of Erie, Niagara, Orleans, Genesee, and Monroe, which have carried live stock may be moved interstate without being cleaned and disinfected.

This amendment is effective on and after January 5, 1909, and is subject to amendment or revision on statutory notice.

Done at Washington this 2d day of January, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 10 TO B. A. I. ORDER 156.

Amendment 10 to Rule 6, Revision 1—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, Other Ruminants, and Swine (effective on and after January 13, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

During the existence of the quarantine to prevent the spread of foot-and-mouth disease in cattle, sheep, other ruminants, and swine, as provided in Rule 6, Revision 1, and amendments thereto, hides and skins removed after January 1, 1909, from the carcasses of cattle, calves, sheep, or goats, slaughtered in the counties of Philadelphia, Delaware, Chester, Lancaster, Dauphin, Lebanon, Berks, Montgomery, Bucks, Lehigh, Northampton, Carbon, Schuylkill, Luzerne, Columbia, Montour, Northumberland, Lycoming, Clinton, Center, Union, Snyder, Mifflin, Juniata, and Perry, and that portion of York County which lies east and south of Conewago Creek, in the State of Pennsylvania; in the counties of Erie, Niagara, Orleans, Genesee, and Monroe, in the State of New York; in the counties of Macomb, Oakland, Wayne, Washtenaw, and Monroe, in the State of Michigan; in Districts 1, 2, 3, 4, 6, 7, 8, 10, 11, and 12, in Carroll County, and in Districts 4, 5, 6, 7, 8, and 10, in Baltimore County, in the State of Maryland, may be moved interstate without disinfection or certification, subject to permission of state authorities at destination, provided that the said hides or skins have not been in contact with hides or skins from the carcasses of animals slaughtered before January 1, 1909, within the above-mentioned counties or parts of counties.

Hides and skins of cattle, calves, sheep, and goats, which originated outside of the counties and parts of counties above specified, that have been removed prior to January 1, 1909, at establishments having federal inspection, may be moved interstate without certification or disinfection, subject to permission of state authorities at destination, provided that such hides and skins have not been in contact with other hides or skins removed prior to January 1, 1909, and which are in the counties and parts of counties above specified.

This amendment is effective on and after January 13, 1909, and is subject to amendment or revision on statutory notice.

Done at Washington this 12th day of January, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 11 TO B. A. I. ORDER 156.

Amendment 11 to Rule 6, Revision 1—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, Other Ruminants, and Swine (effective on and after January 27, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

1. During the existence of the quarantine to prevent the spread of foot-and-mouth disease in cattle, sheep, other ruminants, and swine, as provided in Rule 6, Revision 1, and amendments thereto, particularly amendments 1 and 3, whereby the States of New York, Michigan, and Maryland are quarantined, the interstate transportation, movement, or trailing or driving of cattle, sheep, other ruminants, and swine, or the movement of hay, straw, similar fodder, hides, skins, or hoofs, except as hereinafter otherwise provided, from the following areas in the States of New York, Michigan, and Maryland, is hereby prohibited:

2. NEW YORK.—The entire counties of GENESEE, NIAGARA, and ORLEANS. That portion of ERIE County north of the southern boundaries of the towns of Hamburg, East Hamburg, Aurora, and Wales. That portion of MONROE County west and north of the Genesee River.

3. MICHIGAN.—The entire counties of MACOMB, OAKLAND, and WAYNE. The townships of Salem, Superior, Ypsilanti, and Augusta in WASHTENAW County.

4. MARYLAND.—Districts 5 and 6 in BALTIMORE County. Districts 3, 6, 7, and 8 in CARROLL County.

5. Upon inspection and certification by an employee of the Bureau of Animal Industry, cattle, sheep, other ruminants, and swine from points in the areas hereinbefore described in the States of New York, Michigan, and Maryland may be moved interstate for immediate slaughter, provided that the authorities of the State, Territory, or District of Columbia to which the animals are destined have previously signified their willingness to accept them. When interstate shipments by rail of cattle, sheep, other ruminants, and swine for immediate slaughter are made from points in the areas hereinbefore described, the cars containing them shall be sealed with Department seals affixed by an employee of the Bureau of Animal Industry before the said cars shall be allowed to leave the areas hereinbefore quarantined; and such shipments shall not be unloaded en route or at destination, within or outside the areas hereinbefore described, except into reserved pens which have been designated and approved for that purpose by the Chief of the Bureau of Animal Industry. The specially cleaned and disinfected pens designated and approved for unloading en route shipments of live stock from and to points not included in the quarantined area shall not be used for this class of shipments. When such shipments are unloaded en route, as hereinbefore provided, the cars shall, after reloading, be again sealed by an employee of the Bureau of Animal Industry, it being the purpose and intent of this provision that cars containing such shipments shall remain sealed until the animals arrive at the place of slaughter.

6. Hides and skins removed after January 1, 1909, from the carcasses of cattle, calves, sheep, or goats slaughtered in the areas hereinbefore described in the States of New York, Michigan, and Maryland may be moved interstate without disinfection or certification, subject to permission of the State authorities at destination, provided that the said hides or skins have not been in contact with hides or skins from the carcasses of animals slaughtered before January 1, 1909, within the areas hereinbefore quarantined.

7. Hides and skins of cattle, calves, sheep, and goats which originated outside of the areas hereinbefore described in the States of New York, Michigan, and Maryland and which have been removed from carcasses prior to January 1, 1909, at establishments having inspection under the federal meat inspection law may be moved interstate from the areas hereinbefore described without disinfection or certification, subject to the permission of the state authorities at destination, provided that such hides or skins have not been in contact with other hides or skins removed prior to January 1, 1909, and which are in the areas hereinbefore described.

8. Hides and skins of cattle, sheep, and goats which are within the areas hereinbefore described, but which are not heretofore provided for in this amendment, shall be disinfected under the supervision of, and be certified by, an employee of the Bureau of Animal Industry before being moved interstate from the areas hereinbefore described.

9. Hay, straw, and similar fodder may be moved interstate from the areas hereinbefore described only upon certification by an employee of the Bureau of Animal Industry.

10. When interstate shipments by rail or boat of cattle, sheep, other ruminants, and swine are made from and to points not included in the areas hereinbefore described in the States of New York, Michigan, and Maryland, the said shipments shall not be unloaded within the said areas except under the supervision of an employee of the Bureau of Animal Industry, and into pens which have been specially cleaned and disinfected, and which have been designated and approved for that purpose by the Chief of the Bureau of Animal Industry.

11. CATTLE, SHEEP, OTHER RUMINANTS, AND SWINE, HAY, STRAW, AND SIMILAR FODDER, HIDES, SKINS, AND HOOFS, NOT ORIGINATING IN THE AREAS HEREINBEFORE DESCRIBED, IN THE STATES OF NEW YORK, MICHIGAN, AND MARYLAND, MAY BE MOVED INTERSTATE WITHOUT RESTRICTIONS EXCEPT AS HEREIN IMPOSED, BUT SHALL NOT BE EXPORTED TO ANY FOREIGN COUNTRY EXCEPT UPON THE WRITTEN PERMISSION OF THE SECRETARY OF AGRICULTURE FIRST HAD AND OBTAINED.

12. Rule 6, Revision 1, and all amendments thereto affecting the quarantine of Pennsylvania, are still in full force and effect. Cattle, sheep, other ruminants, and swine, hay, straw, and similar fodder, and hides, skins, and hoofs originating in the State of Pennsylvania shall not be exported to any foreign country except upon the written permission of the Secretary of Agriculture first had and obtained.

13. That part of Rule 6, Revision 1, dated November 19, 1908, effective on and after November 19, 1908, relative to the quarantine of New York, and amendments thereto numbered 1, 2, 3, 4, 5, 6, 7, 8, and 9, are hereby amended accordingly.

This amendment is effective on and after January 27, 1909, and is subject to amendment or revision on statutory notice.

Done at Washington this 26th day of January, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

B. A. I. ORDER 157.

Rule 6, Revision 2.—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, Other Ruminants, and Swine (effective on and after February 25, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

1. In order to prevent the further spread of foot-and-mouth disease among live stock, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority conferred by section 1 of the act of Congress approved March 3, 1905 (33 Stat., 864), do hereby quarantine the following area, to wit:

2. PENNSYLVANIA:

The entire county of PHILADELPHIA, including the city of Philadelphia.

The township of Hereford in BERKS County.

The townships of Milford, Richland, and Springfield, and the boroughs included therein, in BUCKS County.

The townships of Marion and Walker in CENTER County.

The townships of Pine Creek, Dunstable, Woodward, Allison, Bald Eagle, Porter, Lamar, Castanea, and Wayne, the boroughs of Mill Hall and Flemington, and the city of Lock Haven, in CLINTON County.

The townships of Hemlock and Montour in COLUMBIA County.

The townships of Upper Paxton and Halifax, and the boroughs included therein, in DAUPHIN County.

The townships of East Whiteland, Tredyffrin, East Town, Willistown, East Goshen, West Town, Thornbury, and Birmingham, and the boroughs and cities included therein, in CHESTER County.

The townships of Radnor, New Town, Marple, Haverford, Edgmont, Upper Providence, Thornbury, Middletown, Birmingham, Concord, and Aston, and the boroughs of Media and Glen Olden, in DELAWARE County.

That portion of JUNIATA County lying north and east of the Juniata River.

The townships of East Donegal, Rapho, Penn, Warwick, West Earl, Upper Leacock, Leacock, East Lampeter, Manheim, East Hempfield, West Hempfield, Manor, Lancaster, Pequea, West Lampeter, Strasburg. Providence, Conestoga, Martic, Drumore, and the boroughs and the city of Lancaster included therein, in LANCASTER County.

All of LEHIGH County, excepting Hanover Township, and the boroughs of Catasauqua and West Bethlehem included therein.

The city of Williamsport in LYCOMING County.

The townships of Upper Hanover, Skippack, Towamensing, Upper Gwynedd, Lower Gwynedd, Whitpain, Worcester, Lower Providence, Upper Merion, Norriton, Plymouth, Upper Dublin, White Marsh, Lower Merion, and Springfield, and all boroughs and cities included therein, and also that portion of the borough of Lansdale lying in Hatfield Township, in MONTGOMERY County.

The townships of Anthony, Limestone, Valley, West Hemlock, Cooper, Mahoning, and Mayberry, and the borough of Danville, in MONTOUR County.

The township of Lower Saucon, and the boroughs of South Bethlehem and Hallertown, in NORTHAMPTON County.

The townships of Delaware, Lewis, Turbut, West Chillisquaque, East Chillisquaque, Point, Upper Augusta, Gearhart, Rush, Ralpho, Shamokin, and Rockefeller, and the boroughs and cities included therein, in NORTHUMBERLAND County.

All of SNYDER County excepting Monroe, Spring, and West Beaver townships.

All of UNION County, excepting Lewis and Hartley townships.

The townships of Codorus and Manheim, and the boroughs included therein, in YORK County.

3. NEW YORK:

The towns of Newstead, Clarence, Amherst, Tonawanda, Buffalo, Cheektowaga, Lancaster, Alden, West Seneca, and Grand Island, in ERIE County.

The towns of Byron, Bergen, Alabama, Pembroke, and Darien, in GENESEE County.

The towns of Greece, Parma, Hamlin, Clarkson, Sweden, and Ogden, in MONROE County.

All of NIAGARA County, excepting the town of Somerset.

