[PUBLIC RESOLUTION—NO. 43.]

Joint resolution to print the Annual Reports of the Bureau of Animal Industry for the years eighteen hundred and eighty-nine and eighteen hundred and ninety.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That there be printed fifty thousand copies of the Sixth and Seventh Annual Reports of the Bureau of Animal Industry for the years eighteen hundred and eighty-nine and eighteen hundred and ninety, of which thirteen thousand copies of each shall be for the use of the members of the Senate, twenty-seven thousand copies of each for the use of members of the House of Representatives, and ten thousand copies of each for the use of the Secretary of Agriculture.

SEC. 2. That the sum of fifty thousand dollars, or so much thereof as may be necessary, is hereby appropriated, out of any money in the Treasury not otherwise appropriated, to defray the cost of printing and binding said reports, the two reports to be bound in one volume.

Approved, September 25, 1890.

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LETTER OF TRANSMITTAL.

SIR: I have the honor to submit herewith the Sixth and Seventh Annual Reports of the Bureau of Animal Industry, covering the work of the years 1889 and 1890, which, as in the case of the last preceding Reports, have been combined in one volume. A feature of great interest in this volume will be found in the brief history of the active measures undertaken for the suppression of contagious pleuro-pneumonia of cattle and the marked success which has resulted from their enforcement. Indeed, at the time of this writing, pleuro-pneumonia as a prevailing disease has practically disappeared from the United States. For many months past but few cases have been discovered, notwithstanding the constant vigilance of a large force of veterinary inspectors. These cases were confined to isolated localities in the immediate vicinity of New York, where the sanitary conditions were bad, and where it had been found impossible to thoroughly disinfect the contaminated premises. A destruction of such premises having since been accomplished, it is now believed that all sources of infection have been removed.

These reports also show the inauguration of a system of regulations for the prevention of Southern or Texas fever of cattle, which, in the results obtained, have been of scarcely less value to the country than the work for the eradication of pleuro-pneumonia. In both cases a double benefit has followed; our farmers have been saved from the losses which they had previously suffered from these diseases, and the confidence abroad in our export cattle has been increased.

The scientific investigations reported are of unusual interest and importance. The disease of hogs known as swine plague has been carefully investigated, and detailed accounts are given of the experiments which were made to determine its nature, cause, and the characteristics of the germ which produces it. The experiments with Texas fever have been successful in revealing the cause of this malady, which has so long been misunderstood by scientists and stockmen.

The chemical studies made in regard to the chemical substances produced by the microbes of hog cholera and swine plague are also of much interest, and it is hoped that they will lead to the introduction of another means of combating this class of diseases.

The articles on "The Sheep of Great Britain," "The Condition of the Sheep Industry west of the Mississippi River," and "The Chicago Horse Show of 1890," will also be found of much value to those engaged in these industries. Many other articles of general interest, the result of careful investigations by the agents and employés of the Bureau, are included, but which do not call for special mention.

D. E. SALMON,
Chief of the Bureau of Animal Industry.

Hon. J. M. RUSK,
Secretary of Agriculture.

SIXTH AND SEVENTH ANNUAL REPORTS OF THE BUREAU OF ANIMAL INDUSTRY.

REPORT OF THE CHIEF OF THE BUREAU.

TRANSACTIONS OF THE BUREAU FOR 1889.

PROGRESS OF THE WORK OF EXTIRPATING PLEURO-PNEUMONIA.

The measures for the eradication of the contagious pleuro-pneumonia of cattle, as given in detail in former reports, have been continued during the year without interruption or modification. The progress of the work has been notable, though not as rapid as would be possible if the Department had sufficient authority to properly enforce its regulations. It has often been found difficult to secure the prosecution and conviction of parties who have violated the State laws under which the regulations are made. Some parties, who have flagrantly and persistently violated the regulations and even assaulted the officers of the Department, have had their cases dismissed by justices of the peace or by the grand juries before which the matter was brought, with the intimation that prosecutions for such offenses would not be countenanced by them.

The great obstacle to the speedy conclusion of this work is, therefore, not in any inherent difficulties in the work itself, but in the impossibility of securing under the present statutes a strict enforcement of the necessary rules. The infected area is, however, constantly decreasing, and the number of herds in which the disease is found is becoming smaller with each quarter. This improvement will be made plain in the tables which follow.

It is gratifying to be able to state that no outbreaks of pleuro-pneumonia have been discovered during the year in the section of the country west of the Alleghany Mountains. It is also fortunate that no extensions of the contagion have occurred in the Eastern States since the report for 1888 was submitted. The absence of such outbreaks has so increased the confidence of cattle-owners and shippers that our domestic traffic in cattle outside of the infected districts is no longer influenced to any appreciable extent by the presence of this contagion in the country.

WORK IN NEW YORK.

One year ago pleuro-pneumonia existed in the counties of Orange, New York, Kings, and Queens. No cases have been discovered in Orange and New York Counties since June, 1889, so that the disease has been confined for the last five months to Kings and Queens Counties. These two counties have long been the oldest and worst infected sections of the country. Many of the dairymen are unfavorably disposed towards the work of eradication and are unwilling to submit to the regulations. Cattle in many instances have been pastured upon the commons and moved from stable to stable without permit. Exposure in this way accounts for many of the new cases of disease which have been recently developed.

Many stables in the infected districts are without ventilation. They are so constructed that it is impossible to keep them in a proper sanitary condition. There are accumulations of filth under the floors, and the wood-work is rotten and porous. Such buildings can not be satisfactorily disinfected, nor can they be held without stock a sufficient length of time after the diseased herds are removed to insure safety. The result is that in some cases the plague has appeared several times on the same premises.

To prevent these re-infections is one of the most difficult problems which is to be solved. In Maryland there was for a time the same difficulty, and it was removed in the worst cases by the State Live-Stock Sanitary Board condemning and destroying such buildings as could not be properly disinfected. The compensation in such cases was made from the State appropriation. This Department has up to the present declined to expend any part of the appropriation for the purchase and destruction of buildings, but in certain cases in the badly infected districts of Long Island such action may become necessary for the success of the work.

From December 1, 1888, the date to which the figures were given in the previous report, to November 30, 1889, there were inspected in New York 15,861 herds, containing 149,396 head of cattle. Of this number 137,688 were re-examined by the non-professional assistants, and 33,135 were tagged with numbers and registered upon the books of the Bureau.

There were 156 new herds found affected with pleuro-pneumonia during the year, and these herds contained 3,014 animals, 249 of which were pronounced diseased when the inspections were made. There were purchased for slaughter during the same time 1,053 affected cattle, at a cost of $28,210.05, an average of $26.79; also, 2,819 exposed cattle, at a cost of $59,908.93, an average of $21.25. The smaller cost of the exposed cattle as compared with the affected ones is due to the fact that the amount which the owner realized for the carcasses was deducted from the appraised value, the Department paying the balance.

It has been found necessary to disinfect 339 stables, stock-yards, or other premises during the year, and also to make post-mortem examinations upon the carcasses of 15,375 bovine animals, of which 1,012 were found diseased with pleuro-pneumonia.

The total expenses in New York from December 1, 1888, to November 30, 1889, have been $187,814.99, of which $88,118.98 was paid for cattle purchased for slaughter as either diseased or exposed. The remainder constitutes the expense for disinfection, inspection, tagging, registering, supervising the movement of cattle, post-mortem

examinations, and all the various expenses incident to a work of this character.

WORK IN NEW JERSEY.

In this State the operations have been almost entirely confined to Hudson County, with the exception of a large diseased herd found in the distillery stables at East Millstone, and three affected herds in Essex County which were infected by cattle taken by dealers from Hudson County in violation of the quarantine regulations.

The State Board of Health has for more than six months been desirous of removing the quarantine restrictions from Hudson County, but has consented to maintain them up to the present time upon the urgent representations of this Department that such action was necessary to the success of the work. It is doubtful if proper regulations can be continued in New Jersey under the present system of co-operation until the contagion is completely eradicated. The importance of success here is exceptionally great because of the traffic in cattle between the infected district in New Jersey and the neighboring counties in New York. If the disease should again become prevalent in the former State it would be difficult if not impossible to prevent the re-infection of Westchester and New York Counties in the latter State. There would also be great danger of the infection of cattle destined for shipment to Europe from the port of New York, many of which go through the New Jersey stock-yards. To properly protect this enormous trade between the States and with foreign countries greater powers are required than are now possessed by this Department.

From December 1, 1888, to November 30, 1889, there were inspected in New Jersey 8,455 herds, containing 76,001 head of cattle. Of this number, 39,287 were re-examined by the non-professional assistants, 11,672 were tagged with numbers and registered upon the books of the Bureau.

There were 48 new herds found infected with pleuro-pneumonia during the year, and these herds contained 964 animals, 81 of which were pronounced diseased when the inspections were made. There were purchased for slaughter during the same time 116 affected cattle at a cost of $2,659, an average of $22.92 per head; also 704 exposed cattle at a cost of $16,592, an average of $23.57.

It has been found necessary to disinfect 208 stables, stock-yards, and other premises, and also to make post-mortem examinations upon the carcasses of 14,242 bovine animals, of which 189 were found diseased with pleuro-pneumonia.

The total expenses in New Jersey from December 1, 1888, to November 30, 1889, have been $69,345.42, of which $19,251 was paid for cattle purchased for slaughter, because they were either diseased or had been exposed.

THE WORK IN PENNSYLVANIA.

As indicated in the last report, quarantine restrictions at Philadelphia were removed on December 15, 1888, and at that time the greater part of the force of the Bureau stationed there was withdrawn. It was deemed advisable, however, to retain at that city two veterinary inspectors and two assistant inspectors for the purpose of maintaining a supervision of the Philadelphia stock-yards, and to watch the slaughter-houses and rendering works for a few months, in order that any re-appearance of disease might be

promptly detected. The wisdom of this course was made apparent on December 31, when our inspectors discovered at the Philadelphia stock-yards a herd of cattle having contagious pleuro-pneumonia. These cattle had been shipped to Philadelphia from the Somerset Distillery stables at East Millstone, New Jersey. On being slaughtered, seventeen cases of contagious pleuro-pneumonia were found on post-mortem examination. All cattle that had come in contact with this herd were promptly quarantined and slaughtered, and the stock-yards were thoroughly disinfected. The railroad cars in which these cattle had been transported were traced to Altoona, Pa., where they were disinfected by officers of the Bureau.

Under date of September 11, the Secretary of the State Board of Agriculture informed this Bureau that a herd had been discovered by the State officers in Chester County, Pa., having contagious pleuro-pneumonia, that the State veterinarian had killed two animals, and on post-mortem examination had pronounced them to be affected with contagious pleuro-pneumonia in an acute form. An officer of the Bureau was detailed to visit that locality but failed to find any evidence of lung plague among animals there inspected. For the reason, however, that the premises on which the disease had been reported to exist was a public cattle or drove yard from which cattle were transported to Wilmington, Del., the stock-yards at Philadelphia, and into other channels of interstate commerce, it was thought necessary, in order to protect the cattle industry of the country from any possible danger, that these premises, and also all cattle that had been in contact with the herd reported to have been diseased, should be strictly quarantined. This was done; and in addition the stock-yards at Chester, where the disease was said to be, were thoroughly disinfected. The quarantine was maintained for ninety days, and at the end of that time, no evidence of lung plague having developed, all restrictions were removed.

With these exceptions no contagious pleuro-pneumonia has been found in Pennsylvania during the year, and it is thought that the contagion no longer exists there.

From December 1, 1888, to November 30, 1889, there were inspected in Pennsylvania 1,311 herds, containing 24,003 head of cattle. Of this number 1,285 were re-examined by the non-professional assistants, and 1,513 were tagged with numbers and registered upon the books of the bureau.

There were no herds in the State found by our inspectors to be affected with pleuro-pneumonia. There were purchased for slaughter eleven exposed cattle at a cost of $190, an average of $17.27 per head.

It was considered advisable to disinfect six stables, stock-yards, and other premises; 13,412 post-mortem examinations were made upon the carcasses of bovine animals, of which 17 were found diseased with pleuro-pneumonia.

The total expenses in Pennsylvania from December 1, 1888, to November 30, 1889, have been $8,856.25, of which $190 was paid for exposed cattle purchased for slaughter.

WORK IN MARYLAND.

The progress of the work in Maryland has been extremely satisfactory. With the active sympathy of the Governor and Attorney-General, and the earnest co-operation of the Live-Stock Sanitary Board, the quarantine regulations have been enforced and the contagion has been eradicated. Only five herds affected with pleuro-

pneumonia have been discovered in the last ten months, and at this writing (December 20) three months have elapsed since a case of the disease has occurred.

We have here one of the most striking illustrations that the history of the world has furnished of the possibility of exterminating this plague from the worst infected of cities, and from the dairies of the adjoining country districts, within a reasonable time, by the application of proper sanitary measures. In the Old World it has always required many years under the regulations generally adopted to free a long infected district from the disease, while in some cities, as for example Paris, the work has gone on for years without appreciably diminishing the number of cases of disease which annually develop.

From December 1, 1888, to November 30, 1889, there were inspected in Maryland 10,904 herds, containing 79,606 head of cattle. Of this number 4,866 were re-examined by the non-professional assistants, and 10,534 were tagged with numbers and registered upon the books of the Bureau.

There were 18 new herds found infected with pleuro-pneumonia during the year, and these herds contained 295 animals, 21 of which were pronounced diseased when the inspections were made. There were purchased for slaughter during the same time 72 affected cattle at a cost of $2,254.27, an average of $31.31 per head; also 311 exposed cattle at a cost of $7,341.83, an average of $23.61 per head.

It has been found necessary to disinfect 35 stables, stock-yards, and other premises during the year, and also to make post-mortem examinations upon the carcasses of 11,496 bovine animals, of which 76 were found diseased with pleuro-pneumonia.

The total expenses in Maryland from December 1, 1888, to November 30, 1889, have been $57,488.96, of which $9,596.10 was paid for cattle purchased for slaughter as either diseased or exposed.

THE WORK AS A WHOLE.

Including all the districts in which pleuro-pneumonia has existed, there were inspected from December 1, 1888, to November 30, 1889, a total of 36,531 herds of cattle, containing 329,006 animals. Of this number 183,126 were re-examined by the non-professional assistants in addition to the veterinary inspections, and 56,854 were tagged with numbers and registered upon the books of the Bureau.

There were 222 new herds found affected with pleuro-pneumonia during the year, and these herds contained 4,273 animals, 351 of which were pronounced diseased when the inspections were made. There were purchased for slaughter during the same time 1,241 affected cattle at a cost of $33,123.32, an average of $26.69 per head; also, 3,845 exposed cattle at a cost of $84,032.76, an average of $21.86 per head.

It has been found necessary to disinfect 588 stables, stock-yards, or other premises, and also to make post-mortem examinations upon the carcasses of 54,520 bovine animals, of which 1,294 were found diseased with pleuro-pneumonia.

The total expenses of the pleuro-pneumonia work from December 1, 1888, to November 30, 1889, have been $323,505.62, of which $117,156.08 was paid for cattle purchased for slaughter as either diseased or exposed. The remainder constitutes the expense for inspection, disinfection, tagging, registering, and supervising the movement of cattle, of post-mortem examinations, and of all the various expenses

necessary to insure the prompt discovery of this plague when it appears in any herd, and to prevent the further extension of the infection.

The following table gives a résumé of the pleuro-pneumonia work from December 1, 1888, to November 30, 1889, as given in detail above:

	New York.	New Jersey.	Pennsylvania.	Maryland.	Total.
Herds inspected	15,861	8,455	1,311	10,904	36,531
Cattle inspected	149,396	76,001	24,003	79,606	329,006
Cattle re-examined	137,688	39,287	1,285	4,866	183,126
Diseased cattle found by inspection	249	81	.....	21	351
Post-mortem examinations	15,375	14,242	13,412	11,491	54,520
Diseased carcasses found	1,012	189	17	76	1,294
Cattle tagged	33,135	11,672	1,513	10,534	56,854
New herds found affected	156	48	.....	18	222
Animals in affected herds	3,014	964	....	295	4,273
Diseased cattle purchased	1,053	116	.....	72	1,241
Exposed cattle purchased	2,819	704	11	311	3,845
Premises disinfected	339	208	6	35	588

A résumé of the expenditures in the pleuro-pneumonia work from December 1, 1888, to November 30, 1889, is made in the table which follows:

	New York.	New Jersey.	Pennsylvania.	Maryland.	Total.
Salaries	$81,863.02	$36,660.58	$7,630.53	$37,712.99	$163,807.12
Traveling expenses	11,746.78	10,629.92	614.83	8,903.87	31,895.40
Miscellaneous expenses	6,086.21	2,863.92	420.89	1,276.00	10,647.02
Affected cattle	28,210.05	2,659.00	.....	2,254.27	33,123.32
Exposed cattle	59,908.93	16,592.00	190.00	7,341.83	84,032.76
Average paid for affected cattle	26.79	22.92	.....	31.31	26.69
Average paid for exposed cattle	21 25	23.57	17.27	23.61	21.86

COMPARISON WITH THE PREVIOUS YEAR.

The progress accomplished by this work can only be estimated by comparing the number of new herds found affected during the year and the total number of cases of pleuro-pneumonia found on *post-mortem* examination with similar data gathered from the reports of the preceding year. As the carcasses of all animals which die or are slaughtered from the quarantine districts are examined, we have in the returns of the post-mortem examinations the total number of cases of pleuro-pneumonia which have developed.

The following table shows the number of new herds found affected, the number of post-mortem examinations that were made, and the number of carcasses found affected with pleuro-pneumonia at the post-mortem examinations for the years from December 1, 1887, to November 30, 1888, and from December 1, 1888, to November 30, 1889:

States.	No. new herds affected.		No. of post-mortem examinations.		No. of carcasses affected with pleuro-pneumonia.	
	1888.	1889.	1888.	1889.	1888.	1889.
New York	347	156	15,826	15,375	2,374	1,012
New Jersey	216	48	6,892	14,242	536	189
Pennsylvania	23	.....	13,157	13,412	72	17
Maryland	96	18	6,165	11,491	596	76
Total	682	222	42,040	54,520	3,578	1,294

The above table shows that there were less than half as many new herds found affected in New York during the last year as in the preceding year. There were also less than half as many diseased carcasses found on post-mortem examination in 1889 as in 1888, although the number of carcasses examined was nearly the same. In New Jersey there were only about one-fourth as many affected herds and about one-third as many affected animals, although a greatly increased number of carcasses was examined. In Pennsylvania and Maryland the reduction as shown by the table is even more marked, and is still greater than the figures indicate, as the malady has entirely disappeared from those States during the last quarter of the year.

REGULATIONS CONCERNING TEXAS FEVER.

The losses from the disease commonly known as Texas or splenetic fever have for many years been very heavy. Generally the affected animals are export cattle or steers purchased from stock-yards for fall and winter feeding. In both cases the disease is contracted from the stock-yards or from cars in which cattle from the infected district have been yarded or transported. Occasionally a few southern cattle are mixed with a larger number of northern animals and the whole bunch is sold for feeding. The result of this is that all the northern cattle exposed in this manner contract the malady and most of them die.

A disease which can be so easily prevented by providing separate pens for the susceptible and dangerous cattle, and by promptly cleaning the infected cars, should not be allowed to remain a standing menace to the feeders of the country and an incubus upon the foreign trade in live cattle. To correct this evil the following order was issued:

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., July 3, 1889.

To the Managers and Agents of Railroad and Transportation Companies of the United States:

In accordance with section 7 of an act of Congress approved May 29, 1884, entitled "An act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," you are hereby notified that a contagious and infectious disease known as splenetic or Texas fever exists among cattle in the following described area of the United States:

All that country lying south and east of a line commencing at the northeasterly corner of the county of Crittenden, in the State of Arkansas, thence running in a northwesterly direction to the Osage Agency, in the Indian Territory, and thence running southwesterly to the Rio Grande River at the intersection of the southeasterly corner of Pecos County and the northeasterly corner of Presidio County, in the State of Texas.

No cattle are to be transported from said area to any portion of the United States north or west of the above described lines except in accordance with the following regulations:

First. On unloading north or west of this line any cattle in course of transportation to be fed and watered on the way, the places where said cattle are to be so fed and watered shall be set apart and no other cattle shall be admitted into said places. Once a week from the date hereof until the first day of December, 1889, these watering and feeding places shall be thoroughly cleansed and disinfected.

Second. On unloading said cattle at their points of destination the regulations relating to the movement of Texas cattle, prescribed by the cattle sanitary officer of the State where unloaded, shall be carefully observed. The cars that have carried said stock shall be cleansed and disinfected before they are again used to transport, store, or shelter animals.

The cars used to transport such animals and the pens in which they are fed and watered shall be disinfected in the following manner:

(*a*) Remove all litter and manure. This litter and manure may be disinfected by mixing with lime, diluted sulphuric or carbolic acid, or if not disinfected, it may be stored where no cattle can come in contact with it until after December 1.

(*b*) Wash the cars and the feeding and watering troughs with water until clean.

(*c*) Saturate the walls and floors of the cars and the fencing, troughs, and chutes of the pens with a solution made by dissolving four ounces of chloride of lime to each gallon of water.

The losses resulting yearly to the owners of northern cattle by the contraction of this disease from contact with southern cattle, and through infected cars, and by means of the manure carried in unclean cars from place to place, have become a matter of grave and serious concern to the cattle industry of the United States. It is necessary, therefore, that this cattle industry should be protected as far as it is possible by the adoption of methods of disinfection in order to prevent the dissemination of this disease.

A rigid compliance with the above regulations will insure comparative safety to northern cattle and render it unnecessary to adopt a more stringent regulation, such as the absolute prohibition of the movement of Texas cattle except for slaughter during the time of year that this disease is fatal.

Inspectors will be instructed to see that disinfection is properly done, and it is hoped that transportation companies will promptly put in operation the above methods.

Very respectfully,

J. M. RUSK,
Secretary.

The effect of this regulation was very marked, but some infected cars were apparently used between the stock-yards of the interior and the ports at which cattle are shipped, as a number of lots became affected on the voyage and heavy losses resulted. To guard against a recurrence of such cases another circular was sent to the managers and agents of railroad and other transportation companies as follows:

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., August 10, 1889.

To the Managers and Agents of Railroad and Transportation Companies of the United States:

In addition to my order of July 3, 1889, in regard to cleaning and disinfecting cars and pens which have been occupied by cattle liable to disseminate splenetic or Texas fever, I desire to impress upon you the importance of special precautions to prevent the infection of cattle which have been selected for exportation. The number of cattle shipped to Europe has rapidly increased and the trade is probably more promising than ever before. This relieves our markets, gives new vigor to the cattle industry, and proportionally increases the business of transportation companies.

It is feared by shippers that some of these export cattle may become infected from cars which had carried southern cattle before the regulations of July 3, 1889, went into effect. A single shipment of animals thus affected might lead other countries to prohibit the entrance of our cattle and consequently ruin this trade, which is now of so much importance to the country. Not desiring at present to make a regulation requiring that *all* stock-cars should be cleaned and disinfected before cattle are loaded into them, I would earnestly request the managers of all transportation companies doing business between the interior and the sea-board to make provision whereby all cars, in which cattle for export are to be transported, shall be thoroughly cleaned and disinfected previous to loading, in accordance with the instructions contained in my order of July 3.

Arrangements have been made at New York by which one yard, accessible to all railroad companies, has been set apart exclusively for export cattle. I understand that one of the trunk lines between Chicago and New York has already at the request of shippers instructed its agents to furnish disinfected cars for such cattle, and I trust that all others will immediately give the export trade the benefit of similar precautions, thus avoiding the necessity for an extension of the order of July 3, to include all cars in which cattle are transported.

Very respectfully.

J. M. RUSK,
Secretary.

The regulations were removed on November 1, as the danger for the year was believed to be over at that time. The following circular was sent as a notification to interested parties:

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., November 1, 1889.

To the Managers and Agents of Railroad and Transportation Companies of the United States:

The order of July 3, 1889, prescribing regulations for the transportation of Texas and other southern cattle, and for the isolation, cleaning, and disinfection of pens which have been occupied by such cattle, is hereby revoked. It is believed that the danger from splenetic or Texas fever has passed for the present year.

Very respectfully,

J. M. RUSK,
Secretary.

It is believed that by enforcing regulations similar to those contained in the order of July 3, from an earlier period of the year, this disease can be almost entirely prevented in all portions of the country except the permanently infected district.

GLANDERS.

No new regulations have been made during the year concerning the work for the suppression of glanders in the District of Columbia. A systematic inspection of all the horses in the District has not been attempted, but all reported and suspected cases have been investigated. While the disease has not been entirely eradicated, the results of the action so far taken is very marked and satisfactory. The discovery of a glandered horse on the streets of Washington, instead of being a common occurrence as it was formerly, has become very rare indeed. The number of horses killed during the year because affected with this disease was as follows:

1888: December, 13. 1889: January, 21; February, 1; March, 8; April, 18; May, 8; June, 1; July, 1; August, 1; September, 2; October, 2; November, 1. Total, 78.

UNITED STATES CATTLE QUARANTINE.

The superintendents of the various neat-cattle quarantine stations report the names of the importers and the number and breed of each lot of animals imported during the year 1889, as follows:

STATION FOR THE PORT OF NEW YORK, GARFIELD, N. J.

[Dr. Wm. Herbert Lowe, Superintendent.]

Date of arrival.	Name and post-office address of importer.	Port of shipment.	Name of breed.	No. animals.
June 4	Hon. J. R. McPherson, Belle Meade, N. J.	Antwerp, Belgium	Holstein-Friesian	35
14	H. N. Heffner, Delaware, Ohio.	London, England	Red Polled	11
28	Alfred Sully, New York, N. Y.	do	Hereford	3
Aug. 29	E. N. Howell, Poughkeepsie, N. Y.	do	Guernsey	11
Dec. 7	John H. Starin, New York, N. Y.	Liverpool, England	Aberdeen-Angus	7

STATION FOR THE PORT OF BOSTON, LITTLETON, MASS.

[Dr. A. H. Rose, Superintendent.]

Date of arrival.	Name and post-office address of importer.	Port of shipment.	Name of breed.	No. animals.
Jan. 21	Luther Adams, Boston, Mass	Liverpool, England	Sussex	2
			Aberdeen-Angus	3
			Short-horn	30
June 5	E. K. Stratton, Greensborough, Ind	do	Galloway	13
July 16	Hon. Edward Burnett, Southborough, Mass.	do	Guernsey	26

STATION FOR THE PORT OF BALTIMORE, ST. DENIS, MD.

[Dr. A. M. Farrington, Acting Veterinary Inspector.]

June 24	Clark Maxwell, Winchester, Va	Liverpool, England	Galloway	11
Oct. 16	Christian Heurich, Washington, D.C.	Hamburg, Germany	Angeler	14

The following shows the whole number of cattle received at the various stations from January 1, 1889, to January 1, 1890:

Garfield Station	67
Littleton Station	74
Patapsco Station	25
Total	166

No contagious disease appeared among the cattle at any of the stations during the year, and the general health of all the animals imported was good.

INOCULATION AS A PREVENTIVE OF SWINE DISEASES.

Inoculation with hog cholera virus was first tested as a preventive for this disease in the experiments of the Bureau of Animal Industry in the year 1886. The method of inoculation was discovered at that time, but the results were unsatisfactory, as the animals were not sufficiently protected, and the experiments have been repeated under various conditions from that time to the present to learn if any modification of the operation would make it more effectual.

Prevention by inoculation depends on the well-known principle that one attack of a contagious disease generally protects the individual from subsequent attacks of the same contagion. The amount of protection received varies greatly with different diseases and different animals. In no case are all individuals protected in this way from any disease, and in many cases the immunity lasts only for a short period of time.

Inoculation in practice consists in injecting under the skin as much of the strong virus of hog cholera as can be given without producing a fatal attack of the disease. Inoculation is very different from vaccination. The virus used in inoculation is the same in variety and strength as that found in animals dying with the plague, while for vaccination a weakened virus is used, which can not cause a fatal disease. No method of vaccination has yet been introduced for the hog diseases of this country. Inoculation is now being advocated as a preventive for hog cholera, and it should be remembered that this means the introduction into the animal's body

of the strong virus of the malady, and it is only a question of the size of the dose whether the disease produced by this operation is mild or fatal in its character.

The dose is not the only factor which influences the result that follows inoculation. The strength of the virus varies so much in different outbreaks of the same disease, that a perfectly harmless dose obtained from one outbreak would be certainly fatal when obtained from another.

There is another influence which has an even greater effect in varying the results of inoculation, and that is the wide difference in the susceptibility of the animals. A dose of virus that will scarcely affect one animal will kill another in the same herd, and there is also such a great difference in the susceptibility in different herds that the dose which might be used on one herd without producing any noticeable effects would set up a disease in another herd and cause the loss of a majority of the animals.

With these varying conditions, which in many cases can neither be foreseen nor controlled, inoculation is an operation which is attended with more or less danger of producing the very disease which we are seeking to avoid. In our experiments we found that a dose of 1 cubic centimeter, *i. e.*, from 15 to 20 drops, of the strongest cultivated virus would occasionally kill an animal. From one-quarter to one-half this quantity, *i. e.*, from 4 to 10 drops, have been given without serious consequences in any case.

Such doses generally produce a swelling where injected, which is at first warm and more or less painful, and later becomes encysted. The center softens, disintegrates and becomes a purulent mass, which may remain encysted or may force an opening through the skin and discharge for several weeks. An inoculation of this kind produces a slight degree of immunity, because a second inoculation can then be made with two or three cubic centimeters of virus, *i. e.*, with four to twelve times the first dose, and still no fatal effects result.

The second inoculation increases the immunity, but still the animals are not able to resist the effects of feeding with strong virus or exposure in pens where sick animals are kept. We inoculated about fifty animals in this way in our first experiments, varying the doses somewhat, and only five of them resisted the first exposure. By giving two inoculations we, of course, get a greater degree of protection than can possibly be obtained from one inoculation, with safety to the animals, but the expense of two inoculations is so great that, in order to make the method practical, the inoculator gives only one dose and generally increases that beyond the limit of safety. Thus, in some experiments that have been made in the West, I am informed that a dose of 1 cubic centimeter, *i. e.*, from 15 to 20 drops, was given, and many herds contracted the disease and died, as should have been anticipated from the experiments previously made by the Bureau of Animal Industry.

In view of these facts, when any one comes before the farmers of the country and recommends inoculation, it is well to inquire whether he is interested in the operation from a pecuniary point of view. The question as to how much the farmer will save by the adoption of this method of prevention is uncertain, and opens a wide field for discussion, but the sum it will be necessary for him to pay out to the experts who must be employed can be very accurately figured. This is one of the most practical aspects of the question and should under no circumstances be overlooked.

It has been asserted that as many as one hundred and four hogs have been inoculated in seventy-two minutes. At a cost of 50 cents a head, which is the amount now charged for inoculation, this would reach the sum of $43.33 an hour for the services of the inoculator, which certainly appears to be more than those engaged in the hog-raising industry can afford to pay for professional assistance.

Should inoculation be generally adopted in the States in which hog raising is most largely carried on, it would require at least fifty men working five hours a day to comply with the demands. These men, inoculating eighty hogs an hour each, would inoculate a total of twenty thousand hogs a day, which would yield a daily revenue of $10,000. The total cost of hiring fifty men and maintaining a laboratory to supply virus would hardly exceed $300 a day. Putting the expenses at the liberal sum of $500 a day, the net profit to those conducting the inoculations would be $9,500 a day. The inoculation of but a small portion of the hogs in the chief hog-raising States of the country would therefore yield a profit to the inoculator of about $3,000,000 per annum, a sum which is sufficient to account for many of the enthusiastic and exaggerated statements of the benefits to be derived from inoculation which have appeared in public prints.

It has been shown by our experiments and by those of other investigators, that if a sufficient dose of virus is given to produce any degree of immunity the hog will be more or less stunted, and if the strong virus is used there is great danger of infecting the ground. Now, these two faults are inherent in the method; they can not be avoided, and it is impossible to so improve the operation as to overcome them. About a year ago an attempt was made to demonstrate the success of inoculation by inoculating one thousand hogs belonging to farmers in Nebraska. There had been quite a controversy between parties in that State for more than a year as to the merits of the operation, and undoubtedly every precaution known to the operators was practiced to secure a successful issue for this experiment.

The director of these experiments afterwards reported in the Nebraska State Journal of December 16, 1888, that one party who had 260 hogs inoculated had lost 220. Another farmer who had 46 inoculated lost "nearly all." Still another who had 121 inoculated lost "a large number," while a fourth, who had 93 inoculated, lost "all but 18 or 20." It is evident from these statements that out of the 1,000 hogs inoculated, the loss was very little, if any, less than 400 head. The disease in these cases appeared in the inoculated herds from ten to fifteen days after the inoculation, and was evidently introduced in most if not in all cases by this operation.

These experiments show that inoculation is attended with very considerable danger to the health and lives of the animals operated upon. It is no doubt possible to so reduce the dose of the virus as to prevent this heavy mortality following the inoculation, but in that case the protection would be correspondingly less. Leaving out of consideration the question of whether the hog, in case he survives the inoculation, is protected from the disease, it is plain that an operation which is followed by four hundred deaths out of a thousand inoculations has not been sufficiently perfected to merit the confidence of the farmers.

We will now turn for a moment to the question of the protection by the operation. To what extent were the hogs inoculated in Nebraska protected from the contagion, if really exposed to it? The

advocates of inoculation tell us that it has been impossible for them to give the disease to their inoculated hogs. Our experiments at Washington show that nearly all inoculated hogs can be afterwards fatally infected with cholera. Did the animals inoculated in Nebraska receive any greater degree of immunity than those which were inoculated in Washington?

The Board of Inquiry appointed by the Commissioner of Agriculture in 1888 procured a number of hogs that had been inoculated in Nebraska (about seventeen), and tested them by feeding them with cultivated virus of hog cholera and by inoculating them with the virus of hog cholera and swine plague. In each case a number of the animals that had not received the protective inoculation were used in the experiments to determine the effect of exposure upon ordinary swine. The first test was made by feeding cultivated virus, but this did not prove strong enough to kill any of the hogs. Even those which had not been inoculated survived, but all of the hogs, including those that had been inoculated, were very sick. The inoculated hogs were not quite as sick as the others, but there was very little difference. Four of the inoculated hogs from Nebraska, and five hogs from Pennsylvania which had not previously been inoculated, were then inoculated with the virus of the disease known as infectious pneumonia or swine plague. Of the four Nebraska inoculated hogs, three died and one recovered, but this one when subsequently killed for examination proved to be very severely affected. Of the five hogs which had not been previously inoculated one died and four were sick and recovered. When killed for examination one of the four was found seriously diseased, the three others were either slightly or not at all affected.

Still later four Nebraska inoculated hogs and two other hogs which had not been inoculated were fed upon the viscera of hogs which had died of hog cholera. Two of the inoculated hogs and the two that had not been inoculated contracted hog cholera and died. Two of the inoculated hogs remained well.

As a last test, the remaining six animals from Nebraska were inoculated by intravenous injection of the cultivated virus of hog cholera. Of these, three had been inoculated with hog cholera virus, one had been inoculated with the sterilized liquids in which hog-cholera germs had grown, and two had recovered from an attack of hog cholera. The four hogs which had received the protective inoculation all died. One of the recovered hogs died and the other resisted the virus and remained well.

It is quite evident from these experiments that the animals inoculated in Nebraska were fully as susceptible to hog cholera after the operation as were those which had been inoculated in the experiments of this Bureau in Washington.

The conclusion that inoculation is not a satisfactory preventive for hog cholera is by no means inconsistent with the results obtained in investigating other diseases. Various experiments have shown that the protection which follows one attack of a disease or which is produced artificially by inoculation or vaccination is by no means absolute. It is simply an increased power to resist that particular contagion, and it may be sufficient to guard against the small doses of the virus which with most diseases are all that an animal is exposed to under ordinary conditions. But if from any cause a larger quantity of the contagion finds its way into the animal's body it will contract the disease in a fatal form in spite of the immunity derived

from a previous attack or from inoculation. This was strikingly shown in the writer's experiments with fowl cholera (Report Department of Agriculture, 1881–'82, p. 289) and by the researches of Professor Chauveau with anthrax. While therefore it may be perfectly practical to prevent by inoculation those diseases in which the contagion does not multiply outside of the body, and with which the attack is caused by a small quantity of virus floating in the air or adherent to the wood-work of buildings, it may be much more difficult or impossible to prevent that other class of diseases to which hog cholera belongs, and which are caused by germs that multiply freely in water, in the soil, and in moist organic matter, and which are consequently taken into the body in enormous quantities, especially by swine.

There is another very important consideration which bears upon the practicability of preventing swine diseases by inoculation. Hogs inoculated with hog-cholera virus do not receive the slightest degree of protection from any other disease. As there are at least two contagious diseases of hogs in this country, both of which are widely scattered and fatal, we can not hope by any single inoculation to prevent all the losses caused by contagious diseases of swine. To inoculate for two diseases would double the expense, and this would be a very serious objection to such a method of prevention. The existence of two diseases has been very vigorously denied, but the conclusions of the Bureau of Animal Industry on this subject have now been confirmed not only by the Board of Inquiry appointed to consider this question, but also by Professor Welch, the eminent pathologist of Johns Hopkins University. In the future, therefore, the conclusions as to the economy of preventing swine diseases by inoculation must be based upon the assumption that there are at least two diseases, each of which will require a special inoculation for its prevention.

This brings us to the final test which must be applied to all methods of prevention, and that is their economic results. We will now consider inoculation from this point of view. Leaving out of consideration for the present the many reasons for believing that inoculation is a dangerous operation, and that it does not do what is claimed for it in the way of prevention, we will compare the cost of preventing hog cholera by this operation with the amount of the loss caused by this disease.

According to the estimates of the Statistical Division there are about 50,300,000 hogs in the United States. The inoculation of these at 50 cents per head would cost $25,150,000. The total loss from disease during the year 1888 was 3,105,000 hogs at an average value of $5.79 each. This would make the total loss of swine from all diseases $17,980,000. In order to estimate the loss from hog cholera we must deduct from this sum the losses from ordinary diseases, such as animal parasites, exposure, overcrowding, and improper feeding, which are always acting and do not produce epizoötic diseases. These losses were estimated by the Statistician of the Department in 1886 to be about 4 per cent. of the total number of hogs, but as this may be considered rather a large estimate, we will in our calculation take 3 per cent. as the average loss from such causes. This would amount in 1888 to 1,509,000 animals, valued at $8,737,000, and deducting this from the total loss of swine, we have remaining $9,243,000 as the losses from epizoötic swine diseases. In the present condition of our knowledge we must admit that there are at least two entirely distinct

epizoötic diseases of hogs, which have been referred to in the reports of this Bureau as hog cholera and swine plague. The exact proportion of the loss caused by each of these diseases is at present unknown, but if we admit for the purposes of this calculation that but one-third of the loss is caused by swine plague, we have remaining a loss of but $6,163,000 for the year 1888, which can be attributed to hog cholera. To prevent this disease by inoculation, as we have just seen, requires the expenditure in cash of $25,150,000, or more than four times the amount of the actual losses. In addition to this expenditure there should be counted the time required of the farmer in handling the hogs at the time of the operation and in giving them such precautionary care, and in practicing such disinfection as is required to make this operation at all successful.

We should reach the same conclusion if, instead of estimating the loss and expense for the whole of the United States, we should take a single hog-raising State, as for example the State of Illinois. According to the Statistician's estimate, there are 5,275,000 hogs in Illinois, and to protect these by inoculation would cost $2,637,000. In the year 1888 the total losses of hogs in that State from all diseases was about 316,500, with an average value of $7.45 each, which would make the loss for that year $2,359,925. Deduct a loss of 3 per cent. of all the hogs in the State as caused by ordinary diseases, and we find that this would amount to 158,250 hogs, worth $1,178,962. Deducting the losses caused by ordinary diseases from the total losses from all diseases and we have $1,180,963 left to represent the loss from both hog cholera and swine plague. Take from this one-third to represent the loss from swine plague, and we have remaining as the loss from hog cholera about the sum of $800,000. To prevent this loss by inoculation, as we have seen, would require $2,637,000, or more than three times the sum to be saved.

While it is evident from these figures that inoculation can not be recommended for general adoption under the conditions in which the operation must now be performed, it is conceivable that there may be special cases in which it may be found advantageous, provided its protective power is fully demonstrated. At distillery establishments where large numbers of hogs are purchased for feeding, and where the losses are necessarily heavy from epizoötic diseases, inoculation might prove an economic measure, but before deciding this question it would be necessary to have more definite data in regard to the average loss in these establishments.

Again, inoculation might prove efficacious in cases where considerable numbers of hogs are purchased at a distance by farmers for feeding. In this case there are unusual opportunities for infection during transportation, and experience shows that the loss from epizoötic diseases is unusually heavy. Here also it would require considerable experience before it would be possible to say whether the operation would be a financial benefit.

The operation is also being tried by breeders of thoroughbred swine in some sections. In this case there are animals of much more than average value to be protected, and, at first sight, it would appear that an outlay of 50 cents per head might be afforded in case any immunity could be assured. It should be remembered, however, that in case there should be considerable losses from inoculation, this would be more severely felt with high-priced animals than with those of average value. Another consideration even more important appears

to have been overlooked. In inoculating a herd the contagion of the disease is introduced upon the premises, and in spite of any precautions which can be observed the grounds will be infected. This infection remains a considerable time, and the experience of those who have had herds inoculated is said to show that if any uninoculated hogs are added to the herd they are very liable to contract cholera and succumb to the disease. If this observation is correctly interpreted, it is apparent that hogs sold from such herds for breeding purposes are liable to convey the disease to the herds into which they are introduced. This being the case, no breeder could afford to have inoculation practiced on his herd, because none would buy from him knowing that there was danger of introducing a fatal disease with the animals purchased.

The considerations mentioned above, which our present information demonstrates to have a bearing upon the subject of inoculation, should be taken into account by swine breeders before the adoption of this operation. There are undoubtedly other arguments for and against inoculation which greater experience will bring out, but we can only form a reliable opinion of its availability by reasoning from the knowledge at hand, and this we have endeavored to set forth with as much detail as is practicable in a report of this character.

THE EXPORT TRADE IN ANIMALS AND MEAT PRODUCTS.

During the calendar year 1889 the exports of animals and meats were unusually large. The number of cattle exported reached 329,271, which is greatly in excess of those of any previous year. The largest number sent abroad in any preceding year was 190,518, in 1884. The large exports of 1889 were due to a number of conditions, primarily no doubt to the low price of cattle in the United States. The active demand in Great Britain has been an important factor, as also the freedom of nearly the whole of the United States from any dangerous contagious disease. With the rapid eradication of pleuropneumonia in this country and its limitation at the most to three or four counties, the confidence in American beef cattle has increased, and there is greater willingness to receive and handle them. The following tables show the exports of animals and meat products for the calendar years 1888 and 1889:

Table showing number and value of animals exported for the calendar years ending December 31, 1888 *and* 1889.

Animals.	1889.		1888.	
	Number.	Value.	Number.	Value.
Cattle	329,271	$25,673,366	154,813	$12,998,977
Hogs	87,353	741,264	19,396	159,198
Horses	4,288	689,964	2,287	417,483
Mules	3,197	376,391	2,902	362,674
Sheep	143,161	393,185	117,718	243,433

Table showing exports of meat products for the calendar years ending December 31, 1888 and 1889.

Meat products.	1889.		1888.	
	Pounds.	Value.	Pounds.	Value.
Beef products:				
Beef, canned	71,769,708	$6,026,970	45,298,849	$3,807,685
Beef, fresh	170,292,606	13,602,713	106,411,092	9,591,481
Beef, salted or pickled	72,915,854	3,881,077	50,377,426	2,819,047
Beef, other cured	209,968	18,658	106,255	10,665
Tallow	99,637,118	4,717,229	75,470,826	3,736,488
Hog products:				
Bacon	471,743,869	36,320,774	302,128,689	25,958,915
Hams	55,469,050	5,990,570	40,243,275	4,622,032
Pork, fresh	227,735	13,080	47,265	3,354
Pork, pickled	77,231,712	4,997,687	57,772,922	4,414,923
Lard	508,337,428	30,422,370	270,245,146	23,516,097
Mutton	350,779	30,642	205,852	16,955

The following tables, showing the exports for eleven years ending with 1889, are added for reference and comparison. It should be observed that the years referred to in these tables are fiscal years ending June 30, while in the preceding tables they are for the calendar year ending December 31.

Table showing number and value of animals exported for each year from 1879 to 1889, inclusive.

Years.	Cattle.		Hogs.		Horses.		Mules.		Sheep.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
1879	136,720	$8,279,200	75,129	$700,232	5,915	$770,742	4,153	$530,989	215,690	$1,082,938
1880	182,756	13,344,195	82,484	421,089	3,060	675,139	5,198	532,362	209,137	892,647
1881	185,707	14,204,103	77,446	572,198	2,523	300,243	3,207	353,924	179,919	762,932
1882	108,110	7,800,227	36,308	509,651	2,218	470,183	2,632	320,130	139,676	603,778
1883	104,444	8,341,451	16,129	272,516	2,800	475,806	4,237	486,560	237,251	1,154,856
1884	190,518	17,855,495	46,382	627,480	2,721	424,317	3,742	498,809	275,874	850,146
1885	135,890	12,906,690	55,025	579,183	1,947	377,692	1,028	127,580	231,509	512,568
1886	119,065	10,958,954	74,187	674,297	1,616	348,323	1,191	148,711	177,594	329,844
1887	106,459	9,172,136	75,383	561,753	1,611	351,607	1,754	214,734	121,701	254,725
1888	140,208	11,577,578	23,755	193,017	2,263	412,774	2,971	378,765	143,817	280,490
1889	205,786	16,616,917	45,128	356,764	3,748	592,469	2,980	356,333	128,852	366,181

Table showing quantity of beef products exported for each year from 1879 to 1889, inclusive.

Years.	Beef, canned.	Beef, fresh.	Beef, salted, pickled, and other cured.	Tallow.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1879		54,025,832	36,950,563	99,963,752
1880		84,717,194	45,237,472	110,767,627
1881		106,004,812	40,698,649	96,403,372
1882		69,586,466	45,859,737	50,474,210
1883		81,064,373	41,680,623	38,810,098
1884		120,784,064	43,021,074	63,091,100
1885		115,780,839	48,716,138	50,431,719
1886		99,423,562	59,728,525	40,919,951
1887	49,050,588	83,560,874	36,479,379	63,278,403
1888	40,458,375	93,498,373	42,084,420	92,483,052
1889	51,025,254	127,895,391	55,200,435	77,844,555

Table showing value of beef products exported for each year from 1879 to 1889, inclusive.

Years.	Beef, canned.	Beef, fresh.	Beef, salted or pickled.	Beef, other cured.	Tallow.
1879	$7,311,408	$4,883,080	$2,336,378	.....	$6,934,940
1880	7,877,200	7,441,918	2,881,047	.....	7,689,232
1881	5,971,557	9,860,284	2,665,761	.....	6,800,628
1882	4,208,608	6,768,881	3,902,556	.....	4,015,798
1883	4,578,902	8,342,131	3,742,282	.....	3,248,749
1884	3,173,767	11,987,331	3,202,275	$67,758	4,793,375
1885	4,214,791	11,199,481	3,619,145	73,805	3,322,476
1886	3,436,453	9,201,011	3,544,379	89,593	2,144,499
1887	3,462,982	7,228,412	1,972,246	17,942	2,836,300
1888	3,339,077	8,231,281	2,608,479	9,204	4,252,653
1889	4,375,213	11,481,861	3,043,324	17,819	3,942,024

Table showing quantity and value of pork products exported for each year from 1879 to 1889, inclusive.

Years.	Bacon and hams.		Pork, fresh and pickled.		Lard.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1879	732,249,576	$51,074,413	84,401,676	$4,807,568	326,658,686	$22,856,673
1880	759,773,109	50,987,623	95,949,780	5,930,252	374,979,286	27,920,367
1881	746,944,545	61,161,205	107,928,086	8,272,285	378,142,496	35,226,575
1882	468,026,640	46,675,774	80,447,466	7,201,270	250,367,740	28,975,902
1883	340,258,670	38,155,952	62,116,302	6,192,268	224,718,474	26,618,048
1884	389,499,362	39,684,845	60,548,730	4,762,715	265,094,719	25,305,953
1885	400,127,119	37,083,948	72,073,468	5,203,943	283,216,339	22,595,219
1886	419,788,802	31,640,211	87,267,715	5,123,411	293,728,019	20,361,786
1887	419,922,955	33,314,670	85,893,297	5,641,327	321,533,746	22,703,921
1888	375,439,083	32,175,633	58,900,153	4,373,114	297,740,007	22,751,105
1889	400,224,646	34,651,847	64,133,639	4,735,077	318,242,990	27,329,173

The large export trade of the year just ended has done much to relieve the markets of this country and to maintain the price of cattle and beef. While cattle have sold somewhat lower than during 1888 the decline has been very much less than in pork, as has been shown in the preceding section of this report. The enormous corn crop of this year and the low average price of this important article of animal food has been a most important factor in depressing the price of both hogs and cattle. According to the estimates of the Statistical Division of this Department the average price of the last corn crop is but 28.3 cents per bushel, being much the lowest average of any crop raised during the last ten years.

Notwithstanding the fact that the number of cattle in this country per thousand of population has been slowly decreasing during the past four years, the large proportion of these animals that are being marketed still keeps the market overstocked and makes it extremely important that every effort should be made to maintain the export trade at least to its present extent, and, if possible, to increase it. The only danger to the trade in live cattle which has been suggested during the year is the occasional discovery of an animal which the English veterinary authorities supposed to be affected with contagious pleuro-pneumonia. It is impossible to understand how any of the beef cattle going abroad can be infected with this disease. After the most careful and extended investigations in the United States, this Bureau has been unable to discover any pleuro-pneumonia in any section from which steers are shipped. The only districts in which this disease does exist are two counties on Long Island and one county in New Jersey. The Long Island

district is isolated and no cattle from it go into the stock-yards through which the export cattle pass. The infected district in New Jersey is very nearly free from the disease, and while it is not isolated, like the Long Island district, no steers are raised for beef in this section and the stock-yards are believed to be thoroughly protected.

For the reasons given above we are led irresistibly to the conclusion that the disease found in the lungs of American steers when slaughtered on the English wharves is a sporadic inflammation which probably in most cases arises from exposure during the voyage. It is well known that generally no special characters are found by which contagious pleuro-pneumonia can be distinguished with certainty from the sporadic form of inflammation of the lungs and pleura. In making a diagnosis the veterinarian is always assisted by the history of contagion in the herds in which the disease is found, and, in the absence of such a history, if a single case of inflammation of the lungs and pleura is discovered it is difficult or impossible to make a positive diagnosis. With American steers slaughtered in England it is impossible, under existing conditions, to have any history of the animals, and as but a single steer is usually found affected in a whole cargo there is nothing to indicate that the malady discovered is of a contagious nature.

It is plain that the diagnosis of the English veterinarians in the cases of supposed pleuro-pneumonia among our steers must be more or less uncertain and open to doubt, without reflecting in the least upon the professional ability and competency of the inspectors making the examination. As this trade has grown to such an extent, and is of such great importance to the cattle industry of this country, it would seem very proper that we should take some means to determine whether the animals pronounced affected with contagious pleuro-pneumonia are really suffering from this disease. This fact could probably be determined by stationing one or more agents of the Department in England to examine the lungs of animals pronounced diseased and to determine as accurately as possible the exact conditions of their organs. The animals going abroad might also be numbered at the time of their shipment from the American ports according to some system by which any individual animal might be traced back to the herd from which it came. In this way it would be possible to determine whether such an animal had been in any way exposed to the contagion of pleuro-pneumonia. With such precautions it would seem possible to settle this long contested question as to whether the disease found by English inspectors in American steers is or is not contagious pleuro-pneumonia.

Another important consideration in connection with this trade relates to the possibility of increasing the number of animals exported. To what extent this can be accomplished it is impossible to determine. During the last six months the shipments have been about as large as possible with the present capacity of the regular lines of vessels plying between this country and Great Britain. With a continued trade of the present magnitude no doubt the carrying capacity would be soon increased, but this is one of the important factors which has prevented a still larger trade. Farmers and small shippers who have endeavored to send cattle abroad have found that the total space in the steamers had been contracted for months in advance by the large shippers. With sufficient facilities for shipment there is

no doubt that the markets of Great Britain would at present take more cattle than are being sent.

The greatest hindrance to the export trade in live cattle is the regulation of the British Government requiring that all American cattle shall be slaughtered on the docks within a period of ten days after they are landed. This prevents the owner from holding them until they can recover from the effects of the voyage and until the market is in the best condition for selling. Canadian cattle, which are allowed to enter England without any restrictions, are said to yield the shipper from $10 to $15 per head more than can be realized from steers shipped from the United States. The effect of this difference in returns is very marked, both upon our trade and upon the market value of cattle in the United States. If our shippers were able to secure $10 or$15 per head more for their animals it would of course stimulate the trade, and they would be able to pay nearly that amount more for steers purchased in this country. Such an advance in the price of export cattle would have a strong tendency to increase the price of all other kinds of stock. In this respect, then, the removal of the restrictions would be of the very greatest advantage to American cattle-raisers.

The removal of the English restrictions would also enable our shippers to send a kind of cattle which now can not be exported at all to Great Britain. There is no doubt but that our thin steers, or feeders as they are called, could be supplied to the English farmers for feeding purposes much cheaper than store cattle are now obtained from Ireland. The vast numbers of this class of steers which have been thrown upon the markets of the United States during the last three or four years have so exceeded the demand that prices have declined below the cost of production. The inevitable tendency is to force down the price of all meat-producing animals. If the foreign trade would take a considerable number of these thin steers it would be of the greatest benefit in sustaining the prices in this country. The English farmers are already agitating this question and are looking to the United States as a possible source of supply. The prices of Irish store cattle have been so high, and the danger of these animals being infected with pleuro-pneumonia is such that there is no doubt that it would be of great advantage to the feeders of both England and Scotland if they could obtain the cheap and healthy steers which are found in such numbers in all the American markets.

The number of this class of cattle which the English market could take is very uncertain. It has been suggested abroad that four or five thousand store cattle per day might be shipped from here. It does not appear probable that anything like this number could be sold to Great Britain for any considerable time. During the last five years the largest number of store cattle for feeding and breeding purposes sent from Ireland to England and Scotland in any one year is 405,540, or about 1,100 per day. This would indicate that from 100,000 to 150,000 store cattle per year would be as much as we could expect to send, if the restrictions were removed and the facilities provided for shipping that many animals in addition to the regular trade in fat cattle. Even this number would greatly relieve our markets and tend to restore prices to a point which would remunerate our farmers for the cost of production.

It has been suggested that Ireland would probably take a large number of our heifer stock for increasing their breeding herds. It is also possible that our store cattle might be sent to Ireland for fat-

tening. What the effect of this would ultimately be on our trade in fat cattle can not easily be predicted, but for a time at least it would not be great, because the store cattle shipped to Great Britain and Ireland would simply replace cattle which under other circumstances they would raise. It would, however, enable them within a few years to put more beef steers upon the home market, and in that way tend to lessen the number of fat cattle which would be taken from abroad. This need not cause any anxiety, because before such a result could be reached the over-production of cattle in this country would be a thing of the past. There can be but little doubt that within the next four or five years the population of the United States will have so increased beyond the development of the cattle industry that there will no longer be the same necessity of a large export trade.

It has been urged as an objection to exporting store cattle that it would be better for our farmers to feed them at home and ship them in a fat condition. This objection is rather theoretical than practical, and should at the present have little weight. As a matter of fact large numbers of store cattle are thrown upon our markets and depress prices, and, instead of being purchased for feeding, are killed and used for canning purposes. To send a part of these abroad would relieve the market and would not in the least lessen the number of steers that would be fed in this country. Undoubtedly it would be a better agricultural operation to feed such cattle at home and sell them fat than to sell them as store cattle, but as long as prices are so low that feeding is unprofitable they would be thrown upon the market, and it is just as well for them to go abroad as to be killed and canned in this country. The only question to be decided is, in what way would the American farmer obtain the best price for his stock. If the restrictions were removed there is no doubt that a better price could be obtained by exporting store cattle than to kill them here for canning.

The other markets of Europe are being closed against live cattle. An experimental shipment sent to Germany during the past summer realized excellent prices, and undoubtedly a large trade would have resulted were it not for the prohibitory restrictions which were at once enforced.

As has been shown above, the price of cattle in this country is greatly influenced by the price of pork. For this reason any increase of our exports in pork products would have a tendency not only to increase the price of pork in this country, but it would undoubtedly react upon the cattle trade and improve the price of beef as well. For this reason it is particularly important that efforts should be continued to secure the revocation of the prohibitory restrictions placed by various European nations upon our pork products.

There is little doubt that the markets of Europe would take all the surplus animals and meat products of the United States if these markets were not partially or entirely closed by arbitrary restrictions. Our breeding stock has now been improved until our animals compare favorably with those of any other country. They are raised under the most healthful conditions, and their price is far below that of animals of equal quality which can be obtained in any part of the world. There is, consequently, every reason why the people of Europe, where meat is so high in price as to be a luxury rather than a staple article of food with the masses, should look to this country to supply their needs.

INVESTIGATIONS OF INFECTIOUS ANIMAL DISEASES.

The account of the investigations of swine diseases which follows is interesting for several reasons. In the first place it demonstrates what, indeed, might have been expected, that both hog cholera and swine plague may exist under different forms. These differences are due to the fact that the germs which produce the outbreaks are of very different degrees of virulence. An important point is that the changes found in the internal organs on post-mortem examination differ materially in the same disease according to the virulence of the germ which is the exciting cause. It is therefore probable that there will be found all shades of difference in these diseases connecting the types first described in the reports of this bureau with the very distinct types described on these pages.

These extreme differences in the type of disease which may be encountered undoubtedly explain the variety of results of preventive and curative measures in the hands of different individuals. It also explains why hog cholera has shown the most actively contagious characters in some outbreaks while in others it only spreads slowly or not at all.

These researches also confirm the conclusions reached in the studies made during 1886, 1887, and 1888 as to the existence of the two distinct communicable diseases of swine which we have called hog cholera and swine plague. In some cases the germs of both diseases were found in the body of the same animal, indicating that death resulted from a complication of the two maladies. In other instances the most elaborate researches would only reveal the presence of the swine-plague germ, while at still other times only the hog cholera germ could be found. We have here further proof, therefore, that both of these germs are fatal, and that they may act each by itself in producing disease, or the two may be present at the same time and each develop its peculiar effects in the body of the same animal.

The following brief account of the investigations conducted under my direction into the nature of infectious animal diseases has been prepared by Dr. Theobald Smith, who is in charge of this branch of the work of the Bureau of Animal Industry. It will be found of great interest to all who desire a more thorough knowledge of these maladies. Only the most important results are outlined, all minor details of experiments and the autopsy notes being reserved for special reports of the Bureau of Animal Industry.

ON TWO OUTBREAKS OF MODIFIED HOG CHOLERA.

I. Early in January a disease broke out in a small herd of swine near Knowles, Md., which, upon examination, proved to be a modified form of hog cholera. Considerable attention was paid to this outbreak, and the bacillus causing it was carefully studied and identified as a variety of the hog-cholera bacillus described in the reports of 1885–'88, and in the special report on hog cholera. The importance of thoroughly determining the various forms of swine disease, in view of prevention and extermination, and of the methods to be employed for this object, need not be insisted on at this time. The importance is a sufficient reason for these investigations, which can here be given only in abstract.

General characters of the disease.—On December 15, 1888, Mr. P. had eight fine shoats, about three months old, and on this day he

purchased a cheap lot of pigs in the Washington markets. One of these died on the way home; two others died during the two following days, and within ten days seven had died. The last one of the new lot died, greatly emaciated, January 20, after a sickness of from three to four weeks. The original lot on the farm became infected early in January, and up to January 22 four had died. Of the remaining four, two were quite sick and two apparently well. Among the symptoms noticed by the owner was a rapid falling away in flesh, while the appetite remained fairly good up to the time of death. There was a severe cough, coupled with a nasal discharge and considerable diarrhea. In the later stages of the disease the skin of the limbs, belly, and ears became deeply reddened. The ears turned almost black, and "lopped like the ears of a dog." On the limbs and belly the skin became "scabby like a person with small-pox."

One of these pigs was examined on the farm; two others in which disease was manifest were taken to the experiment station of the Bureau, there placed in clean, disinfected pens with board floors, and fresh pigs put with them to determine whether the disease was communicable or not. The following table shows that the disease could be communicated from one animal to another without the intervention of the soil. It also gives the time elapsing between the exposure and the death of the animal exposed:

No.	Age, etc.	Placed in pen.	Death.
1	Examined on farm	.....	Jan. 21
2	Brought to station	Jan. 21	Jan. 22
3	.....do	...do ..	Jan. 30
121	Three and one-half months old	Jan. 22	Feb. 17
126	Four months old	Feb. 12	Mar. 6
128	.....do	...do ..	Mar. 5
116	Five months old	Mar. 5	Mar. 29

A few pigs placed in the pen with these did not take the disease; a few died rather prematurely on account of injuries received by fighting with one another. The four cases recorded in the table (Nos. 121, 126, 128, 116) are sufficient to establish the fact that a period of from three to four weeks is sufficient from the first day of exposure to destroy the animal. It should be borne in mind that this period holds only for pigs constantly exposed to virus in a small pen.

Lesions produced by the disease.—Unfortunately this outbreak, like so many studied since 1886, was a mixture of two diseases. We may now, after the investigations of the past few years, lay down the general statement that almost all extensive lung disease is caused by the swine plague germ. At the same time it is difficult to determine with any degree of certainty, when the outbreak is of a mixed character, the exact rôle which each germ plays in causing disease of the stomach and intestines. The hog-cholera germ may cause certain injuries to the mucous membrane, and the swine-plague germ coughed up from the air-tubes and swallowed may cause additional injury to the whole digestive tract. It is also impossible to determine definitely which germ enters the body of the pig first. Either may prepare the way for the other. As there is much variation in the activity or virulence of either germ, it is very probable that the most virulent makes the first attack and thereby paves the way for the other. We may likewise assume that the germs are transmitted together from one herd or pig to another.

In the pigs obtained from the farms (Nos. 1, 2, 3) as well as in some of the exposed, the lungs, stomach, and large intestines were diseased. The lung disease was a more or less extensive broncho-pneumonia or catarrhal pneumonia, involving also the larger air tubes. The solidified lung tissue was nodular to the touch, the nodules being caseous masses in the ultimate bronchioles and air-cells. The filling up of these spaces with cellular elements had gone on to such a degree that there was distinct saccular dilation of the small air-tubes (bronchiectasis). With this lung disease the swine-plague germ was always associated.

The stomach was either deeply reddened, hyperæmic in the fundus, or else there was (outside of the fundus) a peculiar diphtheretic inflammation, accompanied by cellular exudation, necrosis of the mucous membrane, and subsequent ulceration. This lesion had not previously been observed in swine disease, excepting in a few pigs which had been fed with cultures of hog cholera bacilli. The hyperæmia of fundus and diphtheretic condition of the remainder of the mucosa were in a few cases found associated together.

The lesions of the large intestine were quite varied in character. In several cases they consisted of large neoplastic projections from the mucous membrane, often one-half inch high and one inch wide, The neoplasms were very firm, yellowish white, capped by a thin black slough and extended into the muscular coat, or even to the serosa. Some had the concentric markings quite common in hog cholera, while others were irregular in outline. The more common appearance presented in this outbreak by the large intestine was a complete necrosis of the mucosa over large areas. The mucosa itself was converted into a rather firm, yellowish-white, homogeneous layer, the surface of which was made irregular by small lumps of caseous matter reminding one of rough cork-lining. In some cases the sheet necrosis was more smooth. In a few instances the upper large intestine was beset with numerous small ulcers which seemed to have their origin in the solitary follicles and mucous glands.

How far the swine-plague germ contributed to the disease in the digestive tract it is of course impossible to say. Its presence was detected several times by inoculating rabbits from the mucous membrane. The investigation as a whole seems to indicate that its action was a subordinate one.

Characters of the hog-cholera bacillus causing this disease.—The methods employed in isolating the pathogenic organisms were in general the same as those hitherto employed. They consisted in tube cultures usually agar and bouillon from the spleen, in plate and roll cultures (agar and gelatine), from the diseased lungs and pleura, and from the recently diseased mucosa in the stomach and large intestine. The cultures were re-inforced by the use of inoculations into rabbits from the same organs, as well as from cultures made directly from the pigs to test the disease-producing character of the bacteria thus obtained. The results from these different lines of work usually confirmed one another and may be briefly summarized. The hog-cholera bacilli were found in the spleen in the majority of the cases examined. In several cases plate cultures from the deeper layers of diphtheretic deposits and ulcers contained a large number of colonies of the same bacilli. The swine-plague bacteria were present in the diseased lungs and occasionally found in the digestive tract. The hog-cholera bacillus of this outbreak differed in a number of characters from the one found in outbreaks since 1885.

It grows more actively in bouillon-peptone, causing a considerable turbidity of the liquid. Its colonies in gelatine are larger, the surface colonies more especially so. These spread out in the form of fleshy, perfectly round, flat discs on the gelatine layer. The bacilli themselves are perhaps slightly larger than the true hog-cholera bacilli. In other respects they are the same.

When we come to the pathogenic effect a decided difference is observed between the two forms. Calling, for the sake of convenience, the first described bacillus *a* and the one now under consideration *b*, the latter is much less virulent. This has been observed both on pigs and on smaller animals, such as rabbits and mice. Pigs, when fed with bouillon cultures, became very sick for a few days and had more or less diarrhea. Recovery usually took place in a week. One pig was fed after a fast of a day with some carbonate of soda solution before receiving as a drench somewhat less than a pint (400 cubic centimeters) of a bouillon culture of this bacillus. It died in four days, and at the autopsy considerable inflammation of the stomach and intestines was observed. The germs were not found in the spleen, but from the mesenteric glands they were obtained in roll cultures, no other bacteria being present. These experiments are sufficient to demonstrate the pathogenic power of this bacillus on pigs. They also show that this power is decidedly inferior to that of bacillus *a*.

The effect on rabbits deserves a moment's consideration, owing to the importance of rabbit inoculation in the study of the hog-cholera bacilli. The bacillus *a* may be considered quite invariably fatal to rabbits, even in very minute doses. This is not true of bacillus *b*, however. When a moderate quantity of a bouillon culture (one-quarter of a cubic centimeter) is injected beneath the skin, the rabbit may die in from ten to twenty days. The lesions observable are a rather extensive subcutaneous purulent infiltration, often developing into an abscess which may rupture. The spleen is small, the liver without necrotic foci. The Peyer's patches of the small and large intestine and the follicles in the contracted terminal portion of the cæcum are swollen and appear as whitish points or nodules, varying in size. These may break on the surface of the mucosa and become converted into ulcers with adherent sloughs. Not infrequently the transverse folds in the cæcum and the mucosa in the upper portion of the colon may be studded with typical "hog cholera" necroses or ulcers. Here we have the lesions of hog cholera in pigs reproduced with a remarkable clearness in rabbits by subcutaneous inoculation. While subcutaneous inoculation is not generally fatal to rabbits, intravenous injection of very small doses of bouillon cultures (one-twentieth to one-fifth of a cubic centimeter) is more certain in its effects, and the same intestinal lesions are produced which have been described as the result of subcutaneous inoculation.

These rather remarkable lesions at first sight might induce us to differentiate widely this organism from the true hog-cholera bacillus *a*. Their essential identity is demonstrated by the very instructive results obtained by inoculating attenuated cultures of the bacillus *a*. We then are able to produce the same peculiar follicular swelling and ulceration in the intestines, while the spleen remains small and the liver free from necrosis.

Another proof of the essential identity of these two bacilli, *a* and *b*, was furnished by rabbit vaccination. A number of rabbits were inoculated twice with the bacillus *b* in quantity sufficient to produce a rise of 3° or 4° F. in the temperature of the animals for a week or

longer, but not sufficient to prove fatal. Subsequent inoculation with the virulent bacillus *a* failed to kill these animals, although their temperature rose 4° or 5° F., and the control animals all succumbed. In other words the bacillus *b* proved to be a vaccine for the bacillus *a*.

The investigations with reference to this bacillus have elicited the following facts: (1) It is essentially identical with the true hog-cholera bacillus as shown by rabbit experiments; (2) it is much less pathogenic than the latter.

II. During September Dr. Kilborne visited Clarke County, Va., where more or less swine disease was prevalent. The disease seems to have been lingering along the river below Berryville since last winter, and became especially virulent during August. It was estimated that about 75 per cent. of the swine in the vicinity of Berryville succumbed to the disease. At the time of the inspector's arrival there were very few sick, many having died during the two or three weeks preceding. The symptoms observed by the owners of herds were frequent coughing, diarrhea, and occasional vomiting. The affected animals lost flesh and strength very rapidly. There were also general reports of skin disease accompanying these symptoms. Pieces of skin were said to drop off, leaving raw, deep sores. The skin of the ears and belly became purplish and was covered with sores.

Owing to the meager material on hand, the notes are given somewhat more in detail:

Two sick pigs were brought to the Experimental Station of the Bureau and there confined in an isolated disinfected pen. At the same time a healthy pig, whose history was well known, was penned with them. Both pigs arrived at the Station September 4. One (No. 3) died September 11, the other (No. 4) September 23. The former had ulcers on gums and tongue, inflammation of the mucous membrane of the stomach and small intestines, and ulcers in cæcum and colon; parenchymatous inflammation of kidneys. The anterior half of lungs hepatized; bronchitis. The lymphatics throughout the body considerably enlarged, reddened, and mottled with paler spots and occasional petechiæ. The mesenteric glands differed, however, in presenting a peculiar yellowish-green color, due to caseation, which was distributed in small masses throughout the gland substance. Cultures on plates of gelatine and agar, in tubes of bouillon, agar, etc., from blood, spleen, liver, lungs, mesenteric and inguinal glands were unsatisfactory, owing to the fact that every organ examined contained several varieties of organisms. The swine plague germ was found in four organs; besides this were streptococci and various non-motile organisms. From Esmarch rolls a germ closely resembling the modified hog-cholera bacillus was obtained, but its effect on one rabbit was negative. The second case was more satisfactory in this respect. This lived to September 23, as stated above. The lesions found at the autopsy were the same as in the preceding case, so far as the lungs, mesenteric glands, kidneys, and stomach are concerned. In addition to these there were small infarcts in the spleen. The lesions in the intestines differed quite materially. The mucosa of ileum was covered with a diphtheritic exudate and its wall very much thickened. The mucous membrane of the cæcum and colon was likewise diphtheritic; only one ulcer penetrating the mucosa was found. From the spleen and liver numerous

hog-cholera bacilli were obtained, and their effect on rabbits was the same as that of the modified bacillus already described. From the diseased lungs swine-plague germs were obtained.

The healthy pig penned with them September 18 was killed December 9. The skin of the major portion of the body was covered by firmly adherent, thick, dry crusts or scabs, and in general the condition of the pig was unthrifty and poor. The internal organs were normal, however. In the cæcum and upper colon there were a few cicatrices indicative of former ulceration.

The discovery of this modified hog cholera raises several important questions. May there not exist in different parts of our country other varieties of the hog-cholera bacillus perhaps still less virulent than the one described? If so, it necessarily follows that there must be considerable differences in the general character of the disease and in its infectious and contagious qualities. Bacteria which possess pathogenic activities in a high degree will generally make the resulting disease contagious. The germs carried out of one animal will, sooner or later, produce disease in another animal coming in contact with them. This direct transmission of bacteria from one animal to another, and the consequent outbreak of disease in the second animal, makes the disease *contagious*, whether the bacteria be carried in the dust of the air or transferred to the soil in the discharges and the urine to infect the food of another animal. The transmission of bacteria, in whatever manner, from one animal to another, provided the bacteria do not undergo any necessary changes during the passage, constitutes contagion. This is the character of the virulent hog cholera. Animals placed in contact with such disease in pens where there is no "soil" whatever will take the disease and die.

When we come to the weaker varieties of this germ the case is different. Large quantities of virus do not prove fatal, though they may cause severe disease, and in order that the bacteria may manifest their highest potency the animal must have been debilitated by some other cause. This was illustrated in the feeding experiment cited above by the use of the carbonate of soda. This made the stomach alkaline and allowed the bacteria to pass into the intestine. Any derangement of the stomach by which its activity is reduced may act in the same way. Overfeeding or sudden change of feed, disease of the liver, ascarides plugging the bile-duct, disease of the lungs, all these tend to impair digestion directly or indirectly and prepare the way for the introduction and multiplication of the specific bacteria. It is also evident that in such outbreaks all animals will not be attacked unless all have been subjected to the same or similar debilitating influences. In other words, the disease is communicable, but only under special conditions. Unfortunately these debilitating influences usually do come upon all animals in a herd alike, whether they pertain to the food, to exposure, or to animal parasites.

It is evident that many erroneous impressions are gained by insufficient knowledge concerning such modifications of the disease, especially in regard to treatment and prevention. An inoculation may appear to protect animals from a mild type of the disease when it would be unable to do so from a virulent one. Again, the inoculated animals may have been placed in such conditions that their system would have resisted the disease even without inoculation. The same is true with regard to so-called remedies and preventives.

These may prove efficacious in one type of disease, but when applied to others the remedy may utterly fail. As a general rule only those remedies or preventives are worthy of the name which prove efficacious in the genuine virulent hog cholera. This, according to our experiments, has proved transmissible from animal to animal under any circumstances.

The existence of such modifications still more complicates the study of swine diseases already made difficult by the frequent admixture of two diseases, hog cholera and swine plague, in the same herd. The additional difficulty arises from the fact that the less virulent germs often fail to penetrate into the internal organs, such as the spleen and liver, where they are easily detected, and remain limited to the intestines or the lungs wherever the disease process is actually going on. Under certain conditions the detection of bacteria in the affected lungs is a very simple matter, but it is always a difficult and frequently an insoluble problem when the investigations must be limited to the miscellaneous, ever-changing contents of the digestive canal. The importance of exercising the greatest care in investigations and the greatest caution in coming to conclusions must be impressed upon all those who are investigating what seems to be exactly the same disease in different parts of our country.

These investigations also suggest the possibility that there may be still other diseases falsely called hog cholera, which are of a purely temporary character, and which are called forth by various unsanitary conditions. Such diseases, if they should be proved to appear now and then, would not be communicable, but would be self-limited and disappear when the exciting cause is removed. Such localized diseases have been reported as occurring now and then among the human family after eating spoilt or diseased meat. Only lately has attention been directed to the bacteriological side of these occasional diseases. A very good illustration is reported by Professor Gärtner,* in Jena.

A cow affected with diarrhea, accompanied by discharge of mucus from the bowels, was slaughtered and the meat used for food, because the inspector, after a careful examination, pronounced it normal. Of about ninety persons who ate of this meat, either raw or boiled, fifty-seven became ill from two hours to several days thereafter. The severity of the disease varied with the quantity of raw meat consumed. One person who consumed 1½ pounds died in thirty-five hours. From the meat of the slaughtered cow, as well as from the organs of the deceased person, a bacillus was obtained which had not been before recognized, and which was denominated *bacillus enteriditis*. It proved to be pathogenic on the smaller experimental animals such as mice, guinea-pigs, and rabbits. It destroyed them when inoculated or fed in sufficient doses, and usually produced inflammation of the intestines. There could be no reasonable doubt, in view of the investigations, that this bacillus was the cause of the epidemic. At the same time it is not known to be the cause of any recognized infectious disease in man. According to investigations made subsequently in the province of Herzegovina, by Karlinski,† this *bacillus enteriditis* is not an uncommon inhabitant of the dried meat of that country, and he traced a case of acute poisoning to such meat. He also claims to have found the same germ in the intestines of healthy animals and of man.

* Corresp. d. allg. ärztl. Vereins Thüringen, 1888.
† Centralbl. f. Bakteriologie (1889), VI, 289.

The manner in which swine are fed in some parts of our country does not preclude the occurrence of disease very similar to that just described. At the same time it would by no means deserve the name of hog cholera. It might attack all the animals of a herd at the same time, stop when these had recovered or died, and thus give the impression that certain preventives or cures had brought about the recovery when perhaps a change of food would have resulted equally well. The dangers to which domesticated animals, and especially those of the omnivorous type, are exposed by the miscellaneous food which they receive, contaminated by germs of every kind, are very great, and it would seem, when we take into consideration the progress of investigations in the field of preventible disease, that the methods of rearing swine must be radically changed and adapted more to sanitary laws if disease is to be kept in check.

The hypothesis of the occurrence of disease not to be classed under swine plague or hog cholera receives some support from the fact that we occasionally meet with disease in swine involving the lungs or the intestines, or both organs together, from which no positive bacteriological results are obtainable. Sometimes unusual forms of bacteria will predominate, at others such ubiquitous germs as streptococci are the only ones to be detected. These facts indicate either the insufficiency of bacteriological methods or else the production of disease, under aggravated conditions, by germs which, under ordinary circumstances, must be regarded as harmless.

SWINE PLAGUE.

It has already been stated that lung disease associated with the swine-plague germ was present in the outbreaks of modified hog cholera described briefly in the preceding pages. It has been one of the chief difficulties in the study of this disease to obtain it free from complication with hog cholera. These mixed outbreaks, as they might be denominated, have been encountered with rare exceptions ever since 1886. They have led to various attacks on the work of the Bureau, attacks as unfounded as they seem to be inspired with personal malice. It was maintained that swine plague was merely grafted on hog cholera or secondary to it. A careful survey of facts would lead one to adopt the conclusion that in a fraction of the outbreaks just the reverse is true, and that hog cholera attacks the herd after it has been invaded by the infectious lung disease.