The towns of Clarendon, Shelby, Carlton, Gaines, Kendall, and Murray, in ORLEANS County.

4. MICHIGAN:

The townships of Washington, Shelby, Sterling, and Warren, in MACOMB County.

The townships of Oakland, Avon, Troy, Royal Oak, Southfield, Farmington, and Novi, in OAKLAND County.

The townships of Northville, Plymouth, Livonia, Redford, Greenfield, Hamtramck, Grosse Point, Springwells, Dearborn, Nankin, Gratiot, and Canton, and the city of Detroit, in WAYNE County.

5. MARYLAND:

District No. 6 in CARROLL County.

District No. 6 in BALTIMORE County.

6. During the existence of this quarantine, the interstate or foreign transportation, movement, or trailing or driving of cattle, sheep, other ruminants, and swine, or the interstate or foreign movement of hay, straw, similar fodder, hides, skins, or hoofs, except as hereinafter otherwise provided, from the said area herein quarantined in the States of Pennsylvania, New York, Michigan, and Maryland, is hereby prohibited.

7. When interstate or foreign shipments by rail or boat of cattle, sheep, other ruminants, and swine are made from and to points not included in the area herein quarantined, the said shipments shall not be unloaded within the quarantined area, except under the supervision of an employee of the Bureau of Animal Industry, and into pens which have been specially cleaned and disinfected and which have been designated and approved for that purpose by the Chief of the Bureau of Animal Industry.

8. Upon inspection and certification by an employee of the Bureau of Animal Industry, cattle, sheep, other ruminants, and swine from points in the area herein quarantined, may be moved interstate, for immediate slaughter, provided the authorities of the State, Territory, or District of Columbia, to which the animals are destined, have previously signified their willingness to accept them. When shipments by rail of cattle, sheep, other ruminants, and swine, for immediate slaughter, are made from points in the area herein quarantined, the cars or crates containing them shall be sealed with Department seals, affixed by an employee of the Bureau of Animal Industry, before the said cars or crates shall be allowed to leave the area herein quarantined, and such shipments shall not be unloaded en route or at destination, within or outside the area herein quarantined, except into reserved pens which have been designated and approved for that purpose by the Chief of the Bureau of Animal Industry. The specially cleaned and disinfected pens provided for in section 7 of this order shall not be used for this class of shipments. When such shipments are unloaded en route, as hereinbefore provided, the cars shall, after reloading, be again sealed by an employee of the Bureau of Animal Industry, it being the purpose and intent of this provision that cars or crates containing such shipments shall remain sealed until the animals arrive at the place of slaughter.

9. Cattle, sheep, other ruminants, and swine intended for purposes other than slaughter may be moved interstate from the area herein quarantined only upon permission of the Secretary of Agriculture, first had and obtained, and under such restrictions as he may impose in each case.

10. Hides, skins, and hoofs removed after January 1, 1909, from the carcasses of cattle, calves, sheep, or goats slaughtered within the area herein quarantined may be moved interstate without disinfection or certification, subject to permission of the State authorities at destination, provided that the said hides, skins, or hoofs have not been in contact with hides, skins, or hoofs from the carcasses of animals slaughtered before January 1, 1909, within the area herein quarantined.

11. Hides, skins, and hoofs of cattle, calves, sheep, and goats which originated outside of the area quarantined and which have been removed from carcasses prior to January 1, 1909, at establishments having inspection under the Federal meat inspection law, may be moved interstate from the area herein quarantined without disinfection or certification, subject to the permission of the State authorities at destination, provided that such hides, skins, or hoofs have not been in contact with other hides, skins, or hoofs removed prior to January 1, 1909, and which are in the area herein quarantined.

12. Hides, skins, and hoofs of cattle, calves, sheep, and goats which are within the area herein quarantined, but which are not hereinbefore provided for in this order, shall be disinfected under the supervision of and be certified by an employee of the Bureau of Animal Industry before being moved interstate from the area herein quarantined.

13. Hay, straw, and similar fodder may be moved interstate from the area herein quarantined only upon certification by an employee of the Bureau of Animal Industry.

14. Rule 6, Revision 1, dated November 19, 1908, effective on and after November 19, 1908, and all amendments thereto, being Amendments 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11, shall cease to be effective on and after February 25, 1909, on and after which date this Rule 6, Revision 2, which for purposes of identification is designated as B. A. I. Order 157 and which is subject to amendment or revision on statutory notice, shall become and be effective until otherwise ordered.

Done at Washington this twenty-fourth day of February, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 1 TO B. A. I. ORDER 157.

Amendment 1 to Rule 6, Revision 2—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, Other Ruminants, and Swine (effective on and after March 15, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that the contagious and communicable disease known as foot-and-mouth disease is not now known to exist among the live stock in certain areas in the States of Michigan and Maryland which were quarantined by Rule 6, Revision 2, dated February 24, 1909, effective on and after February 25, 1909.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, do hereby remove and revoke the quarantine placed by Rule 6, Revision 2, upon the following areas, to wit:

MICHIGAN.

The townships of Washington, Shelby, Sterling, and Warren, in MACOMB County.

The townships of Oakland, Avon, Troy, Royal Oak, Southfield, Farmington, and Novi, in OAKLAND County.

The townships of Northville, Plymouth, Livonia, Redford, Greenfield, Hamtramck, Grosse Point, Springwells, Dearborn, Mankin, Gratiot, and Canton, and the city of Detroit, in WAYNE County.

MARYLAND.

District No. 6 in CARROLL County.

District No. 6 in BALTIMORE County.

Paragraphs 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13 of Rule 6, Revision 2, are hereby amended accordingly.

The effect of this amendment is to release from the quarantine for foot-and-mouth disease the entire States of Michigan and Maryland.

This amendment is effective on and after March 15, 1909, and is subject to amendment or revision on statutory notice.

Done at Washington this eleventh day of March, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 2 TO B. A. I. ORDER 157.

Amendment 2 to Rule 6, Revision 2—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, Other Ruminants, and Swine (effective on and after March 26, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that the contagious and communicable disease known as foot-and-mouth disease is not now known to exist among the live stock in certain areas in the States of Pennsylvania and New York which were quarantined by Rule 6, Revision 2, dated February 24, 1909, effective on and after February 25, 1909.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, do hereby remove and revoke the quarantine placed by Rule 6, Revision 2, upon the following areas, to wit:

NEW YORK.

The towns of Newstead, Clarence, Amherst, Tonawanda, Buffalo, Cheektowaga, Lancaster, Alden, West Seneca, and Grand Island, in ERIE County.

The towns of Byron, Bergen, Alabama, Pembroke, and Darien, in GENESEE County.

The towns of Greece, Parma, Hamlin, Clarkson, Sweden, and Ogden, in MONROE County.

All of NIAGARA County.

The towns of Clarendon, Shelby, Carlton, Gaines, Kendall, and Murray, in ORLEANS County.

PENNSYLVANIA.

The entire county of PHILADELPHIA, including the city of Philadelphia.

The township of Hereford, in BERKS County.

The townships of Milford, Richland, and Springfield, and the boroughs included therein, in BUCKS County.

The townships of Marion and Walker, in CENTER County.

The townships of Pine Creek, Dunstable, Woodward, Allison, Bald Eagle, Porter, Lamar, Castanea, and Wayne, the boroughs of Mill Hall and Flemington, and the city of Lock Haven, in CLINTON County.

The townships of Hemlock and Montour, in COLUMBIA County.

The townships of Upper Paxton and Halifax, and the boroughs included therein, in DAUPHIN County.

The townships of East Whiteland, Tredyffrin, East Town, Willistown, East Goshen, West Town, Thornbury, and Birmingham, and the boroughs and cities included therein, in CHESTER County.

That portion of JUNIATA County lying north and east of the Juniata River.

All of LEHIGH County.

The city of Williamsport, in LYCOMING County.

The townships of Upper Hanover, Skippack, Towamensing, Upper Gwynedd, Lower Gwynedd, Whitpain, Worcester, Lower Providence, Upper Merion, Norriton, Plymouth, Upper Dublin, White Marsh, Lower Merion, and Springfield, and all boroughs and cities included therein, and also that portion of the borough of Lansdale lying in Hatfield Township, in MONTGOMERY County.

The townships of Anthony, Limestone, Valley, West Hemlock, Cooper, Mahoning, and Mayberry, and the borough of Danville, in MONTOUR County.

The township of Lower Saucon, and the boroughs of South Bethlehem and Hellertown, in NORTHAMPTON County.

The townships of Delaware, Lewis, Turbut, West Chillisquaque, East Chillisquaque, Point, Upper Augusta, Gearhart, Rush, Ralpho, Shamokin, and Rockefeller, and the boroughs and cities included therein, in NORTHUMBERLAND County.

All of SNYDER County.

All of UNION County.

The townships of Codorus and Manheim, and the boroughs included therein, in YORK County.

The townships of Radnor, New Town, Marple, Haverford, Edgmont, Upper Providence, Thornbury, Middletown, Birmingham, Concord, and Aston, and the borough of Media, in DELAWARE County.

The borough of Glen Olden, in DELAWARE County, and the townships of East Donegal, Rapho, Penn, Warwick, West Earl, Upper Leacock, Leacock, East Lampeter, Manheim, East Hempfield, West Hempfield, Manor, Lancaster, Pequea, West Lampeter, Strasburg, Providence, Conestoga, Martic, Drumore, and the boroughs and the city of Lancaster included therein, in LANCASTER County, will remain under the quarantine for foot-and-mouth disease imposed by Rule 6, Revision 2, and amendments thereto, until further notice.

Paragraphs 1, 2, 3, 6, 7, 8, 9, 10, 11, 12, and 13 of Rule 6, Revision 2, are hereby amended accordingly.

The effect of this amendment is to release from the quarantine for foot-and-mouth disease the entire State of New York, and the State of Pennsylvania excepting the borough of Glen Olden, in DELAWARE County, and the townships of East Donegal, Rapho, Penn, Warwick, West Earl, Upper Leacock, Leacock, East Lampeter, Manheim, East Hempfield, West Hempfield, Manor, Lancaster, Pequea, West Lampeter, Strasburg, Providence, Conestoga, Martic, Drumore, and the boroughs and the city of Lancaster included therein, in LANCASTER County.

This amendment is effective on and after March 26, 1909, and is subject to amendment or revision on statutory notice.

Done at Washington this 22d day of March, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

B. A. I. ORDER 158.

Rule 1, Revision 4—To Prevent the Spread of Splenetic Fever in Cattle (effective on and after April 1, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that a contagious and infectious disease known as splenetic, southern, or Texas fever exists among cattle in the following-named States, to wit:

CALIFORNIA, OKLAHOMA, TEXAS, MISSOURI, ARKANSAS, LOUISIANA, MISSISSIPPI, TENNESSEE, ALABAMA, VIRGINIA, NORTH CAROLINA, SOUTH CAROLINA, GEORGIA, and FLORIDA.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority conferred by section 1 of the act of Congress approved March 3, 1905 (33 Stat., 1264), do hereby quarantine the area hereinafter described, and do order by this Rule 1, Revision 4, under the authority and discretion conferred on the Secretary of Agriculture by section 3 of the act of Congress approved March 3, 1905 (33 Stat., 1265), that the interstate movement of cattle of the area herein quarantined to any point not located in the said quarantined area shall be made only in accordance with the regulations of the Secretary of Agriculture designated as B. A. I. Order 143, promulgated March 22, 1907, and effective April 15, 1907, and amendments thereto, subject only to the exceptions hereinafter contained.