I. During the fall of 1889 several epizoötics of swine disease were again carefully studied in order to elucidate as far as possible the relation between the two diseases of swine plague and hog cholera. The first epizoötic appeared among swine fed at a slaughter-house near the Station. Late in September the owner had purchased in the Washington markets thirty-five animals in two lots, possibly in three. They began to die about one week thereafter, and within little more than one month they were all dead. A small number had already succumbed before the outbreak came to our notice.*

Thirteen animals were examined.† They were small, weighing from 25 to 35 pounds each. It is impossible, in a small space, to give an adequate idea of the lesions manifested in these thirteen cases. In all, the lungs and the large intestine were diseased, but the extent of the disease varied considerably. Of the lung tissue from one-half to

*A small number of older animals on the place and freely mingling with these did not take the disease.

†For the details of this and the succeeding outbreak see the special report on swine plague (1891).

three-fourths was hepatized. The bronchi contained a muco-purulent secretion. The hepatization was of a bright red color, mottled in many cases with greenish-yellow, necrotic areas; in others the necrosis was absent. The pneumonia was accompanied in most cases by more or less extensive exudative pleuritis, limited, at least in its severer form, to the covering of the solidified lung tissue. The pericardium, and more rarely the epicardium, was covered with the same exudate. As a rule the lobes of the lungs were glued to each other, to the chest wall, and to the diaphragm. The lesions of the digestive tract involved the stomach and the large intestine. The former was usually hyperæmic, bordering on hemorrhage, occasionally with localized sloughs or ulcers. The large intestines were as a rule ulcerated, but the ulceration varied very much. In some animals it was limited to the follicles, in others the necrosis of the mucous membrane was very extensive. Pigmentation and hyperæmia were not uncommon.

The bacteriological examination comprised cultures on gelatine, agar, and in bouillon, from the spleen, liver, and pleural exudate; gelatine and agar roll and plate cultures from different regions of the diseased lung tissue, and the inoculation of rabbits with bits of the same tissue. The results of this laborious examination are somewhat different from those obtained from former outbreaks, and they indicate how important it becomes in these inquiries to know something of the previous history of the infected herd.

No.	Nature of the germs obtained.	Remarks.
1	Swine-plague germs	Ulceration of large intestine slight; lung disease severe.
2	.....do	Do.
3	Hog-cholera germs; swine-plague germs only in lungs.	Ulceration very extensive; lung disease moderate.
4	Hog-cholera germs	Do.
5	Swine-plague germs	Ulceration moderate; lung disease moderate.
6	Hog-cholera germs	Do.
7	Swine-plague germs	Do.
8	Swine-plague	Ulceration slight; lung disease severe.
9	Swine-plague and hog-cholera germs.	Ulceration extensive; lung disease severe.
10	..... do.....	Do.
11	.....do.....	Ulceration moderate; lung disease moderate.
12	Swine-plague germs	Ulceration moderate; lung disease severe.
13	Hog-cholera germs	Ulceration slight; lung disease moderate.

An examination of the table shows that in spite of the careful search no hog-cholera bacilli could be found in Nos. 1, 2, 5, 7, 8, and 12, while on the other hand no swine-plague bacteria could be found in Nos. 4, 6, and 13. The rest—Nos. 3, 9, 10, and 11—contained both hog-cholera and swine-plague bacteria. In general, the lesions corresponded with the bacteriological facts. This was particularly so with the first four cases examined. In Nos. 1 and 2 the ulceration of the large intestine was slight, apparently follicular, while the lung disease was very severe. In Nos. 3 and 4 the reverse was true; the intestinal ulcers were very large and numerous, the lung disease moderate and without pleuritis. In Nos. 1 and 2 no hog-cholera bacilli could be found, although special attention was paid to this point. In No. 4 no swine-plague germs could be found; in No. 3 they were only detected by rabbit inoculation with bits of lung tissue. In cultures from the other organs hog-cholera germs were present exclusively. In the other cases a similar parallelism between the lesions and the germs found was present, but not so well marked as

in the first four cases. If we had limited our investigations to Nos. 1 and 2 we should have no doubt considered the outbreak as swine plague. If we had only examined No. 4 we should have pronounced the disease hog cholera, whereas, in fact, the herd was affected with both diseases.

If we should attempt an explanation, by using statements which can not be clearly demonstrated as facts, we might come to the following conclusions: The pigs, which came from two or three different sources, came infected with two different diseases. This view will be borne out by the earliest four cases actually examined. When the animals were thrown together secondary infection took place, those having swine plague becoming infected with hog cholera, and those having hog cholera with swine plague (see Nos. 9, 10, 11). As regards the intestinal lesions in those animals in which, after very diligent search, no hog-cholera bacilli could be found, we do not venture an opinion, because the hog-cholera bacilli may have been limited in their distribution to the digestive tract, which was not examined directly. What may be maintained, however, is that in these cases the internal organs were flooded with swine-plague germs; the diseased lungs, also flooded with swine-plague germs, after very careful examination proved to be free from hog-cholera germs. When we take into consideration the fact that when hog-cholera germs are at all present in the diseased animal they generally appear in all organs, and that they are far more easily detected there than are the swine-plague germs—the latter generally failing to grow on gelatine—we may safely assume that in those cases in which hog-cholera germs were not detected they were either wholly absent, or, when present, exercised a very minor influence on the course of the disease, and that the swine-plague or infectious pneumonia was the primary disease and the cause of death.

In view of the skepticism which prevails to some extent as to the existence of a disease independent of hog cholera, the following inoculations, which clearly demonstrate the pathogenic effect of the swine-plague germ, are briefly reported:

Four pigs were inoculated with a turbid suspension of swine plague germs, grown on *agar*.

No. 272 received 2 cubic centimeters subcutaneously; killed after three weeks. No effect.

No. 273 received one-half cubic centimeter through the right chest-wall into the lungs. Sick for a week, breathing with difficulty. Seems to have recovered after two weeks, when it was killed. Diaphragm pressed downward. Both pleural sacs converted into large abscess cavities, surrounded by thick pyogenic membranes, and distended with a thin, milky fluid. Both lungs compressed into a very small space. Pericardium and epicardium covered with purulent exudate.

No. 274 received 1 cubic centimeter of the suspension into the abdominal cavity. Dead in twelve hours. Exudative peritonitis, pleuritis, and pericarditis.

No. 275 received into the right lung 1½ cubic centimeters of the suspension. Dead in sixty hours. Double exudative pleuritis and pericarditis. Right lung almost entirely necrosed; the left has a typical pneumonia in principal lobe. Intense catarrhal inflammation of the stomach.

II. Another outbreak of swine disease among penned pigs not far from the Station, during November, 1888, deserves a brief description here, because of the very curious and instructive fact that swine plague occurred in one pen and hog cholera in another; nor was it possible to find hog-cholera germs in the swine plague pigs, or swine-plague germs in the hog cholera pigs. The details as regards the characters of the surroundings, the pens, etc., must be reserved for future publication.* A sow in one of the pens became sick November 8, and died suddenly next day. It had seven pigs seven weeks old, small for their age. All of these died in the space of four days, from November 9 to November 12, inclusive, and all but two were examined. The disease in these five cases was very much alike. The lungs were hepatized, the hepatization involving from one-half to two-thirds of the entire lung tissue, and invariably the dependent portion. The hepatization was quite firm, varying from a granular, grayish-red, mottled appearance to an occasional hemorrhagic infiltration.

Exudative pleuritis extending to the pericardium was present in every case. The stomach was usually contracted, empty, containing a bilious, catarrhal coating. The liver was unusually firm to the touch. The large intestine more or less hyperæmic or pigmented, with slight roughening (necrosis?) of the surface in one case. There was not a sign of ulceration in any of these five cases. Mingled with the feces in several instances were masses of a soft, pale, yellowish color, which were probably exudates from the congested membrane. Careful bacteriological examination of the spleen, liver, lungs, and pleura resulted in finding swine-plague germs in every case. The hog-cholera germ was conspicuous by its absence. It is difficult to see how the disease in these cases can be credited to anything but the swine-plague germ. The hyperæmia of the large intestine, which might have resulted in croupous or diphtheritic inflammation later on, may be explained by the swallowing of the virus either as it came from the bronchial tubes or as it was mixed with the food by the nasal discharges and feces of the diseased animals.

In another pen, but not in communication with the last, were five pigs recently purchased (in October). Three died, of which one was examined. The two remaining sick ones were taken to the Station, and they, together with the viscera of the one examined, were made the starting point of a typical hog cholera outbreak. The one examined was affected with *extensive necrosis and ulceration of the cæcum and colon, hemorrhagic lymphatics, scattering foci of hepatization in the lungs without pleuritis.* In the various organs, including the lungs, hog-cholera bacilli were present in large numbers. No swine-plague germs detected.

In a contiguous pen one pig died. This proved to be a case of hemorrhagic hog cholera without lung disease. Beginning necrosis, with hyperæmia in the intestine, hemorrhagic kidneys and lymphatics, and hemorrhages in different parts of the body. In this case only hog-cholera bacilli were found. The other pens on the farm remained free from disease.

If we sum up the result of the investigations we have five animals in one pen affected with extensive lung disease, which is associated with swine-plague germs only. We have two other pens, not in communication with this one, affected with hog cholera only. These facts demonstrate as clearly as any which we have thus far been able

*See foot-note to preceding outbreak.

to obtain that swine plague or infectious pneumonia may appear as an independent disease, fraught with a high mortality.

In connection with these investigations a few facts which may be of interest to those who may engage in this work in different parts of our country are briefly given. The swine-plague germs found in these two outbreaks differed considerably in their pathogenic power. In fact they must be regarded as distinct varieties in this respect. The germ obtained from the mixed outbreak first described was sufficiently virulent to kill rabbits in from sixteen to twenty hours, even after the slightest prick of the lancet upon which a minute speck of the germ growth had been deposited. In all the organs of the dead animal the germs were present in large numbers. The germ obtained from the outbreak just described differed in causing death in from three to seven days. Instead of the septicæmia and the presence of germs in the blood of all organs they were restricted more or less to the peritoneal or pleural cavities, or to both, where they produced exudative inflammation.

In swine in the earliest acute cases of swine plague the lungs are practically a pure culture of the swine-plague germs, and from the pleuritic exudate pure cultures can always be obtained without resorting to plate cultures. Animals which succumb later on are less and less suitable for examination. The swine-plague germs are being destroyed in the lung tissue by the secondary processes of degeneration going on, and their place is taken by various bacteria from the air passages, which have no causal relation to the disease. The pleural cavities are lastly invaded by bacteria from the dead lung tissue, and this invasion may even extend to the spleen and other organs. The lesson to be drawn from these facts is obvious. In any outbreak all the animals should be examined and the investigation should never be limited to a few cases from a miscellaneous variety of epizoötics. The chances of being misled are particularly great in the study of swine plague, unless we trace the disease from the earliest to the last cases, which is equivalent to saying from the most acute to the most chronic. Unfortunately for the investigator the existence of disease is rarely reported until a number of animals are dead, and these among the best cases for study which the whole epizoötic has to offer. Another fact to be borne in mind by the investigator is the comparative uselessness of gelatine for cultivations. Neither of the two varieties of swine-plague germs described could be made to grow upon this medium with any degree of certainty.

Lung worms associated with these outbreaks of swine plague.—The autumn of 1889 seems to have been very favorable to the lung worms (*strongylus paradoxus*), for most of the pigs of the swine plague outbreaks were infested with them. They were, as a rule, limited to the air tubes of the large principal lobe of both lungs. They were frequently so numerous as to completely occlude the principal bronchus and collateral branches. The resulting pneumonia was limited to the posterior (caudal) extremity of the lobe and to scattered regions through which the plugged branches passed. In fact, in a few cases examined from another outbreak, they were so numerous as to become a sufficient cause for all the lung disease observed. It is of considerable importance to determine how far the lung worms in their migrations may be held responsible for carrying disease germs into the lungs. In the epizoötics of swine plague the pneumonia caused by the worms was limited to the caudal tip of the principal lobe, while the infectious pneumonia invades the small an-

terior lobes first, then the principal lobe. If, therefore, there exists any relation between the lung worms and the swine plague at all, it must be regarded as indirect. The life history of these parasites, by reason of their widespread destructive presence in certain seasons of the year, demands careful investigation. Experience at the Bureau Station seems to show that swine kept off the ground in pens do not become infested with these parasites, and this experience is worthy of more careful observation.

INVESTIGATIONS OF TEXAS FEVER.

Since the introduction and development of better methods in the study of micro-organisms, it seemed desirable to make more careful and elaborate investigations of this disease in order to determine if possible its nature and cause, and to derive therefrom rational means of prevention in addition to those already well known and applied. The difficulties in the way of such investigations are insurmountable, unless cases of the disease can be obtained which are within reach of a well equipped laboratory where the more delicate methods of research may be applied. The material at the disposal of the laboratory has therefore been very meager, in spite of continued efforts to obtain it during the season when it is most apt to appear north of the permanently infected area.

During the summer of 1888 about five cases were examined. The disease had broken out in Maryland, about 60 miles from the laboratory, and in spite of the care exercised in hunting it up only five cases fell into the hands of the inspector in a condition fit for examination. The various organs were brought in specially devised refrigerator cans to the laboratory, where they were subjected to a careful microscopical and bacteriological examination. The result of this work was in general negative. The internal organs were free from bacteria so far as the microscope and cultivation were able to go. At the same time investigations conducted in this manner were open to many objections, and during the summer of 1889 it was decided to produce the disease at the Experiment Station of the Bureau and thus have cases under observation from the beginning of the infection. Cattle from North Carolina, brought to the station during the last week in June, infected the pasture there so that the first native animal died late in August. Another importation of North Carolina cattle, late in September, was equally successful in giving rise to a second outbreak of the disease.

During the entire season eleven head of exposed native cattle died. Besides these fatal cases a number of cases which terminated in recovery came under observation. The symptoms and lesions may be very briefly summarized.

The first indication that the disease had entered the system and was there unfolding its destructive activity was a continuous high temperature, fluctuating very slightly and subsiding only when death or recovery ensued. The temperature rose from 101°–102° Fahrenheit to 106°–107° Fahrenheit, and in the fatal cases remained high from four to fifteen days. After a variable number of days the high temperature was accompanied by general weakness lasting but a few days, when death ensued. A few days before death the urine became more or less deeply colored with hæmoglobin, and in nine out of eleven cases the bladder after death contained deeply tinged urine. In the tenth case hæmoglobinuria was present three days be-

fore death. The destruction of red globules causing this condition could be easily demonstrated by examining blood taken from an incision through the skin. In severe cases, on the day before death, the number of red globules had fallen to about one million in a cubic millimeter of blood, the normal being about five and a half million. In one case, now recovered, the corpuscles were reduced in number nearly one-half several days before the temperature fell to normal, and a week later the number had not yet risen to three million. This enormous loss of red globules gave the blood an exceedingly thin, watery appearance. At the autopsy, besides the condition of the blood as noted, it was found to coagulate rapidly and form clots of unusual firmness.

The following description of the most obvious lesions will apply with more or less emphasis to all ten cases. The spleen is enlarged to several times its natural size. When incised, the tense capsule retracts and discloses a dark red, more or less disorganized pulp, occasionally running out as a semi-liquid mass. This engorgement is due chiefly to the presence of an enormous number of red globules. The liver is the seat of considerable disturbance. Its color is a yellowish brown. The parenchyma is deeply bile-stained, and when examined under the microscope the finest bile canaliculi are found plugged in many cases with consistent, cylindrical masses of bile. We have, in fact, a complete pathological injection of the intra-lobular biliary system. The bile in the gall-bladder is usually so thick that it scarcely flows. This is due to the presence of a large amount of solids in the form of minute yellow flakes. The kidneys in some cases are suffused with the color of hæmoglobin, and the connective tissue around them distended with reddish serum. Lesions of the fourth stomach were either absent or else did not differ in degree from those observed in healthy cattle. In one case there were superficial ulcers in the fourth stomach. A more or less extensive ecchymosis of the duodenum is occasionally met with, more rarely in the cæcum. In none of the eleven cases was there any appreciable jaundice. The condition of those organs engaged in the destruction of red corpuscles, such as the liver and spleen, as well as the large quantity of blood pigment in the urine, led to the inference that the disease was primarily due to an enormous destruction of red corpuscles. Moreover, the absence of bacteria pointed to parasites in the blood different from these organisms.

When the investigations of the past summer were begun particular attention was paid to the blood. This led at once to the discovery of peculiar bodies within the red corpuscles. In fresh spleen pulp they are visible as round or oval, nearly colorless, spots, from one-half to 2 micromillimeters ($\frac{1}{50000}$ to $\frac{1}{12000}$ inch) in diameter on the disk of the red corpuscles, and always somewhat excentrically placed. Careful focusing leaves no doubt that they represent bodies within the corpuscles. There may be but one, quite commonly two, and very rarely three or four, in the same corpuscle. In organs kept in the cold for nearly two weeks they were still visible, but faintly, owing to the diffusion of the hæmoglobin around and perhaps into them. When cover-glass preparations are dried, heated, and stained with the ordinary aniline dyes, these intra-globular bodies stain as readily as nuclei and bacteria, and hold the stain with a similar tenacity. The smallest forms then appear like deeply-stained cocci, about one-half to 1 micromillimeter ($\frac{1}{50000}$ to $\frac{1}{25000}$ inch) in diameter, situated within the unstained circle of the corpuscle. Occasion-

ally the bodies are nearer 2 micromillimeters ($\frac{1}{12000}$ inch) in diameter, and then the staining may be less intense. Besides the spherical forms ovoid forms are not uncommon. These usually occur in pairs within the red corpuscle. A still rarer pear-shaped form is encountered in stained preparations of the blood. It is rounded at one pole, while the other is pointed and sometimes drawn out as a short filament. These forms quite invariably occurred in pairs, a corpuscle being occupied by a single pair. I am very much inclined to consider the pair as the result of a division of the single body within the globule. One other abnormal form found in the blood deserves mention. When dried cover-glass preparations are stained in Loeffler's alkaline methylene-blue a few red corpuscles appear as if their surfaces had been dusted over with minute specks of coloring matter. Whether they are due to the anæmia or whether they belong to the cycle of the parasite remains to be determined experimentally. As to the relative number of intra-globular bodies in the different organs of the same animal, the eleven cases which have come under observation afford some noteworthy facts. As a rule there are very few in the circulating blood, whether taken from incisions through the skin before or during the death agony or from the heart after death. There are exceptions to this rule, however. In one case they were readily detected in the blood from a skin incision one day before the animal was killed. Blood from the right ventricle showed an enormous number of these bodies in pairs within the red globules. As a rule, then, the circulating blood contains comparatively few parasites. They are filtered out by the spleen and liver. They may be numerous in one or both of these organs, and rare in blood from the right ventricle. They are somewhat more numerous in the spleen than in the liver. This estimate may, however, be erroneous, owing to the larger number of corpuscles in the spleen pulp.

There are also a few facts at hand concerning the relative number of parasites in different animals at the time of death. In perhaps one-half of the cases they were so few in number in the spleen that they might have easily escaped the attention of an observer searching for bacteria. In four out of eleven cases the organisms were very numerous in spleen and liver, and could not well be overlooked. They could be seen in a thin layer of fresh spleen pulp, with a dry apochromatic objective giving a magnification not more than 250 diameters. In one case they were so few in number even in the spleen pulp that a number of fields had to be scanned before any were detected. In this case the spleen was completely disintegrated. The urine, containing much hæmoglobin several days before death, was found of nearly normal color at the autopsy. The animal had evidently overpowered the parasites, but died from the havoc caused by them.

The second outbreak of the disease in October was fatal to but two animals. Of the remainder exposed only a few showed signs of disease. When, however, the blood of all the exposed was examined it was found that most of them were affected. The number of blood corpuscles had fallen to one-third or one-fourth of the normal; in one case to one seventh. They presented all the appearances characteristic of Texas fever blood.

The nature of the bodies found within the red corpuscles can only remain a subject of conjecture at the present stage of the investigations, and it is evidently useless to present the various theories which we might hold in regard to them.

The work of the summer, besides having gotten under way experiments which are destined to clear up the external characters of the disease so mysterious and so unlike other known diseases of man or animals, has elucidated a few very important facts concerning the nature and diagnosis of the disease.

(1) It has demonstrated that Texas fever is essentially a blood disease, and that all the symptoms and lesions are referable to the destruction of red corpuscles. The disease may appear in two forms, an acute fatal and a mild form. The former, occurring in summer, is characterized by the sudden enormous destruction of corpuscles. The waste products resulting from this destruction clog up the liver, disintegrate the spleen, and lastly pass out unchanged through the kidneys, producing the "red water" or hæmoglobinuria. The mild form, occurring late in the season, is characterized by a moderate destruction of red corpuscles. The waste products are readily transformed without deranging the vital organs. The resulting anæmia gradually disappears as cold weather sets in.

(2) It has shown that this destruction of corpuscles is very probably due not to bacteria but to micro-organisms which are found within the red corpuscles and whose life history is still to be worked out.

(3) It will enable any microscopist to demonstrate either *during the life* of the diseased animal, by examining the blood and counting the red corpuscles, or immediately after death by examining microscopically the spleen or liver tissue, whether the disease is Texas fever or not.

(4) It has shown that animals may be suffering from Texas fever without manifesting any definite symptoms, and that the animal may erroneously be regarded well unless the blood be examined.

ANTHRAX.

In June, 1889, Dr. Wray, an inspector of the Bureau, brought from Mississippi two sealed tubes, one containing blood from a mule which had a large swelling on the under surface of the neck, the other containing blood from a cow which had succumbed to some disease. The blood in the tube from the mule had a very disagreeable odor and contained three different bacteria. They were not pathogenic, and were probably contaminations.

The tube of cow's blood contained but one form, a bacillus. Its peculiar colonies on gelatine and agar, as well as its beautiful flocculent growth in the bottom of tubes of bouillon and its spore-formation, indicated at once that it was the true anthrax bacillus. Inoculation of two mice confirmed the diagnosis. One died within twenty-four hours with no marked internal or external changes. The spleen contained an enormous number of bacilli, the liver and blood less. The second mouse died in forty-eight hours, afflicted with an extensive subcutaneous œdema. The internal organs contained the anthrax bacilli in considerable numbers. Further investigations with this organism were not attempted, owing to the absence of facilities for conducting experiments with material dangerous to man.

The observations definitely prove the existence of anthrax in the Lower Mississippi Valley.

GLANDERS.

During the year the investigations in glanders were continued partly for the purpose of enlarging the work done in 1888 on the

same subject, already published in the report for that year, and partly to confirm the diagnosis made by the veterinarian (Dr. F. L. Kilborne) on suspected horses in the District of Columbia. The investigations confirm those of last year without bringing to light any facts that deserve mention in this place.

INTERSTITIAL PNEUMONIA IN CATTLE.

During the past three years, three lungs came to the laboratory in which only the pleura and the interlobular tissue were affected. The parenchyma was normal, or at most slightly œdematous. The interlobular tissue was represented by firm whitish bands from one-eighth to one-half an inch in diameter. In these bands were cavities varying from the size of a pin's head to a large pea and communicating with one another. Some were empty, some filled with a mold of material similar to that of the bands themselves; some contained a rather thick, semi-liquid, grayish mass. The exudate forming these honeycombed bands was partly cellular, partly fibrinous, in character. The disease of the pleura was the same as that affecting the interlobular tissue.

Of the history of these cases nothing definite could be obtained. The importance of determining whether there are types of lung disease closely simulating the lesions of pleuro-pneumonia, as these did, led to bacteriological investigations of these three cases. In all a micrococcus was found (in the first case none other in fact) in the interlobular exudate, which closely resembled the swine-plague germ. The general distribution of this germ throughout the exudate in different parts of the lung leads to the inference that it was the cause of the disease. Its pathogenic properties confirm this view. Subcutaneous inoculation destroys rabbits in less than twenty-four hours.

Injection of bouillon cultures through the chest wall into the lungs of two calves produced a septicæmia fatal in less than twenty-four hours.

The bacteria can not be distinguished from those of swine plague, excepting, perhaps, in one particular. In bouillon cultures not more than twenty-four hours old a distinct capsule may be seen around each germ when the culture is examined fresh in a hanging drop. The bacteria on the edge of the drop do not touch one another, and the capsules can be distinctly made out as the cause of this separation. In subsequent cultures they are not to be seen.

The significance of this disease and the bacteria associated with it, as well as its relation to pleuro-pneumonia, can not be interpreted with the aid of the meager material and the incomplete histories of the cases examined. The lesions suggest pleuro-pneumonia, while the presence of specific bacteria separates this disease from pleuro-pneumonia in which no bacteria have hitherto been found. It is not improbable that the isolated and rare occurrence of this affection constitutes it a disease of septic origin. The localization of the disease points to an infection from the blood and lymph channels and not from the air. The bacteriological observations briefly sketched will enable us in the future to differentiate this lung disease from pleuro-pneumonia, provided the disease is at its height when the animal is killed and the lung perfectly fresh when presented for examination.

TUBERCULOSIS IN DOMESTICATED ANIMALS.*

Tuberculosis is an infectious disease of man and the lower animals, the term infectious being applied to all diseases due to the presence of micro-organisms. It is moreover an infectious disease of the contagious type; that is, it is communicable from one person or animal to another. The infectious nature of tuberculosis was, however, not fully recognized until demonstrated by Villemin in 1864. He showed that the inoculation of the cheesy matter found in the tubercles was followed by the appearance of similer tubercles in the inoculated animals, in other words, by the disease itself. Perhaps the most important advance in our knowledge of the disease as a whole was the discovery of the *bacillus tuberculosis* by R. Koch, in 1882. Before this time there existed much difference of opinion concerning the identity or non-identity of tuberculosis in man and in the lower animals. The discovery of the same bacillus in the various forms of the disease in man and animals practically settled this question, and it is now generally believed that tuberculosis in man and in the domesticated animals is the varied expression of the same disease.

The wide distribution of the disease among cattle, as well as the large percentage of animals diseased, has led to a great activity in the study of the disease in all its bearings. The most important questions now before the public are: (1) How can the disease be restricted among the domesticated animals? (2) Are human beings infected by consuming the flesh and milk of tuberculous animals, and if so, to what extent? Before briefly discussing these two practical questions a few preliminary subjects demand our attention.

THE GENERAL CHARACTER OF THE DISEASE.

As its name implies, the disease is characterized by the formation, in different organs of the body, of certain nodules or tubercles of varying size. They consist of cellular elements crowded together, and owing to the absence of blood vessels they soon die for want of nutriment, and are converted into cheesy masses often impregnated with calcareous particles. The increase in size of these tubercles crowding upon and destroying the surrounding tissue of the internal organs, and the subsequent breaking down into cheesy matter, may be considered the chief injury inflicted upon the body by the disease. The tubercles are not limited to any particular region or organ of the body. Though they seem to show predilection for certain organs, which predilection varies with the species of animals affected, they may appear in almost any organ. Often beginning in some one locality, the tubercles there formed enlarge, become cheesy, and the virus lodged in this cheesy substance may be carried into other regions of the body. Sometimes the tubercle discharges the cheesy matter into a blood-vessel. It becomes disseminated throughout the body by the circulating blood, and wherever it lodges a new crop of tubercles appears in course of time.

The infection residing in the tubercle is due to a bacillus discovered by R. Koch in 1882, and demonstrated by him as the specific cause of the disease. This bacillus is a slender rod-shaped body, from $\frac{1}{17000}$ to

*Consult also Dr. James Law's report on tuberculosis as discussed at the International Veterinary Congress held at Brussels in 1883. First annual report of the Bureau of Animal Industry (1884), p. 350–366.

$\frac{1}{7000}$ of an inch long, differing in certain respects from all other bacilli thus far discovered. It is found within the tubercle in greatly varying numbers, and is detected by special microscopical and bacteriological methods. Within the tubercle the bacilli form certain resistant bodies called spores. These enable the organism to resist various destructive agents, such as heat and cold, moisture, dryness, and putrefaction for a variable length of time. Koch has demonstrated, and after him many others, that the bacillus found in the various forms of tubercular disease in man and animals may be cultivated on blood serum at the body temperature. The bacilli grown outside of the body from different animals present the same appearance, and when animals are inoculated with them the same disease is produced by all. This disease has all the characters of the original disease from which the tubercle bacilli were obtained. The proof is thus satisfactory that this particular bacillus causes tuberculosis in man and animal.

THE DISEASE AS MANIFESTED IN MAN AND DOMESTICATED ANIMALS.

The disease in *man* presents various forms, the most common being tuberculosis of the lungs, known as phthisis or consumption. It may appear in various other organs. The condition known as scrofula in children has been demonstrated to be a form of tuberculosis involving the lymphatic glands. In the very young tuberculosis of the mesenteric glands is not uncommon, and it has been ascribed to infected milk from tuberculous cows. The tubercle bacilli are coughed up from the diseased lungs in large numbers, in the expectoration or so-called sputum, especially in the advanced stage of phthisis. This sputum is thus endowed with highly infectious characters, and is to-day considered by many authorities as the chief agent in the spread of the disease. Statistics seem to show that at least 10 per cent of mankind perish from tuberculosis. Monkeys living in the confinement of zoölogical gardens usually die of tubercular lung disease resembling the human disease very closely.

Tuberculosis in the horse is a rare disease, and the cases on record are very few. It is not unlikely that owing to the similarity of tubercular and glanderous lesions it may have been occasionally mistaken for glanders. The disease is said to resemble, in a general way, that in cattle. It may appear in the lungs, on the serous membranes (*i. e.*, the smooth lining of the ribs, the covering of the lungs, and the smooth lining of the abdominal cavity), and in other organs. In the lungs the tubercles vary in size from a millet-seed to a walnut, not infrequently with cheesy contents. The bronchial glands (those clustered on the trachea and its two branches) may reach the size of a fist. Tubercles also may appear in the liver, spleen, and bones.

Trasbot* reports two cases, one examined in 1878, the other in 1884. The disease was very slow and insidious in its development, accompanied towards the end by great emaciation, cough, and irregular fever. At the autopsy large numbers of nodules and tubercles were found disseminated through the spleen and the lungs. These organs were very much enlarged. The tubercle bacilli were found in the diseased organs.

Nocard,† in reporting a case of tuberculosis in the horse, refers to the fact that he had mistaken this disease for *Lymphandénie pul-*

* Annales vétérinaires, 1884, p. 922.

† Recueil de Médicine vétérinaire, annexe, 1885, p. 45.

monaire. He referred to at least seven cases of this disease reported between 1878 and 1882. In examining alcoholic preparations of these cases he was able to demonstrate the tubercle bacillus in every case. The differences between tuberculosis of the horse and that of other animals in part explained the error into which he had fallen. The neoplasm or tubercle in the horse is homogeneous throughout; there is no caseation and hence no formation of cavities. The ordinary signs of lung disease are absent, and there is no discharge from the nose. The cases usually occur isolated, although the animals come from large stables. The lesions seem to indicate that the disease begins in the abdominal organs and that the lungs are invaded later.

During the past few years more cases have been reported, and inasmuch as the diagnosis is not made at present without examining the tuberculous products for the presence of tubercle bacilli, we may be certain that tuberculosis is after all not so uncommon in the horse. Schortmann* observed a case in which the disease apparently began as a pleurisy. The temperature and pulse fluctuated more or less; there was considerable difficulty in breathing and gradual wasting away. After the disease had lasted for a little over a month the animal died. At the autopsy the lymphatic glands of the abdomen (mesenteric and retro-peritoneal) and the lung glands (bronchial) were found very much enlarged and caseous. There were tubercles on the pleura and peritoneum and a large number in the lungs. It was supposed that in this case the virus entered the system both from the air passages and the intestines. Schindelka † observed a case in which the disease began with a bronchitis. Among the symptoms noticed were difficulty of breathing, cough, fluctuating temperature, loss of appetite, and great weakness. The passage of large quantities of urine (polyuria), to which Nocard has called attention in tuberculosis of the horse, was also observed in this case. At the autopsy, besides the plastic pleuritis, the lungs were found studded with small tubercles. In this case the tubercle bacilli must have entered the system with the inspired air, so frequently the starting point in human tuberculosis.

A. Peters ‡ reports a case of tuberculosis of the lungs in a pet dog which had acquired the filthy habit of eating the sputum coughed up by a consumptive member of the family. The dog was shot, and on examination the lungs were found diseased. The intestines were not examined, although this would have been very desirable. It is supposed by some that infection in dogs is not infrequently due to the consumption of human sputum. In one case three dogs belonging to a consumptive patient died of tuberculosis.

Nocard§ found tuberculosis in a cat nine months old which did not eat raw meat, but was fed upon milk every day. The disease was limited to the abdominal organs, the intestines, mesenteric glands, spleen, and liver. Subsequently he met with another case. Bollinger found two cases of generalized (miliary) tuberculosis in the cat.

Tuberculosis among sheep is very rare. The few cases described may have been confounded with the tubercular diseases in sheep due to worms found in the lungs and large intestines. Among goats the disease has been determined by Lydtin and others, although with

* Deutsche Ztschr. f. Thiermed. XV (1889), 339.
† Oesterr. Ztschr. f. wiss. Veterinärkunde, II (1888), 69.
‡ The Veterinary Journal, XVIII, 1889, p. 394.
§ Recueil de Méd. Vét. annexe, 1888, 537; *ibid.*, 1889, 66.

them, too, tuberculosis is infrequent. Lydtin* found the disease in three cases. The goats mingled with a herd of milch cows, and it was supposed that the disease was transmitted from the cows to the goats. The diseased goats became emaciated, the mucous membranes pale, a cough appeared, and the milk was reduced in quantity, which necessitated slaughter. The disease was limited to the lungs, in which were numerous tubercles. These were also found on the pleura covering the lungs and the ribs.

Tuberculosis in swine is certainly very rare in this country. The writer has not seen any lesions similar to those described as occurring in European swine in upwards of a thousand cases examined. It is probable that the manner in which pigs are fed and the source of the food may account for this absence of tuberculosis in American swine. At the same time much of what has been described as tuberculosis may be in reality the result of lesions caused by swine plague and hog cholera, both producing caseous changes in the lungs and large intestines respectively.

Swine may be infected by running with tuberculous cows and by consuming their tuberculous milk. As the disease is said to be most common among pigs less than a year old, the disease may also be induced in sucking pigs by the milk of tuberculous sows. Besides the caseous changes in lungs and intestines, upon the nature of which we may entertain some well-grounded doubts, true tubercles may appear on the pleura and peritoneum. In generalized tuberculosis tubercles are found in the spleen, kidneys, testicles, and lymphatic glands. As regards the frequency of tuberculosis among swine statistics are not very abundant. In Baden .02 per cent of all swine slaughtered within a period of eight years were found tuberculous. In Berlin, of all swine slaughtered in 1883 and 1884, .5 to .9 per cent were similarly diseased.

Among wild animals confined in menageries, such as lions, tigers, etc., tuberculosis is not uncommon. Even the lower vertebrates are not spared. Sibley† recently described tuberculosis in a snake (*Tropidonotus matrix*). It had been brought from Italy to a zoölogical garden, where it died after a confinement of several months. Scattered through the body were nodules of varying size containing tubercle bacilli.

Fowls and other birds have been found affected with tuberculosis; The reports of outbreaks seem to indicate that the disease is due to the introduction of the virus into the body with the food. The tubercular lesions are limited to the intestines and the liver, or they may involve the ganglia and the ovary. Johne‡ describes the appearance of tuberculosis among fowls fed by a consumptive woman. The sputum of this person was usually thrown upon the manure pile where the fowls had access to it. The symptoms were great emaciation and debility. The stomach and liver were tuberculous, the other organs rarely so. Examination of the diseased livers revealed the presence of great numbers of tubercle bacilli.

Nocard§ also reported a very instructive case of tuberculosis among poultry, due to feeding upon the expectoration of a phthisical man. The latter had charge of the poultry yard, as his feebleness

*Arch. f. wiss. u. prakt. Thierheilkunde, X (1884), 36.
†Arch. f. path. Anat., CXVI (1889), 104; Journ. Comp. Med. and Surg., 1889, 318.
‡Deutsche Ztschr. f. Thiermed., X (84), 155.
§Recueil de Méd. Vét. (1885) annexe, 93.

did not permit any hard work. Three months after he began to do this work the first fowl died, and in all about ten succumbed. An examination showed tuberculosis of the abdominal organs. The keeper himself had noticed the avidity with which they ate the sputum.

Subsequently Nocard* found the disease among the fowls of a slaughter-house, which were being fed with the diseased organs of cattle which could not be sold in the market.

Of six hundred hens examined Zürn found sixty-two affected with tuberculosis. Besides hens, turkeys, pheasants, and partridges are occasionally found tuberculous. Sibley† found the same disease in an owl which had been brought from Africa and died after a confinement of several months.

Whether the disease is ever conveyed from one bird to another is highly problematical. The instances cited above, and the locality of the disease (intestines and liver), are quite sufficient to prove that in birds the disease is caused by eating material containing tubercle bacilli, and that this material is found in our surroundings, and comes from man or the higher animals.

TUBERCULOSIS IN CATTLE.

This is unquestionably the most important phase of the subject. The disease in its various manifestations has been known for many centuries, and legislative enactments having reference to the destruction of affected animals and forbidding the use of the flesh thereof date far back into the Middle Ages. The opinions entertained regarding the nature and the cause of the malady varied much in different periods and very markedly influenced the laws and regulations in vogue. Thus in the sixteenth century the disease was considered identical with syphilis in man. In consequence of this belief very stringent laws were enacted, which made the destruction of tuberculous cattle compulsory. In the eighteenth century this erroneous conception of the nature of the disease was abandoned and all restrictions against the use of meat were removed. Since that time, however, the tide of opinion has again turned against this disease. The particular opinion held at any time concerning the nature of this disease usually furnished for it a name. There are in most languages, therefore, a large number of peculiar terms which have accumulated, but which do not concern us here.

The cause of the disease in cattle, as perhaps in all other species, may be considered as twofold in its nature—the tubercle bacillus and certain predisposing causes which prepare the way for it. The ways in which the tubercle bacillus may be introduced into the body are various. The germs may enter the lungs by inhalation or they may pass into the body with the food. The frequency with which tuberculosis is found localized in the lungs of cattle indicates that they are in many instances the primary seat of the disease. The milk of diseased cows is a source of infection for sucking calves. Calves may be born tuberculous. In such cases the tubercle bacillus passes from the mother to the fœtus during gestation. Tuberculosis has even been found in fœtuses during the early months of fœtal life. It has likewise been maintained that tuberculosis may be communicated from one animal to another during coition. It is more difficult to understand how the tubercle bacilli are transmitted from one

*Compt. rend. Soc. Biologie (1885), 601.
†*Loc. cit.*

animal to another in stables and on pastures, since there is little if any discharge of bacilli, such as occurs so abundantly in human phthisis from the diseased lungs. At the same time it has been frequently noticed that the introduction of a tuberculous cow was followed by the infection of other animals in the same stable.

The causes which may be considered as predisposing are varied in character. Unsanitary conditions, such as overcrowding in poorly ventilated and poorly lighted stables, and feeding of food which is not nutritious, are not insignificant in this respect. Conditions which injure the lungs are favorable to the development of tuberculosis. Among these are the inhalation of dust and smoke, and all conditions which may induce chronic inflammation of the bronchial tubes, with abundant secretion and subsequent pneumonia (broncho-pneumonia). Among the other causes which are said to favor tuberculosis are the overproduction of milk, too many births, the improvement of stock by continual inbreeding and the consequent inheritance of certain constitutional characters of a debilitating nature.

These predisposing causes determine to a great extent the occurrence of the disease. Thus animals living in the lowlands are more subject to this disease than the more robust races living in elevated mountainous regions. Similarly, animals on the open pasture are less susceptible than stabled animals. This may, however, be due to concentration of virus in the stables. The disease is likewise far more common in cows than in oxen, owing to the strain which bringing forth young and milking subject the females. Animals subjected to special feeding, such as dairy cows, cows in distilleries, breweries, and other manufactories having waste available as food, are the most susceptible to the disease. The distribution of tuberculosis in general is also governed by climate and other meteorological factors, as well as by the amount of infection. As regards the latter it is well known that the greatest number of cases occur in the immediate environment of cities where virus may be regarded most abundant. The disease is said to be rare in northern countries, such as in the north of Sweden and Norway, on the steppes among wild herds, on islands such as Sicily and Iceland.

Statistics indicate that the percentage of cattle attacked varies greatly. From tables compiled by Göring for Bavaria,* we learn that in 1877 and 1878 the number of tuberculous cattle was .16 per cent., or about 16 head in every 10,000. The disease was distributed in accordance with age and sex as follows:

	Per cent.
In 1,000 steers	5.84
In 1,000 oxen	1.39
In 1,000 cows	2.50
In 1,000 young animals	.35
In 1,000 calves	.09

According to age, the disease had attacked 64 under one year, or 1.31 per cent. of all those diseased; 328 from one to three years old, or 10.81 per cent. of all those diseased; 1,846 from three to six years old, or 37.80 per cent. of all those diseased; 3,445 over six years old, or 50.07 per cent. of all those diseased.

Statistics of tuberculosis among cattle slaughtered in the larger cities of Germany, collected during the years 1879 and 1880, give a percentage ranging from 1.25 to 3.4 per cent.

In Baden, where meat inspection is regularly practiced in all the communities, and where quarterly reports are handed in to the dis-

*Lydtin, Archiv. f. wiss. u. prakt. Thierheilkunde, x (1884), 28.

trict veterinarians, it was found that there were but 8 tuberculous animals in 1,000, and in those communities where chiefly cows were slaughtered the number rose to 15 in 1,000.

Among the more recent statistics carefully compiled at the places of slaughter, the following may find a place here. At Göttingen, Germany, out of 1,784 head of cattle slaughtered from April, 1886, to April, 1887, 18, or about 1 per cent., were tuberculous. Of 5,981 calves only one was tuberculous. At Munich, during 1886, 2.75 per cent. of all slaughtered cattle were tuberculous. At Augsburg, during the ten years beginning with 1877, 2.91 per cent. were found tuberculous. In Dresden, during 1886, 1.6 per cent. of the adult cattle and .15 per cent. of the calves were affected with this disease. At Zittau one herd contained 26 per cent. of tuberculous animals. In Nürnberg, during 1886, 33 out of 11,255 oxen, or about .3 per cent., were tuberculous; of 1,621 steers 2 were diseased; of 1,150 cows, 26, or about 2 per cent., were diseased. In France, according to figures given by Arloing, there are, on the average, 5 animals tuberculous in every 1,000, or about one-half per cent. In the various cities of France the figures obtained by inspectors at the abattoirs vary from 1.43 to 14.5 per 1,000, the observation extending over a period of one to five years. In Belgium, according to Van Hertsen, the rate is 4 per cent. In Holland it varies from 4 to 19.6 per 1,000. In England, according to Cope, it varies from 1 to 26 per cent., according to the locality.* At Copenhagen, according to Bang, during 1888 the rate was 6 per cent.; for cows alone it rose to 16 per cent. In the Argentine Republic, according to Even, tuberculosis seems to attack the recently imported improved stock (10 to 15 per cent.), while it is comparatively rare among natives (one-half per cent.).† In Algiers, according to Texier,‡ the disease is very rare; only 7 cases (5 old cows, 1 old oxen, 1 sucking calf), or about 1 in 10,000, were found in 72,623 animals slaughtered in 1884 and 1886, inclusive.

In our own country cattle slaughtered at Baltimore under the auspices of the Bureau of Animal Industry were found tuberculous to the extent of from 2½ to 3½ per cent.

It is evident that statistics obtained from slaughtered cattle must necessarily vary greatly. The territory from which cattle are obtained and the tendency to send unthrifty animals to the abattoir may artificially raise the percentage of tuberculous cattle, especially in our large cities. It is in the vicinity of large communities where the concentration of cows for dairy purposes brings into play the two factors necessary for the development of the disease, importation and concentration of the virus, and an increased predisposition, owing to an unsanitary environment and exhaustion of vitality, that we should expect to find the highest percentage of the disease.

CHARACTERS OF THE LESIONS IN BOVINE TUBERCULOSIS AND THEIR DISTRIBUTION IN THE VARIOUS ORGANS OF THE BODY.

The changes which are found in tuberculosis are limited in a large number of cases to the lungs and the serous membranes § of the thorax and abdomen. Pathologists have therefore called the lung disease

*Veterinary Journal, 1889, 398.

†Recueil de Méd. Vét., 1889, 598.

‡Études sur la tuberculose, 1887, I, 339.

§These comprise the smooth, very delicate, glistening lining of the large body cavities. In the thorax the serous membrane (pleura) covers the ribs and diaphragm as well as the whole lung surface. In the abdomen a similar membrane (peritoneum) lines the interior of the cavity and covers the bowels, liver, spleen, etc.

tuberculosis, the disease of the serous membranes "pearly disease." Statistics have shown that in about one-half the cases both lungs and serous membranes are diseased, in one-third only the lungs, and in one-fifth only the serous membranes. At the same time the lymphatic glands near the diseased organs are usually involved. Other organs, such as the liver, not infrequently contain tubercles. Though the disease may remain restricted to a single organ, it now and then is found generalized, affecting all organs of the body.

In the lungs the changes observed vary according to the age and intensity of the disease process. They usually begin with the appearance of miliary tubercles. These are minute bodies not larger than a pin's head, firm, yellowish white, opaque. They may appear in large numbers on the surface of the lungs or within the lung tissue. Later a change goes on within these tubercles by which the contents become cheesy and partly calcified. When these tubercles are sufficiently numerous to become confluent, larger masses or nodules are formed which may undergo the same retrogressive changes of caseation and calcification. In addition to the tubercles in the lung tissue certain other changes take place. There is usually present bronchitis with abundant catarrhal secretion. This plugs up the smaller air tubes, and the lung tissue supplied by these tubes with air collapses. Subsequently it becomes filled up with yellowish, cheesy matter, which greatly distends the small air tubes and air vesicles (broncho-pneumonia). The connective tissue between the lung lobules, around the tubercles and around the air tubes, becomes thickened and indurated. In the larynx and the bronchi, tubercles may vegetate upon the mucous membrane, and ulcers may result from their breaking down. The inflammatory irritation which the growth of the tubercles on the surface of the lungs arouses gives rise to adhesion of the lungs to the ribs and diaphragm. This adhesion is sometimes so firm and extensive that the lungs appear grown to the chest wall. When, therefore, the lungs in advanced stages of the disease are cut open, we observe large yellowish masses from one-quarter to three-quarters of an inch in diameter, of a very firm texture, in which calcified, gritty particles are embedded and which are surrounded by very firm bands of connective tissue. The neighboring lung tissue, when collapsed and involved in broncho-pneumonia, has the color and consistency of pale-red flesh. The air tubes, large and small, stand out prominently on the cut surface. They are distended with a pasty, yellowish, cheesy mass, surrounded and enveloped in thick mucus, and their walls greatly thickened. The larger bronchi may be sacculated, owing to the distension produced by the cheesy contents.

The disease usually involves the bronchial glands which are situated on the trachea and bronchial tubes at the bifurcation. The changes in the glands are the same as those going on in the lung tissue, and they frequently reach an enormous size.

The tubercle formation on the serous membranes, which may go on at the same time with the lung disease or independent of it, has been called "pearly disease" on account of the peculiar appearance of the tubercles. These begin as very minute grayish nodules, which give the originally smooth, lustrous membrane a roughened appearance. These minute tubercles enlarge, become confluent, and project above the surface of the membrane as wart-like masses reaching the size of a pea. These may be closely sprinkled over the membrane and be situated on the lung surfaces, the ribs, the diaphragm, in the abdominal cavity on the walls, and on the omentum

(caul). But they may grow much larger and attain the size of hen's eggs. The manner in which the smaller tubercles group themselves into a mass gives the latter a variety of shapes. They likewise undergo retrogressive changes. The center partly softens, partly calcifies into a grayish mortar-like mass, and when cut into they feel gritty. Associated with the formation of tubercles on the pleura those glands situated back of the lungs (posterior mediastinal) become greatly enlarged and the center cheesy. They may compress the œsophagus and interfere with swallowing. The size attained by these tumors and new growths is well illustrated by the fact that taken together they not infrequently weigh from 60 to 80 pounds. The bronchial glands, which in the healthy state are not as large as horse-chestnuts, have been found to attain a weight of over 10 pounds.

In the abdominal cavity tubercles may appear in the liver. Here they vary in size from a pea to a hen's egg, and usually appear on the surface, projecting above it and dipping down into the liver tissue. The smaller ones are firm, smooth, or lobulated; yellowish, gritty on section; the larger may be softened into a yellowish cheesy mass. The organ may become enormously enlarged and very heavy. Similar tubercles may appear in the spleen, the kidneys, the uterus, and the testicles. The ovaries are occasionally greatly enlarged by tubercular processes.

The lymphatic glands may enlarge on account of tubercular infiltration. This is true of the glands within the large cavities, as well as those which can be felt under the skin, such as the glands found at the joints of the limbs, under the jaws, along the neck, etc. The glands of the thorax have already been mentioned in this respect. Those in the abdomen, such as the mesenteric glands, those near the liver, spleen, and kidneys may likewise become diseased.

Tubercular affection of the intestines seems to be quite rare, although ulcers of the large intestine have been observed. Nodules may also form under the serous covering of the intestines.

The brain and spinal cord are occasionally found tuberculous. Of forty cases, Semmer found tuberculosis of the brain in four. It is not improbable that, owing to the infrequency of exposing the brain and spinal cord, tuberculosis may have escaped the attention of pathologists, and it may be that it is not so uncommon as is generally supposed. The tubercles occur on the membranes of the brain as well as in the substance of the brain itself. They project into the ventricles as masses varying in size from a pin's head to a hen's egg. They finally lead to various inflammatory changes Johne has observed numerous small tubercles on the membranes of the spinal cord.

Very rarely tuberculous lesions have been observed in the bones and muscles of the body.

Tubercular disease of the udder in cows has received considerable attention of late from sanitarians, owing to the infection of the milk with the virus of tuberculosis. According to those who have given this subject special attention, the udder becomes swollen uniformly and quite firm. This swelling, which is painless, frequently attacks but one quarter, more rarely two, these being usually the hind quarters. The larger milk ducts contain yellowish cheesy particles in which are many tubercle bacilli. Later on larger nodules can be felt within the udder, which undergo the various changes to which tubercles are subject. The udder may grow very hard to the touch and become very large, weighing in some cases up to 40 pounds. The milk, at first normal, becomes thin and watery after a month or so, and is mixed with flakes and numerous tubercle bacilli.

As regards the frequency of the tubercular processes in the different organs, the following carefully compiled statistics of the disease in Bavaria and Baden may serve as a guide:

	Per cent.
Bavaria:	
Tuberculosis of lungs and serous membranes	41
Tuberculosis of lungs alone	33
Tuberculosis of serous membranes alone (pearly disease)	17
Tuberculosis of other organs	8
Baden:	
Tuberculosis of lungs alone	21
Tuberculosis of serous membranes alone	28
Both combined	39
Generalized tuberculosis	9
Tuberculosis of the sexual organs alone	3

SYMPTOMS OF TUBERCULOSIS IN CATTLE.

The beginning of the disease usually passes unnoticed, inasmuch as it is very slow and insidious and rarely accompanied by fever. When the lungs are involved a dull, short cough is noticed, which may later on become prolonged, convulsive, and very troublesome to the animal. The cough is more frequent in the morning after movement and drinking. The breathing varies; only when much of the lung tissue is diseased is it labored and accompanied by active movements of the chest and nostrils. Discharge from the nose is rare or absent. At times, however, when the tubercles have broken down and formed in the lungs cavities containing cheesy masses, or when the air tubes have become filled with cheesy and mucous masses, coughing will dislodge these and cause their discharge. In advanced stages the breath may have a disagreeable odor. Pressure on the chest wall may give rise to pain.

The general effect on the body is at first slight. In fact, animals may remain in good flesh for a considerable time. Invariably, as the disease progresses, loss of flesh and appetite and paleness of the mucous membranes become manifest. These are accompanied by a gradual diminution of the milk secretion. The debilitated condition of the animal is also manifested by a staring coat and a tough, dry, harsh skin (hide-bound). Digestive disturbances are indicated by tympanites or distension of the rumen by gas, colic and diarrhea alternating with constipation. The animal generally dies from exhaustion after a period of sickness which may last months and years.

Tuberculosis in the abdominal organs is often signalized by abortion and by abnormal sexual manifestations. When the brain is involved the disease may cause convulsions, unconsciousness, paralysis, as well as peculiar movements in a circle, oblique position of the head, etc. Lydtin quotes the following description of the disease as taken from a Swiss sanitary order:

A dry, short, interrupted, hoarse cough, which the sick animals manifest especially in the morning at feeding time, still more after somewhat violent exertion. At first these animals may be full-blooded and lay on a considerable amount of fat when well fed. As the disease progresses they grow thin and show more and more those appearances which indicate diseased nutrition, such as a staring, lusterless, dishevelled coat; dirty, tense skin, which appears very pale in those regions free from hair. The temperature of the skin is below normal. The loss of fat causes sinking of the eyes in their sockets. They appear swimming in water and their expression is weak. The cough is more frequent, but never or very rarely accompanied with discharge. The body continues to emaciate even with plenty of food and a good appetite, so that the quantity of milk is small. At times, in the early stages of the disease, still more in the later stages, the diseased animals manifest considerable tenderness when pressure is applied to the front or the sides of the chest, by coughing, moaning, etc. Often all symptoms are wanting in spite of the existence of the disease.

Lydtin also quotes at length a description of the abnormal sexual desire occasionally observed among cows when affected with this disease.

A disease so varied in its attack upon the different organs of the body and in the extent of the disease process must necessarily lead to mistakes of diagnosis. It has been confounded with the later stages of pleuro-pneumonia, with parasitic diseases of the brain, the lungs, and intestines. A parasitic disease in cattle, quite common in this country, which is accompanied by tubercles under the mucous membrane of the small intestines, has been mistaken for tuberculosis. The tubercles vary in size from mere specks to peas. The larger ones contain a crumbling, caseous mass of a dirty grayish color. In many of them the worm causing the tubercle is still within, and may be detected under the microscope in the contents of the tubercle. The absence of tuberculosis of the lungs, pleura, and lymphatic glands in the animal is a pretty certain indication that tuberculosis does not exist.

Tuberculosis does not, as a rule, end in recovery, and treatment is useless. Preventive measures in this as in most other diseases are the only reliable ones. They consist in removing and isolating the suspected animals and destroying them when there is sufficient evidence that tuberculosis exists. The milk of such animals should not be used in the feeding of calves, swine, and other domesticated animals. Concerning the use of the flesh and milk for human food, some facts will be given further on. The carcasses of tuberculous animals should be carefully buried, or burned if possible. In short, the diseased animals and their remains should be regarded as a menace to the health of man and animals and treated accordingly.

BOVINE TUBERCULOSIS IN ITS RELATION TO THE PUBLIC HEALTH.

Tuberculosis being restricted more or less to thickly settled communities, and causing in general but slight losses when all the cattle of a country are taken into consideration, is not a very serious matter to the owner of cattle from a financial point of view. The interest which has been manifested in this disease is due to quite different causes. The identity between human and animal tuberculosis, combined with the extraordinary mortality of human beings from this disease, often amounting from 10 to 14 per cent., has raised the question in all civilized countries as to how far animal and especially bovine tuberculosis was to blame for this high mortality. The medical and veterinary professions have approached this problem with equal zeal, and much has come to light within recent years which enables us to come to some conclusion. If the disease is transmitted from animals to man how does the transmission take place? As very few people come in direct contact with tuberculous cattle, it must be if at all either through the meat or the milk, or through both, that the virus enters the human body. The question has thus narrowed itself down to the food products furnished by cattle.

Is flesh from tuberculous cattle the bearer of infection?—This question has become a very urgent one in the Old World, since meat is a scarce and expensive article of food. It is argued there that if it can be shown that in the majority of cases of tuberculosis the muscular system is free from infection, there is no reason why the meat should not be put on sale under certain restrictions. The question may be resolved into two divisions: (1) How frequently

does the disease invade those parts of the body which are used as food? (2) When the disease process is manifestly restricted to the internal organs do tubercle bacilli circulate in the blood and lymph, and can they be detected in the muscular tissue?

(1) Disease of the bones is not unknown, although very rare. According to Walley it appears chiefly in the spongy bones of the head and backbone and in the long bones of the limbs. Occasionally the ends of the bones, where they are covered by the synovial membrane of the joints, are dotted with tubercles. The muscular system itself is very rarely the seat of tubercular deposits, although the lymphatic glands lying near and among the muscles may be not infrequently diseased.

(2) Whether tubercle bacilli are found in muscle juice independent of any tubercular deposits is a question which must be approached experimentally. There is on record a great variety of opinion on this matter, some authorities considering all flesh from tuberculous animals unfit for food, while others hold a contrary view. Such opinions are, however, worth little unless backed by positive evidence, such as is afforded by direct inoculation of animals susceptible to tuberculosis. The diametrically opposite views of the older authorities are due partly to the fact that they fed the material to be tested to different species of animals, some of which are now known to be insusceptible to such feeding, partly because nothing was known of the presence or absence of the tubercle bacilli in the material fed. It is well known among pathologists to-day that there is much variation in this respect. Tuberculous growths may contain enormous numbers of bacilli or they may contain but very few. Their number seems to vary with the age of the disease process, with its location, and the species of animals from which the tuberculous matter is obtained. Moreover, feeding even susceptible animals is at best a method of doubtful utility, upon which little reliance can be placed. There are, however, a few experiments on record which can be considered trustworthy, inasmuch as they were made according to the approved method of injecting the suspected material directly into the peritoneal cavity of guinea-pigs.

Kastner,* under the direction of Bollinger, inoculated animals with the juice expressed from the flesh of tuberculous animals. The flesh of twelve cows was used for this purpose. Sixteen guinea-pigs received of the meat juice from 1 to 2 cubic centimeters each into the peritoneal cavity. All remained healthy.

Nocard† expressed the juice of the heart muscle taken from tuberculous cattle and injected from 10 to 20 drops into the peritoneal cavity of guinea-pigs. Eleven cows in an advanced stage of consumption were employed for this experiment. None of the inoculated guinea-pigs showed signs of disease.

Subsequently he‡ repeated this experiment with ten tuberculous cows. The juice of muscular tissue from one of the thigh muscles was expressed and 1 cubic centimeter injected into the peritoneal cavity of guinea-pigs, four being used for each case. Of the forty animals thus inoculated only one became tuberculous. These experiments led Nocard to formulate the following conclusions:

(1) The flesh of tuberculous animals may in certain instances present some danger.

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* Münchener med. Wochenschr., 1889, 583.

† Recueil de Médecine vét. annexe, 1885, p. 49.

‡ Recueil de Méd. vét., 1888, p. 574.

(2) But it is very exceptionally dangerous.

(3) In those cases in which it is dangerous it is always so in a very slight degree.

But all experiments are not equally negative. Chauveau and Arloing inoculated ten guinea-pigs with the juice expressed from the muscles of a diseased ox. Of these two became tuberculous. Six guinea-pigs, inoculated with the meat juice from another case, remained well. Galtier obtained five positive results out of twenty-two series of inoculations. Arloing concludes from these various observations that the flesh of one out of every ten tuberculous bovines contains tubercle bacilli demonstrable by inoculation.* The stage of the disease no doubt determines to a great extent the presence or absence of tubercle bacilli in the muscular tissue. In cases far advanced they may be more abundant and hence more easily detected. Thus Steinheil † inoculated guinea-pigs from the flesh juice of nine persons who had died in an advanced stage of tuberculosis. Positive results were obtained in every case.

The milk of tuberculous cows.—Concerning the infectious nature of milk secreted by tuberculous cows, authorities have universally agreed that when the udder itself is in the slightest degree involved the milk possesses infectious properties and is therefore dangerous. Tubercle bacilli have been found in large numbers in the milk and the udder under such circumstances. Unlike other affections of the udder, tuberculosis of this organ does not at once change the appearance and the quality of the milk secreted. Bang states that for at least a month after the disease has appeared the milk is normal in appearance and may be consumed and sold without arousing the suspicion of the owner. There is therefore considerable danger involved in this disease, and the necessity for the careful inspection of dairy cows seems more urgent than ever before.

Authorities are, however, not fully agreed as to whether the milk from tuberculous cows in which the udder is apparently not invaded by the disease should be considered dangerous or not. Some are inclined to believe that the milk secreted by healthy udders is never infectious even when the lungs or other organs are affected; that, in other words, the tubercle bacilli are rarely, if ever, separated from the lesions which they produce; that the udder itself must be diseased before tubercle bacilli can appear in the milk. Experiments made with the milk of tuberculous cows in which there were no indications of udder disease do not bear out this theory, as the statistics to be given below will show. Tubercle bacilli have been found in the milk of such cows. Some authorities, among them Nocard, still believe that the udder is diseased when the milk is infected, but that the disease escapes observation. However this may be, the fact that the udder may be diseased and the disease not recognizable simply casts suspicion upon all milk from tuberculous animals. That this suspicion is not without foundation some recent investigations may be here briefly summarized as evidence.

Under the auspices of the Massachusetts Society for the Promotion of Agriculture, Dr. H. C. Ernst, assisted by Dr. A. Peters, made some experiments to test the character of the milk from tuberculous cows having no recognizable udder disease. The milk was examined microscopically and the tubercle bacilli demonstrated in the milk of

* Congrés pour l'étude de la tuberculose, 1888, 64.
† Münchener med. Wochenschr., 1889, No. 40, 41.

ten out of thirty-six cows, or 27.7 per cent. Guinea-pigs also were inoculated with the milk from fourteen cows, and from the milk of six of these, or 42.8 per cent., the inoculation was successful.

Hirschberger, under Bollinger's direction, made a number of experiments to test the infectious properties of milk from tuberculous cattle. Of twenty cases the milk of eleven (55 per cent.) produced tuberculosis when injected into the peritoneum of guinea-pigs in quantities of 1 to 2 cubic centimeters ($\frac{1}{50}$ to $\frac{1}{250}$ pint). Of five cows highly tuberculous the milk of four was infectious; of six cows moderately tuberculous the milk of four was infectious; of nine cows slightly tuberculous, the disease being restricted to the lungs, three gave infected milk. Only in one specimen of milk were the tubercle bacilli discovered under the microscope.

The following experiments indicate a much smaller percentage of infection:

Nocard* inoculated guinea-pigs with milk from eleven tuberculous cows. Of these only one had the udder diseased. The guinea-pig inoculated from the milk of this animal died of generalized tuberculosis; the rest remained well.

Bang† injected into the abdominal cavity of rabbits from 1 to 2 cubic centimeters of milk from twenty-one cases of advanced tuberculosis in which the udder appeared normal. Positive results were obtained from but two of these cases.

Concerning the infection of swine with milk from tuberculous cattle the following interesting statement is worth quoting:

> The owner of a valuable herd of cows, finding that a large proportion of them were tuberculous, so large a proportion indeed as strongly to suggest infection by association in the sheds, withdrew his milk from the market and used it, unfortunately without boiling, for fattening his pigs, of which he has a large number and on which he prides himself not less than on his cows. The result has been that the pigs have, almost without exception, been affected with the disease to an extent that has necessitated the slaughter of the whole stock. Another point of practical interest is that he has not been able to discover nodules or other indications of localized tubercle in the cows' udders, a condition still held by some to be necessary to render the milk capable of transmitting the disease.‡

Bollinger§ has shown that it is more dangerous to consume the milk of a single cow for a period of time than to take the mixed milk from many animals. Any virus contained in the milk of one cow is thus greatly diluted, and the few bacilli consumed may be harmless. Thus guinea-pigs inoculated with mixed milk generally remained well. Infected milk lost its virulence in one case when diluted with forty parts of water; in another when diluted with fifty parts; in still another the milk did not lose its infectious properties until diluted with one hundred parts.

In comparison with this rather feebly infectious character of milk human sputum was found exceedingly infectious. A dilution of one hundred thousand times did not rob it of its infectious character.

If any positive conclusion could be arrived at from the small quantity of evidence now on hand it would be to throw suspicion both upon the flesh and the milk of tuberculous cattle. These products in any given case may be free from infection or they may not be. As Bollinger has shown, the tendency to mix the milk in dairies may dilute the infection proceeding from any one cow so much as wholly to

* Recueil de Méd. vét. annexe, 1885, p. 49.
† Congrès pour l'étude de la tuberculose, Paris, 1889.
‡ British Medical Journal, 1889, I, 30.
§ Münchener Med. Wochenschr., 1889, 73 L.

neutralize it, provided the number of diseased cows is proportionally very small. Fortunately we have at our command a ready means of destroying any suspected virus in the milk. Boiling for five or ten minutes is sufficient. Similarly the dangers possibly inherent in meat are overcome by the heat to which meat is usually exposed in its preparation for the table. This appears sometimes insufficient in rare meat, but even then the tubercle bacilli may be so much attenuated as to become powerless for evil. The dangers inherent in milk are greatest for children, who are more susceptible, and whose food during the earlier years of life is made up largely of milk.

THE PRESENT STATUS OF LEGISLATION IN FOREIGN COUNTRIES ON BOVINE TUBERCULOSIS.

The attention of the various governments of the European States has been for several years directed to this subject of bovine tuberculosis on account of its bearing upon the health of mankind. Very little has yet been done in the form of legislation, owing to the hitherto unsettled or incomplete knowledge on the part of recognized medical and veterinary authorities. This, however, no longer exists, and there is a strong unanimous sentiment over the civilized world that something must be done to keep the evil in check. In 1888 a congress for the study of tuberculosis was held in Paris. At its sessions the relation of bovine to human tuberculosis formed a prominent part of the discussion. It likewise was the important topic discussed at the International Veterinary Congress held in Brussels in 1883 and in Paris in 1889. It is the important topic in all societies devoted to sanitation and public health, and great pressure is being exerted through these bodies as well as in the medical press upon the various governments to take hold of this subject.

In France the veterinary associations have long since demanded that tuberculosis be classed with the contagious diseases of animals. This was done by a decree dated July 28, 1888. The ministerial order of the same date contains the following prescriptions:

ART. 9. When the existence of tuberculosis has been established in cattle, the prefect issues an order placing these animals under the care of a sanitary veterinarian.

ART. 10. Every animal known to be tuberculous is isolated and sequestrated. The animal can only be moved for slaughter. The killing is done in the presence of the veterinarian who is to make the autopsy, and send to the prefect the protocol within five days after the autopsy.

ART. 11. The flesh of tuberculous animals is excluded from consumption (1) when the lesions are generalized, *i. e.*, not confined exclusively to the internal organs and their lymphatic ganglia; (2) when the lesions, although localized, have invaded the greater part of a single organ, or manifest themselves by an eruption on the walls of the chest or abdomen. This meat, excluded from consumption, as well as the tuberculous organs, can not be used to feed animals, but must be destroyed.

ART. 12. Utilization of the hides is only permitted after disinfection.

These regulations, according to Vallin, will at least prevent the slaughter of all consumptive cattle in private places beyond reach of all control, and the transformation of the flesh into "foreign" meat, smuggled into the markets of the cities. It will also prevent the movement of such cattle into the markets to be sold, after many stables in which the animals have lodged have been soiled and infected by them.

In England* the diseases of tuberculosis and pleuro-pneumonia among cattle were referred to a departmental committee, who sat during April, May, and June, of 1888. A considerable number of

*Annual Report, Agricultural Department, for 1888.

witnesses were examined. Some of the recommendations of the committee are as follows:

Legislation directed to the protection of cattle from tuberculosis should, at the same time, include such measures as will also prevent its communication to man.

In the first place, the question of curative treatment may be dismissed in a few words, except in those cases (almost entirely confined to the human being) where it is only locally manifested, and in which, consequently, its foci can be excised and removed by surgical treatment.

This being so, it is evident that legislation must follow two lines of—

A. *Prevention.*

B. *Extirpation.*

A. *Preventive measures.*—These should include provisions for *improved hygiene of cattle sheds*, etc. (especially in the direction of providing proper ventilation, pure water supply, and adequate disinfection of stalls, etc., wherein tubercular animals have been kept). This has been partly met in the Dairy and Milk Shops Order, but its administration by the local health authorities is at present imperfect, and we would suggest that it should be much more stringently enforced, and that veterinary inspectors should be given more extended powers of entry into all places where animals are kept.

Improvement in the hygienic surroundings of animals should include isolation of all suspected cases, precautions against the flesh or milk of diseased animals being given as food to others, *e. g.*, to pigs, fowls, etc., and care that fodder, litter, and water should not be taken from one animal or stall to be given to another.

Our attention has been drawn to the frequency with which animals, obviously diseased, sometimes even in the last stage of the malady, are sold in open market.

Although in England and Ireland, under the provisions of the nuisance removal act, as embodied in the public health act, 1885, the medical officer of health or inspector of nuisances may seize such animals, yet such seizure is rarely performed.

We find the veterinary inspector has no power to prevent such sales or to seize the beast for slaughter, since tuberculosis is not included in the contagious diseases (animals) act of 1878.

We further find that there is actually a regular trade in such stock infected with tuberculosis, and that they go by the name of "wasters" and "mincers," being frequently slaughtered in the neighborhood of the larger towns, to which such portions of the meat as are likely to escape the observation of the inspector of nuisances are sent for the purposes of sale among the poorer inhabitants and especially for the making of sausages.

We are therefore very strongly of opinion that power should be given to the veterinary inspector to seize all such animals in fairs, markets, or in transit. * * * Since all authorities are agreed that the disease is very marked by heredity, we think it highly desirable that breeders should, in their own as well as in the public interest, discontinue breeding from tuberculous stock.

B. *Extirpation.*—In order to insure the gradual extirpation of tuberculosis, we are of opinion that it should be included in the contagious diseases (animals) acts for the purposes of certain sections of those acts, so as to provide:

(*a*) For the slaughter of diseased animals when found diseased on the owner's premises.

(*b*) For the payment of compensation for the slaughter of such animals.

(*c*) For the seizure and slaughter of diseased animals exposed in fairs, markets, etc., and during transit.

(*d*) For the seizure and slaughter of diseased foreign animals at the place of landing in this country. * * *

Professor Brown, in commenting on these recommendations, points out a number of difficulties which would oppose the successful execution of a law embodying them. Among these are the difficulty of distinguishing tuberculosis in cattle from actinomycosis, lymphadenoma, diseases of the udder, and rheumatism with enlargement of the joints in young cattle. It is also difficult to make an ante-mortem diagnosis, and this difficulty would become very serious in case of valuable pedigree stock. In short, the difficulties were sufficient to prevent the passage of the Order of Council prepared on the lines of the committee's report. Meanwhile the question of what to do with the flesh from tuberculous cattle is in a very unsettled condition. Cases are constantly coming up for decision before the magistrates.

These decisions are not uniform, however. Thus, in Belfast* one judge ordered the destruction of the carcasses; two others sitting several weeks later refused to give an order for the destruction of two carcasses which were clearly shown to have been diseased with tuberculosis.

The British Medical Journal, in commenting on this condition of things, says:

> What we want and what the medical profession must fight for is a definite system of control, placed in the hands of thoroughly qualified inspectors, who shall have full power to condemn without appeal and destroy all meat that they may consider unfit for human food.

In the German Empire bovine tuberculosis has not, up to the present time, been included among those animal plagues upon which extensive statistical reports are being issued annually. This exclusion is not due, however, to any lack of interest in this matter or to unbelief in the dangers and perils to public health lurking in the untrammeled existence and spread of the disease; for Germany, in her scientific researches and in the attitude of the medical and veterinary fraternities, has been foremost in promulgating the doctrine of the essentially contagious nature of tuberculosis. The obstacles to any legislation thus far have been those cited by Professor Brown, of England—the difficulty of detecting the disease during the life of the affected animal, and insufficient knowledge of its nature and extent. In consequence of numerous petitions from all parts of the Empire, expressing the wish that something be done to check the spread of bovine tuberculosis, the Chancellor of the Empire, on October 22, 1887, issued a circular† to the different States for the purpose of obtaining as complete statistics as possible on the present status of the disease. These statistics were to include (*a*) the number of cases of tuberculosis in slaughtered cattle, as determined in public and private abattoirs by the meat inspectors, as well as the total number of cattle slaughtered; (*b*) the number of cases of tuberculosis in living animals as determined at markets, in dairies, etc., as well as in the private practice of veterinarians. At the same time the existence of the disease was to be indicated as definite, probable, or suspected, as the case might be. Special care was to be exercised in determining the following points in addition to those already mentioned:

(*a*) The sex (bulls, oxen, cows, heifers, and calves under six weeks of age).
(*b*) The age (six weeks to one year; one to three years; three to six years; over six years).
(*c*) The race or breed.
(*d*) The source of the cattle, with statement whether the business is chiefly in pasturing or stabling them.
(*e*) The seat of the disease; external (udder), internal (only in slaughtered cattle), under the following heads:
Affection of only one organ with the related serous membrane and lymphatic glands.
Extension upon several or all organs of the body cavity.
Extension into several cavities of the body.
Existence of tubercles in meat.
Generalized tuberculosis.
(*f*) The quality of the meat from tuberculous animals (first, second, and third grade).
(*g*) The veterinary police regulations as to the disposition of the meat of tuberculous animals.
To these answers may be appended general information concerning the distribution of tuberculosis, heredity, contagion, etc.

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*British Med. Journal, 1889, Nov. 2.
†Veröffentl. d. kais. Gesundheitsamtes, 1887–1888, passim.

In response to this circular the governments of the various States issued instructions to the various department officials, veterinarians, and meat inspectors, embodying in tabulated form the questions formulated in the circular. These were issued at different times during the year 1888, and the statistics were to cover one year from the time they were begun. The results of these inquiries will of course not be made known for some time. That they will, however, lead to stringent measures for the suppression of the disease and the greater protection of human health there can be little doubt.

TRANSACTIONS OF THE BUREAU FOR 1890.

PROGRESS OF THE WORK OF EXTIRPATING PLEURO-PNEUMONIA.

The year has passed without any discovery of contagious pleuro-pneumonia outside of the districts which were recognized in the last report as infected. The regulations of the Department have been enforced without difficulty, and the progress of the work for the eradication of this plague has been continuous and rapid.

No cases of the disease have occurred in the State of New York except on Long Island. No cases have been discovered in Pennsylvania during the year, although a constant inspection has been maintained. The last case discovered in Maryland occurred in October, 1889, and since that time the State has been free from all evidence of the contagion. The condition of New Jersey as regards this plague has also improved rapidly. No other States have been affected.

The efficiency of the regulations and of the methods employed under them is demonstrated by the fact that for two years there has not been a case of the disease outside of the very restricted areas on the Atlantic seaboard which have from the first been recognized as infected. These regulations are still in force, and with the almost complete eradication of the contagion the danger of any infection extending to other sections has practically disappeared.

WORK IN NEW YORK.

In order to hasten the work on Long Island more radical measures of disinfection were adopted early in the year and in certain cases where the disease had reappeared several times stables were torn down and burned. It also became necessary in order to maintain any respect for the Department regulations that vigorous measures should be adopted to prevent cattle from grazing upon the commons in the infected district. There appeared to be a widespread opinion, fostered by interested parties, to the effect that the Department had no power to enforce its regulations. As the total eradication of the disease could never be accomplished while the cattle of the infected districts were allowed to pasture in common and mingle together on the pastures and highways, it was determined to put a stop to this practice by seizing and slaughtering all cattle found off of the owners' premises without a permit from the chief inspector. The first seizure included over one hundred head of cows, and this

was followed by others at short intervals. The owners, however, soon discovered that it was to their interest to abide by the regulations, and from that time the disease has rapidly disappeared. There can be no doubt but that these measures, though they appear arbitrary and severe, were the means of bringing speedy success to the work on Long Island, when before their adoption there was reason to fear that the contagion might still linger there for an indefinite time.

From July 1, 1889, to June 30, 1890, there were inspected in New York 17,767 herds, containing 147,988 head of cattle. There were 151,284 animals reëxamined and 34,905 were tagged with numbers and registered upon the books of the Bureau.

There were 128 new herds found affected with pleuro-pneumonia during the year, and these herds contained 2,879 animals, 182 of which were pronounced diseased when the inspections were made. There were purchased for slaughter during the same time 603 affected cattle at a cost of $15,756.37, an average of $26.13; also 2,513 exposed cattle at a cost of $55,744.54, an average of $22.18. The smaller cost of the exposed cattle was due, as in previous years, to the fact that the amount which the owner realized for the carcasses was deducted from the appraised value, the Department paying the balance.

It has been found necessary to disinfect 416 stables, stock yards, or other premises during the year, and also to make post-mortem examinations upon 17,109 carcasses of bovine animals, of which 631 were found diseased with pleuro-pneumonia.

The total expenses in New York from July 1, 1889, to June 30, 1890, were $174,952.48, of which $71,500.91 was paid for cattle purchased for slaughter as either diseased or exposed. The remainder constitutes the cost of disinfection, inspection, tagging, registering, supervising the movement of cattle, post-mortem examinations, and all the various expenses incident to a work of this character.

WORK IN NEW JERSEY.

In this State the active work has been almost entirely confined to Hudson County. The diseased herds discovered have not been numerous, and both affected and exposed animals have been promptly slaughtered.

From June 30, 1889, to July 1, 1890, there were inspected in New Jersey 8,624 herds, containing 64,108 head of cattle. Of this number 40,305 were reëxamined and 9,780 were tagged with numbers and registered upon the books of the Bureau.

There were 29 new herds found affected with pleuro-pneumonia during the year, and these herds contained 405 animals, 46 of which were pronounced diseased at the time the inspections were made. There were purchased for slaughter during the same time 69 affected cattle at a cost of $1,848.50, an average of $26.79 per head; also 451 exposed cattle at a cost of $10,947.75, an average of $24.27 per head.

It has been found necessary to disinfect 167 stables, stock yards, or other premises, and also to make post-mortem examinations upon the carcasses of 10,741 bovine animals, of which 89 were found diseased with pleuro-pneumonia.

The total expenses in New Jersey from July 1, 1889, to June 30, 1890, were $60,828.02, of which $12,896.25 was paid for cattle purchased for slaughter because they were either diseased or had been exposed.

WORK IN MARYLAND.

Although the last case of pleuro-pneumonia was discovered in Maryland in October, 1889, it was deemed best to keep up the inspection for a considerable time in order that there might be a certainty of the complete extermination of the disease. Quarantine restrictions were removed May 1, 1890, but inspections have been continued, and it may now be definitely announced that Maryland is free from the contagion.

From July 1, 1889, to June 30, 1890, there were inspected in Maryland 7,296 herds, containi g 71,503 head of cattle. Of this number 8,368 were reëxamined and 10,298 were tagged with numbers and registered upon the books of the Bureau.

There were 2 new herds found affected with pleuro-pneumonia during the year, and these herds contained 28 animals, 2 of which were pronounced diseased when the inspections were made. There were purchased for slaughter during the same time 4 affected cattle at a cost of $99.19, an average of $24.80 per head; also 69 exposed cattle at a cost of $1,115.01, an average of $16.16 per head.

It was found necessary to disinfect 5 stables or other premises during the year and to make post-mortem examinations upon the carcasses of 15,109 bovine animals, of which 4 were found diseased with pleuro-pneumonia.

The total expenses in Maryland from July 1, 1889, to June 30, 1890, were $38,558.17, of which $1,214.20 was paid for cattle purchased for slaughter as either diseased or exposed.

THE WORK AS A WHOLE.

Including all the districts in which pleuro-pneumonia has existed there were inspected from July 1, 1889, to June 30, 1890, a total of 33,687 herds of cattle, containing 283,599 animals. Of this number 199,957 were reëxamined, and 54,983 were tagged with numbers and registered upon the books of the Bureau.

There were 159 new herds found affected with pleuro-pneumonia during the year, and these herds contained 3,312 animals, 230 of which were pronounced diseased when the inspections were made. There were purchased for slaughter during the same time 676 affected cattle at a cost of $17,704.06, an average of $26.19 per head; also 3,033 exposed cattle at a cost of $67,807.30, an average of $22.36 per head.

It has been found necessary to disinfect 588 stables, stock yards, or other premises, and also to make post-mortem examinations upon the carcasses of 42,959 bovine animals, of which 724 were found diseased with pleuro-pneumonia.

The total expenses of the pleuro-pneumonia work from July 1, 1889, to June 30, 1890, have been $274,338.67, of which $85,511.36 was paid for cattle purchased for slaughter as either diseased or exposed.

The remainder constitutes the expense for inspection, disinfection, tagging, registering, and supervising the movement of cattle, of post-mortem examinations, and of all the various expenses necessary to insure the prompt discovery of this plague when it appears in any herd and prevent the further extension of the infection.

The following table gives a résumé of the pleuro-pneumonia work from July 1, 1889, to June 30, 1890, as given in detail above:

	New York.	New Jersey.	Maryland.	Total.
Herds inspected	17,767	8,624	7,296	33,687
Cattle inspected	147,988	64,108	71,503	283,599
Cattle reëxamined	151,284	40,305	8,368	199,957
Diseased cattle found by inspection	182	46	2	230
Post-mortem examinations	17,109	10,741	15,109	42,959
Diseased carcasses found	631	89	4	724
Cattle tagged	34,905	9,780	10,298	54,983
New herds found affected	128	29	2	159
Animals in affected herds	2,879	405	28	3,312
Diseased cattle purchased	603	69	4	676
Exposed cattle purchased	2,513	451	69	3,033
Premises disinfected	416	167	5	588

A résumé of expenditures in the pleuro-pneumonia work for the same period is made below:

Items.	New York.	New Jersey.	Maryland.	Total.
Salaries	$82,386.60	$35,583.31	$30,139.62	$148,109.53
Traveling expenses	12,619.26	10,323.16	6,366.08	29,308.50
Miscellaneous expenses	8,445.71	2,125.50	838.27	11,409.28
Affected cattle	15,756.37	1,848.50	99.19	17,704.06
Exposed cattle	55,744.54	10,947.75	1,115.01	67,807.30
Total	174,952.48	60,828.02	38,558.17	274,338.67
Average for affected cattle	26.13	26.79	21.80	26.19
Average for exposed cattle	22.18	24.27	16.16	22.36

COMPARISONS WITH PREVIOUS YEARS.

The progress accomplished by this work can not be appreciated without comparing the number of new herds found affected during the year and the total number of cases of pleuro-pneumonia found on post-mortem examination with similar data gathered from the reports of preceding years. As all carcasses of animals which have died or which have been slaughtered in the infected districts are carefully examined, we have in the returns of the post-mortem examinations the total number of cases of pleuro-pneumonia which have occurred.

The number of cattle and of new herds found affected with pleuro-pneumonia on post-mortem examination during the year ending June 30, 1890, as compared with the preceding year, is as follows:

States.	Affected cattle.		Affected herds.	
	1889–'90.	1888–'89.	1889–'90.	1888–'89.
New York	631	1,561	128	225
New Jersey	89	362	29	91
Pennsylvania	.....	29	.....	7
Maryland	4	242	2	46
Total	724	2,134	159	379

The total number of diseased and exposed cattle which have been purchased and slaughtered each year since the work for the eradication of pleuro-pneumonia was commenced is shown by the following table. The figures are for the fiscal year ending June 30.

	1886–'87.	1887–'88.	1888–'89.	1889–'90.	Total.
Diseased	1,342	2,398	1,903	676	6,319
Exposed	1,576	5,345	4,583	3,033	14,537

These tables show a very marked decrease of the disease. There were not half as many new herds found affected in 1889–'90 as in the preceding year, and only about one-third as many affected cattle. The largest number of cattle were slaughtered in 1887–'88, as previous to this the work had not covered the whole of the infected district. Since that time the number slaughtered has been largely decreased each year. The eradication of the disease has been most rapid, however, since April, 1890, the number of new herds found affected and the cases of pleuro-pneumonia found on post-mortem examination during the quarter being as follows:

	April.	May.	June.	Total.
Herds affected	13	5	5	23
Animals affected	33	62	9	104

This shows a gratifying improvement over the preceding months of the year, but it is only when we compare the figures for this quarter with those for the first quarter of the year 1890–'91 that we can appreciate the rapidity of our recent progress. The statement for this quarter is as follows:

	July.	August.	September.	Total.
Herds affected	2	4	3	9
Animals affected	2	13	13	28

When we add that during the month of October, 1890, no cases of disease were found, it is conclusively shown that we are rapidly nearing the time when pleuro-pneumonia can be declared exterminated from the United States. Until from 4 to 6 months have elapsed after the last case of this disease has been found it will be necessary to maintain the same inspection force and to keep up the same vigilant supervision as we now have. Otherwise neither our own people nor foreign governments will be convinced of the complete success of the work.

REGULATIONS CONCERNING TEXAS FEVER.

The losses from Texas fever were so much reduced by the regulations of 1889 that a similar order was issued early in 1890 to take effect March 15. By commencing the supervision at this early date it was hoped that the infection of northern pastures might be entirely prevented and the dissemination of the disease reduced to a minimum.

This anticipated relief from the fever was very generally realized, but there were some outbreaks in Kansas which occurred from infection introduced before the regulations went into effect. This was no doubt due to the exceptionally warm winter and could not be foreseen.

The regulations, also, differed from those of 1889 by allowing no cattle from the Indian Territory or from Texas, with the exception of the northern part of the Panhandle, to mingle with the uninfected cattle. While it is doubtless true that the northwestern portion of the Indian Territory and a considerably larger section of Texas are free from permanent infection, the absence of local laws preventing free driving of dangerous cattle makes it unsafe to allow cattle from such districts to go into the same cars and yards as those from farther north. The full text of the order is as follows:

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., February 24, 1890.

To the Managers and Agents of Railroad and Transportation Companies of the United States:

In accordance with section 7 of an act of Congress approved May 29, 1884, entitled "An act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," you are hereby notified that a contagious and infectious disease known as splenetic or Texas fever exists among cattle in the following described area of the United States:

All that country lying south and east of a line commencing on the Mississippi River at latitude 36° 30′ north, thence running westward on that parallel of latitude, being the southern boundary of Missouri, to the eastern boundary of Indian Territory, thence running northward to the southern boundary of Kansas, thence westward along said boundary of Kansas to the one hundredth meridian of longitude, thence southward along said one hundredth meridian of longitude to the southern boundary in Childress County in Texas, thence westward along the southern boundary of the counties of Childress, Hall, Briscoe, Swisher, Castro, and Parmer to the eastern boundary of New Mexico.

From the 15th day of March to the 1st day of December, 1890, no cattle are to be transported from said area to any portion of the United States north, east, or west of the above described line except in accordance with the following regulations: *Provided*, That these regulations shall not apply to any cattle taken into or through the State of Colorado for feeding purposes in accordance with the regulations of that State:

First. When any cattle in course of transportation from said area are unloaded north, east, or west of this line to be fed or watered, the places where said cattle are to be so fed or watered shall be set apart and no other cattle shall be admitted thereto.

Second. On unloading said cattle at their points of destination pens shall be set apart to receive them, and no other cattle shall be admitted to said pens, and the regulations relating to the movement of Texas cattle, prescribed by the cattle sanitary officers of the State where unloaded, shall be carefully observed. The cars that have carried said stock shall be cleansed and disinfected before they are again used to transport, store, or shelter animals.

Third. Whenever any cattle that have come from said area shall be reshipped from any of the points at which they have been unloaded to other points of destination the car carrying said animals shall bear a placard stating that said car contains southern cattle, and each of the waybills of said shipment shall have a note upon its face with a similar statement. At whatever point these cattle are unloaded they shall be placed in separate pens, to which no other cattle shall be admitted.

Fourth. The cars used to transport such animals and the pens in which they are fed and watered and the pens set apart for their reception at points of destination shall be disinfected in the following manner:

(*a*) Remove all litter and manure. This litter and manure may be disinfected by mixing it with lime, diluted sulphuric acid, or, if not disinfected, it may be stored where no cattle can come in contact with it until after December 1.

(*b*) Wash the cars and the feeding and watering troughs with water until clean.

(*c*) Saturate the walls and floors of the cars and the fencing, troughs, and chutes of the pens with a solution made by dissolving 4 ounces of chloride of lime to each gallon of water, or disinfect the cars with a jet of steam under a pressure of not less than 50 pounds to the square inch.

The losses resulting yearly to the owners of northern cattle by the contraction of this disease from contact with southern cattle and through infected cars, and by means of the manure carried in unclean cars from place to place, have become a matter of grave and serious concern to the cattle industry of the United States. It is necessary, therefore, that this cattle industry should be protected as far as possible by the adoption of methods of disinfection in order to prevent the dissemination of this disease.

A rigid compliance with the above regulations will insure comparative safety to northern cattle and render it unnecessary to adopt a more stringent regulation, such as the absolute prohibition of the movement of southern cattle except for slaughter during the time of year that this disease is fatal.

Inspectors will be instructed to see that disinfection is properly done, and it is hoped that transportation companies will promptly put in operation the above methods.

Very respectfully,

J. M. RUSK,
Secretary.

It has been found that the regulation requiring a placard to be placed upon the car in which southern cattle are shipped is of little practical benefit, as shippers and others remove these marks in so many instances that this method of distinguishing infected cars can not be relied upon. Railroad companies have, however, in nearly all cases, stamped their waybills in accordance with the regulations, and this has proved sufficient for the identification of cars and cattle.

It will be noticed that the regulations thus far made have not extended east of the Mississippi River. There is no doubt, however, that the Gulf and South Atlantic States are infected with this disease to the same degree as Texas, and there should be the same regulation of cattle coming from them. The traffic has been so light and the difficulties of regulating it have been such that up to the present the attempt has not been made. Before the disease can be entirely prevented it will be necessary that the line of infection shall be drawn to the Atlantic seaboard and that the same rules be enforced east of the Mississippi as were enforced west of it during the last two years. This will prevent the infection of a number of stock yards that during the present year have been centers from which the dissemination of the disease has taken place with cattle bought both for home and for export markets.

On the whole the effect of these regulations has been extremely beneficial. As compared with former years but a small amount of the disease has been reported either in the United States or among cattle shipped abroad. The losses during the ocean voyage have been so much less than usual that insurance is said by shippers to have been reduced over 50 per cent. If this statement is correct it means a saving of over a million dollars to our shippers by this reduction of insurance alone.

Since the danger of shipping export cattle infected with pleuropneumonia has been removed a number of English writers have expressed great fear of the permanent introduction of Texas fever into Great Britain by cattle from the United States. This fear certainly must be groundless and one that could arise only through ignorance of the characters of the disease. In the first place, cattle that are sick from this disease do not transmit it to other animals, and consequently affected animals which are landed on the other side may

be left out of consideration as carriers of the infection. In the second place, cattle which are shipped by cars or boat lose the infection in about three weeks after leaving their native pastures. If, therefore, the time should come when Texas cattle shall be exported to Great Britain, there would be little danger from them, as it would require fully three weeks, if not longer, to transport them. In the third place, this disease never occurs in our Northern States until the middle of summer, after there has been a protracted period of intense heat, the temperature of our spring and early summer being generally insufficient to develop the disease. The summer temperature in Great Britain is probably neither high enough nor is the high temperature continued a sufficient time to allow the development of this fever.

Leaving these facts out of consideration, we should be able to prevent the exportation of any cattle that are infected, or any that are capable of disseminating the infection, by properly enforced regulations which will prevent the mingling of southern and northern cattle in our cars and stock yards. The disease is one of the easiest to prevent of any which affects our domesticated animals, and for that reason we should be able to guard against all danger from it either to our own cattle or those of other countries to which our animals are sent.

The success of the regulations during the past two years has been all that was anticipated. It has not been found difficult to identify cattle from south of the line of infection in Texas by their brands, and railroad companies have, as a rule, been prompt to clean and disinfect their cars. The principal stock-yard companies have also furnished separate pens, which have been maintained with great regard to cleanliness and the proper handling of cattle, and from every point of view it has been demonstrated that the prevention of this disease is practicable without any hardship to those engaged in the cattle traffic. Indeed, it is now asserted that southern cattle bring better prices when sold from the quarantine yards than when indiscriminately mixed with other stock, and for this reason many lots of cattle from just north of the line are sent by choice of the owners to the quarantine yards for sale.

INSPECTION OF AMERICAN CATTLE IN GREAT BRITAIN.

The rapid progress and practically complete success of the work for the eradication of contagious pleuro-pneumonia from the United States removes the cause alleged by foreign governments for the exclusion of American cattle from their countries.

Great Britain for a number of years has maintained an absolute prohibition against the introduction of American cattle into that country, and only permits their reception at the foreign animal wharves, where they are to be slaughtered within ten days after their arrival.

The several governments of the continent of Europe have also enforced a quarantine of from two to four weeks on all American cattle, which has almost entirely prevented shipments from this country.

For a number of years the British authorities have reported the arrival at their ports of American cattle affected with contagious pleuro-pneumonia, and it became, therefore, absolutely necessary that this Bureau should be represented by its own officials at the

post-mortem examinations made on American cattle at the foreign animal wharves in order that we should determine, to our own satisfaction, whether the lung disease found there was, as they claimed, contagious; and if it were found to be contagious, the affected animal should be traced back to the farm in this country from whence it came. With this object in view the aid of the State Department was solicited in opening negotiations through Minister Lincoln with the British Government looking to such an arrangement. Through the active coöperation of the State Department and the intelligent efforts of Minister Lincoln the privilege was obtained from the British Government of stationing three veterinary inspectors, one at each of the principal animal wharves where American cattle are slaughtered, and who would be allowed every facility in participating with the local officers in the work of inspecting and making post-mortem examination on American cattle landed in British ports. As soon as this privilege was secured three competent veterinary officers of the Bureau were dispatched to Great Britain in charge of the Chief of the Bureau of Animal Industry, who remained with them until their duties were clearly defined and the best means decided upon to enable them to carry on their work effectually and in harmony with the British authorities.

This work was commenced on August 16 of the present year, and from that date to November 8, inclusive, there were inspected and post-mortem examinations made on 104,296 head of cattle arriving in Great Britain from the United States at the several ports, as follows:

London	43,488
Liverpool	50,342
Glasgow	10,466

No indications of contagious pleuro-pneumonia were found in any of these animals, and on account of the eradication of the disease in this country it is believed that none will be found in the future.

INSPECTION OF EXPORT CATTLE BEFORE SHIPMENT.

The act of August 30, 1890, providing for the inspection of all export cattle, sheep, and swine, has enabled this Bureau to introduce a system of tagging export cattle by means of which it will be possible to determine the section of the country from which any animal has come that may be found at a foreign port affected with any disease. This act also prevents the exportation of any diseased animals. The amount of work required to carry out this inspection may be comprehended by the fact that during the year ending June 30, 1890, the number of animals exported was as follows:

Cattle	394,836
Hogs	91,148
Sheep	67,521

The following rules and regulations under the tenth section of the above named act were prescribed by the Secretary of Agriculture on October 20, 1890:

Order and Regulations for the Inspection of Cattle and Sheep for Export.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., October 20, 1890.

The following order and regulations are hereby made for the inspection of neat cattle and sheep for export from the United States to Great Britain and Ireland and the continent of Europe by virtue of the authority conferred upon me by section

10 of the act of Congress approved August 30, 1890, entitled "An act providing for the inspection of meats for exportation, prohibiting the importation of adulterated articles of food or drink, and authorizing the President to make proclamation in certain cases, and for other purposes:"

(1) The Chief of the Bureau of Animal Industry is hereby directed to cause careful veterinary inspection to be made of all neat cattle and sheep to be exported from the United States to Great Britain and Ireland and the continent of Europe.

(2) This inspection will be made at any of the following named stock yards: Kansas City, Missouri; Chicago, Illinois; Buffalo, New York; Pittsburg, Pennsylvania; and at the following ports of export, viz: Boston and Charlestown, Massachusetts; New York, New York; Philadelphia, Pennsylvania; Baltimore, Maryland, and Norfolk and Newport News, Virginia. All cattle shipped from any of the aforesaid yards must be tagged before being shipped to the ports of export. Cattle arriving at ports of export from other parts of the United States will be tagged at said ports.

(3) After inspection at the aforesaid stock yards all cattle found free of disease and shown not to have been exposed to the contagion of any contagious disease will be tagged under the direction of the veterinary inspector in charge of the yards. After tagging the cattle will be loaded into cleaned and disinfected cars and shipped through from said yards in said cars to the port of export.

(4) All animals will be reinspected at the port of export. All railroad companies will be required to furnish for the transportation of cattle and sheep for export clean and disinfected cars, and the various stock yards located at the ports of export shall keep separate clean and disinfected yards for the reception of export animals only.

(5) Shippers will notify the veterinary inspector in charge of yards of intended shipments of cattle, and will give to the said inspector when possible the name of the locality from which said animals have been brought and the name of the feeder of said animals, and such further and other information as may be practicable for proper identification of the place from which said animals have come.

(6) The inspector, after passing said cattle and tagging the same, will notify the veterinary inspector in charge of the port of export of the inspection of said animals, giving him the tag numbers and the number and designation of the cars in which said animals are shipped.

(7) Export animals, whenever possible, shall be unloaded at the port of export from the cars in which they have been transported directly at the wharves from which they are to be shipped. They shall not be unnecessarily passed over any highway or removed to cars or boats which are used for conveying other animals. Boats transporting said animals to the ocean steamer must be first cleansed and disinfected under the supervision of the veterinary inspector of the port, and the ocean steamer must before receiving said animals be thoroughly cleansed or disinfected in accordance with the directions of said inspector. When passage upon or across the public highway is unavoidable in the transportation of animals from the cars to the boat it must be under such careful supervision and restrictions as the veterinary inspector may in special cases direct.

(8) Any cattle or sheep that are offered for shipment to Great Britain or Ireland or the continent of Europe, which have not been inspected and transported in accordance with this order and regulations, will not be allowed to be placed upon any vessel for exportation, as they will be deemed under the law to have been exposed to infection so as to be dangerous to other animals.

(9) The supervision of the movement of cattle from cars and yards to the ocean steamer at the ports of export will be in charge of the veterinary inspector of the port. No ocean steamer will be allowed to receive more cattle or sheep than it can comfortably carry. Overcrowding will not be permitted.

(10) The veterinary inspector at the port of export will notify the collector of the port of the various shipments of cattle or sheep that are entitled to clearance papers, and certificates of the inspection of said animals will be given to the consignors for transmission with the bills of lading.

J. M. RUSK,
Secretary.

This work was inaugurated at the various ports of export named in the regulations on or about the 17th of November, and from that date up to the 28th of said month there have been inspected and

tagged 12,055 head of export cattle from the different ports, as follows:

Boston	3,703
New York	3,893
Philadelphia	518
Baltimore	2,559
Newport News	1,197
West Point, Va	185

The work of inspecting and tagging at the interior stock yards named in the regulations commenced on or about the 1st day of December, and the entire system as adopted is now in full running order.

INSPECTION AND QUARANTINE OF IMPORTED ANIMALS.

Regulations for the quarantine of neat cattle from the countries not located on the American continent continue to be enforced. The period of quarantine—three months—is regarded as amply sufficient under the regulations to prevent the introduction of disease, and no additional restrictions have been imposed, notwithstanding the fact of the restrictions imposed by Great Britain on cattle from this country and the additional fact that pleuro-pneumonia is much more prevalent and widely spread in Great Britain than it ever was in the United States.

There has long been danger of the introduction of foot-and-mouth disease by the importation of sheep, swine, and other susceptible animals that have heretofore been allowed to land without either quarantine or inspection; indeed, this disease has several times been brought to this country by cattle from Great Britain, but it has fortunately been detected in time to prevent its dissemination here. Notwithstanding this fact our sheep have been excluded from Great Britain for more than ten years owing to the alleged existence of this disease in the United States, where it has never been seen except when brought by British cattle that were affected before landing.

In order to avoid any danger of the introduction of this disease from foreign countries into the United States the Secretary of Agriculture, under the provisions of the act of August 30, 1890, prescribed on October 13, 1890, the following regulations for quarantine and inspection of all neat cattle, sheep, and other ruminants, and all swine imported into the United States:

Regulations for the Inspection and Quarantine of Neat Cattle, Sheep, and other Ruminants, and Swine imported into the United States.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., October 13, 1890.

In pursuance of sections 7, 8, and 10 of an act of Congress entitled "An act providing for the inspection of meats for exportation and prohibiting the importation of adulterated articles of food or drink, and authorizing the President to make proclamation in certain cases, and for other purposes," approved August 30, 1890, the following regulations are hereby prescribed for the inspection and quarantine of neat cattle, sheep and other ruminants, and swine imported into the United States:

(1) With the approval of the Secretary of the Treasury the following named ports are hereby designated as quarantine stations, and all cattle, sheep, and other ruminants, and swine, imported into the United States must be entered through said ports, viz: on the Atlantic seaboard, the ports of Boston, New York, and Baltimore; on the Pacific seaboard, San Diego; along the boundary between the United States and Mexico, Brownsville, Paso Del Norte, Eagle Pass, Laredo, and Nogales;

and along the border or boundary line between the United States and British Columbia and Canada, through the custom ports in the collection districts of Aroostook and Bangor, Maine; Vermont, Vermont; Buffalo Creek, Niagara, Cape Vincent, Champlain, and Oswegatchie, New York; Detroit, Port Huron, and Superior, Michigan; Minnesota and Duluth, Minnesota; and Puget Sound, Washington.

(2) The word "animals," when used in these regulations, refers to and includes all or any of the following kinds: Neat cattle, sheep, and other ruminants, and swine. The words "contagious diseases," when used in these regulations, includes and applies to all or any of the following diseases: Anthrax in cattle, sheep, goats, or swine; contagious pleuro-pneumonia in cattle; tuberculosis in cattle; foot-and-mouth disease in cattle, sheep, goats, and swine; rinderpest in cattle and sheep; sheep pox, foot rot, and scab in sheep; hog cholera and swine plague in swine.

(3) All cattle, sheep, and other ruminants imported into the United States from any part of the world except North and South America shall be accompanied with a certificate from the local authority of the district in which said animals have been for one year next preceding the date of shipment, stating that no contagious pleuro-pneumonia, foot-and-mouth disease, or rinderpest has existed in said district for the past year. And all swine imported into the United States from any part of the world except North, Central, and South America shall be accompanied with a similar certificate relating to the existence of foot-and-mouth disease. All such animals shall also be accompanied with an affidavit by the owner from whom the importer has purchased them stating that said animals have been in the district where purchased for one year next preceding the date of sale, and that neither of the above mentioned diseases has existed among them, or among any animals of the kind with which they have come in contact, for one year last past, and that no inoculation has been practiced among said animals for the past two years. Also by an affidavit from the importer or his agent supervising the shipment stating that the animals have been shipped in clean and disinfected cars and vessels direct from the farm where purchased; that they have not passed through any district infected with contagious diseases affecting said kind of animals, and that they have not been exposed in any possible manner to the contagion of any of said contagious diseases.

(4) The foregoing certificate and affidavits must accompany said animals and be presented to the collector of customs at the ports of entry and by him be delivered to the inspector of the Bureau of Animal Industry stationed at said port to allow them to be imported into the United States.

(5) All neat cattle imported into the United States from any part of the world except North, Central, and South America shall be subject to a quarantine of ninety days, counting from date of arrival at the quarantine station. All sheep and other ruminants and swine from any part of the world except North, Central, and South America shall be subject to a quarantine of fifteen days, counting from date of arrival at the quarantine station.

(6) Any person contemplating the importation of animals from any part of the world except North, Central, and South America must first obtain from the Secretary of Agriculture two permits, one stating the number and kind of animals to be imported, the port and probable date of shipment, which will entitle them to clearance papers on presentation to the American consul at said port of shipment; the other, stating the port at which said animals are to be landed and quarantined, and the approximate date of their arrival, and this will assure the reception of the number and kind specified therein at the port and quarantine station named at the date prescribed for their arrival, or at any time during three weeks immediately following, after which the permit will be void. These permits shall in no case be available at any port other than the one mentioned therein. Permits must be in the name of the owner of or agent for any one lot of animals. When more persons than one own a lot of animals for which permits have been issued a release from quarantine will be given each owner for the number and kind he may own, and this release will be a certificate of fulfillment of quarantine regulations. Permits will be issued to quarantine at such ports as the importer may elect, so far as facilities exist at such port, but in no case will permits for importation at any port be granted in excess of the accommodations of the Government quarantine station at such port. Every importer shall, on the day of the shipment from a foreign port, telegraph to the Chief of the Bureau of Animal Industry the number and kind of animals shipped, the vessel on which they are shipped, and the port at which they are to be landed. United States consuls at foreign ports are hereby notified to give clearance papers or certificates for importation of animals only upon presentation of permits as above provided, with dates of probable arrival and destination corresponding with said permits, and in no case for a number in excess of that mentioned therein.

(7) All animals imported into the United States shall be carefully inspected by a veterinary inspector of the Bureau of Animal Industry, and all animals found to be free from disease and not to have been exposed to any contagious disease, except as provided in regulation 5, shall be admitted into the United States. Whenever any animal is found to be affected with a contagious disease, or to have been exposed to such disease, said animal, and all animals that have been in contact or exposed to said animal, will be placed in quarantine, and the inspector quarantining the same shall report at once to the Chief of the Bureau of Animal Industry, who will direct whether or not said animals quarantined shall be appraised and slaughtered, as provided by section 8 of the act under which these regulations are made. All animals quarantined by reason of disease or exposure to disease shall not be admitted to the established quarantine grounds, but shall be quarantined elsewhere, at the expense of the importer, or be dealt with in such manner as the Chief of the Bureau of Animal Industry shall determine.

(8) In case of imported animals proving to be infected, or to have been exposed to infection, such portions of the cargo of the vessel on which they have arrived as have been exposed to these animals or their emanations shall be subjected, under the direction of the inspector of the Bureau of Animal Industry, to disinfection in such manner as may be considered by said inspector necessary before it can be landed.

(9) No litter, fodder, or other aliment, nor any ropes, straps, chains, girths, blankets, poles, buckets, or other things used for or about the animals, and no manure shall be landed excepting under such regulations as the veterinary inspector shall provide.

(10) On moving animals from the ocean steamer to the quarantine grounds they shall not be unnecessarily passed over any highway, but must be placed on cars at the wharves or removed to the cars on a boat which is not used for conveying other animals. If such boat has carried animals within three months it must be first cleansed and then disinfected under the supervision of the inspector, and after the conveyance of the imported animals the boat must be disinfected in the same manner before it may be again used for the conveyance of animals. When passage upon or across the public highway is unavoidable in the transportation of animals from the place of landing to the quarantine grounds it must be under such careful supervision and restrictions as the veterinary inspector may, in special cases, direct.

(11) The banks and chutes used for loading and unloading imported animals shall be reserved for such cattle, or shall be cleansed and disinfected as above before being used for such imported cattle.

(12) The railway cars used in the transportation of animals to the quarantine grounds shall either be cars reserved for this exclusive use, or box cars not otherwise employed in the transportation of animals or their fresh products, and after each journey with animals to the quarantine grounds they shall be disinfected by thorough cleansing and disinfection under the direction of the veterinary inspector.

(13) While animals are arriving at the quarantine stations, or leaving them, all quarantined stock in the yards adjoining the alleyways through which they must pass shall be rigidly confined to their sheds. Animals arriving by the same ship may be quarantined together in one yard and shed, but those coming on different ships shall in all cases be placed in separate yards.

(14) The gates of all yards of quarantine stations shall be kept locked, except when cattle are entering or leaving quarantine.

(15) The attendants on animals in particular yards are forbidden to enter other yards and buildings, except such are occupied by stock of the same shipment with those under their special care. No dogs, cats, or other animals except those necessarily present shall be allowed in the quarantine grounds.

(16) The allotment of yards shall be under the direction of the veterinary inspector of the port, who shall keep a register of the animals entered, with description, name of owner, name of vessel in which imported, date of arrival and release, and other important particulars.

(17) The veterinary inspector shall see that water is regularly furnished to the stock and the manure removed daily, and that the prescribed rules of the station are enforced.

(18) Food and attendance must be provided by the owners of the stock quarantined. Employés of such owners shall keep the sheds and yards clean to the satisfaction of the veterinary inspector.

(19) "Smoking" is strictly forbidden within any quarantine inclosure.

(20) No visitor shall be admitted to the quarantine station without special written permission from the veterinary inspector. Butchers, cattle dealers, and their employés are especially excluded.

(21) No public sale shall be allowed within the quarantine grounds.

(22) The inspector shall, in his daily rounds, as far as possible, take the temperature of each animal, commencing with the herds that have been longest in quarantine and ending with the most recent arrivals, and shall record such temperatures on lists kept for the purpose. In passing from one herd to another he shall invariably wash his thermometer and hands in a weak solution (1 to 100) of carbolic acid.

(23) In case of the appearance of any disease that is diagnosed to be of a contagious nature the veterinary inspector shall notify the Chief of the Bureau of Animal Industry, who shall visit the station personally or send a veterinary inspector, and on the confirmation of the diagnosis the herd shall be disposed of according to the gravity of the affection.

(24) The yard and shed in which such disease shall have appeared shall be subject to a thorough disinfection. Litter and fodder shall be burned. Sheds, utensils, and other appliances shall be disinfected as the veterinary inspector may direct. The yards, fence, and manure box shall be freely sprinkled with a strong solution of chloride of lime. The flooring of the shed shall be lifted and the whole shall be left open to the air and unoccupied for three months.

(25) In the case of the appearance of any contagious disease the infected herd shall be rigidly confined to its shed, where disinfectants shall be freely used, and the attendants shall be forbidden all intercourse with the attendants in other yards, and with persons outside the quarantine grounds.

J. M. RUSK,
Secretary.

[The designation of the ports, named in the foregoing regulations as quarantine stations, was approved by the Secretary of the Treasury on the 16th day of October, 1890, as provided by section 8 of the act of Congress approved August 30, 1890, providing for inspection of meats and animals.]

It is believed that these regulations will not only protect our herds and flocks, but in view of the assurances to that effect received from the British authorities it will probably result in the revocation by the British Government of its regulation excluding American sheep from Great Britain.

The inspection and quarantine of all cattle, sheep, and swine imported into the United States will add largely to the work of this Bureau. During the twelve months ending June 30, 1890, cattle were imported to the number of 30,695 head and sheep to the number of 393,794. The figures of the Treasury Department fail to give the number of swine imported.

The increased duties levied under the present law may greatly diminish the number of animals imported into this country, although during the year just past 3,935 head of cattle and 16,303 head of sheep were admitted duty free on the ground that they were imported for breeding purposes.

INSPECTION OF SALTED MEATS FOR EXPORT.

The act of August 30, 1890, provides "that the Secretary of Agriculture may cause to be made a careful inspection of salted pork and bacon intended for exportation, with a view to determining whether the same is wholesome, sound, and fit for human food, whenever the laws, regulations, or orders of the government of any foreign country to which such pork or bacon is to be exported shall require inspection thereof relating to the importation thereof into such country, and also whenever any buyer, seller, or exporter of such meats intended for exportation shall request the inspection thereof."

This inspection has been assigned to the Bureau of Animal Industry and all arrangements have been made to carry the law into effect. It is too early at this writing to estimate the quantity of

meat that the Department will be called upon to inspect under this law, but should the prohibition now enforced by certain continental governments be removed so far as regards inspected meats, as there is now reason to hope, there is no doubt but that the amount will be very large. The regulations adopted for this inspection are as follows:

Regulations for the Inspection of Salted Pork and Bacon for Export.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., September 12, 1890.

By virtue of the authority conferred upon the Department of Agriculture by section 1 of an act entitled "An act providing for the inspection of meats for exportation, prohibiting the importation of adulterated articles of food or drink, and authorizing the President to make proclamation in certain cases, and for other purposes," approved August 30, 1890, the following regulations for the inspection of salted pork or bacon for export, and the marks, stamps, or other devices for the identification of the same, are hereby prescribed:

(1) Whenever any foreign country, by its laws, regulations, or orders, requires the inspection of salted pork or bacon imported into such country from the United States, all packers or exporters desiring to export to said country shall make application to the Secretary of Agriculture for such inspection; also, whenever any buyer, seller, or exporter of such meats intended for exportation shall desire inspection thereof, he shall likewise make application to the Secretary of Agriculture for such inspection.

(2) The application must be in writing, and shall give the name of the packer of such meats, and, if the packer be the exporter, the probable amount of such meats to be exported per week or month for which inspection is requested; the name of the country, or countries, to which such meats are to be exported; the place at which inspection is desired and the date for such inspection. The applicant shall likewise agree to abide by these regulations, and to mark his packages as hereinafter provided.

(3) Every package containing salted pork or bacon which has been inspected must be branded or stenciled both on the side and on the top by the packer or exporter, as follows:

FOR EXPORT.

(*a*) (Here give the name of the packer.)
(*b*) (Here the location and State of the factory where packed.)
(*c*) (Here give the net weight of the salted pork or bacon contained in the package.)
(*d*) (If exported by other than packer, the name of the exporter.)
(*e*) (Name of consignee and point of destination.)

The letters and figures in the above brand shall be of the following dimensions: The letters in the words "for export" shall not be less than three-fourths of an inch in length and all he other letters and figures not less than one-half an inch in length. All letters and figures affixed to the top and sides shall be legible and shall be in such proportion and of such color as the meat inspector of the Department of Agriculture may designate.

(4) The meat inspector of the Department of Agriculture, having, after inspection, satisfied himself that the articles inspected are wholesome, sound, and fit for human food, shall affix to the top of said package a meat inspection stamp, to be furnished by the Department of Agriculture, said stamps bearing serial numbers, and the inspector will write on said stamp the date of inspection. The stamp must be securely affixed by paste and tacks, in such a way as to be easily read when the package is standing on its bottom. Not less than five tacks shall be driven through each stamp, one at each corner and one in the middle.

The stamp having been affixed it must be immediately canceled. For this purpose the inspector will use a stencil plate of brass or copper, in which will be cut five parallel waved lines long enough to extend beyond each side of the stamp on the wood of the package. At the top of said stencil will be cut the name of the inspector, and at the bottom of said stencil will be cut the district in which inspection is made. The imprinting from this plate must be with blacking or other durable material, over and across the stamp, and in such manner as not to deface the reading matter on the stamp; that is, so as not to daub and make it illegible.

The stamp having been affixed and canceled, it must immediately be covered with a coating of transparent varnish or other substance. Orders for stamps must be made by the inspector on the Chief of the Bureau of Animal Industry. The inspector having inspected and found wholesome the contents of said package and affixed the stamp thereon, will issue to the packer or exporter a certificate of inspection, reciting the time and place of inspection, the name of the packer, the name of the exporter, and the name of the consignee and country to which exported. He will also place on said certificate the number of the package. One certificate only will be issued for each consignment and must designate the stamp numbers of all the packages contained in said consignment.

(5) The inspector will enter in the stub of his stamp book the information given by the packer's brand on the package inspected, and will report daily on blank form (*m. i.* 1) the number of stamps issued on each date and all the information required by said blank.

(6) The certificates of inspection will be furnished by the Department of Agriculture and be issued in serial numbers and in triplicate form. The inspector will deliver one copy of said certificate to the consignor or shipper of such meat inspected, one copy he will attach to the invoice or shipping bill of such meat, and the third copy he will forward to the Chief of the Bureau of Animal Industry of the Department of Agriculture for filing therein. He will likewise make a daily report on blank form (*m. i.* 2) of all certificates issued on that date, and fill out said blank with all the information required thereon.

(7) Whenever the inspection of any salted pork or bacon is requested by an exporter or shipper at any other place than where packed, the packages containing such meats are to be opened and closed at the expense of the exporter, and said packages must be branded or stenciled in the same manner and contain the same information as prescribed in the case of inspection for a packer.

J. M. RUSK,
Secretary.

The new duties connected with this inspection of animals and meats, which have been assigned to this Bureau during the last year, will be seen by the above statement to be numerous and responsible. They involve a greatly increased amount of work, but their fulfillment will undoubtedly be of enormous benefit to the country, as they will insure the protection of our live stock from imported diseases and furnish a guaranty to foreign buyers that our meats are wholesome and that our export animals are free from the contamination of any communicable malady.

INVESTIGATION OF REPORTED DISEASES.

During the year the Bureau has been requested to investigate many cases of diseases supposed to be of a contagious nature, including a considerable number of cases of disease supposed by the owners of the animals to be contagious pleuro-pneumonia or foot-and-mouth disease. Careful investigation in every case showed that these suppositions were incorrect and that the affection was either an ordinary sporadic disease, or that it was tuberculosis or some other equally common disorder. There have been no cases of pleuro-pneumonia found except in a small district on Long Island and an equally small district in New Jersey, which has long been infected, but from which the contagion is now nearly or quite eradicated.

There have been several reports of foot-and-mouth disease in the interior of the country from persons who had never seen the European disease known by this name. Investigations have, however, shown in every case that the diagnosis was not justified by the facts, and that the actual disease was of a sporadic nature and not contagious. There has been no real foot-and-mouth disease in the United States since March, 1884, when it was introduced into the Portland quarantine station by cattle from Great Britain. The contagion in

this case was disseminated to a small extent outside the quarantine station, but it was immediately recognized and eradicated by prompt measures. With the three months' quarantine to which all bovine animals are subject, and the inspection of all other animals coming into the country, it is next to impossible to introduce foot-and-mouth disease without its being immediately recognized, and it would certainly be impossible for it to reach the interior of the United States without being discovered by the inspectors of the Department of Agriculture.

A recent circular issued by the State veterinarian of the State of Missouri, which was headed, "Foot-and-mouth disease," and which gave a somewhat detailed description of the symptoms of a disease which the State veterinarian thought might be the European foot-and-mouth disease, has excited considerable comment abroad and has been considered by some veterinary authorities as a demonstration of the existence of that disease; but careful investigation made by one of the inspectors of the Bureau demonstrated that the disease was not of a contagious nature, and that it had little, if any, resemblance to the foot-and-mouth disease of Europe. There had been no cattle or other animals taken to Missouri which had been imported from any country where foot-and-mouth disease exists, consequently there was no explanation of the appearance of a foreign contagion in that part of the country. Again, but one or two animals in a herd of twenty or thirty were affected, while with foot-and-mouth disease not one in a herd of that size would escape. In most cases there was little fever, the sores in the mouth were not of the nature of vesicles, and it is doubtful if any affected animals had any lesions about the feet which were the result of the disease. So small a proportion showed signs of lameness that this probably resulted in those animals from accidental causes.

There should be no difficulty in diagnosing at once such a disease as this as distinct from the foot-and-mouth disease of Europe. The foot-and-mouth disease could not originate spontaneously. It must have a point of origin by contagion which would connect the disease with the same malady in some other section of the world; again, foot-and-mouth disease is extremely contagious, being rapidly and unmistakably transmitted from animal to animal and from herd to herd. It attacks every animal in a herd, and not one animal in one hundred or even in a thousand exposed to the contagion escapes the disease, while the vesicles are prominent and unmistakable both in the mouth and about the feet. The increase in temperature and the fever are too marked to be overlooked. A disease with these characteristics has never existed in the interior of the United States. Rumors of such disease have been frequent, but they are started by people who are ignorant of the character of such diseases and who have had their imaginations excited by reading the accounts of these diseases in other countries.

Indeed, the reports are generally made in such a way as to show that the description of the disease is taken from some publication on the subject and not from the disease itself. This is the only possible explanation of the resemblance of the symptoms given in such reports to those observed in the disease suspected, for, when the disease itself is examined, such characters as they mention can not be found.

The report of the Bureau inspector, the main points of which were concurred in by the State veterinarian after a careful investigation, should be sufficient to remove any fears of the existence of this dis-

ease in the United States. Indeed, the report of the existence of this disease would have attracted little attention had it not been for the great interests at stake and the evident desire of parties in other countries to find a pretext to sustain the restrictions and prohibitions now in force against the introduction of American cattle. These parties have always been ready to give credence to the wildest rumors and to put the worst construction upon any report in regard to disease in this country. The order that all American sheep and swine should be slaughtered on the English docks on account of foot-and-mouth disease, which has been enforced for the last ten years, and the unhesitating acceptance of the recent rumors of the same disease are sufficient evidence of the correctness of this statement. The United States Department of Agriculture now has a large and capable force of veterinary inspectors, whose whole time is devoted to the investigation of diseases, and the official reports of this Department are worthy of the same respect and credence as the government reports of any of the countries of Europe. Usually when a government makes an investigation of a rumored disease its report is believed without question. The numerous attempts which have been made to discredit the conclusion of this Department after the investigation of the disease in Missouri, without giving any adequate reason for not accepting it, show that these parties are influenced in regard to American questions by motives which do not apply to the same subjects when affecting other countries.

SCIENTIFIC INVESTIGATIONS.

The original scientific research of the year has been mostly confined to southern or Texas cattle fever and to the infectious diseases of swine. With both very important results have been obtained from the scientific as well as the practical point of view.

SOUTHERN OR TEXAS FEVER OF CATTLE.

The discovery of a germ in the red corpuscles of the blood in this disease—a germ entirely distinct from bacteria but belonging to the protozoa—was mentioned in the report of last year. This notable discovery was abundantly confirmed by the investigations of the year just past, and an additional point in the problem has been brought to light.

It has long been suspected by cattle owners that the appearance of the disease in northern cattle was in some way connected with the ticks distributed by southern cattle. This hypothesis has, however, been generally discredited by scientific men, and indeed the evidence in favor of it was very slight and intangible. It seemed, however, worthy of investigation, and the result has been to obtain indisputable evidence that the disease is produced by ticks from southern cattle.

Ticks taken from southern animals and placed upon pastures which could have been infected in no other way, so infected these grounds that susceptible cattle placed upon them contracted the disease in the same length of time and were as seriously affected as were other susceptible cattle placed upon pastures in company with southern cattle. Again, young ticks that were hatched from the eggs of large ticks picked from southern cattle were placed upon susceptible animals and produced the disease.

There are, consequently, two factors in the production of southern fever: first, the tick; and secondly, the protozoal microörganism which lives in and destroys the red blood corpuscles of the affected cattle. Where the tick obtains the protozoön is not yet known, but that the microörganism can be transmitted from one generation of ticks to another through the egg is demonstrated. It is important to learn through how many generations of ticks the germ can be transmitted without losing its virulence and whether there is any other means by which it gains access to the system of cattle in addition to being introduced by the punctures made by ticks.

There are evidently ticks which do not harbor this minute parasite, because cattle susceptible to southern fever are frequently badly infested with ticks without showing any marked symptoms of disturbed health. On the other hand there may be means by which the protozoön gains access to the blood of cattle independently of the agency of ticks; but it appears from the investigations just made that in the great majority of cases cattle are infected by means of ticks. That is, the adult ticks drop from southern cattle and lay their eggs upon the pastures. The eggs hatch and the young ticks get upon susceptible cattle and produce the disease.

If this supposition is correct it is of great practical importance. In the first place, susceptible cattle taken to the South for breeding purposes could be protected from the fever by keeping them in such a manner that they would not become infested by ticks. That is, they could be kept in stables not previously occupied by other cattle, bedded with clean straw and fed upon hay or grass cut from fields where no cattle had been for a considerable time. In the second place, it would seem that southern cattle might be rendered innocuous by washing them with some preparation that would destroy the ticks, or by holding them upon uninfected ground a sufficient time for the ticks which are upon them to mature and drop to the ground, but not long enough upon any one pasture for the young ticks to hatch and reinfect them.

The probability of reaching important practical results is such that these investigations should be continued until the subject is thoroughly understood.

SWINE DISEASES.

The investigations of swine diseases have been carried on with the idea of determining (1) the relative prevalence of hog cholera and swine plague, (2) the value of protective inoculation by various processes as a preventive of hog cholera, and (3) to test the practicability of preventing those diseases by the use of the ptomaines or bacterial products developed by growing the germs in proper culture media.

These researches have shown that swine plague is relatively more prevalent than was first anticipated and that it is probably the cause of as much mortality as is hog cholera. They also confirm our conclusion of last year, that inoculation is not a practical or reliable method of preventing hog cholera.

The investigations of the bacterial products have been very interesting, at least from a scientific point of view and as regards their application to the prevention of human diseases. This interest is increased at the present time by the announcement of the celebrated German investigator, Professor Koch, that he has discovered a remedy for tuberculosis. This remedy is now believed to be a product

of the growth of the bacillus of tuberculosis in appropriate culture material.

It should not be forgotten that the possibility of applying these bacterial products to the prevention and cure of diseases was first made evident by the investigations of the Bureau of Animal Industry, and that if Professor Koch's remedy is of the nature supposed his method consists in the application of a principle discovered here.

Our recent work in this line has been to separate the substance which has this preventive power from the many other chemical principles present in the culture liquids, and to study its nature and properties. This chemical work was placed in the hands of Dr. von Schweinitz with general directions as to the character of the investigations, in the spring of 1890, and since that time the products of the hog-cholera germ have been studied quite thoroughly and their remarkable power in conferring immunity has been confirmed.

Unfortunately these products are very irritating, and in the dose necessary to produce an effect upon the system of the hog they cause an inflammation at the point where injected into the tissues, which is a great objection to their use. They could be given in smaller and more numerous doses, but this increases the expense so much as to make their use impracticable. When administered by way of the stomach their effect is lost.

That this method of preventing disease with other maladies and other species of animals and particularly with mankind is destined to be of much service seems very probable. With this ultimate object in view we have endeavored to produce artificially a drug which would have the same composition and effect as the bacterial products. By such a process we hope to obtain the preventive agent at less expense and without danger of being contaminated with the deadly germs that cause the disease. To a great extent these researches have been successful and we are now able to produce a substance entirely by chemical processes which not only resembles the bacterial product of the hog-cholera germ in composition but which has almost if not quite the same power of conferring immunity from the disease.

By these preliminary studies we have worked out the proper methods of investigation, and it is hoped that by applying them to tuberculosis and other diseases which affect animals of greater value than hogs successful means of prevention may be secured. And if incidentally these methods of prevention can be applied to diseases affecting mankind, their value to the country and to the world will only be increased thereby.

GLANDERS.

The improvement in the District of Columbia in regard to this disease is shown by the number of affected animals discovered in 1890 as compared with those in 1889. The last report of this Bureau gave the number of horses condemned each month up to and including November, 1889. Since then the number condemned monthly has been as follows:

December	0	July	4
January	2	August	1
February	2	September	2
March	0	October	2
April	4	November	0
May	2		
June	4	Total	23

During the twelve preceding months the number condemned was seventy-eight. During the spring of 1890 a very general inspection was made through the city with especial attention to all large stables, and the fact that so few animals were discovered shows that now the District is very nearly free from the disease. It is impossible, of course, to maintain absolute freedom from such a malady, as it is frequently introduced by horses from other parts of the country that are sold in this market.

PUBLICATIONS.

The great need of publications for gratuitous distribution which treat in a systematic and thorough manner of the different subjects connected with the breeding and care of the domestic animals has long been apparent. The field is a large one to cover and can not be properly treated in the works of private firms without making the publications so expensive that they would be beyond the reach of the people who most need them. For this reason the Bureau of Animal Industry has undertaken the preparation of a series of reports on the breeding and management of live stock in health and disease.

These reports are intended for popular use, and while so complete and accurate that they will be useful to the professional man or scientist, their language is to be as plain and free from technicalities and unusual expressions as is consistent with a clear and forcible treatment of the subject. Their purpose is educational, and it is hoped that they will do much to clear away the absurd traditions and practices born of ignorance which still obtain in some parts of the country, and that they will furnish a basis for a progressive and successful management.

Large amounts of money are being expended for improved stock, and unless buyers understand the peculiar characters of the different breeds, the conditions under which they have been formed, the care which is necessary for their existence, and the diseases to which they are subject, they can only meet with indifferent success in breeding them. The best stock is the result of the most intelligent management, care, and selection, and unless this management and selection are continued the stock will deteriorate.

The number of breeders who have succeeded in establishing or improving a breed have been relatively few, and the number who can even maintain all the good qualities of our most improved breeds without continually infusing new blood are not numerous. This shows a lack of knowledge among the great majority of breeders as to the requirements of improved breeds of animals which calls for correction. It is the object of this Bureau to collect this valuable information from the few who do know and distribute it broadcast to the many who ought to know.

The first work of the series treats of the animal parasites of sheep, one of the most important subjects which confronts the sheep breeders. This work has been received with great favor, and the first edition was exhausted within a few months after it was ready for distribution. A second edition was immediately ordered and the applications for copies are still numerous.

The second report of the series is at this writing going through the press, and it will probably be ready for distribution by the 1st of February, 1891. It treats of the diseases and accidents from which

horses suffer, and it will be useful to an even larger class than the volume which has preceded it. No labor has been spared either on the text or the illustrations, and we have endeavored to make it compare favorably with the splendid volumes in other and less practical fields of science and research which the various departments of the Government have from time to time issued.

A volume on sheep husbandry and one on trotting and thoroughbred horses will be ready for the press almost as soon as the report just mentioned is out of the way. In addition to these the regular report of the Bureau of Animal Industry for the years 1889 and 1890 is in an advanced stage of preparation and will be sent to the press early in 1891.

CONDITIONS AFFECTING THE PRICE OF HOGS.

The conditions affecting the price of the animals produced upon the farm is one of the most interesting and important studies which can be made for the benefit of the stock grower, and as the chief of the Bureau has recently made an investigation of this subject a brief statement of the facts and conclusions are inserted in this report.

The fluctuations in the price of hogs appear at present to be more easily traced and more subject to principles that can be definitely formulated than the variations in the price of other farm animals, and consequently they have been selected for this preliminary investigation.

The calculations which follow are principally based upon the statistics of the United States Census Bureau, the estimates of the Statistical Division of the Department of Agriculture, the report of the Bureau of Statistics of the Treasury Department, and the annual report of the Cincinnati Price Current. The population for the intermediate years is estimated by the rate of growth for the ten years, taking account each year of the immigration.

The following table shows the population of the United States, the total hog product including lard put on the market by the packing establishments, the quantity which this constitutes per capita of population, the quantity of hog product exported, and the total and per capita quantity remaining for home consumption for each year since 1873:

TABLE 1.

Years.	Population.	Hog products.				
		Total.		Exported—year ending June 30.	Home consumption.	
		Pounds, year ending March 1.	Per capita.		Pounds.	Per capita.
1873	42,125,489	1,654,707,583	39.3	690,063,405	964,644,178	22.9
1874	43,281,338	1,701,314,614	39.3	623,415,255	1,077,899,359	24.9
1875	44,374,463	1,611,038,842	36.3	473,308,273	1,137,730,569	25.6
1876	45,431,938	1,457,743,118	32.1	550,331,129	907,411,989	20.0
1877	46,482,434	1,669,369,043	35.9	764,470,273	904,898,770	19.5
1878	47,550,552	2,045,239,979	43.0	1,007,371,526	1,037,868,453	21.8
1879	48,679,389	2,515,978,153	51.7	1,143,209,938	1,372,668,215	28.2
1880	50,155,783	2,423,525,672	48.3	1,230,702,175	1,192,833,497	23.8
1881	51,473,728	2,643,053,296	51.5	1,233,015,127	1,410,038,169	27.4
1882	52,928,275	2,357,932,478	44.5	798,841,846	1,559,090,632	29.5
1883	54,215,969	2,148,369,223	39.6	627,003,446	1,521,275,777	28.1
1884	55,435,564	2,238,427,478	40.2	715,142,817	1,513,284,661	27.3
1885	56,547,693	2,441,877,868	43.2	755,416,926	1,686,460,942	29.8
1886	57,613,057	2,586,117,896	44.9	800,784,530	1,785,333,296	31.0
1887	58,848,103	2,677,814,968	45.5	827,349,998	1,850,464,970	31.4
1888	60,155,838	2,525,552,000	42.0	732,079,843	1,791,472,157	29.8
1889	61,378,141	2,479,053,000	40.4	782,601,275	1,696,451,725	27.6
1890	62,622,250	3,047,651,000	48.7	1,159,642,885	1,888,008,115	30.1

The quantity of pork products put upon the markets by the packing houses of the East and West is partly estimated, but is so nearly correct that the exact figures could not in any way change the conclusions which are here drawn from the table.

We see by this table the enormous amount of hog product put upon the market in this country, an amount which varies in round numbers from 1,457 million pounds in 1876 to 3,047 million pounds in 1890. No account is taken of the hogs killed and consumed by farmers or sold in villages, towns, and cities, but which are not packed, as there are no definite data from which it can be determined. Although this quantity is large it probably has no great effect upon the price of hogs in the packing centers, since it is the visible supply of hog products, the quantity put into the channels of commerce by the packing establishments, which we would expect to influence prices.

As would be expected there has been a great increase of hog product during the years covered by the table. From 1873 to 1877 the total amount was less than 2,000 million pounds per annum, varying from 1,457 millions in 1876 to 1,701 millions in 1874. From 1878 to 1889 the product was over 2,000 millions each year, varying from 2,045 millions in 1878 to 2,677 millions in 1887, and reaching the enormous aggregate of 3,047 millions in 1890. The quantity which this constitutes per capita of population varies from 32.1 pounds in 1876 to 51.7 pounds in 1879 and is only 48.7 pounds for the great output of 1890.

The quantity of pork products exported reached the highest figures in 1880 and 1881, dropping off in 1882 and subsequently, as a result of the unfavorable restrictions and prohibitions imposed by several foreign governments. Deducting the exports from the total production we find that the quantity left on the domestic market for home consumption has varied from 19.5 pounds in 1877 to 31.4 pounds in 1887 and was 30.1 pounds in 1890.

In order to bring out the effect of demand and supply upon the price the following table has been compiled, which shows in parallel columns the cost of the hogs used for the winter packing in the West, the total hog product per capita, and the domestic supply per capita for the year:

TABLE 2.

Year.	Cost of hogs, winter packing to March 1.	Hog product, per capita.	Domestic supply per capita.	Year.	Cost of hogs, winter packing to March 1.	Hog product per capita.	Domestic supply per capita.
1873	$3.73	39.3	22.9	1882	$6.06	44.5	29.5
1874	4.34	39.3	24.9	1883	6.28	39.6	28.1
1875	6.66	36.3	25.6	1884	5.18	40.2	27.3
1876	7.05	32.1	20.0	1885	4.29	43.2	29.8
1877	5.74	35.9	19.5	1886	3.66	44.9	31.0
1878	3.99	43.0	21.8	1887	4.19	45.5	31.4
1879	2.85	51.7	28.2	1888	5.04	42.0	29.8
1880	4.18	48.3	23.8	1889	4.99	40.4	27.6
1881	4.64	51.3	27.4	1890	3.66	48.7	30.1

This table shows that in a general way the cost of hogs has varied inversely with the total hog product per capita, that is to say, the cost has increased in most cases as the product decreased, and *vice versa*. The variations are not always, however, in this inverse sense,

and there is even less correspondence to be found between the fluctuations in cost and the quantity remaining for domestic consumption per capita. It is evident that there is some influence aside from the mere question of supply and demand, which has had an equal or greater effect on the price of hogs. Our investigation indicates that this important factor is the price of corn.

The following table is compiled to show in parallel columns the value on the farms of the corn crop and the cost of hogs for the succeeding winter's packing:

TABLE 3.

Year.	Cost of corn on farms.	Year.	Cost of hogs, winter packing to March 1.
	Cents.		
1872	39.8	1872-'73	$3.73
1873	48.0	1873-'74	4.34
1874	64.7	1874-'75	6.66
1875	42.0	1875-'76	7.05
1876	37.0	1876-'77	5.74
1877	35.8	1877-'78	3.99
1878	31.8	1878-'79	2.85
1879	37.5	1879-'80	4.18
1880	39.6	1880-'81	4.64
1881	63.6	1881-'82	6.06
1882	48.4	1882-'83	6.28
1883	42.0	1883-'84	5.18
1884	35.7	1884-'85	4.29
1885	32.8	1885-'86	3.66
1886	36.6	1886-'87	4.19
1887	44.4	1887-'88	5.04
1888	34.1	1888-'89	4.99
1889	28.3	1889-'90	3.66

The above table shows that the fluctuations in the price of corn and of hogs correspond so closely as to be really surprising. The only discrepancies are in accordance with what appears to be a general rule that there is a tendency, after corn has been high, for the price of hogs to be sustained or even to advance for one year after corn has declined.

These facts are best shown by the accompanying diagrams. The domestic supply of hog product per capita, that is, the total hog product put on the market by the packing houses less the quantity exported, is compared in Diagram A with the price paid by packers in the West for hogs used in the winter's packing. It will be seen that while the direction of the lines representing the fluctuations is generally in an opposite direction, this relation is by no means constant. It is evident that there are other and more important factors which influence the price of hogs.

Diagram B illustrates the fluctuations in the price of corn, the price of hogs, and the total hog product per capita placed upon the markets by the packers. By following the direction of the lines from year to year it is seen that there was a sharp advance in the price of the corn crops of 1873 and 1874, the price of hogs immediately following. The decline in the price of corn in 1875 was not at once followed by a decline in the price of hogs, but, on the contrary, the winter packing ending March 1, 1876, cost more than that of 1875, although made from cheaper corn. The reason for this is seen in the decline in production. In 1879, 1880, and 1881 we find another advance in corn, followed at once by an advance in hogs. Again we find the

DIAGRAM A.

Average price of hogs and home consumption of hog products per capita.

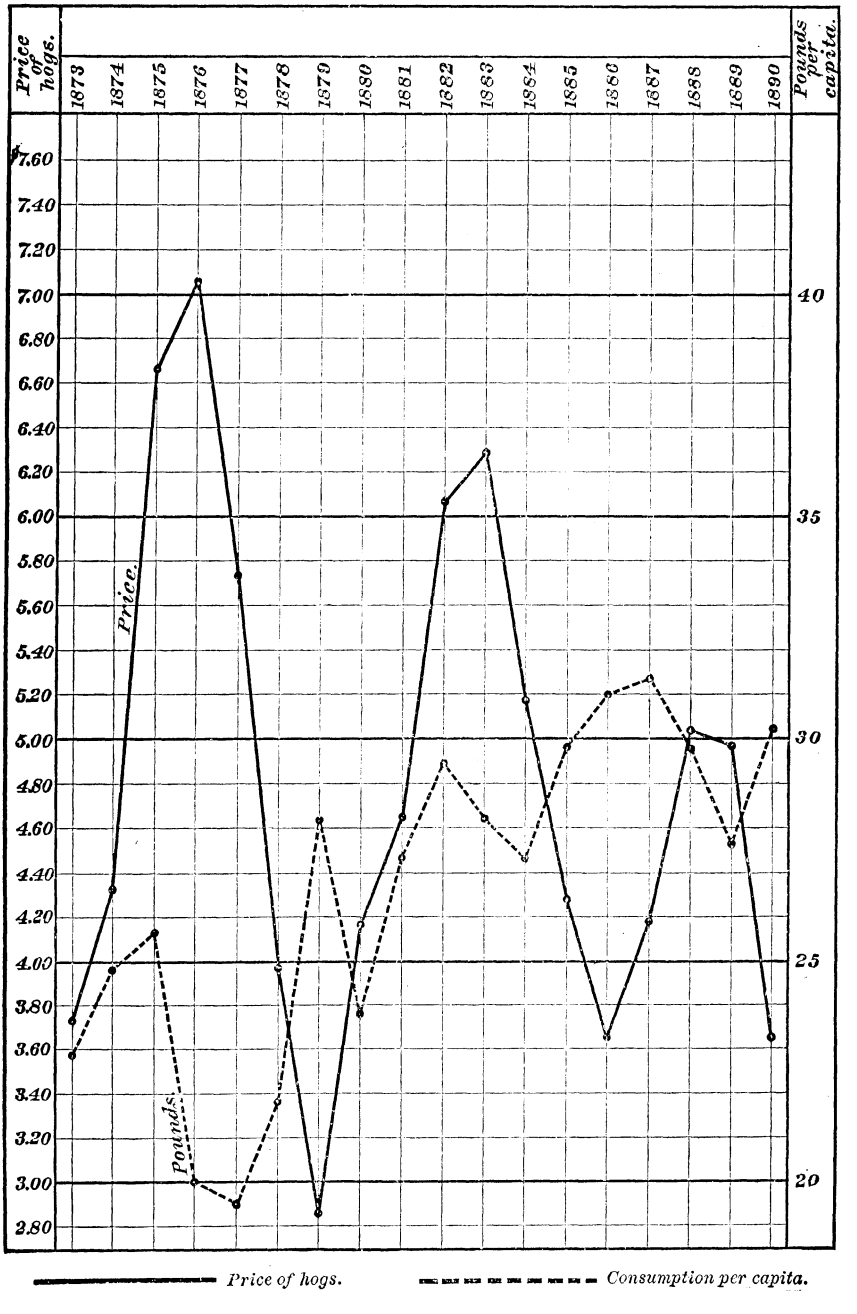
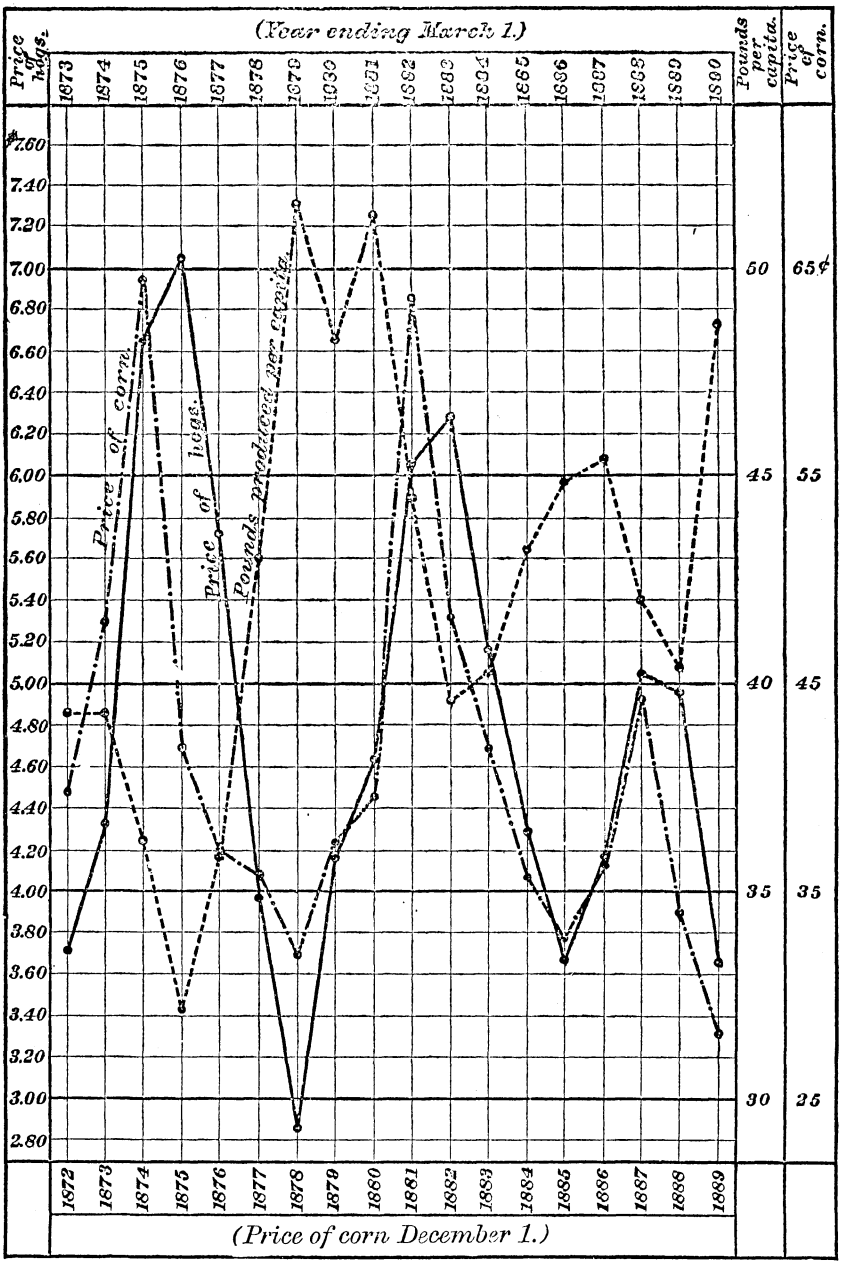


DIAGRAM B.

Average price of hogs, compared with the total production of hog products per capita, and the price of corn.



price of hogs advancing in the winter of 1882–'83, although the 1882 corn crop shows a very considerable decline in price. This advance in the price of hogs corresponds with a decreased production of hog product per capita of population. The second year of decline in the price of corn, that is, 1883, is followed by a marked decline in the price of hogs, and this corresponds with a slight increase in production of pork product. Then we find that, with the continued decline in corn during 1884 and 1885, there was also a decline in hogs. The 1886 corn crop brought more money and the price of hogs at once advanced. The crop of 1887 was still higher in price and the price of hogs again advanced. The 1888 corn crop was lower in price, and here we see the effect of the rule above referred to, for, while the price of hogs did not advance, it was sustained and the drop was very slight, only 5 cents per hundred pounds. In 1889 the price of corn was still lower and the drop in the price of hogs was very marked.

If, now, we turn our attention to the line on the chart showing the quantity of hog product in proportion to the population we find that in 1874 the price of hogs advanced before there was any decrease in production. The second year after the advance in corn the reduction in the quantity of hog product is marked, and the reduction continued one year after there was a fall in the price of corn. In 1878–'79 the production per capita reached the highest point, corresponding with the low-priced corn crop of 1878. In 1880 there was a decrease in hog product corresponding to the advance in corn, and in 1881 we find an exception to the rule—an increase in hog product and at the same time a second increase in price of corn. Then comes a drop in production in 1882 corresponding to the increase in the price of the corn crop of 1881. With the drop in the price of corn in 1882 we find that the hog product instead of increasing continued to decrease. This shows a tendency, exhibited also in 1876, that should be noted, which is that the hog product does not always respond to a fluctuation in the price of corn until the succeeding year. That is, when the hog crop has been decreasing for one or more years it requires some time to change the conditions and increase it, or *vice versa*. We see the operation of this rule again in the increase in the product of 1887 over 1886, although there was an advance in the price of the crop fed. So again the decrease in the price of corn in 1888 over 1887 was not followed by an increase in hog production until the succeeding year.

From these facts we may conclude that during the eighteen years covered by the tables and charts the following general rules appear to bear upon this question:

(1) The price of hogs increased with the price of corn without regard to the amount of hog product placed upon the market.

(2) After an advance in the prices of corn and hogs for a series of years the price of corn dropped one year before the decline came in the price of hogs.

(3) The fluctuation in the quantity of hog product per capita of population which followed an advance or decline in the price of corn after having moved in the opposite direction did not usually occur until a year had intervened. When corn had been high this failure of the hog product to increase with the first decline in corn kept up the price of hogs or even increased it for one year after corn dropped; but when corn had been low the failure of the hog product to decrease in quantity the first year that corn advanced did not prevent the

advance in the price of hogs immediately following the increase in the price of corn.

It would appear that the above conclusions are worth remembering, for if these rules have held good for eighteen years they will likely apply for some time in the future.

Having determined some of the factors which have influenced the price of hogs, and having found that the most important of all was the price of corn, it may be well to briefly consider the causes which fix the latter. The following table shows the price of corn, the total production, and the production per capita of population.

TABLE 4.

Year.	Price of corn.	Production per capita.	Total production.	Year.	Price of corn.	Production per capita.	Total production.
	Cents.	*Bushels.*	*Bushels.*		*Cents.*	*Bushels.*	*Bushels.*
1873	48.0	22.1	932,274,000	1882	48.4	30.6	1,617,025,100
1874	67.7	19.6	850,148,500	1883	42.0	28.6	1,551,066,895
1875	42.0	29.8	1,321,069,000	1884	35.7	32.4	1,795,528,000
1876	37.0	28.2	1,283,827,500	1885	32.8	34.2	1,936,176,000
1877	35.8	28.8	1,342,558,000	1886	36.6	28.9	1,665,441,000
1878	31.8	29.2	1,388,218,750	1887	44.4	24.7	1,456,161,000
1879	37.5	36.0	*1,754,591,676	1888	34.1	33.0	1,987,790,000
1880	39.6	34.2	1,717,434,543	1889	28.3	34.4	2,112,892,000
1881	63.6	23.2	1,194,916,000				

* Census.

Diagram C illustrates these fluctuations graphically. We see that, beginning with 1872, there was a decreased production of corn per capita of population in 1873, and a further decrease in 1874, and that there was a corresponding increase in price. In 1875 there was an increase in production and a decrease in price. In 1876 there was a decrease in production and a further decrease in price. In 1877 there was a slight increase in production and an equally slight decrease in price. In 1878 there was another increase in production and a decrease in price. In 1879 there was a considerable increase in production and also an increase in price. In 1880 there was a slight decrease in production and a slight increase in price. In 1881 there was a great decrease in production and an equally marked increase in price. In 1882 the production increased and the price decreased. In 1883 there was a decrease both in production and price. In 1884 and 1885 the production increased and the price decreased. In 1886 and 1887 the production decreased and the price increased. In 1888 and 1889 the production increased and the price decreased. This shows that as a rule the increase in production corresponds with the decrease in price, and *vice versa*, the only exceptions being found in the years 1876, 1879, and 1883, or three years in the eighteen covered by the diagram.

It is interesting to note concerning the three exceptional years just mentioned that two of them, 1876 and 1883, correspond to the years on Diagram B, where it is shown that the price of hogs advanced in spite of the fact that the price of corn declined. That is to say, the reduction of the stock of hogs not only increased the price of hogs but lowered the price of corn, because there were not so many hogs to feed and the corn which would otherwise have been fed was put upon the market. The remaining exception, 1879, which is a fluctuation in the opposite direction, corresponds to the year on

DIAGRAM C.

Production of corn per capita, and the average price per bushel on farms, December 1.

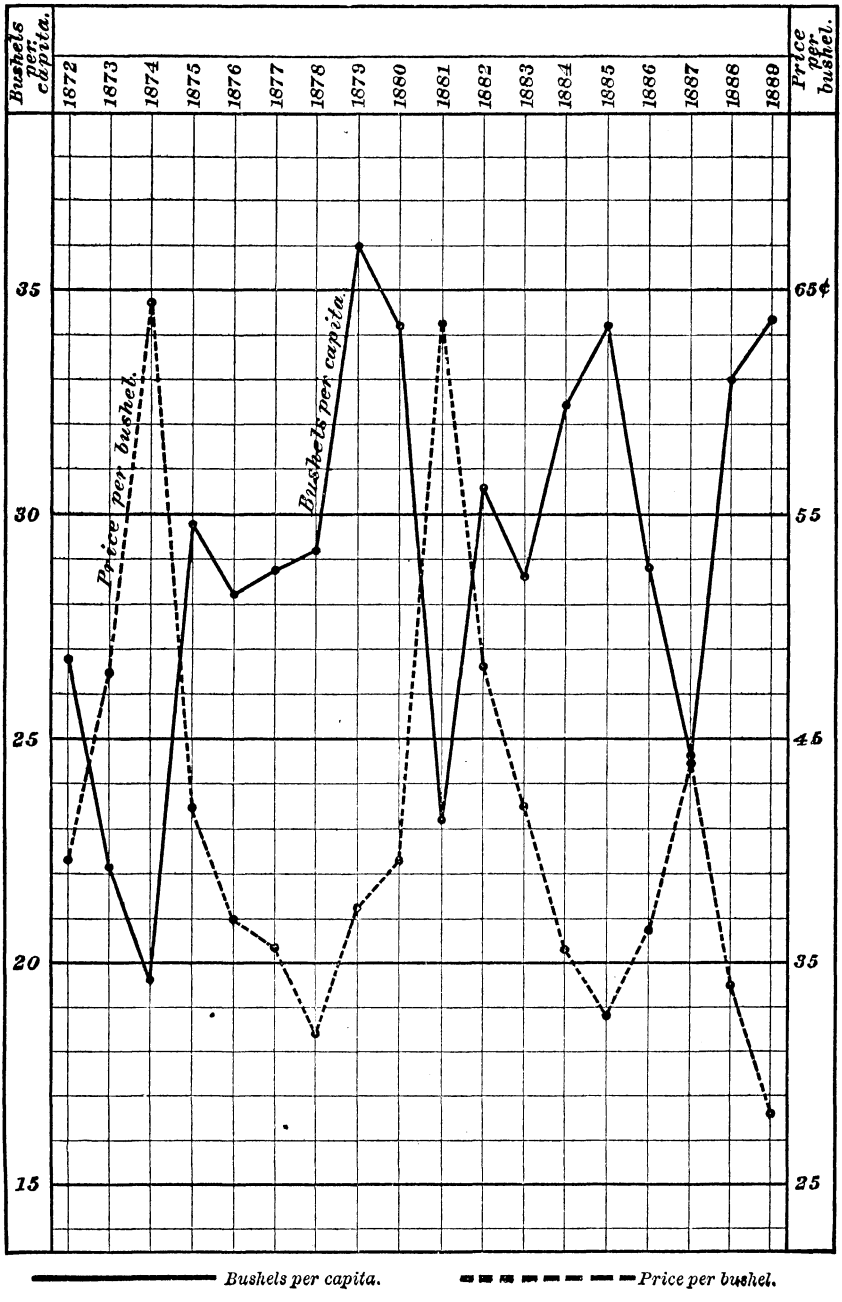


Diagram B, when the production and consequently the stock of hogs had reached the highest point. The large stock of hogs then on hand evidently was the means of furnishing a home market for the corn and caused an advance in price when under other conditions there would have been a further decline.

The price of corn is therefore governed primarily by the law of supply and demand, but it may also be influenced by the financial condition of the country, the purchasing power of money, and the relative supply of other cereals, and perhaps by other conditions.

There is one other point deserving of consideration in this connection. It is a very common custom when corn advances in price for farmers to hurry their hogs to market and reduce their breeding stock. A glance at the table demonstrates the existence of this custom, for we see that the hog product was invariably decreased as the price of corn advanced and when the price of corn declined the hog product again increased.

This fact has led the writer to inquire if there was in reality any less return to the feeder for each bushel of corn when the price was high than when it was low. To determine this the three years 1874, 1881, and 1887, were taken, at which the ascending lines were at their highest point, and it was found that the average price of corn for those years was 57.5 cents and the average price of hogs $5.92—that is, the value of a bushel of corn was equivalent to the value of 9.54 pounds of hogs.

Taking now the four years 1872, 1878, 1885, and 1889, when the descending lines reached their lowest point, we find the average price of corn to have been 33.2 cents and the average price of hogs $3.47. In this case a bushel of corn is equal in value to 9.56 pounds of hogs, or practically the ratio is exactly the same as when corn was high.

It appears that the best returns for hogs in comparison with the price of corn were received during the intermediate years between the extremely high or extremely low prices. Taking the eight years 1873, 1876, 1877, 1879, 1880, 1883, 1884, and 1886, we find the average price of corn to have been 39 cents and the average price of hogs $4.59. For these years it will be seen that 8.5 pounds of hogs brought as much as a bushel of corn.

These facts are important as indicating the proper course for the farmer to pursue under the varying conditions which are here considered. Their application is so plain to those who are interested that it is not necessary to go into greater details in this report.

UNITED STATES CATTLE QUARANTINE.

The superintendents of the various neat cattle quarantine stations report the names of the importers and the number and breed of each lot of animals imported during the year 1890, as follows:

Station for the port of Baltimore, St. Denis, Maryland.

[Dr. A. M. Farrington, acting veterinary inspector.]

Date of arrival.	Name and post-office address of importer.	Port of shipment.	Name of breed.	No. of animals.
1890. Mar. 17	S. C. Kent, West Grove, Pa.....	Liverpool.....	Guernsey.....	62

Station for the port of New York, Garfield, New Jersey.

[Dr. Wm. Herbert Lowe, superintendent.]

Date of arrival.	Name and post-office address of importer.	Port of shipment.	Name of breed.	No. of animals.
May 13	H. N. Heffner, Delaware, Ohio	London	Red Polled	14
15	Alfred Sully, New York City	....do	Hereford	6
21	E. M. Barton, Hinsdale, Ill	Antwerp	Swiss	14
Nov. 27	W. W. Law, New York City	London	Jersey	4
	Total			38

Station for the port of Boston, Littleton, Massachusetts.

[Dr. A. H. Rose, superintendent.]

Mar. 21	R. J. Mendenhall, Minneapolis, Minn	Liverpool	Shorthorn	7
May 2	S. P. Clarke, Dover, Ill	....do	Galloway	2
July 3	....do	....do	....do	3
	Total			12

Station for the port of Boston, Littleton, Massachusetts.

[Dr. A. H. Rose, superintendent.]