The following areas are quarantined for splenetic, southern, or Texas fever in cattle:

CALIFORNIA.

The counties of San Diego, Orange, Los Angeles, Ventura, Tulare, San Luis Obispo, those portions of San Bernardino and Riverside counties west of the one hundred and sixteenth meridian west longitude, Santa Barbara County with the exception of the island of Santa Rosa, and that portion of Fresno County west of the right of way of the main line of the Southern Pacific Company are quarantined.

During the continuance of this quarantine no cattle of the area hereinbefore described shall be moved or allowed to move except as provided for immediate slaughter to any point in the United States not in the State of California which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

TEXAS.

The entire State of Texas is quarantined, with the exception of the counties of Dallam, Sherman, Hansford, Ochiltree, Lipscomb, Hartley, Moore, Hutchinson, Roberts, Hemphill, Oldham, Potter, Carson, Gray, Wheeler, Deaf Smith, Randall, Armstrong, Donley, Collingsworth, Parmer, Castro, Swisher, Briscoe, Hall, Childress, Bailey, Lamb, Hale, Floyd, Motley, Cochran, Hockley, Lubbock, Crosby, Dickens, Yoakum, Terry, Lynn, Garza, Kent, Gaines, Dawson, Andrews, Martin, El Paso, Jeff Davis,' Presidio, Brewster, Reeves, Loving, Winkler, Ector, Midland, and Ward.

During the continuance of this quarantine no cattle of the counties of Cottle, Hardeman, Foard, Wilbarger, King, Knox, Baylor, Stonewall, Haskell, Borden, Scurry, Fisher, Jones, Howard, Mitchell, Glasscock, Sterling, Crane, Upton, Reagan, Irion, those portions of the counties of Pecos and Terrell north and west of a line beginning at the southwest corner of Terrell County; thence in a northerly direction to the northwest corner of section No. 63, block D10, Texas Central Railway Company; thence north along the western boundary of sections Nos. 64, 65, 66, 67, 68, 69, 70, 71, and 72 of said block D10 to the northwest corner of said section No. 72; thence continuing north through the western parts of sections Nos. 36, 25, 24, 13, 12, and 1, block 150, Texas and St. Louis Railroad Company, to the roadbed of the Galveston, Harrisburg and San Antonio Railroad Company; thence southeasterly, following the roadbed of the said Galveston, Harrisburg and San Antonio Railroad Company, to a point on section No. 36, block A2, Galveston, Harrisburg and San Antonio Railroad Company; thence north with the pasture fence through the eastern part of sections Nos. 36, 13, and 12 of said block A2 and across section No. 1, Gulf, Colorado and Santa Fe Railway Company; thence continuing north with said pasture fence through the eastern part of sections Nos. 16, 17, 46, 47, 76, 77, 106, 107, 136, 137, 142, 143, and 194, block D, Missouri, Kansas and Texas Extension Railway Company; thence continuing in a northerly direction to a point on the northern boundary of section No. 6, block 160, Gulf, Colorado and Santa Fe Railway Company, same being corner of pasture fence; thence east along the northern boundary of sections Nos. 6, 9, 10, 11, 12, 15, and 16, block 160, Gulf, Colorado and Santa Fe Railway Company, to the northeast corner of said section No. 16, the same being corner of pasture fence; thence in a northerly direction with the eastern boundary of sections Nos. 22, 21, 20, 23, 24, 25, 26, 27, 28, 29, 30, 31, and 32, block 1, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, to the northeast corner of said section No. 32; thence west with the northern boundary of sections Nos. 32 and 33, same block, to the northwest corner of section No. 33, block 1, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, corner of fence; thence north with the eastern boundary of sections Nos. 1, 12, 13, 24, 25, 36, 37, 48, 49, 60, 61, and 72, block 2, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, to the northeast corner of said section No. 72; thence in an easterly direction with the pasture fence to the southeast corner of section No. 9, patented to James E. Evans; thence north along the eastern boundary of said section No. 9 to the northwest corner of section No. 100, block A2, Texas Central Railway Company; thence east with the northern boundary of sections Nos. 100 and 89, same block, to the northeast corner of said section No. 89, block A2, Texas Central Railway Company; thence north along the eastern boundary of sections Nos. 90, 91, 92, and 93 to the southeast corner of section No. 94, block A2, Texas Central Railway Company; thence northwest diagonally across section No. 94 to the northwest corner of said section; thence continuing in a northwesterly direction diagonally across sections Nos. 14, 18, and 28 to the northeast corner of section No. 29, block C4, Gulf, Colorado and Santa Fe Railway Company; thence west with the northern boundary of said section No. 29 to the northwest corner of said section; thence northwest diagonally across section No. 1, Texas Central Railway Company, section No. 97, block 194, Gulf, Colorado and Santa Fe Railway Company, to the northeast corner of section No. 96; thence in a northerly direction across section No. 94 to a point on its northern boundary 600 varas west of its northeast corner; thence continuing north through sections Nos. 93, 90, 89, 86, 85, and 58, block 194, Gulf, Colorado and Santa Fe Railway Company, to a point on the northern boundary of said section No. 58; thence northwesterly with the pasture fence through section No. 59 to the northeast corner of section No. 82 and the southeast corner of section No. 81, same block; thence continuing northwesterly to section No. 17, Houston and Great Northern Railroad Company; thence north along the eastern boundary of said section No. 17 to the Pecos River; thence northwesterly along said Pecos River to the northwest corner of Crockett County, or that portion of Tom Green County west of a line extending due north from the northeast corner of Irion County to the southern boundary of Coke County, shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Texas which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties and portions of counties in that part of Texas which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

OKLAHOMA.

The entire State of Oklahoma is quarantined, except the counties of Cimarron, Texas, Beaver, Harper, Woods, Alfalfa, Grant, Woodward, Major, Garfield, Ellis, Dewey, Blaine, Kingfisher, Logan, Roger Mills, Custer, Beckham, Washita, Oklahoma, that portion of Canadian County north of the Canadian River, that portion of Cleveland County north of the Canadian River and west of the Atchison, Topeka and Santa Fe Railway, that portion of Noble County west of the Atchison, Topeka and Santa Fe Railway and north of the line between townships 23 and 24 north, and that portion of Kay County west of the Arkansas River.

During the continuance of this quarantine no cattle of Greer County, that portion of Jackson County west of the Kansas City, Mexico and Orient Railroad, that portion of Caddo County north of the Mangum branch of the Chicago, Rock Island and Pacific Railway, that portion of Canadian County south of the Canadian River, that portion of Kay County east of the Arkansas River, that portion of Cleveland County east of the Atchison, Topeka and Santa Fe Railway and north of the line between townships 7 and 8 north, that portion of Payne County north of the line between townships 19 and 20 north, or that portion of Noble County east of the Atchison, Topeka and Santa Fe Railway and south of the line between townships 21 and 22 north, shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Oklahoma which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties and portions of counties in that part of Oklahoma which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

During the continuance of this quarantine no cattle of the quarantined area of any State other than the State of Oklahoma shall, except as hereinafter provided, be moved or allowed to move into Osage County: *Provided,* That from October 1 of each year to May 15 of the following year cattle of the quarantined area of any other State may be moved into Osage County after having been satisfactorily dipped in Beaumont crude petroleum, or otherwise properly treated, under the supervision of an inspector of the Bureau of Animal Industry.

MISSOURI.

Ripley County, that portion of Oregon County south of the line between townships 22 and 23 north, that portion of Newton County west of the right of way of the Kansas City Southern Railway, and that portion of McDonald County west of the right of way of the Kansas City Southern Railway are quarantined.

During the continuance of this quarantine no cattle of those portions of Oregon, Newton, and McDonald counties hereinbefore described shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Missouri which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From Ripley County cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

ARKANSAS.

The entire State of Arkansas is quarantined except the counties of Carroll, Randolph, Clay, Green, Lawrence, and Craighead.

During the continuance of this quarantine no cattle of the counties of Benton or Washington, that portion of Fulton County east of Spring River, or that portion of Sharp County north of Strawberry River shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Arkansas which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties and parts of counties in that portion of the State of Arkansas which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

TENNESSEE.

The following-mentioned counties and parts of counties are quarantined: The counties of Hardeman, McNairy, Chester, Henderson, Decatur, Hardin, Wayne, Lawrence, Hamilton, James, Bradley, Polk, Warren, Overton; that portion of Madison County east and south of a line beginning at a point on the southern boundary line of Madison County where the Illinois Central Railroad intersects said line, thence northerly along the Illinois Central Railroad to the south fork of Forked Deer River, thence easterly along said river to the mouth of Warlick Creek, thence northerly along said creek to its intersection with the Jackson and Cotton Grove road, thence northerly along said road and the Cotton Grove road and Spring Creek road to Spring Creek, thence northeasterly along the Jackson and Spring Creek road to the southern boundary of Carroll County; that portion of Benton County south of the Louisville and Nashville Railroad; that portion of Lincoln County south of Elk River; that portion of Marion County south and east of the Tennessee River; that portion of Dekalb County south and east of a line beginning at the intersection of the northeastern corner of Cannon County with the west prong of Dry Creek near the southeast corner of the third civil district of Dekalb County, thence northerly along said creek to its intersection with the southern boundary of the twentieth civil district of said county, thence easterly and northerly along the southern and eastern boundaries of said twentieth civil district to the southern boundary of the tenth civil district of said county near Capling, thence southeasterly along the southern boundary of the tenth and twenty-second civil districts of said county to Big Hurricane (or Hurricane) Creek, thence northerly along said creek to Caney Fork River, thence northwesterly along Caney Fork River to the eastern boundary of the eighteenth civil district of said Dekalb County, thence northerly along the eastern boundary of said eighteenth civil district to the southern boundary of Putnam County; that portion of Putnam County not included in the ninth, tenth, eleventh, and twelfth civil districts; and that portion of Fentress County west of the East Fork of Obey River.

During the continuance of this quarantine no cattle of the counties of Warren, Overton, or those portions of the counties of Dekalb, Putnam, and Fentress, hereinbefore described, shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Tennessee which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties and portions of counties in that part of the State of Tennessee which is quarantined for splenetic, southern, or Texas fever cattle shall only be moved or allowed to move interstate to points outside of the quarantine area in accordance with the regulations for immediate slaughter.

GEORGIA.

The entire State of Georgia is quarantined except the counties of Union, Towns, and Rabun.

During the continuance of this quarantine no cattle of the counties of White, Habersham, or Stephens shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Georgia which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties in that part of the State of Georgia which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

SOUTH CAROLINA.

The entire State of South Carolina is quarantined.

During the continuance of this quarantine no cattle of the counties of Oconee, Pickens, Greenville, or Anderson shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of South Carolina which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties in the State of South Carolina cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

NORTH CAROLINA.

The counties of Franklin, Wake, Chatham, Randolph, Stanly, Montgomery, Moore, Harnett, Johnston, Wilson, Nash, Halifax, Northampton, Hertford, Bertie, Gates, Chowan, Perquimans, Pasquotank, Camden, Currituck, Edgecombe, Martin, Washington, Tyrrell, Dare, Hyde, Beaufort, Pitt, Wayne, Sampson, Cumberland, Richmond, Scotland, Robeson, Bladen, Green, Lenoir, Craven, Pamlico, Carteret, Jones, Duplin, Onslow, Pender, Columbus, Brunswick, and New Hanover are quarantined.