SHEEP.

Oct. 28	Jno. Milton, Marshall, Mich.	Liverpool	Shropshire	41

The following shows the whole number of cattle and sheep received at the various stations from January 1, 1889, to January 1, 1890:

Patapsco station	62
Garfield station	38
Littleton, Massachusetts	53
	153

INVESTIGATIONS OF THE INFECTIOUS DISEASES OF ANIMALS.

By Dr. Theobald Smith.

The following brief account of the investigations conducted under my direction into the nature of the infectious diseases of animals has been prepared by Dr. Theobald Smith, who is in charge of this branch of the work of the Bureau of Animal Industry. All minor details, as well as the greater part of the autopsy notes, have been reserved for special reports, and only the most important results are given in this place.

INVESTIGATIONS OF TEXAS CATTLE FEVER.

The investigations into the nature and causes of Texas or southern cattle fever have been busily pushed during the summer of 1890, and some very important advances made which are destined to be of great practical importance.

During the summer of 1888 much time was spent in determining

whether or not any specific bacteria are the cause of this disease as they are of a host of human and animal infectious diseases. This was the more necessary inasmuch as former observers have always described bacteria of one kind or another associated with it. But no bacteria could be found in the bodies of animals which had succumbed to Texas fever excepting those which quite invariably multiply in dead bodies after a time and have no significance whatever. At the same time the writer came to the conclusion that the disease was confined to the blood and consisted essentially in a breaking down of the red corpuscles.

During the summer of 1889 arrangements were made by which the disease could be studied near the laboratory in Washington, and, as reported, a parasite was found within the red corpuscles whose presence could only mean the breaking up of the corpuscle itself sooner or later. This discovery was adapted to explain satisfactorily the various lesions observed, as well as the great reduction in the number of corpuscles observed in those cases which died after prolonged disease or which ultimately survived. In some of these cases the blood is watery; it has in fact scarcely any color remaining. This condition was expressed mathematically by counting the number of blood corpuscles. Thus in most cases before death the number of corpuscles was but one-sixth of the number normally present in the body. When we contemplate the very important functions of these elements we need not be surprised at the serious effects resulting from loss to the body, within one or two weeks, of five-sixths of its corpuscles.

During the present year the disease was produced at the Experiment Station by the importation of North Carolina and Texas cattle and the investigations continued. The work was sufficiently extensive to occupy most of the time from July to December, while the examination of preparations and other work connected with this subject occupied much of the writer's time last winter and will of necessity require much additional labor this winter.

During the summer about fifty-three native animals, distributed around in various experimental inclosures at the station, received more or less careful attention. The temperature of all was taken every other day by Dr. Kilborne to detect the beginning of the disease. Of these about twenty-four either succumbed to Texas fever or else were killed in a dying condition. These cases were subjected to a careful post-mortem examination, and the internal organs underwent a careful microscopic scrutiny at the laboratory. The surviving animals were examined at different intervals of time, more especially with reference to the condition of the blood. The blood corpuscles were counted and carefully examined with reference to the presence of the Texas fever parasites in order to determine the presence of any disease and the progress it was making. Those animals that died were also examined more or less frequently during the course of the disease in the same way. It was found moreover that these blood examinations were absolutely necessary in many cases to detect any disease whatever, and they put the field experiments, to be outlined later on, on a positive basis.

The examination of the internal organs, such as the spleen, liver, and kidneys, from those animals that died of Texas fever showed the presence of the blood parasite described last year in every case; in some in such enormous numbers that every other blood corpuscle appeared infected. In the course of the disease the parasites were

detected in many of the cases examined. They were also present in the circulating blood one or two days before the animal died.

This parasite, which, as has been stated before, does not belong to the bacteria but to the protozoa, received considerable attention during the summer. It has appeared under several forms, and distinct amœboid movements of the largest forms were seen within the red corpuscles whenever the preparation was maintained above a certain temperature.

The work of the summer has thus confirmed that done during the two previous summers. There can be no doubt of the existence of genuine parasites within the red corpuscles and their destructive activity.

THE RELATION OF TICKS TO TEXAS CATTLE FEVER.

While the investigations into the nature of this disease were going on other equally important work was being carried on at the Experiment Station on the external characters of the disease.

It is well known to those who have come in contact with southern cattle in summer that they are infested with the so-called cattle-tick, a pest belonging to the class *Arachnoidea* and to the family *Ixodidæ*. These ticks are carried north with cattle during the warm season of the year. When fully matured they drop off from the southern animals, lay their eggs on the ground, and perish. The young ticks are hatched within fifteen to thirty days after the eggs are laid and at once get upon the cattle, where they become mature within twenty to thirty days to again drop off, lay their eggs, and die. This process goes on continuously until the cold weather comes.

At various times and in different parts of the country it has been suggested that the ticks were the cause of Texas fever in northern cattle. This inference was undoubtedly suggested by the fact that nearly all cattle that die of Texas fever are observed to have these ticks of various sizes attached to the skin. Moreover the disease only makes its appearance after the young ticks have attached themselves to cattle. Though this was purely a *post hoc propter hoc* inference, it was nevertheless true, as the experiments to be recorded will amply prove.

During the summer of 1889 Dr. F. L. Kilborne, in arranging the various inclosures at the Experiment Station for the exposure of native cattle to the infection of Texas fever, conceived the happy idea of testing this popular theory of the relation of ticks to the disease. This he did by placing southern (North Carolina) cattle with native cattle in the same inclosure and picking the ticks from the southern stock as soon as they had grown large enough to be detected on the skin. This prevented any ticks from maturing and infecting the pasture with the eggs and hence prevented any ticks from infesting native cattle subsequently. At the same time, in another inclosure, the ticks were left on the southern cattle. The natives in the latter field died of Texas fever; those in the former did not show any signs of the disease.

Another experiment was made in September in the same manner by preparing three fields, one with southern cattle and ticks, a second with southern cattle from which the ticks were being removed, and a third over which only adult ticks had been scattered. The result was equally positive. In the first field no natives died, but careful examination of the blood by the writer showed Texas fever in an un-

mistakable manner. In the "tick" field one animal died of Texas fever, and the examination of the blood showed that most other natives in the field were sick. In the third field containing southern cattle without ticks no disease could be detected.

These two tests pointed directly to ticks as being in some way the cause of Texas fever. At the same time it was thought best to confirm these results by further experiments during the present year before other agencies could be eliminated. The immediate inference was that the ticks infect the pastures, and that in some unexplained manner the infection finds its way into the body of susceptible cattle. The preliminary conclusions deducible from the work of 1888 and 1889 can be formulated as follows:

(1) Texas fever is a disease not caused by bacteria. Its nature can not be understood by supposing a simple transfer of bacteria from southern cattle to pastures and from pastures to northern cattle.

(2) The cause is very probably a protozoön, with a more complex life history, living for a time within the red corpuscles of infected animals.

(3) Southern cattle without ticks can not infect a pasture.

(4) Ticks alone scattered on a pasture will produce the disease.

The work of 1890 was planned to confirm or refute these preliminary conclusions and to furnish additional information.

The fields were arranged as before. One contained North Carolina cattle with ticks, a second Texas cattle with ticks, a third North Carolina cattle without ticks, a fourth ticks only, and a fifth soil from the pastures of infected North Carolina farms. Other fields were also laid out to test questions which need not engage our attention in this brief survey.

The results confirmed those of last year. The first animal to die was in the "tick" field, containing no southern cattle. No disease appeared in the soil field. Unfortunately, owing to the limited space of ground at our disposal and its barren, rolling character, ticks or eggs were washed during the very heavy rains of the summer from the tick field into the field containing southern cattle without ticks, although a wide lane intervened. The natives in this field thereupon all died of Texas fever. At the autopsy of these cases ticks were found attached to their skin in abundance.

The disease caused by Texas cattle could not be distinguished in character from that which was produced by North Carolina cattle.

These results similarly pointed to ticks as the cause. The precise manner in which they caused the disease was by no means clear, however. The theory which seemed for a time most acceptable was that the adult ticks as they dropped off infected the pastures with germs which they had taken in with the blood of southern cattle, and that the germs were introduced into the body of northern cattle with the food. At the same time no parasite could be detected in the blood of southern cattle examined at various times, on which fact I would lay no great stress, however. Of more importance is the peculiarity which is exhibited by this disease in its period of incubation, as it may be provisionally denominated, and which is opposed to this theory. Thus, when native and southern cattle are placed on the same pasture at the same time it will take from forty to sixty days for the disease to appear. After the disease has once shown itself fresh animals placed on the same pasture may die, according to our experience, within thirteen days after the begin-

ning of the exposure. We might say that the virus has "to ripen" on the pasture, which takes nearly two months, depending on meteorological conditions. When once "ripened" this virus does its deadly work within two or three weeks. This explanation, however, would be merely formulating our ignorance concerning the true nature of the infectious principle.

To the writer there seemed but one inference to be drawn from the facts, and that is that the presence of young ticks is in some way directly associated with the appearance of the disease. It requires from forty to sixty days for the matured ticks to drop from the southern cattle and the eggs laid by them to develop into young ticks. After that period young ticks are present on the pastures until they are destroyed by the cold, or until the cold interferes with the development of the embryo in the egg. In other words, the period of incubation of the disease is explained without any difficulty by the life history of the tick.

The question was solved, experimentally, in the following manner: Eggs laid by ticks sent from North Carolina were placed on dried leaves in dishes partly filled with moist soil and kept in the laboratory until the young emerged from the egg. The period of incubation depends entirely upon the relative amount of heat, and has varied from fifteen days in midsummer to forty days in November, when the rooms of the laboratory became cold at night (50° to 60° F.). These young ticks were placed on four different animals of different ages, kept away from any infected inclosures. Two were placed in stalls, one of them on an adjoining farm, and two were allowed to stay in a patch of woodland with healthy cattle. Of these four two died of Texas fever, as determined by careful post-mortem examination. One of them was in the stall away from the station, the other in the patch of woodland. The other two became very ill. One of them never recovered, but had to be killed later on; the other recovered. In all of them the germs were observed in the blood. The disease possessed the same characters as those observed in cattle in the infected pastures during the summer. There was an elevation of temperature from nine to twelve days after the young ticks were placed on the animals, going as high as 107° F. in one animal. Accompanying the fever a gradual reduction in the number of blood corpuscles was observed. In order to show more conclusively the truth of the statements made, a few brief notes from one of the experimental cases is appended:

No. 144.—Cow about eight years old, purchased September 16 from a neighboring farm and placed among a number of healthy reserve cattle in a piece of woodland at some distance from any infected field.

September 17.—A considerable number of young ticks, hatched in the laboratory from the eggs laid by ticks sent from North Carolina, placed on this animal.

September 18.—Temperature 101.2° F., 6.3 millions normal red corpuscles in blood.

September 24.—Another lot of recently hatched ticks placed on the animal.

September 27.—A. M., temperature 104° F.

September 29.—10.45 a. m., temperature 106.2°, pulse 54, respirations 27; 4.93 millions corpuscles in blood. Ticks abundant on body, especially on inside of thighs. Still quite small.

September 30.—P. M., 107°.

October 1.—P. M., 106.3°.

October 2.—P. M., 104°.

October 3.—Found dead this morning. Seen alive at 6 p. m. yesterday. A large number of ticks on animal, just through second molt. None of them large as yet. Lungs only partly collapsed; trachea and bronchi filled with foam. Ecchymo-

ses under epicardium of both ventricles of heart and under endocardium of left ventricle.

Spleen very large, blackish, soft. Weighs 4½ pounds. (Normal weight about 2 pounds.)

Liver weighs about 12 pounds; enlarged, yellowish on section. Complete injection of the intra-lobular bile capillaries. Extensive fatty degeneration of liver tissue. Occasional groups of hæmatoidin crystals.

Bile dark, scarcely flows. Density due to large quantity of yellowish flakes and mucus.

Kidneys deeply congested; tubules contain much yellowish pigment. Urine in bladder of a deep, port wine color, barely translucent in small test-tube; alkaline; specific gravity, 1.015; no sediment; albuminous precipitate very abundant (.6 per cent., according to Esbach). Heavy flocculent precipitate when acetic acid added (hæmoglobin).

In preparations of blood from the heart, of liver, spleen, and kidneys a small number of corpuscles contain parasites, in contracted state, from 1.5 to 2 micro-millimeters in diameter. In the blood, spleen, liver, and kidney preparations a moderate number of large bacilli of post-mortem growth. (These bacilli are invariably present when the animal dies early in the night and is not examined until next day. They are never found in animals killed in a dying condition. They occur in other diseases under similar conditions.)

These brief notes demonstrate that Texas fever can be produced by placing young ticks on cattle, and that the disease can not be due to any abstraction of blood, for the ticks were still quite small and had scarcely begun to draw blood on a large scale. Moreover the corpuscles perished *in the body* as is shown by the coloring matter in the urine, by the thick bile, and the presence of pigment in the liver and kidneys. No disease appeared among the other cattle in the same inclosure.

While the nature of Texas fever is by no means made clear as yet, we are able to affirm that ticks can produce it. Whether the disease can be transmitted by any other agency must be decided by future investigations. Meanwhile the evidence accumulated thus far seems to favor very strongly the dictum: No ticks, no Texas fever.

SWINE DISEASES.

AN EXPERIMENT TO TEST THE VALUE OF SUBCUTANEOUS INJECTIONS OF HOG-CHOLERA BACILLI AS A MEANS OF PREVENTING HOG CHOLERA.

The first tests in this direction were made at the Experiment Station early in 1886, soon after the hog-cholera bacillus had been discovered. The tests at that time consisted in making two injections under the skin of minute quantities of culture liquid containing hog-cholera bacilli, several weeks apart. This method was modeled after that of Pasteur in anthrax vaccination. No favorable result could be detected at that time. Although there was little hope that such a method would prove efficacious in another trial, still it was thought best to make it, inasmuch as the disease to which the inoculated swine had been exposed in 1886 was of more than the usual virulence.

The method of subcutaneous injections of culture liquids containing hog-cholera bacilli, while on the one hand fraught with the possible danger of scattering disease germs where they do not originally exist, is nevertheless the simplest and cheapest method that can be devised for the vaccination of animals. These qualities of simplicity and cheapness are of vital importance in a question which has only a commercial aspect. It was therefore thought best to

give this method another and final trial, and in planning such an experiment it was considered necessary to eliminate all those sources of error which might possibly lead to an erroneous interpretation of results. Hence the following important conditions were kept in view:

(1) The animals must be young, unexposed hitherto even to a suspicion of disease. (2) There must be a large number of control or check animals of the same age and breed, which are to be subsequently exposed to the disease under precisely the same conditions as the vaccinated animals. (3) The disease to which they are exposed must have been carefully studied, the absence of other infectious diseases, such as swine plague, determined, and the virulence of the hog-cholera germs causing it tested on rabbits. The disease must be virulent enough to prove fatal to the control animals to make the test of any value whatever.

That all these conditions are of prime importance is evident from general considerations, and was made evident in a very striking manner by the outcome of the experiment, as will be seen further on.

The vaccine used.—In order to obviate the fatal effect of doses of hog cholera cultures injected under the skin, which sometimes shows itself quite unexpectedly, especially in young animals, the writer deemed it advisable to reduce the virulence of the cultures by appropriate means, so that larger quantities of the culture liquid might be injected to increase, if possible, the vaccinating effect without endangering the life or stunting the future development of the animal.

In reducing the virulence, or attenuating it, as it is more commonly denominated, the following method was pursued: Tubes of peptone bouillon* inoculated with hog-cholera bacilli were placed in a favorable temperature for multiplication (95 to 100°) over night. On the following day the culture liquid, now slightly clouded, was placed in an unfavorable temperature of 110 to 111° F. (43.5 to 44° C.) and kept there for about ten days. Thereupon fresh tubes were inoculated from these and subjected to the same process. From time to time rabbits were inoculated to test any attenuation that might have taken place, and it was noticed that there was a slight modification of the disease in rabbits after a time. After the bacteria had thus been exposed to a high, unfavorable temperature for more than two hundred days and passed through twenty cultures, a small dose of one-tenth cubic centimeter (one five-thousandth of a pint approximately) injected under the skin did not prove fatal to a rabbit, while larger doses were still fatal. Small quantities injected into an ear vein were likewise fatal. The reduction of virulence was therefore not very great, even after this very prolonged exposure to a high temperature. At the same time it was thought advisable to use it as vaccine *a*.

A second vaccine was prepared at the same time. It was exposed for only ninety to one hundred days, and passed through nine cultures in place of twenty, as with vaccine *a*. It was still virulent enough to kill rabbits in small doses, and in fact there was little difference between this and the original virus. This we shall call vaccine *b*.

The animals used.—The pigs that were chosen for vaccination numbered forty-eight in all. Of these twenty-seven were from one farm in the District of Columbia where no disease had existed among swine for years. They were all raised in pens. The remaining

* Beef broth containing a little peptone and common salt.

twenty-one were obtained from a fa m in the District which likewise had been free from disease for a lo g time. They, however, had not been raised in pens, but were allo ed to range over a large pasture. At the time of vaccination they were all about three months old. The first lot were the product of an Essex boar and Berkshire sows, pure bred. The second lot were mixed Jersey Red and Chester White grades. At the date of vaccination they weighed from 50 to 75 pounds each, the weight being slightly in favor of the first lot.*

A large pen had been built for this purpose, divided into compartments, which were separated from one another by tight board partitions. We will denominate for convenience the twenty-seven pen-fed swine as lot A, the twenty-one pasture-fed pigs as lot B. They were divided as follows:

In compartment 1..... 7 of lot B.
In compartment 2..... 7 of lot B.
In compartment 3..... 7 of lot B.
In compartment 4..... empty.
In compartment 5..... 9 of lot A.
In compartment 6..... 9 of lot A.
In compartment 7..... empty.
In compartment 8..... 9 of lot A.

The vaccination consisted in injecting a definite quantity of peptone bouillon, in which the attenuated bacilli had grown for about twenty-four hours, into one or both thighs according to the quantity used. The date of the two vaccinations and the quantity injected into each pig is given in the following table:

Compartment.	Lot.	October 18, 1889.	November 5, 1889.	
1.....	B.	Checks.....	.....	
2.....	B.	10 cubic centimeters* vaccine *a*....	4 receive 2½ cubic centimeters.....	Vaccine *b*
			3 receive 5 cubic centimeters.....	Do.
3.....	B.	5 cubic centimeters vaccine *a*.....	4 receive 10 cubic centimeters.....	Vaccine *a*
			3 receive 2½ cubic centimeters.....	Vaccine *b*
4.....		.....	.....	
5.....	A.	10 cubic centimeters vaccine *a*.....	4 receive 2½ cubic centimeters.....	Vaccine *b*
			4 receive 5 cubic centimeters.....	Do.
6.....	A.	5 cubic centimeters vaccine *a*.....	4 receive 10 cubic centimeters.....	Vaccine *a*
			5 receive 2½ cubic centimeters.....	Vaccine *b*
7.....		.....	.....	
8.....	A.	Checks.....	.....	

*1 cubic centimeter is equivalent to $\frac{1}{118}$ gill or to $\frac{1}{30}$ fluid ounce approximately.

From this table it will be seen that the pigs received two injections each, eighteen days apart. Both lots were treated alike, while the quantity of liquid injected was varied somewhat. It will also be noted that some pigs from both lots received only vaccine *a* both times.

After the first injection and as a result of it one pig in compartment 5, belonging to lot A, died nine days after the injection. The spleen contained hog-cholera bacilli. Thus but one out of thirty succumbed to vaccine *a*, and in this case death may have been due to the accidental puncturing of a vein under the skin by the needle of the hypodermic syringe, by which means the bacilli may have been injected into the blood. This procedure is quite invariably fatal when large doses are used, as will be seen from the details of the experiment to be reported further on. Fourteen days after the second inocula-

* The selection of pigs, arrangement of pens, and inoculations were in charge of Dr. F. L. Kilborne.

tion a second animal in the same compartment died, evidently as a result of it, since hog-cholera bacilli could still be detected in the internal organs. Thus two out of thirty were killed by the inoculation, or 6⅔ per cent., a proportion rather high for any method destined to have any practical value. But the problem before us now was to see whether any method of subcutaneous inoculation could be relied upon to give sufficient immunity to resist the natural disease. A method sufficiently severe to lead to the death of 6⅔ per cent. of the vaccinated animals should therefore in the sequel prove specially efficacious for those animals that survived it. This, however, did not prove to be the case.

Of the control animals two from compartment 8 died sixteen and twenty-one days, respectively, after the vaccinated animals had received the second injection of the vaccinal culture. In one there was found diphtheritic inflammation of the middle portion of the small intestines, in the other the mucous membrane of the large intestine was more or less inflamed. In neither case, however, could hog-cholera bacilli or any other bacteria be detected in the internal organs. It might be inferred that this compartment had been infected by the vaccinated pigs. It will be seen, however, that the neighboring compartment was left empty and the greatest care was taken not to use utensils indiscriminately. Moreover the evidence of hog cholera, the presence of the bacilli in the body, was not obtainable. Meanwhile the check pigs in compartment 1, adjoining the vaccinated lot in compartment 2, showed no signs of disease.

It should also be noted that all four deaths were from lot A, the pen-fed pigs. Lot B stood the vaccination without any accident, and the checks remained well till the time of exposure to the natural disease. The effect of the injections manifested itself in general by a slight indisposition and a refusal to eat the daily ration for one or two days. The place of injection showed in most cases a subcutaneous tumor from 1 to 2 inches long.

The exposure to diseased pigs.—The two injections or vaccinations, as may be seen from the table, were made October 18 and November 5, 1889. On December 19, about one and one-half months after the last injection, the pigs were exposed to the disease. At this time there were twenty-three of lot A, of which seven were checks or control animals and sixteen vaccinated, and twenty-one of lot B, of which seven were checks and fourteen vaccinated; so that there were in all twenty-eight vaccinated and fourteen control animals to be exposed.

The animals in the different compartments, hitherto kept apart, were allowed to mingle by removing the partitions and thus making one large pen. At the same time eight infected and diseased pigs were placed in the pen with the rest. These had been infected on the station from an outbreak carefully studied, from which swine plague could be excluded with certainty. That the introduced disease was sufficiently virulent is shown by the fact that all eight infected pigs died between December 20 and December 27, at the rate of about one a day, beginning the day following their mingling with the vaccinated and control animals.

The result of the experiment was curious and quite unlooked for. The exposed pigs began to die on the 28th of December and continued to succumb until February, when apparently all the susceptible animals had been weeded out. The status of the experiment February 1 was as follows:

Of the lot of pen-fed pigs only one animal died, and this one of the

check animals. It had been small and unthrifty before the exposure, and at the autopsy besides the rather mild hog-cholera lesions there was a general anæmic condition manifest. Hence practically all of lot A resisted the disease, control animals included. The infection had been too mild for them.

With the other lot of pigs the case was different. At the beginning of the exposure there were fourteen vaccinated and seven control animals. At this time (February 1) there were left but three vaccinated and one control animal. The disease had made no discrimination between the treated and the not treated and had killed seventeen out of twenty-one. Of the whole lot remaining all were thriving excepting two or three, which were stunted in growth.

The inference to be drawn from these results is that the subcutaneous inoculations had little or no effect on the course of the disease. For lot A the disease was too mild, for lot B it was fatal in spite of the vaccination. This is practically the conclusion arrived at in 1886 when the experiments gave no better results than those just quoted. It may be possible that, by increasing the quantity of the culture liquid and the number of inoculations, a point may be reached at which immunity is produced. But such modification, besides endangering the life of the animal, would be too tedious and expensive to be of practical value.

There are some other not unimportant inferences to be drawn from this experiment. They bear upon the methods employed in testing the truth or falsity of subcutaneous vaccination and the evidence that can be adduced in its favor.

Had we chosen the pen-fed pigs to be vaccinated and the pasture-fed pigs as control animals we might have reached the erroneous conclusion that our vaccination was a complete success. Or had the circumstances been just the opposite—had the pasture-fed pigs been used for vaccination, the pen-fed for checks—we would have seemed justified in concluding that vaccination or preventive inoculation is not only a failure but predisposes swine to the natural disease. Neither of these inferences is correct, however, as the experiment proves. We should therefore be extremely cautious to accept any conclusions in regard to matters of such importance without the results of carefully conducted experiments before us. Experiments conducted in the field have at best but a partial value, since the disease may be introduced into a given herd or not, depending on circumstances over which no proper control can be exercised, or else if the disease appears the animals are of different ages and of different degrees of health or else not exposed to the same dangers, etc.

Thus this experiment as well as those of former years affords sufficient evidence for the conclusion that the subcutaneous injection of culture liquid containing hog-cholera bacilli is not capable of protecting swine from hog cholera.

In order to determine the effect of the vaccination and exposure upon the surviving pigs their weight was roughly estimated February 1. Of lot A the six control pigs had an average weight of 105 pounds each, the fifteen vaccinated ones about 93 pounds. The individual weights varied from 60 to 160 pounds, the heaviest being a control animal. Of lot B the three surviving vaccinated animals weighed on an average 84 pounds each, and the surviving check or control animal 105 pounds. The vaccination had thus the effect of slightly reducing the body weight in comparison with the control animals.

A few additional experiments were made with this lot of pigs which may be very briefly summarized:

March 18, 1890.—One cubic centimeter of a peptone-bouillon culture of the hog-cholera bacillus was injected into one of the crural veins of two control and four vaccinated pigs, all from lot A. Of these six animals one control died six days later. The others recovered. This showed that some immunity had been gained by the vaccination.

April 18.—Six other pigs from lot A, two control and two vaccinated animals, were fed each with nearly a quart of viscera from hog cholera cases. All survived.

April 29.—Another and final test was made by taking the five pigs of lot A, which had survived the intravenous injection of March 18, together with four others of the same lot and two of lot B, not thus treated March 18, and injecting into the crural vein another dose of bouillon culture of hog-cholera bacilli. Three of those which received the injection of 1 cubic centimeter March 18 now received the large dose of 5 cubic centimeters. All the rest received 2½ cubic centimeters.

Of these eleven animals thus inoculated three died within two, four, and forty-two days, respectively, after the inoculation. These three belonged to the lot of six which had not previously received the intravenous injection. The other three survived. Expressed in another form, of those which had received the intravenous injection March 18 100 per cent. survived; of those which had not received it 50 per cent. survived. Of the three which died, the two which died in two and four days after the injection belonged to the original check animals, the one which died forty-two days after was a vaccinated animal.

These last tests lead to the inference that injections of hog-cholera bacilli into the veins in small quantity protects the animal against injections of large doses ordinarily fatal.

The history of the surviving vaccinated animals up to November 1, 1890, may be given very briefly. They were kept in the same pens in which they had been exposed to the disease. Three died subsequently, two being in very good condition at the time of death. In one (June 22) there was a rupture of the œsophagus at its insertion into the stomach, permitting the contents of the stomach to enter the chest cavity. The second (September 3) was not examined. The third died from enlargement and softening of the bones of the head, impeding respiration. The remaining animals weighed from 140 to 280 pounds apiece. Those that received the injections into the veins were the poorest in weight.

AN EXPERIMENT TO TEST THE VALUE OF INJECTIONS OF HOG-CHOLERA BACILLI INTO THE VEINS AS A MEANS OF PRODUCING IMMUNITY.

The preceding test had shown that two injections of hog-cholera bacilli under the skin had no appreciable effect in protecting swine from the disease itself. Subsequent experiments with the same lot of animals proved that when small doses of hog-cholera bacilli are injected directly into a vein the animal so treated is able after a time to resist fatal doses administered in the same manner.

The plan laid out for this experiment was to inject into a vein of the leg a very small quantity of culture liquid containing hog-cholera

bacilli to begin with; then after a certain period of time, depending on the effect produced by the first inoculation, to inject a larger dose in the same manner, and perhaps a third dose still larger, using control animals to gauge the effect of the various doses on fresh pigs; finally, to expose these inoculated animals to the natural disease.

The actual experiment carried out may be briefly summarized: Twenty-five pigs were selected, and at the time of the first injection they were about seven months old, in good condition, and weighing from 75 to 90 pounds each. The culture employed was derived from an outbreak studied in 1889 and somewhat attenuated by age.

On August 23 thirteen pigs of this lot received the first injection. Five received one-eighth of a cubic centimeter of a peptone-bouillon culture, five one-quarter of a cubic centimeter, and three one-half of a cubic centimeter each. In every case the small dose was diluted with some sterile liquid, such as beef broth to bring it up to 1 cubic centimeter. On the following day all pigs were sick and in proportion to the dose received. This was shown by a refusal to eat, and lasted but one or two days.

On September 4, twelve days after the first injection, only one pig had lost weight. They were all inoculated in the same way with 1 cubic centimeter each, and in addition four fresh pigs with the same dose. After one or more days of slight illness following the inoculation they all recovered, excepting the four fresh pigs. These grew thin and weak, and two died September 29.

On October 17 a final injection of 5 cubic centimeters was given to all surviving pigs and three fresh ones. The result of the inoculations is given in a more condensed form in the following table:

Table giving the results of intravenous inoculations of culture liquid containing hog cholera bacilli.

Pig. No.	August 23.	September 4.	October 17.	Remarks.
347	⅛ cubic centimeter.	1 cubic centimeter.	5 cubic centimeters	November 8, condition good.
348	....do	....do	....do	November 8, stunted.
349	....do	....do	....do	November 8, condition good, swelling and ulceration over left tarsus.
350	....do	....do	....do	November 8, condition fairly good.
351	....do	....do	....do	November 8, condition very good.
359	¼ cubic centimeter.	....do	....do	November 8, condition fair, crippled by swelling on feet.
364	....do	....do	....do	November 8, condition good.
365	....do	....do	....do	November 8, condition very good.
366	....do	....do	....do	Dead October 21.
367	....do	....do	....do	November 18, stunted.
256	½ cubic centimeter.	....do	....do	November 18, condition good.
357	....do	....do	....do	Do.
358	....do	....do	....do	November 18, condition fair, swelling and sores on all feet.
352		....do	....do	Dead October 20.
353		....do		Dead September 29.
354		....do	5 cubic centimeters	November 18, condition good, enlargement of left fore and hind feet.
355		....do		Dead September 29.
361			5 cubic centimeters.	Dead October 21.
362			....do	Dead October 23.
363			....do	Dead October 20.

From this table we learn that the three last control animals died three, four, and six days, respectively, after the inoculation. This indicates a decided immunity on the part of those which received

the two previous injections, since but one of these thirteen succumbed to the last inoculation on October 21, or in other words, 100 per cent. of the last control animals and but 7 per cent. of the previously inoculated animals died as a result of the last injection (which has thus far always proved fatal to pigs).

When we come to the four control animals of the second inoculation (Nos. 352 to 355 inclusive) which received 1 cubic centimeter to begin with, we find that two of these died as a result of the inoculation, the third died as a result of the last inoculation, and the fourth survived.

Although this method thus showed that pigs can be made more or less insusceptible to fatal doses injected into the veins, it is not as yet proven that it will eventually prevent the treated animals from acquiring the disease in the ordinary way. We have thus far been unable to expose these animals, since no outbreak has been found during the fall within reach to furnish the starting point at the Experiment Station.

Another point deserves consideration, and this is the effect of this method of inoculation. If we examine the remarks appended to the twelve cases which were inoculated three times, we learn that only seven are in good condition, two are stunted and small, and three are affected with enlargement and ulceration of the feet (from the carpal and tarsal joints down), though otherwise in good condition. These injuries are most likely the result of the inoculations, which one it is impossible to state, and may be directly due to the injected bacilli lodged in the bones perhaps and causing their destruction. How much damage will be done thereby can not be surmised at this time.

SWINE PLAGUE.

The standpoint of pathologists and students of infectious diseases both in man and animals at the present time is that two diseases must be regarded as identical or dissimilar according as the causes which produce them are the same or different. Two maladies in many respects the same are yet different from one another if the bacteria which produce them are different. Not only is this standpoint theoretically correct but sound also from a practical point of view, for the simple reason that only an exhaustive study of the causes of disease can eventually help us in suppressing them. While pathology has done but little in the treatment of infectious diseases of man and animals, most authorities being opposed to any treatment as useless and dangerous, it has already done much in formulating rules for the prevention of such diseases by tracing the insidious ways by which diseases are carried from place to place and introduced into herds of animals, by studying the nature of the virus, its vitality under various conditions, and the agents which are capable of destroying it.

All these important facts result from the study of the disease-germ in the laboratory, in the diseased animals, and in nature. Hence it follows that the disease-germ is the most important factor to be studied before other problems can be solved and before any sound information concerning the disease itself is obtainable. It also follows from these considerations that it is of essential importance to recognize the specific disease-germs wherever they may be found. This study of bacteria or bacteriology lies therefore at the basis of all investigations of infectious diseases and upon it subsid-

iary investigations relating to vaccination, inoculation, and treatment must rest.

Two infectious diseases of swine have been recognized in the investigations of the past five or six years, denominated, respectively, hog cholera and swine plague. The specific bacteria which cause them, and which can be made to reproduce them by inoculation, are readily distinguished by any novice in bacteriological studies. Their differences are sufficiently pronounced to demand careful separate investigations, although the diseases themselves may be easily confounded and may occur side by side.

It has been maintained in some quarters that this position of the Bureau of Animal Industry in insisting upon the existence of two distinct infectious swine diseases is wrong and that there is but one disease in the country demanding attention. This latter position may be due either to inability to distinguish between the germs causing these diseases, to inability to find them in diseased animals by not applying appropriate methods, or else to the non-existence of one of these diseases in that part of the country where the investigations were made.

No amount of time and labor has been spared in the study of these two diseases, especially swine plague, in order that a thorough knowledge of its nature might be obtained. During midsummer of this year we had the good fortune to find an outbreak of swine plague on the coast of New Jersey, several miles from Pleasantville and Atlantic City. The owner of the herd in which the disease had broken out, Mr. Joseph Young, gave us all the assistance in his power and freely sacrificed his animals for the purpose of investigation.*

The history of the outbreak may be stated very briefly as follows: In May of the present year the owner purchased two lots of pigs from a dealer, numbering ninety-seven in all. At the time of the purchase more or less coughing was noticed among some unthrifty animals in the lots. On the farm they were kept on dry, sandy soil, and fed with hotel slops from Atlantic City. The coughing did not entirely disappear, and on July 1 they began to die. Up to July 19 thirty-four had perished. July 20 four died, July 21 seven died, and on July 22 eight died. These few facts indicate a very virulent and rapidly fatal disease. It was without doubt brought with the pigs themselves, as there had been very few pigs and no disease upon the farm for years, nor was any disease reported among swine in the vicinity though fed and kept in the same way.

The symptoms noticed by the owner were coughing, loss of appetite, and emaciation. Vomiting was a common occurrence. The sick animals were in the habit of straying and hiding themselves in out-of-the-way places and under bushes. Some died within three to five days after the first symptoms of disease; others lived a few days longer. Some died suddenly without manifesting any signs of disease.

From this herd about seventeen animals were examined after death. Ten of these were examined on the farm between July 21 and 23 inclusive and cultures made from the internal organs of six. This part of the work could not be done very thoroughly, owing to the primitive facilities and the innumerable insect pests on the farm. The results of this work indicating that we had an outbreak of swine

*For full details of this outbreak see special report on swine plague, 1891.

plague instead of hog cholera to deal with as we had anticipated, it was deemed advisable to make a more thorough investigation of this disease. Dr. Kilborne was therefore directed to return alone to this farm July 28, and send to the Experiment Station at Washington some sick animals, where the disease could be more carefully investigated in connection with the laboratory. On the farm two more autopsies were made on dead pigs and five diseased ones sent by express to the Experiment Station. Of these latter one died on the 1st, three on the 3d, and one on the 5th of August. Subsequent information from the owner showed that only seven out of the entire herd had survived the infection, *i. e.*, about 8 per cent.

It would be out of place in this brief report to go into detail concerning the appearance presented on post-mortem examination of the affected animals. In general both lungs and intestines were diseased and the impression made upon the writer at first was that of an outbreak of hog cholera. The disease resembled very closely that studied in Iowa in 1888, and the belief at that time on making the post-mortem examination in several herds was that the disease was hog cholera in some herds and swine plague in others. As in the Iowa disease, so in this New Jersey outbreak, the impression that the disease was hog cholera was entirely dispelled by the bacteriological work, as will be shown further on.

As regards the lungs, these were consolidated more or less in ten out of the seventeen cases. The hepatization was in most cases accompanied by pleurisy of varying degrees of severity and more rarely by pericarditis. The spleen and lymphatic glands were engorged with blood in the majority of cases. The mucous membrane of the stomach was usually deeply congested and in a few cases portions of the membrane had undergone mortification or necrosis.

In the large intestine there was disease in almost every case. This disease was manifested by a general reddening or by discoloration and pigmentation of the mucous membrane, by more or less extensive diphtheritic inflammation, causing superficial necrosis or mortification, and by isolated ulcerations. In nearly all cases ulcers were present. It is not surprising that hog cholera and swine plague should be regarded as one disease when the lesions they produce are so much alike to the casual observer.

In order to determine the true nature of the disease it became necessary to learn whether hog-cholera or swine-plague bacteria were present or whether perhaps some third unknown germ could be regarded as cause of the disease. Cultures were, therefore, made from the organs of six animals on the farm and from five animals in the laboratory. The result of this laborious work was the discovery of very virulent swine-plague bacteria in four cases. In one case a bacillus was found resembling hog cholera, which, however, possessed no pathogenic properties. From another a similar bacillus was obtained, which possessed feebly pathogenic properties with reference to rabbits, but which seemed to have no effect on swine after intravenous and intrathoracic injection, and feeding of large quantities of culture liquid containing these bacilli in abundance. Thus an injection of 5 cubic centimeters of a bouillon culture of moderately virulent hog-cholera bacilli into a vein of a pig 3 to 4 months old is quite invariably fatal in 48 to 60 hours. A similar injection of 7 cubic centimeters of bouillon culture of these bacilli had no visible effect. They nevertheless possessed all the characteristics of hog-cholera bacilla excepting the virulence. Their relation

to this outbreak, in view of the fact that they were found in only one case, and in view of their feeble pathogenic power, must be regarded as purely secondary. In several earlier cases bacilli fatal to guinea-pigs, and probably identical with those of malignant œdema, were also encountered.

The following experiments are designed to prove that the swine-plague bacteria were very likely the chief, if not the only, primary cause of the outbreak:

Inoculation of healthy pigs.—Two pigs three months old and weighing 40 pounds received into a vein of the leg 1 and 5 cubic centimeters, respectively, of a peptone-bouillon culture of the swine-plague bacteria derived from this outbreak. The animal which had received 5 cubic centimeters was dead within sixteen hours. There was more or less redness of the skin, œdema of the lungs, commencing peritonitis, hemorrhagic condition of the kidneys, and congestion of the mucous membrane of the stomach. The pig which had received but 1 cubic centimeter died in four days. There was found at the autopsy extensive double pleuritis, pericarditis, and consolidation of a small portion of the left lung. The kidneys contained numerous abscesses. At the same time a third pig was inoculated by injecting 5 cubic centimeters of the culture liquid into the right lung. This animal died within twenty-four hours with pleuritis, beginning hepatization of the lungs, peritonitis, and pericarditis. These results are indicated to show how virulent the swine plague germ of this outbreak was and that the destructive activity of this germ is fully equal to that of the hog-cholera bacillus.

In order to test the effect of feeding substances containing this germ the organs of six rabbits which had been inoculated with it were fed to two pigs. They showed no signs of disease. A subcutaneous injection of 5 cubic centimeters of culture liquid was likewise without effect. The negative result following these methods of introducing the swine-plague germ into the body simply confirms former experiments of a similar character with swine plague germs from other outbreaks.

Exposure of healthy pigs to sick animals from this outbreak.—The five pigs sent to the Experiment Station were placed in a wooden pen with two healthy pigs. One of these died eleven days after with a large number of necrotic masses in the lungs, exudative inflammation of the pleura and pericardium, intense hyperæmia of the stomach and portion of the large intestine. Swine-plague germs were detected in lungs and intestines. The other pig exposed at the same time became very unthrifty and was killed several months later. No disease could be detected, but the weight of the animal at the time it was killed was but 25 in place of 70 or 80 pounds. Three other healthy pigs were placed into this pen, one of them while two of the diseased pigs were still alive, the remaining two when all of the original lot had died. These three exposed pigs also survived, but they became unthrifty and after several months they were all over 50 pounds behind in weight. The explanation of this condition is by no means obvious, although it would appear that the infection disappeared in great part from the pen with the death of the diseased animals and that more direct contact with such diseased animals is necessary to produce a fatal result in swine plague than in hog cholera.

Little need be said in this connection of the swine-plague germ itself. It did not differ from the same germ obtained from various sources since 1886, and described in detail in the reports of the Bu-

reau of Animal Industry issued since that date, excepting perhaps in its greater virulence. A very minute quantity of growth from cultures placed beneath the skin of rabbits proves fatal in less than sixteen hours. Its fatal effect on guinea-pigs and mice is no less pronounced. These small animals are thus of great service to the pathologist in exactly gauging the virulence of the same germs from different localities.

The investigation of this outbreak of swine disease has once again demonstrated the existence of a highly infectious, extremely fatal disease, which can not be included under hog cholera, and which may be ranked with hog cholera in economic importance to the farmers of the country.

Its mode of introduction into a herd is probably mainly through sick animals, which are suffering from the disease in a chronic form and are the remnants of other outbreaks sold by unscrupulous persons or those who are not aware of the dangers and losses to which they may subject owners of swine into whose herds these remnants are taken.

The disease still awaits a complete explanation of its various characters, however, more especially as to any other channels by which it may be transmitted from herd to herd, from animal to animal, and its capacity for thus transmitting itself, which capacity was very feeble in the disease after it had been brought to the station. Meanwhile the same rules of prevention* and for the application of disinfectants apply to both swine plague and hog cholera, although there are points of difference which need not be dwelt upon in this connection.

TWO OUTBREAKS OF HOG CHOLERA.

Two other outbreaks of swine disease may be briefly mentioned, inasmuch as there was no difficulty in making the diagnosis of hog cholera.

A limited outbreak was reported as having occurred in the District of Columbia, a few miles from Washington City, during September. There were eight in the herd, all of which died with the exception of one, which was brought to the Experiment Station for examination. After lingering several weeks it also died. The most important lesions found were superficial necrosis of the ileum and about a dozen large ulcers in the large intestine. *The lungs were normal and in the spleen hog-cholera bacilli were detected,* which produced by inoculation the characteristic disease in rabbits.

The disease was traceable to the Washington market, where the animals were purchased. This is not the first time that outbreaks in the vicinity of Washington have been traced to this source.

Another outbreak was investigated by Dr. E. C. Schroeder at Quantico, Virginia, during October, whose report may be briefly summed up as follows:

On October 28 Dr. Schroeder made post-mortem examinations of two pigs which had been dragged from the farms where they belonged to the common to be disposed of by the buzzards. One had been dead one or more days, the other was still warm, having died very probably only a few hours before. In the first animal were noted enlarged spleen, reddening of mucous membrane of the stomach, numerous ulcers in the large intestine. In the lungs were a few small collapsed areas, otherwise they were healthy.

*See Report of the Bureau of Animal Industry for 1887–'88, page 148; Bulletin on hog cholera, page 123; Report of the Secretary of Agriculture for 1888, page 156.

In the second animal the lesions were practically the same. There was no consolidation of lung tissue as in the preceding case. From the spleen of this animal cultures were made and these contained only hog-cholera bacilli, which produced in rabbits the peculiar and characteristic inoculation disease of the hog-cholera germ.

Dr. Schroeder furthermore was informed that hundreds of pigs had perished of hog cholera this season. The manner of disposing of the carcasses mentioned above, as well as the custom there prevalent of allowing swine to roam at large over the country, does not make this extension of the disease appear at all surprising.

RESULTS OF CHEMICAL INVESTIGATIONS FOR THE PREVENTION OF DISEASE.

By E. A. v. SCHWEINITZ, *Chemist.*

In January, 1890, the writer was appointed to take charge of the chemical work of the Bureau of Animal Industry and investigate the chemical side of the diseases of animals, especially hog cholera and swine plague. It was necessary first of all to secure laboratory room suited to this class of investigation. On account of the crowded condition of the offices of the Department, space was procured by partitioning off rooms in the Museum building. This laboratory was supplied with water, gas, and steam, the necessary working desks, apparatus, and chemicals, and by April 1 it was in proper condition to begin the investigation.

HOG CHOLERA.

The first problem undertaken was the study of the culture liquids of the hog-cholera germ.

Investigations of recent years have shown that when different disease germs are allowed to multiply in artificial nourishing media, as beef broth, they form substances which have the general composition of alkaloids and proteids, and give a number of the chemical reactions characteristic of these two classes of bodies. The alkaloids formed by germs are called, as a class, ptomaines, and the proteids albumoses. Some of these substances, that have been isolated, are very poisonous in small doses; others only slightly so, or not at all. The fatal effects of a number of diseases which are known to be produced by specific germs are held to be due to the fact that the multiplication of the germ in the animal organism, just as when allowed to grow upon artificial media, forms large quantities of these poisonous alkaloids and proteids, which in their turn produce death.

The thought lies near: If this is true can not these poisons be isolated by chemical methods and their exact nature and properties determined? And, further, is it not possible by giving small doses of these poisons at a time to so accustom the animal organism to their effect that a subsequent large dose of the same poison, even when produced in the body by the active multiplication of the germ, would not result fatally? That this object may be accomplished by treating animals with sterilized artificial culture media, in which

the germ had been allowed to grow for some time, was demonstrated by the work of this Bureau upon pigeons in 1886 and 1887.

The problems for solution were:

I. To isolate the chemical compounds, alkaloidal and albuminoidal, which the hog-cholera germ forms.

II. Determine whether one or more of these compounds exist in the artificial culture liquids.

III. Which are the important ones?

IV. Will the isolated compounds produce immunity in animals from the disease of hog cholera?

V. What is their exact chemical constitution?

VI. Are there known compounds of the same or similar composition, or one that can replace them?

VII. Can these compounds be made artificially?

VIII. Can chemical inoculation be made practical, and if so, what is the minimum amount of substance and time required?

The results of the experiments permit of positive answers being given to all of these questions but the last, so far as the diseases of hog cholera and swine plague are concerned, and only some practical details remain to be worked out.

After a number of experiments we found that acid beef infusion containing one-half per cent of peptone is the most satisfactory medium in which to grow the bacillus of hog cholera. Erlenmeyer flasks of 500 cubic centimeters capacity were used to contain the liquids, the mouths of the flasks being closed with a cotton plug, and after inoculation allowed to stand in the incubator at 37° C. for two or three weeks. The liquids had by this time become alkaline in reaction, and careful examination showed that there was no contamination with foreign germs.

In isolating the chemical products from these solutions the methods by which Brieger has obtained such excellent results were, with slight modifications, followed.

The culture liquid, after being neutralized with dilute HCl, was evaporated on the water bath. The residue was then extracted with 96 per cent alcohol and the filtered solution treated with mercuric chloride. A heavy crystalline precipitate was formed which increased upon standing. After filtration this precipitate was treated with water, decomposed with sulphureted hydrogen, and the mercury sulphide removed by filtration. From the filtrate, after removal of the excess of H_2S and concentration, I was able to isolate cadaverine and methylamine. The filtrate from the mercuric chloride precipitate was freed from excess of mercury by sulphureted hydrogen, and the mercury sulphide filtered off. The residue, after concentration of this filtrate, was extracted with absolute alcohol, the solution thus obtained showing the presence of a salt of an alkaloidal character. The reactions were as follows:

With phosphomolybdic acid	light yellow precipitate.
With bismuth potassium iodide	red needles.
With phosphotungstic acid	a white precipitate
With potassium iodide and iodine	brown-red precipitate.
With platinum chloride	yellow crystalline precipitate.
With gold chloride	yellow-red crystalline precipitate.

Subsequently the use of $HgCl_2$ was omitted, and repeated extraction of the residue with alcohol alone substituted.

The double salt obtained with $PtCl_4$ was submitted after crystal-

lization from 96 per cent alcohol, to a preliminary analysis, giving results which correspond to the formula, $C_{14}H_{34}N_2PtCl_6$. The free base I have not yet succeeded in obtaining in a pure form. The hydrochloride of this base is soluble in absolute alcohol as well as water, and can be obtained as needle-like crystals.

By treating the original culture liquids of the hog-cholera germ with a large excess of absolute alcohol, a white flocculent precipitate was obtained, a portion of which was soluble in water and could again be precipitated by alcohol. By repeated treatment of this sort with water and alcohol a small quantity of an albuminoid body containing C, H, N, O, S, was finally obtained. This substance, which we will call albumose, was dried over sulphuric acid *in vacuo*, giving white, translucent crystalline plates. After drying it was still soluble in water, though dissolving with more difficulty. The water solution gave with $PtCl_4$ an almost insoluble precipitate, appearing under the microscope as needle-like crystals. The composition of this platinum salt shows it to be a substance allied in composition to peptone. As to the exact nature of this latter substance, whether it is a true proteid or belongs to the class of ferments, remains to be determined by subsequent study and investigation.

Brieger and Fraenkel (*Ber. Klin. Woch.*, 1890, No. 11), who have extracted a similar substance from culture liquids of the diphtheria, tetanus, and cholera germs, and Bakinsky and Stadthagen (*Ber. Klin. Woch.*, 1890, No. 13), who obtained an allied body from cultures of the cholera infantum germ, hold that the substances are proteids. Roux and Yersin (*Annales de l'Institut*, Pasteur, 1890, p. 385), on the contrary hold that the substances obtained by precipitation with alcohol are ferments. Hankin (British Medical Journal, July 12, 1890, p. 65), who has also isolated a substance from cultures of anthrax possessing albuminoid properties, holds the same view as Brieger and Fraenkel—that the body in question belongs to the class of proteids.

In so far as our work upon the hog-cholera culture liquids goes we are inclined to the same opinion, viz, that we have to deal with albumoses which can be heated in presence of acid to 70° without decomposition. I am preparing now a considerable quantity of this albumose, and hope to be able in a short time to have something more definite as to its exact nature. To be sure that the substance one is dealing with is absolutely pure is very difficult, when it is a body of this nature, and only extended experiments can be regarded as conclusive.

As to the nature of the new ptomaine which has been isolated, we will not go into a discussion of its exact chemical composition until it is more definitely determined.

In order, however, to distinguish the active principles formed by the hog-cholera germ, I have named the ptomaines as a class sucholotoxins, and the new base sucholotoxin (from the Greek συς, a hog, χολέρα cholera: from χολή bile, and τοξικόν poison). To the proteid body I have given the name sucholoalbumin. These names will be used in referring to these bodies in the future.

Some experiments were made later, but may be inserted here, in regard to substituting some other material for peptonized beef infusion in furnishing nourishing media for the artificial cultivation of the germ. Potato broth, pea broth, and plain beef infusion have been used. In all of these the hog-cholera germ grows very vigor-

ously, forming the ptomaines and albumoses, but not in so large a quantity as in the peptonized beef infusion.

Now, in regard to the toxic effect of the sucholotoxin and sucholoalbumin, active poisons for guinea-pigs; in small doses they are not. In large doses, corresponding to from 6 to 15 cubic centimeters of the culture liquid, death is produced in guinea-pigs in from six to twenty-four hours. A small subcutaneous injection causes the animal to appear stupid and uncomfortable for a short time (fifteen minutes), produces a slight rise in temperature, necrosis of tissue, and ulceration at the point of injection.

It may be added here that in making these and all the following experiments special precautions were taken to prove that the material used was entirely free from germs. Cultures were always made from the substances used for injection.

The autopsy of a case resulting from poisoning with the ptomaines may be inserted here: Liver, pale and fatty; subcutaneous tissue over abdomen, necrosed and infiltrated; muscle soft and friable; other organs apparently normal.

The next point to be decided was, can immunity be produced from hog cholera by previously treating the animals with these substances isolated from the culture liquids? The results are recorded in the following experiments, which are very conclusive. For the laboratory experiments guinea-pigs were used, as being convenient to handle and susceptible to hog cholera. They have proved very satisfactory.

The first of our experiments that we will record were made with sucholotoxin.

Experiment I.—Two guinea-pigs, each weighing about three-fourths of a pound, were treated with a solution of about 0.05 gram of sucholotoxin hydrochloride each. The solution was introduced under the skin of the inner side of the left thigh. Immediately after the operation the animals appeared uncomfortable, but were not made ill. For a few days there was a rise in temperature and also a slight swelling at the point of inoculation, which, however, disappeared in about five days, and the animals were then well.

Two more guinea-pigs were now selected as checks, approximately of the same size and weight as those which had been treated, and the four animals were then inoculated with 0.1 cubic centimeter of hog-cholera virus each (0.1 cubic centimeter beef infusion and peptone culture one day old, plus 0.2 of sterile normal salt solution). This is the dose which previous experiments made in the Bureau had shown to be the proper quantity to kill a guinea-pig in from eight to ten days. The inoculations with the virus were also made subcutaneously in the thigh. The checks died in eight and nine days. Post-mortem examination showed a large swelling at the point of inoculation, infiltration of a purulent, grayish substance into the connective tissue, and necrosis of the superficial layer of the muscles of the thigh. Enlargement and reddening of inguinal glands. Peyer's patches enlarged and pigmented; liver pale and covered with a number of necrotic foci; spleen very much enlarged, dark colored, and friable. Cover-glass preparations from the spleen and liver showed hog-cholera germs. This was the characteristic appearance of all the check guinea-pigs upon post-mortem examination, and it will not be necessary to repeat these details.

Of the animals which had been first treated with the substance mentioned, and afterward inoculated, one died two days after the

last check. Autopsy revealed the following: At the point of inoculation in the left thigh the subcutaneous tissue was infiltrated with a grayish-white substance, and the superficial layer of muscles of the inner side of thigh and 4 square centimeters of the abdominal wall were necrosed. Liver pale; spleen much enlarged, dark-colored, and friable. Cover-glass preparations from the spleen showed a large number of hog-cholera germs. Both ventricular walls of the heart were light grayish and very brittle. The other guinea-pig of this set was quite ill for ten days, with a large swelling at the point of inoculation. This finally opened and healed, and the animal was quite well within three weeks after the inoculation, and has continued so to date—five months.

Experiment II.—The next series of experiments were made with sucholoalbumin from beef infusion, plus peptone, culture media.

Two guinea-pigs were again selected and treated with about 0.008 gram each of sucholoalbumin. There was a slight rise of temperature in the animals and the formation of a small, hard lump at the point of injection. This disappeared by the eighth day and the animals were quite well. Two more guinea-pigs were now taken as checks, and all four animals were inoculated with 0.10 cubic centimeter of hog cholera culture. The checks died within seven days. The post-mortem appearances were practically the same as those noted in the first series. The two guinea-pigs which had been treated with the sucholoalbumin died ten days after the checks. This indicates considerable resistance to the disease. Autopsy showed, at the point of injection with the albumin, the subcutaneous tissue infiltrated and reddened. The animals were considerably emaciated. At the point of inoculation a cyst the size of a walnut, and composed of a grayish purulent substance, was also found. The muscular wall surrounding this was sprinkled with punctiform hemorrhages; Peyer's patches swollen and pigmented; mucous membrane of small intestines covered with a dry, yellowish, firm layer of mucus; stomach contained a considerable quantity of liquid; liver pale, and showed fatty degeneration; spleen slightly enlarged and dark. Cover-glass preparations showed no germs, but a culture made from the spleen showed hog cholera germs. Beneath the peritoneum, in the region of the spinal column, and in the mesentery was a considerable number of small grayish tubercle-like bodies. Several other experiments were made by treating guinea-pigs with the albumin in varying quantities, all showing resistance, and subsequently immunity.

Experiment III.—Three guinea-pigs were treated with sucholoalbumin, 0.1 gram being given to each subcutaneously in the thigh. The albumin for two of the animals was derived from cultures containing blood serum; the albumose given to the third was from ordinary beef infusion peptone culture. Ugly ulcers formed at the point of inoculation, which healed, however, in from ten to fourteen days, and the animals, with the exception of a slight rise of temperature, were well.

Two checks were again selected and the five animals were inoculated with 0.10 cubic centimeter hog-cholera virus. The checks died respectively in eight and ten days from hog cholera. The animals which had received the preventive treatment were slightly ill for a few days with swelling at the point of inoculation, which finally opened and then healed nicely, and within a week the guinea-pigs were well.

Three weeks after the inoculation one of these animals was chloroformed and examined post-mortem. Not the slightest scar could be discovered; all the organs appeared perfectly normal, and no germs were found.

Experiment IV.—Four guinea-pigs were treated, two with a mixture of sucholotoxins, two with sucholotoxin and albumin. The injections were made as before, subcutaneously in the thighs, and at intervals extending over a period of four weeks. The sore caused by each injection was allowed to heal before the next one was made. After the animals had recovered from the last treatment two checks were selected, and the six were each inoculated with 0.10 cubic centimeter hog cholera virus. The checks died, one in eight and the other in ten days, the post-mortem examination showing characteristic hog-cholera lesions. The animals having the preventive treatment were ill about four days, those that received only the sucholotoxins being more dull than the others. There was also slight swelling at the point of inoculation with the germ, which subsided in ten days, after which the animals were perfectly well, and have remained so—four months.

Experiment V.—Six guinea-pigs were inoculated for this experiment, two with solution of the sucholotoxin and four with a solution of the mixed sucholotoxins. The sucholotoxin solution produced only slight local lesions, while the mixed toxins caused ulceration at the point of injection which did not heal for two weeks. The treatment in this case again extended over a period of from three to four weeks. The animals having by this time recovered, the test experiment with hog-cholera virus was tried. Four of the animals mentioned above were taken, two from each set, and also two checks, and the six were inoculated. The checks died in eight and nine days, the autopsies showing the characteristic conditions of death from hog cholera. Those that had the preventive treatment were ill and dull for from four to six days after the inoculation. At the point of inoculation there was also some swelling and infiltration, very slight, however, compared with the similar swelling on the checks. In the treated animals the swelling sloughed and healed, and within ten days after the inoculation they were perfectly well.

To test the resistance of animals that had been treated by this method to ordinary exposure the following experiments were conducted:

Experiment VI.—Two guinea-pigs that had received the preventive treatment, two blanks (*i. e.*, animals that had received no treatment), and two check animals that were inoculated with hog cholera virus were placed in one large cage. The checks became ill and died in eight or nine days from hog cholera. During this time the cage was cleaned only three times, so as to give full and free opportunity for contagion. One week after the checks had died one of the blanks became ill and died within ten days. The autopsy showed hog-cholera lesions. The second blank became ill a few days after the first blank succumbed, and died within thirty days. The animals which had the preventive treatment are now and have been quite well, though continually exposed for five weeks to every opportunity for contagion.

These experiments have answered conclusively the first five propositions named in the beginning of this report, and bring us to the sixth. Can these substances be replaced by one of allied composition and character that we already know and can prepare synthetically in the laqoratory? The experiments also give an affirmative answer

to this problem. If the ptomaines when introduced into the system produce certain changes, or induce certain powers of resistance on the part of the animal to subsequent doses of the poison, then it is possible that not only this one particular alkaloid but several, belonging to the same class and of approximately the same chemical composition, should produce similar effects when introduced into the system, as the true ptomaine extracted from the culture liquids, and subsequent immunity should result when the animal should be exposed to the virus of hog cholera. I thought of a substance which could be prepared without difficulty, and which I will refer to as purely chemical. Some of it was prepared and the solution used for injection. The injections and treatment were conducted in the same manner as already recorded for the other guinea-pigs, three animals being used for this experiment.

Experiment VII.—There was a slight rise in the temperature of the animals and swelling and soreness at the point of injection. After this had healed these animals and two checks were inoculated with 0.10 cubic centimeter of hog-cholera culture. The checks died in eight and nine days. The animals which had been previously treated became ill, two dying five and six days after the checks. The third entirely recovered.

Post-mortem examination of the two that died showed the following: At the point of inoculation the skin had sloughed away over an area of 1 square centimeter. The artificial muscular layer was necrosed over an area of about 3 square centimeters and to a depth of 1 millimeter. Lymphatics in the fold of the knee much enlarged; Peyer's patches enlarged and pigmented; spleen very slightly enlarged and not discolored; kidneys reddened; lungs normal. Cover-glass preparation from the spleen showed a few hog-cholera germs. On both sides of the spinal column were several tubercle-like bodies, from one-fourth to 2 millimeters in diameter, lying just beneath the peritoneum.

Experiment VIII.—One guinea-pig was treated with solution of the chemical in the same way as the previous experiment, except that a somewhat larger dose was given. Two pigs were again taken for checks, and the three inoculated with 0.10 cubic centimeter of hog-cholera culture. The checks died in six and seven days respectively of hog cholera; the treated animal recovered entirely. In the treated animal there was a slight swelling at point of inoculation with the germ, but this gradually decreased, finally opened, sloughed, and healed within a few days after the death of the checks.

Experiment IX.—Four guinea-pigs were treated with the solution of the chemical substance. This modification of the injections was adopted, *i. e.*, very small quantities were used at a time and the dose repeated every day. The local irritation was in this way much diminished and what soreness was produced healed more rapidly. Two checks were taken and the six animals inoculated with 0.10 cubic centimeters of hog-cholera culture. The checks died of hog cholera in eight days, one vaccinated pig in thirteen days; the others recovered.

Experiments were also made in producing immunity with the ptomaines obtained from the potato, pea, and simple beef broth cultures, which resulted successfully.

Two of the guinea pigs which had recovered from Experiment IV and two that had recovered from Experiment V were now reinoculated with double the dose of hog-cholera virus used in the first test. Checks were taken and given one-half dose in quantity of the virus.

These died in eight and nine days. The other pigs were a little stupid for a day or so, but at no time ill, and have since remained perfectly well.

One pig from Experiment V and one from Experiment III were chloroformed four or five weeks after their recovery, and an autopsy made. All the organs appeared perfectly normal, not even a scar being left at the points of injection, and the immunity produced was therefore perfect.

Our experiments had now proved that the chemical principles produced by the germ could be isolated; that their injection into guinea-pigs rendered the animals secure against an attack of hog cholera, and that we have at hand a compound fairly easily obtained which will give the same results in securing immunity.

An experiment showing the fatal effect upon guinea-pigs of moderately large doses of hog-cholera albumose may be given here. One pig of eleven ounces in weight was given an injection of a solution of hog-cholera albumose at three different times during one week, the amount of substance used altogether being 0.2000 gram. Some four days after the second injection there began to be a swelling at the point of injection, and within seventeen days after the first injection the animal was found dead. Autopsy showed at the point of inoculation with the albumose a small sac containing a cheesy, yellowish mass; a few areas of lungs in state of red hepatization, including one or two lobules. Cover-glass preparations and cultures from the spleen and liver showed no germs, and otherwise the condition of the animal was normal.

EXPERIMENTS UPON HOGS.

The next question was, Will these same materials produce immunity in hogs, and can the production of immunity by this method be made practical? The experiments were carried on at the Animal Experiment Station of the Bureau. The injections were made by Dr. Kilborne, who recorded the notes upon the condition of the animals. Necessarily the hogs were not as easy to handle as the guinea-pigs, and the first experiments are not conclusive; but considering the time which must elapse before a question of this sort can be positively decided we regard the ultimate practical solution of the problem only as a question of detail, which a few more experiments will enable us to decide.

In order to test the value of this ptomaine, which had proved so satisfactory for guinea-pigs, and also of the synthetically prepared chemical compound upon hogs, the following experiment was conducted:

Nine pigs, black Essex grade, aged three months, were selected, four of them being placed in one pen and five in another.

Pig No. 374, aged three months, weight 60 pounds, treated on July 26 with solution of the ptomaine; 18 cubic centimeters of solution were used, the injection being made subcutaneously at three points. On July 30 there was large swelling at seat of injection. By August 8 this had sufficiently healed to permit of injecting more of the solution of the ptomaine. The dose was repeated on August 16. August 20 there was a swelling (lumps the size of a hen's egg) at the points of injection. These sores had healed by sloughing, and on September 9 the animal was inoculated in the femoral vein with 2 cubic centimeters of beef infusion peptone hog cholera culture one day old.

Pig No. 375, aged three months (weight 60 pounds), was treated in the same way as pig No. 374, with solution of the ptomaines, and

showed the same soreness and symptoms. On September 9 inoculated with 2 cubic centimeters of hog-cholera beef infusion peptone culture one day old.

Pig No. 376, aged three months (weight 50 pounds), treated with ptomaine as other two and inoculated September 9 with 2 cubic centimeters beef infusion peptone hog-cholera culture.

Pig No. 377 (weight 50 pounds), aged three months, treated on same dates as the above with a solution of the synthetical compound, and inoculated September 9 with 2 cubic centimeters beef infusion peptone hog cholera culture one day old.

Pig No. 378, aged three months (weight 45 pounds), treated in same way as pig No. 377 and inoculated September 9 with 2 cubic centimeters beef infusion peptone hog-cholera culture.

Pig No. 379, aged three months, weight 60 pounds; pig No. 380, aged three months, weight 60 pounds; pig No. 381, aged three months, weight 50 pounds; pig No. 382, aged three months, weight 50 pounds, were all inoculated in the vein on September 9 with 2 cubic centimeters beef infusion peptone hog-cholera culture one day old. These served as checks to Nos. 374 to 378, inclusive.

All the autopsies upon the hogs which died in this experiment were made by Dr. T. Smith, and the notes written by him are as follows:

The examination of these animals was limited to the organs of thorax and abdomen. Any organs not especially mentioned were found unchanged. The subcutaneous caseous masses are the results of the injection of the chemical substances.

September 13.—Pig No. 380 died at noon; kept on ice till September 15. Spleen moderately enlarged, dark, firm; contains hog-cholera bacilli. Serosa of lungs glistening, dotted with ecchymoses. Cephalic half of lung tissue emphysematous. Trachea and bronchi contain a small quantity of reddish foam. Right auricle of heart blackish from extravasations of blood, walls of left ventricle moderately ecchymosed. Condition of blood as in 376. No degeneration of the muscular fibers.

Liver tissue firm; on section acini come away from their connective boundaries as a whole. Cloudy swellings as shown by microscopic examination. Bile thick, flaky. Hyperæmia of fundus of stomach; several ascarides in contents. A few petechiæ on mucosa of rectum. Kidney with parenchymatous degeneration of cortex.

September 14.—Pig No. 374 found dead this morning. Examined September 15; meanwhile in refrigerator. In the left groin, under the skin, a cyst 1½ inches long, 1 inch thick; cyst wall intensely hyperæmic and pigmented. Contents cheesy. A similar cyst in right groin and on right side of abdomen. Spleen very large, dark, firm; contains many hog-cholera bacilli. Lungs œdematous, cephalic, half emphysematous. A few ecchymoses on left principal lobe. Heart muscle more or less discolored and pale; blood as in 376. Kidney with cortex quite pale, evident parenchymatous degeneration. Glands near hilus hemorrhagic. Liver pale and flabby, acini not clearly marked. Cells granular; nucleus not visible. Marked parenchymatous degeneration. Slight hyperæmia of mucosa of fundus of stomach. Glands on lesser curvature hemorrhagic.

September 14.—No. 381 died in the forenoon. Kept on ice till September 15. Skin purplish over ventral aspect of body. Spleen very large, dark, still firm; contains numerous hog-cholera bacilli. Lungs œdematous; slight ecchymosis under pluera. Right lung hypostatic. The subpleural lymphatics of principal lobe filled with blood. Condition of heart and contained blood as in No. 376. Liver firm; imparts a gritty sensation to knife. Acini projecting; interlobular tissue depressed as viewed from surface. Occasional dark red acini showing on surface and section. Condition of parenchyma and bile as in No. 380. Kidneys as in No. 380. Stomach contracted; contains very small quantity of food. Mucosa of fundus reddened in the form of minute crowded points.

September 15.—Pig No. 376 found dead in the morning. On the right thigh under skin a cyst about size of walnut, with firm, caseous contents, easily removable *in toto*. Animal quite fat. Delicate fibrils of exudate stretched across coils of intestine. Minute ecchymoses under serosa of large intestines. Spleen very large, dark, moderately firm; contains many hog-cholera bacilli. Surface of lungs covered with ecchymoses. In right principal lobe a wedge-shaped mass of dark red

hepatized tissue extending inward 2 inches from lateral border. Right side of heart contains a considerable quantity of tarry-looking blood containing lumps of clotted blood. Capillaries of heart muscle filled with corpuscles. No fatty degeneration. Liver moderately firm. Capillaries gorged with blood corpuscles. Hepatic cells containing much pigment in the form of yellowish granules, especially near intralobular vein. In fresh sections many acini show opaque foci within them. Kidneys with cortex pale, base of pyramids rather dark red. Lymph glands near hilus with hemorrhagic cortex. Stomach well filled with food. Mucosa of fundus hyperæmic, the hyperæmia made up of crowded points. Outside the fundus a number of circular hemorrhagic patches extending to submucosa; glands of lesser curvature hemorrhagic. In rectum a hemorrhagic patch one-half inch in diameter with thin adherent clot.

September 26.—No. 382 found dead at 10 a. m. Muscles of right thigh and leg eaten away by other pig in same pen. Animal has lost in weight since inoculation. Spleen moderately enlarged; contains hog-cholera bacilli. Collapse of the greater portion of the cephalic ventral and portion of principal lobe of right lung; color of collapsed portions dark red; emphysema of remainder of right cephalic and of left ventral and part of principal lobe. Bronchi contains a small amount of very viscid mucus. Small quantity of gelatinous lymph in pericardial sac. Left side of heart contracted, empty; right side contains dark semi-solid clots. Liver like that of 377; bile very thick, flocculent. Kidney as in 377; urine turbid; no albumen or casts. Stomach contracted, nearly empty; slight hyperæmia of fundus; lymph-glands on smaller curvature enlarged, pigmented. More or less hyperæmia and pigmentation of mucosa of large intestine.

October 18.—Treated pig No. 377, found dead already on October 12. The animal showed that it was unwell, being weak and stunted. Original weight 50 pounds, weight 25 pounds; animal very much emaciated. At two points of injection on right flank two cysts, containing yellowish white cheesy matter. One cyst one-half inch in diameter, the other 1½ inches. One similar cyst on right thigh and near right axilla. Spleen small. Cultures show hog-cholera bacilli. A few areas of collapse in ventral and cephalic lobe of right lung. In both sides of heart, thick, dark semi-coagulated blood, most in right side. Liver congested; tissue firm; slightly gritty sensation imparted to the knife on cutting it. Stomach empty; mucosa coated with a layer of thick orange-colored mucus. Light punctiform reddening of fundus. Cortex of kidneys pale; veins prominent. Urine free from albumen. One epithelial cast observed.

Check No. 379 and the two treated pigs, Nos. 375 and 378, recovered.

The results of this experiment were that of four checks three died, two in four and five days after the inoculation with the germ, the third in seventeen days, and the fourth check recovered.

Of the three pigs treated with the ptomaine, one recovered, two died in five and six days after the inoculation.

Of the two pigs treated with the synthetical compound, one died in thirty-nine days after inoculation and fourteen days after the last check. The other one recovered entirely. Though this experiment is not conclusive, it certainly indicates that the pigs which had been treated offered considerable resistance to the disease, and that the synthetical compound is more effective than the ptomaine obtained from the culture liquids.

The second experiment upon hogs was as follows:

On September 14 ten pigs, black Essex grade, were selected for the experiment. The animals were numbered as follows:

Number.	Weight.	Age.
	Pounds.	*Mos.*
388	40	3
389	40	3
390	50	3
391	50	3
392	40	3
393	40	3
394	45	3
395	45	3
396	35	3
397	50	3

Of these animals, Nos. 393, 396, and 397 were reserved for checks. Of the others, Nos. 394 and 395 were treated by intravenous injection of the chemical substance, about 0.5 gram being given to each animal. Nos. 388, 389, and 390 were treated by subcutaneous injection of a solution of the mixed albumose and ptomaine, and Nos. 391 and 392 were treated by subcutaneous injection of the chemical, about 4 grams being given to each animal. The injections were made on September 18, October 4, and October 27, 1890. The albumose and ptomaine produced considerable local irritation, large abscesses being formed at the points of injection. In the case of the chemical there were small lumps formed at the points of injection, but the irritation was not so marked as in the other case. On November 19 all the animals were exposed to hog cholera by inoculating them in the vein with 2 cubic centimeters of beef infusion peptone culture one day old.

On November 23 pig No. 388, one of the treated animals, was found dead. The autopsy by Dr. Smith showed death from hog cholera.

On December 3 one of the pigs which had received the intravenous injection of chemical was found dead, and on December 13 the others, Nos. 394 and 395. The remaining animals, though sick for from two to three weeks, recovered from the disease.

The condition of these animals, as taken from Dr. Kilborne's notes, March 12, 1891, about four months after the exposure to the hog cholera, was as follows:

The check No. 393 was small and stunted, but looking and feeding well. Check No. 397 had made a fairly good recovery from the hog cholera.

Of the treated animals, Nos. 389 and 391 had made a good recovery. No. 390 was thin and stunted, and No. 392 thin but feeding well.

The result of the experiment is one check and one vaccinated animal dead. Two animals given intravenous injection of a very small amount of the chemical died one and two weeks after the check; the others recovered. The vaccinated animals made a somewhat better recovery than the checks, being, as noted after several months, in better condition.

As the dose of virus was not sufficient to kill all of the checks no positive conclusions can be drawn from this experiment, but it served to show resistance of the treated animals to disease, giving encouragement for continuing the experiments on a practical scale.

I may take occasion here to mention the valuable assistance rendered me by Dr. V. A. Moore in connection with the bacteriological work, autopsies, etc., and by Dr. Theobald Smith in allowing the use of the facilities of the bacteriological laboratory in his charge, and also the uniform kindly encouragement of Dr. Salmon, Chief of the Bureau.

SWINE PLAGUE.

While awaiting the results of further experiments upon hog cholera I thought it well to begin a study of the swine-plague cultures, with the object of obtaining from them albuminoid and alkaloid poisons. The swine-plague germ grows but slightly in the ordinary beef infusion culture. Dr. Moore, however, found that if, instead of making a simple beef infusion, a beef broth was prepared by boiling the meat the growth of the swine-plague germ in this liquid was much larger. Alkaline media of this description were therefore used, and 1,000 cubic centimeters in Erlenmeyer flasks were inoculated

and kept in the incubator for two days at a temperature of 37° C. The growth of the germ was by this time very perceptible. The contents of the flasks proved to be uncontaminated. When opened a disagreeable pungent odor was noticed.

After filtration a portion of the filtrate was submitted to distillation with strong hydrochloric acid and the distillate tested for phenol and indol. Bromine water showed the presence of a considerable quantity of phenol, while nitrous acid gave proof of traces only of indol. In this respect the culture liquids differ entirely from those of the hog cholera, as the latter upon distillation with steam yield ammonia, and with acid give no volatile product. Cultures of the German Schweineseuche also yield phenol and indol, but in larger quantity than the American swine-plague germ.

The larger part of the filtered culture liquid was now treated with eight times its volume of absolute alcohol, and a considerable white flocculent precipitate was obtained. This after settling was filtered off, redissolved with water and again precipitated with absolute alcohol. The precipitate was thoroughly washed with absolute alcohol and dried over sulphuric acid *in vacuo*. A white translucent mass was thus obtained, with difficulty soluble in water, and having properties of an albuminoid or proteid body.

The filtrate from the albumose was neutralized with hydrochloride acid evaporated to dryness and the residue extracted with absolute alcohol. This alcohol extract gave alkaloidal reactions with mercuric chloride, phosphomolybdic acid, platinum chloride, etc., showing the presence of a base.

The double platinum salt yielded upon analysis figures corresponding closely to the formula $C_{11}H_{24}N_4O_2PtCl_6$.

	Found.	Calculated.
	Per cent.	*Per cent.*
C	20.31	20.08
H	3.58	3.66
N	8.32	8.56
O	.....	5.03
Pt	30.62	30.12
Cl	31.84	32.41

The correctness of this formula can only be determined by further careful study of the substance and its derivatives.

I have demonstrated, however, the existence in the culture liquids of the swine-plague germ of a ptomaine and albumose. The name suplagatoxin may be given to the ptomaine (from the Greek συς a hog, πλήγή plague, and τοξοκόν poison), and suplagoalbumin to the albumose. This would be distinctive from the hog-cholera products.

While purifying a larger quantity of these substances in order to make a closer study of them chemically, I thought it advisable to use the material at hand for making some experiments in the production of immunity in guinea-pigs from swine plague by preventive treatment.

Previous to this Dr. Moore had made a number of inoculations of guinea-pigs with swine plague, which showed that $\frac{1}{1000}$ cubic centimeter of beef infusion peptone culture of swine plague one day old was sufficient to kill a guinea-pig in from twenty-four to forty-eight hours. Further, in order to see if the treatment which proved satisfactory for producing immunity against hog cholera might have any effect in

retarding the disease of swine plague, two guinea-pigs that had been submitted to the preventive treatment for hog cholera but never exposed by inoculation were inoculated with $\frac{1}{1000}$ cubic centimeter of beef infusion swine-plague culture one day old. Both animals succumbed in forty-eight hours to the disease of swine plague. Two guinea-pigs that had been subjected to the preventive treatment, then inoculated with hog cholera and recovered, and were perfectly well, were inoculated with $\frac{1}{1000}$ cubic centimeter each of beef infusion peptone swine-plague culture one day old. Both died, as was expected, in forty-eight hours. The autopsy of one, practically the same for all of the pigs dead from swine plague, made by Dr. Moore may be given here. At the point of inoculation of the germ there was a slight cellular infiltration into the subcutaneous tissue, and the surrounding blood vessels were considerably injected. Small intestines reddish yellow, containing a yellowish somewhat viscid mucus. Liver reddened and sprinkled with minute grayish dots. Spleen slightly enlarged, dark colored. Cover-glass preparations from spleen and liver show swine-plague germs. Kidneys very pale. Blood vessels of heart muscle much injected. These experiments serve further to demonstrate, if proof is necessary, that the diseases of hog cholera and swine plague are distinct, and that an animal which has had the hog cholera and recovered is still as susceptible as ever to the swine plague.