From the counties above mentioned cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

VIRGINIA.

The counties of Fluvanna, Chesterfield, York, Mecklenburg, Lunenburg, Brunswick, Greenesville, Sussex, Surry, Southampton, Isle of Wight, Nansemond, and that part of Warwick County not included in the Newport News magisterial district are quarantined.

During the continuance of this quarantine no cattle of Lunenburg County shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Virginia which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties and parts of counties in that portion of the State of Virginia which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

LOUISIANA.

The entire State of Louisiana is quarantined.

During the continuance of this quarantine no cattle of the parishes of Lincoln and Claiborne shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Louisiana which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other parishes in the State of Louisiana cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

MISSISSIPPI, ALABAMA, FLORIDA.

The entire States of Mississippi, Alabama, and Florida are quarantined.

From the above-mentioned States cattle shall only be moved or allowed to move to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

GENERAL PROVISION.

During the continuance of the quarantine as herein established no cattle of the quarantined area of any State (except those portions from which cattle may be moved upon inspection) shall be moved or allowed to move to any portion of the quarantined area of another State from which, under the specific provisions of this rule, cattle are allowed to be shipped for purposes other than immediate slaughter upon inspection and certification by an inspector of the Bureau of Animal Industry.

OPEN SEASON.

During the months of January, November, and December of each year cattle of the quarantined area of any State may be moved interstate therefrom for purposes other than immediate slaughter into the State of Kansas, the Territories of Arizona and New Mexico, those portions of the States of California and Texas not included in the quarantined area, and that portion of the State of Missouri south of the Missouri River, if the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and shall first have been inspected under proper facilities for inspection at the point of origin and found free of infection and a certificate authorizing the movement issued by an inspector of the Bureau of Animal Industry, and if permission shall first have been obtained from the proper official of the State or Territory to which the cattle are destined.

During the period from November 15 of each year to January 31 of the following year, cattle of the quarantined area of any State may be moved interstate therefrom for purposes other than immediate slaughter under the above-mentioned restrictions into that portion of the State of Arkansas not included in the quarantined area.

During the months of January and February, the first fifteen days of March, and the last sixteen days of December in each year cattle of the quarantined area of any State may be moved interstate therefrom for purposes other than immediate slaughter under the above-mentioned restrictions into those portions of the States of Virginia and North Carolina not included in the quarantined area. During the month of January and the last seventeen days of December in each year cattle of the quarantined area of any State may be moved interstate therefrom for purposes other than immediate slaughter under the above-mentioned restrictions into that portion of the State of Oklahoma not included in the quarantined area.

Cattle of the quarantined area that have been shipped interstate during the months of January, November, and December of each year to any State or Territory outside of the quarantined area other than those States and Territories and portions thereof set out herein shall not be moved into any of the States or Territories or portions thereof hereinbefore mentioned within three months of the date of the movement from the quarantined area.

Cattle which are moved interstate from the quarantined area of any State into those States or Territories or portions thereof hereinbefore mentioned, under certificates from inspectors of the Bureau of Animal Industry, for feeding or stocking purposes shall, when shipped, be transported in cleaned and disinfected cars or boats, and shall not be placed in stock pens which have been reserved for cattle originating in the quarantined area.

FEEDING STATIONS FOR NONINFECTED CATTLE.

Cattle not of the quarantined area which are transported interstate by rail through the quarantined area may be unloaded therein for rest, feed, and water into properly equipped noninfectious pens set apart for such cattle at the Fort Worth stock yards, at Forth Worth, Tex.; the stock yards of the Missouri, Kansas and Texas Railway at Hodge and Denison, Tex.; the stock yards of the International and Great Northern Railroad at Laredo, Tex.; the Southern Pacific Railway stock yards at Los Angeles, Cal.; the stock yards at Colton, Cal.; the stock yards of the St. Louis and San Francisco Railroad at Sapulpa, Okla.; the stock yards of the Missouri, Kansas and Texas Railway at Muskogee, Okla.; the stock yards of the Kansas City, Mexico and Orient Railway at Altus, Okla.; and at such other points as may from time to time be authorized by the Secretary of Agriculture, provided such pens and the platforms, chutes, and alleyways leading thereto have been cleaned and disinfected under the supervision of an employee of the Bureau of Animal Industry and are constructed and maintained in accordance with the specifications set out in the regulations of the Secretary of Agriculture to prevent the spread of splenetic fever in cattle.

All cattle handled in such noninfectious pens shall be free from ticks (*Margaropus annulatus*) and shall not have been unloaded at any point in the quarantined area other than the designated unloading points named herein or hereafter authorized by the Secretary of Agriculture, and they shall be reloaded into the same cars from which unloaded or into other cars which have been cleaned, washed, and disinfected as required by B. A. I. Order 143 and amendments thereto, immediately before loading therein, and reshipped as uninfected cattle.

INTERPRETATION.

This Rule 1, Revision 4, shall be construed in connection with the regulations of the Secretary of Agriculture promulgated March 22, 1907, and effective on and after April 15, 1907, and amendments thereto, and is subject to amendment or revision on statutory notice.

Rule 1, Revision 3, dated March 17, 1908, effective April 1, 1908, and all amendments thereto, shall cease to be effective on and after April 1, 1909, on and after which date this Rule 1, Revision 4, which for purposes of identification is designated as B. A. I. Order 158, shall become and be effective until otherwise ordered.

Done at Washington this seventeenth day of March, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 1 TO B. A. I. ORDER 158.

Amendment 1 to Rule 1, Revision 4—To Prevent the Spread of Splenetic Fever in Cattle—Amendment Regarding Irion and Sterling Counties and a Portion of Tom Green County in the State of Texas (effective on and after June 1, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

It is ordered that that portion of Rule 1, Revision 4, to prevent the spread of splenetic fever in cattle, effective on and after April 1, 1909, which relates to the quarantine in the State of Texas, is hereby amended to read as follows:

TEXAS.

"The entire State of Texas is quarantined, with the exception of the counties of Dallam, Sherman, Hansford, Ochiltree, Lipscomb, Hartley, Moore, Hutchinson, Roberts, Hemphill, Oldham, Potter, Carson, Gray, Wheeler, Deaf Smith, Randall, Armstrong, Donley, Collingsworth, Parmer, Castro, Swisher, Briscoe, Hall, Childress, Bailey, Lamb, Hale, Floyd, Motley, Cochran, Hockley, Lubbock, Crosby, Dickens, Yoakum, Terry, Lynn, Garza, Kent, Gaines, Dawson, Andrews, Martin, El Paso, Jeff Davis, Presidio, Brewster, Reeves, Loving, Winkler, Ector, Midland, and Ward.

"During the continuance of this quarantine no cattle of the counties of Cottle, Hardeman, Foard, Wilbarger, King, Knox, Baylor, Stonewall, Haskell, Borden, Scurry, Fisher, Jones, Howard, Mitchell, Glasscock, Crane, Upton, Reagan, or of those portions of the counties of Pecos and Terrell north and west of a line beginning at the southwest corner of Terrell County; thence in a northerly direction to the northwest corner of section No. 63, block D10, Texas Central Railway Company; thence north along the western boundary of sections Nos. 64, 65, 66, 67, 68, 69, 70, 71, and 72 of said block D10 to the northwest corner of said section No. 72; thence continuing north through the western parts of sections Nos. 36, 25, 24, 13, 12, and 1, block 150, Texas and St. Louis Railroad Company, to the roadbed of the Galveston, Harrisburg and San Antonio Railroad Company; thence southeasterly, following the roadbed of the said Galveston, Harrisburg and San Antonio Railroad Company to a point on section No. 36, block A2, Galveston, Harrisburg and San Antonio Railroad Company; thence north with the pasture fence through the eastern part of sections Nos. 36, 13, and 12 of said block A2 and across section No. 1, Gulf, Colorado and Santa Fe Railway Company; thence continuing north with said pasture fence through the eastern part of sections Nos. 16, 17, 46, 47, 76, 77, 106, 107, 136, 137, 142, 143, and 194, block D, Missouri, Kansas and Texas Extension Railway Company; thence continuing in a northerly direction to a point on the northern boundary of section No. 6, block 160, Gulf, Colorado and Santa Fe Railway Company, same being corner of pasture fence; thence east along the northern boundary of sections Nos. 6, 9, 10, 11, 12, 15, and 16, block 160, Gulf, Colorado and Santa Fe Railway Company, to the northeast corner of said section No. 16, the same being corner of pasture fence; thence in a northerly direction with the eastern boundary of sections Nos. 22, 21, 20, 23, 24, 25, 26, 27, 28, 29, 30, 31, and 32, block 1, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, to the northeast corner of said section No. 32; thence west with the northern boundary of sections Nos. 32 and 33, same block, to the northwest corner of section No. 33, block 1, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, corner of fence; thence north with the eastern boundary of sections Nos. 1, 12, 13, 24, 25, 36, 37, 48, 49, 60, 61, and 72, block 2, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, to the northeast corner of said section No. 72; thence in an easterly direction with the pasture fence to the southeast corner of section No. 9, patented to James E. Evans; thence north along the eastern boundary of said section No. 9 to the northwest corner of section No. 100, block A2, Texas Central Railway Company; thence east with the northern boundary of sections Nos. 100 and 89, same block, to the northeast corner of said section No. 89, block A2, Texas Central Railway Company; thence north along the eastern boundary of sections Nos. 90, 91, 92, and 93 to the southeast corner of section No. 94, block A2, Texas Central Railway Company; thence northwest diagonally across section No. 94 to the northwest corner of said section; thence continuing in a northwesterly direction diagonally across sections Nos. 14, 18, and 28 to the northeast corner of section No. 29, block C4, Gulf, Colorado and Santa Fe Railway Company; thence west with the northern boundary of said section No. 29 to the northwest corner of said section; thence northwest diagonally across section No. 1, Texas Central Railway Company, section No. 97, block 194, Gulf, Colorado and Santa Fe Railway

Company, to the northeast corner of section No. 96; thence in a northerly direction across section No. 94 to a point on its northern boundary 600 varas west of its northeast corner; thence continuing north through sections Nos. 93, 90, 89, 86, 85, and 58, block 194, Gulf, Colorado and Santa Fe Railway Company, to a point on the northern boundary of said section No. 58; thence northwesterly with the pasture fence through section No. 59 to the northeast corner of section No. 82 and the southeast corner of section No. 81, same block; thence continuing northwesterly to section No. 17, Houston and Great Northern Railroad Company; thence north along the eastern boundary of said section No. 17 to the Pecos River; thence northwesterly along said Pecos River to the northwest corner of Crockett County, shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Texas which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

"From the other counties and portions of counties in that part of Texas which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter."

The effect of this order is to place the counties of Irion and Sterling and that portion of Tom Green County west of a line extending due north from the northeast corner of Irion County to the southern boundary of Coke County in the quarantined area from which cattle shall only be moved or allowed to move interstate in accordance with the regulations for immediate slaughter.

Done at Washington this 21st day of May, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 2 TO B. A. I. ORDER 158.

Amendment 2 to Rule 1, Revision 4—To Prevent the Spread of Splenetic Fever in Cattle. Amendment Regarding Cattle for the Oklahoma State Fair.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

It is hereby ordered that the provisions of Rule 1, Revision 4 (B. A. I. Order 158), dated March 17, 1909, and effective on and after April 1, 1909, as amended, under which cattle of the area quarantined for Texas or splenetic fever are only permitted to be shipped interstate to points outside of the quarantined area for immediate slaughter, be, and the same are hereby, suspended in so far as they may apply to cattle intended for exhibition or sale purposes at the Oklahoma State Fair to be held at Oklahoma City, Okla., September 29 to October 8, 1909, inclusive.