Experiment I.—Two guinea-pigs were selected, and on three successive days .0030 gram of swine-plague albumose was injected subcutaneously in the thigh. About .0010 gram of substance was given at each injection. There was a slight swelling at the point of injection, which disappeared in four or five days, and the animal appeared well. Two checks were now taken, and the four inoculated with $\frac{1}{1000}$ cubic centimeter swine-plague culture. The checks died, one in forty-eight hours and the other in thirty-six hours.

The autopsy, practically the same for both, is as follows:

At the point of inoculation there was a slight infiltration of a grayish substance, the surrounding tissue being sprinkled with punctiform hemorrhages. Small intestines deeply reddened. Peyer's patches thickened and grayish. Blood vessels of serous coat of stomach considerably injected. Liver deeply reddened, sprinkled with a few round grayish dots. Spleen much enlarged; dark colored. Cover-glass from it showed swine-plague germs. In the pericardial sac was a small quantity of exudate composed of cells and swine-plague germs. The muscle of the left ventricle was hemorrhagic.

The treated pigs appeared a little stupid for a day or two, and then recovered entirely.

Experiment II.—Two guinea-pigs were treated with a solution of the ptomaine extracted from the culture liquids. The injections were made subcutaneously in the inner side of thigh, the quantity of ptomaine used corresponding to about 15 cubic centimeters of the culture medium. There was a slight swelling and soreness at the point of injection, but otherwise the pigs appeared well. These, together with two checks, were inoculated with $\frac{1}{1000}$ cubic centimeter of swine-plague culture. The checks died of swine plague. One of the treated animals died in thirty-six hours. The autopsy, however, showed but few marked characteristics of swine plague. At the point of inoculation there was a slight infiltration. Blood vessels in heart were much injected; liver slightly reddened; bladder distended with urine. Otherwise the organs were normal. Cover-glass from spleen and liver showed *no swine-plague germs*, but cultures

from the liver showed that the swine-plague germ was present. The other treated pig died five days after the checks, or eight days after the inoculation.

Autopsy showed at the point of inoculation skin sloughed away over an area of a square centimeter. Subjacent muscle apparently normal. At the point of injection of ptomaine there was a slight infiltration. Abdominal wall, mesentery, and intestines were covered with a gray, viscid exudate, composed of cells and containing a large number of swine-plague germs; spleen and liver pale, not enlarged; heart and lungs normal; kidneys pale.

The ptomaine, therefore, produced some resistance to the disease.

Experiment III.—Two guinea-pigs, weight 13½ and 12 ounces respectively, were treated with suplagatoxin about 0.1000 gram being given in four injections. The material produced considerable local soreness and necrosis of tissue. After this was healed the pigs were inoculated with $\frac{1}{1000}$ cubic centimeter swine-plague culture one day old, together with two checks. The checks died three days after the inoculation, the treated animals in seven and eight days.

The autopsies upon the latter two may be given:

(1) At the point of inoculation with the germ there was a cyst the size of a walnut containing semifluid pus. Peyer's patches were prominent. Liver and spleen apparently normal, but cultures from the liver showed swine-plague germs. Kidneys reddened. In the pleural cavity there was considerable blood-stained serum. Both lungs were covered with a grayish membranous exudate and the thoracic walls lined with a similar exudate. Pericardial sac contained dark-colored serum. The left ventricle of the heart muscle was hemorrhagic.

(2) At the point of inoculation there was an abscess 1½ cubic centimeter square. There was a small amount of serum in the abdominal cavity. Liver deeply reddened sprinkled with fine grayish dots. Cultures from the liver showed swine plague germs. Spleen was dark-colored and enlarged. Pericardial sac contained dark-colored serum. The left ventricle of the heart muscle was hemorrhagic.

As in the first experiment in which suplagatoxin alone was used for treating the animals, so here there was considerable resistance shown to the disease by the treated animals, but not immunity, and it would seem that in case of the swine plague the albumose alone is the really active principle.

Experiment IV.—On November 21 two guinea-pigs were treated with 0.0150 grams of swine-plague albumose each, and again on November 24 with the same dose. On December 3 they were inoculated with $\frac{1}{1000}$ cubic centimeters swine-plague culture one day old, together with check. All of the animals were found dead December 6.

The post-mortem notes on the treated animals were as follows:

At point of inoculation over an area of 1½ by three-fourths millimeters there was considerable infiltration of a grayish pasty substance into the subcutaneous tissue, the skin and subjacent muscles being deeply reddened, due to the injection of the blood vessels. Covering the intestines and peritoneal membrane was a thin, grayish, viscid exudate; also over the liver and spleen. Pericardial sac contained more than the usual quantity of grayish liquid. The blood vessels of the heart were much injected, and near the base of the left ventricle was a grayish protuberance about 2 millimeters in diameter. Cover-glass from the liver showed swine-plague germs.

As previous and subsequent experiments were successful in rendering guinea-pigs immune by the method recorded, there was certainly an unexplained cause which produced the fatal results in this experiment.

It is probable, as has been suggested, that there is a limit to the quantity of substance used in preventive treatment, beyond which

limit an increased amount of the material does more harm than good. As the quantity of substance used in this case was much larger than before, this would seem to be a fair conclusion.

Experiment V.—January 15, 1891, three guinea-pigs, about 1 pound in weight each, were given a subcutaneous injection of .0060 gram swine-plague albumose dissolved in 2 cubic centimeters of water each. There was a very slight reddening of the skin and swelling at point of injection, otherwise the animals were quite well. On January 28, 1891, these three pigs and one check were inoculated with $\frac{1}{1000}$ cubic centimeters swine-plague culture one day old.

The checks died January 29. The autopsy was as follows:

At the point of inoculation there was a slight purulent infiltration into the connective tissue over an area of 5 millimeters square, the blood vessels in the immediately surrounding tissue being considerably injected. Liver was sprinkled with a considerable number of bright red areas, due probably to injection of the blood vessels. Cover-glass from liver shows a small number of swine-plague germs.

The spleen was not enlarged and but little discolored, a cover-glass preparation showing a few swine-plague germs. There were a few germs in the blood, no apparent intestinal lesions, and the stomach was empty.

The three treated animals appeared a little stupid and ill for two or three days after the inoculation with the germ, but afterwards became quite well and have remained so.

This was a further confirmation of the experiments already conducted with the swine-plague germ products, proving conclusively that but very small quantities of albumose in this instance are sufficient to produce immunity.

These experiments, following the more extended ones upon hog cholera, prove conclusively that both these diseases can be prevented in guinea-pigs by chemical inoculation. The experiments upon swine plague will be extended and a careful study made of the ptomaine and albumose produced by this germ.

Just how this immunity from disease in the animal is produced, what the effect of the albumose and ptomaine really is, is more a question for the pathologists to decide than for the chemist, and can only be learned by extended investigation. It may be that the substances introduced into the blood and tissue furnish food to the germs long enough to permit the leucocytes and phagocytes in their normal actions to overcome and annihilate the germs. Or on the other hand the germ when entering the blood may find that the substances from which they derive their nourishment is protected from attack by the poisonous materials already introduced into the system and hence they are unable to multiply. We may refer further to the experiments of Buchner and Voit (Archiv. für Hygiene, vol. x, 1 and 2 pts.), in which they show that the power of killing bacteria which exists in the blood of certain animals lies in the blood serum, and that there is a compound of albumenoid matter with a mineral salt in the serum which is the active principle. This compound can be decomposed by heating the serum to 59° C. whereby the germicidal power is destroyed, or by dialysis, by which the mineral matter is removed. Perhaps then, in the cases of immunity in the guinea-pigs, there are, comparatively speaking, large amounts of these compounds formed between the albuminoidal matter of the blood and the salts introduced, and the blood thereby rendered a strong germicide.

Hankin holds that albumose is the one and principal factor in the production of immunity, and that the reason more results have not been secured in this direction is because the proper material has

never been used. We think, however, that the albumose is only an intermediate product of the germs, and the final and most fatal effect of the disease results generally from the ptomaines. At any rate the experiments upon hog cholera lead to the conclusion that while a mixture of the albumose and ptomaine seems to produce greater immunity than either substance alone, nevertheless when used separately they are of about equal value.

In order to see if possibly an animal that had been treated for and recovered from swine plague would show any resistance to the disease of hog cholera, the following two sets of experiments, which may be given here together, were conducted. Four guinea-pigs that had recovered from swine plague were given one-tenth cubic centimeter each of hog-cholera culture one day old, together with four checks. The checks died in nine and ten days and the other animals in ten and eleven days, autopsy showing characteristics of hog cholera. This, combined with the reverse experiment previously conducted and recorded, showed again the independent character of the two diseases of hog cholera and swine plague.

EXPERIMENTS UPON HOGS FOR SWINE PLAGUE.

I. These experiments were conducted for the purpose of testing the effect of the albumose obtained from the cultures of the swine plague in producing immunity in hogs from the disease of swine plague. As already recorded in the case of guinea-pigs, a single injection of a very small quantity of the swine-plague albumose or the suplagoalbumin, as we have named it, was sufficient to produce immunity from the disease.

In the case of the hogs the same process was followed, only a larger dose was given, corresponding to the proportional increased weight of the animal.

Four hogs, Black Essex and Berkshire, were selected.

Number.	Weight.	Age.
	Pounds.	*Mos.*
410	40	3
411	40	3
412	45	3
413	40	3

Nos. 410 and 411 were treated with the albumose; the other two served as checks.

On November 26, 1890, Nos. 410 and 411 received an injection of 7 cubic centimeters each of suplagoalbumin subcutaneously in the thigh, 3½ cubic centimeters being used for each injection. Each animal received 0.2000 gram of albumose.

There were no results from this injection either in the production of a local lesion or in the general health of the animals.

On December 4 these two animals and also the checks were inoculated in the femoral vein with 1¼ cubic centimeters beef infusion peptone swine plague culture one day old.

Both of the checks Nos. 412 and 413 died on December 5, fifteen hours after the inoculation. These also served for checks in an experiment of Dr. Smith's, and the autopsies will be found in that connection.

No. 410 was but slightly affected by the inoculation with the germ, and on December 9 appeared to have entirely recovered.

No. 411 on December 9, on the contrary, was very sick from the inoculation with the germ, had been down unable to rise since December 7, and finally died December 22, two weeks after the checks. The autopsy by Dr. Smith was as follows:

The animal was greatly emaciated, weight only 28 pounds. There was an enlargement of both knee and hock joints, but the disease appeared to be confined to the joints only. Lungs show no inflammation or hepatization. Right heart filled with large dark clot, left with larger partially washed clot. Gall bladder distended with very thick bile holding large quantities of solid in suspension. Liver more firm than normal. Stomach contracted; contained very small quantity of viscid bile-stained liquid. Spleen not enlarged; pulp rather dark. Kidneys rather small; on section show fatty degeneration. Two rabbits inoculated with virus from the knee joint, dead in twenty-four hours, autopsy showing death from swine plague; cover-glass preparations from spleen and liver showing swine-plague germs.

The results of the experiment were, therefore, both checks dead. One treated animal lived two weeks longer than the checks, the other treated animal recovered. A saving of 50 per cent in the treated animals against an entire loss of checks, thus showing the possibility of practically treating this disease.

II. In the case of the second experiment, conducted upon hogs for swine plague, the exposure with the germ was not sufficiently severe to kill even the check animals, consequently no conclusions could be drawn as to the value of the treatment. It is probable, however, that the disease of swine plague in hogs can be practically treated.

Exposure of an animal that had recovered from swine plague to hog cholera. On December 30, 1890, pig No. 410, that had recovered from swine plague, was inoculated in the vein with 4½ cubic centimeters of hog-cholera culture one day old, together with checks and a number of other animals, that had been already inoculated several times with the germ by Dr. Smith.

On January 1, 1891, the animal No. 410 was very sick, but on the 5th and 6th seemed to be improving. On February 10 it was very thin and sore, smaller than when inoculated, and finally died on February 20. The autopsy by Dr. Kilborne was as follows:

Lungs normal. Right side of heart distended with large clot of blood; in left ventricle small clot. Liver capsule marked by numerous bluish-white patches one-third to three-fourths centimeter across. On section liver was firm, feeling gritty under the knife. Cortex of kidneys was pale and thickened; other organs apparently normal.

The checks had died on January 1, two days after the inoculation with the germ. The swine-plague animal thus showed considerable resistance to the disease. This animal was treated at the same time as a number of animals by Dr. Smith and must be considered at the same time and in connection with them.

IS IMMUNITY FROM HOG CHOLERA HEREDITARY?

A pair of guinea-pigs which had been rendered immune to hog cholera in August, 1890, were carefully kept apart from other animals for a number of months. The offspring (which it may be noted did not grow rapidly for the first month) were when three months old inoculated with one-tenth cubic centimeter hog-cholera culture one day old, together with two checks. The checks, which were a little smaller and younger than the other animals, died seven and twelve days after the inoculation. The other animals died fourteen days after the inoculation.

The autopsies upon the latter two were as follows:

No. 1. At the point of inoculation subcutaneous tissue indurated over area 1 inch in diameter, the superficial layer of abdominal muscle being involved. Follicles in cæcum infiltrated with a grayish substance. Peyer's patches swollen, pigmented. Liver deeply reddened and sprinkled over surface with minute grayish areas. Cover-glass shows hog-cholera germs. Spleen apparently normal. Blood vessels of kidneys much injected.

No. 2. Inguinal glands enlarged and reddened. On the left side at the seat of inoculation a cheesy tumor "2 by ¼," the surrounding tissue having a blue-black color. Immediately under the peritoneum along the dorsum a number of tubercle-like bodies. Abdominal cavity contains 1 cubic centimeter of clear yellowish serum. A white opaque exudate was spread over liver and spleen. Lungs emphysematous, the surface sprinkled with translucent dark dots. Cover-glass from liver showed few hog-cholera germs.

Thus is proved that the offspring from immune guinea-pigs in the case of hog cholera are not themselves immune.

GLANDERS.

A study of the chemical products in cultures of the glanders germ has been begun. At this writing a non-poisonous albumose has been extracted, but only traces of a ptomaine-like body have been obtained. It is probable that in the case of this germ an albumose is the principal and practically only product.

Experiments are being conducted with the purpose of seeing if animals can perhaps be rendered immune to glanders by a manner of treatment similar to that adopted in the case of hog cholera and swine plague.

MISCELLANEOUS.

In addition to the study in connection with the diseases just recorded the writer has given some little attention to the presence of tyrotoxicon in milk and cheese. In May, a sample of milk from Maryland came into his hands which was supposed to have caused the sickness of a number of children. The symptoms as given indicated a possible tyrotoxicon poisoning. The milk was examined for the poison, but the latter could not be detected. Some months after this, cheese, which had produced sickness in this city, and two lots which had caused illness in Ohio, were received. In all three cases the questionable tyrotoxicon was blamed for the sickness. I could not, however, establish the presence of tyrotoxicon in any instance by the methods prescribed by Vaughan. This led me to repeat one of Vaughan's experiments, which should have given me considerable quantities of tyrotoxicon. A half gallon of fresh normal milk was placed in a loosely stoppered glass jar and allowed to stand at the temperature of the room for three months during the summer. At the end of this time it was examined for tyrotoxicon, but the test failed to establish its presence. From this milk as well as from the samples of cheese Dr. Moore isolated several different germs, but other more important work has prevented a closer study of these and their products.

Our own experiments, supported by the negative results of a number of other chemists, force us to conclude that the toxic principle of poisonous cheese and milk has not been yet sufficiently studied, and that there is here a very important field for further investigations.

A number of other unimportant examinations and analyses have been made, but the facts established in regard to hog cholera and swine plague are the important results of our work.

Tabulated results of experiments in producing immunity from hog cholera in guinea-pigs.

Number of experiments.	Material used for treatment.	Hog-cholera virus used for each animal (centimeters).	Number of animals used.	Number of checks.	Number of days between inoculation with virus and death of checks.	Result in treated animal.
I	Sucholotoxin	0.10	2	2	8 and 9	1 died in 11 days; 1 recovered.
II	Sucholoalbumin ..	0.10	2	2	7	Died in 17 days; great resistance.
III	Sucholoalbumin ..	0.10	3	2	8 and 10	Recovered; immunity.
IV	1. Sucholotoxins ..	0.10	2	2	.....	Do.
	2. Sucholotoxin and albumin.	0.10	2		8 and 10	Do.
V	1. Sucholotoxin ...	0.10	2	2	8 and 9	Do.
	2. Sucholotoxins ..	0.10	2	2	8 and 9	Do.
VI	Sucholotoxins	0.10	2	(*)	8 and 9	Blanks died in 18 and 30 days; others not affected; immunity.
VII	Pure chemical....	0.10	3	2	8 and 9	2 died in 13 and 14 days; third recovered; immunity.
VIII	Pure chemical. ..	0.10	2	2	6 and 7	Recovered; immunity.
IX	Pure chemical....	0.10	4	2	8	1 died in 13 days; others recovered; immunity.

*Two blanks and two checks.

Experiments upon hogs (Essex grade).

X	Sucholotoxins	2.00	3	4	4 and 5 and 17 days.	2 died in 5 days; 1 in 36 days.
XI	Pure chemical....	2.00	2		1 recovered.	1 recovered; resistance.
XII	Sucholoalbumin and toxin.	2.00	3	4	1 check died in 6 days.	1 died in 4 days.
	Pure chemical....	2.00	2		3 recovered.	None died.
	Pure chemical (intravenous).	2.00	2		.....	Both died in 14 and 24 days.

Experiments in producing immunity from swine plague in guinea-pigs.

Number of experiments.	Substance used.	Amount of virus issued (centimeters).	Number of animals.	Number of checks.	Number of days between inoculation with virus and death of checks.	Results in treated animals.
I	Suplagoalbumin..	.001	2	2	36 and 48 hours.	Recovered; immunity.
II	Suplagatoxin	.001	2	2	36 hours.	One in 36 hours; other in 8 days.
III	Suplagatoxin	.001	2	2	3 days.	7 and 8 days.
IV	Suplagoalbumin..	.001	2	2	3 days.	2 days.
V	Suplagoalbumin..	.001	3	1	24 hours.	Recovered; immunity.

Production of immunity from swine plague in hogs.

VI	Suplagoalbumin..	1.25	2	2	15 hours.	1 died in 2 weeks; other recovered.

REPORT OF THE UNITED STATES BOARD OF INQUIRY CONCERNING EPIDEMIC DISEASES AMONG SWINE.

Hon. J. M. RUSK,
Secretary of Agriculture:

SIR: The above-named Commission received appointment from the Department of Agriculture during the month of December last, and their formal notification thereof was accompanied by a letter of instructions similar to the following:

U. S. DEPARTMENT OF AGRICULTURE,
COMMISSIONER'S OFFICE,
Washington, D. C., November 27, 1888.

SIR: I inclose with this an appointment for you as a member of a Board of Inquiry, the other two members of which are Prof. William H. Welch, of Johns Hopkins University, and Prof. T. J. Burrill, of the University of Illinois. The Board will convene at the Department of Agriculture, Washington, D. C., on December 12, and decide upon the plan of investigation and the methods to be employed. The details of this investigation will be left to the Board, without instructions or interference on the part of the Department, but all the facilities of the Department will be placed at its disposal.

I desire that the investigations of the Board will determine the following points:

(1) If the diseases of swine investigated by the Bureau of Animal Industry were properly described in the reports for 1885, 1886, and 1887, and if they were caused by the germs mentioned in connection with them, and if these germs were properly described.

(2) To what extent were these descriptions of the germs original, and to what extent had they been antedated by other correct descriptions and by investigations which would *demonstrate* their etiological relation to the diseases of swine, and particularly to the diseases as they exist in the United States.

(3) Is the disease which has been investigated by Drs. Billings and Roberts, in Nebraska, identical with one of the diseases described by the Bureau of Animal Industry, or is it different from both of them? Are their descriptions of the disease and the germ correct? Do their investigations show that the conclusions as given in the Bureau report are incorrect? Have any facts been established in regard to the swine diseases of this country by these investigations which differ materially from the conclusions given in the reports of the Bureau of Animal Industry?

(4) To what extent is Dr. Detmers justified in his assertion that "Dr. Salmon's *Bacterium Suis*, discovered by him in 1885, as a substitute for his *micrococcus*, has nothing whatever to do with swine plague. It is a septic germ, readily kills rabbits (*cf.* Bulletin of the Ohio Agricultural Experiment Station), and causes septicæmia, but has no connection with the disease in question?" Has Dr. Detmers published the details of any investigations which demonstrate the etiological connection of any microbe with an infectious disease? If so, does the microbe he has discovered differ specifically from both of those described in the Reports of the Bureau of Animal Industry?

Please make such suggestions as may occur to you in the course of your investigations in regard to the proper method of treating and preventing these diseases. The report of the Board should be submitted to me on or before April 1, 1889.

Very respectfully,

NORMAN J. COLMAN,
Commissioner of Agriculture.

Dr. E. O. SHAKESPEARE,
1336 *Spruce street, Philadelphia, Pa.*

(NOTE.—Professor Welch declined, and Prof. B. Meade Bolton, of the University of South Carolina, was appointed in his stead.)

Modifications of the letter of instructions were made with one member of the Commission, viz, Professor Burrill, before his acceptance of his appointment; but as these were not made with the other members, they are not here inserted.

In fulfillment of the object of their commission, as explained by the accompanying instructions, the Commissioners met at Washington during the week of last Christmas and organized by the election of Dr. Shakespeare as chairman, and Prof. B. Meade Bolton as secretary. They sketched out a plan of work as follows:

(1) Examine methods of observation and research pursued in the Bureau of Animal Industry at Washington.

(2) Examine diseased hogs furnished by the Bureau of Animal Industry, making special endeavor to find the two diseases described by the Bureau authorities and the two germs claimed by them to be the cause of the respective maladies.

(3) Visit South Carolina for the purpose of examining into the nature and cause of epidemic diseases among hogs prevalent there.

(4) Visit Nebraska for the purpose of examining the methods of Dr. Billings and the disease upon which he was at work.

(5) Examine into nature and cause of disease among hogs in various localities in that State.

(6) Visit as many outbreaks of swine disease in different parts of the country as possible with a view of finding if such existed—the two diseases and the two germs described by the Bureau authorities.

(7) Visit Dr. Detmers to examine his claims of priority and his methods of investigation.

(8) Examine separately and individually the morphological and pathogenic qualities of the germs found in the various localities where the Commission might find epidemics prevalent among hogs.

(9) Examine the question of immunity after a natural attack and after artificial inoculation from the standpoint of experience in Nebraska.

(10) Test especially the question of artificial immunity by experimentation at Philadelphia upon inoculated and recovered pigs obtained in Nebraska, as compared with controls.

After a session in Washington of several days, during which the first and second objects above mentioned were carried out, the Commission proceeded to Columbia, S. C., where they arrived January 1, 1889. They found and examined two outbreaks in the immediate vicinity of Columbia, and one other some 80 miles distant therefrom, viz, near the village of Florence, in the same State. The disease found in that State presented the clinical features and anatomical lesions, as well as germs, of "hog cholera," the latter, however, associated with some other microbes.

The Commission next proceeded to Lincoln, Nebr., and were cordially received by Dr. Billings, who rendered every facility for the prosecution of their inquiries. His methods were examined, and some five or six hogs which had been previously inoculated by him were studied post-mortem and bacteriologically. The lesions found were in the main corresponding to "hog cholera," as previously described by him under the name of "swine plague," and also noted by the authorities of the Bureau of Animal Industry as "hog cholera." Specimens were also obtained from a natural outbreak located some nine miles away, with lesions and germs apparently

identical with those of the inoculated pigs at the Agricultural Station. One of our number also visited Surprise, in the same State, and inquired into the history of the preventive inoculations there, as well as obtained two or three autopsies of pigs naturally affected with the disease. Anatomical specimens and cultures were made on the spot and brought to Lincoln for study.

Arrangements were made for the purchase and shipment to Philadelphia of a number of Nebraska pigs, viz: Four pigs recovered from a natural attack of prevalent disease; five pigs survivors of preventive inoculation performed at Gibbon; five pigs survivors of preventive inoculation performed at Surprise; and four pigs from the Agricultural Station at Lincoln, two of which, as stated by Dr. Billings, had been inoculated during the last summer with sterilized hog-cholera cultures and subsequently exposed to the natural contagion without showing any sign of the disease; besides two others, survivors of an inoculation of nineteen pigs at the Agricultural Station, nearly all of which had subsequently succumbed to the artificial disease.

On their way homeward two of the Commission examined an outbreak of epidemic diseases among hogs near Lexington, Ky., and the member resident in Illinois subsequently found and examined an outbreak within that State.

After the Commission returned to their respective homes, in the latter part of January, it was found necessary that the chairman should again visit Lincoln in the latter part of February in order to expedite the shipment to Philadelphia of the above-named experimental Nebraska pigs, and finding it convenient on his way homeward he called a meeting of the Commission at Columbus, Ohio, to visit Dr. Detmers, in response to his invitation, and learn of his methods and work upon swine diseases.

Towards the latter part of February the eighteen Nebraska pigs reached Philadelphia in fair condition, and were, through the courtesy of Dr. R. S. Huidekoper, dean of the veterinary department of the University of Pennsylvania, placed on the grounds of that institution, where they were kept for experimentation, together with a number of control pigs purchased in the neighborhood of Philadelphia by the chairman of the Commission, as determined upon by the Board. Subcutaneous inoculations and feeding experiments were at once begun with virus obtained from Nebraska, Washington, Kentucky, and Illinois. The Commission again convened at Philadelphia the last week in March in order to confer concerning a report required by the 1st of April, as per letter of instruction, and found themselves unable at the time to formulate definite conclusions. The chairman reported this state of indefiniteness and requested the Secretary of Agriculture for extension of time. This request was granted, two months longer being allowed.

The Commission then dispersed again to continue independent researches at their own homes during the two additional months allowed, but about the 20th of April a letter from the Secretary of Agriculture was received by each commissioner, instructing them that, owing to exhaustion of appropriated funds, cessation of investigations at the end of the first extra month was necessitated.

The commissioners were consequently obliged to terminate their investigations before reaching conclusions which were entirely satisfactory to themselves. Looking on their letter of appointment with accompanying instructions as a direction, not only to examine the

respective opinions and claims of Drs. Salmon, Billings, and Detmers, but more especially to conduct a searching study by original and entirely independent investigations of the nature, cause, and means of prevention of the swine plagues of this country, the Commission can not but regret the necessity of terminating their work and reporting that they themselves feel that they had not proceeded sufficiently far in their independent labors to satisfy the reasonable expectations of the scientists on the one hand and of the swine-breeders on the other. Whether the germs with which Dr. Salmon has been experimenting are genuine and are the real causes of the respective diseases for which they are claimed to be pathogenic or not; or whether the microbe with which Dr. Billings is working is or is not the sole and only peccant agent; or whether Dr. Detmers was the original discoverer of the real germ, are all questions of great interest from the scientific standpoint; but the only question, in the opinion of the Commission, in which the farmers of this country, who suffer annually the loss of $20,000,000 by these devastating swine plagues, are vitally interested, is, "How can these enormous losses be prevented?"

It will be seen that we venture to offer no definite conclusions concerning this exceedingly grave question. It is a problem into which so many factors enter, and for the complete solution of which so many prolonged experiments upon pigs are required, that the time at our disposal has been entirely inadequate; and yet it was chiefly the hope of making some substantial contribution toward the solution of this very serious matter that induced the undersigned to accept at great personal inconvenience the appointment tendered them.

After the 1st of May the commissioners continued their work, but without pay, desirous of obtaining additional facts before reporting.

The Commission report only the results and definite conclusions deduced from the observations which they have been severally and collectively able to make. Conforming more or less closely to the order of the questions set forth in the letter of instructions above mentioned, they are as follows:

CONCLUSIONS.

(1) It is the opinion of the Commission, based upon their own individual observations and examinations of the subject, that there are at least two widespread epidemic diseases of hogs in this country which are caused by different microörganisms, but which have clinical history and pathological lesions more or less similar and very difficult to distinguish without the aid of a microscope and resort to bacteriological methods; and that these two epidemic diseases have been fairly well described in the recent annual reports of the Bureau of Animal Industry, except it does not appear that "hog cholera" of these reports can be said to have its special and exclusive seat in the digestive tract of the animal as distinct from the lungs. So far as the knowledge and observation of the Commission go, one of these epidemic diseases, viz, that called by the Bureau authorities "swine plague," appears to be far less prevalent than the other, which has been named by them "hog cholera."

The Commission are further of the opinion that the disease called by the authorities at Washington "hog cholera" is caused by the specific action of a certain microbe named by them "the hog-cholera germ," which has certain characteristics of form, size, movement,

mode of growth in artificial cultures, and action upon certain lower animals, and taken together enable one to distinguish it from other microbes which have been described from time to time by various authors as present in swine disease; and that the descriptions of this microbe and its peculiarities, as set forth in recent annual reports of the Bureau of Animal Industry, are fairly accurate.

The Commission are also of the opinion, although to a less positive degree, that the epidemic disease called by the Bureau authorities "swine plague" has as its specific cause a certain microbe possessing characteristics which have been fairly well described in recent annual reports of the Bureau of Animal Industry, which distinguish it both biologically and pathologically from the first-mentioned "germ of hog cholera."

(2) It is the opinion of the Commission that the actual and undeniable proof of the pathogenic relations between the so-called "hog-cholera" germ above mentioned and the disease of hog cholera was first published in the annual report of the Department of Agriculture for 1885, and in the second annual report of the Bureau of Animal Industry of the same year, hence was not antedated with respect to epidemic diseases of swine existing in the United States. The discovery of the disease called "swine plague," and of the microbe to which it is due, must be considered original on the part of the Bureau authorities, at least as far as work in the United States is concerned.

(3) In the opinion of the Commission the epidemic disease of swine investigated by Drs. Billings and Roberts, in Nebraska, however seemingly different in the published descriptions, is identical in its clinical features, pathological lesions, and specific cause with the disease investigated by the Bureau of Animal Industry at Washington, and called by the latter "hog cholera;" and, furthermore, that the pathogenic microbe which is the specific cause of this disease is identical in both instances. It is also their opinion that the descriptions of this germ published by each of these investigators are in the main correct. The two chief points in these descriptions upon which the above-mentioned investigators have differed more or less widely are as to some minor points of morphology and variations of the behavior of the microbe under various methods of staining.

(4) It is the opinion of the Commission that the microbe that Dr. Detmers at present regards as the specific cause of "hog cholera" is probably the same microbe which is considered by the Bureau authorities as the specific cause of hog cholera; but, according to present requirements of bacterial research and interpretation, it is impossible to declare that the organism as described by him in his reports published by the Department of Agriculture was the same thing.

In their observation of the methods of bacteriological research pursued by the Bureau of Animal Industry at Washington the Commission are of the opinion that as to carefulness and precision they are up to the standard of modern requirements concerning bacteriological investigations. They are essentially the same as those pursued at Berlin in the pathological laboratory of the Imperial Board of Health, and in the Hygienic Institute, of which Professor Koch is the head.

From their observation of the methods of bacteriological research pursued by Dr. Billings in Nebraska, the Commission are of the opinion that it was difficult, if not impossible, for that distinguished investigator by his usual method to discover and isolate a germ associated with the "hog-cholera germ" in the tissues of the body of the pig,

and this is particularly true of the so-called "swine-plague" germ, claimed by the Bureau authorities to be the specific cause of the epidemic disease latterly named by them "swine plague." In the opinion of the Commission, therefore, the failure of Dr. Billings in his researches to find the so-called "swine-plague" germ in the tissues of the spleen (the organ from which he almost invariably made his cultures) can not be regarded as incontestible proof that the "swine-plague" germ has had no existence in the affected hogs which have fallen under his observation, and affords no evidence that this last-named disease does not occur in Nebraska.

The Commission regard their experiments concerning immunity as inconclusive and more or less indefinite; yet it seems to be evident that there is a certain degree of protection against artificial acquisition of hog cholera possessed by the Nebraska pigs which had been inoculated and which had recovered from the natural disease, the latter appearing to be slightly less protected than the former. Furthermore, the feeding experiments above mentioned appear to indicate that the hog can be artificially protected against the action of virulent living cultures even to a greater degree by introducing the germs into the stomach than by subcutaneous inoculation.

It is the opinion of the Commission that the only proper way to test practically the real value of artificial protection against "hog cholera" is to expose the supposed protected pig to the natural acquisition of the disease under ordinary conditions, such as exist among a herd of hogs suffering from the natural disease. It is a well-known fact, brought to light by recent investigations concerning the nature of infectious diseases, that immunity or protection from a second attack, whether artificial or natural, is not absolute, but only relative in degree. There is no known infectious disease either of man or beast capable of producing by one attack a degree of protection which is surely and absolutely effective against a second attack.

Experience has abundantly shown that animals that are naturally or artificially protected can be practically overwhelmed by enormous doses of the germs of the disease, and thus be made to suffer a recurrent attack, which may even be fatal. Furthermore, the method of artificial inoculation and the mode of natural acquisition of the disease also seem to materially influence the degree of protection acquired. For example, it is well known that Pasteur has put into extensive practical application in France his method of producing artificial immunity against anthrax in sheep and cattle by subcutaneous inoculation; and it is also well known that the losses by this disease among herds where the inoculation has thus been performed have been reduced 90 per cent as the result of inoculation; yet Koch, as an opponent of Pasteur concerning the practical value of protective inoculation, has demonstrated beyond cavil that cattle in which subcutaneous inoculation has been practiced are but little protected against the acquisition of the disease experimentally by way of the digestive apparatus.

It is the opinion of the Commission that disinfection as a general practical means of preventing the enormous annual losses from diseases of swine in this country can not be made effective under the conditions which exist in the West and other regions where hog-raising is extensive.

As far as our present knowledge extends, treatment of existing cases is utterly futile. There remain, therefore, to be considered but two alternative means of prevention—quarantine and extermination

of infected hogs with their surroundings, or, on the other hand, some form of preventive inoculation.

The vast importance of the subject calls for an exhaustive investigation as early as possible of this latter means, for the former is very difficult of application.

Some of the tests made in Nebraska under the direction of Dr. Billings certainly give promise of great possibilities in this direction. It is the opinion of the Commission, however, that an attempt to produce immunity from "hog cholera" artificially by the use of the living germs of the disease, either through the stomach or through hypodermic inoculation, is very objectionable and involves a serious risk of more widely extending the disease and increasing rather than diminishing the already enormous losses therefrom; for every hog thus treated becomes for a time at least a center of infection from which an epidemic may directly or indirectly spread widely. Furthermore, the use of the living germs seems, at least in many instances, to permanently stunt the growth of the pig. Experience acquired in recent years shows that the chemical products of certain disease-producing germs in artificial cultures possess the same power to create immunity as do the living germs themselves; and some incomplete experiments performed by ourselves and others seem to strongly indicate that the chemical products of the "hog-cholera" germ in artificial cultures also possess a similar power.

If further investigations shall prove this to be an indisputable fact, then, in our opinion, a safe, harmless, efficient, and extremely practical means of preventing "hog cholera," free from any risk or thereby extending the disease and continuing the enormous losses at present suffered by our countrymen, will soon follow.

We have reason to believe that the threshold of such an important discovery has already been crossed; and we therefore earnestly advise that thorough and exhaustive investigation be as rapidly as possible made in this direction and without stint of money or hampering limitations of time.

The undersigned regret that the departure of one of their number for Europe before the drafting of this report has made it impossible for the entire Commission to sign it.

Respectfully submitted.

E. O. SHAKESPEARE, *Chairman.*
T. J. BURRILL.

WASHINGTON, D. C., *August* 1, 1889.

REPORT OF PROF. B. MEADE BOLTON.

Hon. JEREMIAH M. RUSK,
Secretary of Agriculture:

SIR: I have the honor of submitting the following report as a member of the United States Board of Inquiry concerning epizoötic diseases of swine. I regret having to report independently of my colleagues, but am compelled to do so, as I shall not have time in the near future to continue my investigations, and I believe that the conclusions I have been able to reach do not differ essentially from those of the other members of the Commission.

Before receiving my appointment on the Commission, I had already started investigations of epizoötic diseases of swine in South Carolina on behalf of the South Carolina Agricultural Experiment Station, in conjunction with Dr. W. B. Niles, veterinarian to the experiment station, State veterinarian, and professor of veterinary science in the University of South Carolina, and I am indebted to Dr. Niles for valuable assistance in the whole course of my investigations.

The letter of appointment from the Hon. Norman J. Colman, late Secretary of Agriculture, is doubtless before you, and I have thought the most satisfactory way in which to attempt the solution of the problems therein stated would be to make investigations independently of any previous work of others. To this end I have visited, in company with my colleagues of the Commission, or with Dr. Niles, various portions of this and other States, examining diseased animals wherever opportunity offered, and collecting material for further investigations. But I also visited with the other members of the Commission the various laboratories where the disease in question had been studied.

The results of our investigations on behalf of the Experiment Station will soon appear in the form of a bulletin, and will contain substantially what I here have to report.

(1) During my work as commissioner I have failed to meet with an epizoötic which I am satisfied was what is termed "swine plague" in the Bureau reports, though previous to my appointment on the Board I studied one such outbreak. In this case, however, I directed my attention to the bacteriological questions exclusively, and I am therefore unable to pronounce on the difference in the pathological lesions in the two diseases. But I am not inclined to attach any great importance to these differences as set forth in the reports. The descriptions otherwise I find correct and well stated. In my investigations as commissioner I have been able to find but one organism which, in my opinion, caused the outbreaks under examination, and that I regard as identical with the hog-cholera germ described in the reports of the Bureau, and I find the description therein given correct. As will be inferred from what has gone before, I feel sure that another organism, correctly described in the reports as the "swine-plague germ," is found under circumstances which render it highly probable, if not certain, that it also causes disease.

As to whether these two organisms are always present and operate together to cause disease, or whether the two are merely varieties of the same germ, must be decided by future investigation. The differences between them, as pointed out by the Bureau, are sufficient to compel us to treat them as different germs, however perplexing it may seem that two microörganisms are capable of producing such similar or, it may be, identical lesions.

By subcutaneous inoculations of the germ which I obtained from Nebraska, South Carolina, Washington, and Baltimore, I failed to produce the disease by subcutaneous inoculations of even 5 cubic centimeters of bouillon cultures and more in hogs. I have, however, succeeded in producing it, though not every time, by feeding fasting animals (hogs) with bouillon culture.

(2) I have not been able to find that the descriptions of the germs contained in the above-mentioned reports from the Bureau have been antedated by other correct descriptions. Indeed, the bacteriological methods previous to the appearance of these reports were not nearly as accurate as those described in the latter, and consequently the

value of the earlier observations is proportionally less. It is only by the correct application of Koch's methods that trustworthy results can be obtained, and it does not appear that these methods are employed in any investigations previous to the Bureau reports.

(3) The disease which has been investigated by Drs. Billings and Roberts in Nebraska I take to be identical with the hog cholera described by the Bureau. In the cultures I obtained from material in Nebraska I only found hog cholera as described in the Bureau reports, and the description of the organisms of the above-named gentlemen tallies more nearly with the description of hog cholera than with the description of swine plague contained in the reports of the Bureau. I do not see that any important facts have been established by any one which differ materially from the conclusions given in the reports of the Bureau of Animal Industry. The answers to the other questions in this paragraph are implied in what has already been said.

(4) My opinion in regard to the bacterism of swine plague, as described in the reports, I have already given under paragraph 1. What was regarded as proof of the etiological connection between a microörganism and disease at the time when Dr. Detmers made his observations are no longer considered sufficient. I believe that Dr. Detmers would readily acknowledge that we can only be sure in such cases when we can isolate the organism and reproduce the disease with the organism so isolated, and it is not to his discredit that he was unable with the methods then employed to do this.

In our report to the Agricultural Experiment Station we say that we regard treatment of individual cases as useless or worse than useless. In regard to the prevention of the spread of the disease I can only recommend the measures as advised in the report of the Bureau.

There are still many interesting problems in regard to the epizoötic diseases of swine which would reward investigation, but I have no doubt that they will all be solved in time by the Bureau without any aid from outside.

I was unable to visit Kentucky, where my colleagues studied an outbreak.

Very respectfully,

B. MEADE BOLTON.

UNIVERSITY OF SOUTH CAROLINA,
Columbia, S. C., May, 1889.

SUPPLEMENTAL REPORT OF DR. E. O. SHAKESPEARE.

Hon. J. M. RUSK,
Secretary of Agriculture:

SIR: I have the honor to present the following supplementary report of experiments relating to hog cholera and swine plague, performed by me upon Nebraska inoculated hogs and Pennsylvania controls at the Veterinary Department of the University of Pennsylvania.

After the results related in the report of the swine-plague commission, last summer, of which I had the honor to be chairman, nearly all the Nebraska inoculated hogs survived, and most of the Pennsylvania controls were also still living. It seemed desirable to further

test the relative immunity of these hogs. To this end a series of intra-abdominal and intrathoracic injections of virulent swine-plague culture fluid was instituted on December 3, 1889. On December 23, 1889, a number of hogs were fed with a lot of intestinal lesions from typical cases of hog cholera. Finally 6 hogs were given an intravenous injection of virulent hog-cholera culture January 26, 1890. Hereto I append a condensed abstract from my notes of these various experiments.

(N. B.—I desire to make here the general statement, applicable to every case unless the notes state otherwise, that the material used for experiment was tested by the microscope and by culture, and was found pure—of course, excepting the intestinal lesions; also the general remark that in two or more pigs from each series representative lesions post-mortem gave pure cultures of the germ inoculated.)

Results of Drs. Smith and Kilborne's injections of cultures of swine-plague germs, performed in my presence, December 3, 1889.

A black Walker inoculated Nebraska small pig (lower pen) received an intra-abdominal injection $1\frac{1}{2}^{cc}$ of virulent swine-plague culture, furnished by Drs. Smith and Kilborne. This pig died next morning, and the autopsy, made on the following day (December 5), showed the thoracic cavity and organs normal, except lungs studded with minute ecchymoses. The abdominal cavity and organs presented the following lesions: Parietal and visceral peritoneum much injected; liver dark red, slightly enlarged; spleen lighter red, but little enlarged, with pulp somewhat friable (culture from this organ failed); kidneys intensely congested; stomach rather full of half-digested food; a large area of fundus in which the mucous membrane is much thickened and intensely hyperæmic; small intestine shows three or four enlarged and prominent Peyer's patches; general swelling and hyperæmia of upper two-thirds; a few ulcerated solitary follicles of the colon, and slight swelling and redness of the mucous membrane; the mesenteric glands are somewhat enlarged and red. The skin of abdomen and inner aspect of thighs and axilla red; the inguinal and axillary glands slightly swollen and red.

A black Walker (Nebraska) inoculated pig (lower pen) received intrathoracic injection of $1\frac{1}{2}^{cc}$ of virulent swine-plague culture, furnished by Drs. Smith and Kilborne. Next day very sick and thumping heavily. This pig grew worse until it died on the 13th. The autopsy showed a red skin of abdomen and inner aspect of thighs and axilla; inguinal and axillary glands slightly large and a little red: pleuritis pretty general on the right side (inoculation was on this side); left pleural cavity quite normal; left lung normal except numerously studded with minute dark red ecchymoses and the presence of a few dark red small areas of atelectasis; the right lung showed, besides a thickened and inflamed pleura, numerous areas of atelectasis and consolidated lobules of broncho-pneumonia; culture from the latter gave pure cultures of the Washington swine-plague germ: pericardial fluid slightly increased, and a few scattered ecchymotic spots over the base of heart; walls of latter dark red and a little softened. Abdominal cavity normal, as also the contained organs, except some capillary hyperæmia of mucous membrane of small intestine.

A small white Chester County control pig (pen No. 12) received an intraabdominal injection of $1\frac{1}{2}^{cc}$ of virulent swine plague culture, furnished by Drs. Smith and Kilborne. This pig died next day, and the autopsy was performed the day after (December 5), with the following result:

Skin of abdomen and inner aspect of thighs and axilla quite red; inguinal and axillary glands a little red and swollen; thoracic organs normal; abdominal cavity pretty full of pus, suspending flakes of lymph; coils of intestine bound together with recent lymph and reddened; liver and spleen covered with recent lymph, otherwise apparently normal; kidneys injected; stomach full; mucous membrane of fundus dark pink and slightly swollen; small and large intestines show intensely congested and much swollen mucous membrane, but no other lesion; mesenteric glands enlarged and reddened.

A small black and white Gibbon (Nebraska) inoculated pig (pen No. 1) received an intraabdominal injection of $2\frac{1}{2}^{cc}$ of culture of swine plague, furnished by Drs. Smith and Kilborne. This pig died next day. Autopsy December 5, with following results:

Skin of abdomen and inner aspect of thighs and axilla red; enlarged and red inguinal and axillary glands; pleural cavity normal; right lung normal, collapsed; heart full of black currant-jelly clots; coils of intestine bound together with recent lymph; some straw-colored fluids, suspending flakes of lymph; enlarged and red mesenteric glands; outer edge of liver covered with lymph, liver otherwise normal; stomach full of half-digested food; fundus of stomach shows large area of intensely red and swollen mucous membrane, engorged mesenteric lymph glands, and spleen dark red and enlarged; small intestine shows throughout its whole extent much swelling and engorgement of mucous membrane; no Peyer's patches visible; swelling and engorgement of mucous membrane of colon; no ulcers visible.

A small white Chester County control pig (pen No. 3) received an intrathoracic injection of $2\frac{1}{2}^{cc}$ of virulent culture of swine plague, furnished by Drs. Smith and Kilborne. This pig was sick and off food the second day, and grew much worse for several days, but afterwards improved until it was killed, January 4, 1890. The autopsy gave the following results:

External appearance normal; right pleural cavity constitutes one large cyst, with much thickened wall, containing semi-purulent, semi-cheesy, grumous, yellowish contents; right lung completely compressed against the vertebræ; left lung normal; abdominal cavity normal; liver normal; spleen elongated, slightly enlarged; kidneys normal; stomach injected, and swollen mucous membrane over a wide area of the fundus; small and large intestines normal.

A white Chester County control pig (pen No. 5) received an intrathoracic injection of $1\frac{1}{2}^{cc}$ of virulent swine-plague, furnished by Drs. Smith and Kilborne. This pig showed but little signs of illness, being off food only a day or two. It was killed January 4, 1890, and the autopsy was as follows:

Inguinal glands normal; external appearance normal; left pleural cavity normal; right covered with bands of lymph and adhesions; the corresponding part of right lung covered with lymph bands; the general color of lungs pink, right studded with numerous areas corresponding to acini of dark red, due to inspired blood; the trachea found to contain blood clot (blood had exuded from nose after blow on head); only the right lung, on which side the pig lay, showed this aspect; lungs crepitant throughout except at extreme tip of right, which is solid and dark red for an inch or more; liver, spleen, and kidneys normal; stomach shows increase of pink tint of mucous membrane in large area of fundus; small and large intestines normal.

A small black Walker (Nebraska) inoculated pig (pen No. 1) received an intrathoracic injection of $2\frac{1}{2}^{cc}$ of virulent swine-plague culture, furnished by Drs. Smith and Kilborne. This pig was quite sick next day, and remained ill for several days off its food, but soon began to recover and eat well. It rapidly improved until January 6, when it was killed.

A small white Chester County control pig (pen No. 1) received an intrathoracic injection of $1\frac{1}{2}^{cc}$ of virulent swine plague culture, furnished by Drs. Smith and Kilborne. This pig became sick and was off its food for several days, but gradually improved until January 6, when it was killed.

The autopsies of these two pigs gave the following results:

Small black Walker pig was killed January 6, 1890, by blow on head and bled. External appearance normal, but skinny; axillary glands, as also inguinal, normal; left pleural cavity shows diaphragmatic and some lateral pleural adhesions; left lung normal; right pleural cavity one large purulent cyst, containing pus and coagulated lymph; thickened cyst wall; lung completely compressed; small and large intestines normal. Culture made from the pleural fluid. The lung removed and placed in jar with thickened ileum of last autopsy.

Small white Chester County control pig was killed January 6, 1890, and bled. External appearance normal; thorax normal; abdominal cavity normal; liver normal; spleen one-fourth enlarged, light color, firm; kidneys normal; stomach, large area of fundus thickened and dark pink; an area around cardiac orifice of white and thickened mucous membrane; the small and large intestines normal.

A white Chester County control pig (pen No. 5) received an intra-abdominal injection of $1\frac{1}{2}^{cc}$ of virulent swine-plague culture, furnished by Drs. Smith and Kilborne. The only sign of illness presented by this pig was that it was off its food for two days. It was killed January 4, 1890, and the autopsy showed the following:

External appearance normal; inguinal and axillary glands normal; pleural cavity normal; heart normal; lungs generally pink, crepitant; upper portion of posterior lobes of each with fine dark red points of ecchymoses, due no doubt to inspired blood. The trachea, when opened, contained frothy mucus and clotted blood. Abdomen cavity normal; liver normal; spleen also; kidneys also; stomach normal; fundus pinkish; intestines normal.

Results of feeding of chopped intestines containing numerous typical hog-cholera ulcers, brought by Dr. Kilborne from Washington, December 23, 1889. The feeding was witnessed and directed by myself.

A black and white Gibbon (Nebraska) inoculated pig (pen No. 11), after 36 hours fast, was fed two-thirds of a quart of finely chopped hog cholera intestine as above. This pig died January 4, after eight days of illness, and the autopsy was as follows:

External appearances, pinkish color of skin, of abdomen, inner part of thighs, and axillary. Inguinal and axillary glands slate color, but little if at all enlarged; gland at angle of jaw in same condition; right lung normal; left, the same except outer edge somewhat atelectatic and congested; pericardial fluid a little increased; abdominal cavity normal; some coils of intestine near the pelvis on the right side intensely congested, and the corresponding mesenteric glands are large, soft, hyperæmic; cortex deep red; medulla pinkish gray; liver large, slightly dark acini marked; mesenteric glands elsewhere much the same condition as above; spleen elongated, not much enlarged or softened (culture made from it); kidney hyperæmic, otherwise normal; bladder moderately full; stomach, fundus intensely congested and swollen condition of mucous membrane; some superficial ecchymoses; small intestine, also one quarter corresponding to intense congestion of exterior, shows mucous membrane swollen, covered with croupous membrane, stained yellow, the membrane itself being congested; large intestine not abnormal.

A small Chester County control pig (pen No. 11), after 36 hours fast, was fed like the preceding. This pig was found dead on the morning of January 9, after twelve days of illness. Autopsy as follows:

Skin of abdomen, inner aspect of thighs, and axillary, quite red; much emaciation; left lung shows areas of dark red atelectatic; rest of this lung normal; right lung normal; abdominal cavity normal; liver dark red, and little enlarged, but normal; spleen had elongated dark red material, friable (culture made from it); kidneys normal; stomach generally the color of the mucous membrane, pink; that of the membrane of the fundus a little darker, but there is no sharply outlined area of intense inflammation. There is a rectangular patch of white thickened mucous membrane around the cardiac orifice; small intestines dark red externally; colon pinkish gray externally; mesenteric glands enlarged and injected. The colon, when opened and cleaned, is seen to be one mass of discrete and confluent ulcers; three or four ulcers in the middle portion of the ileum; mucous membrane of the ileum is intensely injected; colon and piece of ileum kept.

A black and white Gibbon (Nebraska) inoculated pig (pen No. 6), after 36 hours fast, was fed like the last two. This pig died January 13, 1890, after seventeen days of illness. The following is the autopsy:

External appearance, redness of skin of abdomen and inner aspect of thighs and axilla; axillary and inguinal glands enlarged, and on section show cortical reddening; thorax normal; abdominal cavity normal; some coils of intestine near the pelvis show external reddening; mesocolic and mesenteric glands much enlarged and intensely reddened; liver dark red, but normal; spleen enlarged and dark red, some light red, smallish nodules studding it, the size of lentils scattered through it; some superficial nodules of this character apparently umbilicated. On the surface they are slightly raised. The cut surface of the spleen shows the same appearance. Kidneys enlarged; mesenteric and mesocolic glands intensely injected. The cut surface shows them to be studded with light red, gray, small granules. The lower third of small intestine shows the mucous membrane intensely congested and somewhat swollen. The ileocæcal valve ulcerated; somewhat raised, umbilicated, smallish ulcers in the cæcum, and a considerable number of similar ulcers in the length of the colon; mucous membrane of cæcum and colon intensely injected.

A white Chester County control pig (pen No. 6), after a fast of 36 hours, was fed like the three last. This pig died January 23, 1890, after 26 days of illness. The autopsy revealed the following:

Much emaciation; belly and skin of belly, inner aspect of thighs and axilla, bright pink; inguinal and axillary glands swollen, and on section show cortical redness; left lung normal; right lung large; top of posterior lobe hepatized; outer edge very dark in color but crepitant. In the middle lobe there are small areas a half inch in size, atelectatic and dark red; heart normal; abdominal cavity normal; coils of intestines in posterior portion of the abdomen dark red externally; the rest light pink or gray; no peritonitis; spleen enlarged and dark red (culture made from it); liver dark red, normal in size and appearance (culture made from it); stomach large; mucous membrane of fundus much mammillated and shows an area of dark pink with much thickening of the membrane in that portion. There is a pocket the size of a hen's egg near the cardiac end, the edge of which and its mucous surface show superficial ulcers having a granular floor and edges, and a diphtheritic membrane adherent thereto and projecting some distance over the ulcer; no hyperæmia

here; kidneys normal; mesenteric glands enlarged and having a dark red surface with a more or less gray interior. The small intestines show mucous membrane somewhat hyperæmic, but no ulcers. In the cæcum there are very few small ulcers. About a foot below the cæcum there are inumerable ulcers, round and irregularly oval, with the long axis transverse; many located on the ridges of the transverse folds of the colon. These ulcers are somewhat raised and have an injected zone surrounding their edges. They have a yellowish gray, granular floor. The whole tract of the colon and rectum shows the ulcers so thickly studded together that their area is relatively greater than that of the surrounding mucous membrane, which latter is somewhat thickened and somewhat red. This colon is preserved.

A black and white Gibbon (Nebraska) inoculated pig (pen No. 7), after 36 hours of fast, was fed like the four last. This pig remained well until January 25, when it was further experimented upon.

A large white Billings, Nebraska (ptomaine), pig (pen No. 7), after 36 hours fast, was fed like the five last. This pig remained well until January 25, when it was further experimented upon.

Results of intravenous injections of hog cholera cultures, brought from Washington by Dr. Kilborne; the injections performed by him in my presence and by my direction, January 26, 1890.

A large black and white Gibbon (Nebraska) inoculated pig (pen No. 9) received into the right femoral vein 5^{cc} of hog-cholera cultures as above.

This pig died January 29, 1890, in the morning. It had been sick and constantly growing worse since the day after inoculation. The following is the autopsy of this pig:

External appearance of the skin of belly, inner aspect of thighs and axilla, red; inguinal and axillary glands dark red, and on section show small ecchymoses in a light pink ground. In the thorax was some increase of pericardial fluid, which is clear. There are superficial small ecchymoses around the base of the heart. Left pleural cavity normal; corresponding lung completely fills it. This lung is entirely crepitant and pink, except for numerous small dark red ecchymoses which stud it. The right pleural cavity is nearly obliterated by quite firm bands of pleural adhesions. The right lung is crepitant and pink, but more densely studded with dark red ecchymotic spots. The cut surface of each lung shows also dark red ecchymotic spots. The right ventricle of the heart dilated; walls thin; they contained blood fluid, and there is a very small dark red clot. The left ventricle is contracted, nearly empty, and little fluid blood; walls slightly softened (?), dark red. Liver large, dark red, very soft, otherwise normal in appearance. Spleen enormously enlarged and dark red (culture made from it); pulp, soft, dark red. Kidneys injected, showing minute ecchymotic spots. Stomach full; a large area of the mucous membrane of the fundus of the stomach shows characteristic intense congestion and thickening. An area, more or less rectangular, of white thickening of the mucous membrane surrounds the cardiac orifice. The colon shows nothing especially abnormal save a few scattered small ecchymotic, dark red spots. The general surface of the mucous membrane is slate gray. The ileocæcal membrane is dark red, and there is in its close vicinity an abraded area of mucous membrane.

A small black and white Gibbon (Nebraska) inoculated pig (pen No. 9) received into the right femoral vein 5^{cc} of hog-cholera culture as above. This pig died January 29, and had been sick since the day after the operation.

External appearance of skin of belly, inner aspect of thighs and axilla, red. The inguinal and axillary glands are intensely engorged and swollen; on cut surface they are mottled red and gray. Pleural cavities normal. Lungs show superficial, numerous, small, dark red ecchymoses, surrounded by a pink and healthy looking parenchyma. Abdominal cavity normal. Liver much enlarged, dark red, friable. Spleen enormously enlarged, dark red, friable (culture made from it). Stomach full. There is a large area of intensely reddened and thickened mucous membrane in the fundus. Kidneys engorged. Mesenteric glands enlarged and intensely engorged; they show many scattered, dark red, small points of ecchymoses. There is a general capillary engorgement in spots of the colon and small intestine, but there are no ulcers.

A large white Billings (ptomaine inoculated) Nebraska pig (pen No. 7) received into the right femoral vein 5^{cc} of hog cholera as above. (N. B.—This pig had been fed, December 23, 1889, with chopped hog cholera intestine.) This pig died January 30, 1890, after having been sick since the day after the operation.

External appearance of the skin of the abdomen, inner aspect of thighs and axilla, deep red. Red inguinal gland much enlarged with cardiacal injection shown, and some also between the lobules. The red inguinal and axillary glands are not

so much enlarged, but are equally congested. Lungs fill the thoracic cavity; both lungs are intensely congested; the blood flows freely out of the cut surface. The left lung is the more intensely congested. There are no areas of consolidation, but there is crepitation everywhere except in a few small areas of collapse, mainly in the outer edge of the right lung, middle and posterior lobes. Each lung shows on the external surface exceedingly numerous small, dark red ecchymoses, surrounded by the parenchyma, having a color from a dark pink to light red. The cut surface shows the same appearance. Abdominal cavity normal; stomach full. There is a large area of the mucous membrane of the stomach in which there is only a slight hyperæmia and moderate swelling. There is an area around the cardiac orifice of whitened and slightly thickened mucous membrane; a small patch near the same location. The liver is dark red, friable, and is enlarged. The spleen is enormously enlarged, dark red (culture made from it). Kidneys are engorged; the small intestines are hyperæmic in spots, and these portions are slightly swollen. The colon is mainly of a slaty gray color, with some small areas of reddish gray, and the membrane appears slightly thickened and softened.

A large black Dought sow (had natural hog cholera in Nebraska and recovered) (lower or stable pen) received into the right femoral vein 5cc of hog cholera as above. This large black Dought sow, which had had a litter of pigs the latter part of the previous spring or early summer, died February 4, 1890, the weather being very cold.

In the external appearance there was nothing marked and no emaciation. Inguinal and axillary glands slightly enlarged, having cortical injection. Lungs filled thoracic cavity; no pleuritic effusion; slight increase of pericardial fluid. Surface of the lungs spotted with small dark red ecchymoses. Cut surface shows the same dark red spots. The rest of the parenchyma is pink and crepitant. Heart full of dark clots and fluid blood.

Abdominal cavity normal, dark red; colon distended; stomach very large, and dark mesenteric glands. Liver pale, somewhat hard. The spleen much enlarged and dark red. Stomach is fully distended. Large area of the mucous membrane of the fundus of the stomach is slightly enlarged and swollen. Small intestine not much beyond slight capillary hyperæmia in areas of an inch in size or more. Ileocæcal valve, intense dark red surface abraded and a few small spots. Mucous membrane of the cæcum shows an area of an inch and a half or two inches superficial abrasion. Contents of the cæcum and of the colon, large firm masses of dark clotted blood, mixed with feces. At the transverse and descending portion of the colon there are numerous small irregular round ulcers with raised ragged edges, surrounded by a pretty wide hemorrhagic zone; some lengths of the middle and descending colon show mucous membrane intense dark red, and here also are prominent darker red, apparently swollen, isolated follicles. In the upper portion of the rectum there is a small number of minute ulcers of a character similar to that already described. The rest of the mucous membrane of the colon is of a dark red slate color.

A small black and white Gibbon (Nebraska) inoculated pig (pen No. 10) received into the right femoral vein 5cc of hog-cholera virus as above. This pig died after a somewhat lingering illness on February 13, 1890. Autopsy as follows:

External appearance, much emaciated; the wound on the inner aspect of the right thigh healed, but the tissues around it swollen. The right inguinal gland much swollen and has a superficial redness. The left inguinal gland swollen also, but not to the same degree. The axillary glands are in much the same condition as is the left inguinal. Pleural cavity normal, as also the pericardial cavity. Left lung normal, pale pink and crepitant, except in one or two lobules of the middle lobe, which are dark red and collapsed. Right lung pretty generally diseased. Nearly the whole of the middle and anterior lobes are so. Lobules in this portion are dark red and solid; some show on section small yellow spots, embedded in a dark red tissue of a granular aspect. The posterior lobe shows numerous lobuli, dark red, solid aspect, near the outer edge of the lobe.

Abdomen, no peritonitis. The stomach not excessively full or distended. The fundus shows a wide area of redness and thickening of the mucous membrane. There are several small raised ragged ulcers with red edges, and with a yellow granular floor. Most of these are in the neighborhood of the cardiac orifice. They are mainly on the top of the folds of the mucous membrane. Liver is slightly enlarged and is dark red, with marked interlobular tissue of gray color. Gall-bladder distended. Spleen large, light red, and the malpighian bodies are prominent and gray. The kidneys are normal. Large intestine reddened externally. Small intestines are of a lighter external color. The mesenteric glands are enlarged and hyperæmic. The cæcum has a reddish gray mucous membrane, but there are no ulcers here. The ascending and transverse colon shows numerous small yellow umbili-

cated ulcers, with a raised edge. The mucous membrane itself is generally hyperæmic.

A large black Dought Nebraska pig, which had the natural hog cholera in Nebraska and recovered (pen No. 10), received into the right femoral vein 5^{cc} of hog cholera as above. This pig is still alive and apparently well.

The results of these supplementary experiments seem to warrant the following general conclusions:

(1) Intraabdominal injections of virulent swine-plague cultures are decidedly more fatal than are intrathoracic injections.

(2) The Nebraska inoculated pigs seem to be as susceptible to the action of this virus as are the Pennsylvania controls.

(3) The fresh intestinal lesions of virulent hog cholera fed to inoculated pigs after fasting are about as fatal to them as to the Pennsylvania controls which had survived feeding of virulent hog-cholera cultures; and they are considerably more fatal than are pure cultures of the virulent hog-cholera germs. Several of both classes of pigs were able to resist.

(4) Intravenous injection of virulent hog-cholera cultures is far more fatal than the introduction of the germs in any other manner attempted. Only one of the six pigs thus inoculated was able to resist successfully. This pig had recovered from a natural attack of hog cholera about a year ago.

The last two series of experiments show that whatever the force of the immunity may have been there was an artificial means of overwhelming its protective power. Such experiments do not, however, conclusively prove that there is no immunity, either naturally or artificially acquired, capable of practically protecting against a natural attack.

I have the honor to be, sir, your obedient servant,

E. O. SHAKESPEARE, M. D.

PHILADELPHIA, *February 27*, 1890.

THE SHEEP OF GREAT BRITAIN.

By EZRA A. CARMAN.

Up to within comparatively few years the principal aim of sheep husbandry in the United States was the growth of wool. Mutton was a secondary consideration, and, in general, was not considered at all. It was not esteemed as an article of food, and at times, when wool fell in price and whole flocks were sacrificed, it paid better to try out the fat and feed the carcass to the hogs than it did to send it to the butcher. But the decreasing profits of woolgrowing under adverse legislation, and the rise in value of land, and the growing popularity of mutton as an article of food in the manufacturing centers and large cities, effected a change in the East about forty or fifty years since, and the mutton sheep received some attention; the old native breed and the fine-wooled Merino and its grades were crossed by rams of improved breeds of English sheep. This substitution began in southern New England, eastern New York, eastern Pennsylvania, New Jersey, Delaware, and Maryland, and in those sections is now complete, mutton being the object of sheep raising, and the preponderance of the sheep being of the Southdown and Shropshire blood. Up to 1880 in all that country north of the Ohio and west of the Alleghanies woolgrowing was the principal object, but within the last ten years western Pennsylvania, Ohio, Indiana, Illinois, Michigan, and other States have been repeating what was done by the East many years before, making great changes by replacing the Merino and its grades with the English long-wooled sheep, so that, in 1890, over one-half the sheep between the Alleghanies and the Mississippi are estimated to be of native or English blood. In all the South Atlantic States, Kentucky, and Tennessee, the English mutton sheep, represented by the old native stock and by some improved breeds, is vastly predominant. Taken as a whole the entire country east of the Mississippi is practically abandoning to the far west and to foreign countries the growing of fine wool, and substituting therefor the raising of sheep for food, and, incidentally, combing wool. This change in the character of the industry has caused increased attention to English breeds of sheep, the foundation of American mutton sheep husbandry, and suggested the preparation of this paper.

Nowhere has sheep husbandry received such attention and been prosecuted with such success as in England, and the lesson derived from the experience of breeders, as compiled from standard authority, can not fail to be of value to the American reader and farmer.

The sheep is the mainstay of English agriculture, the foundation of English prosperity, and a potent factor in British commercial supremacy. The wool trade was a monopoly of England from the earliest records till at least the middle of the seventeenth century,

and the woolen manufacture is to-day one of her leading industries. English history is woven with wars entered into to protect her woolen trade, or to strike down those who came in competition with it, and her statute books are full of enactments restricting both importation and exportation of wool. The recapitulation of them is unnecessary.

When the sheep was introduced into Great Britain is not known, but after its conquest by Cæsar the Romans established a woolen manufactory at Winchester, from which it is naturally inferred that sheep were cultivated at that time. And the cultivation must have been of fine-wooled sheep, for when some of the Winchester fabrics reached Rome they were highly appreciated, and a Roman writer records the fact that "the wool of Great Britain is often spun so fine that it is in a manner comparable to the spider's thread."

What sheep furnished this wool it is idle to inquire, for history is silent on the subject and we are left to conjecture, knowing only that when history did take note of the existence of various breeds many breeds were found suitable to the localities in which they were raised, and we doubt not that for many centuries after the Roman conquest certain distinct breeds were perpetuated, with little improvement and little change.

At the present day the breeds of sheep exhibit extraordinary diversities of size, form, and other characters, caused, it may be believed, in part, by a difference of descent, in part by the long-continued influence of climate, food, and other agencies, and in part by the effects of breeding and artificial treatment. And this process is a continuous and continuing one. Old breeds have given way to new ones, and new breeds have been formed by judicious crossing.

Thus the varieties of British sheep, original and modern, are so numerous that upon first sight it appears an impossibility to reduce them into any regular classes. They may, however, be divided in two ways: first, as to the length of their wool—into long-wooled, short-wooled, and middle-wooled; and, secondly, as to the presence or absence of horns. These may be termed the scientific or physical classifications. A third classification may be adopted, having reference to the place or district in which such breeds are supposed to abound, to have originated, or gained their greatest perfection. This may be termed the geographical system, and for convenience shall be adopted in this brief survey of British sheep, beginning with the most northerly parts of the United Kingdom.

The Orkney and Shetland Islands.—These two groups of islands form the northernmost county of Scotland. The Orkneys are nearest the mainland, from which they are separated by the Pentland Firth, while the Shetlands lie to the northwest about 50 miles. Fifty-six islands and islets compose the Orkney group, with a total area of 240,476 acres; while the Shetland group has more than one hundred islets, with an area of 352,876 acres. Not all these islands are inhabited, many being used only for pasturage. The climate presents smaller variations in temperature than that of Scotland or England, but severe rain storms are of frequent occurrence.

The sheep inhabiting these two groups of islands were originally of the same breed, manifestly of the same origin with the sheep of Norway and other parts of northern Europe; but numerous intermixtures with Dutch sheep, and perhaps others, have caused a degree of difference in the different islands and even in the different flocks of the same island. Of these sheep the least admixture with the foreign

blood is found in those of the remoter islands, while those of the Orkneys, nearer the mainland, are of a more mixed descent, with wool lacking the fineness yielded by the ancient race.

The ancient, or, as we may call them, the native sheep of Shetland possess many of the characteristics of the goat. The ewes as well as the rams have generally short horns; sometimes they are wanting in the ewes and occasionally a ram is without them. The horns are straight and upright, resembling those of the goat. Their tails are short and broad and their limbs slender, their aspect wild and their motions active. Their wool is long and of a quality that has from the earliest period been celebrated for its unrivaled fineness. It is white, black, speckled gray, and a peculiar russet brown; sometimes it is streaked. The mutton of these sheep is considered good, resembling that of the Welsh sheep.

Nature seems to have adapted these little wild sheep to the soil and humid climate and barren country in which man has placed them. Scarce a tree is to be found or a shrubby plant beyond the heath which covers the soil when there is enough of that to cover the rocks. Many of the islets are little else than rocks with a covering of peat, washed by the spray of the boisterous seas which surround them, and occupied only by a few sheep left to find their own food. Under these circumstances the sheep are small in size but extremely hardy, and capable of subsisting under great privations of food. The wethers may be fattened to an average of from 6 to 7 pounds to the quarter.

At certain seasons they find their way from the mountains to the shores and feed on the fuci and other marine plants. It is remarkable to see them, on the receding of the tide, running down from the hills as if possessing an instinctive knowledge of the time of ebb. They remain feeding while the sea allows, and sometimes they are caught by the surrounding tide and drowned. Sometimes they are unable, from exhaustion, to ascend again the cliffs of the coasts, and so perish. Sometimes they are driven into caves, where they are imprisoned until the retiring tide permits them to escape. It is remarkable that these sheep feed readily on animal substances. One of the greatest resources in some of the islands for keeping them, when no other provender exists, is fish, which are dried on the rocky shores for that purpose. They manifest in their habits the rudeness of their condition. The rams will often set upon the other sheep of the flock, if wounded, and destroy them. They will furiously attack the females and new-born lambs, as if, in the dreary circumscribed islets which they inhabit, they had acquired the instinct of endeavoring to prevent the too great multiplication of their numbers. The ewes, conscious of the danger, make their escape at the time of lambing that they may bring forth their young in secret. When brought to the richer countries these wild creatures make every effort to escape from the inclosures which confine them, find their way to the nearest elevated grounds, and wander from place to place. They crop the tops of herbs in the manner of goats, and endeavor to reach the branches of shrubs and trees. Their descendants, for more than a generation, retain the wild habits of their race.*

Youatt quotes Mr. Johnson, in his "Survey of the Shetland Isles," as giving a description of a ram of the pure ancient breed: His skin, when the hair is parted, and his palate, and the bridge of his nose,

*Low's Domesticated Animals of the British Islands.

and his horns, and his hoofs, should be white. His horns also, if he has any—but the hornless breed is the best—should be set wide at the roots. The body should be long, the legs short, the hoofs broad, the head narrow, and the countenance pleasant; the wool fine on almost every part of the sheep, and weighing from 1½ to 2 pounds, and worth on the average from 3*s.* to 4*s.* per pound. By the cross with the Dutch, and which used to be the prevailing one, the carcass is heavier; the wool coarser, and often even on the neck and shoulders; and the fleece weighing 4 pounds or more, but not worth one-fourth so much per pound. The tail is about 6 inches long, and shaped like a flounder, whence arose the name applied to them of "the flounder-tailed sheep."

There is, remarks Youatt, perhaps no part of the world in which the breed, or the few of it that are at present found, have remained, century after century, precisely in the same state. This admits of a ready explanation. The pure Shetland sheep deserves not the name of a domestic animal. He is scarcely seen more than once in the year, when he is hunted home in order to be pulled. Often he is scarcely seen even at that period, for he left his coat among the bushes, and is suffered to escape, disregarded. He can not, therefore, be improved by selection; nay, it seems determined that he shall not.

These sheep as a rule are pastured in common and left to their resources to subsist themselves. Once a year they are hunted up, collected together, stripped of their fleeces, marked by their respective owners, and then turned adrift until another season rolls around. Should one be wanted from the pasture he is run down by dogs trained for that purpose.

The practice of pulling the wool from the sheep, instead of shearing it, seems to be rude and cruel, but it is however the method of treatment best adapted for obtaining the wool unmixed with hairs, which would render it less valuable for being spun and woven. It may be thus taken from the animal without violence, and would fall off naturally and be left among the heaths and bogs. A reason sometimes given for pulling it is that such a process insures a finer second crop.

During the two decades closing the last century the subject of fine wools attracted the attention of the English manufacturer and the English farmer. George III imported some Spanish Merinos, but could not overcome English prejudice against them. Others turned their attention to the native breeds, believing, or hoping at least, that among them might be found a breed that, with care and improvement, could rival the wool of Spain and Saxony. Investigations were made with that idea into the character and possibilities of the Shetland sheep and wool, but they were not reassuring.

The substance of one report and the conclusions will be given. In 1790 a committee of the Highland Society of Scotland stated in a report upon the Shetland wool that its exact nature, quality, and use made of it had never been fully ascertained, but that it was certainly preferable to any other for stockings, and probably for all light woolen manufactures, as shawls and waistcoats. Perhaps, mixed with Spanish wool, it might be employed in making broadcloth. There could be no doubt of its answering for hats, a manufacture that should be encouraged in the Highlands. If the same breed were reared in the Hebrides and in the Orkney Islands, where they would thrive equally well, wool would be produced in those

neglected parts of Great Britain to the value of perhaps a million. In process of time, also, the same species might be extended to other districts of Great Britain. It was thought proper to remark that attention to the fineness of the wool would always diminish in proportion as the carcass became valuable, consequently fine-wooled sheep were more likely to be preserved in their highest state of perfection in remote parts of the country than in the neighborhood of the metropolis; at the same time, were the Spanish breed of sheep introduced and multiplied and the importation of Spanish wool prohibited, it would soon become of more consequence to attend to the fleece in every part of the kingdom.

There were two kinds of sheep producing fine wool to be found in the islands; one known by the name of the *kindly sheep*, whose whole body was covered with it; another, whose wool was fine only about the neck and other particular parts of the body. The color of the fine wool varied, sometimes being a pure white, supposed to be the softest and most silky; at other times a light gray; sometimes of a black and sometimes of a russet color. The sheep producing this wool were of a breed which, for the sake of distinction, were called *beaver sheep*, for, like that animal, many of them had long hairs growing amongst the wool, which covered and sheltered it, and the wool was a species of fine fur, resembling down, which grew, in some measure, under the protection of the hair with which the animal was covered. The sheep producing this fine wool were of the hardiest nature, were never housed or kept in any particular pasture, and in the winter season were often so pinched for food that many of them were obliged to feed upon the seaweed driven upon the shore, but the healthiest sheep were those which lived constantly upon the hills and never touched seaweed. The Shetland sheep were never clipped or shorn, but about the beginning of June the wool was pulled off, which was done without the smallest pain or injury to the animal, leaving the long hairs, which sheltered the young wool and contributed to keep the animal warm and comfortable at a season of the year when cold and piercing winds were occasionally expected in so northern a latitude. These long hairs came out later in the season, towards the end of September.

The Merino sheep were tried for the purpose of crossing and improving the native race, but the progeny was found unfitted to encounter the severity of the climate, and the exposed situation of the country. The Cheviot sheep were, however, more successful in establishing themselves, and from all appearances seem the best adapted to it of any British breed.

Orkney had 31,548 sheep in 1883, chiefly Cheviots and a cross between them and the Leicester; but the native sheep, identical with those of Shetland, were still kept in considerable numbers in Hoy and South Ronaldshay. Shetland in the same year had 81,163 sheep, and among them were many Cheviots and the hardy Blackfaced of Scotland.

At one time the woolen manufacture was of some importance in the Orkneys, but was superseded by linen about the close of the last century. The staple production of the Shetlands is woolen goods, made from the finest wool, which is highly prized by the natives, who work it into various articles for domestic use. It is largely worked, also, into those soft shawls, veils, mitts, etc., so favorably known and so much esteemed in the south of England. By knitting these articles for sale the women of the Shetland families add

materially to their income. The wool is so fine that from one ounce three thousand yards are often spun, forming a thousand yards of threefold worsted. Stockings knit with this beautiful material are so fine as to be passed through a finger-ring, and have sold at as high a price as $10 a pair. George III was very fond of showing at his public levees a pair which he passed through the finger-ring of a lady of the court. At the beginning of the present century the value of knit stockings sent from the Orkneys and Shetland averaged about $100,000 yearly. Manufacture of gloves was introduced in 1800, of shawls about 1840, and of veils in 1850. Fair Island has long been famous for its colored hosiery and the arts of knitting, into which the inhabitants are said to have been initiated by the wrecked mariners of one of the ships of the Spanish Armada. The various dyes employed are extracted from the plants and lichens of the island.

The Hebrides or Western Islands.—The original breed of these islands bears a considerable resemblance to that of Shetland, and is the smallest sheep of Great Britain. The general color is white, but there are animals gray, brown, and black, and sometimes all these colors meet in the fleece of one animal. Though delicate in appearance they are hardy, active, and handsome. They are small, with straight short horns, and carry a wool distinguished by a silky gloss to the eye and a peculiar softness to the touch. It is not frizzled like the Spanish, but rather longer and gently waved. It rarely exceeds one pound to the fleece, and not often more than half a pound. When compared with the best Spanish wool in the London market it was found to be finer in the proportion of seven to five. Livingston says stockings have been made of it at Aberdeen that sold at five and six guineas a pair. The wool, however, like that of Shetland, is very much mixed with hair, so as to render the separation very difficult.

The Blackfaced breed was introduced into the Hebrides about 1830, and has done very well, though subject to many diseases from which the natives were exempt. The sheep in these islands are principally kept on account of their wool, a quarter part of which is consumed in domestic manufactures of a rude kind. Like Shetland, Iceland, and Denmark in Europe, and all the countries of Asia, the primitive manufacture was in the hands of the women. They spun the wool, dyed the yarn, and made the articles of clothing for the family.

Other islands on the coast of Scotland have sheep of different breeds. In some of them traces of the natives remain, such as are known in the Orkneys and Shetland, but as a rule these have given way to improved breeds. The Blackfaced sheep were introduced on the isle of Arran from Argyleshire about the beginning of this century, and thrive remarkably well; but many of the ancient native breed still remain, distinguished by their dun or yellow faces and legs and the fine flavor of their mutton. They weigh only 7 or 8 pounds per quarter. The isle of Islay, also Jura, formerly devoted almost entirely to the raising of cattle, now supports many sheep, principally of the Blackfaced breed.

Though not a part of Great Britain, yet lying near its northern extremity, is a group of Danish islands whose sheep probably had the same origin as those of Shetland, the Orkneys, and the north of Scotland, and should be noticed.

Faröe Islands.—This group of islands, so named for the great flocks of sheep on the principal island, lie nearly midway between Iceland and the north of Scotland, being 200 miles northwest of the

Shetland Islands. The group has 510 square miles, the seventeen inhabited islands comprising 490. It is a region of rocks and hills, with narrow valleys and ravines. The climate is foggy and violent storms are frequent. Horses and cows are few, and the latter give but little milk. There is much fine pasturage, and sheep form the chief riches of the islanders. They were on the main island in great numbers as early as 825, and wild sheep are spoken of as being on Little Diamond, one of the group, in 1670. Landt, writing of these wild sheep in 1810, says they "are black, of a small size, have short curled wool, and do not readily mix with the others introduced into the island; their flesh also has a peculiar dark appearance, and in taste approaches near to that of other wild animals. These wild sheep shelter themselves from the severity of the weather in some natural caverns found in the island." Years after this the small remnant remaining had not yet become domesticated. They were sometimes caught by dogs, but could seldom be secured without being shot, or driven over the cliffs upon the rocks below.

The number of sheep upon Faröe is about 80,000, in small flocks, some of the farmers, however, having as many as 300 to 500. They are never housed, summer or winter, and in inclement seasons suffer severely. The wool is generally coarse, and torn off the animals in so rough a manner as often to lacerate the skin. From the wool the women make homemade clothing, and manufacture for the Danish market hosiery gorgeously colored with the native dyes of the island. The sheep is the same as those met with in Iceland and Shetland.

Having noted the sheep of the islands lying adjacent to Scotland, we proceed to the consideration of those proper to the mainland.

Scotland.—The aboriginal sheep of Scotland, or at least those coming within the period when any record was made of them, were of small size and of lank, agile form, with short, slender horns, sometimes polled, and bore a fleece of soft wool, fitted for the making of flannels, but not well adapted for felting. It was, however, superior to the wool of the Blackfaced sheep of the present day, and was described about the year 1460 as white, fine, and excellent wool, "as the like of it is hardly to be found again in the whole island." They had long tails, and not short and flat like the sheep of northern Europe. They varied in color from white to nearly black, most frequently brown, and often this brown color characterized the face when the rest of the body was white, on which account they have sometimes been called the dun-faced breed. They were hardy to a remarkable degree, gave but little trouble, and their flesh was of excellent flavor. They were of good health, and exempt from the diseases prevalent among the sheep of later days. For several centuries prior to the eighteenth a small flock of these sheep was kept, herded, and folded near the home of the Scottish peasant, the mountains then being overrun by wolves and foxes. Remnants of the ancient race still survive in the Hebrides and in the central highlands of Scotland, and it is thought that the older sheep of Wales and Iceland may have been of this or an allied race.

The Blackfaced sheep.—This Scottish sheep is the most widely disseminated of any of the breeds of Great Britain. Its origin is shrouded in mystery; its age and original habitat unknown. Where facts are wanting theories are plausible and not always uninteresting. One of these is that the Blackfaced sheep are the native original stock of Scotland; while another is advanced that they were intro-

duced into Ettrick Forest by James IV, King of Scotland, in 1503; but omission is made to inform us where the king secured the flock of 20,000 sheep of this breed, which he is said to have brought into Selkirkshire, though they are supposed to have been brought from Fifeshire. A race of sheep similar to the Scotch Blackfaced is said to have existed in Yorkshire at a very early period, and it is of course possible that the king may have brought them from that quarter; but here again no evidence exists to prove that he did so. Again, tradition asserts that the breed was originally confined to various districts in Scotland, where it was known by the several names of Linton Forest, Tweeddale, and Lammermoor.

Naismyth, writing in 1706 of his visit to Lammermoor, states that the prevalent breed there was the Blackfaced moor kind, having generally horns, and called the "short sheep," but that it was impossible to trace their origin, there being no tradition of the sheep here ever being of a different kind; nor could they be called a distinct variety of the species, for a considerable difference of figure and fleece was discernible among the individuals, even of the flocks to which the greatest attention had been paid. The writer on the Dunfaced breed, which is only another name for Blackfaced, in Loudon's Cyclopedia, says that the Dunfaced, generally considered the genuine Blackfaced, were said to have been imported into Scotland from Denmark or Norway at a very early period, and still existed in most of the counties to the north of the Firth of Forth, though only in very small flocks; of this ancient breed he recognized several varieties, produced by peculiarities of situation and different modes of management and by occasional intermixture with other breeds. The Rev. Mr. Findlater, in 1802, wrote a report on the agriculture of Peebles, in which he stated that no clear tradition, nor even conjecture, could be given as to when or whence sheep were first introduced into that county, or whether the existing breed were indigenous or from another country. There was, indeed, an obscure tradition that previous to the introduction or general prevalence of sheep in the parish of Tweedsmoor the farmers in that parish paid their rents by grazing for hire, through the summer, the oxen then generally used by Lothian farmers for their winter plowing. The native Tweeddale breed, which has continued as far back as memory or tradition extends, were all horned, with black faces and black legs and coarse wool.

Galloway has also been surmised as the original home of the breed. In a statistical account of Scotland the Rev. James Muirhead, who wrote the report on the parish of Urr, fixed the date of the introduction of Blackfaced sheep as about the year 1603, but asks the question whence they came. "It may be observed that Galloway abounds with goats which, in the marshy or soft tracts, are almost entirely of a black color." The reverend writer then cites some cases giving plausibility to the theory that the goats and sheep bred together, mentioning that crosses between the two animals were quite common. But while venturing on this suggestion, he confesses that any inquiry on this subject is not attended with much satisfaction.*

Low supposes the breed to have found its way into Scotland by the mountains of the north of England, and that formerly it was chiefly found in the heathy lands of Yorkshire and Lancashire, across the vales of Kendal and Eden to the higher mountains of Cumberland and Westmoreland on the west, and by the Carter Fell into Scotland.

* History of Blackfaced Sheep, by John and Charles Scott.

Youatt considers it doubtful whether they are the aboriginal breed of these districts, or indeed of Scotland, and he cites Culley to the effect that the Dunfaced sheep were the early inhabitants of this mountainous range, some of which remained at the beginning of the present century. They are thus described: Their faces are of a dun or tawny color; the wool is fine, and mixed and streaked with different colors. They are polled, small in size, weighing, at four or five years old, not more than 7 or 8 pounds a quarter, the flesh being of excellent flavor. They are hardy and require little trouble; but in every essential quality, except the fineness of the wool, they were far inferior to the Blackfaced.

A writer of more recent date thinks that the Scotch Mountain or Blackfaced sheep of the present day owe their origin to the ancient Dunfaces, and that they have been improved by breeding from carefully and judiciously selected specimens to an extent which renders the features of the parents scarcely recognizable in the progeny. If the early history of the Blackfaces has a foreign association, it must be admitted they have crossed very successfully with the native sheep. It is quite possible that the sheep of the royal farm at Ettrick Forest were not of foreign extraction at all, but only greatly improved by cultivation and attention. In the present century we have seen improved rams of the pure Blackfaced breed harmonize astonishingly with ewes of the old variety.*

Where so much is given as conjecture it is quite impossible to form any definite conclusion of the origin of the breed, based on the facts presented, and the historian of these sheep admits that—

> All that can be ascertained is, that from time immemorial Blackfaced sheep have been settled in the mountainous districts of the south of Scotland, and they are supposed to be the direct descendants of the aboriginal Scotch sheep, their present improvement having been brought about by a long-continued and judicious process of selection. If it be true, and there is no reason to think otherwise, that no foreign blood has been introduced into the breed since the time when the old Scotch variety called "short" or Dunfaced sheep existed, it is certain that the Blackfaced breed, as it now exists, is the oldest variety known in Great Britain. Crossing with other races, although it has been attempted, has never succeeded; and although the breed is now very different in point of quality to what it was formerly, it can lay claim to an unbroken line of pedigree many centuries old.

The habitat of this breed is the chain of rugged mountains extending from the highlands of Derbyshire, England, on the south to the confines of Scotland on the north. The elevation of this tract is from 1,200 to 3,000 feet. This central chain is separated from the yet higher mountains of Cumberland and Westmoreland on the west. It is destitute of boldness and grandeur, and towards the east passes into the tame moorlands of Northumberland, Durham, and Yorkshire. It is a dreary tract generally, covered with coarse heaths, mixed with sedges, rushes, and the less nutritious grasses, and from being exposed to the winds of both the eastern and western seas possesses a cold climate. These dreary tracts of heath, sedges, and rushes, it is claimed by many, have given rise to the widely diffused Blackfaced sheep, while others claim it as a native of Scotland, where it has been known from time immemorial as an inhabitant in all the highlands of southern Scotland. The introduction of the Blackfaces into the highlands proper of Scotland is of recent times, and can be traced with some accuracy, having taken place

* The Blackfaced or Scotch Mountain Sheep; by John Coleman.

about the middle of the last century, when sheep began to supersede the herds of cattle which then abounded in the highlands, and by degrees displacing the ancient races of the country, so that at the present day, excepting Orkney and Shetland, there are not many specimens entire of the time-honored Dunfaces in Scotland. The first appearance of the Blackfaced sheep in the highlands is mentioned in reports on the counties of Dumbarton and Perthshire at about 1750. From Perthshire they were taken to the northern counties and into the west highlands about 1762, where they were soon found far more profitable than cattle for the higher parts of the country, to which they afterwards rapidly spread throughout the whole of Scotland. Upon this movement Sir John Sinclair observed that the fact was not to be disputed that a much greater value of mutton and wool than of beef was speedily attained from the higher grounds and all those situations where little or no provision could be made for cattle in winter. The best interests of the nation at large, as well as of proprietors, were therefore promoted by the change.

The Blackfaced were extended widely and grew rapidly in favor until shortly after the beginning of the present century, when their popularity declined under the great partiality shown for the Cheviots. To such an extent were the Blackfaces supplanted, that the breed came very nearly being totally extinguished, a revolution caused by the difference in the value of wool which told in favor of the Cheviot.

A few severe winters, however, soon revealed the fact that the Cheviots were unable to exist in exposed situations, and the Blackfaces were again reinstated to at least all the higher grazings in the country. For many years after this—perhaps quite half a century—little changing took place in the position of the two breeds. Farms as well as farmers were known to be inseparably associated with one or other of the breeds, and in this way many years intervened. For the while, however, the Cheviots reigned supreme. But about 1860, which year happened to be a very severe one on hill flocks, the Cheviots began to decline in favor among hill farmers. Every year following saw many old flocks of that breed displaced by the hardier Blackfaces, and the changes which have taken place within the last few years have been not a little extraordinary. This may be attributed partially to the Cheviots having been bred too tender in constitution, but chiefly owing to the great improvement recently effected in the quality of the Blackfaces.*

Where, as in the case of the Blackfaces, a sheep has undergone great improvement, it is not only a matter of some interest but of value to note the characteristics of the animal as presented at various stages of the improvement, and in this case the records are reasonably ample and at hand. The ancient Dunfaced has already been described.

In Walker's "Hebrides" the true Blackfaced sheep was described as having a plump barrel-shaped body, his head horned, and his face and slender legs as black as jet, without any mixture of white. His face was set off with a thick, prominent collar of wool surrounding the neck. He was the boldest, the most hardy and active of all the sheep kind. He fattened readily and to a considerable size. When this was the case and when he was of a proper age, with access to

*History of Blackfaced Sheep, by John and Charles Scott.

heather, his meat by general consent was preferable to every other sort of mutton, that of the small native race perhaps excepted.

Naismyth, who made a tour through the sheep pastures of southern Scotland in 1795, says that in the Lammermoor district sometimes a fallow ewe from the hill, killed, weighed from 9 to 10 pounds per quarter and that 23 fleeces made 24 pounds of wool. The length of the staple was from 4 to 5 inches. In the Lanarkshire district from six to seven fleeces made 24 pounds, the wool not washed before shearing. The lambs were mostly white, but some had black spots on different parts of the body, and one perhaps in thirty-six was black all over. In Peebleshire the defect was in the quality of the wool and an indisposition to fatten at an early age. The fleece was often marked with blue or gray spots and the length of the staple was 4 to 5 inches. In Dumfriesshire the Blackfaced sheep had been known from time immemorial, and but few of them had been mixed with other kinds. Many farmers brought into the county improved rams of the same breed with good effect. Originally those sheep were short-wooled, ill-furnished in the forequarters, and small sized, which defects had been considerably removed by the change of rams. The best kinds did not exceed 12 pounds per quarter, with about 6 pounds tallow; when carried into superior pastures wethers of four or five years old rose to 15 or 16 pounds per quarter. The mutton is at perfection at four or five years, and is delicious. In his "General Report of Scotland," 1814, Sir John Sinclair said that the produce of these sheep, in mutton and wool, varied according to the quality of their pastures. Their flesh was well known as excellent, and their fleece as very coarse and of little value. The average weight of a fat wether was then about 52 pounds the four quarters, and of a ewe 40 pounds. In Tweeddale or Peebleshire, which may be considered the headquarters of the breed in Scotland, the prices in 1813 were, for fat lambs, from 10*s*. to 14*s*. Their wool sold in 1811 and 1812 at 10*s*. for 24 pounds, and in 1813 at 12*s*.; but afterwards, in the course of the summer, was worth 17*s*. From six to seven fleeces made 24 pounds. Youatt, who wrote in 1837, described the Blackfaced sheep as mostly horned, more or less spirally formed, but the females were frequently without horns. The faces and legs were black, or at least mottled; the eyes wild and fierce. They were covered with wool about the forehead and lower jaw, and the wool generally was somewhat open and long, and coarse and shaggy; not so long, however, but that the sheep might be properly classed among the middle-wooled breeds. There was a hardness of feeling about the wool which materially lessened its value. The form of the sheep had been considerably improved by good selection, within the compass of a very few years, and the carcass had become so short, round, firm, and handsome, as to acquire for it the name of *short* sheep, in opposition to the Cheviots, or *long* sheep. They were a hardy, active race, and better calculated to resist the severe winters of their mountainous district than any other breed, or at least with only one exception, the Cheviots, and the propriety of that exception was doubted. Those of the best descriptions were bred chiefly in the hilly districts of the south of Scotland, where breeding stocks could be profitably kept, and were, when designed for grazing, bought while lambs, or at one year old, and kept on the Grampians, or other similar pastures, until three years old, when they were sold to the low-country farmers, in order to be fattened on turnips, and sent to a near or distant market in the following winter or spring.

Professor Low, who always throws around his subject a pleasing philosophy, and is likewise given to comparison, says that the Black-faced Heath breed possesses characters which distinguish it from every other in the British Islands. It is of the smaller races of sheep with respect to the weight at which it arrives, but it is larger and more robust than the Zetland, the Welsh, and the ancient soft-wooled sheep which it displaced. It somewhat resembles the Persian, so that it might be conjectured that it is derived from the East. But it is more natural to assume that its peculiar characters have been communicated to it by the effects of food and climate, in the rough heathy district from which it is derived. Their limbs are long and muscular, and their general form is robust; but the shoulders are not so low as in the Welsh breeds, nor are the posterior limbs so long. The face and legs are black, and there is a tendency to this color in the fleece; but there is no tendency to the brown or russet color, which distinguishes the older fine-wooled races. The fur is shaggy and the wool coarse, in which respect it differs from that of all other mountain breeds of the country. It is of medium length, and weighs about three pounds the fleece when washed. These sheep are very hardy, and capable of subsisting on the coarsest heaths. They do not, however, like the sheep of Wales, prefer the summits of mountains, but feed wherever pasture can be obtained; and are not so nice in the choice of herbage as the Southdowns, Merinos, and other races derived from countries yielding the finer grasses. Although wild and independent in their habits, they are not so restless as the mountain sheep of Wales and other parts, but can be induced to remain in inclosures when sufficient food is supplied to them. The ordinary weight of the wethers, when killed at the age of about four years, is 15 pounds the quarter; but individuals are made to exceed this weight when properly treated and sufficiently fed from an early age. The mutton is not so delicate as that of the sheep of Wales, or the Southdowns of England, but it is more juicy, has more of the venison flavor, and is preferred to every other by those who are used to it. It is the mutton which is principally consumed in all the larger towns of Scotland, and great numbers of the sheep, at the age of three years and upwards, are carried to the pastures of the south to be fattened for the English markets.

A great defect of this breed is the character of the fleece, which, besides being thin on the body, yields wool fit only for the manufacture of carpets and the coarser stuffs. Little general attention has been paid to the quality of the fleece, although it is susceptible of considerable improvement. A defect of the wool, very common in this breed, is the existence of what are termed kemps. These consist of hard and wiry filaments mixed with the pile. They are deficient in the felting property, and in the oily secretion which moistens the home wool. The removal of kemps is effected by superior food, and by breeding from parents free from the defect. Sometimes individuals are born with wool which is fine and short. Were advantage taken of this occurrence it might be possible, by means of breeding, to produce a variety with fine in place of coarse wool.

Extending as it does over a great variety of situation and soils, from the moist moors of Yorkshire and other parts to the rocky mountains of the north of Scotland, this breed presents a great diversity of size and aspect. In some of the lower and less heathy moors, both of England and Scotland, the sheep have so far deviated from the ordinary type as to have lost their horns and the black

color of the legs and face. This variety is generally of smaller size and less hardy habits than those which are naturalized on the dryer mountains of abundant heath. The best of the breed are found in Tweeddale in Scotland, which may be partly due to the nature of the country, and partly to the superior care bestowed in breeding. Those existing in the hills of Cumberland, Westmoreland, Yorkshire, and Lancashire are much inferior to those of the border counties of Scotland. Over a great part of the highlands and islands of Scotland the breed has degenerated from the want of care and from insufficient food. In many of these situations, indeed, the stock may be said to be mixed, for it has been the result of crosses with the original races.

So great has been the improvement since Low's time that his description does not give full justice to the Blackfaced of the present day. Now, the prominent features of a good specimen of the breed are a rough, shaggy fleece, great agility, hardy appearance, and a bold, defiant action. Both ewes and rams are horned. A model ram has the following characteristics, as given by the Scotts: Head large and masculine; Roman nose, with wide open nostrils and black muzzle; the face covered with a variegated black and white, or sometimes all black, close, hard hair, the colors clearly defined and not running into each other. The black, as a rule, predominates, although many well-bred specimens have rather most white on their faces. Large full eye, and broad between eyes. Horns strong and nicely curved, clear of the side of the head, and about an inch apart at the roots—never meeting on the cantle nor rising above the level of the cantle. Tups whose horns rise much above the crown of the head are objected to for breeding purposes, as the horns in the lambs are liable to cause severe injury to the ewe at lambing. The neck is rather short, strong, and slightly crested. Shoulder level and well filled up to the neck. Back straight and not too long. Ribs well sprung and deep, giving the animal a round, barrel-like appearance. Back broad. Hindquarters deep and fleshy. Deep and broad chest, with wide brisket. Strong legs, especially from the knee upwards. Large feet, with open hoofs and springy pasterns. Such a shaped foot is a great safeguard against foot-rot, as a close-hoofed foot can not be so easily cleaned and cured, and is not so answerable for climbing steep hills. The wool is strong and thick in staple, and about 12 to 22 inches in length; slightly "wavy" and free from hairs and dark or blue-gray spots. Blue or black streaks about the neck or tail-head, though still common to the breed, are not desirable. The wool, when full grown, reaches to within an inch or two of the ground. The legs are generally of a jet-black color, and squarely planted under the body. The chest and hindquarters are broad and square, imparting fine symmetry to the frame. The movements are elastic and active; and a ram with all these properties is majestic and carries himself with great style. The Blackfaced ewe is in all respects similar to the ram, only more feminine in appearance, and having much weaker horns. As a rule, the color of the face shows more dark than white, some being entirely black. The horns in ewes should also spring low and wide at the root, and be entirely free from a reddish tinge (blood-horned); otherwise the animal may be regarded as soft or unhealthy.

A very remarkable characteristic of the breed is the activity of the new-born lambs. With lowland sheep the lambs, after being dropped, take a considerable time before getting on their pins, but it is not so with Blackfaces. After a shake of

the head and a look around, the youngsters are on their feet and sucking in less than five minutes. But for this quality, arriving as they often do in the midst of snow, many of them would freeze to the ground before regaining consciousness. When the lamb is newly born, if well bred, every inch of it except the hoofs is thickly covered with wool. It is this characteristic which renders the breed so valuable for high, exposed grazings, and it is also a quality which distinguishes the Blackfaces among other breeds when they are reared in lower situations.*

The improvements that have been made in the Blackfaced sheep have mostly been effected by careful and judicious selection. Crosses have generally failed with that other famous mountain sheep of Scotland, the Cheviot. It has frequently been attempted, but the result has shown a progeny inferior both in the shape and quality.

To effect a change in the old forest breed, Cheviot rams were admitted to the hardy natives of the more elevated parts of the country. The independent habits of the mountain flocks were lost, and a mongrel progeny of a clumsy figure occupied the lowest and warmest of the pastures. Although both of the parents were hardy, the issue of the two were easily subdued by the cold of winter.†

But as it is not always safe to change a stock of sheep grown up and fixed in their locality, the custom prevailed of a continued crossing with the Cheviot until the flock acquired the character of the latter, so that the original Blackfaced became in time almost Cheviot; and again, when the Cheviots declined in favor the continued use of Blackfaced rams on the same flock restored it to its original characteristics.

The crossing of the Blackfaced ewes with the rams of the Leicester, the Southdown, the Cotswold, and other lowland breeds has been more successful, the first cross between the Blackfaced and the Leicester being held in the highest repute. The lambs resulting from this mixture are very hardy, fatten very readily, and reach a greater weight than those of the pure Blackfaced sheep. These first crosses are known as "gray-faces," or simply as "crosses." The desirable ewes are much sought after and make valuable ewes for breeding. A still further crossing of the "gray-face" ewes with a whitefaced ram produces a progeny usually larger than the first cross, and partaking more of the whitefaced type. Ewes of the second cross are again in many cases bred to whitefaced rams, and this produce will have still further advanced towards the whitefaced breed, possessing mutton not so prime as that from the first cross but more weight of it, and wool somewhat improved in quantity and in value by the pound. These Blackfaced and whitefaced crosses generally are constitutionally strong; under fairly good circumstances they thrive and do well, and they appear to be good rent-paying sheep on a large portion of the second quality land throughout Scotland and the north of England. They are considered more hardy than the half-bred and adapted to higher grazings.

It has been found that the Border-Leicester ram is superior to all others in crossing with the Blackfaces, being possessed of the greatest aptitude to fatten rapidly, combined with a good, hardy constitution. These characteristics ingrafted upon Blackfaced ewes, which carry mutton of a fine quality but light in quantity, produce a good carcass of a superior quality of mutton. A cross with the Southdown ewes produces handsome sheep, having perfectly black faces and legs and a good fleece, but they do not attain the size of the Border-Leicester crosses.

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*History of Blackfaced Sheep, by John and Charles Scott.
†W. Hogg in Quarterly Journal of Agriculture, I, 175.

As related at the beginning of our treatment of this sheep, the Scotch Blackfaced is more widely disseminated and occupies a much greater area than any other breed of sheep in the British Islands. They have found their way all over Scotland, from the Hebrides on the north to its southern border, and thence far into the interior of the north and midland counties of England; also into Wales, where they are now found in great numbers. In the north of Scotland they are not so well bred, nor are the pastures as good as those in the south of Scotland, but the infusion of the new blood was so effectual that they soon almost obliterated the Dunfaces. The finer breeding flocks have long occupied the higher grounds in Lanarkshire, Ayrshire, Dumfriesshire, and Stirlingshire; but along the west coast the Cheviots encroached extensively upon them up to within recent years, the opinion being held by many that the Cheviots were as hardy as the Blackfaces; that they would arrive earlier at maturity; would carry a greater quantity of mutton possessed of quite as fine a flavor

As long as the Blackfaces remained in a comparatively unimproved state it was seldom that people living in lowland districts saw anything of them. They were strictly confined to the highest and wildest of the mountain ranges, and lowland farmers regarded them as unfit to tread upon the same quality of land along with the Cheviots or Leicesters. But all this has changed. The Blackfaces, which were formerly looked upon with contempt, proved their worth on the highest-lying grazings in the country, and gradually they began to encroach upon the ground held by the Cheviots. They had been steadily improving in size and quality, which also fitted them for lower ranges, and every year a few more flocks were added to their strength, till at length they have become the most numerous and widely distributed breed in Great Britain. In their march towards the lower pastures of the country they have, in many instances, fairly ousted the Cheviots from old-established quarters, and at the present moment they are contending with lowland breeds for supremacy on the very choicest quality of land. And in this they have succeeded to a surprising extent. It is now quite common to see large flocks of Blackfaces pasturing on the richest and best farms in Scotland, and when given a similar chance they are found not only equal to but superior to most of the lowland breeds.*

The Blackfaces are lively animals, very instinctive, become deeply attached to their pastures, and return to them after being removed to a great distance. No variety is known that can take better care of itself, either in shifting for the means of subsistence or enduring the effects of heavy snowstorms. If they have some shelter they will scrape among deep snow for heath, moss, or furze, and tide over the storm with a very scanty supply. In the first half of the present century, when more of the mountain sheep were wintered on the summer grazings in the uplands than was afterwards deemed advisable, it was not uncommon—and heavy snowstorms were more prevalent then than now—to have large numbers buried under immense accumulations of snow. The length of time that those sheep endured and survived these storms is surprising. Excellent authority says:

We have seen several animals of the Blackfaced breed, not very far removed from the ancient Dunfaces, taken out from below a huge wreath of snow alive, after being buried there five weeks. Some of the animals died immediately after ex-

* History of Blackfaced Sheep, by John and Charles Scott.

posure, while others, though weak for some time, lived several years. All they had to subsist upon during those five weeks was what they could get where lying; they were, of course, unable to rise under such a pressure. Heather roots, grass, and even the soil were eaten to a mournful extent so far as the creature's head could reach; in fact, nothing grew for many years on those bitten specks.*

The Blackfaces produce a fine quality of mutton, of a peculiarly delicate flavor. Formerly the wethers were considered fit for killing at from three to five years, but of late years the breed has been so improved in size and quality, that lambs sold from the grazings in the month of August at 14*s.* to 16*s.* per head to feeders are again resold by them in June (then fourteen months old) to butchers at from 45*s.* to 52*s.* each. Their mutton always brings the highest price in market. While it has been considered that it was unprofitable to fatten mountain sheep before they had reached a certain age, recent experience of the Scottish breeders has shown that Blackfaces can be fattened with as much success and profit under fifteen months as any other variety of sheep in existence.

The treatment of this race of sheep varies according to the circumstances of the country in which it is produced and the market for which it is intended. Within the last half century it has undergone many changes, but now presents three characteristics, viz, the purely breeding stocks in the southern counties of Scotland, the wether stocks in the northern counties, and the mixed ewe and wether flocks in the central and northern counties. The breeder of the sheep is not usually the person who fattens them for the butcher's knife. He rears them to the age which suits the nature of his farm and sells them to farmers who have farms on which they can be kept till they have arrived at the proper age for fattening. Then they are again disposed of to the graziers and farmers who have grazings or artificial food with which to prepare them for the butchers. This transfer goes on constantly, the sheep ultimately finding their way to the markets of London and other great towns in a condition of flavor, juiciness, and general perfection difficult to equal. The means of meeting the great demand of the market are afforded by the stocks of ewes maintained on the farms of the breeders, the number of each flock of ewes depending on the quality and extent of the natural pastures and the age to which the progeny is reared on the breeding farms. On the breeding farms in the southern counties of Scotland it is usually the practice to winter the ewe hogs separately from the old sheep on the lower grounds, sometimes giving them turnips. Meadow hay is given all over the country, during heavy, protracted snowstorms. The principal breeders in the southern counties sell the wether lambs in the Lanark market during the autumn months, retaining through the winter only the purely breeding animals.

Those who raise wether stocks in the northern and central counties of Aberdeen, Inverness, and Perth, buy the wether lambs in the Lanark market at high prices, ranging from 12*s.* to 24*s.* a head, and after about three years keep on the now-breeding farms these animals turn to the southern market as three-year-old wethers, and are sold at from 35*s.* to 40*s.* each. By this time some of the wethers are ready for the butchers, and the majority about half fat—in which case they are bought by fleshers and dealers, and put on turnips in England and elsewhere a few months.

* John Coleman.

Breeding from Blackfaced lamb rams is a comparatively recent practice, but has grown to great proportions, as ram breeding occupies a prominent place in the pastoral economy of Scotland, over two hundred and fifty breeders being engaged in it and producing annually over five thousand rams of this breed, which are sold in north Britain. To such an extent is this carried, and in many cases so carelessly, that rams are sold as low as 10*s.* to 12*s.*

At Lanark, however, which is the natural center of the breed, and where the best specimens are to be found, they bring from £5 up to £75 ($25 to $375), the last price named being realized in 1887 for a shearling selected from the flock of Mr. Murray, Parkhall. (Blackfaced rams are generally used four seasons; so that, including both rams that have been purchased and rams that have been bred and reared on the farms where they are used, it is probable that not fewer than 40,000 Blackfaced rams are put to the ewes in Scotland every year.)

The rams are admitted to the ewes about the 20th of November, and in the higher districts about a week later, so that the season of lambing may coincide with the appearance of grass in the spring, but not before, nor indeed much later, for late lambs are quite as bad as those which come too early, and for this reason the rams are not left with the ewes after the Christmas holidays. One ram may have fifty ewes, or even a few more; but to prevent him having to travel too far the shepherds and farmers are usually careful to throw the ewes together night and morning, and, weather permitting, to keep the ewes on the higher ground in detached bodies here and there, with a proper proportion of rams along with each body of ewes.

During the winter months the pregnant ewes range over those parts of the farm where they can pick up, at the best, a scanty subsistence, rendered precarious by the falls of snow which often cover the dreary hills and wastes for weeks at a time. Then a little coarse hay is given them, doled out in small quantities; sometimes even that is wanting, and all the food supplied is what the animals can collect on their natural pastures. They dig up the snow to reach the grass and herbs beneath, and support themselves under circumstances in which the more delicate races would perish. Yet, notwithstanding its hardiness and self-reliance, many of these sheep die from the inclemency of the weather and the want of food. The winter of 1859–'60 furnishes an illustration. A storm set in on the 26th of October, 1859, and continued with great severity all through the winter, snow, sleet, rain, and frost coming in succession. At Christmas came the most intense frost of modern times. Heavy losses resulted in the following spring, about one-fifth of the old sheep and three-fourths of the lambs having perished. In no season since the end of the seventeenth century had the loss been so heavy. On one farm, out of a flock of 2,500, the loss was 440 ewes and hogs, but instead of ninety score of lambs there were only thirty score, many of them in poor condition. The superiority of the Blackfaces over the Cheviots, as a hardy sheep, was shown at this time; they invariably suffered about 50 per cent less than the Cheviots, and that, too, though confined to considerably higher grazings.

The lambing season is usually from the middle of April to the middle of May, and twins are the exception. The ewe is a good mother and watches her young with great devotion. Such is her

attachment that many of them have been seen to remain within a few yards of their dead lambs for several days, even though the latter had not survived birth, and though they themselves were on the brink of starvation. A few days before lambing many of the ewes wander to distant spots of the walks, and, unless carefully watched at this season, considerable loss is occasioned by lambing unobserved.

Coleman says:

What is very remarkable, ewes were known to have gone year after year to the same locality, several miles distant from the rest of the flock, to lamb. So uniformly was this system practiced by the older ewes in some of the less strictly watched flocks twenty or thirty years ago (1860 or 1850) in the hilly district, that when a certain ewe happened to be missing in April or May, search was at once made in the particular part of the hill where she was known to have lambed before, and in almost every case with success. For several years the ewes in the larger flocks have been carefully herded on the lower parts of the walks until the lambing season is over. We have known of lambs only five or six months old leaving flocks or pastures which they had lately joined, and going back to their native runs, a distance of several miles; and in case of ewes newly removed from well known to strange grounds, we have experienced their clandestine return to the former, a distance of 40 or 60 miles, in a marvelously short time, with one of Scotland's noblest rivers to swim. When these animals are fairly bent on returning to their favorite haunt, they travel night and day, and overcome barriers which in any other circumstances would be insurmountable.

Of all breeds, Blackfaces are preëminently the most hardy and cause least trouble at lambing. And not only do they cause least trouble, but they will rear 20 per cent more lambs than their next neighbors, the Cheviots, having the very same opportunities. It is for this reason, more than any other, perhaps, that they have ousted the Cheviots from so many of their grazings. A Blackfaced ewe can maintain her condition where a Cheviot would starve; and at lambing time she not only gives more milk, but her lamb possesses the same qualities of endurance, which enables it to withstand the sleety blast and survive where a Cheviot would perish.*

The Blackfaced sheep are generally washed in May and June, usually in streams or pools; the animals, when practicable, being driven to a river or pool and made to leap from the bank and swim across. This is the practice on the highlands, but in the lower arable grounds tub washing in cold water is considered better. The use of either hot water or soap is injurious to the wool, while to cold water washing there can be no such objection. While it is true that the best and most careful farmers wash their sheep, the practice is not general, and is opposed by many on various grounds, chiefly that it is injurious to the sheep; that the washing can be done cheaper after the wool is off the sheep than before, and that buyers will not pay enough more for washed fleeces to pay the cost of washing, together with the shrinkage in the weight of the wool.

The number of days that should intervene between washing and shearing the sheep depends partly upon the state of the weather as well as upon the condition of the fleece, but usually it is about ten days. Shearing is the event of the season, and is participated in by the neighbors for some distance around, each one in turn assisting at the other's shearing. As a rule the shearing is coarsely done, all the hill farmers leaving a short growth of wool to protect the sheep from sudden storms of cold, wet nights.

A practice formerly existed in the case of these mountain sheep

*History of Blackfaced Sheep, by John and Charles Scott.

of anointing the skins previous to the months of winter. The substances generally used were tar and butter, prepared by boiling the butter and tar together. The proportions used varied in different districts. In some places 6 pounds of butter and 1 gallon of tar were used for twenty sheep, and in others the quantity of tar was larger. The period of smearing was the end of October or beginning of November. The method was to separate the wool by the finger, and spread the ointment longitudinally from head to tail so that the whole body should be covered. The purpose arrived at was to remove insects and cutaneous diseases and to defend the skin from wetness. It was thought to be peculiarly beneficial in the case of this breed, whose fleece was more open and coarse than that of other sheep. The effect, however, was to diminish the value of the wool by staining it with the coloring matter of the tar, which rendered it less fitted for receiving the brighter colors in dyeing. It was thought to conduce to the health of the animal in rendering it less liable to be injured by the coldness and humidity to which it was exposed, and whatever doubts may have existed as to the expediency of the practice in the case of other mountain breeds, experience showed its importance in the case of this one all over the bleak and stormy countries which it inhabited.

Smearing, however, has now been laid aside in favor of the less expensive and more effective process of dipping, now considered a necessary operation in all well-regulated flocks. Many do this after the sheep have been shorn, when the wool is short and less material suffices for soaking the fleece, while others do it in October. Dipping the lambs has also become a very common practice, especially on farms where the sheep can be readily collected. Good authority, however, asserts that the best results of all are attained by having the operation performed twice during the year—first, after the sheep have been shorn, and again either a week or so before the rams are put out in the autumn, or about the beginning of February. The summer dipping is useful in preventing the annoyance of flies, and it also materially promotes the growth of wool, indirectly of course, owing to the sheep thriving better. The winter dip, if consisting of the proper materials, may also be made to act as a protection against wet and cold—and these are important advantages—while at the same time keeping the sheep almost entirely free of vermin.

The attention of the Scottish breeders being directed more particularly to the carcass, the wool of the Blackfaced sheep is considered of small comparative value, and when considered at all the aim has been to increase the length and weight of the fleece, comparatively regardless of its quality. The average weight per fleece is about 3 pounds, but in some flocks so great has been the improvement that the staple is 22 to 24 inches long, and the average weight of the fleece 5 to 6 pounds. The natural coarseness of this wool unfits it for the manufacture of the finer class of goods, its general use being confined to rugs, carpets, and Scotch blankets. Immense quantities of it are used by American manufacturers.

The following is given as a scale fairly representing the character and relative value of the various points of a Blackfaced ram:

Head.—Large and masculine; nose, thick and slightly arched; nostrils, expanding; muzzle, broad and black; forehead, broad; eyes, large and bright; face, covered with close, hard hair, all black, or black and white, the colors clearly defined and not running into each other..... 12

Horns.—Strong and nicely covered, clear of the side of the head, about an inch apart at the roots and not rising above the cantle..... 6

Neck.—Strong and slightly crested	4
Shoulder.—Narrow on top, and well filled up to neck	5
Chest.—Steep and broad	12
Back.—Broad, level, and not too long	10
Ribs.—Well sprung and deep	7
Hindquarters.—Wide, deep, and fleshy	12
Tail.—Set on level with the back; strong, and hanging well down the legs	2
Feet and legs.—Feet large, with open hoof; pasterns moderately long and sloping; legs strong, especially from the knee upwards, of a black, or black and white color, and squarely planted under the body	5
Wool.—Strong and thick in staple, 12 to 22 inches long; slightly wavy or curly and free from hairs or blue-gray spots	15
Constitution, pedigree, etc	10
Total	100

A description of Blackfaced sheep farming, or in fact that of any mountain sheep farming in Scotland and the north of England would be incomplete without notice of the practice of herding. Large sheep farms are divided into what may be termed smaller farms or hirsels. Each hirsel has a shepherd who keeps the flocks under his charge upon its own ground, for there are no fences; and yet rarely do the sheep of one hirsel stray off their ground. The sheep in each hirsel are again divided into "cuts" or bands, and each band has its own range of feeding ground, so apportioned that the sheep assigned to it get as great a variety of soil and grasses as possible. The number of sheep in one of these "cuts" varies from 50 to 200, depending on the nature of the ground. An important point in herding is to divide the sheep as equally as possible over the whole of the ground, so that one part may not be overstocked and another part understocked. Change and variety of pasture are looked to, for where the pasture is very much similar in character it is apt to be deficient in the elements necessary for the proper development and nutrition of the animal system; consequently the sheep became impaired in health and body. This evil is sometimes obviated by requiring that all the sheep under one man's charge travel over the whole of their ground daily, by which every sheep gets as much variety of pasture as it can possibly obtain.

Every evening the various "cuts" into which the flock is divided meet at the highest part of the ground and rest for the night. The herding the sheep at the hilltop is an important point. While it is the coldest and most exposed situation the sheep could possibly find, it is the most healthful one. The high pure air agrees with the sheep, and they are never so healthy as when they are allowed to breathe it, even if it is colder and sometimes more than abundant. They naturally prefer to rest on the higher ground, although they can be taught to lodge on the lowest, to which they will draw in the evening of their own accord. Scotch farmers think that housing sheep on the hilltops would not be good for them. They experience occasional blasts, from which they might escape if housed or allowed to rest on lower ground, but taking the year round the open hilltop is the best and most suitable place for them to rest overnight.

When morning comes each company of sheep starts off to its separate feeding ground, and they make no mistakes, stringing away one after another without halting until they arrive at the lowest part of the grazing. Then they begin to feed until noon, when they move outwards, scatter themselves over every part of the ground, and gradually working upwards reach the hilltop again about dusk. This practice is continued throughout the year.

The Cheviot sheep.—In the border county of Northumberland, England, extending into the county of Roxburgh, Scotland, there is a range of beautiful conical mountains, of a porphyritic geological character, mostly covered with grasses, ferns, wild thyme, and other plants characteristic of such formation. The vegetation clothes these mountains to their very summits, which rise in places to 2,600 feet above the level of the sea, and are frequently capped with snow long after its disappearance from the lower grounds and the narrow valleys separating the ridges. These are the Cheviot Hills, and in their northern extension they come in contact with the rough heathy country which we have shown to be the true habitat of the Black-faced or Highland sheep, while on the other side they are connected with a rich cultivated country. The true Cheviot district is somewhat limited in extent, and has supported from time immemorial a race of sheep entirely different from the Blackface on the north and those south of Northumberland, or even in the county adjoining the hills. From its habitat it is called the Cheviot sheep. Tradition says that the Cheviots came from the border districts of Scotland, but they are totally different from the Blackfaced sheep and bear little or no resemblance to the original Dunfaced Scottish stock. How two breeds so totally different from each other came to inhabit the neighboring districts of Ettrick forest and the Cheviot hills neither history nor tradition has attempted to explain.* Tradition says also that these sheep were brought into England by the Spanish Armada, having made their way to land from some of the ship-wrecked vessels of that ill-fated expedition that were drifted on the Western Isles.

These sheep, like all others of Great Britain, have undergone such changes, both as to form and the character of their wool, that a description of them as they have appeared at different times is advisable. Sir John Sinclair, who wrote of them in 1792, before they were changed by the admixture of the Leicester, says that perhaps there is no part of the whole island where, at first sight, a fine-wooled breed of sheep is less to be expected than among the Cheviot hills. Many parts of the sheep walks consist of nothing but peat bogs and deep morasses. During winter the hills are covered with snow for two, three, and sometimes four months, and they have an ample proportion of bad weather during the other seasons of the year, and yet the Cheviot sheep will thrive in the wildest part of it. Their shape is excellent, and their forequarter in particular is distinguished by such justness of proportion as to be equal in weight to the hind one. Their limbs are of a length to fit them for traveling and enable them to pass over bogs and snows through which a shorter-legged animal could not penetrate. They have a closer fleece than the Tweeddale and Leicester breeds, which keep them warmer in cold weather and prevents either rain or snow from incommoding them. Their fleece is shorter, and consequently more portable over mountain pastures. They are excellent snow travelers, and are accustomed to procure their food by scraping the snow off the ground with their feet, even when the top is hardened by frost. They have never any other food, except when it is proposed to fatten them, than the grass and natural hay produced on their own hills. Their weight when fat, is from 17 to 20 pounds per quarter, and when fed on heath and kept to a proper age their meat is fully equal in flavor to any that the highlands can produce.

* Farmer's Magazine, February, 1824.

A writer in the *Farmer's Magazine*, 1810, gives a representation of what they were, or what a good Cheviot should be, before the breed had received the last improvement from the Leicester:

> The head polled, bare and clean, with jawbone of a good length. Ears not too short. Countenance of not too dark a color. Neck full, round, and not too long; well covered with wool, and without any beard of coarse wool beneath. Shoulders deep, full, and wide set above. Chest full and open. Chin long, but not too long. Straight, broad, and wide across the fillets. Hams round and plump. Body in general round and full, and not too deep and flat in the ribs or flanks. Legs clean, of a proportionable length, and well clad with wool to the knee-joints and hocks. Fleece fine, close, short, and thick set; of a medium length of pile, without hairs at the bottom, and not curled on the shoulders, and with as little coarse wool as possible on the hips, tail, and belly. A sheep possessing these properties in an eminent degree may be considered as the most perfect model of the Chevoit breed.

Thirty years later the Cheviot was described as destitute of horns in the male and female; the eye lively and prominent; the countenance open and pleasing; the ear large, and with a long space from the ear to the eye; the body long and closely covered with wool, short and sufficiently fine for the making of certain cloths. The wool extended over the whole of the body and came forward behind the ear, but left the face uncovered, which gave the animal a pleasing appearance. The face and legs were generally white, the exception being that some individuals had dun faces and legs.

The earlier descriptions of these sheep do not give us an idea of the well-proportioned Cheviots of the present day; but as inferior as they then were their peculiar adaptation to the soil and climate caused them to spread over a great part of the elevated lands in the south of Scotland long before any attempt was made to improve them.

The earliest known attempt to improve these sheep was about 1790–'95, and was very successful. A Mr. Robson, of Belford, traveled over the greater part of England for the purpose of examining the various breeds of sheep in different districts, with the view of selecting rams to cross his flock of Cheviots. The sheep he considered most suitable were of a breed then existing in Lincolnshire, of which he purchased several rams to put to selected ewes. The cross answered admirably, greatly improving the flock in every respect, without materially lessening its hardy character. Mr. Robson then occupied several high and stormy farms on the border, and the crossed breed did well upon them. Twenty years afterwards he made a second visit to Lincolnshire to obtain another infusion of the same blood, but found the breed had become so much larger and less hardy that he declined to venture on them. Noted Cheviot breeders believed that these sheep, purchased in Lincolnshire, were Leicesters, a belief that has been confirmed by the statement of persons known to the facts, that the sheep were really purchased from Bakewell, the noted improver of the Leicester; but John Usher, good authority on Cheviot sheep, comes to the conclusion that the sheep were Bakewell's Leicester when in a state of transition, and before coming to the perfect type which they subsequently attained.

Mr. Robson's flock was the nucleus from which Cheviot breeders drew their supply of rams for many years. The impetus given to the breeding of Cheviots was immense. They rapidly found their way into other districts of Scotland and the north of England, temporarily supplanting the Blackfaced breed, with which the Cheviots share the mountainous part of the north of England and the whole

of Scotland. Each has its advocates, and each is a useful and valuable sheep.

Early in this century the Cheviot sheep were largely introduced into the northern counties of Scotland, chiefly by farmers of large capital on the border, and they maintained a supremacy over the Blackfaces until 1860, when the severe storms of that year put to the test the hardiness of the two breeds, and demonstrated that the Blackface could live where the Cheviot perished, especially on the higher grazings. From that time the Cheviot have been obliged to yield, gradually, some of the ground taken from the Blackfaces earlier in the century; but prior to 1860 they had spread from their native mountains to a large extent of country, and covered a great part of the elevated moors from which the Blackfaced sheep had been pushed. They had spread over the southern mountains of Scotland, supplanting to a great extent the heath breed which previously existed. They had been carried beyond the Grampians to the extreme north of Scotland, where they were reared in increasing numbers. Sir John Sinclair carried them into Caithness. But in many cases they were placed in situations to which the coarser and hardier Blackface would have been better adapted, and many of the farmers, after a dear experience, were obliged to revert to the ancient race.

The breed, however, has still an extensive range, dividing Scotland with the Blackfaces, taking 9,300,000 acres to 9,000,000 for the Blackfaces, but having only 1,400,000 acres in England, where the Blackface had 4,100,000 and all other breeds 27,000,000. Like all other sheep the Cheviot has the property of adapting itself to the country in which it is sought to naturalize it. Thus the sheep which are reared in the north of Scotland must give birth to a hardier race than would be produced in the lower mountains of the south; and it was upon this fact that the friends of the Cheviot grounded their expectation of the ultimate extinction of the Blackface breed by one its superior in some respects. The great extension of this breed, however, was of much benefit to the breeders and the country. Besides its northward extension it was carried to the west of England and Wales, and found suited to the cold and mountainous counties. In its native hills the Cheviot has been cultivated with great care by breeders noted for intelligence and enterprise, and thus breeders from all parts have a resort to the native districts of the breed for the means of maintaining their stocks in a state of purity.

The Cheviot sheep are of quiet habits, more contented than the Blackfaced on whatever kind of pasture they may be put, and it is an universally admitted axiom among breeders that contentedness and a disposition to thrive are inseparable companions. These sheep possess all the independence of a mountain race, with none of the indocility which distinguishes some other races. They are exceedingly hardy and their close covering of wool enables them to resist extreme cold. They come to maturity earlier than the Blackface, and at whatever age the fattening process commences with them they leave the Blackface far behind. Placed upon turnips the Cheviot will gain many pounds, or placed on the scantiest pasture he will manage to retain his condition as well and as long as his antagonist. They feed more on the grasses and less on the shoots of heath than the Blackfaces, and hence are less adapted to a country of entire heath, and require a larger range of pastures to support an

equal number of animals. Another reason for a larger range of pasture is found in the superior size and weight of the Cheviot. So many of them can not be kept on the same area of ground, but a greater quantity of mutton will be produced, and a greater profit to the farmer, and this accounts for the great increase in sheep farms in the border counties, the doubling of their price and the multiplication of sheep.

A two-shear wether, when fat, weighs from 15 to 18 pounds the quarter, depending on the natural productiveness of the pastures and the method of treatment when young. The ewes weigh from 12 to 15 pounds the quarter, though with such differences as depend on the nature of the soil and pastures and the method of treatment. The mutton of these sheep is very good, though inferior in delicacy to that of the Southdown and Welsh sheep, and in flavor to that of the Blackfaced sheep. Their natural form is, like that of all mountain breeds, with a light fore quarter, but this character is removed by the effect of breeding, and the modern Cheviots are of good form. The body is somewhat longer than is usually the case with the heath breed, which has given rise to the popular distinction in districts where both breeds are cultivated of "long" and "short" sheep. They are larger in the lower countries, where a supply of turnips can be given; they are lighter in the more elevated tracts, where artificial food is scanty or wanting. The breeders adopt the kind of animal which is suited to the pastures, preferring a short-legged, larger sheep for the lower farms and one of lighter and more agile form for the more upland and colder.*

Youatt points to a comparison between the two Scotch breeds as to their hardiness, the power of resisting the combined and long-continued influence of cold and hunger. When the contest first commenced on this point there is no doubt that the Blackfaced sheep had a decisive victory. The Cheviots did not weather the inclemency of a Highland winter, and the loss of the ewes and lambs almost, and in some cases more than, balanced the advantage of finer wool and early maturity.

> But the trial was not fairly made [contends Youatt]; the pasture, the soil, the nature of the climate from which the Cheviot was taken, and to which he was brought, were not compared; they were often as dissimilar as possible; it was therefore not to be wondered at if he sank under the unaccustomed hardships to which he was exposed. The Blackfaced sheep sent to the Cheviot hills would probably have yielded if exposed to similar trials. The cases, however, are exceedingly few in which the Cheviots have failed to maintain their ground, especially those that have been imported from their native hills; for with them it was a change of locality, but not of habit, or of food, or of climate. * * * There probably may be localities in which, on account of climate or of food, or possibly the want of food, they may fail when the native sheep of the mountains may maintain their ground.

A quotation from the opinion of a noted breeder is given to sustain this position. He is speaking of the Grampian Hills, and they will try the constitution of any sheep:

> On some of the more sheltered hill grazings Cheviot sheep have been tried and are thriving well. They pay better than the native sheep where the land is adapted for them, and it is admitted by many of the stock farmers that by a judicious arrangement on some of the extended farms Cheviots and crosses with the mountain sheep might profitably occupy a part of what is at present entirely occupied by the native Highland. But the most experienced agree that on the wildest of the Grampian pastures no other stock can exist but the Blackfaced mountain sheep.

* Low's Domesticated Animals of Great Britain.

These opinions were advanced many years ago, before the experience of 1860 and immediately succeeding years, and the spring of 1875, demonstrated that the Blackfaced sheep would live where the Cheviot died. Since that time a decided reaction has set in in favor of the Blackfaces; so much so that, instead of the Cheviots making further encroachments upon them, not a few stocks of the latter variety are brought, by gradual crossing and otherwise, to be Blackfaced. This reaction has been helped by the exceptionally high prices which can now be got for ewe lambs of the Blackfaced breed, a large number of which are being used for rearing cross lambs by Leicester and Lincoln sires.

There is another reason for the recent restriction on the extension of the Cheviots into the higher elevations. They were at one time a hardy, good sheep, but during the last twenty-five years they have deteriorated in the former respect very considerably. They have been bred too big and soft for any but the very best quality of hill grazings, and are little different in constitution from some of the lowland breeds.

The washed wool of the Cheviot sheep weighs about three and a half pounds to the animal, or about one-third more than the fleece of the Blackfaces, and is, on an average, 50 per cent better than the same weight of the Blackface wool, and the white Cheviot wool is more valuable in a still higher proportion. It was formerly used wholly for the making of coarse cloths. Since breeders have given more attention to the fattening properties of the sheep the wool has increased in length and diminished in fineness. Upon the introduction and extensive employment of Merino wool from Spain and Saxony it ceased to be much used for cloth manufacture, and was prepared by the process of combing in place of carding for the coarser manufactures. Finer than the Cotswold wool, it is advantageously mixed with English combing wool. The recent application of this wool, or a mixture of it, with fine Merino wools to certain cloths by the Scotch woolen manufacturers has led to the modern fashion of wearing coarse clothes for business and morning costumes. The basis of the Scotch cassimeres, tweeds, and cheviots is the coarse Cheviot wool spun with a mixture of fine Buenos Ayres wool. The fabrics from this material are liked for hot climates, and are in demand upon the continent. Even the manufacturers of Elbœuf, in France, so celebrated for their production of fine cloths, have been compelled to import the Cheviot wools, although they complain bitterly of the scarcity and high price. In view of these facts it can scarcely be doubted that the demand for coarse wools for clothing purposes will be likely to continue, and for the production of such wools no race appears so well fitted as the Cheviot.*

The quality of the Cheviot wool varies somewhat with pasturage, being finer when the shorter grasses prevail, and coarse where the herbage is rough and heathy.

The management of the Cheviot differs but little from that of the Blackfaced sheep, but as, for the most part, they occupy a lower range of mountains better means exist of supplying them with food during the winter season. Generally speaking they are suffered to go at large over the grounds assigned to them during the whole season, never taking a very wide range. The area required for each sheep varies from about two to four acres, according to quality. Their artificial food

* Bulletin of National Association of Wool Manufacturers, vol. III, p. 225.

is only subsidiary to the natural herbage that they can obtain from the farm. It is supplied chiefly when the ground is covered with snow, and consists of hay where this can be obtained from the grasses or clover of the farm. Turnips are supplied to help out the season of winter. The breeder is not necessarily the person who feeds them for ultimate use. He rears them to a certain age, and then transfers them to those whose farms enable them to bring them to the required maturity. This constitutes the great traffic between the farmers of the higher and lower country, and is a fitting division of labor and employment. Sometimes, however, when the breeder possesses low and cultivated ground in addition to his higher holdings he combines the business of breeding and fattening; but the principal, in fact the essential, destination of the higher farms is the rearing of stock to be fattened elsewhere on the lower lands.

The time of admitting the rams to the ewes, and consequently the period of lambing, depends principally on the situation and character of the farm; but Youatt lays down one rule applicable to mountain sheep farming everywhere, namely, that all other things being alike, it is much better, both for the mother and the offspring, to have the lambing time a little too late than a little too early. The inclemency of the weather will be more likely to be passed, the ewes will be a little recovered from the trials of the winter, the lambs will have less to contend with, and the ewes themselves, comfortable and in good condition, will be more kindly to their lambs and more careful about them. The rams, however, should not remain too long with the ewes, otherwise the ewes will be injured for the ensuing season. The average time for lambing in one of these farms would probably be from the middle to the end of April. It is the general practice to assign one ram to sixty ewes.

During the period of gestation the ewes feed on the natural herbage of the farm, but when heavy snows cover the ground a supply of hay is given them, which they will take only when all their efforts by scraping away the snow with their feet to get at the grass is unavailing. When turnips as well as hay are produced on the farm, some are given to the ewes when the ground is covered with snow, but it is particularly at the period of lambing that turnips are fed.

The time of shearing these sheep, on the mountain farms, is of considerable importance, and varies with the situation. The precise period is noted by the full growth of the wool, when it separates readily from the skin, when the new wool begins to appear; or, in other words, when nature begins to change the winter coat of the animal for a summer one. This is generally from the middle of June to the beginning of July. The general fault is that the wool, and particularly that of the wethers, is kept on too long. The sheep are first washed either individually by men standing in water pools and handling each sheep, or by swimming the flock two or three times across the streams of clean running water. After washing they are kept on clean ground for two or three days, when, if there be no rain, they are shorn, but it is generally thought better to wait seven or eight days, in which case the unctuous secretion which protects the wool has again been formed.

The weaning of the lambs takes place soon after the ewes are shorn, say from the latter part of July to the 10th of August, depending, however, on the nature of the pasture. It should not be before the middle of July, nor later than the last of August. It is

simply effected by a short separation of the lambs from their dams. In some cases the lambs are allowed to go on without being weaned at all, but such a system is undoubtedly injurious to the future progeny and is falling into disfavor. In some cases the lambs, or hogs as now called, are kept separated from the ewes, which gives an opportunity of supplying them with more generous treatment in stormy weather, but frequently they are allowed, shortly after weaning, to graze together. This gives them the advantage of a mother's care, for they generally recognize each other. It was formerly the general practice to milk the ewes for several weeks after the lambs were weaned, but this practice is now in disrepute, experience showing that the exhaustion and disturbance of the ewes rendered them less fitted to endure the severities and privations of winter. It is still the custom, however, to milk the ewes after weaning for a few days, so as to allow them to dry by degrees, but this practice is not as general as in former years. In the now rare cases where the custom of milking for several weeks still prevails, the milk is churned for the use of the farm, and twenty ewes yield about 5 pounds of butter per week.

In autumn comes the drafting of the old and undesirable stock. All the old ewes which have borne the required number of lambs, and are not likely to bring any more; such as are of bad form and not strong, or from any other cause undesirable, are gotten rid of by sale to the butcher. The ewes are generally sold at five or six years old, and are replaced by the best ewe lambs. John Usher says that ewes have their first lambs in April at two years old, which are invariably sold for producing a crop of lambs by Leicester tups. These, with the wether lambs, the small ewe lambs, and wool, usually form the whole produce of the farm. This applies to Cheviots in the southern counties of Scotland; in the north the practice differs considerably. There the wether lambs are not sold, but kept on till sold as wethers at three years old. The wether hogs are never wintered at home, but sent into winter quarters in Ross-shire and neighboring counties—some as far as Aberdeenshire—where they have the outrun, as it is called, on arable farms, viz, nearly the whole grass, on which they are kept till the weather becomes stormy, when they are folded on turnips. They are sent about the 10th of October and remain till the beginning of April. The cost of wintering varies from about 7*s*. to 9*s*. each. A cartload of turnips per day will suffice for about 150 animals.

Smearing the skins before winter with tar was formerly in more general use than at present, and is now confined to the more northern counties or the more elevated districts. Its disuse is on account of the injury done to the quality of the wool, and not that it was found not efficacious in preserving the health of the sheep. As a substitute for smearing with tar and tar and butter mixed, olive oil, mixed with turpentine, impure naptha, or other substances which serve the purpose of destroying vermin and removing cutaneous affections, were used, and these mixtures and the practice which employed them have now given way to the custom of dipping, similar to that which prevails with the Blackfaced sheep, which has been noted on a preceding page.

The old and, indeed, the modern management of the Cheviot sheep conforms much to that pursued in the case of the Blackface. The flocks on large farms are divided into companies or hirsels sufficient for one shepherd to attend. These hirsels are in a manner separate

and distinct farms in themselves. Each hirsel has a shepherd, and although undivided by fences, as a general rule, especially on the higher ground, the flocks of each are quite distinct and keep to their own ground. Trespassing is as rare between the sheep of different hirsels as it is between those of different farms. The natural conformation of the hills has assisted in the division of the farms into hirsels, the boundaries of which are usually marked by mountain streams or height and hollow.

Sheep left to their own free will would devour the herbage unequally, and the consequence would be that they would starve one another by grazing continually on the sweeter parts and leaving the coarse untouched. To prevent all this the sheep on each hirsel are divided into "cuts" or bands, and each cut has its own range or feeding ground, which is so apportioned that the sheep it carries receives a share of as much variety of soil and grasses as possible. The number of sheep in each cut varies according to the description and slope of the ground. On some farms, where the surface is even and regular in outline, the sheep in each cut may number as many as ten or twelve scores, whereas when the ground is irregular and difficult of access from two to five scores are about the average size of the cuts. As this practice has been quite fully noted when treating of the Blackfaced sheep, it will be unnecessary here to pursue it further; but it may be remarked that in the case of the Cheviot it is followed much less than formerly and is now more particularly confined to the higher hill farms, the treatment on the lower grounds more nearly resembling that of the sheep natural to the lowlands. Folding at night, too, for the purposes of farm manuring, is nearly or quite obsolete.

Professor Low notices the fact that the entire management of the Cheviot and other mountain sheep of the northern part of Britain has no parallel, it is believed, in the same latitudes in Europe. In no other country, similarly situated with respect to climate, are the sheep kept so entirely exposed to the inclemencies of the weather, without the shelter of pens and houses. The absence of wolves is the cause of that freedom which is allowed to these mountain flocks; and the shepherds have been taught by experience that the animals may be exposed by night as well as by day without harm. Were these sheep managed as in other parts of the continent of Europe, penned and fed in houses, and prevented from taking their natural food, the mountains of the country could not maintain one-fourth part of the present numbers.

A supply of food for winter and shelter in that inclement season are considerations much sought after in Cheviot hill farming, and upon which later years have seen much improvement. Hay is now generally provided sufficient to carry a sheep along three months, at the rate of 1½ pounds per day for the breeding ewes and 1 pound for the younger sheep. The necessity for hay led to inclosing certain portions of the land for the express purpose of raising it, and the hay thus grown is far superior to that cut from among the sheep's feet. The latter consists only of coarse grasses devoid of nourishment, which have previously been picked over by the sheep in grazing, whereas the former contains all the finer in abundance, and is as nutritious as summer pastures. Inclosures for hay have been followed by inclosures for other purposes, and general improvements by which the sheep have not only been better fed, but better sheltered; the lives of many saved during the winter drainage, which

has increased the quantity and quality of the grass and afforded a drier, more comfortable and healthy bed for the stock, by which the rot has been lessened and the general condition of the sheep improved. A certain portion of these inclosed lands is, when the land can be cultivated, set apart for turnips, which help out the winter's supply of food.

Another advantage of inclosures is that they insure quietude to the sheep and lessen the labor of the shepherd. Gentle herding is of great consequence to the well-doing of the flock, and the confining of the sheep to certain limits, well marked by fences, creates economy and an even cropping of the pasture not to be expected where sheep are allowed to run over great areas. Fences are made of stones, sometimes of turf or sods, but more recently of wire.

The value of shelter on mountain farms is now everywhere recognized. Where natural valleys and sheltered nooks exist these are utilized to shelter the flock from the inclement storms that sweep the high grounds in autumn and winter. Upon the approach of these storms the shepherd drives his flock to such of these places as afford shelter, and the instinct of the sheep itself carries it to these natural coverts. But the instinct of the sheep does not tell it that the lee sides of eminences are the very situations in which they may be overwhelmed with snow, which, when accompanied by high winds, fill up all the hollows in a few hours; consequently disasters occur so sudden and violent that whole flocks are buried under immense masses of snow. Dear experience suggested remedies, and it is now considered of prime importance and indispensable to a mountain farm that a shelter be provided where the flocks can be protected from storms and fed during their continuance. Inclosures, formed of trees thickly planted to break the force of the wind and catch the drifting snow, are sometimes formed, but the scarcity of cultivated wood at high elevations precludes the economical and general construction of these, and a simple substitute is adopted. This is an open inclosure, capable of containing a small flock of sheep, formed by a dry stone wall or turf, 6 to 8 feet high, generally circular and about 15 to 18 feet in diameter, with an opening and wing dike of say 3 roods long, running at a tangent from the circle from one of the posts of the gateway. The position of this inclosure or "stell" is selected with reference to its dryness and the general direction of the storms. Into these places the sheep are driven when occasion requires, and as a stack of hay is placed just within the gate they are not only protected from snow but are fed during its continuance. These "stells" are cheaply constructed and may be multiplied to accommodate all the sheep on the farm.

The Cheviot sheep, of such great economical importance in cold and tempestuous countries, has received the attention of skilled and energetic agriculturists and has been greatly improved in form and enlarged in size, and to use the words of one of his admirers—

> There is perhaps no finer animal of the sheep species than the Cheviot tup. Possessing the general conformation of the Border-Leicester, he is altogether a more stylish sheep, carrying his head higher, with greater fire in his eye and grace in his movement. Compared with the Leicester he is as a cavalier to an alderman.

Besides reproducing their own kind, the Cheviots are extremely valuable for crossing with the Border Leicesters, with which they amalgamate freely, the former giving hardiness, the latter great tendency to fatten. Upon this kindness in amalgamation a system

of breeding has been extensively pursued for producing first crosses. The rams employed are of the pure Leicester breed and the progeny shows an increase in size and weight of wool, though the wool loses in fineness. But the benefit ends with the first cross; pursued further and a loss of hardiness follows which unfits the Cheviot for its home. For general cultivation in the high and tempestuous situations in which nature has placed the Cheviot a less hardy sheep would not answer; therefore it has been the custom to preserve the Cheviot in its native purity and to make but one cross for an improvement that places it earlier and better in the market. And this cross is made on the lower grounds of Scotland and England. Usher says that by infusing the Cheviot and Leicester in different proportions other breeding stocks are raised suited to medium soils and temperatures. Thus, taking the Leicester as the center of agricultural improvement, the others may be said to radiate. First, we find three parts bred in the intermediate; next half-bred in the higher altitudes; then we come to Cheviot entire on their native mountains; and above and beyond them the Blackfaces, among their fastnesses of rock and purple heather.

Efforts to amalgamate the Cheviot and the Blackfaced sheep have frequently been made, but without success. Experience shows that the progeny is inferior both in shape and quality, and the practice is not commended.

Other crosses of the Cheviots have been attempted, but with small success. One of the earliest of these of southern blood was that with Southdown, a sheep that never did well in the North. Early in this century an attempt was made to improve the quality of the Cheviot wool by crossing a considerable number of the best ewes that could be selected from the flocks of the principal sheep farmers with two Southdown rams, purchased at a very high price from Mr. Ellman, of Glynde. The experiment was pursued during several successive years, but totally failed; the produce not having sufficient hardiness to endure the severity to which the Cheviots are usually exposed. At a later period the experiment was repeated in the county of Sutherland. A Southdown ram, very carefully selected, was put to a number of Cheviot ewes, with rather coarser wool than usual. This was continued five or six years, the seasons being favorable, and it began to be imagined that a cross breed of considerable value had been established; but in the winter and spring of 1816 came a frost—a killing frost—and not one of the mixed blood was left alive upon the farm.* Subsequent efforts have met but little better success, and serve but to amplify the proof of the position taken by Darwin, that where nature has planted a breed peculiarly adapted to its surroundings man can make but little improvement that is permanent. This eminent scholar, naturalist, and philosopher says:

> It has often been observed that breeds of animals inhabiting wild and mountainous countries can not be permanently modified by our improved breeds; and as these latter are of modern origin, it has been thought that the greater antiquity of the wilder breeds has been the cause of their resistance to improvement by crossing; but it is more probably due to their structure and constitution being better adapted to the surrounding conditions.†

The English and Scotch Cheviot of the present day may be described as hornless, with white face and legs, remarkable for their snowy

* Youatt.

† Animals and Plants under Domestication. Charles Darwin, Am. Ed., vol. II, p. 39.

whiteness, and a striking characteristic of the breed is their extraordinary likeness to each other. The fault of the Cheviot is the narrowness of the back, ribs, and shoulders, which renders them incapable of carrying a large accumulation of mutton. Good judges, therefore, choose those with broad faces, because this characteristic is indicative of a broad, bony development. The body of the Cheviot is long; the forequarters somewhat light; the legs clean, and small turned; the feet thin; the wool close and fine, but neither so soft or so elastic as that of the Southdown. The improvement of the sheep, owing to a mixture of the Leicester blood, has added a little to the breast and shoulders; neither has it diminished its feeding qualities. The neck and shoulders are fuller. The breast has become slightly prominent, but is still narrow. The back retains its narrowness, but the fall behind the shoulders, common in the old breed, has been filled up. The ribs are still flatter than either the Southdown or the Highland. They bear traveling and driving better, perhaps, than any other kind of sheep, and are sometimes driven very great distances.

The Cheviot mutton is finer in the grain than the Leicester, and is very tender and delicate. It is neither so bright nor so high colored as that of the Southdown or the Highland, but it has somewhat of its high flavor, and the fat is more dispersed than in the Leicester. They are now sometimes fatted at one year old, and the flesh resembles in appearance, when well kept, the Welsh mutton; though more tender it is not so highly flavored.

The question, when Cheviot and when Blackfaced sheep should be selected for breeding and rearing on mountain pasture, depends upon circumstances of herbage. When the produce of the hills is simply black furze or heather, the Blackfaced Highland sheep will be preferable. When the grass is green, though ever so poor, the Cheviot will pay a greater amount of profit.

The following, taking this principle as to the comparative merits of the two breeds, is laid down by a Scotch writer who is an enthusiastic friend of both of them:

Blackfaced.	*Cheviot.*
Wool inferior.	Wool superior.
Mutton superior.	Mutton inferior.
Hardiness equal.	Hardiness equal.
Maturity later.	Maturity earlier.
Feeding less rapid.	Feeding more rapid.
Less mutton.	More mutton.

The balance, on the whole, on suitable lands, seems to be decidedly in favor of the Cheviots.* Others contend, and experience seems to be on their side, that the Cheviot is less hardy than the Blackface. It may be accepted as true, however, that no animal has conduced so much to the prosperity of the Scottish farmer as the Cheviot sheep, and more especially to those who have engaged exclusively in hill farming. This may be partly attributable to the fact that stock farming is generally embarked in by men of capital, as it involves a considerable immediate outlay, and the farm being usually large, competition for them is necessarily limited; whereas arable farms are competed for by men who have made money in other walks of life, and the demand being greater than the supply, rents have in many

*D. G. F. McDonald, in Cattle, Sheep, and Deer; 1872.

cases become exorbitant. Stock farmers are, besides, not nearly so much influenced by the weather, and their expenses are nothing in comparison. The practical working of the stock farm is managed by a few shepherds, a class of men in the rural districts of Scotland distinguished for great moral worth and simplicity of character. They receive their wages in the grazing of one or more cows and a certain number of sheep. They are thus small capitalists, and their interests are identical with their masters'. In arable farming, a very serious increase has of late years arisen in the expense of cultivation, not only by the rise in wages of agricultural laborers, but in implements, machinery, and in fact every department of skilled labor connected with the farm. During the last few years severe winters and lower prices of sheep, lambs, and wool have put hill farmers much upon a par with the cultivators of the soil.*

The Cheviot sheep were imported into the United States about 1840, and before that into Canada, where they do remarkably well. In the various mountain parts of New York State they are found to stand the cold weather admirably, and it is believed that they would form a valuable addition to the mountainous regions of Idaho, Montana, and Wyoming.

The Wensleydale sheep.—This sheep is sometimes known in the south of Scotland as the Yorkshire; its origin is not certainly known. It takes its name from the locality in the north of England, where it has been bred for one hundred years. Professor Scott, of the Royal Agricultural College, writing to the *Yorkshire Post* some years ago, said: "The origin of this breed was somewhat involved in obscurity. The sheep bred in Upper Wensleydale about two hundred years ago were the black-faced horned, and in Lower Wensleydale the white-faced horned. The latter disappeared entirely about eighty years ago. About one hundred and twenty years since another breed was introduced called Mugs, which were no doubt a branch of the old Teeswater breed. The present race is undoubtedly descended from them." The editor of the Wensleydale Flock Book says that he has no means of knowing how or when the white-faced horned disappeared from Lower Wensleydale, but that the Teeswater took their place admits of no doubt. A Mr. Robinson, who was a Yorkshire yeoman and lived on his own land at Edgby, and who bought both fat cattle and sheep in North Yorkshire and South Durham and sold them at Skipton market after having driven them up the valley of Wensleydale the latter part of last and the early part of the present century, left his son Ralph one of the best flocks of Mugs, as they were at that time called. At Ralph Robinson's death his brother, Henry Robinson, succeeded him at The Cliffe, near Leyburn, and up to his death in 1887 kept them and won prizes at local shows, and sold his rams to most of the best breeders of the dale.

"Everything points to the present breed being the descendants of the old Teeswaters; the same ewe will frequently have one lamb with a very blue head; the other will not be blue but have a dark nose, with black spots on both face and ears. The black spots were the chief characteristic of the old Teeswaters, and as a proof, last year (1889), at the royal show at Windsor, the judges of Border Leicesters disqualified two rams because in their opinion the black spots on their faces and ears told of their descent from the old Teeswaters. Mr. A. Trotter, of Danby, whose ancestors had bred

*John Usher, in Cattle, Sheep, and Pigs of Great Britain. London, 1887.

Teeswaters in both North Yorkshire and South Durham for three generations on both banks of the Tees, came into Wensleydale in 1827, bringing a flock of Teeswaters with him, and the greatest proof that the sheep in the dale were Teeswaters was that he used Wensleydale rams and sold his own rams to other breeders in the dale."*

The Wensleydale sheep have had great success in crossing with other breeds of sheep on high and exposed situations, and when once tried for crossing purposes on mountain sheep they are rarely given up, frequently serving ewes on ground from 1,000 to 1,400 feet above sea level. Large numbers of the rams are sent every year into Scotland to cross with Blackfaced ewes. This began about 1840. Mr. J. MacQueen, a breeder of south Scotland, keeps about 1,200 Blackfaced ewes for crossing purposes, and uses only Wensleydale rams. He tried Shropshires, Oxford Downs, and Border Leicesters, but preferred the Wensleydales. The rams are hardier and the lambs finer, and sell for more money. This cross of the Wensleydale and Blackfaced ewes have been shown and sold at Masham for many years, and are known to the trade as *Mashams*. The Wensleydales have been much improved within the last fifty years, to which they are indebted to the noted ram Blue Cap, a cross from a Leicester ram and a Wensleydale ewe, and it is through this cross that the blue faces were introduced into the flocks.

The breeders of these sheep claim that "the great utility of the Wensleydales lies in keeping up their own breed, and especially in crossing inferior breeds. Their own good properties are that they are good breeders, excellent mothers, good feeders, have a good leg of mutton, and a class of wool that makes a price equal to any Leicester wool. They frequently produce 70 to 80 per cent of twins, and when crossed with the Blackfaced mountain or Cheviot and the produce of a second cross are called three-parts bred, and frequently produce sheep that at twelve to fifteen months of age weigh from 90 to 100 pounds. The cross-bred ewes appear to inherit all the Wensleydale prolific breeding properties, and their large legs of mutton and lean flesh in the carcass make them great favorites with the butchers."

The general character of this sheep is its hardiness, and a tendency to accumulate flesh rapidly. It is a stylish, upstanding animal, with a strong coat and moderately fleshed back. The face is dark, head broad and flat between the ears, a tuft of wool on the forehead, and the eyes bright and full. The neck is well set on the shoulders; the shoulders broad and oblique; the chest deep and wide; the ribs well sprung and deep; the loin broad and covered with meat; the legs are straight and a little fine wool below the hock, fore legs well set apart, hind legs well filled with mutton. The skin is blue, fine, and soft, and the wool a bright luster, curled all over the body, all alike in staple.

The Herdwick sheep.—The Blackfaced and Cheviot just described may be considered as the sheep of Scotland, though extending also into England. For hardiness, a breed in the mountains of Cumberland may be considered as allied to them and as forming the transition from the sheep of Scotland to the sheep of England. This is the Herdwick, the most valuable sheep on the mountains of Cumberland, of whose origin and introduction into the country nothing is known, though a vague tradition says that the original parents came out of

*Wensleydale Flock Book, vol. I, 1890.

one of the ships of the Spanish Armada. Youatt says that in the beginning of the last century a ship was stranded on the coast of Cumberland that had on board some Scotch sheep which seem to be now unknown in that country. They were got on shore, and being driven up the country, were purchased by some farmers who lived at Wasdale-head, in the neighborhood of Keswick. They were small, active, polled, and their faces and legs speckled, having a great proportion of white, with a few black spots strewed upon it. They were turned at once upon the neighboring hills. They had not been there long before they evinced a peculiar sagacity in foreseeing the approach of a snowstorm, for, a little before its coming, they clustered together on the most exposed side of the mountain, where the violence of the wind usually prevented the snow from lodging. This instinct caused them to be regarded with a degree of interest, and almost of superstition; and their excellent qualities and adaptation to their new situation became speedily evident. Their fleece was considerably finer than that of the common Blackfaced sheep, and the matted quality of the wool enabled them to endure any severity of weather, and even to pass the whole of the winter without the smallest quantity of hay being expended upon them. They were continually moving about, and therefore rarely or never overwhelmed with snow; and by their ceaseless activity they scraped away the snow, however deeply the herbage might be buried under it. According to Millburn—

> They are very small and lively, and are polled, have speckled faces and legs, short and rather fine wool, weighing about 2¼ pounds per fleece. The ewes weigh 6 to 8 pounds per quarter, and the wethers perhaps 11 pounds. In winter they scratch down to the breast through the snow, and live on a small amount of very poor food. They are said to be more hardy than almost any others; and rams of this very diminutive breed are sometimes purchased to improve the hardiness of other breeds, though they must also influence their size.

According to another writer a very remarkable characteristic of the breed is that they have fourteen ribs instead of thirteen, the number possessed by all other sheep. It is believed, however, that this latter peculiarity was confined to a distinct strain of this sheep about Seathwaite, and that as a distinct strain it no longer exists; yet individual sheep possess this peculiarity, and a noted breeder records instances as not uncommon in his own flock, and that he does not notice any other peculiarity or difference between them and sheep possessing the normal number of ribs.

The breed existed for a long period in the neighborhood of Muncaster, in the Dudden and Esk districts, before it spread all through the lake district of Cumberland, Westmoreland, and Lancashire, superseding the smaller Blackfaced heath variety once so commonly met with on the sheep farms, and also the old Fell breed, which, tradition says, was white-faced and horned, larger than the Herdwick, but neither so hardy nor such quick feeders. From the fact that these sheep belong generally to the proprietors of the sheepwalks and have been farmed out with them from time long past, in herds of from 300 to 1,000, they have obtained the name of Herdwicks.