Provided, That all such cattle shall be free from ticks (*Margaropus annulatus*) at time of shipment from points of origin; that they shall be transported in cleaned and disinfected cars; that they shall be consigned "Care of State Fair Association of Oklahoma;" that while outside of the quarantined area they shall be yarded and otherwise handled in the manner prescribed by Regulation 14 as contained in Amendment 4 to B. A. I. Order 143, and that at the close of the fair all such cattle shall be either returned to the quarantined area, or shipped as "southern cattle" for immediate slaughter, or dipped in accordance with Regulation 17, as contained in Amendment 4 to B. A. I. Order 143.

It is further provided, That at the close of the fair the premises occupied by said cattle during the fair, and the chutes, etc., through which they were handled shall be cleaned and disinfected in the manner prescribed by Regulation 14 above referred to, and that no hay, straw, or litter shall be removed from said premises without disinfection.

Done at Washington this 3d day of July, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 3 TO B. A. I. ORDER 158.

Amendment 3 to Rule 1, Revision 4—To Prevent the Spread of Splenetic Fever in Cattle—Amendment Regarding the Return of Cattle of the Nonquarantined Area that are Exhibited at the North Carolina State Fair at Raleigh, N. C., October 18 to 23, 1909.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

It is ordered that that portion of Rule 1, Revision 4, to prevent the spread of splenetic fever in cattle, effective on and after April 1, 1909, which relates to the quarantine in the State of North Carolina, is hereby modified to permit the interstate shipment to points outside the quarantined area as uninfected cattle, of cattle of the nonquarantined area that are exhibited at the North Carolina State Fair, to be held at Raleigh, N. C., October 18 to 23, 1909, subject to the following restrictions:

(*a*) Such cattle shall be shipped by rail to Raleigh and shall not be unloaded in the quarantined area elsewhere than at Raleigh.

(*b*) Separate cleaned and disinfected chutes and other facilities shall be provided for the exclusive unloading and loading of such cattle at Raleigh.

(*c*) Such cattle shall be hauled in clean and disinfected wagons direct from the cars in which they arrive at Raleigh to the fair grounds, and from the fair grounds direct to the cars in which they are to be reshipped.

(*d*) That portion of the fair grounds and other premises to be occupied by such cattle shall have been inaccessible to other cattle for at least six months previous to the date of the opening of the fair.

(*e*) The hay, straw, or similar material required for feed and bedding by such cattle during the time they are within the quarantined area shall be shipped in cleaned and disinfected cars from points outside of the quarantined area and so handled at Raleigh that it may not become infectious.

(*f*) Such cattle shall not be returned from Raleigh to points outside of the quarantined area except in cleaned and disinfected cars, nor unless accompanied by a certificate issued by an inspector of the Bureau of Animal Industry, showing that such cattle have had no opportunity to become infected with the cattle tick (*Margaropus annulatus*).

Done at Washington this twenty-third day of September, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 4 TO B. A. I. ORDER 158.

Amendment 4 to Rule 1, Revision 4—To Prevent the Spread of Splenetic Fever in Cattle. Amendment Regarding Cattle for the Tri-State Fair in Memphis, Tenn.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

It is ordered that the provisions of Rule 1, Revision 4 (B. A. I. Order 158), to prevent the spread of splenetic fever in cattle, dated March 17, 1909, and effective on and after April 1, 1909, as amended, under which cattle of the area quarantined for Texas or splenetic fever are only permitted to be shipped interstate to points outside of the quarantined area for immediate slaughter, be, and the same are hereby, suspended in so far as they may apply to cattle intended for exhibition or sale purposes at the Tri-State Fair to be held at Memphis, Tenn., September 28 to October 9, 1909, inclusive.

Provided, That all such cattle shall be free from ticks (*Margaropus annulatus*) at the time of shipment from points of origin; that they shall be transported in cleaned and disinfected cars; that they shall be consigned "Care of Tri-State Fair Association;" that while outside of the quarantined area they shall be yarded and otherwise handled in the manner prescribed by Regulation 14 as contained in Amendment 4 to B. A. I. Order 143, and that at the close of the fair all such cattle shall be either returned to the quarantined area, or shipped as "Southern cattle" for immediate slaughter, or dipped in accordance with Regulation 17, as contained in Amendment 4 to B. A. I. Order 143.

It is further provided, That at the close of the fair the premises occupied by said cattle during the fair, and the chutes, etc., through which they were handled shall be cleaned and disinfected in the manner prescribed by Regulation 14 above referred to, and that no hay, straw, or litter shall be removed from said premises without disinfection.

Done at Washington this twenty-fifth day of September, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 5 TO B. A. I. ORDER 158.

Amendment 5 to Rule 1, Revision 4—To Prevent the Spread of Splenetic Fever in Cattle (effective on and after October 11, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

On account of temporary local conditions prevailing in the State of Texas it is ordered that that portion of Rule 1, Revision 4, to prevent the spread of splenetic fever in cattle, effective on and after April 1, 1909, which relates to the quarantine in the State of Texas, is hereby amended to read as follows, effective on and after October 11, 1909:

TEXAS.

"The entire State of Texas is quarantined, with the exception of the counties of Dallam, Sherman, Hansford, Ochiltree, Lipscomb, Hartley, Moore, Hutchinson, Roberts, Hemphill, Oldham, Potter, Carson, Gray, Wheeler, Deaf Smith, Randall, Armstrong, Donley, Collingsworth, Parmer, Castro, Swisher, Briscoe, Hall, Childress, Bailey, Lamb, Hale, Floyd, Motley, Cochran, Hockley, Lubbock, Crosby, Dickens, Yoakum, Terry, Lynn, Garza, Kent, Gaines, Dawson, Andrews, Martin, El Paso, Jeff Davis, Presidio, Brewster, Reeves, Loving, Winkler, Ector, Midland, and Ward.

"During the continuance of this quarantine no cattle of the counties of Cottle, Hardeman, Foard, Wilbarger, King, Knox, Baylor, Stonewall, Haskell, Borden, Scurry, Fisher, Jones, Howard, Mitchell, Glasscock, Crane, Upton, Reagan, or of those portions of the counties of Pecos and Terrell north and west of a line beginning at the southwest corner of Terrell County; thence in a northerly direction to the northwest corner of section No. 63, block D10, Texas Central Railway Company; thence north along the western boundary of sections Nos. 64, 65, 66, 67, 68, 69, 70, 71, and 72 of said block D10 to the northwest corner of said section No. 72; thence continuing north through the western parts of sections Nos. 36, 25, 24, 13, 12, and 1, block 150, Texas and St. Louis Railroad Company, to the roadbed of the Galveston, Harrisburg and San Antonio Railroad Company; thence southeasterly, following the roadbed of the said Galveston, Harrisburg and San Antonio Railroad Company to a point on section No. 36, block A2, Galveston, Harrisburg and San Antonio Railroad Company; thence north with the pasture fence through the eastern part of sections Nos. 36, 13, and 12 of said block A2 and across section No. 1, Gulf, Colorado and Santa Fe Railway Company; thence continuing north with said pasture fence through the eastern part of sections Nos. 16, 17, 46, 47, 76, 77, 106, 107, 136, 137, 142, 143, and 194, block D, Missouri, Kansas and Texas Extension Railway Company; thence continuing in a northerly direction to a point on the northern boundary of section No. 6, block 160, Gulf, Colorado and Santa Fe Railway Company, same being corner of pasture fence; thence east along the northern boundary of sections Nos. 6, 9, 10, 11, 12, 15, and 16, block 160, Gulf, Colorado and Santa Fe Railway Company, to the northeast corner of said section No. 16, the same being corner of pasture fence; thence in a northerly direction with the eastern boundary of sections Nos. 22, 21, 20, 23, 24, 25, 26, 27, 28, 29, 30, 31, and 32, block 1, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, to the northeast corner of said section No. 32; thence west with the northern boundary of sections Nos. 32 and 33, same block, to the northwest corner of section No. 33, block 1, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, corner of fence; thence north with the eastern boundary of sections Nos. 1, 12, 13, 24, 25, 36, 37, 48, 49, 60, 61, and 72, block 2, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, to the northeast corner of said section No. 72; thence in an easterly direction with the pasture fence to the southeast corner of section No. 9, patented to James E. Evans; thence north along the eastern boundary of said section No. 9 to the northwest corner of section No. 100, block A2, Texas Central Railway Company; thence east with the northern boundary of sections Nos. 100 and 89, same block, to the northeast corner of said section No. 89, block A2, Texas Central Railway Company; thence north along the eastern boundary of sections Nos. 90, 91, 92, and 93 to the southeast corner of section No. 94, block A2, Texas Central Railway Company; thence northwest diagonally across section No. 94 to the northwest corner of said section; thence continuing in a northwesterly direction diagonally across sections Nos. 14, 18, and 28 to the northeast corner of section No. 29, block C4, Gulf, Colorado and Santa Fe Railway Company; thence west with the northern boundary of said section No. 29 to the northwest corner of said section; thence northwest diagonally across section No. 1, Texas Central Railway Company, section No. 97, block 194, Gulf, Colorado and Santa Fe Railway Company, to the northeast corner of section No. 96; thence in a northerly direction across section No. 94 to a point on its northern boundary 600 varas west of its northeast corner; thence continuing north through sections Nos. 93, 90, 89, 86, 85, and 58, block 194, Gulf, Colorado and Santa Fe Railway Company, to a point on the northern boundary of said section No. 58; thence northwesterly with the pasture fence through section No. 59 to the northeast corner of section No. 82 and the southeast corner of section No. 81, same block; thence continuing northwesterly to section No. 17, Houston and Great Northern Railroad Company; thence north along the eastern boundary of said section No. 17 to the Pecos River; thence northwesterly along said Pecos River to the northwest corner of Crockett County, shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Texas which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been kept on premises free of infection and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

"From the other counties and portions of counties in that part of Texas which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter."

Amendment 1 to B. A. I. Order 158 is hereby revoked from and after October 11, 1909.

Done at Washington this fifth day of October, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

B. A. I. ORDER 159.

Regulations Concerning the Importation of Hay and Straw from the Island of Jamaica, British West Indies.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., March 23, 1910.

Under authority of the act of Congress entitled "An act to enable the Secretary of Agriculture to more effectually suppress and prevent the spread of contagious and infectious diseases of live stock, and for other purposes," approved February 2, 1903, and to prevent the introduction of the contagion of anthrax, pleuro-pneumonia, or foot-and-mouth disease,

It is hereby ordered, That all hay or straw, the product of the island of Jamacia, British West Indies, or which has been transported through said island, shall be disinfected as may be prescribed by the Chief of the Bureau of Animal Industry, at the expense of the importer, before being unloaded from the vessel bringing it into any port of the United States, and when unloaded and landed it shall be stored and held in quarantine for a period of not less than three months in some place acceptable to the Chief of the Bureau of Animal Industry and under conditions prescribed by him.

JAMES WILSON, *Secretary of Agriculture.*

B. A. I. ORDER 160.

Rule 7.—Revoking the Quarantine to Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, Other Ruminants, and Swine (effective on and after April 24, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that the contagious and communicable disease known as foot-and-mouth disease has been eradicated from and does not now exist in the United States.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, do hereby remove and revoke the quarantine placed upon certain areas within the United States by Rule 6, Revision 2, dated February 24, 1909, effective on and after February 25, 1909, and Amendment 2, dated March 22, 1909, effective on and after March 26, 1909.