The Herdwicks are active, with considerable wild nature in their composition, and with jumping powers and proclivities that are marvelous. They are said to run up dry walls like cats, and if they can not run up they will leap great heights. Ewes which have been sold have been known near lambing time to travel great distances in

order to lamb in their old haunts, jumping fence after fence and crossing streams; and if one should happen to lamb on her journey to her old home it does not delay her long, as her lamb is soon on its feet, and once on them can travel nearly as fast and as far as the mother. This natural attachment of the Herdwick to its own ground or that part of the grazing where it generally feeds is seized upon by the shepherd for knowing that all his charge is right, for mentally dividing the fell into certain tracts he expects to find in them certain sheep. However, some straying does take place.

As a rule they give but little trouble in their rearing and management; in fact, they do their own management tolerably well. In hard weather or snow they make for the exposed places, where they are not likely to be drifted up, and afterwards scratch down till they reach the grass. Occasionally a thick, soft, heavy snow comes on so suddenly that they are drifted up almost unawares, and in this state of being literally buried alive they have been known to live for three weeks, and after being taken out recover and do well, their only subsistence having been what they could reach from where they lay.* Only in the hardest weather is it necessary to feed them hay; then some of it is taken up in the high grounds in sheets or strapped on men's backs, but unless accustomed to it, as lambs or hogs, the sheep will almost starve before eating it.

The lambs dropped in May are well protected by wool, and the wethers are in their prime at three years or four years old, and weigh about 10 or 11 pounds per quarter when fat, and the ewes from 7 to 9 pounds. Notwithstanding the scanty herbage on which they are fed they are generally slaughtered as they come from the hills, and are supposed to be most in season, and their meat to possess a superior flavor, from June till September, when the heath plants are in bloom. When killed at home the legs are usually cured and dried, the same as pigs' hams; and a Scotch writer informs us that it is jocosely said that the inhabitants of these uplands never eat mutton, but when they find a fallen sheep they shake it by the leg and if it drops to pieces it is rejected, but if not it is carried home, dressed, and eaten. "This," adds our writer, "will certainly be gamish enough for the most depraved palate; but it is remarkable that the strong heath-like flavor is the one which the epicures chiefly seek after in purchasing their mutton in the markets of large towns."

The ewes, like those raised on the Welsh mountains, will breed for ten, fifteen, and even twenty years; and are always kept as long as they will continue to do so, the sales being made of the fatted wethers.

The wool is rather shorter in staple and finer in quality than that of the Blackfaces, and commands a higher price in the markets. It has greatly improved in recent years, and though still grayish, is nearly free from the kemps or gray hairs that used to disfigure it. Formerly the fleece weighed but 2 or 2½ pounds; now it will average about 3½ pounds, though where attention has been paid, and there has been no overstinting, they will reach 4 pounds, and some flocks have been known to average nearly 4¾ pounds.

Like all other sheep of Great Britain worthy of preservation, the Herdwicks have undergone improvement, and a description that would have been correct years ago would not be applicable now. Now, the legs and faces of this breed, as lambs, are black, or black

*H. A. Spedding, in Coleman's Sheep of Great Britain.

with a few white flecks; but they soon begin to brighten out, till, by the time they are two years old, all that was black has become a frosty or silver gray, darkening slightly toward the forehead, except a blue-black mark or patch at the back of the neck; any brown tinge is a defect, it being considered a less hardy color. The eye should be bright and good, and the forehead broad, with a tuft on it; the ears should be white and sharp, and the wool should come well up to them, and in the case of tups form a kind of mane or heckling of a dark color. They should be wide between the fore legs, with the breast well forward, and be well ribbed up to endure hardships; the hind legs should be straight and well muttoned down to the hocks; the knees and feet should be large, the latter white, and the bone between them fine; above all, a Herdwick should stand square and walk well. The ewes are not horned, but the tups generally are, though not always; when they are, the horns should be white and waxy, and, rising well out of the back of the head, curl once or twice. Of course, most sheep fall off more or less from this ideal, but the commonest fault is a slackness behind the shoulder. There is also in every flock a certain proportion of darker colored sheep, and these "breuked" ones, as they are called, are often of the best blood; they are not by any means disliked as long as they are of a black and not a brown tinge, for many people deem them hardier, and also consider them useful in keeping up the distinctive markings of the breed; in fact, some very dark colored tups have been great prize winners.*

The Herdwick is crossed with the mountain sheep to improve the hardiness of the latter, and the progeny is variously colored about the heads and legs, some being white and others speckled, and not a few perfectly black. They are horned, high-shouldered, narrow-backed, flat-sided, and with coarse and rather long hair.

The Lonk or Lanks sheep.—These hardy mountain sheep originated in the hill ranges or mountains of Lancashire and Yorkshire, but have extended themselves to the peaks of Derbyshire on the one side, and through the mountain ranges of the north of England even to Scotland on the other. Their faces are picturesque, being streaked black and white, as are also the legs. They have large and beautifully curved horns of a yellowish tinge. They are very hardy and often graze almost equally well with the Cheviots.

Some maintain that the pure Lonk should be copper-colored on the nose, and have the face and legs of the same hue, but fashion differs on this point. A white face is generally avoided as soft, and any approach to a brindle shade is indicative of cross breeding. They are light in the fore quarter. Their scrags are rather light and their legs long, and the loin often lacks strength. The lambs shoot their horns with the new year, and the wethers never go beyond one curl. Breeders make much of the horn, and consider its strength a great proof of constitution. It ought to be self-colored and finer than that of the Blackfaced, but it should come out square from the head, with the same fine, gentle curl.

The live weight of a wether fit for slaughter at four years old is about 110 pounds, a ram 130 pounds, and a ewe 90 pounds. A dressed wether, excluding head and feet, gives 70 pounds of meat, a ram 70, and a ewe 52. The lambs are remarkably strong, hardy, and agile to that degree that in a short time after birth it is difficult

*Coleman's Sheep of Great Britain.

to catch them, and so lively are they that immediately when dropped, even on a bed of snow, they are on their feet in a few minutes, and after partaking of their natural food can trot along almost as rapidly as their mothers. At the age of one year they are good-sized sheep, producing a valuable fleece of wool. The young ewes bear lambs when two years old, and will stand for stock purposes until five or six years old, when they are usually sold off to lowland farmers, who put them to a Lincolnshire or long-wooled ram. The lambs so crossed are of superior quality and command when four months old good prices in the English markets.

As a rule the wethers are permitted to run on the mountain until they are three years old, when they are brought down to the grass land for a few months, and then sold for the market, when their mutton is much esteemed.

A cross between a Lincolnshire ram and a Lonk ewe makes better mutton if reared entirely on grass land. If lambs are intended to be brought up on the high grounds or mountains, they must be kept pure, as a cross with an open-wooled sheep would render them totally unsuitable for mountain life; but a cross between a heavy, long-wooled ram and a Lonk ewe produces one of the very best ewes for low grass land, carrying wool long, fine, and of excellent quality, and as a store ewe having no superior, and thought by some to have no equal.

The wool of the Lonk is used principally in the manufacture of the finest blankets, the staple being too long for cloth. It is soft and silky, equaling in fineness that of the Southdown, and commands a higher price than any other Scottish wool. The average weight of one year's clip from a ewe is 7 pounds, washed; from a ram 10 to 12 pounds, and from a wether 9 pounds. The staple of a ewe's wool is 5 inches in length, of a ram's 7 inches, and of a wether's 7 inches.

The general characteristics of this sheep recommend it in every way as peculiarly suitable for high hills and mountains where the pasturage is principally heather and bushes, and for such situations it is doubtful if they have any superior, unless it be the Blackface and the Herdwick. Being hardy, strong, agile, and close wooled, the high winds and drizzling rain which so often accompanies such winds on the mountain sides are unable to shed open the fleece and penetrate to the skin; nor does their wool easily become entangled in the shrubs and bushes; and as they are remarkably well wooled with a thick, solid fleece on their breasts and bellies, they can withstand severe cold and even lie down on a bed of snow, which they do very often without apparent injury or discomfort. Their lambs, too, when born, are clad in a thick, close fur. Their feet are uncommonly hard and naturally adapted to steep, rough, and strong ground. The rams of this breed are remarkably strong and courageous, and being provided with large horns are more than a match for those of any other breed with which they come in contact.

There is another sheep peculiar to Lancashire, found mostly from Warton Crag, in that county, and extending into Westmoreland to the lake district of the mountains, the home of the Herdwicks. This is the *Limestone-Crag sheep* which feeds on lower ranges of hills than the Herdwicks, and is said to thrive on land where other sheep would die—certainly a great consideration; otherwise they have no merit.

The various breeds of mountain sheep are kept on grounds to which they are best adapted and on which other breeds could not thrive.

Their mutton is superior, especially with one cross. Their wool is generally mixed with gray, and the breech large and very coarse. English and Scottish farmers and growers, with an experience of centuries, oft-repeated and dearly paid for, have found which class of sheep are best adapted to given sections of country, and they keep those sheep on the soil to which they are best fitted. Nature is no longer antagonized, but, instead, improvement follows where her footsteps lead, and mountain sheep farming, like sheep farming elsewhere in Great Britain, has been reduced to an exact science.

The Old Norfolk breed.—From time immemorial there has existed on the higher lands of Norfolk, Suffolk, and Cambridge a remarkable and peculiar variety of sheep, which from its greater numbers in Norfolk has been known as the Norfolk sheep. These sheep, once very numerous, are wild and hardy and well fitted for the heaths and other districts of scanty herbage. Their limbs are long and muscular, their bodies long and slender; their general form indicates strength and activity, and accordingly they are regarded as well-fitted for long journeys and the rough treatment of the fold. Luccock, in writing of these sheep at the close of the last century, observes that individuals of the pure blood had horns and remarkably black faces and legs. The visage was long and thin, very flat in the front, and pointed towards the extremity. The carcass was generally narrow, long, and light, and in many respects the animal resembled the deer or the antelope; and it expressed both in its motions and by its eye a great degree of timidity. The horns of the ewes and wethers were of a middle size and somewhat straight, resembling those of the Dorset ewe; the horns of the lamb long and spiral, like those of the old Wiltshire ram. The loin was wide according to some authorities, but to most observers it seemed narrow, and the hind quarters were sufficiently large for the general make; but there was a deficiency in the fore quarters. The shoulders were low and the chine sharp and unsightly. The wool was short and fine but small in quantity, giving but 2½ to 3 pounds to the fleece, possessing sufficient felting properties to fit it for being made into coarse cloths. As undesirable as this sheep would appear at the present day, Luccock remarks that what he described was a sheep that had undergone great improvement, and that in times not very remote its wool was kempy, rough, and thin, but the introduction of a new mode of husbandry, particularly distinguished by the name of the Norfolk, roused the attention of the farmers and fixed it upon those general objects which were connected with their calling. While at that time it did not much excel the heath sheep of other districts, yet its quality of thriving to a certain extent with coarse and scanty food and its great utility as a folding sheep could not fail of directing the anxious care of the Norfolk farmer to its preservation and improvement. In the course of a few years the improvement of the sheep showed itself in a great change in the wool; the color was superior and the coarse buttock wool disappeared.

Low institutes a comparison between the Norfolk and the Blackfaced sheep; they had much of their aspect in common, but differed in the fact that the limbs and body of the Norfolk were longer, and the fleece superior to that of the Blackfaced in being soft and suited for felting. Youatt thought the Norfolks were better folding sheep than the Southdowns, but that the latter were better suited to a country in which the system of inclosures had made considerable progress. The Norfolks possessed the property of doing well on

coarse sour pastures, such as would be frequently found in a district beginning to come under arable cultivation, and which the Southdowns could scarcely be induced to touch, and certainly on which they would not thrive. The Norfolks were favorites with the butchers, for they carried quite as much loose fat as any other sheep of their weight, and, generally speaking, considerably more kidney fat than any breed whatever. On the other hand, the tractable, contented disposition of the Southdowns rendered them far more valuable than the wild and restless Norfolks. The Norfolks were first crossed with the Southdowns, and with evident advantage. The Southdown was subsequently substituted for them and the Norfolks are now confined to the higher grounds of their ancient homes.

The Suffolk sheep.—This new breed is a cross between the Norfolk Blackfaces of half a century ago and the Southdowns, probably improved with Hampshire Down crosses. It was first described in August, 1883, by H. Kains Jackson in *The Field*, and we follow his account. They are extremely dark, so far as face and legs go, and the blacker they are the better. The meat of the Suffolk is juicy and lean and the mutton is much in request in various centers. The breed is active and hardy and can live where many varieties would famish.

The Penistone sheep.—Connected with the Heath breeds or mountain sheep, though distinguished from them by extreme coarseness of their forms, especially at the extremities, and the large, muscular and bony character of their long tails, are the Penistone sheep, so named from the market town of Penistone, lying a few miles to the south of Huddersfield, in the West Riding of Yorkshire, and to which they are usually driven for sale. They inhabit a very limited tract of the coal formation on the confines of Yorkshire, Lancashire, and Derbyshire, and subsist on the coarse and heathy herbage of the greater elevations; on the lower slopes they have merged into crosses that have been made with other breeds, chiefly with the Leicester. The weight of the fleece is from 4 to 5 pounds, the wool being of a silky appearance and medium length, but harsh and wiry, and only fitted for the coarser fabrics. They have mottled faces and legs; some, however, have white faces and legs. The rams are much larger than the ewes and have large horns lying close to the head and projecting forward. They are very coarse in form, having bony legs, large feet, heavy shoulders, and flat sides, and a long and clumsy tail. This enlargement of the tail is peculiar to this sheep and is merely muscular and bony and not at all analogous to the growth of fat which we observe on the tails of some Eastern sheep. The sheep feed well and their flesh is esteemed for its flavor and juiciness. It has been a matter of some surprise that this coarse sheep should maintain itself in the center of England, on the borders of districts noted for their breeds of sheep. The answer is that the small district, 26 miles by 20, is not sufficiently fertile for the Leicester and other improved sheep, and the old Penistone has been found so hardy and well adapted by nature that man has been little disposed to make a change.

The Old Wiltshire.—The Old Wiltshire was a race of sheep extending over the greater part of Wiltshire and was found also in considerable numbers in North Devon, Somersetshire, Buckinghamshire, and Berkshire, where they had ranged before the Roman invasion and up to the beginning of this century, when they were only found pure on one farm near Hindon, bequeathed on the condition that a

flock of this breed should be preserved pure, the former owner adopting this expedient for perpetuating the existence of his favorite breed against the encroachment of the Southdown and other superior sheep. The last flock of this breed disappeared about 1819, and the substitution of the Southdown commenced late in the last century.

They were the largest short-wooled sheep of England. Their heads were large, coarse, and clumsy, with Roman noses and wide nostrils. Both the male and female had horns curling back behind the ears. They had flat sides, were high in the withers, and sharp in the spine; had long and thick limbs, even to awkwardness, but they were very active and hardy. Their legs and faces were white. They had no wool on the belly. Their wool was of medium length and very fine, though scanty, weighing about two and a half pounds to the fleece. The mutton was of medium quality, and the wethers, although fattening slowly, attained a good size.

Although adapted to the chalky inland hills on which it was raised, and its wool in great request, with large numbers of the fattened sheep finding a ready sale in London markets, the introduction of the Southdown entirely superseded and displaced it, either by direct substitution or by crossing it until its distinctive characters had been lost. In many cases Southdown ewes as well as rams were brought out of Sussex to replace the horned home flocks, but in numerous instances the two breeds were crossed, and by the continued use of the Southdown ram the chief characteristics of the horned breed were merged into the Downs. The cause of the very rapid substitution of the Southdown for the Old Wiltshire may be found in the fact of the large number of inclosures of common fields which then took place. The sturdy horned wether was thoroughly competent to take care of himself when the system of feeding in common prevailed, but when each farmer could keep his flock separate an animal of superior quality was preferred.

This displacement of the ancient sheep was stoutly resisted by the older farmers, who looked upon the tall Old Wiltshire as the best in the kingdom, and who prophesied that the little black-faced Southdowns would not leave a pile of grass in the country.

The Old Wiltshire has some interest to the American reader from the fact that it was one of the English sheep earliest brought into New England at the first settlement of the country.

The Wiltshire Down.—The first effect of a cross of the Old Wiltshire with the Southdown was the production of a sheep which, though of short existence, may be termed the Wiltshire Down. It had many of the characteristics of the Old Wiltshire, but more of the Southdown. It had lost the horns of the old breed and had taken on the black face and legs of the Downs. The same causes that operated to substitute the Southdown or Wiltshire Down for the old breed, the inclosures of commons, operated also to merge the Wiltshire flocks as also those of Dorset into the improved Hampshire Downs. Large areas of the down pasture lands were broken up, and a little later artificial manures were introduced. These conditions induced the farmers to largly increase the growth of artificial crops for sheep feed, such as turnips, rape, vetches, clover, rye, and Italian rye-grass. The consumption of these artificial crops by sheep led the breeders generally to turn their attention to the system adopted by the Hampshire men, of selling their wether lambs in the late summer or early autumn, instead of keeping them, as was then the custom, until they became two-teeth or four-teeth

sheep, when they were sold at a smaller price than the lambs now realize. Under these conditions it was important to secure early maturity and greater size, and the flockmasters, with very few exceptions, at once crossed with the Hampshire Down, and now successfully compete at all the early fairs with their Hampshire brethren.*

The Old Hampshire.—The Old Hampshire sheep may be referred to a group which inhabited a portion of the midland chalk counties of England until a recent period, of which the Old Wiltshire breed may be regarded as the type. They were horned, had the faces and legs white (though in some cases speckled), long limbs, and lank bodies. This ancient sheep has been crossed with the Southdown to such an extent as to have lost its original character.

The Old Berkshire.—Allied to the Old Hampshire, sometimes even confounded with it, was the Berkshire, an old breed of sheep feeding on a light, sandy, and barren soil. In the center of Berkshire this old breed was found in greatest number. Most of them were horned, but some were polled. They had generally black faces, Roman noses, black or mottled legs, and long tails; some few, however, had white or mottled faces. They were strong, active, and tall, and folded well, and when fattened grew to an enormous size, but it generally took a long time to fatten them. These sheep were next in weight to the old Leicester breeds, but higher than them on the legs. The wool, although somewhat coarse, ranked among the short varieties. The first cross of this breed was with the Wiltshires, and was not altogether satisfactory; then the Southdowns gradually spread in the district and effected a complete revolution in the character of the sheep, and with few exceptions the Berkshires are now either pure Southdowns or very deeply crossed by them. A new breed, or rather an old one immeasurably improved, was the result, which now claims our attention.

The Hampshire Down sheep.—These sheep are bred on the chalk formations of Berkshire, Hants, Wilts, and Dorset, and occasionally are found in Sussex and Surrey. Youatt says the black-faced sheep of Hampshire are a cross between the old black-faced Berkshire and the pure Southdown. The modern Berkshire owes its best qualities to the same source, and the Wiltshire became but a variety of the Southdown. Robert Smith, a noted English breeder, in a communication to the Royal Agricultural Society's Journal, in 1858, stated that the Hampshire sheep were closely descended from an original hardy race peculiar to the county. Their strength of constitution and size have been retained, and are characteristic of the animal. Prof. John Wilson, in his report on British sheep, published in 1855, said that this rapidly increasing breed appeared to be the result of a cross between the pure Southdown and the old horned sheep of Hampshire and Wiltshire, by which the hard working though fine quality of the former was combined with the superior size and constitution of the latter. The breed was commenced at the early part of the present century, and by a system of judicious crossing possess the leading characteristics of the two parent breeds. E. P. Squarey, in his treatment of the "West Country Down sheep," asserts that the breed undoubtedly dates its origin from the crossing of the Old Wiltshire horned sheep and the Old Berkshire Nott with the Southdowns, which were introduced into Wiltshire and Hampshire early in the present century.

* E. P. Squarey on the Hampshire Down Sheep.

For a long time after the displacement of the Wiltshires and Berkshires, the charming character and high quality of the Southdowns which superseded them satisfied the most advanced of the farmers of Berks, Dorset, Wilts, and Hants, and only when they came to realize how much they had lost in the size, early maturity, and hardiness of the Old Wiltshire type, as represented in the Old Wiltshire itself and the Berkshire, did they bethink them of going back to those animals for additional substance and development to the Southdowns. Then they began a system of crossing with Hampshire rams with varying degrees of success, depending simply on the instinctive capacity of the farmer to properly select the animals for this purpose. Whilst one aimed at the production of a large-framed long-wool producing, hardy animal, another devoted his attention to the maintenance of the high quality and beauty of the Southdown, with earlier maturity and greater size. The consequence was that from about 1815 to 1835 the Hampshire Downs of the north of Hants and the south of Wilts were totally dissimilar in character. It was evident that the leading ram breeders of each district had aimed at and secured a different type. The North and East Hampshire sheep were large, muscular, early maturing animals, growing a fair quality of wool of moderate fineness; the head large and well set on, of dark brown color verging toward black, covered with coarsish hair, with Roman nose; the neck with greatly developed muscles; the ears thick, of the same color as the face, and an occasional tendency to recur to the original type by producing "snig horns;" the legs with large bones, and in the most strongly marked type the wool growing below the hocks and knees. An occasional white spot was exhibited on the face, ears, or legs, but the efforts of the ram breeders were uniformly directed to avoid this, and to procure perfect uniformity of color. On the other hand the Wiltshire breeders had adopted a more largely framed and probably less handsome animal than their Hampshire brethren. They were less careful as to the uniformity of color, and an ewe with speckled face or ears was not dismissed from their flocks, provided she had size and other good qualities.*

The Hampshire breeders, as a rule, selected the largest, coarsest, and blackest faced Sussex or Southdown rams, which it was thought would suit the coarse sheep with which they had to amalgamate. How many crosses were made is not known, but enough materially to alter the character of the breed, to cause the horns to disappear, and to change the color of the face from white to black; to impart a more compact form, a broader back, rounder barrel, shorter legs, and superior quality altogether, and yet preserving the hardiness and disposition to make early growth, which the original flocks possessed, and with it the large head and Roman noses which form so distinguishing a character of the Hampshire Downs, and which are derived from the original breed. Having thus formed a sheep desirable in every respect, except the size of the head, the breeders began reducing the size of the head, which, by careful selection, was accomplished, and finally a breed was formed or rather established admirably adapted to the system of fattening off at earlier ages than formerly.

The Hampshire sheep may therefore be instanced as an example of successful crossing, and as a proof of what can be done by the male parent in changing in a

*The Hampshire or West Country Down Sheep, by E. P. Squarey.

very few generations the character of the originals, and yet retaining some of its good qualities, thus forming a breed more intrinsically valuable than either source from whence it is derived.*

Mr. Spooner had no reason to believe that after a few generations the Hampshire breeders continued to use the Southdown rams. As soon as the Hampshire's horns were gone, to which perhaps the Berkshire Notts contributed, and the white face had become black, they employed their own cross-bred rams with their cross-bred ewes, and eventually the Sussex or Southdown blood predominated in the Hampshire sheep.

It may be noted here that in Wiltshire a different plan was pursued. Here the same large, flat-sided, uncouth horned sheep, whose ancestors were its denizens in the days of the Roman occupation, roamed over the Wiltshire downs. Their breeders began with the Sussex ewe and crossed with the Hampshire ram, while the Hampshire breeders used the original horned ewe and the Sussex ram.

The early improvement of these sheep then, as we have seen, was due to many farmers acting on various lines. Prominent among those of a later day for skill, sagacity, energy, and care, was Mr. William Humphrey, of Oak Ash, near Newbury, who was first to perceive the results likely to follow the infusion into the Hampshire Down of the blood of the largest and best fleshed of Jonas Webb's Southdowns. To him, probably, for the care he exercised, the ability he displayed, and time and money expended, is due the present almost perfect animal known as the Improved Hampshire Down. Others followed in the line laid down by Mr. Humphrey, so that greater uniformity was arrived at, a uniformity perhaps unequaled among the flocks of any other Down breed.

The plan pursued by Mr. Humphrey is known and is full of instruction to the breeder and of interest to all intelligent readers. About 1834 or 1835, in forming his flock, he purchased the best Hampshire or West Country Down ewes he could meet with, some of them from Mr. Budd, Mr. William Pain, Mr. Digweed, and other eminent early breeders, giving 40*s.* when ordinary ewes were making 33*s.* to 34*s.*, using the best rams he could get of the same kind until the Oxford show of the Royal Agricultural Society. On examining the different breeds exhibited there he found the Cotswolds were beautiful in form and of great size, and on making inquiries as to how they were brought to such perfection, he was informed that a Leicester ram was coupled to some of the largest Cotswold ewes, and the most robust of the produce were selected for use. The thought struck him that his best plan would be to obtain a first-rate Sussex Down sheep to put to his larger Hampshire Down ewe, both being of the short-wooled breed. He thus determined to try an improvement in the quality and form of his flock, still retaining the size and hardihood so necessary for the low lands and cold exposed hills of Hampshire. With this object in view he wrote to Mr. Jonas Webb to send him one of his best sheep, and Mr. Webb sent a shearling by his favorite sheep Babraham, which made some good stock out of his larger ewes. He went down the next two years, and selected for himself, but the stock did not suit his taste so well as the one Mr. Webb had sent him, and he did not use them. He then commissioned Mr. Webb to send him the sheep which obtained

*Spooner on Cross Breeding; Journal of the Royal Agricultural Society of England, vol. xx.

the first prize at Liverpool, and from these two sheep, the first and the last, by marking the lambs of each tribe as they were dropped, then coupling them together at the third and fourth generations, his flock was made. Not having used any other blood on the male side for more than twenty years, he found some difficulty at first, when putting the first-produce ram to the first-produce ewe, the lambs coming too small to suit his customers. To obviate this difficulty Mr. Humphrey drafted out the finest and smallest bred ewes, replacing them with the largest Hampshire Down ewes he could find that suited his fancy, still continuing to use the most masculine and robust of his rams to keep up size. Some of his friends advised the use of a large coarse ram to these small ewes to remedy the defect, but the larger ewe seemed to Mr. Humphrey the better way, and that course he pursued. He got rid of his smallest ewes and replaced them with larger ones, which gave him what he thought to be an advantage. Then using no male animal but of his own blood, the pedigree of which he knew for more than twenty years, he succeeded beyond his expectations. His object was to produce a Down sheep of large size with good quality of flesh, and possessing sufficient strength and hardiness to retain its condition while exposed in rough and bad weather to consume the root-crops on the cold hills. Independently of the value of the Hampshire or West County Down in an agricultural point of view for such a locality as Hampshire, they produce when slaughtered a valuable carcass of mutton, giving the consumer a good proportion of flesh to the fat, which is a point not sufficiently looked to in the case of many sheep.

A later breeder than Mr. Humphrey is Mr. Rawlence, of Bulbridge, near Wilton, who, since 1863, has maintained and increased the reputation of the Hampshire Down, having obtained a large number of prizes at the Royal Agricultural Society, the Smithfield Club, the Bath and West of England and local shows. The original flock from which Mr. Rawlence's flock descended was of the Sussex breed and of moderate quality. He began by drafting all the small and delicate ewes, and the remainder were crossed with rams of the Hampshire breed. He bred from their produce for two or three years and then had another cross with the Hampshire, still continuing to cull defective ewes. After he had obtained considerable size from the infusion of the Hampshire blood, he had recourse to some of the rams bred by Mr. Humphrey, the produce of the Jonas Webb Southdowns and the large Hampshire ewes. Mr. Rawlence then used his own rams, and also frequently purchased a few of the best Hampshire ewes he could get, and put his own sheep to them and used their lambs. He also put a Humphrey ram to some of his best ewes, and selected rams from their produce, thus getting fresh blood without making an entire cross. Other Wiltshire breeders have generally followed the system practiced by Mr. Rawlence; and the Southdown flocks of Wiltshire and Dorset have gradually merged into the improved Hampshire Downs.

The improvement of this sheep has its lesson in giving an illustration of "what breeders can accomplish in preserving vigor of constitution and general hardihood, and in adding to them the desirable qualities of early maturity, disposition to lay on flesh with fat and lean properly intermingled, and symmetry of form, with a most useful and valuable fleece of wool."

James Wood, of Mount Kisco, New York who has made extended examination of the districts occupied by these sheep, and given care-

ful study of them, gives us the best description of the improved Hampshire Down and its management: His head is rather large, with a Roman face; neck long and usually well set on; shoulders sloping; brisket deep, with abundant room for the vital organs; back straight with a good spring of rib going around the barrel; loin broad; quarters long and broad; hams round and heavy; legs bony and strong, and feet large and open, with a tough sole and crust. The face and legs are the blackest of any of the Down breeds. Gray faces are avoided. The wool is of medium length and strong fiber. It is used for making cheviots, tweeds, and such business cloths, and commands the top prices. Flocks of breeding ewes average about 7 pounds to the fleece. Mature rams weigh 300 pounds and ewes something over 200. The peculiar advantages claimed for the Hampshire are constitutional vigor, a greater exemption from foot-rot than other breeds, rapid growth, early development and excellent fattening qualities of the lambs; to which, last but not least, must be added that quality which, in the opinion of many, gives to this sheep his greatest practical value, and the one which above all others commends him to the average American sheep-raiser.

Mr. Wood says:

> It is his extraordinary prepotency—that power which enables him to stamp his characteristics with unerring certainty upon his offspring. This is especially important where the blood is crossed with common ewes, either for the sale of the first cross or for grading up a flock so as to make them as good as pure bred for all but breeding purposes. The first cross so strongly resembles the Hampshire that in many cases it takes a good judge to distinguish them.

The Hampshire is scarcely so prolific as the Dorset horned ewes, but under good management and more even and liberal feeding the yield of lambs has been increased. The ewes are usually bred from for three years, and, as full-mouthed ewes, are sold at the autumn fairs to breeders of early lambs, who generally put them to a Lincoln or Cotswold tup and fatten the ewe and lamb together. The first cross produces an animal with great aptitude to fatten, and if kept till they become shearlings they carry a large quantity of mutton and wool.

The general management of these sheep is that which prevails in the south of England, where spring and grass come early. They are kept in the open fields throughout the year. The breeding ewes are separated by midsummer and the rams are put with them at such time, from July until the middle of September, as best suits the purpose for which the lambs are to be bred. Ram lambs are almost invariably used, by which it is believed the early development of the breed has been aided. Those lambs which have the strongest masculine characteristics and show the greatest vigor and force are selected. The best breeders keep the rams and ewes apart at night; others alternate their rams with the flock, thus giving to each an opportunity for recreation, while still others turn a greater or less number of rams in with the ewes, all together, and leave them to roam at their sweet will. Meanwhile the ewes are given such food as will put them in good condition, a matter considered of much importance. As winter approaches turnips are given, and during the winter months hay and straw, cut together, with bran and malt dust, to which is sometimes added a little oil-cake. When lambing time arrives some sheltered spot is selected and inclosed with hurdles, convenient to the field in which are the turnips or Swedes that are to be fed. Storms are severe and the exposure great, but the losses in

the lambing yard are seldom serious. If the weather is fine the lambs are allowed to go out on turnips in a few days after they are dropped, but some farmers keep them in the lambing yard or pen for two or three weeks, the ewes being fed there. The ewe and lamb are generally kept on turnips and hay until about the first week in April, when the water meadows, or irrigated pastures, being ready, they go there by day, feeding on the new grass, and are taken at night to be folded on Italian rye-grass, rye, winter barley or trifolium, the tup and wether lambs getting a little cake or corn. When vetches are in flower they furnish a very valuable food for the growing lambs. On farms where there are no water meadows there is usually a larger quantity of late Swedes provided, after consuming which the sheep are kept on rye, winter oats, barley, mangolds, and trifolium until the vetches are in flower. Lambs are generally weaned about the first or second week in May, when they are kept on sainfoin or clover by day and are folded on vetches by night. When the vetches give out they are fed rape or cabbages with the aftermath clover or sainfoin. The sale lambs have large folds of the above, the ewe lambs or the stock ewes clearing up any food which they leave. Grass, cabbages, rape, and clover are the reliance in summer and until such time in the autumn as the turnips are ready. Ram and wether lambs have the choice of everything, and are first served, the ewe stock cleaning up after them. By this management the wether or sale lambs attain great size, and realize high prices at the early fairs. Many go to the butchers as early spring lambs.

Shearing takes place in May or June, when professionals in that line go through the country in parties of six to ten, doing the work at so much per hour. After shearing, the full-mouthed ewes are overhauled, and a draft is made of all such as are not desired for another crop of lambs. These draft ewes are fattened upon the farms, or as store sheep are disposed of at the fairs to go into other counties, to be fattened there or to produce one crop of cross-bred lambs. Here, as in other parts of England, the keeping of breeding flocks and the fattening of sheep are considered quite distinct lines of business.

These sheep were introduced into the United States, principally into Virginia, some time before the war of the rebellion, and many fine flocks suffered destruction at the hands of hungry soldiers. Within a few years past they have grown in popularity and many importations have been made.

The Southdown sheep.—The Southdowns of Sussex are part of a long range of low, chalky hills, of five or six miles breadth, stretching along the English coast upwards of sixty miles, entering Sussex on the west side and continuing almost in a direct line as far as East Bourne and Beachy Head, where they reach the sea. Lying along this range of hills is a tract of low cultivated ground, usually connected with the down farms, although many of the latter have no vale or flat land attached. The herbage of these hills is short, but well adapted to the keeping of sheep, of which vast numbers of a certain breed have been cultivated for many centuries in greater perfection than elsewhere; hence they sent out those colonies which have produced an alteration in the short-wooled sheep of the surrounding counties, and of distant parts of England and Ireland. The Southdown sheep, though greatly altered by management, is supposed to have descended with unmixed blood from the original stock which at a very early period diffused itself over the southern

parts of England, even from the eastern shore to the extreme point of Cornwall. Whilst the Leicesters can not trace their origin more than a rounded century, when they, as it were, sprung into being a different animal altogether from their predecessors, the Southdown, on the other hand, "can trace a long line of pure descent from a period antecedent to William the Conqueror."*

Whilst the dryness of the air, the moderate elevation of the land, and consequent mildness of the climate are all eminently favorable to the rearing of a race of down or mountain sheep, the contact of the cultivated country affords the means of supplying artificial food in due quantity. It is this combination of favorable circumstances which has rendered these calcareous hills capable of supporting a greater number of sheep than perhaps any tract of similar fertility in the country, and has afforded the means to the breeders of applying the resources of artificial feeding to their improvement. The original breed of the Sussex Downs was not superior to that of many other districts of the chalk formation, but the means of supplying the animals with artificial food, which the geographical situation of this long and narrow chain of hills in contact with the richer country afforded, aided the breeders in applying to the improvement of the race a system of breeding and feeding which has rendered the Southdown breed the most esteemed in the counties suited to it of all the short-wooled sheep of England.†

The quantity of sheep ground on the downs was computed by Arthur Young, in 1788, at 150,000 acres—Youatt says it is much more than that—and the number of sheep at 270,000 in summer and 220,000 in winter. Luccock, but a few years later, calculated that not less than 864,000 of these animals occupied the hill and the underhill grounds, a rate of stocking which Youatt thinks is not exceeded in any other part of England, marsh land alone excepted, and which is only to be accounted for by reason of the great quantity of artificial food which is raised on the arable part of every farm. All the sheep farms have a very considerable quantity of arable land attached to them. Young knew of no lands in the kingdom, rich marshes excepted, which were stocked in such proportion, and records the fact that Mr. Ellman, the great improver of the Southdown sheep, on 500 acres, had 700 ewes, lambs, and wethers in winter, and 1,450 of all sorts in summer, besides 140 head of cattle. Youatt quotes authority that a farm carrying 1,000 ewes would consist of 600 acres of arable and 600 acres of down; and the arable land held under the same restrictions as in the other parts of the country, from which he reasons that—

> Sheep are therefore necessary in order to feed on the otherwise almost useless pastures of the downs, and also to contribute by their dung to the productiveness of the arable land; and, on the other hand, arable ground yields the principal part of the winter and spring food of the sheep. One reason that the Leicesters never succeeded on the downs was that they would not bear to be driven two or three miles twice every day from the fold to the pasture and from the pasture to the fold.

But the Southdown sheep are unquestionably the purest and most unmixed breed of England, holding a place in the esteem of breeders inferior to no other, and ranking first among the short wools, as the latter is among the long wools.

They were of a small size originally, and far from possessing a good shape, being long and thin in the neck, high on the shoulders,

*Spooner on Sheep. †Low's Domesticated Animals of the British Islands.

low behind, high on the loins, down on the rumps, the tail set on very low, perpendicular from the hip bones, sharp on the back, the ribs flat, not bowing, narrow in the fore quarters, but good in the leg, although having big bone. Arthur Young writes of them as he saw them in 1776 as having a thin chine, low fore end, and rising backbone. These three defects were common in all flocks, inasmuch as not more than one sheep in a hundred, perhaps two hundred, was to be seen free from them.

Still referring to the original breed, Mr. Young, writing in 1788, said that the true Southdown, when very well bred, had no horns; a long, speckled face; clean and thin jaws; a long but not a thin neck; no tuft of wool on the forehead, which they call owl-headed, nor a frieze of wool on the cheeks; thick in the shoulder, open-breasted and deep; both fore and hind legs stand wide, round, and straight in the barrel; wide upon the loin and hips, shut well in the twist, which is a projection of flesh on the inner part of the thigh that gives a fullness when viewed behind and makes a Southdown leg of mutton remarkably round and short, more so than in most other breeds; thin, speckled legs free from wool; the belly full of wool; the wool close and hard to the feel, curled to the eye, and free from projecting or strong fibers. Flocks not bred with particular care and attention were apt to be coarse wooled on the back, but some were fine all over.

This description gives a more favorable showing than most of the early writers, but the contrast between the Southdown of 1788 and that of the best specimens of the present day, as shown by eminent breeders in England and America, is very great. Compare it with the description given by Mr. Young at a later date, after John Ellman had improved the animal, and with the description given by Mr. Ellman quoted on a subsequent page. At a somewhat later day, near the first year of the present century, John Luccock writes of them:

> This kind of sheep, though greatly altered by management, is supposed to have descended with unmixed blood from the original stock which at a very early period diffused itself over the southern parts of England, even from the eastern shore to the extreme point of Cornwall. In the fleeces of the Southdowns we have observed a great want of uniformity. That part of them which grew upon the back of the animal often differs considerably from the produce of the sides and shoulders; and the breech becomes suddenly coarse, being larger also than might have been expected from sheep bearing such fine wool and grazing in the neighborhood of the oldest manufactures. Sometimes the pile is not so uniform in itself as the clothier wishes it to be, but contains a number of those coarse and long hairs which have been described as giving the fleece a bearded appearance, and proving hurtful to the cloth. The zeal, however, with which the shepherds of these parts pursue the improvement of their flocks may have produced a great alteration in the qualities of the fleece since the time when I was more accustomed to that kind of wool than at present.

As a whole the wool was short, fine, and curling, although not equaling in delicacy and softness that of the white-faced, hornless breed of the western counties; nor even that of the Blackfaced varieties of the older forests and commons.

Both male and female were destitute of horns, at least back to the times of which we have any records; but it is probable that the older race was horned, like other varieties inhabiting the same kind of country. The faces and limbs were covered with black hair, and a tendency existed in the entire fleece to assume the same color. The dusky or black hue of the face and legs and the tendency of the

wool in the same direction is generally accepted as proof of the original color of the sheep, and perhaps of all sheep, and also the later period at which it was seriously attempted to get rid of this dingy, rusty, black hue. Youatt says that in almost every flock, notwithstanding the great care which is now taken to prevent it, several party-colored lambs will be dropped; some with large black spots, some half black, and some entirely black; and he quotes a writer in the "Annals of Agriculture" as stating that "he has frequently had twelve or fourteen perfectly black lambs, although he never kept a black ram or ewe." From this he draws the conclusion that their original color was black; that art alone produced the white wool; and that, if the best of the Southdowns were left in a wild state, they would in a few years become black again.

But since that time in which Young and Luccock wrote of them the Southdowns have materially improved, yet not by any admixture of foreign blood; for, as Youatt observes, "even the cross with the Leicesters was a failure, and the promised advantages to be derived from the Merinos were delusive." The sheep-owners began better to understand and carefully to practice the true principles of breeding. The sorting of their flocks was no longer left to the menial; the sexual intercourse of the sheep was no longer a matter of almost chance medley; but a system of selection was adopted and sedulously followed. In addition to this there was a great improvement in agriculture generally. The introduction of the turnip husbandry enabled the farmer to keep more sheep on the same quantity of land and to keep them better, and in fact to feed them up earlier and more certainly to that development of form and utility of which they were capable.

John Ellman says:

> They are now much improved both in shape and constitution. They are smaller in bone, equally hardy, with a greater disposition to fatten, and much heavier in carcass when fat. They used seldom to fatten until they were four years old; but it would now be a rare sight to see a pen of Southdown wethers at market more than two years old, and many are killed before they reach that age.

The modern Southdown breed, like the older race, is destitute of horns in both sexes, has the face and legs of a dusky gray or black, and the body closely covered with short and curling wool. While the general form of the older breed has been preserved, the too great lightness of the fore quarters has been corrected, the chest has been widened, the back and loins broadened, and the ribs more curved. The trunk has been rendered more symmetrical and the limbs shorter with relation to the body; in other words, the body has become relatively larger when compared with the legs. The neck retains the arched characteristic of the older race, but has been shortened. The wool comes well forward upon the face, and terminates in a tuft on the forehead. The animals are docile and suited to the husbandry of the fold, which is yet generally pursued in the downs.

Low says that they are capable of subsisting on the short herbage of the drier soils, and yield mutton which has always been held in great estimation; the wethers are usually fattened after having completed their second year, although individuals of superior flocks are often ready at the age of about fifteen months; whereas the wethers of the older breeds were rarely killed until they had completed their third, or arrived at their fourth year. It is to the effect of careful culture under favorable circumstances that the modern breed of the

Southdowns owes the superiority which it has acquired over all the other short-wooled sheep of the midland and southern counties of England. With the advancement of tillage and the large production of turnips and other succulent plants, the breeders of Sussex had the means of treating their animals well while advancing to maturity; increased attention was also given to the selection of the breeding parents and to the consequent calling forth of those properties of form which evince the tendency to arrive at early maturity of muscle and fatness.

Youatt, Low, Spooner, and other English writers have written fully on the system of management of the Southdown sheep, which varied with the nature of the farm or district and the amount or quality of sheep that could be afforded. On some farms, too small or otherwise unsuitable for keeping a constant flock, it is customary to take in and keep the sheep of other farmers at so much a head, the price varying of course with the abundance of feed, being sometimes 2*d*. to 4*d*. per week, and at other times, when feed is very plentiful, it is given for the sake of the manure left behind. Some farmers will put out their own heavy ewes in the winter to keep on some park or dry pasture, and take in a wether flock to feed on their own turnips. Sometimes vetches or turnips are thus fed off by the acre, the price being generally moderate, such as 20*s*. to 50*s*. per acre, in consideration of the dung and urine left behind.

The improvement of the Southdown breed began about 1780, and has progressed until the present time. Most prominent in this improvement and the earliest was John Ellman, of Glynde, near Lewes, in the county of Sussex. He continued his experiments for more than fifty years, during which period he directed his attention in an especial degree to the improvement of the native sheep of the downs by a selection of those having the properties of health and soundness of constitution, as well as symmetry of form and facility of fattening; and therefore did not, like Bakewell, confine himself rigidly to the blood of his own stock, but resorted to others, that he might infuse fresh vigor into his flocks and prevent them from becoming too delicate.

> His aim, in short [says Low], was the really useful; and, though he reaped the due reward of his enterprise and skill, it was never obtained by arts of any kind, by deception, or useless ostentation. His character throughout was one of sincerity and manly simplicity; and it is pleasing to add that he closed a long and honorable life respected and regretted by all that came under the influence of his social virtues.

It is thought by excellent authority that Ellman's attention and efforts would have been in vain but for the facilities afforded in the growth of root crops for a regular and nutritious diet.

> So long as the sheep were expected to work hard for subsistence during the day, traveling long distances to and from their feeding ground, and often having to cover much ground in order to obtain a bellyful, and were folded at night on bare fallow, neither early maturity nor perfection of form would be possible.*

While Mr. Ellman was apparently frank, concealing nothing, and disdaining to throw a cloud of mystery over and around his methods, yet we know but little of the course he pursued. Experiments he doubtless made, possibly with the Leicester blood, but it is generally believed that by selecting the best specimens from his own and neighbors' flocks he could, as he did, by the exercise of care and

*John Coleman,

judgment, gradually produce a more symmetrical sheep. Improvement was steady but appreciation was slow, and it was reserved for that indefatigable writer, Arthur Young, whom we have quoted, showing what the breed was before Ellman began his labors, to say at a later day, in calling public attention to the Southdown sheep for their hardy constitution and the fine quality and flavor of their mutton, that—

> Mr. Ellman's flock of sheep is unquestionably the first in the country, the wool the finest, and the carcasses the best proportioned. Both these valuable properties are united in the flock at Glynde. He has raised the merit of the breed by his unremitting attention, and it now stands unrivaled.

But public favor can best be judged by prices realized. In the year 1787 a Southdown ram fetched for the first time as much as 10 guineas, Mr. Ellman selling two for £21 to Lord Waldegrave, of Essex. In the previous year Mr. Arthur Young bought 80 ewes of the same gentleman at 18*s.* apiece. These were sent into Suffolk. In 1780, Mr. Ramsden, of Nottinghamshire, bought 40 ewes from the Glynde flock at 25*s.* each, and Mr. Boys, of Betshanger, in East Kent, gave Mr. Ellman 8 guineas for a ram. The same year Mr. Macro, of Norfolk, acquired from the same flock 170 ewes at 23*s.* a head. In 1790, Mr. Crowe, also of Norfolk, bought of Mr. Ellman 40 ewes at 26*s.* each, and a ram at 12 guineas. In 1791, Mr. Boys gave 31*s.* 6*d.* per head for 60 of the Glynde ewes.

The fame of Mr. Ellman's flock was not confined to England, for in 1798 the Czar of Russia, in looking around for a sheep suitable to cross on the northern sheep of his country, selected his Southdowns from those of the Ellman stock. He bought two rams, the Duke of Bedford, at the request of Mr. Ellman, putting a price upon them, the owner observing that he did not wish to charge a foreign sovereign who had done him so much honor more than any other individual. The price fixed by the duke was 300 guineas for the two, and he purchased two more for himself at the same rate.

At the sheep-shearing at Woburn, in 1800, a Southdown ram belonging to the Duke of Bedford was let for one season at 80 guineas, two others at 40 guineas each, and four more at 28 guineas each. The practice of letting and selling rams was more prevalent and more profitable among the breeders of the Southdown sheep than of any other kind except the Leicesters, and was continued by Mr. Ellman until he retired in 1829. His flock was then brought under the hammer and realized prices which in those days were considered extraordinary and extravagant to the verge of folly. Seven hundred and seventy ewes of all ages averaged £3 1*s.* 6*d.* each, 320 lambs 36*s.* each, 36 rams £25 each, 32 ram lambs £10 each, and 241 wether lambs 21*s.* each.

Mr. Ellman left many successors breeding Southdowns, but the most successful one was Mr. Jonas Webb, of Babraham, Cambridge, who commenced operations about 1823. His connection with the Southdowns began when he was a young man. He entered upon a series of experimental trials with several different breeds of sheep in order to find out which breed was most suited to the Cambridgeshire uplands. At that time Mr. Webb had no particular preference for any one breed, but after visiting Glynde as well as other noted Sussex farms, and after repeated trials, he fully satisfied himself that Southdown sheep produced the greatest weight and gave the best quality of mutton for the amount of food consumed, and were consequently the most profitable both to breeder and grazier. These

trials determined him to have nothing to do with any other breed of sheep than Southdown, so he purchased for the Church farm, at Babraham, ewes and rams of John Ellman, of Glynde, and other noted breeders of Sussex, and thus laid the foundation of his flock, which eventually became, and was for many years, by far the most valuable collection in the country and the source from whence all the highest flocks were invigorated. Having formed his flock he set to work to remodel them into his own class of Southdowns, and having obtained his type, maintained it by close breeding.

His sheep were noticeable for greater size than the denizens of the downs, a natural consequence of physical influences. He farmed largely and his flock was sufficiently numerous and sufficiently diverse in its origin to allow of selection without close affinity.

His first letting of rams by public auction took place in 1826, and they were continued annually down to the year 1860, and no man before or since made such prices for Southdown rams, and these Babraham lettings drew from near and far, even from the United States, and have been happily alluded to by many writers fortunate enough to possess them.

In 1855 a 2-year-old ram was let for the season for 170 guineas, and in 1860 a yearling was sold, after being used at Babraham, for 250 guineas. These were believed to be the highest prices made by Babraham rams. Mr. Webb was a most successful exhibitor of Southdown sheep at the royal and other agricultural shows. The first prize won by him was at Essex show, held at Saffron Walden. He was subsequently awarded prizes for his sheep at exhibitions in Ireland, Scotland, and France. He first exhibited at the Royal Agricultural Society's meeting at Cambridge in 1840, where he received the first prize for ewes, taking both prizes. Afterwards he showed only rams, finding that the forcing requisite to prepare the females for successful exhibition seriously injured breeding properties. He continued to exhibit with marked success at most of the royal shows down to and including the Canterbury meeting in 1860, when he made a clean sweep of the prizes for rams.

In 1861 the Babraham rams and ewes were sold by auction; they realized £10,926. In the following year the shearling rams and ewes born in 1861 were also publicly disposed of and fetched £5,720. Thus the entire Babraham flock fetched the large sum of £16,646, or over $83,000. Surviving but a few months the dispersion of his favorite flock, the owner passed away in November of the same year.

Both the two great Southdown breeders were scrupulously careful to maintain the purity of the breed, but each aimed at a different type of animal. Mr. Ellman's aim was to get a small and good sheep, while Mr. Webb aimed to get a large and good one. Believing that large sheep were much the best and would be the sheep of the future, Mr. Webb bred in that direction, and succeeded in producing animals of larger frame and greater weight than the Southdowns of Mr. Ellman's day, while at the same time retaining the true type and all the essential points of a pure-bred Southdown sheep.

The increase in size follows naturally from the course adopted by the breeders. The animals are reared under favorable circumstances with respect to the supplies of food, and a tendency is thus produced to an enlargement beyond that characterizing a breed suited and bred for generations in a district of downs and short herbage. The Southdown finds its proper locality on grounds suited to the lighter kinds of sheep, while the richer plains find their true tenants in the

long and heavy fleeced sheep, such as the Leicester and other varieties of long-wooled sheep. That transplanting to more fertile pastures and stimulating by artificial food would bring the Southdown up to the size of the Leicesters is not beyond probability, and progress makes in that direction in the hands of some of the principal English breeders.

But [as set forth by Low] the change is one which in proportion as it may adapt the breed to a richer country may render it less suited to those more dry and sterile tracts over which it has been spread, and in which hardiness and soundness of constitution and the capacity of subsisting on scanty food are properties to be regarded as much as the disposition to arrive at early maturity and fatten quickly. Nevertheless the past efforts of Sussex breeders to improve the breed by rearing it in a more artificial condition than is suited to it, have hitherto been eminently successful in rendering it of more economical value.

Ellman and his contemporaries paid at first especial attention to the fineness of the wool, which then bore a high price for the purposes of the clothier, but attention being gradually directed to other properties, the staple of the wool became longer and the relative value of the wool declined. The fleece weighed in 1800 about 2 pounds; now it weighs 3 pounds to 3½ pounds when washed, but in some of the more highly-fed flocks of the lower counties, where the unimproved sheep gave 3 pounds, the weight is now 4 pounds or more. This comes from the different mode of feeding and the larger size of the animal. While the length of filaments, or the staple, in the older breed rarely exceeded 2 inches, and more frequently fell below that length, it is now from 2½ to 4 inches, and in some instances exceeds that length. The color of the wool differs materially according to the nature of the soil. The shortest and finest wool is produced on chalky soils where the sheep have to travel far for food, but there is a harshness and brittleness about it which always found objections, and rendered it unfit for the manufacture of the finer woolen cloths, and required a considerable admixture of the softer wools of domestic or foreign growth. The clothiers were always careful not to use too much of it in the making of their finest cloths. Now, however, when it is materially increased in length and has become a combing wool and applicable to so many more purposes than it was before; now that it enters into the composition of flannels, baizes, and worsted goods of almost every description, its fineness and its felting, compared with some of the other short wools, render it a truly valuable article.*

When Napoleon's wars in Europe culminated in the exclusion of the English manufacturers from most of the foreign markets, which supplied the raw material, necessity compelled the use of domestic wool, and gave a high relative value, not only to the Southdown wool but to all the other varieties of the fine and short wooled sheep—as the Norfolk, the Wiltshire, the Dorset, the Ryeland, and the Cheviot. But with the overthrow of Napoleon came the opening of all the ancient marts of trade. Fine wool came from Spain, Saxony, Austria, and all the other countries of Europe where the Merino was cultivated, and from Australia. The change in the market price of the fine English wools was immediate and caused them to be used for other purposes than the manufacture of woolen cloth—they found their market for worsteds and the coarser fabrics. This decrease of price and displacement of use produced an important change in the

* Youatt.

sheep husbandry of England. It led to an increase in the number of the long-wooled sheep, and a decrease in the fine or short wooled, and called more particular attention to weight of fleece. The Ryeland, Morfe Common, and all the lesser breeds of sheep producing a fine and delicate wool, are either extinct or have lost their distinctive characters by intermixture with other races, and entire tracts of country which seventy years ago supported vast flocks of short-wooled sheep can not show a single flock. For many of these breeds the Southdown has been substituted, which is now classed as a middle-wooled sheep.

The Southdown has spread from Sussex into all the southeastern counties of England and into many of the midland counties. It first established itself in Ireland, in Wicklow County, and then diffused itself over the western counties. Of the 34,532,000 sheep of Great Britain in 1870, the Downs and their allies numbered 6,130,000; of 154,182,750 pounds of wool, the Downs furnished 24,520,000, or an average of 4 pounds each; of the area used for pasturage in England, 32,500,000, the Downs appropriated 12,000,000.

Mr. John Ellman thus describes his improved Southdowns:

The head small and hornless; the face speckled or gray, and neither too long nor too short; the lips thin, and the space between the nose and eyes narrow; the under jaw or chop fine and thin; the ears tolerably wide, and well covered with wool, and the forehead also, and the whole space between the ears well protected by it, as a defense against the fly; the eye full and bright, but not prominent; the orbit of the eye (the eye cap or bone) not too projecting, that it may not form a fatal obstacle in lambing; the neck of a medium length, thin towards the head, but enlarging towards the shoulders, where it should be broad and high and straight in its whole course above and below; the breast should be wide, deep, and projecting forwards between the fore legs, indicating a good constitution and a disposition to thrive. Corresponding with this the shoulders should be on a level with the back, and not too wide above; they should bow outwards from the top to the breast, indicating a springing rib beneath, and leaving room for it; the ribs coming out horizontally from the spine and extending far backward, and the last rib projecting more than the others; the back flat from the shoulders to the setting on of the tail; the loin broad and flat; the rump long and broad; and the tail set on high and nearly on a level with the spine; the hips wide; the space between them and the last rib on either side as narrow as possible, and the ribs generally presenting a circular form like a barrel; the belly as straight as the back; the legs neither too long nor too short; the fore legs straight from the breast to the foot, not bending inward at the knee, and standing far apart both before and behind; the hocks having a direction rather outward, and the twist, or the meeting of the thighs behind, being particularly full; the bones fine, yet having no appearance of weakness, and the legs of a dark color; the belly well defended with wool, and the wool coming down before and behind to the knee and to the hock; the wool short, close, curled, and fine, and free from spiry projecting fibers.

To these characteristics may be added a patience of occasional short keep, and an endurance of hard stocking scarcely surpassed by any other sheep, an early maturity not inferior to that of the Leicesters, the flesh finely grained, and the wool of the most useful quality.

In most respects a good typical flock of Sussex Downs at the present day would answer to the above description given by Mr. Ellman more than seventy years ago. In one respect, however, a marked alteration has occurred, viz, in color. Speckled faces and legs would now be looked upon with horror, as indicative of bad blood. A uniform tint now prevails, varying from brown to fawn, or almost gray. The Sussex bred sheep are, as a rule, lighter of feature than the sheep cultivated on richer and flatter soils; the forehead is covered with short wool, and the cheeks are moderately wooled. Owing to better resources for feeding, the sheep are larger, reach maturity sooner, and are more cultivated.

John Coleman, in closing his description of the Southdowns, said that although he had quoted from early writers on the subject he had not attempted to frame for himself a description, and he approached the subject with dread. He says, briefly:

The Sussex Down is noticeable for the light shade of feature, profusion of wool on forehead and on sides of face, short head, flat forehead, large, full, projecting eye, fine nose and muzzle, short neck, level contour, great leg of mutton, barrel-shaped carcass, level underlines, fine bone, and fine close wool. The Southdown as cultivated in Norfolk or Berkshire is a larger animal, with darker and larger features, and more substance of fore quarter; the shoulders are generally well laid, and width of bosom and thickness through is very noticeable.

It is of course a recognized fact—or ought to be by every careful breeder of Southdown sheep—that the first and greatest point is to maintain extreme purity; to allow no cross to diminish the inestimable value of purity of blood. The direction in which improvement in Southdown sheep is desirable is uniformity of character, strength of constitution, excellence of wool, development of symmetrical form, mutton-producing properties, smallness of bone as compared with weight of meat, yet not such smallness as to prevent the carrying of an increased amount of flesh.

This is the language of Henry Wood in his lecture on the Southdown sheep to the Institute of Agriculture, in March, 1884, on which occasion he set forth the treatment followed in the Merton flock, a flock under his management for upwards of thirty-six years:

In the formation of a flock of Southdowns or any other breed of ewes uniformity of character, so that the ewes look alike, should be the first object. If it is desired to judge of the general character of a flock of Southdown ewes, and to see if they have, as it were, a family likeness, have them driven a short distance from where you stand and then suddenly wheeled round so that their heads are thrown up and their faces seen at a glance. This will enable a person to detect any marked want of uniformity. In a word, the ewes should be "matching" to the eye. When drawing ewes and separating them into lots for the rams, great care and judgment must be exercised in the selection, carefully noting individual formation and peculiarities, so that the ewes in each lot are as much alike as possible, and adapted to the style of ram intended to be put to them.

There is no flock so perfect but some defects will be found in the ewes which require correcting, and therefore care should be taken to use a ram which will be likely to improve in the offspring the faulty points observable in the ewes. It must, moreover, be a matter to which the flockmaster gives anxious attention in selecting a ram, that in correcting defects in the ewes he does not overlook any faulty points in the ram which may be transmitted through the ewe and thereby create imperfections in the lamb which the mother did not possess. Only by practice and carefully observing the true principles of breeding is the flockmaster able to make a proper and judicious selection of rams and ewes, so as fitly to mate them.

No matter what the breed of sheep may be, there is an absolute necessity for the agricultural student or the farmer to become thoroughly and practically acquainted with the good and bad points of the sheep. Each breed has its own marked peculiarities, faults, and merits, which must be well studied and carefully looked after or a man will never become a good and successful sheep-breeder.

With these general observations we note the particular treatment of the Merton flock of Southdowns, comprising twelve different families; each family well known to the shepherds by long experience, who can tell how to select the ewes for each family, which ram to put to them, and the kind of lambs likely to be produced. By this careful plan of managing the several families there was produced and maintained the large size of the Merton sheep, and it was remarked that when rams had been hired for use at Merton they had only in three instances given a first-prize animal, but that the second and third generations, after an intermingling of fresh blood, had been most successful. It is the rule at Merton that when a hired ram has left a promising ram-lamb the lamb is used to eight or ten

ewes to see how far he may be relied upon for use as a shearling, and thus the disappointment which might arise from his produce not being satisfactory is avoided.

For ten days or a fortnight before putting the rams with the ewes it is considered advisable to change the food of the ewes to something more stimulating than that which they have been previously fed upon. This not only causes the ewes to come into use more quickly than they would otherwise do, but invariably leads to a better fall of lambs. The fresh food must be continued for at least five or six weeks, when doubtless the greater part of the ewes will be seasoned. During pregnancy great care is exercised in supplying the ewes with nutritious food and in keeping them quiet. Where ewes are kept on grass land until after they have lambed there is but little fear of abortion, providing they are kept free from injury, are not jumped over ditches and water courses, are not overdriven nor subjected to annoyance and fright. Experience has proven with the Merton ewes that keeping them entirely away from turnips until after they had lambed was a decided safeguard against abortion. Up to the year 1853 the Merton ewes were folded on turnips from the end of October until the spring of the following year. They were then as unhealthy as any ewes in England or Scotland. In the early part of 1854 there were something like 110 cases of abortion, and 80 ewes died. Feeling that a change in the treatment must be made, Mr. Wood determined that in the future the ewes should not be fed on turnips (except for five or six weeks when the rams were with them), until after they had lambed. Since that time they have been folded and fed on grass land, with the supply of grass daily supplemented by a reasonable allowance of a mixture of hay chaff and fresh-made broad bran, at the rate of 4 bushels of chaff to 1 of bran. At about the fifteenth week of gestation half a bushel more bran is added to each 4 bushels of chaff, and this allowance of mixed food is gradually increased in proportion to the increasing demand made by the unborn lamb on the system and strength of the ewe. Since the introduction of this change in the system of feeding the in-lamb ewes cases of abortion have been unknown in the Merton flock, and the mortality among the ewes has been at a minimum. To enable him to arrive at something like a definite idea as to the cause of the fearfully large number of ewes which aborted and died in many parts of England in the early part of 1877, Mr. Wood sent out more than four hundred circular letters of inquiry, each letter containing twenty questions to flockmasters and others throughout the United Kingdom. The replies to these letters showed clearly and conclusively that the greater part of the abortions and deaths occurred in flocks where the ewes had been fed on a comparatively unstinted allowance of common turnips and swedes unmixed with dry food, and that a good allowance of dry food undoubtedly does away with many of the ill effects produced by simple root diet. It was also very clearly shown that where the ewes were grass-fed there was an entire absence of any serious amount of abortion and mortality.

As the time draws near for the ewes to lamb a sheltered, well-littered yard should be provided. This should be surrounded by covered sheds of board or straw, so divided as to have a nice, comfortable pen for each ewe when she lambs. These yards may be constructed for a comparatively small expenditure, and the cost will be amply compensated by the saving of life both among the ewes

and lambs, many that would otherwise probably be lost in severe weather being preserved by means of this timely protection. After the lamb is born and the ewe somewhat recovered from the fatigue and exhaustion of the labor, she should be sparingly fed, at first with a mixture of good hay, chaff, bran, and crushed heavy oats, for the more judiciously and generously a ewe is fed after having fully recovered from the lambing the better she will be able to nurse the lamb. When the time arrives for weaning the lambs preparations should be made to have a supply of coleseed or cabbages, or a similar kind of food to feed them upon at night, and during the day they should be run out on clean, fresh grass; but on no account should they be allowed to feed on grass growing upon land which may have been fouled by being heavily sheep-fed. Grass growing on such land is pernicious to lambs and should be carefully avoided. The evil effect may not be observed until much harm has been done. The lambs should have a daily allowance of from three to four ounces per head of mixed, bruised, heavy oats, linseed cake, and fresh broad bran. Where it can be conveniently given a frequent change of pasture is most desirable, and any extra trouble or inconvenience this may cause will be amply repaid by the thriving and healthy condition that it will be sure to promote. The ewes require extra care and attention when the lambs are weaned from them. For a few days they should be sparingly fed, so as to check the production of milk, and the udder should be carefully watched and any tendency to an excess of milk relieved by drawing it off with the hand.

These sheep were known in the United States at a very early day, and frequent importations have been made from the most noted English flocks, and at the present day it is, next to the Merino, the most widely known of all the breeds of sheep, finding its greatest popularity in the Middle and Western States. The ewes are prolific, make excellent mothers, and their lambs are uniformly hardy and vigorous. In size they are above medium, 2-year-old fat wethers weighing as high as 200 to 225 pounds, and mature breeding rams about 170 to 190 pounds.

The following description and characteristics and scale of points gives the American idea of a perfect Southdown:

SCALE OF POINTS.

Head	5	Hips	6
Lips	1	Thighs	6
Ears	2	Legs	3
Eyes	3	Fore legs	2
Face	3	Hind legs	2
Neck	4	Belly	5
Shoulders	5	Fleece	12
Breast	5	Form	9
Back and loin	7	General appearance	8
Ribs	6		
Rump	6	Perfection	100

Color of face and legs an uniform tint of brown, gray, or mouse (formerly speckled faces were admitted, but later breeders aim to exclude all except the colors mentioned); head medium in size, horn-less; forehead and cheeks well covered with wool; ears rather small, wide apart and lively; eyes light and full; neck short, fine at head, but well set on to broad shoulders. The chest is wide and deep; back and loin broad; ribs well arched; hips wide and close to floating ribs;

thigh fleshed low down, and legs fine-boned, short, and wooled to knee and hock. The belly is straight and well covered with wool; general appearance smooth (with no trace of coarseness), spirited, and attractive. The fleece is white, compact, moderately long and close, and carrying some yolk. They are fair, not heavy shearers, running some from 6 to 7 pounds per fleece in high-class flocks; but their mutton is unexcelled, and has always commanded the top of the market.

The Banstead Heath sheep.—This sheep, first supplanted by the Wiltshire, and that in its turn by the Southdown, was a small variety of sheep, one of the original inhabitants of Surrey, and a few of them may still be seen on some of the wild and sterile heaths of that county. The original breed was small; the head small, low, and yet light in the shoulders and fore quarters; the back a little ridged, the loin moderate. This small breed was clad in a short, thick, and close fleece—a circumstance of some importance; but it was for its unrivaled flesh that it was so celebrated. Charles II was a great lover of this mutton, and its reputation still survives.

The Old Horned Dorset.—A valuable sheep has from a very remote period been naturalized, and for a long time preserved its breed unmixed, in the county of Dorset and in the adjacent country, more decidedly, however, within a circle extending 10 or 12 miles from Dorchester. It was found also in other parts of Great Britain in small scattered flocks. It is decidedly the best of the old upland horned sheep. It has small horns, common to the male and female. It is somewhat larger than the Southdown and longer on the legs, which are white, as is its face. Its wool is moderately fine, somewhat longer than the Southdown, averaging about 4 pounds to the fleece, but only applied to the making of inferior cloths. The shoulders are low and the loins broad and deep, the back straight, the lips and nostrils black, though with a frequent tendency to assume a pinkish fleshy color. The wethers fatten at three years old to about 18 to 20 pounds the quarter; the fore quarter is somewhat deficient. It is a strong, hardy race of sheep, good travelers, active and docile, yet not as much so as the Southdown in the latter respect; suited to the practice of folding and capable of subsisting on scanty pastures. It makes good mutton, not equaling in juiciness, however, that of the mountain breeds.

That character, however, which has commended these sheep to the English breeder is the fecundity of the females and their readiness to receive the male at an early season, and their excellence as nurses. They frequently have twins, and rear a greater number of lambs than any other sheep. They have been known, like the sheep of some warmer countries, to produce twice in the year; this, however, is rare, but it is common for the ewes, especially when well fed, to take the ram and become impregnated while they are nursing their young. They will receive the ram as early as the months of April or May, the usual time being the early part of June, so that the lambs shall be born in October and be ready for use by Christmas, at which time they are considered a great luxury and command a high price. This has given rise to the practice of rearing the lambs in houses until they are ready for market. This system has long been regularly and systematically pursued on a large scale, especially within reach of London, where a great demand exists for this kind of luxury.

The race is not as widely diffused now as of old. William Ellis, writing in 1749, describes the west country sheep as having "white

faces, white and short legs, broad loins, and fine curled wool." He says they were of different sizes, the smaller sort being fed on commons, and that they were more tender of their young than any other, and in an especial manner the Dorsetshire variety; "whereupon," says he, "those farmers that live in Hertfordshire, Bedfordshire, Middlesex, Surrey, and Kent, and would be masters of a fine kind of sheep for folding, fattening, and breeding lambs, can not have a better sort." Mr. Claridge, in furnishing his report to the Board of Agriculture in 1793, said:

The original breed of Dorset sheep is very scarce to be met with, as most of the farmers have crossed their flocks with either Hants, Wilts, or Somerset sheep, which certainly improved them in size.

Mr. Parkinson, who wrote very early in the present century respecting these sheep, says:

I look upon the Dorset ewe as the best horned ewe in the kingdom, those of Somerset excepted, and they are so near alike that few people, unless the natives of the two counties, know the difference. The best of the Dorset ewes are more correct in their shape than many of the improved breeds of sheep. Mr. Bridge says they have been much improved of late years; they used to be long legged, which is by no means the case at present.

He then describes them as straight in carcass, deep in body, the rump much larger than in most sheep, the horns thin and rather bending backwards, the eye quick and lively, the face thin, the mouth small, the head standing up well, the neck very proper, the scrag neither thin nor clumsy, the leg well let down toward the shank; and he adds that they are "set full in the shoulder, which gives flesh on the back, and is an indication of flesh in every part;" and also, "the ribs are not so high or round in the upper part as in some improved sheep, which, when as high as promoted by Mr. Bakewell, proves a fault and diminishes the weight." Since the days of the writers just quoted the Dorset sheep, as known to them, have been continually decreasing in numbers. The extension of the improved Leceisters and Southdowns gradually circumscribed the limits of the ancient Dorsets; and in the various midland and western counties in which they formerly abounded, scattered flocks only are found, and these rarely pure.

A flock of the original Dorset breed existed until about 1880 on the farm of Mr. Miller, at Plush, near Cerne Abbas, when they were dispersed and none now remain. These sheep were much smaller in size than the improved Dorset, but neat, tolerably well shaped, and thickly wooled.

They bore almost as strong a resemblance to the Portland breed as to the modern Dorset, and were regarded by some as the connecting link between the two, for the opinion was once very prevalent that the Portland in reality was the original ancestral type to which all Dorset horned sheep owe descent.*

The last sixty years have witnessed a great improvement in the Dorset. If these sheep had been greatly improved in the latter part of the last century, the progress from 1830 to the present time can only be expressed by the word "vast," and justifies amply the name of Improved Dorset. The struggle between them and the Southdowns for the occupancy of the chalk soils of Dorset, long and bitter, shows how good the sheep were at that time, and the subject is alluded to by many writers of that day. The Southdowns finally supplanted the Dorsets, not because they were considered as so

*The Cattle, Sheep, and Pigs of Great Britain; by J. Coleman.

much the better sheep, but because they were better fitted to crop the close herbage of the chalk hills, and being smaller many more could be supported on a given acreage. A prominent factor in the struggle for preference was the wool. The fleece of the Southdown in those days was held in great estimation. Though the Dorset would shear from 1 pound to 1½ pounds more wool than the Southdown, the higher and advancing prices of the latter turned the scale in their favor, and the Dorsets were compelled to relinquish the chalk region and confine themselves to the better land in the western part of the county over which they had formerly ranged unchallenged and supreme. Though thus pushed back from their old grazings, the Dorsets have not been content to remain stationary, and have made occasional efforts, with varying success, to regain their old position. Much has been done for their improvement since 1850, more perhaps than during the previous years of their progress, and but for the great improvement and spread of the Hampshires they might have regained the ground from which they were expelled. It certainly excelled the old Hampshires and the old Wiltshires.

Shorter on the legs, with a more compact frame and a rounder barrel, this sheep, besides its peculiar value for the production of early lamb and its remarkable prolific qualities, is by no means to be despised for its feeding properties. It is not unusual for these sheep, as well as the kindred though somewhat larger Somersetshire, to be brought into the market in March or April, together with their lambs and sometimes pairs of lambs, all fit for the butcher at the same time.

So says Spooner in his essay on crossbreeding in 1859; and some years later Mr. H. Mayo, of Dorchester, testified that the grazing qualities of these sheep were greatly improved, and to such a degree that some of the best bred Dorset lambs arrived at maturity and put on flesh as fast as the Downs. The breed had made a rapid development, and the ewes bred more lambs than formerly.

Joseph Darby, in his article on the Dorset Horned sheep, summed up the later improvements with a statement that it was an unquestionable fact that an improved form and greater aptitude to fatten had been imparted to them, and that whereas within the memory of the present race of farmers wether lambs and tegs sold at low prices compared to those of other breeds, purely because of their indisposition to fatten until the second year, the defect had been sufficiently removed to advance very materially the current rates of this class in the market and fairs. This great improvement is partially due to a union with the Somersets, by which increased size was secured, and then by a careful and judicious selection, in the first instance by a few leading breeders, and subsequently by the distribution of their rams and the infusion of their better blood into flocks generally.

The great improvement made in these sheep within a few years past has added to the demand for them. They possess good quality, fatten readily, and incur but little risk in lambing, while the lambs come to early maturity. Within the past few years they have doubled in size, their fleeces are twice as heavy, while their fattening propensity has been increased to the extent that the best Dorset lambs now arrive at maturity quite as early as the Downs. Although they have been so much improved, they retain their hardihood and fecundity as much as ever.

Losses in lambing and barrenness are so rare that from 150 to 160 lambs may usually be calculated on for every 100 ewes placed with rams, and their fecundity is so great that the possibility of getting from these sheep two crops of lambs in one year does not exist merely

as rare and exceptional, but has often been effected. Mr. Ensor gives the aggregate statistics of a few flocks, showing that "out of 3,547 ewes only 60 were lost, and that they reared 4,425 lambs, or 125 per cent of lambs, with a loss of only 1.6 per cent of ewes."

With moderate feeding a wether of this breed comes out fat at from thirteen to fourteen months old, with carcass weight of from 70 pounds to 80 pounds each. The lambs are generally fit for the butcher from ten to twelve weeks old, when they average from 10 pounds to 14 pounds per quarter.

The rams clip from 10 pounds to 12 pounds of wool, the ewes from 5 pounds to 6 pounds, and the lambs, which are usually shorn, yield about half as much as the ewes. The wool of the lambs is in great demand.

The ordinary management of these sheep differs but little from that pursued in the case of the Hampshires and Southdowns, which has been somewhat described, beyond bringing the ewes to lamb earlier.

There are several breeders of them both in the United States and Canada, and during the last few years they have grown in favor.

The Somerset.—Low says that when the Dorset had been extended to Somersetshire and become thoroughly naturalized there, it increased rapidly, and greater numbers were reared in that rich and beautiful county than in Dorsetshire itself. It exhibited, however, some difference of character, being distinguished from the pure Dorset by the color of the nose, which was of a fleshy or pink color, resembling that of the Merino. The pink-nosed Somerset was larger than the black-nosed Dorset and of lanker form. The wool was somewhat longer, but nearly of the same fineness. The wethers, when fattened, attained greater weight, and the lambs were larger. As in the case of the true Dorset, this variety is practically extinct as it was formerly known; the crossing of the Southdown on it changed it.

The numerous varieties of the same group which inhabited the older commons of Dorsetshire and Somersetshire are now virtually extinct, although traces of the characteristic form may still be observed in certain places. One variety, however, is still to be found in a state of purity. It inhabits the isle of Portland, where it has been kept unmixed for an unknown period.

The Portland sheep.—Though now confined almost entirely to the island which gives them a name, these sheep formerly extended into the neighborhood of Weymouth and about Wareham and Poole. These little sheep, both male and female, have horns. They are very gentle, and though somewhat short in the carcass have good forms. Their wool, like that of the Dorsets, is of medium fineness and weighs from 1½ to 2 pounds the fleece. They are washed, being shorn in the salt pools left on the shores by the receding tide. Their mutton is exceedingly delicate and much sought after, and the wethers, when fat, at 2 years and 4 months old, weigh from 9 to 12 pounds to the quarter. The climate of the Isle of Portland is moist, and the natural herbage, which is abundant, is largely mixed with wild thyme, which is said to give flavor to the mutton.

The old Forest breeds.—England before the Norman conquest was covered with forest, and much of it was in the same condition in the reign of Elizabeth. Vast tracts were in later times in a state of commonage, upon which the inhabitants of neighboring towns had

right of pasturage for cattle and sheep. The native sheep of these ancient forests and commons presented distinctive characters and formed well-defined breeds. Several yet remain, and until late in the last century were quite numerous in Windsor Forest, Sherburne Forest, Mendip Forest, and many more, and were known as the Forest breeds. Most of these, however, are no longer to be recognized as separate varieties, and few of them remain without intermixture with the sheep of the adjoining country.

Those of Cannock Chase, or *Sutton Coldfield sheep*, the native short-wooled breed of Staffordshire, were polled, with gray faces, or of every intermediate color between black and white. They were thin in proportion to their length, otherwise they would resemble more the Southdown sheep, from a common stock with which they probably sprung. Their mutton was good, and they fattened with moderate food; at three years old their flesh was equal to that of any other breed. They were capable of growing to a very great weight. The wool averaged about 3 pounds to a fleece. It was fine, closely covering the carcass, but inferior to that of the Southdown. Attempts made to improve the breed by crossing resulted in improved form, increased weight, and wool of enhanced value.

The Delamere Forest or Cheshire sheep are the type of the old sheep of Shropshire, and approach to the general form of the Southdown. Usually they have small horns, and black, brown, gray, or spotted faces and legs. They somewhat resemble the diminutive Norfolk, and weigh about 8 to 10 pounds per quarter. The flesh equals that of other small breeds, and the wool is short and particularly fine, weighing about 1½ pounds per fleece. They are a variety of the true native breed of England. Their wool used to be in much demand by the Yorkshire manufacturers of fine cloths.

The Cannock Heath sheep and the Delamere are practically extinct, or so crossed with other breeds as to have lost their ancient characters, but of the forest breeds two remain which preserve more decidedly their identity. They exist in the elevated country between the Bristol and British Channels, the one inhabiting the heathy tract of granite forming the forest of Dartmoor, the other the district of Greywacke of the forest of Exmoor, at the sources of the river Exe, on the confines of Somerset and Devon. These two races have long attracted attention from their having supplied the well-known Oakhampton mutton, so named from the sheep having been killed at that town, whence the carcasses are sent to London. But the Oakhampton mutton now not only includes that of the forest sheep, but that of the crosses between them and other breeds.* They are everywhere of nearly the same character and betray on a smaller scale a great affinity with the Dorsets.