Bureau of Animal Industry Order 157, being Rule 6, Revision 2, and all amendments thereto are hereby revoked.

The effect of this Rule 7 is to remove and revoke the subsisting quarantine for foot-and-mouth disease heretofore in effect in the United States.

This rule is effective on and after April 24, 1909.

Done at Washington this nineteenth day of April, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

B. A. I. ORDER 161.

Special Order Providing for the Importation of Canadian Sheep for Exhibition Purposes at the Alaska-Yukon-Pacific Exposition, Seattle, Wash.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., April 27, 1909.

It is hereby ordered, That from May 20 to October 10, 1909, Canadian sheep may be imported into the United States for exhibition purposes at the Alaska-Yukon-Pacific Exposition, to be held at Seattle, Wash., from June 1 to October 15, 1909, without being subject to the thirty days' quarantine, provided they pass a satisfactory inspection at the port of entry and are accompanied by an affidavit of the owner or importer, and a certificate issued by a Canadian official veterinarian, as required by Amendment 3 to B. A. I. Order 142, amending Regulation 41 of the regulations for the inspection and quarantine of horses, cattle, sheep, and other ruminants, and swine imported into the United States; and provided further that the sheep which are not sold to remain in the United States shall be returned immediately to Canada at the close of said exposition.

The Department must be notified by the owner or importer, through the office of its veterinary inspector in charge at Seattle, of any Canadian sheep which are to remain in the United States for breeding purposes, and such sheep will be maintained in quarantine at the exposition grounds under the supervision of an inspector of this Department, who shall issue a certificate before shipment to a destination is allowed.

The thirty days of quarantine will be counted from the date of entry into the United States.

All Canadian sheep intended for this exposition must be shipped directly to the exposition grounds, and must not be unloaded in any public stock yards.

JAMES WILSON, *Secretary of Agriculture.*

B. A. I. ORDER 162.

Revocation of Regulations Concerning the Importation of Hay and Straw from the Island of Jamaica, British West Indies.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., May 25, 1909.

Under the authority of the act of Congress entitled "An act to enable the Secretary of Agriculture to more effectually suppress and prevent the spread of contagious and infectious diseases of live stock, and for other purposes," approved February 2, 1903, and to prevent the introduction of the contagion of anthrax, pleuro-pneumonia, or foot-and-mouth disease, a regulation, designated as B. A. I. Order 159, was issued on March 23, 1909. It provided that all hay or straw, the product of the island of Jamaica, British West Indies, or which had been transported through said island, should be disinfected as might be prescribed by the Chief of the Bureau of Animal Industry, at the expense of the importer, before being unloaded from the vessel bringing it into any port of the United States, and when unloaded and landed it should be stored and held in quarantine for a period of not less than three months in some place acceptable to the Chief of the Bureau of Animal Industry and under conditions prescribed by him.

The necessity for the measures required in the regulation, designated as B. A. I. Order 159, having passed, the said regulation so designated is hereby canceled, such cancellation to take effect from June 1, 1909.

JAMES WILSON, *Secretary of Agriculture.*

B. A. I. ORDER 163.

Rule 8.—To Prevent the Spread of Lip-and-Leg Disease (Necrobacillosis) in Sheep (effective on and after August 12, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that a contagious, communicable disease known as lip-and-leg disease (necrobacillosis) exists among sheep in the State of Wyoming.

Now therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority conferred by section 1 of the act of Congress approved March 3, 1905 (33 Stat., 1264), do hereby quarantine the following area, to wit:

All territory in the State of Wyoming situate within the boundaries of the counties of Fremont, Natrona, Converse, Weston, Crook, Sheridan, Johnson, and Big Horn.

During the existence of this quarantine the interstate transportation, movement, or trailing or driving of sheep, except as hereinafter provided, from the said area herein quarantined is hereby prohibited.

1. Sheep that are affected with lip-and-leg disease shall under no conditions be removed interstate from the quarantined area.

2. Sheep that are not affected with lip-and-leg disease, but which have been exposed to the contagion of the disease may be moved interstate from the quarantined area for stocking or feeding purposes after one dipping under Bureau supervision as hereinafter set forth, or they may be shipped interstate as hereinafter provided to a recognized slaughtering center for immediate slaughter without dipping.

3. Healthy sheep that have not been exposed to the contagion of lip-and-leg disease may be moved interstate from the quarantined area only when they are accompanied by a certificate of inspection issued by an inspector of the Bureau of Animal Industry authorizing the movement. Sheep shipped interstate under a certificate from an inspector of the Bureau of Animal Industry are not guaranteed uninterrupted transit; for in the event of the discovery of lip-and-leg disease or of exposure thereto en route the sheep shall thereafter be handled as diseased or exposed sheep, as herein provided, and the cars or other vehicles and the chutes, alleys, and pens which have been occupied by them shall be cleaned and disinfected or properly placarded as hereinafter provided.

4. When it is desired to dip exposed sheep for interstate shipment as hereinbefore provided, this may be done in one of the cresol or coal-tar creosote dips permitted by the Department of Agriculture in the official dipping of sheep for scabies, provided the dip is used at a strength one-fourth greater than that specified for use in the dipping of sheep for scabies. The dipping shall be done carefully and the sheep handled as humanely as possible. The Department disclaims responsibility for any loss or damage resulting from the dipping, and those who wish to avoid any risks that may be incident to dipping in transit, as well as to avoid liability to prosecution for shipping diseased animals, should see that their sheep are free from disease before shipping them to market.

5. When, as hereinbefore provided, exposed sheep are shipped interstate without dipping for immediate slaughter, the proper officers of the transportation company shall affix to both sides of each car a durable placard not less than 6½ by 10 inches in size, on which shall be printed with permanent black ink in bold-face letters not less than 1¼ inches in height the words "SHEEP FOR SLAUGHTER EXPOSED TO LIP-AND-LEG DISEASE." These placards shall also show the name of the place from which the shipment was made, the date of the shipment (which must correspond with the date of the waybills and other papers), the name of the transportation company, and the name of the place of destination. Each of the waybills, conductors' manifests, memoranda, and bills of lading pertaining to such shipments by cars or boats shall have the words "EXPOSED TO LIP-AND-LEG DISEASE" written or stamped on its face. Whenever such shipments are transferred to another transportation company or into other cars or into other boats, or are rebilled or reconsigned to a point other than the original destination, the cars into which said sheep are transferred and the new waybills, conductors' manifests, memoranda, and bills of lading covering such shipments by cars or boats shall be marked as herein specified for cars first carrying said sheep and for the billing, etc., covering the same. If for any reason the placards herein required are removed from the car or are destroyed or rendered illegible, they shall be immediately replaced by the transportation company or its agents, the intention being that legible placards shall be maintained on the cars from the time of shipment until they arrive at destination and the disposition of the cars is indicated by an inspector of the Bureau of Animal Industry.

6. All public stock yards, feeding stations, and approaches, chutes, alleys, and pens thereof which have contained diseased animals shall, before healthy or nonexposed ani-

mals for interstate transportation are placed therein, be cleaned and disinfected as hereinafter provided. Failure to clean and disinfect said places will subject them to quarantine.

7. Cars and other vehicles, yards, pens, sheds, chutes, alleys, etc., that have contained diseased sheep shall be cleaned and disinfected in the following manner: Remove all litter and manure from all portions of the cars, including the ledges and framework outside, and from the posts, floors, and fences of yards, pens, sheds, chutes, alleys, etc., and empty all troughs, racks, or other feeding or watering facilities; then saturate the entire interior surface of the cars, including the inner surface of the car doors, or the entire surface of the fences, posts, floors, troughs, and racks of the yards, pens, sheds, chutes, alleys, etc., with a 5 per cent solution of pure carbolic acid,[a] or with a 3 per cent solution of liquor cresolis compositus, U. S. P.[b]

This Rule 8, which for the purpose of identification is designated as B. A. I. Order 163, will become and be effective on and after August 12, 1909, and is subject to amendment or revision on statutory notice.

Done at Washington this sixth day of August, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 1 TO B. A. I. ORDER 163.

Amendment 1 to Rule 8—To Prevent the Spread of Lip-and-Leg Disease (Necrobacillosis) in Sheep (effective on and after September 15, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

It is ordered that that part of Rule 8 (B. A. I. Order 163) to prevent the spread of lip-and-leg disease (necrobacillosis) in sheep, dated August 6, 1909, and effective on and after August 12, 1909, which specifies the area quarantined for the said disease, be, and the same is hereby, amended to read as follows:

All territory in the State of Wyoming situate within the boundaries of the counties of Big Horn, Johnson, Sheridan, Weston, Crook, Converse, and Natrona; that part of Fremont County north of the Sweetwater River and that part of Albany and Laramie counties north of the Sixth Standard Parallel North.

This amendment will become and be effective on and after September 15, 1909, and is subject to amendment and revision on statutory notice.

Done at Washington this tenth day of September, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] WILLIS L. MOORE, *Acting Secretary of Agriculture.*

B. A. I. ORDER 164.

Special Order Providing for the Importation of Canadian Sheep for Exhibition Purposes at the International Live Stock Exposition, Chicago, Ill.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., September 2, 1909.

It is hereby ordered, That from November 19 to December 5, 1909, Canadian sheep may be imported into the United States for exhibition purposes at the International Live Stock Exposition, to be held at Chicago, Ill., from November 27 to December 10, 1909, without being subject to the thirty days' quarantine, provided they pass a satisfactory inspection at the port of entry and are accompanied by an affidavit of the owner or importer and a certificate issued by a Canadian official veterinarian, as required by Amendment 3 to B. A. I. Order 142, amending Regulation 41 of the Regulations for the inspection and quarantine of horses, cattle, sheep, and other ruminants, and swine imported into the United States; and provided further that the sheep which are not sold to remain in the United States shall be returned immediately to Canada at the close of said exposition.

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[a] A small amount of lime may be added to this solution.

[b] This can be prepared at any reliable drug store, but no lime should be added to it.

The Department must be notified by the owner or importer, through the office of its veterinary inspector in charge at Chicago, of any Canadian sheep which are to remain in the United States for breeding purposes, and such sheep will be maintained in quarantine at the exposition grounds under the supervision of an inspector of this Department, who shall issue a certificate before shipment to destination is allowed.

The thirty days of quarantine will be counted from the date of entry into the United States.

All Canadian sheep intended for this exposition must be shipped directly to the exposition grounds, and must not be unloaded in any public stock yards.

WILLIS L. MOORE, *Acting Secretary of Agriculture.*

B. A. I. ORDER 165.

Rule 8, Revision 1—To Prevent the Spread of Lip-and-Leg Ulceration (Necrobacillosis) in Sheep (effective on and after November 22, 1909).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that a contagious, communicable disease known as lip-and-leg ulceration (necrobacillosis) exists among sheep in the State of Wyoming.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority conferred by section 1 of the act of Congress approved March 3, 1905 (33 Stat., 1264), do hereby quarantine the following area, to wit:

All territory in the State of Wyoming situate within the boundaries of the counties of Big Horn, Johnson, Sheridan, Weston, Crook, Converse, and Natrona; that part of Fremont County north of the Sweetwater River and that part of Albany and Laramie counties north of the sixth standard parallel north.

During the existence of this quarantine the interstate transportation, movement, or trailing or driving of sheep, except as hereinafter provided, from the said area herein quarantined is hereby prohibited.

1. DISEASED SHEEP.—Sheep that are affected with lip-and-leg ulceration shall under no condition be moved interstate from the quarantine area.

2. EXPOSED SHEEP.—Sheep that are not affected with lip-and-leg ulceration but which have been exposed to the contagion of the disease through infected premises, may be shipped interstate in placarded cars, as hereinafter provided, to a recognized slaughtering center for immediate slaughter without dipping, or they may be moved interstate for breeding or feeding purposes after one dipping, as hereinafter set forth.

3. SHEEP OF DISEASED BANDS.—(*a*) *Market.*—Sheep that are not visibly diseased with lip-and-leg ulceration, but which are part of a diseased band, may, without dipping, be shipped interstate in placarded cars, as hereinafter provided, to a recognized slaughtering center for immediate slaughter.

(*b*) *Breeders.*—Sheep that are not visibly diseased with lip-and-leg ulceration, but which are part of a diseased band, may be moved interstate from the quarantined area or from public stock yards for breeding purposes, provided they are first dipped as hereinafter specified and held seven days for a second inspection, and further provided that if, upon second inspection, disease is found the animals apparently free shall be segregated and again properly dipped before interstate movement is permitted. However, if no disease is found on reinspection the sheep may go forward without a second dipping.

(*c*) *Feeders.*—Sheep that are not visibly diseased with lip-and-leg ulceration, but which are part of a diseased band, or sheep that have been exposed to the disease through infected premises, may, without dipping, be moved interstate from the quarantined area or from public stock yards for feeding or grazing in fenced inclosures, provided permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the sheep are to be shipped. If State permission is not obtained, the sheep shall, before being moved interstate, be dipped as provided for sheep exposed to disease through infected premises or for breeding sheep of a diseased band, as the case may be.

4. HEALTHY SHEEP that have not been exposed to the contagion of lip-and-leg ulceration may be moved interstate from the quarantined area only when they are accompanied by a certificate of inspection issued by an inspector of the Bureau of Animal Industry.

5. DIPPING.—When it is desired to dip sheep for interstate movement as hereinbefore provided, the dipping shall be done under the supervision of an employee of the Bureau of Animal Industry and in one of the cresol or coal-tar creosote dips permitted by the

Department of Agriculture in the official dipping of sheep for scabies, provided the dip is used at a strength specified for use in the dipping of sheep for scabies. The dipping fluid shall be thoroughly mixed before flowing into the vat and also before the sheep are placed therein. The dip shall be maintained at a temperature of from 85 to 95 degrees Fahrenheit and the sheep shall be retained therein about one minute. The dipping shall be done carefully and the sheep handled as humanely as possible. The Department disclaims responsibility for any loss or damage resulting from the dipping.

6. PLACARDING CARS.—When, as hereinbefore provided, exposed sheep or sheep of diseased bands are shipped interstate without dipping for immediate slaughter, the proper officers of the transportation company shall affix to both sides of each car a durable placard not less than 6½ by 10 inches in size, on which shall be printed with permanent black ink in bold-face letters not less than 1½ inches in height, the words "SHEEP FOR SLAUGHTER EXPOSED TO LIP-AND-LEG ULCERATION." These placards shall also show the name of the place from which the shipment was made, the date of the shipment (which must correspond with the date of the waybills and other papers), the name of the transportation company, and the name of the place of destination. Each of the waybills, conductors' manifests, memoranda, and bills of lading pertaining to such shipments by cars or boats shall have the words "EXPOSED TO LIP-AND-LEG ULCERATION" plainly written or stamped on its face. Whenever such shipments are transferred to another transportation company or into other cars or into other boats, or are rebilled or reconsigned to a point other than the original destination, the cars into which said sheep are transferred and the new waybills, conductors' manifests, memoranda, and bills of lading covering such shipments by cars or boats shall be marked as herein specified for cars first carrying said sheep and for the billing, etc., covering the same. If for any reason the placards herein required are removed from the car or are destroyed or rendered illegible, they shall be immediately replaced by the transportation company or its agents, the intention being that legible placards shall be maintained on the cars from the time of shipment until they arrive at destination and the disposition of the cars is indicated by an inspector of the Bureau of Animal Industry.

7. DISINFECTION.—All public stock yards, feeding stations, and approaches, chutes, alleys, and pens thereof which have contained diseased animals shall, before healthy or nonexposed animals for interstate transportation are placed therein, be cleaned and disinfected as hereinafter provided. Failure to clean and disinfect said places will subject them to quarantine.

Cars and other vehicles, yards, pens, sheds, chutes, alleys, etc., that have contained diseased sheep shall be cleaned and disinfected in the following manner: Remove all litter and manure from all portions of the cars, including the ledges and framework outside, and from the posts, floors, and fences of yards, pens, sheds, chutes, alleys, etc., and empty all troughs, racks, or other feeding or watering facilities; then saturate the entire interior surface of the cars, including the inner surface of the car doors, or the entire surface of the fences, posts, floors, troughs, and racks of the yards, pens, sheds, chutes, alleys, etc., with a 5 per cent solution of pure carbolic acid,[a] or with a 3 per cent solution of liquor cresolis compositus, U. S. P.[b]

This Rule 8, Revision 1, which for the purpose of identification is designated as B. A. I. Order 165, will become and be effective on and after November 22, 1909, and is subject to amendment or revision on statutory notice.

Rule 8, dated August 6, 1909, and effective on and after August 12, 1909, and Amendment 1 thereto, dated September 10, 1909, and effective on and after September 15, 1909, are hereby revoked.

Done at Washington this thirteenth day of November, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

B. A. I. ORDER 166.

Rule 1, Revision 5—To Prevent the Spread of Splenetic Fever in Cattle. (Effective on and after December 6, 1909.)

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that a contagious and infectious disease known as splenetic, southern, or Texas fever exists among cattle in the following-named States, to wit:

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[a] A small amount of lime may be added to this solution.

[b] This is described in the Eighth Revision of the Pharmacopœia and can be prepared at any reliable drug store. No lime should be added to this disinfectant.

CALIFORNIA, OKLAHOMA, TEXAS, MISSOURI, ARKANSAS, LOUISIANA, MISSISSIPPI, TENNESSEE, ALABAMA, VIRGINIA, NORTH CAROLINA, SOUTH CAROLINA, GEORGIA, and FLORIDA.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority conferred by section 1 of the act of Congress approved March 3, 1905 (33 Stat., 1264), do hereby quarantine the area hereinafter described, and do order by this Rule 1, Revision 5, under the authority and discretion conferred on the Secretary of Agriculture by section 3 of the act of Congress approved March 3, 1905 (33 Stat., 1265), that the interstate movement of cattle of the area herein quarantined to any point not located in the said quarantined area shall be made only in accordance with the regulations of the Secretary of Agriculture designated as B. A. I. Order 143, promulgated March 22, 1907, and effective April 15, 1907, and amendments thereto, subject only to the exceptions hereinafter contained.

The following areas are quarantined for splenetic, southern, or Texas fever in cattle:

CALIFORNIA.

The counties of San Diego, Orange, Los Angeles, Ventura, Tulare, San Luis Obispo, those portions of San Bernardino and Riverside counties west of the one hundred and sixteenth meridian west longitude, Santa Barbara County with the exception of the island of Santa Rosa, and that portion of Fresno County west of the right of way of the main line of the Southern Pacific Company, are quarantined.

During the continuance of this quarantine no cattle of the area hereinbefore described shall be moved or allowed to move except as provided for immediate slaughter to any point in the United States not in the State of California which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

TEXAS.

The entire State of Texas is quarantined, with the exception of the counties of Dallam, Sherman, Hansford, Ochiltree, Lipscomb, Hartley, Moore, Hutchinson, Roberts, Hemphill, Oldham, Potter, Carson, Gray, Wheeler, Deaf Smith, Randall, Armstrong, Donley, Collingsworth, Parmer, Castro, Swisher, Briscoe, Hall, Childress, Bailey, Lamb, Hale, Floyd, Motley, Cochran, Hockley, Lubbock, Crosby, Dickens, Yoakum, Terry, Lynn, Garza, Kent, Gaines, Dawson, Andrews, Martin, El Paso, Jeff Davis, Presidio, Brewster, Reeves, Loving, Winkler, Ector, Midland, Ward, and Scurry.

During the continuance of this quarantine no cattle of the counties of Cottle, Hardeman, Foard, Wilbarger, King, Knox, Baylor, Stonewall, Haskell, Borden, Fisher, Jones, Howard, Mitchell, Glasscock, Crane, Upton, Reagan, or of those portions of the counties of Pecos and Terrell north and west of a line beginning at the southwest corner of Terrell County; thence in a northerly direction to the northwest corner of section No. 63, block D10, Texas Central Railway Company; thence north along the western boundary of sections Nos. 64, 65, 66, 67, 68, 69, 70, 71, and 72 of said block D10 to the northwest corner of said section No. 72; thence continuing north through the western parts of sections Nos. 36, 25, 24, 13, 12, and 1, block 150, Texas and St. Louis Railroad Company, to the roadbed of the Galveston, Harrisburg and San Antonio Railroad Company; thence southeasterly, following the roadbed of the said Galveston, Harrisburg and San Antonio Railroad Company, to a point on section No. 36, block A2, Galveston, Harrisburg and San Antonio Railroad Company; thence north with the pasture fence through the eastern part of sections Nos. 36, 13, and 12 of said block A2 and across section No. 1, Gulf, Colorado and Santa Fe Railway Company; thence continuing north with said pasture fence through the eastern part of sections Nos. 16, 17, 46, 47, 76, 77, 106, 107, 136, 137, 142, 143, and 194, block D, Missouri, Kansas and Texas Extension Railway Company; thence continuing in a northerly direction to a point on the northern boundary of section No. 6, block 160, Gulf, Colorado and Santa Fe Railway Company, same being corner of pasture fence; thence east along the northern boundary of sections Nos. 6, 9, 10, 11, 12, 15, and 16, block 160, Gulf, Colorado and Santa Fe Railway Company, to the northeast corner of said section No. 16, the same being corner of pasture fence; thence in a northerly direction with the eastern boundary of sections Nos. 22, 21, 20, 23, 24, 25, 26, 27, 28, 29, 30, 31, and 32, block 1, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, to the northeast corner of said section No. 32; thence west with the northern boundary of sections Nos. 32 and 33, same block, to the northwest corner of section No. 33, block 1, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, corner of fence; thence north with the eastern boundary of sections Nos. 1, 12, 13, 24, 25, 36, 37, 48, 49, 60, 61, and 72, block 2, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, to the northeast corner of said section No. 72; thence in an easterly direction with the pasture fence to the southeast corner of section No. 9, patented to James E. Evans; thence north along the eastern boundary of said section No. 9 to the northwest corner of section No. 100, block A2, Texas Central Railway Company; thence east with the northern boundary of sections Nos. 100 and 89, same block, to the northeast corner of said section No. 89, block A2, Texas Central Railway Company; thence north along the eastern boundary of sections Nos. 90, 91, 92, and 93 to the southeast corner of section No. 94, block A2, Texas Central Railway Company; thence northwest diagonally across section No. 94 to the northwest corner of said section; thence continuing in a northwesterly direction diagonally across sections Nos. 14, 18, and 28 to the northeast corner of section No. 29, block C4, Gulf, Colorado and Santa Fe Railway Company; thence west with the northern boundary of said section No. 29 to the northwest corner of said section; thence northwest diagonally across section No. 1, Texas Central Railway Company, and section No. 97, block 194, Gulf, Colorado and Santa Fe Railway Company, to the northeast corner of section No. 96; thence in a northerly direction across section No. 94 to a point on its northern boundary 600 varas west of its northeast corner; thence continuing north through sections Nos. 93, 90, 89, 86, 85, and 58, block 194, Gulf, Colorado and Santa Fe Railway Company, to a point on the northern boundary of said section No. 58; thence northwesterly with the pasture fence through section No. 59 to the northeast corner of section No. 82 and the southeast corner of section No. 81, same block; thence continuing northwesterly to section No. 17, Houston and Great Northern Railroad Company; thence north along the eastern boundary of said section No. 17 to the Pecos River; thence northwesterly along said Pecos River to the northwest corner of Crockett County, shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Texas which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle, on account of temporary local conditions prevailing in the State of Texas, shall have been kept for not less than fifteen days on premises free of infection and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties and portions of counties in that part of Texas which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

OKLAHOMA.

The entire State of Oklahoma is quarantined, except the counties of Cimarron, Texas, Beaver, Harper, Woods, Alfalfa, Grant, Woodward, Major, Garfield, Ellis, Dewey, Blaine, Kingfisher, Logan, Roger Mills, Custer, Beckham, Washita, Oklahoma, Harmon, Canadian, that portion of Cleveland County north of the Canadian River and west of the Atchison, Topeka and Santa Fe Railway, that portion of Noble County west of the Atchison, Topeka and Santa Fe Railway and north of the line between townships 23 and 24 north, that portion of Kay County west of the Arkansas River, that portion of Caddo County north of the Mangum branch of the Chicago, Rock Island and Pacific Railway, and that portion of Greer County west of the Kansas City, Mexico and Orient Railway.

During the continuance of this quarantine no cattle of that portion of Greer County east of the Kansas City, Mexico and Orient Railway, that portion of Jackson County west of the Kansas City, Mexico and Orient Railway, that portion of Kay County east of the Arkansas River, that portion of Cleveland County east of the Atchison, Topeka and Santa Fe Railway and north of the line between townships 7 and 8 north, that portion of Payne County north of the line between townships 19 and 20 north, or that portion of Noble County east of the Atchison, Topeka and Santa Fe Railway and south of the line between townships 21 and 22 north shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Oklahoma which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties and portions of counties in that part of Oklahoma which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

During the continuance of this quarantine no cattle of the quarantined area of any State other than the State of Oklahoma shall, except as hereinafter provided, be moved or allowed to move into Osage County: *Provided,* That from October 1 of each year to May 15 of the following year cattle of the quarantined area of any other State may be moved into Osage County after having been satisfactorily dipped in Beaumont crude petroleum, or otherwise properly treated, under the supervision of an inspector of the Bureau of Animal Industry.

MISSOURI.

Ripley County, that portion of Oregon County south of the line between townships 22 and 23 north, that portion of Newton County west of the right of way of the Kansas City Southern Railway, and that portion of McDonald County west of the right of way of the Kansas City Southern Railway are quarantined.

During the continuance of this quarantine no cattle of those portions of Oregon, Newton, and McDonald counties hereinbefore described shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Missouri which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From Ripley County cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

ARKANSAS.

The entire State of Arkansas is quarantined except the counties of Carroll, Randolph, Clay, Green, Lawrence, Craighead, Mississippi, and Poinsett.

During the continuance of this quarantine no cattle of the counties of Benton or Washington, that portion of Fulton County east of Spring River, or that portion of Sharp County north of Strawberry River shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Arkansas which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties and parts of counties in that portion of the State of Arkansas which is quarantined for splenetic, southern, or Texas fever cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

TENNESSEE.

The following-mentioned counties and parts of counties are quarantined: The counties of Hardeman, McNairy, Chester, Henderson, Decatur, Hardin, Wayne, Lawrence, Hamilton, James, Bradley, Polk, Overton, that portion of Madison County east and south of a line beginning at a point on the southern boundary line of Madison County where the Illinois Central Railroad intersects said line, thence northerly along the Illinois Central Railroad to the South Fork of Forked Deer River, thence easterly along said river to the mouth of Warlick Creek, thence northerly along said creek to its intersection with the Jackson and Cotton Grove road, thence northerly along said road and the Cotton Grove road and Spring Creek road to Spring Creek, thence northeasterly along the Jackson and Spring Creek road to the southern boundary of Carroll County; that portion of Benton County south of the Louisville and Nashville Railroad; that portion of Lincoln County south of Elk River; that portion of Marion County south and east of the Tennessee River; and that portion of Fentress County west of the East Fork of Obey River.

During the continuance of this quarantine no cattle of Overton County, or that portion of Fentress County hereinbefore described, shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Tennessee which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties and portions of counties in that part of the State of Tennessee which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

GEORGIA.

The entire State of Georgia is quarantined except the counties of Union, Towns, and Rabun.

During the continuance of this quarantine no cattle of the counties of White, Habersham, or Stephens shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Georgia which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties in that part of the State of Georgia which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

SOUTH CAROLINA.

The entire State of South Carolina is quarantined except the counties of Oconee, Pickens, Greenville, and Anderson.

From the other counties in the State of South Carolina cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

NORTH CAROLINA.

The counties of Franklin, Wake, Chatham, Randolph, Stanly, Montgomery, Moore, Harnett, Johnston, Wilson, Nash, Halifax, Northampton, Hertford, Bertie, Gates, Chowan, Perquimans, Pasquotank, Camden, Currituck, Edgecombe, Martin, Washington, Tyrrell, Dare, Hyde, Beaufort, Pitt, Wayne, Sampson, Cumberland, Richmond, Scotland, Robeson, Bladen, Greene, Lenoir, Craven, Pamlico, Carteret, Jones, Duplin, Onslow, Pender, Columbus, Brunswick, and New Hanover are quarantined.

From the counties above mentioned cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

VIRGINIA.

The counties of Fluvanna, Chesterfield, Brunswick, Greenesville, Sussex, Surry, Southampton, Isle of Wight, Nansemond, and that part of Warwick County not included in the Newport News magisterial district, and that part of York County not included in the Bruton magisterial district are quarantined.

From the counties and parts of counties above mentioned cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

LOUISIANA.

The entire State of Louisiana is quarantined.

During the continuance of this quarantine no cattle of the parishes of Lincoln and Claiborne shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Louisiana which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and unless and until the cattle shall have been inspected and found free of infection and a certificate authorizing the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other parishes in the State of Louisiana cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

MISSISSIPPI, ALABAMA, FLORIDA.

The entire States of Mississippi, Alabama, and Florida are quarantined.

From the above-mentioned States cattle shall only be moved or allowed to move to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

GENERAL PROVISION.

During the continuance of the quarantine as herein established no cattle of the quarantined area of any State (except those portions from which cattle may be moved upon inspection) shall be moved or allowed to move to any portion of the quarantined area of another State from which, under the specific provisions of this rule, cattle are allowed to be shipped for purposes other than immediate slaughter upon inspection and certification by an inspector of the Bureau of Animal Industry.

OPEN SEASON.

During the months of January, November, and December of each year cattle of the quarantined area of any State may be moved interstate therefrom for purposes other than immediate slaughter into the State of Kansas, the Territories of Arizona and New Mexico, those portions of the States of California and Texas not included in the quarantined area, and that portion of the State of Missouri south of the Missouri River if the said cattle shall have been continuously kept on premises known to have been free of infection for at least six months and shall first have been inspected under proper facilities for inspection at the point of origin and found free of infection and a certificate authorizing the movement issued by an inspector of the Bureau of Animal Industry, and if permission shall first have been obtained from the proper official of the State or Territory to which the cattle are destined.

During the period from November 15 of each year to January 31 of the following year cattle of the quarantined area of any State may be moved interstate therefrom for purposes other than immediate slaughter under the above-mentioned restrictions into that portion of the State of Arkansas not included in the quarantined area.

During the months of January and February, the first fifteen days of March, and the last sixteen days of December in each year cattle of the quarantined area of any State may be moved interstate therefrom for purposes other than immediate slaughter under the above-mentioned restrictions into those portions of the States of Virginia, North Carolina, and South Carolina not included in the quarantined area.

During the month of January and the last seventeen days of December in each year cattle of the quarantined area of any State may be moved interstate therefrom for purposes other than immediate slaughter under the above-mentioned restrictions into that portion of the State of Oklahoma not included in the quarantined area.

Cattle of the quarantined area that have been shipped interstate during the months of January, November, and December of each year to any State or Territory outside of the quarantined area other than those States and Territories and portions thereof set out herein shall not be moved into any of the States or Territories or portions thereof hereinbefore mentioned within three months of the date of the movement from the quarantined area.

Cattle which are moved interstate from the quarantined area of any State into those States or Territories or portions thereof hereinbefore mentioned, under certificates from inspectors of the Bureau of Animal Industry for feeding or stocking purposes, shall, when shipped, be transported in cleaned and disinfected cars or boats, and shall not be placed in stock pens which have been reserved for cattle originating in the quarantined area.

FEEDING STATIONS FOR NONINFECTED CATTLE.

Cattle not of the quarantined area which are transported interstate by rail through the quarantined area may be unloaded therein for rest, feed, and water into properly equipped noninfectious pens set apart for such cattle at the Fort Worth stock yards, at

Fort Worth, Tex.; the stock yards of the Missouri, Kansas and Texas Railway at Hodge and Denison, Tex.; the stock yards of the International and Great Northern Railroad at Laredo, Tex.; the Southern Pacific Company stock yards at Los Angeles, Cal.; the stock yards at Colton, Cal.; the stock yards of the St. Louis and San Francisco Railroad at Sapulpa, Okla.; the stock yards of the Missouri, Kansas and Texas Railway at Muskogee, Okla.; the stock yards of the Kansas City, Mexico and Orient Railway at Altus, Okla., and at such other points as may from time to time be authorized by the Secretary of Agriculture, provided such pens and the platforms, chutes, and alleyways leading thereto have been cleaned and disinfected under the supervision of an employee of the Bureau of Animal Industry and are constructed and maintained in accordance with the specifications set out in the regulations of the Secretary of Agriculture to prevent the spread of splenetic fever in cattle.

All cattle handled in such noninfectious pens shall be free from ticks (*Margaropus annulatus*) and shall not have been unloaded at any point in the quarantined area other than the designated unloading points named herein or hereafter authorized by the Secretary of Agriculture, and they shall be reloaded into the same cars from which unloaded or into other cars which have been cleaned, washed, and disinfected, as required by B. A. I. Order 143 and amendments thereto, immediately before loading therein, and reshipped as uninfected cattle.

INTERPRETATION.

This Rule 1, Revision 5, shall be construed in connection with the regulations of the Secretary of Agriculture, promulgated March 22, 1907, and effective on and after April 15, 1907, and amendments thereto, and is subject to amendment or revision on statutory notice.

Rule 1, Revision 4, dated March 17, 1909, effective April 1, 1909, and all amendments thereto, shall cease to be effective on and after December 6, 1909, on and after which date this Rule 1, Revision 5, which for purposes of identification is designated as B. A. I. Order 166, shall become and be effective until otherwise ordered.

Done at Washington this second day of December, 1909.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

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