The Dartmoor sheep.—These sheep are very small and have long, soft wool, in which respects they differ from the other forest breeds. They have white faces and legs and generally have horns; they are small in the head and neck and small in the bone everywhere; the carcass is narrow and flat-sided, and they weigh when fat from 9 to 12 pounds per quarter. They produce delicate mutton, which finds a ready sale at high prices in the metropolitan market; and the flesh of the old wethers, when it has been hung a sufficient length of time, has considerable resemblance to venison. These sheep are exceedingly wild and restless and are apt to break their pastures when

* Youatt.

removed to a more inclosed country.* They are well adapted to the barren district to which nature assigned them, but on the whole are not profitable because of their small size, defective form, and above all, their wild and restless temper. They are being crossed so persistently with the Leicester and Southdown that as a pure breed they are practically extinct.

The Exmoor sheep.—The Exmoor sheep, another mountain race, are yet smaller, wilder, and more intractable than the Dartmoor. The district they inhabit in the far county of Somerset and also bordering North Devon is of limited extent, being an elevated range of hills extending from Minehead to South Molton, and mostly of open, uncultivated commons, bearing little but heather. Here these wild and hardy sheep have existed beyond the pale of history or tradition. Coleman admits the probability that the breed had its origin from the same ancient stock as the Portland or even the Dorset, for the sheep that once existed on the Mendip Hills seemed a connecting link between them. Although ranging heaths so near the Dartmoors, they differ in some respects, and so may be termed a breed. They possess strong constitutions, which admit of their being buried for several days in a snowdrift; a fine, curly horn; a broad, square loin; round ribs; a drum-like (not square) carcass, on short legs; and a close-set fleece, with wool well up to the cheeks. They have white faces, legs, and fleeces, and though standing well on their fore legs there is a failing point behind the shoulder. They are also indifferent about the neck. The males have a large beard under the chin, which causes them to resemble goats, and they greatly resemble those animals in strength and agility. Like goats they ascend precipices, and it is with difficulty that they are kept in ordinary inclosures. They are bold and pugnacious, and attack sheep larger than themselves. They are on the whole a hardy and prolific breed. The females, as in the case of other wild breeds, are considerably smaller than the males. Both ewes and wethers run on the hill commons nearly all the year round; the former only being brought down at the lambing season, which is usually in March and April, when they often give birth to twins or triplets.

The wool of these sheep is long and silky, averaging about 4 to 4½ pounds. Their mutton is excellent, of which they give 15 pounds to the quarter, and in some improved flocks an eighteen months' old sheep has given 20 pounds to the quarter. Like the Dartmoors, in some places where these sheep were once known, they have now disappeared, giving way to crosses or to the Cheviot, but in some districts they have maintained themselves, and a great demand has sprung up for superior rams of this breed.

Coleman, in closing his interesting description of these sheep, the mode of treatment and their improvement, says that their improvement has been brought about by a careful and judicious selection of rams, comprehensive welding of ewes, and skillful matchings; or in other words, by breeding on the in-and-in system, and, whatever is thought of the Exmoor, sufficient merit is exemplified under cultivation to invest the sheep with high claims for perpetuity of existence. The improvement of the breed has recently progressed quite as

*Youatt says that the diminutive horned sheep kept in the neighborhood of Oakhampton, and from which the Dartmoor mutton that supplies the distant markets is chiefly obtained, are small Dorsets, or at least very much resemble the smaller Dorset breed.

fast as the reclamation of the hill commons; and if sufficient quality and capability to put on flesh rapidly can be imparted to this hardy and prolific stock, for the future requirements of agriculture on this elevated tract of country, we may hope that it will be one of the few mountain species that the hand of civilization will spare.

Traces of the Exmoor form appear in the races of the country on the Mendip Hills; and along the Bristol Channel is a remnant of an allied breed. The sheep of the Mendip Hills were formerly distinguished for the fineness of their wool, but these sheep no longer exist in their pure state; they have been crossed with superior breeds or abandoned for other sheep until none are cultivated of pure blood. Some of the forest breeds were at least equal to the original Southdown, among which may be mentioned those of Staffordshire—the Cannock Heath, or Sutton Coldfield sheep.*

The Ryeland breed.—Lying between the mountains of Wales on the west and the river Severn on the east, there is a tract of country that from the earliest known period has sustained a race of sheep of small size, seldom exceeding 14 to 16 pounds the quarter, and noted for the softness and fineness of their wool, which grows close to and sometimes shades their eyes. This breed extended also into Monmouthshire on the south, into Shropshire on the north, and into Gloucestershire and Warwickshire on the east, occupying many forests and commons, and was known under many different names, such as Hereford, from the county where most generally raised; Archerfield, from that town; and sometimes the Ross breed, from the southeastern district of the county lying between Dean Forest and Malvern Hills. But the name by which it is generally known is the Ryeland, so called from a district in the southern part of Hereford County, on which a great quantity of rye used to be grown, and where many of these sheep were bred.

History gives us no record of the derivation of this breed from any other country, from which it may be assumed that it was indigenous to the district, or at least had been for a long time an occupant there. It is placed by some as a variety of that widely diffused race of soft-wooled sheep extending at one time from the mountains and islands of Scotland to the mountains of Wales, and in possession of the earliest Celtic inhabitants of the British Islands. Low conjectures that from its diminutive size, patience of scanty food, and the lightness of its fleece, it was the native of countries of a low degree of fertility, probably of districts of forest, which, until cleared of their wood, are always unproductive with respect to the nutritious grasses, and that the noted fineness of its fleece caused the preservation of the breed long after the forests were cleared and the country became capable of supporting larger animals.

The wool of this ancient sheep was long regarded as the finest produced in Britain, and the old chroniclers compare it to that of Apulia and Tarentum. One practice calculated to preserve and increase the fineness of the wool was that of cotting, which continued until a recent period. Although now almost entirely neglected, it was probably founded on the evident utility and humanity of the practice—preserving the sheep from cruel and injurious exposure to cold and from the ravages of wolves. During the winter, and especially at the time of lambing, the animals were kept during the night in large houses or in a place erected for this special purpose, capable

* The Cattle, Sheep, and Pigs of Great Britain.

of holding from 100 to 500. They were fed with hay or barley straw, given to them in racks, frequently suspended by ropes, and so contrived as to be easily raised in proportion as the dung accumulated below; for neither the owner nor the shepherd thought of cleaning out the place while there was room for the sheep to go in and out. It may be supposed that this practice was continued by habit, but special reasons have been assigned—that the wool, being preserved from the injurious effect of sudden change or inclemency of weather was sounder and finer; that the sheep were in better health; that especially they were preserved from the rot; that fewer lambs were lost at yeaning time; that great losses were always incurred when it was attempted to fold the sheep; and that much valuable dung was collected and saved. It is sufficiently evident, however, that the requisite protection of the sheep from cold, when yeaning and at other times, could have been afforded in open sheds at less expense; that in the usual way of folding the dung could have been more cheaply carried to the ground and more equally spread and better trodden; and that many sheep could scarcely have been crowded together during the night, in a close building and on an accumulating and fermenting heap of dung, without serious loss.*

The Ryeland and its subvarieties have practically disappeared. Their former value, arising from the worth of their wool in the manufacture of native cloth, could not be maintained against the Spanish and Saxony wool, and as mutton sheep they have yielded the ground to those longer-wooled sheep producing larger returns to the breeder.

The Shropshire Down sheep.—Sheep husbandry in England is not only an exact science but a progressive one, working continuously on natural laws for the improvement of good breeds, and, at times, producing new ones of superior merit. Among these may be named the Shropshire. The old sheep of Shropshire were of many breeds, but time and circumstances gave them a more equal character. Many of these breeds have passed away; some of them yet remain, but in an improved condition. These were originally horned, and with black or mottled faces and legs. They were about the size of the Southdown, but the neck was longer and the carcass not so compact. They were hardy, and rarely had food given to them in the winter, except in a deep snow. At the beginning of this century the Shropshire sheep weighed from 14 to 16 pounds per quarter; the fleece of the wether about 2½ pounds, but that of the ewe not more than 1¾ pounds. They used sometimes to be crossed by the Dorsets. The carcass was increased to 18 to 20 pounds the quarter, and the fleece to 3 or 4 pounds, but the quality of both was deteriorated. They were, however, thought to pay the farmers better than the old breed.

The common mountain sheep of Shropshire was smaller, being scarcely more than 10 or 12 pounds to the quarter; but the wool was finer, and sold at a somewhat higher price. Another Shropshire sheep was the Clun Forest, a white polled variety, from 12 to 14 pounds the quarter, and the fleece weighing from 2½ to 3 pounds; and one smaller than all others, called the "Tadpole."

The Long Mynd or Mound sheep were horned, with black faces, weighing about 12 pounds the quarter, and the wool being very little

*Youatt.

inferior to that of the common mountain sheep. On the hills near Wales the sheep were polled, with white faces. They were larger, shorter in the legs, and the fleeces heavier and closer than those of the Long Mynd sheep. Youatt says that the sheep, however, which was the pride and boast of Shropshire, and scarcely excelled in fineness of wool even by the Ryelands, was the Morfe Common sheep. This tract of land is situated on the borders of the Severn, near Bridgenorth, and contains nearly 4,000 acres. The ewes were fed on the common from the middle of June to October, when the young sheep were brought on it for the winter. From the shortness of the pastures and the quantity of furze about the common the sheep began to lose their teeth at five years old, and were then disposed of.

The Morfe sheep had small horns, with speckled, dark, or black faces and legs; the wether weighing about 13 pounds, and the ewe 9 pounds the quarter, and the fleece weighing about 2 pounds. In many points resembling the Ryeland, if indeed not a variety of that breed, it had been found from time immemorial in various parts of Worcestershire, Shropshire, and Staffordshire. It was probably this species of Shropshire wool that in 1343 was the choicest and the dearest in England, and at every succeeding period, when mention has been made of it, justice has been done to its excellent quality. It has now shared the fate of every short-wooled fleece. The importation of a better material and the tyranny of fashion tempted the farmer to cross even this breed with a heavier sheep; and the experiment, however it may have answered to him in a pecuniary point of view, materially changed the character and the destiny of the Morfe fleece.

In 1792, when the British Wool Society procured all the information possible regarding the sheep of England, they reported that on Morfe Common there were about 10,000 sheep kept during the summer months, which produced wool of superior quality. They were considered a native breed; were black-faced or brown or spotted-faced, horned sheep, little subject to either rot or scab; weighing, the wethers from 11 to 14 pounds, and the ewes from 9 to 11 pounds the quarter.

Upon this and other evidence Professor Wilson concludes that the original stock from which the present breed of Shropshire Downs sprung was the old Morfe Common, and as the country advanced and the breeds became valuable for their carcasses as well as for their wool, the Morfe Common sheep were crossed with other breeds, but more particularly with the long-wooled Leicester and Cotswolds or the short-wooled Southdown. The admixture of such different blood has produced a corresponding variation in the character of the present breed of Shropshire Downs, and tended materially to sustain the hesitation which long existed to allow them a place as a distinct breed. Where, however, the original cross was with the Southdown and the breed has been continued unmixed with the long-wooled sheep, they present the characteristics of a short-wooled breed.*

This view is not universally shared, and it is not unhesitatingly acknowledged that the Shropshire Down is a pure sheep descended from the Morfe Common. It is held by many that, though modern sheep in their improved character, the original stocks were the Long Mynds in Shropshire and the Cannock Chase of Staffordshire, and

*Prof. John Wilson, in Journal of the Royal Agricultural Society of England, vol. XVI.

they bring forward evidence to sustain their position. About 1858 Mr. Tanner made an agricultural survey of Shropshire and paid particular attention to its sheep, and his conclusion, after much inquiry and personal investigation, is thus expressed: "For my part I do not consider them a pure breed, but a cross-bred animal from the original Long Mynd or old Shropshire sheep." Plymley, who published in 1803 a general view of the agriculture of Shropshire, says:

> There is a breed of sheep on the Long Mynd with horns and black faces that seem an indigenous sort; they are nimble, hardy, and weigh near 10 pounds per quarter when fatted. The fleeces upon the average may yield 2½ pounds, of which one-half pound will be the breechens or coarse wool, and is sold distinct from the rest. The farmers of the hill country seem to think the greatest advantage they derive from the access of foreign stock is from the cross of the Southdown with the Long Mynd sheep; the produce they state to be as hardy and to bite as close as the Long Mynd sheep, and the weight of the carcass is increased.

From this positive statement of an observer in the beginning of the century and from his own observations nearly sixty years later, Tanner thought it evident that this cross of the Southdown and the Long Mynd was an early favorite, and that the practice continued could not be doubted, for it was well known that first-class flocks of pure Southdowns were kept in Corfe Dale, and annual ram sales were held for very many years until they were gradually superseded by the improved Shropshire Down, and at the time Tanner wrote Southdown rams from the best breeders still found their way from the east of England to Shropshire. Even those flockmasters who claimed to be holders of the original breed could give no proof of purity of blood for twenty-five or thirty years.

Spooner, in his essay on cross-breeding, is explicit in his statement that the Shropshire is "undoubtedly a cross-bred animal, and indeed affords a striking example of the perfection that can be derived from a judicious mixture of various breeds," and he quotes Mr. Meire, a breeder, who at a meeting of a farmers' club in Shropshire, 1858, observed:

> It is not attempted to be denied that the Shropshire is a cross-bred sheep. The original breed was horned, and the first attempt at improvement was to get rid of these incumbrances, and there is little doubt that this was effected by a cross of the Southdown. This sheep was well adapted for the downs, but for the inclosures of Shropshire something more docile was required, consequently recourse was had to the Leicester.

This crossing and recrossing at length gave place to the practice of careful selection, "and thus," says Spooner, "uniformity was sought for and attained, and the present superior breed was established. It is now held that no further cross is required."*

Those who hold that some of the improved Shropshires are from the Cannock Chase sheep point to many facts, among others that the dry surface of Cannock Chase and its good climate favor a heavier heath sheep than occurs elsewhere, and that the original sheep had a short light fleece of about 3 pounds, and a carcass which might be fattened at three years old to eight or nine stone, and that their descendants, crossed by the Southdowns, whilst retaining the same hardy character, are much larger, mature earlier, yield a heavy fleece, and a frame weighing ten stone at thirteen months without

*W. C. Spooner on Cross Breeding; Journal of the Royal Agricultural Society, vol. xx.

extraordinary treatment. Stafford adjoins Shropshire. Southdown rams were brought into both about the same time and crossed with native ewes; the produce crossed on each other, and thus the Cannock Chase blood became infused in the Improved Shropshire Down.

These facts are held to be conclusive by many, that it is to the Southdown chiefly, though not entirely, that the present form and character of the Shropshire are due; indeed, about the only objection that could be urged against the breed up to 1875 or 1880 was that, although for the twenty years preceding it had received much attention, there was still a lack of uniformity; but this defect has now almost entirely disappeared, as breeders are at last tolerably agreed as to the particular type that is most desirable. "The variety," says John Coleman, "could only be accounted for by the supposition that different crosses in different proportions had been tried; and we think there is no doubt this had been the case."

The disputed origin of the Shropshire has elicited much controversy. We have stated the position occupied by leading men on either side, thinking, however, with some of them, that the differences of opinion appear very unimportant; for if the Shropshire is not an original breed, it is very certain that it is an established breed, and that its character and peculiarities can be perpetuated most satisfactorily. In fact, the rapidity with which this breed has risen into favor is very strong evidence of the general estimation in which it is held. Only a few years since any mention of the Shropshire Down raised an inquiry, even amongst intelligent English agriculturists, as to their character. Now it is known as a sheep combining the symmetry and quality of the Southdown with the weight of the Cotswold, and possessing the fattening tendency of the Leicester, without its delicate constitution.

Economical merit is usually promptly recognized in England, but it was not until 1853 that this was the case with Shropshire sheep, and then but partially. In that year, when they were exhibited at the Royal show yard at Gloucester, their general superiority was apparent, and from that time breeders were awakened to use careful judgment in breeding and selecting flocks, which gradually brought them to the front. At the great national show in 1857, at Salisbury, England, sweepstake prizes were awarded to Shropshire rams "Celebrity," "Patentee," and "Earl of Salisbury." But a great impetus was given to Shropshire breeders when the Royal Agricultural Society recognized the importance of the breed by giving it a separate class, which was first done at the Canterbury show in 1860, at which time 192 Shropshires were exhibited with marked success. Coleman says the wisdom of this step has been abundantly illustrated by the numbers and quality of the entries at all subsequent shows, which have for many years past far outnumbered any other breed. One reason for the difference of character which so long prevailed may be found in the fact that, while many breeders achieved from time to time prominent positions, there was no one in early days who took such a decided lead as to impress his type permanently, as was the case with the Leicesters and Southdowns.

Mr. Alfred Mansell, of College Hill, Shrewsbury, in Shropshire, most excellent authority, says that since 1859, despite the great prejudice and opposition of exhibitors of other breeds, the Shropshires have steadily increased in number at the Royal shows, culminating in the grand display of 1884 at Shrewsbury, "when 875 Shropshires were exhibited against 420 Southdowns, Hampshires, Lincolns, Lei-

cesters, Cotswold, Mountain, and all other distinct breeds, being considerably more than double the number of all other breeds, and demonstrating very conclusively that the Shropshire is a sheep that meets the requirements of the day, and surely is the coming race." Another fact worthy of notice is that this breed seems to thrive and become acclimatized in all places if properly cared for, as is proved by the success of exhibitors extending over a wide area, noticeably at the Royal show of Shrewsbury in 1884, the exhibitors of this breed numbering no less than sixty, and hailing from fifteen counties, including Ireland, whereas the best that can be said of any other distinct breed is that the Southdowns came from eleven breeders in six counties; and by experience of others who have seen the breed flourishing in every country—in England, Scotland, Ireland, the United States, South America, Canada, the colonies, France, Germany, Greece, and most other continental countries whose soil and surroundings differ to a great extent. This power of acclimatizing itself, no doubt, has not escaped the notice of foreigners, who of late years have exported the breed largely.

The precise process of forming a flock of Shropshires, one that carried off many prizes, may be learned from the experience of Samuel Meire, of Birrington. Mr. Meire was an excellent judge of stock, and set to work upon the coarse Shropshire, going chiefly for three points—straight spine with well-sprung ribs, oblique shoulders, and good rumps. These points could not be obtained by cultivation or selection alone, and Mr. Meire introduced the Southdowns, buying or hiring rams from the celebrated flock of John Ellman, of Glynde. Aptitude to feed, with the short back and chine, were derived from a cross of Leicester blood introduced with great judgment. Having thus obtained the desired form of the animal, he endeavored to fix the same by close breeding. In this he succeeded and thus founded a flock from which has come improvement to many others.

Another mode of improvement was that adopted by Mr. George Adney. He stuck to the coarse Shropshires as he found them, making his improvements by selection, which he did with rare judgment and skill. His most fortunate production was Buckskin, a ram of rare points, who was descended from a Southdown cross; and Buckskin got Old Patentee out of a ewe bred by Mr. Adney, a superior sheep and a prize winner, whose blood still runs in every Shropshire flock of any note, not only in England but in North America. This sheep had a large, plain, and dark head.

We have stated that one of the stocks of the Shropshire was the Cannock Chase sheep, bred principally in Staffordshire. Flocks have originated also from the Whittington Heath sheep—a breed of hardy sheep very similar in type to those of Cannock Chase, and confined to a district of but 400 acres. These were grand sheep and much appreciated by the breeder. Pure flocks of the Cannock Chase Shropshire and the Whittington Heath Shropshire exist, but as a general rule the blood of all the strains mingles in the Improved Shropshire Down.

The characteristics of this sheep as set forth in England are quite as well exhibited in Canada and the United States, where triplets are not exceedingly rare. The compiler of the American Shropshire Sheep Record, Mortimer Levering, Lafayette, Ind., records the fact that he had received letters stating the successful raising of four lambs from one ewe in two cases.

The Shropshire sheep of to-day exhibit much of the quality of the Southdown, with considerably more size. They have a well-developed head; the eye full and large, giving a clear and striking expression of countenance; the forehead well wooled; the ears rather large and thin, standing well out from the head; a muscular neck, well set on good shoulders; the body symmetrical and deep, placed as squarely as possible on short legs, due regard being paid to grandeur of style; a well-covered head of a uniform dark but not black tint; the skin of a nice cherry or pink color, and the legs a nice soft black, free from all white specks; the belly and legs well wooled to the knees; and all inclination for the wool to peel at the jaw and legs should be avoided.

These sheep are now very numerous in the United States and Canada, and for convenience we give the scale of points adopted by the American Shropshire Association, in 1884, as a standard of excellence in judging Shropshire sheep:

Constitution.—Constitution and quality indicated by the form of body; deep and large in breast and through the heart; back wide, straight, and well covered with lean meat or muscle; wide and full in the thigh, deep in flank; skin thick but soft, and of a pink color; prominent, brilliant eyes and healthful countenance—25 points.

Objections.—Deficiency of brisket, light around the heart, fish back, pointed shoulders, tucked-in flank, pale or too dark skin objectionable.

Size.—In fair condition when fully matured; rams should weigh not less than 225 pounds, and ewes not less than 175 pounds—10 points.

Objections.—Rams in full flesh 175 pounds or under; ewes in full flesh 150 pounds or under.

General appearance.—General appearance and character, good; carriage, head well up, elastic movements, showing great symmetry of form and uniformity of character throughout—10 points.

Objections.—Head dropping, low in neck, sluggish movement.

Body.—Well proportioned, medium bones, great scale and length; well finished hind quarters; thick back and loins; twist deep and full, standing with legs well placed outside; breast wide and extending well forward—15 points.

Objections.—Too fine bones, short body, deficient in twist, legs close together, light in brisket.

Head.—Head short and broad; wide between the ears and between the eyes; short from top of head to tip of nose; ears short, of medium size; eyes expressive; head should be well covered with wool to a point even with the eyes, without any appearance of horns; color of face dark brown—10 points.

Objections.—Horns disqualify, white face disqualifies, head with prominent bones, bare on top of head.

Neck.—Medium length, good bone and muscular development; and especially with the rams heavier towards the shoulders; well set high up, and rising from that point to the back of the head—5 points.

Legs and feet.—Broad, short, straight, well set apart, well shaped; color, dark brown, and well wooled to the knees—10 points.

Fleece.—Body, head, belly, and legs to knees well covered with fleece of even length and quality; scrotum of rams well covered with wool—10 points.

Quality of wool.—Medium, such as is known in our markets as "medium delaine" and "half-combing wool," strong, fine, lustrous fiber, without tendency to mat or felt together, and at one year's growth not less than 3½ inches in length—5 points.

Great numbers of these sheep have been imported into the United States, and the importation still continues, such a favorite have they become. They are medium wooled and are good shearers. An American flock of 70 head in 1888 averaged 13½ pounds of wool per head. They are a good mutton sheep and bring the highest price in the markets of some of our largest cities. They are hardy, prolific, generally free from disease, and carry a close, compact fleece, which adapts them to a rainy or cold climate, and are known to do well in the United States and Canada.

The Oxfordshire Down.—This is a comparatively new breed of sheep, and originated in 1833 in the desire to construct a breed that should in great measure possess the weight of the long wooled with the quality of the Down. The leader in this movement was Mr. Samuel Druce, of Eynsham, Oxford, and he had as colaborers Mr. Gillett, of Southleigh, Mr. Twynham, of Hampshire, and Mr. Blake, of Stanton Harcourt. The foundation of the breed was a neat, improved Cotswold ram and Hampshire Down ewes; and by careful, skillful breeding a cross-bred sheep was produced of great value and deserved popularity. As a number of breeders were engaged in the attempt there was always an opportunity of getting fresh blood by selecting sheep which suited different flocks, thereby maintaining the uniform character which came to be established. Some of the breeders used a Cotswold ram with the Southdown ewe, whence, with a mixture of blood of the various flocks, the blood of the improved Southdown was infused in the cross. For many years after the breed had become recognized as distinct the want of uniform character was a source of criticism, which was met by Mr. Druce with the assertion that he found no difficulty to keep the form and size of the animal as it should be, the wool of a valuable quality and not deficient in quantity; and he maintained that the good qualities could be better secured by employing the cross-bred animals on both sides than by using the first cross. A comparison was instituted with other sheep with this showing as to proceeds of fleece, carcass, single teg, and flock:

Breed.	Fleece.	Carcass.	Single teg.	Flock.
	s. d.	*s. d.*	*s. d.*	*£ s. d.*
Cotswold	11 4	38 4	49 8	248 6 8
Leicester	9 10	32 7	42 5	222 12 9
Southdown	6 11½	33 9	40 8½	204 2 6
Hampshire Down	9 0	36 10	45 10	263 10 10
Cross-breed	9 11½	41 2	51 1½	292 18 0

This showing in favor of the cross-breeds was certainly very great, arising of course from the superior quality and therefore higher prices per pound of the mutton as compared with the short-wooled sheep. The question, argued Mr. Druce and his supporters, was not whether any of the long wools or the short wools, such as the Cotswold, the Leicester, the Hampshire, or Sussex Down, should be given up, but whether there was room for another; whether in fact it did not require in addition a middle-wool breed beside them. But the evident disadvantage of the system of using only a first cross was this, that as most breeders did not breed their own ewes they must be purchased every year, therefore there was no sure dependence upon keeping up a superior breeding stock.

The difficulty of establishing a new breed, as is well known, consists in the tendency of the cross for many generations to revert to one or other of the original races. Still, many farmers have now (1853) for some years bred this sheep, intermediate between the long wool and the down, and have thereby laid a foundation on which, if it be thought fit, others may build.*

The success of the early promoters of this breed brought many others into the field, and whereas till within a short period the Hampshire Down was the principal sheep kept south of the Cots-

* Journal of the Royal Agricultural Society of England, vol. XIV.

wold district of Oxfordshire, the glory of the county soon became the cross-breeds, the improved Cotswold, the most profitable to the butcher, the producer, and the consumer, and after a period of twenty years without infusion of any fresh blood became a distinct breed of sheep, quite as distinct and pure as the Shropshire, and brought to the same uniformity. They so much resembled the Shropshire as to be taken as the same kind of sheep. The superiority claimed for them was that they combined the early maturity, heavy carcass, and ample fleece of the Cotswold with the fine wool and mutton of the Downs.

At first there was much difficulty in keeping a newly-formed flock of these cross-breeds to one character. The first cross and their produce would be dissimilar; some would partake too much of the long wool, while others were too small and short-coated. The owner formerly divided his flock into three parts, putting a half-bred ram to the ewes that were about right—a Cotswold to the small ones, and a Down to the coarser sheep. By constant attention to these points a flock may be brought to some degree of uniformity, but the breeder frequently found that if the fleece was a little too short or face too white, by using pure Cotswold or Down rams he rushed into the other extreme, the product too much resembling their sires.*

These cross-breeds are considered as profitable as any that can be raised, both on account of size, weight of wool, aptitude to fatten, hardy character, and valuable meat. Not until 1850 were they known as anything but cross-breeds (Down-Cotswolds), under which designation they achieved some success and reputation at the Smithfield shows. In 1850, from the county of their origin and stronghold, they were styled the Oxfordshire Down. A writer in the Journal of the Royal Agricultural Society of England, 1852, said: "On the Oxfordshire side of Northampton County the Leicester flocks have been crossed to some extent with the New Oxfords. These are sheep of large dimensions, and are bred in Oxfordshire and the surrounding districts. A cross of this kind increases the weight and size of the Leicester." From 1850 to 1860 the breed was much extended by sale from different flocks, but more largely by the sale under the hammer of some choice flocks owned by ram breeders of skill, standing high in the estimation of the public. The distribution of these flocks laid a good foundation for many others, and many tenant farmers gave up the old breeds to make room for the improved one, and landed proprietors became interested in and favored it.

As soon as the breed became established some of the most successful breeders began to exhibit their sheep at the show of the Royal Agricultural Society, and as they had no special class their animals were shown with short-wooled sheep and cross-breds. At a meeting at Warwick, in 1859, there were thirty-seven entries. The first prize in the old class (comprising Oxfords, Shropshires, and Hampshire Downs) was taken by Mr. Samuel Druce for a sheep of this breed. The three prize animals were measured with this result: Mr. Druce's Oxfordshire Down, 2 years and 5 months old, girth 4 feet 10 inches; Mr. Humphrey's Hampshire Down, 3 years and 4 months old, girth 4 feet 9 inches; Mr. Adney's Shropshire Down, 2 years and 3½ months old, girth 4 feet 8 inches.

At the Leeds show of 1861 there was a large showing of shearling

*Farming of Oxfordshire; by Clare Sewell Read, J. R. A. S. of England, vol. xv, 1855.

rams, the greater portion of which were Oxfordshires, which were excluded from competition, as they were not considered as coming within the category of short-wooled sheep. The stewards in their report stated:

> At the same time the judges are of opinion that the Oxfordshire Downs should *not* be excluded from competition at these annual shows, as they believe them to be animals possessing great merit, and worthy of having a class to themselves.

The society accorded the breed a separate class, and the Oxfordshire Downs made their first appearance as a recognized breed by the great society in the year 1862, at Battersea, where they numbered sixty-two entries, and were highly spoken of by the judges, who, however, objected to their want of uniformity. The same objection was made at the Newcastle show in 1864, when the judges said they "still exhibit a considerable diversity of color in their legs and faces, but the tendency seems as much as possible toward the dark faces and to the retention of the Cotswold topknot; some were a little too high on the leg." Similar traces of a departure from uniformity were remarked upon by the judges at the annual shows in 1865 and 1868.

From this time a greater fixedness of type was secured, and the reports of the judges and stewards of the annual shows in 1870 and 1872 give high praise for the general excellence and great improvement in uniform character. There were still to be seen, however, a difference in type in the rams offered to the public; but, knowing that a heavy fleece could be obtained with wool thickly set on the skin, and holding the opinion that a fine quality of mutton was not to be found under an open coat, judges thought a great advance would be made, and they have not been disappointed. For rent-payers in England the Oxfordshires are thought not to be excelled, and with their robust constitutions and early maturity, bearing as they do such an abundant supply of mutton and wool, they have made their way into most counties, and many hundreds of rams are yearly sold by the different breeders.

The Oxfordshire is a well formed, round bodied, short legged, mutton and wool combined sheep. It about equals the Hampshire in size, an average weight for mature breeding rams being between 200 and 225 pounds, while 2-year-old fat wethers are frequently found weighing upwards of 275 to 300 pounds. The following figures, taken from the Smithfield Club show catalogue, and given by Coleman in his "Sheep of Great Britain," will give some idea of the live weight of a pen of three shearlings when about 22 months old:

	Weight.			Year.
	Cwt.	*qrs.*	*lbs.*	
Shearling wethers	7	3	27	1870
Shearling wethers	7	1	20	1871
Ewes	8	1	26	1870
Ewes	7	3	9	1871

The average age of the pen of three ewes in 1870 was 57½ months; that of three ewes in 1871 was 61 months.

The weight of wool for a whole flock will average about 7 pounds per sheep; rams have been known to cut as much as 20 pounds when shearlings. The Oxfordshire sheep seem to be particularly adapted for mixed soils and bear close confinement. They are a healthy

class of sheep, and their management closely approaches that practiced in Hampshire and Wiltshire, where the attention to ewes and lambs has become proverbial—early maturity (*i. e.*, 20 pounds a quarter at a year old) requiring great attention during the young stage.

The stock ewes are generally divided in August, and rams selected to suit each lot; they run over the stubbles and are penned on rape or cabbage at night. They then clean up the pastures till Christmas, having bean or pea straw at night. It is considered unwise to give them many turnips before yeaning. They are then brought into the fold-yard for lambing, and are fed on hay, cotton cake, and a few roots, and remain so till the lambs are sufficiently strong to go into the turnip field. They will be found very good mothers, being strong and prolific, producing a considerable proportion of twins; this, however, depends much upon the nature of the land. The lambs when taken in the field have a fold in front of their mothers, where they are supplied with hay, corn, and, as the case may be, cut swedes, or crop off the greens; the ewes with twins are also given corn. The lambs are usually weaned when about 22 weeks old. The plan most recently adopted is to have the fold thoroughly well set, and allow them to remain in front of the ewes, and after a few days they will become quite reconciled.*

The characteristics of a good type of Oxfordshire Downs are: A nice dark drab color of the face and legs; the head medium large, and well covered with wool with a tuft or topknot on the forehead, the tuft not so long as that of the Cotswold, but standing out more from the head; the forehead broad and full; ears set low and well back; eyes large, and muzzle finely pointed. The fleece of wool is thick on the skin but not so long as that of the Cotswold, being about 5 to 7 inches; finer than that of the Cotswold, curly, and standing well out from the body.

One of the finest specimens of this breed was the ram named Freeland, bred by Mr. A. F. M. Druce in 1874. He took all the chief prizes wherever shown in 1875, and was afterwards let for the season. In 1876 he was let to T. S. Cooper, of Coopersburg, Pa., for $425. He weighed 425 pounds when exhibited at Philadelphia at the International Exhibition of 1876, where he gained the honor against all breeds, and received the commendation of the judges "for excellence in quality, uniformity of symmetry, great constitutional development, and for being a very superior specimen of the breed to which it belongs."

Time adds to the popularity of these sheep, and they are now widely distributed. Careful breeding has given them more uniformity of character, and as producers of good quality and heavy weight of mutton and wool at an early age it is difficult to equal them. They have found their way into nearly every part of the world, in every state or kingdom of Europe, into South Africa, Australia, South America, Canada, and the United States.

The New Oxford sheep or Cotswold cross-bred, then called, was introduced into the United States in 1845 or 1846, by Clayton Reybold, of Delaware, and at his annual shearing at Delaware City, Del., May, 1846, two animals were shown:

Number 1 was 3 feet across the back; 5 feet from nose to rump; 7 feet 4 inches in circumference; weighed 320 pounds (live weight), and gave 13 pounds well washed wool.

*Oxfordshire Down Sheep; by A. F. M. Druce and C. Hobbs.

Number 2 was 2 feet 2 inches across the back; 5 feet 2 inches from nose to rump; 7 feet in circumference; weighed 272 pounds (live weight), and gave 17 pounds well washed wool.

A 2-year old Oxfordshire sheep was sold in Maryland in 1848 for $80, which was considered a very low price. We are told that the first importations of the new sheep were not appreciated. In 1853 William C. Rives, then in England, sent home to Virginia one buck and five ewes of the breed, which were the first taken into Virginia. About the same time R. S. Fay introduced them into Massachusetts, from the same flock from which Mr. Rives made his purchase. They are now well known and numerous in the United States. The American Oxford Down Record Association has adopted the following scale of points:

Parts.	Points.	Parts.	Points.
Head	8	Fore flank	5
Face	4	Back and loin	12
Nostrils	1	Belly	3
Eyes	2	Quarters	8
Ears	4	Hock	2
Collar	6	Twist or junction	6
Shoulder	8	Fleece	17
Fore legs	4		
Breast	10	Perfection	100

The Teeswater sheep.—The river Tees separates Durham from Yorkshire and discharges its waters into the North Sea. Upon the rich lowlands bordering each side of this river to the highlands of Durham and Yorkshire there was originally bred a tall, clumsy sheep, without horns, and with white face and legs; the bones small compared with those of other large breeds, but supporting a thicker, firmer, and heavier body than its size would indicate; wide upon the back, somewhat round in the barrel, and yielding a heavier carcass than any other sheep, but proportionally longer in growing to perfection; the meat, however, finer grained than could be expected from such an animal. The wool of the old Teeswater was remarkably long, rough, and heavy, yet so lightly was it set upon the skin that the fleece seldom weighed more than 9 pounds. The ewes were very prolific, usually bearing twins, sometimes three at a birth, and cases are on record where a single animal brought forth sixteen lambs in four years.

This breed is, by nearly all writers, classed among the Lincoln sheep. The pure breed are now very scarce. They have all more or less been improved by crosses with the Leicesters, by which the legs have been shortened and the bone and coarse parts reduced. The wool was also shortened by crossing. The Teeswater do best in small flocks and when disposed over pastures with other stock, rather than when put in large numbers thick upon the ground.

The Lincolnshire.—The old Lincolnshire sheep undoubtedly proceeded from the same stock as the old Teeswater, and like it has passed away, giving way to animals so improved as not to be recognized as of the original family. According to Ellis, who wrote in 1749, "the Lincoln sheep were the largest carcassed sheep of all others, and although their legs and bellies were for the most part void of wool, yet they carried more wool on them than any sheep whatsoever." Culley, who wrote later, thus describes them:

They have no horns, white faces, long, thin, and weak carcasses; the ewes weighing from 14 to 20 pounds the quarter; the 3-year-old wethers from 20 to 30 pounds. They have thick, rough, white legs, large bones, thick pelts, and long wool, from 10 to 18 inches, and weighing from 8 to 14 pounds per fleece, and covering a slow-feeding, coarse-grained carcass of mutton.

Milburn speaks of them as having large and coarse carcasses, the length from the head to the tail being in some cases 4 feet 7 inches. The ribs were flattish, and not covered very thickly with flesh; the belly deep, and the shoulders so forward as almost to hide the breast; the neck thick and large, with a deep and flabby dewlap hanging from it; the skin thick and the flesh often grained; the hind quarters full and fat, the tendency being to lay on fat at the rump; and the legs fleshy and deep. "The whole animal," continues Milburn, "appears to be somewhat unshapely, taking the standard of a connoisseur as a criterion, but the valuable wool which covers it hides all imperfections."

All the older writers agree that the original Lincolnshire sheep were ungainly animals and gross feeders, possessing but little aptitude to fatten. When the Lincolnshire breeders saw, however, what a vast improvement had been made in the Leicester sheep by Bakewell, they determined to follow in his footsteps; and, by a wise and judicious admixture of Leicester blood, they developed an entirely new type of sheep, which retained the preëminent wool-bearing qualities of the old breed and showed a marked improvement in form and in their aptitude to accumulate flesh.

The effect of the change upon the wool has been to make it shorter and finer, and to diminish somewhat its softness of fiber. It is a question if the peculiar quality of the wool could not have been retained in a larger degree without essential injury to its meat-producing quality.*

It was not until about 1850 that the value of the improved Lincolns began to be acknowledged outside the county, and not until 1862 did the Royal Agricultural Society recognize them as a separate class. They are now spread over the whole of Lincolnshire and Rutland and parts of Cambs, Notts, Yorkshire, and Norfolk, and in some districts of Ireland and Scotland. Many have been sent to Australia, New Zealand, Cape of Good Hope, North and South America.

The improved Lincolns are wonderfully prolific and mature early. MacDonald says that the improved breed has been crossed with the Leicester slightly in the lowlands; much more deeply in the wolds, the flocks in which have fully three-fourths of Leicester blood to one-fourth of old Lincoln. The lowland sheep have a large, massy frame of flesh, covered and grained with fat. They are compact, light of offal and kindly feeders, but they require more food than those sheep in which a larger proportion of Leicester blood is found. They can not be put on land of so low a quality, nor can the same average number be fed on the better quality of land as of the more improved breed; but for weight of wool they excel most breeds. There are many remarkable instances of this and of their weight when fatted to the utmost extent. A wether, for example, out of an equal lot of twenty-seven, was killed at Grantham which clipped 17 pounds of wool and weighed 308 pounds.*

The Lincolnshire sheep introduced into Australia and New Zealand for crossing purposes has produced a class of sheep which have a

*Cattle, Sheep, and Deer; by D. G. F. MacDonald, 1872.

beautifully pure and silky hair of great length, some fleeces measuring 36 inches. Some of the largest sheep reach from 350 to 360 pounds weight. They are more numerous in Canada than in the United States, but there are flocks of some size in Missouri, Minnesota, Ohio, Iowa, Wisconsin, and Kansas, where they do well, especially on the rich prairie soils, where they can get rich food and plenty of it.

The Romney Marsh.—As elsewhere stated the sheep of the British Islands may be divided into two general classes: (1) The smaller sheep of the mountains, moors, downs, and less fertile tracts, and producing for the most part short wool fitted for carding and the manufacture of cloths; and (2) the larger sheep of the plains, marshes, and richer country, producing wool with long filaments, adapted to the manufacture of worsteds. With a better system of agriculture and the introduction of the turnip and other increased means of supplying artificial food, the long-wooled breeds continually gained in numbers upon the short-wooled. They are divided by Low into those which inhabit the fens and marshes and those which are found in the inland and drier country. Of the former class the most numerous and remarkable was the old Lincolnshires, of which remnants only now exist, if indeed they have not entirely disappeared. Another variety of this class grazed over a limited tract of low, reclaimed land, termed Romney Marsh, on the southern coast of Kent, at the western entrance to the Straits of Dover. This tract of land is a plain of alluvial land not much above the level of the sea, and protected from its tides by dikes similar to those constructed on the marshy flats of Holland. It is 14 miles in length and at its broadest part 10 miles in width.

Price, who wrote at the beginning of this century, said the Romney Marsh or Kentish sheep were at that time distinguished by thickness and length of head, a broad forehead with a tuft of wool upon it, a long and thick neck and carcass. They were flat-sided, sharp-chined, tolerably wide on the loin, a narrow and not deep breast, with the fore quarter not heavy nor full. The thigh was full and broad; the belly large and tabby; the tail thick, long, and coarse; the legs thick with large feet; the muscle coarse and the bone large; the wool long and not fine and coarsest on the breast; they had much internal fat and were great favorites with the butcher. They were hardy, bore their cold and exposed situation well, and during the hardest winter required no artificial food except a little hay. The average weight of the fleece was 6½ or 7 pounds; the wool was of medium fineness, long, and of good color, and more than 20 pounds weight was produced on each acre of marsh land.

It was readily acknowledged by Youatt, and other writers and by some breeders, that there were many good points about this sheep, and that it was a most valuable breed for the purposes for which it was reared. It demanded a pasture of unusual richness and found it on these marshes. The produce in wool and the thickness in stocking were scarcely equaled in any other breed or situation. It was not unusual for six or seven tegs and seven or eight fattening wethers to be placed on 1 acre.

However valuable the old Romney Marsh sheep might be, there were many points which a sheep-breeder would wish to see rectified, and although later than in most other parts of England, about the beginning of the present century the new Leicester sheep found their way from the midland counties into Kent, some gentlemen in-

troducing fine rams of that breed. As in other places so here, opposition was made, the Kentish men obstinately resisting every encroachment on their favorite breed, and predicting disappointment and loss in all possible varieties of form. They argued that the decrease of size and deterioration of the fleece were not compensated by the earlier maturity and greater tendency to fatten of the imported breed; that the latter were less salable to the butchers, and that the ewes were less prolific and inferior as nurses. It was contended, besides, that the new breed and its descendants were less suited than the former to the open marshes on which they were to be reared without shelter or artificial food; and that they were apt to be driven into the ditches by the strong gales which at certain seasons swept over the marsh. These objections were more or less satisfactorily answered. It was said in reply that the decrease of weight was, to a certain extent, more apparent than real, arising from a diminution in the size of bone and the coarser parts; and there was always a more than corresponding gain by the breeders being enabled to bring their animals to market at an earlier period. The depreciation in the weight and quality of the wool was little in the case of this breed; the wool of the Romney Marsh never having been in the first class, with respect either to quality or productiveness. That the new breed was less acceptable to the butchers is true; but this was because the fat was more deposited on the external parts, and because the offal was less.

By degrees it began to be found that the smaller, deeper, closer, and more compact sheep, caused by an infusion of Leicester blood, weighed heavier than the old long-legged and long-bodied ones; that they did not consume so much food, and that the hard stocking of former days might be increased; that they were ready a full year sooner for the market, and therefore became far more profitable; that the fat began to form more on the exterior of the animal, where it was most advantageously placed for the farmer and the consumer, and did not accumulate within for the profit of the butcher alone; and that by careful selection, although the wool was somewhat shorter, lighter, and weaker, it was improved in fineness, in color, and in felting property, where that was wanted. There can be no doubt that the old breed of sheep was materially improved.*

That the Romney Marsh sheep have considerably improved since Youatt's time is well known, partly owing to more scientific management and partly to the influence of foreign blood. The substitution of the Kentish sheep by the Leicester was not possible, for the latter was not sufficiently hardy for the marsh lands, nor would their progeny preserve all their good qualities when exposed to cold and privations to which they had not been accustomed. They would rapidly degenerate and become the bony and coarse animals which such a situation would almost necessarily produce; but they would effect some valuable service in producing greater depth, roundness, and symmetry of form, and connected with these earlier maturity and greater propensity to fatten. This is what was actually done, and the advantage is retained among judicious sheep-owners by occasional recourse, for it is easy to introduce too much of the Leicester blood and to make the progeny too tender for the bleak and exposed pastures of the marsh. A dash of the blood would, however, increase propensity to feed without seriously affecting the constitutional

* Youatt.

vigor which is so marked and essential a feature of the marsh-born sheep. On the arable lands adjoining the marshes, where there could be more shelter and artificial treatment, a more decided cross would be found beneficial. The best treated sheep of the present day, says Coleman, are capable of reaching very creditable weights as shearlings; the heaviest pen at the Smithfield show of 1872, for example, were 260 pounds each (live weight). Greater aptitude to feed, more symmetrical frames, and a diminution of bone and offal have been gained by the alliance, whilst the characteristic features remain intact. Though much more symmetrical than of old, with well-covered backs and with springy touch, the want of scale is still apparent; the sides are flat, and there is not that depth of fore quarter which is so marked a feature of the Leicester. It is probable that the peculiarity of form is connected with the hardy character which gives these sheep such peculiar value.

In the western counties of England, says Low, from the southern division of Staffordshire northward to the Solway Frith, the long-wooled varieties were rare, and found only in a few places. They were all of the coarsest kind of sheep and inferior in weight of body to those of the eastern and midland counties. Some of them lingered until a recent period in the lower parts of Westmoreland and Cumberland, and some of them extended across the Solway into the west of Scotland. They have now all disappeared, or left only indistinct traces of their former existence in the flocks of a few careless sheepmasters. It is not known whether Scotland originally possessed a native race of long-wooled sheep, but sheep of this kind were early in the last century introduced into the southeastern border counties, and about the time of the American war were largely mixed in blood with the improved New Leicester.

On the southern and western coasts, from Kent to Devonshire, no distinct breeds of native long-wooled sheep present themselves, but in Devonshire there were, but a few years since, three distinct breeds, or at least so far different in their character and locality as to receive distinct notice from writers on the sheep husbandry of the day. These three varieties are the Southam Notts, the Bampton sheep, and the Exmoor Notts.

The South Ham Notts.—These sheep inhabited the southern part of Devonshire from Axminster or the vale of Honiton westward almost to the borders of Dartmoor. Their early history is not known, but their resemblance to the Romney Marsh is so close that the conclusion is drawn that they had the same origin. They had the same crooked back, flat side, and coarse bone, but they differed in that they had brown faces and legs. They carried a fleece of long wool, moderately soft, weighing from 9 to 10 pounds, and at 30 months old the wethers averaged 22 pounds to the quarter of well flavored mutton. When the New Leicester extended westward they were crossed on the Notts, and the latter are now practically extinct in their pure state. The first mixture of blood at once produced animals greatly superior to the older race, somewhat reduced in size and weight of wool, but of a more symmetrical form, with a greater disposition to fatten and earlier maturity.

The Bampton sheep.—These sheep, so named from the village of Bampton on the confines of Devonshire and Somerset, inhabited the lower and good pasture land of the north of Devonshire, and extended to the vale of Taunton and far into Somersetshire. The "Agricultural Survey of Somerset," published in 1798, alludes to them

as "a valuable sort, not much unlike the Leicester, well made, and covered with a thick fleece of wool weighing in general 7 or 8 pounds, and they sometimes reach even the weight of 12 pounds, and sell at about 10*d.* per pound." The same work says that the sale ewes were put to the ram at about the latter end of July, and the flock ewes about a month after. Young rams were preferred, as it was supposed that old ones degenerated in the quality and weight of their wool. The wethers of this breed, when two years old and fattened on turnips, attained the weight of about 25 pounds per quarter, and, being driven to Bristol market, a distance of nearly 60 miles, were sold without their fleeces in the months of May and June. Vancouver, in his "General View of Agriculture of Devon," published in 1808, says that the most approved sheep in the division of Tiverton were the Bampton Notts, the wethers of which breed at twenty months old, weighed 22 pounds per quarter, and sheared 6½ pounds of wool to the fleece. The same sheep, well wintered and kept on for another twelve months, averaged 28 pounds per quarter and yielded 8 pounds of unwashed wool to the fleece. An early writer quoted by Youatt said these ancient sheep were the best breed in Devonshire, and had existed in the neigborhood of Bampton from time immemorial. A fat ewe of that breed rises to 20 pounds a quarter on an average and wethers to 30 or 35 pounds a quarter at two years old. They were white faced; the best breed being more like the Leicester than any other, but larger boned, and longer in the legs and the body, yet not so long as the Wiltshires, by which they had been crossed, nor so broad backed as the Leicesters. Eighteen pounds of wool had been shorn from a ram of this breed that was supposed to be 40 pounds the quarter. The carcass was coarser than that of the Dorsets, and the wool about 2*d.* per pound cheaper. This breed, it was believed, could be greatly improved by crossing with the New Leicesters.

It may not seem consistent in the writer just cited to affirm in one sentence that the Bampton was the "best breed living," and to conclude with the belief that they may be "greatly improved by crossing with the New Leicester." The breeders fully concurred in the latter opinion some years later, and acted upon it, so that towards the latter part of the last and at the commencement of the present century some considerable infusion of Dishley blood had already been effected, and the process was kept up until the Old Bampton was unknown in its pure state and had given way to what is now known as the Devon Longwool.

The Devon Longwools.—This new sheep, built upon the Bampton about the beginning of the present century by the use of Leicester rams, grew rapidly in esteem from the fact of its improved form and earlier fitness for the market; but there was an objection on account of the extraordinary nursing and care required to be paid to the young couples, the lambs being represented as very tender and much oftener perishing through the severity of the season than the genuine offspring of the native Bampton. While there are other crosses than the Leicester, the latter is in every respect the most valuable; larger and more productive both in meat and wool, better shaped than the true Leicester, smaller boned, and of earlier maturity than the native sheep.

Joseph Darby, in treating of the Devon Longwool, said that the well-bred animal of this variety differs from the pure Leicester in having a longer and larger face, with greater width at the forehead

and nose; the ears longer. The frame is more bulky, and of far greater length, although not quite so round or compact, but the girth is equal to that of the Leicester. In good constitution and hardihood the Devon Longwool surpasses the Leicester; it attains much greater weight of carcass and more flesh in a given time, and is likewise reputed to come earlier to maturity.

While good pastures are desirable for most breeds of sheep, the Devon Longwools will live hard and on high land; they have often been tried with other breeds, and have been found to do well in dry seasons when grass is very short, keeping their own and improving, while other sorts living with them have wasted a good deal and lost much flesh. Such is found to be the case in the experience of breeders, and they have observed also that the ewes are very fair nurses and prolific, yielding many twins. Although not equal in these respects to Dorset Horns or cross-bred sheep, it has also been remarked that the coarser-bred Devon Longwools are more prolific and better nurses than some of the better flocks of higher quality.

Up to a very recent day the different flocks of this improved breed were exceedingly diverse in their characteristics. There seemed to be no fixity of type, but now uniformity of character is reached, and whatever limits may be drawn hereafter as to the true characteristics of the breed and what sheep ought to be included in the denomination of the Devon Longwools, the generality of breeders have long since ceased to draw from the pure Leicester blood and get better results by resorting to the best tups of the breed itself, now so highly perfected.

Old Leicester.—The original Leicester, which was large of frame and heavy of bone, was common to most of the midland counties of England, reaching from the south of Yorkshire and the Yorkshire wolds as far as Oxfordshire and Gloucestershire. It was ill formed in many of the points to which graziers pay much attention. It had a white face, no horns, was long and thin in the carcass, flat-sided, with thick, rough white legs. The weight of the wether at two or three years old was from 20 to 30 pounds a quarter; that of the ewe from 15 to 20 pounds. The wool was from 10 to 14 inches in length, coarse in quality, and weighing from 8 to 13 pounds. Its color was much better than some other kinds of wool, and possessed excellent qualities for the manufacture of worsteds. The pelt and offal were thick and coarse, the animal was a slow feeder, and the flesh was coarse grained, with but little flavor.

New Leicester.—Up to the middle of the eighteenth century but little care or attention had been given in England to the breeding of sheep, but about 1750 Robert Bakewell, of Dishley, near Loughboro, in Leicestershire, began experiments looking to the improvements of the then existing breed of sheep in that county. His purpose was to produce sheep exempt from the defects of Old Leicester and allied breeds and having a greater aptitude to fatten and arrive at early maturity. It was known to Bakewell that by long-continued selection of the male and female parents in a given number of animals the characters deemed defects could, under certain limits, be removed, and the acquired properties rendered permanent in the progeny of continued reproduction with one another. The principle that the virtues of parents are communicated to their young was well known and no new discovery, but "it was reserved for Bakewell to apply it in the case of animals used for human food in a manner,

and to produce more remarkable results than had before been arrived at." He had observed that smaller animals increased in weight with greater rapidity than very large ones, and that the same quantity of food or herbage that would supply the wants of a small number of large sheep would produce more meat when applied to feeding a larger number of small sheep. He also observed that sheep carrying heavy fleeces of wool did not so readily fatten as did those bearing more moderate fleeces.

Upon these observed facts Bakewell acted, beginning with the idea of producing a sheep that would yield the largest quantity of muscle and fat, with the least bone and what is usually termed offal. The fleece was a matter of secondary consideration. He selected from his own flocks and those of his neighbors, without regard to size, the sheep which appeared to him to possess the greatest fattening qualities, and whose shape promised the largest proportion of valuable meat and the smallest quantity of bone and offal. Youatt supposes that in doing this he probably was led to prefer the smaller sheep, "because it is found that perfection of shape more frequently accompanies a moderate sized animal than a very large one." "The sort of sheep, therefore," continues Youatt, "which Mr. Bakewell selected were those possessed of the most perfect symmetry, with the greatest aptitude to fatten, and rather smaller in size than the sheep generally bred. Having formed his stock from sheep so selected he carefully attended to the peculiarities of the individuals from which he bred, and it appears did not object to breeding from near relations when by so doing he put together animals likely to produce a progeny possessing the characteristics that he wished to obtain."

This system carefully and continually pursued gave a permanency to the characters imprinted on his sheep, thus constituting a breed in the full and proper sense of the term. The system pursued also tended to produce a delicacy of form, which is found connected with the power of secreting fat and reaching early maturity, and conduced to render the animals more artificial in their habits, more delicate in temperament as well as in form, less prolific of lambs and less capable of supplying milk to their offspring.

It can not be supposed, says Dr. Low, that Bakewell was not observant of these effects, but he appears to have regarded them as being of a condition secondary to the property of producing, in the shortest time, the largest quantity of fat with the least consumption of herbage and other food. That this was the main result at which he aimed all his practice shows; and his success corresponded with the skill and perseverance with which he applied his principles to practice. His stock became gradually known and appreciated in the country around him, but it was not until after the lapse of nearly a quarter of a century that it arrived at that general estimation in which it was afterwards held.

Bakewell was extremely reticent as to the mode he pursued and as to the parent stock from which he produced his breed. He surrounded the whole procedure with an air of studied and deep mystery, which was never dispelled. The secret was never divulged. Consequently, controversies have arisen and been carried on with much spirit as to the parent stock he used. Some contended that his basis was the old Lincolnshire, some the Teeswater, some the Warwickshire, while others hold that he crossed with the Ryeland, the Southdown, the Charnwood Forest or some other of the short-wooled breeds, in order to communicate that fineness of bone and peculiar character of wool distinctive of his breed.

Youatt believes that the New Leicester was improved to its present state of perfection by selection from the then existing breeds of long wooled sheep.

Youatt's views are now generally adopted, and the belief is quite general that Bakewell adhered entirely to the Leicester, and possibly did not go far from home, or even beyond his own flock, but trusted principally to selection. "Observation," says Coleman, "would convince him that like would produce like; he went for quality rather than size, and finding great jackets associated with strong bone and coarse offal, he was more careful as to frame, quality, and aptitude to feed than as to wool; hence one result of his operations was some diminution of fleece."

Marshall was of the opinion that no cross was used at all, but that the improvement was effected by selecting individuals from the several kindred breeds or varieties of long-wooled sheep by which Bakewell was surrounded on almost every side, and by breeding in-and-in with this selection; seizing the superior accidental varieties which were produced, associating these varieties, and still continuing to select with judgment the superior individuals.

It is said that when the Bakewell sheep first went into Yorkshire their shape was twice altered. Once in particular and at the first they had very short legs and broad backs, and were so heavy and clumsy that in the spring, when loaded with wool, they would get over on their backs and lie there until they died if not continually watched and turned over. To remedy this, in the course of two seasons the practice varied, and rams were hired much longer in the legs.

The sheep produced by Bakewell and his followers have been minutely described by all writers on English sheep husbandry, and their virtues and defects canvassed. Though smaller in bulk of body than the long-wooled races which they supplanted, the New Leicesters are yet of the larger class of sheep with respect to weight. Their limbs being shorter and their bodies more round, compact, and deep than in the former breeds, they are of greater weight in proportion to their apparent bulk. Their actual size is various, depending on the wishes of the breeders to possess larger or smaller animals, and on the fertility, natural or acquired, of the districts in which they are reared. In general it may be said that the wethers weigh from 25 to 35 pounds the quarter when fattened in their second year. The wool is of medium length, having a staple of from 6 to 8 inches, and weighing about 7½ pounds the fleece in sheep of fifteen or sixteen months old. It is too short and weak to be admitted into the first class of combing wools, and in the properties which fit it for the manufacture of worsted; it is more evenly grown, is soft, and of good color, and possesses several properties of long wool in perfection.

But it is neither in the size nor weight of body, nor in the productiveness or quality of the wool that the real value of the New Leicester breed consists. Its value and superiority are to be found in its more perfect form and aptitude to fatten at an early age, in which respects it surpasses all the other varieties of long-wooled sheep which have been cultivated in England or naturalized in any part of Europe. The New Leicester sheep can, under the ordinary management of the farm, be readily fattened for human food at the age of fifteen months, that is, when, in the language of farmers, they are shearlings; and in no case of practice do they need to exceed the age of two years and a few months, whereas the older breeds

were not usually fattened for the market until late in their third or until their fourth year. The females are not regarded as so prolific as those of the older breeds, nor are the lambs so hardy or quickly covered with a coat of wool, nor are the mothers such good nurses; and yet the breed is not deficient in these properties, except where such refinement of breeding has been practiced as to produce a too delicate temperament. In this breed the hind and fore quarters more nearly approximate in weight than in the less cultivated varieties. The fatty tissue, too, is more equally spread over the external muscles, and tends to accumulate less about the kidneys and internal parts, and hence the breed has never been so much of a favorite with the butchers as the less improved races. The flesh, as of all the long-wooled breeds, is more lax in the fiber and less delicate than that of the smaller breeds of the mountains, forests, and downs; but the mutton does not seem in any respect to have been inferior to that of the older breeds of the same class.* The true type of the New Leicester is given by Youatt:

> The head should be hornless, long, small, tapering toward the muzzle, and projecting horizontally forward. The eyes prominent, but with a quiet expression. The ears thin, rather long, and directed backward. The neck full and broad at its base, where it proceeds from the chest, so that there is, with the slightest possible elevation, one continual horizontal line from the rump to the poll. The breast broad and round, and no uneven or angular formation where the shoulders join the neck or the back; particularly no rising of the withers or hollow behind the situation of these bones. The arm fleshy through its whole extent, and even down to the knee. The bones of the leg small, standing wide apart; no looseness of skin about them, and comparatively bare of wool. The chest and barrel at once deep and round, the ribs forming a considerable arch from the spine, so as in some cases, and especially when the animal is in good condition, to make the apparent width of the chest even greater than the depth. The barrel ribbed well home; no irregularity of line on the back or belly, but on the sides the carcass very gradually diminishing in width toward the rump. The quarters long and full, and, as with the fore legs, the muscles extending down to the hock; the thighs also wide and full. The legs of a moderate length; the pelt also moderately thin, but soft and elastic, and covered with a good quantity of white wool.

Having firmly established and perfected this type of sheep, Mr. Bakewell conceived the idea and reduced it to practice of letting his rams for the season to those who wanted their use, instead of selling them to the breeders. This was an improvement on the existing system at that time, because it enabled the ram-breeder to keep a much larger number of rams in his possession, whereby his power of selection from his flock was increased, and it enabled him also, by cautiously using the ram for one season and comparing the produce with those of some other ram, to judge of the comparative qualities of the lambs, and thus save him from the danger of mistakes which would deteriorate the value of his stock. It was of the same value to the farmer as to the professional ram-breeder; but it was an innovation and a novelty, hence it was strongly opposed and not popular. The first ram let in 1760, to a Mr. Wilmore, of Illston-on-the Hill, only made 17*s.* 6*d.*, the same price being taken for two others. He set no price upon the use of the ram, nor did he put it at auction. The hirers put their own valuation on the rams they selected, and offers were accepted or refused. At first his success was far from flattering, and his whole scheme was ridiculed, more especially by his neighbors. Nothing daunted, however, he held on his way, receiv-

* Low.

ing sometimes a guinea, sometimes two or three, for the use of a sheep. It was not until 1780 he got a paying price for them, viz, 10 guineas for the use of a ram. This was twenty years from the time he had offered his new sheep; "a long struggle against the ignorance, and prejudice, and jealousy of his brethren." His sheep were becoming known and his fame extending, and prices rose rapidly until, in 1784 and 1785, his best rams were let for 100 guineas. In 1786 he realized more than 1,000 guineas for the letting of rams; in 1789 he made 1,200 guineas by three rams, and 2,000 guineas by seven others.

In less than three-fourths of a century after their origin the New Leicester sheep spread themselves from their native county over every part of Great Britain, and there were very few flocks of long-wooled sheep in England, Scotland, or Ireland which did not owe to them an improvement. Many they had entirely supplanted. A pure Lincoln or Teeswater flock was rarely to be found; and although some flocks of the pure Cotswold remained, in the greater number of instances they had been crossed with the New Leicesters. It would be interesting and profitable to follow with some detail the dispersion of these sheep, the great improvement they have made in almost every variety of sheep that they have crossed, and the effect of upland and lowland pasture upon them, but the space required would be too great. Low, Youatt, and other English writers have written fully and charmingly on the subject, and they can be consulted with great profit.

Briefly, however, as to the flesh and wool. Whereas in the Old Leicester the flesh was coarse grained with but little flavor, the new breed yields a tender and juicy meat, but not of a pronounced flavor. The fat appears to be absolved or rather introduced between the fibers, or, in the words of Youatt, "the line of distinction between the fat and the lean is in a manner lost, and, with the exception of a few joints and a small part of them, the carcass has the appearance and the taste of a mass of luscious fat." While the old breed gave a coarse wool the one that succeeded it produces a fleece more soft and fine, evenly grown, and possessing some other qualities of wool in great perfection, but which is in general too short and weak to be admitted among the first ranks of combing wool, adapted to the manufacture of worsted yarn.*

The Border Leicesters.—As shown on a previous page, the New Leicester spread itself over most of England and made a lodgment in Ireland and Scotland. Their first introduction into the counties bordering on Scotland is attributed to the Messrs. Cully, who migrated thither from Durham in 1767. They were contemporaries of Mr. Bakewell, had associated with him, entering into all his views, and believed in his ultimate success. They took with them to their farm at Fenton some of the Bakewell sheep, and what Bakewell was doing in his own county they tried to do in the northern counties. They were eminently successful, but the struggle was long and severe. Their success was followed by others. A recent writer indulges in the query whether some of the early breeders in the border counties did not, in imitation of Bakewell's system, try still further to improve by crossing in with the Cheviot, a breed possessing fine style and quality, and whether the change in the general appearance of the sheep is due to selecting animals of the pure breed, high on the leg,

*Luccock on Wool.

with white faces and clean bone, and whether the soil and climate have had their influence; and he concludes that his queries can never be satisfactorily answered.

> Certain it is, that the distinguishing features of the Yorkshire and Border Leicesters, though sprung from the same source, have diverged considerably, the former now showing a blueness in their faces and a tuftiness in their legs, while the latter are white and clean in both, and more, what are generally called *upstanding* sheep.

The flocks tracing the closest lineal descent from the New Leicester, untainted by any other strain of blood, selected and crossed with taste and judgment, and tended with care, are still the best in the Border district.

The care of the Border Leicesters does not differ materially from that of other breeds, and they will live and thrive on little food if they have good land and proper shelter. They mature early and are capable of producing more wool and mutton in a given time than almost any other breed, but the mutton is coarse. But the value of this sheep is not in its mutton; it is in their profitable crossing with the Southdown, the Cheviot, the Blackfaced and other breeds. The cross with the Blackfaced makes the sheep fine at two years old, yielding mutton of fine flavor. That with the Cheviot also comes to fair maturity at the same age, getting to great weight with mutton of good quality.

These sheep are not now confined to the border counties, but have found their way into every part of Scotland, wherever the soil and climate suit for their profitable cultivation; and the tendency is to use rams of half-blood—the first cross between Border Leicester and Cheviot—which produces a stock of bigger bone, larger frames, and more robust constitution, but which, however, does not lay on flesh so rapidly.

Of all the Border flocks that of Lord Polwarth, formed about the beginning of the present century, has maintained the most uniform character, presenting beautiful blood-like heads, deep chests, straight backs and bellies, uniform coating of wool, and family likeness that challenge admiration.

Cotswold sheep.—These sheep are natives of low calcareous hills, running through the eastern side of Gloucestershire, in a direction from southwest to northeast. In Gloucestershire these hills are of moderate elevation, not fertile, yet capable of cultivation, and yielding in the natural state a short sweet herbage. It was formerly a range of bleak wastes employed in the pasturage of sheep, and much of it was in the state of common; but with the progress of the last century the commons were appropriated and cultivation was extended. These hills were called the Cotswold, from the practice in early times of protecting the sheep during winter in long ranges of buildings, three or four stories high, with low ceilings, and with a slope at one end of each floor, reaching to the next, and by which the sheep were enabled to ascend to the topmost one. These sheds were called cots or cottes, and with the open hilly ground or woold, on which the sheep fed in summer, gave name both to the sheep and their habitat.

There is but little doubt that the original Cotswold sheep were, if not the earliest, at any rate one of the earliest breed of sheep in England, and that they obtained a position unrivaled for the production of wool. Camden, one of the early English chroniclers, says:

In these woolds (Cotswold) they feed in great numbers flocks of sheep, long necked and square of bulk and bone, by reason (as is commonly thought) of the weally and hilly situation of their pasturage, whose wool, being most fine and soft, is held in passing great account amongst all nations.

Other writers refer to the excellence and abundance of the wools of the Cotswold. Drayton, who lived in the time of Henry VIII, contrasts the rich fleeces of Cotswold with those of the flocks of Sarum and Leominster, and writers since that time have made similar references to the famous wool which for fineness "comes very near to that of Spain, for from it a thread may be drawn as fine as silk."

The precise character of the sheep which produced this wool is now unknown, as some contend. While Marshall, Youatt, and others consider that they have always been a long-wooled breed, many, including Low, incline to the opinion that they were probably similar to the large fine-wooled breeds of the adjoining counties of Berks and Wilts, a supposition agreeing with the locality of the districts and with "the long necks and square of bulk and bone" ascribed to the Cotswold sheep by Camden.

It is difficult to reconcile these opinions, nor indeed is it necessary; the Cotswolds beyond the memory of our day have been a long-wooled race and valuable principally for their wool. They were large-framed, coarse, slow-feeding sheep; very hardy, and accustomed to travel in search of the short herbage which invariably prevails on limestone hills.

When Bakewell made his great improvement on the Leicester sheep in the middle of the last century his improved sheep soon extended throughout central England, and about 1780 crossed the Cotswold as well as the other long-wooled sheep of Gloucestershire, a system of crossing that was pursued so extensively that but a short time elapsed when there did not perhaps exist a single Cotswold flock which was not more or less mixed in blood with the New Leicester breed. It resulted in diminishing the bulk of body of the old Cotswold and lessening the produce of wool, but in giving to the animal a greater delicacy of form. About 1820, however, the Cotswold breeders thought that their flocks were declining in carcass and fleece and becoming less fitted for the climate of their native hills, and a preference set in for the native stock; crossing was generally suspended, and the former model of the breed adhered to.

The improved Cotswold have not yet been brought to the same perfection of form in England as the New Leicester, and like the sheep of Romney Marsh, they tend to accumulate fat on the rump almost to the degree of producing deformity; but they are hardy, of good constitutions, and the females are prolific and good nurses, and the lambs are early covered with a close fleece. These good qualities commend the sheep, and it now strongly contests the ground with its former more popular favorite.

The feeding qualities of the Cotswolds have been subjected to careful experiments by Mr. Lawes, who found that in comparison with Downs they consumed the least food to produce a given amount of increase, and made the greatest progress in a given time. The fat is principally external and the flesh is coarse and open. Under a liberal treatment, with good care and attention, fed on ground oats, dust oil cake, and followed by turnips, the lambs make great progress, and at eleven and twelve months old are fit for the English market, with a weight of 22 to 35 pounds a quarter.

These sheep, standing rather high upon the legs, and having grand heads, present an imposing appearance. Their fleeces are either white, gray, or mottled. White predominates, but slight variations neither indicate impurity nor detract from appearance. Mr. Coleman cites an instance where some years ago a flock of gray-faced sheep were bred, and at the annual ram sales every animal was more or less colored. For the purpose of crossing with the Hampshire ewe, gray-faced rams were preferred, the produce becoming darker in the face in consequence. The head of the Cotswold is large, wide across the forehead, the eyes full and prominent. The head should be well wooled, particularly the forehead and cranium, long locks hanging down over the face; if the eyes and upper part of the nose are covered, so much the better. The effect of the love-lock is pleasing and adds to the general good style of the sheep. The neck should be long and moderately thick, especially at the base and where it joins the head. The head should be carried easy and high; the ram should so carry his as to be able to look over a hurdle. The carcass should be long, level along the back, and the ribs well sprung. The under lines are not so true and the flank is often weak. The greatest defect in the appearance of the Cotswold is the lightness under and the short space between hips and flanks. The Cotswolds are often too long, high, and lusty, and their height in such instances gives them a weak appearance.

The wool should be long, open, and curly. The staple is coarser, and the weight of fleece is usually rather less than that of the Leicester and considerably under the Lincoln. In quality it is below both the Leicester and Lincoln.

In recent years hundreds of these animals have been introduced into Australia, New Zealand, Canada, and the United States, as well as into France and Germany, to impart size and wool to native breeds. In the United States they are widely known and in general favor as a combined wool and mutton sheep. The American Cotswold Record Association has adopted the following:

Scale of points.

	Ewe.	Ram.		Ewe.	Ram.
Head	8	8	Fore flank	4	5
Face	4	4	Back and loin	12	12
Nostrils	1	1	Belly	5	3
Eyes	2	2	Quarters	8	8
Ears	4	4	Hock	2	2
Collar	6	6	Twist	5	5
Shoulders	8	8	Fleece	18	18
Fore legs	4	4			
Breast	10	10	Total	101	100

Welsh Mountain sheep.—The mountain sheep of Wales embrace several varieties of very ancient origin, which, with black cattle, at one time formed the principal stock of the Celtic race in the mountainous districts; and they must have been, as thought by some, "the only sheep both on hill and plain, on heather-clad mountain and sunny vale, from Anglesea to the Bristol Channel, from the Severn to Cardigan Bay."

Although differing from each other in character in the different districts, the Welsh mountain sheep were doubtless originally the

same breed and have the same origin. Some are horned, others are polled; some are nearly white, and others are of every hue between that and a jet-black. Principally they are white faced, but some have rusty brown faces, some speckled, and others gray. The males are horned, the females generally polled. Sometimes the ewes have very short horns, and occasionally have horns equal in size to those of the rams. The poll is generally clean, but it is not uncommon to find rams with a tuft on the forehead, and also very woolly on the scrotum. These latter characteristics are considered by some breeders valuable indications of vigor and hardihood. As no great care is taken in breeding these sheep, specimens of all the foregoing variations in color, horn, and wool on the forehead may be found on the same mountain range, and even in the same flock. They all, however, agree in the particulars given by Youatt: The head is small; the neck long, erect, and delicate; the fore quarters light, with narrow breast and shoulders; the sides flat; the back and loins narrow; the legs slight and long; the animals possessing considerable agility and an unquiet habit, so as to render them most annoyingly troublesome when attempted to be kept in the small inclosures of the vale. The ewes weigh 8 or 9 pounds per quarter when fat, which is usually at three or four years old, and the wether averages from 9 to 11 pounds. The mutton is particularly well flavored, and in the months of October and November commands a much higher price than that of larger sheep of other breeds. The Welsh sheep begin to reach the London markets in great numbers some time in July, when the grass is failing on the hills. From the irreclaimable disposition to wander, and from other causes, the breeding of the genuine Welsh sheep has never been profitably pursued in England; but, with a temporary halt on the way, in order to become ripe for the market, there is a regular troop of them always on their march from the principality to the metropolis.

The ewes are not prolific, and generally produce but a single lamb on mountain land, where one lamb is enough and two would be too many to nurse properly. Both improved keep and crossing with other sheep are found to increase the number of twins.

The average weight of the fleece of these sheep is from 2 to 2½ pounds. It is usually fine, but in some districts coarse and mixed with long hairs about the neck and along the back. The quality of the wool varies according to the position and locality in which the sheep have been bred for generations rather than to any difference in the breed, for in all other features the Welsh mountain sheep is alike in all localities, and Youatt cites the fact that in Cardigan County the wool from the northern parts differs from that of the more southern parts, while no difference can be detected in the animals yielding it.

Attempts have been made to improve the Welsh mountain sheep, but the efforts have not been crowned with much success. While on the more fertile lowlands, where free and indisturbed communication takes place between Wales and England, the small ancient breed has been crossed with the larger kinds of the adjacent counties, such as the Leicesters, the Cotswolds, and the Downs, the ancient breeds hold sway on the hillsides and on the higher Welsh mountains, subsisting on scanty food, rearing hardy lambs, and offering to the palate of the Englishman the sweetest mutton known to him. Not only does this sheep resist improvement, but it declines to be

superseded. Efforts made to substitute the Cheviots and other breeds have not been successful, and experience has demonstrated that—

No sheep suit the mountain tops of the country so well as the indigenous breed, and the most profitable on the lower ranges of poor soil and waste lands are a cross with the native stock. Welsh mountain sheep are likely to hold preëminent sway in their strongholds at high altitudes for many generations to come, and as long as the geological structure and the climatic influences of the country remain unchanged.

Sheep farming still maintains its importance as a branch of agriculture in the mountainous districts of Wales. The farms vary in area from 500 to 15,000 acres. The average cost per sheep a year to the breeder, everything included, is from 72 to 84 cents on the Welsh hills. The average proportion of sheep to shepherds is from 1,000 to 2,500 sheep to each man, depending upon the size of the farm. Shepherds are paid from $97 to $121 a year, with board and lodging. The average weight of the fleece has declined of late years from 2 pounds to 1½ to 1¾, its quality as well as quantity depending upon the seasons. Breeders received in 1889 on an average from 14 to 17 cents per pound for wool. The average size of a flock is from 500 to 10,000. As a general thing the sheep are not kept under shelter, and the proportional annual loss from exposure and neglect depends upon the season. Evan R. Jones, United States consul at Cardiff, reports that during the forty years' experience of a sheep farmer of his acquaintance the greatest loss was one sheep in four, and during the best seasons two in a hundred. The loss in lambs during bad seasons is stated at one lamb raised for three ewes; good season, sixteen lambs for twenty ewes. He further remarks that "the change noticed in sheep taken to graze upon better land than our Welsh hills is that they will grow much larger, while the quality of the wool will also improve. The cause of this change is the quality of the fodder and the nature of the climate."

The Radnor sheep.—A breed of local importance only, and not likely to extend beyond its present limits, is the Radnor, found on the hills of Brecon, Montgomery, and some parts of Merioneth, as well as in the county from which it takes its distinctive name. While not likely to extend beyond these limits there is but little probability that they will be superseded on their native hills, for their gradual improvement in recent years makes them preëminent there and commends them above all other breeds. These sheep are supposed to be a remnant of some of the oldest indigenous breeds of England. They are characterized by black or dark faces, and probably had the same origin as the original Shropshires on the Long Mynd and Morfe Common, which were black or speckle-faced horned sheep. These sheep are a hardy, active race, that, under improved management, have developed into a breed of fair size, with good weight of fleece, retaining at the same time the outward form and constitution of the primitive type of wild mountain sheep.

One of the most successful and intelligent breeders of Wales says that the best kind of Radnors are those having black faces, but a large number are of a tan, grimy, or gray color, and others, though of questionable purity, have faces partly white. The rams are horned; the ewes should be hornless—a sexual variation thought by some high authorities to be almost always the result of breeding and domestication. The Radnors are short legged and active, hardy when exposed to severe weather, and thrifty in seeking for food on the scant

herbage of the mountains. Like all sheep of their class, they are light in the fore quarter, and, compared with modern improved breeds, slow-feeding animals; but the mutton they produce is of excellent flavor. When fed on the mountain side and the adjoining pastures, the wethers at three and four years old produce mutton of the true flavor—a flavor not unnaturally supposed to be in great measure due to the peculiar grasses mountain sheep feed on in such places.

Mr. Morgan Evans considers the improved Radnor as a superior animal to the white-faced Cardiganshire sheep, or to its remote ancestors, and that it requires a somewhat better climate and herbage. They have of late years greatly increased in size, and the weight of fleece and quality of wool have been much improved. The old breed was very small, and a great point with old breeders was a very large tail, heavily wooled, and a large quantity of coarse wool or hair about the breech. The Radnors have recently been developed into more useful, respectable looking animals. The wethers are sold at three or four years old, and now weigh, when fat, from 14 to 15 pounds per quarter. The ewes, sold at about four years old, weigh, when fat, 13 or 14 pounds per quarter. The wool is of good quality, and the fleece weighs from 4 to 5 pounds, which must be considered a fair amount in proportion to the size of the animal.

The Radnors are improving still; are evidently in a transition state, not yet reduced to a fixed type, the different breeders producing flocks each after his own fashion and ideal, some crossing on the Shropshire for flesh, others on the Leicesters for weight of fleece.

The Anglesea sheep.—Separated from the main land of North Wales by a narrow channel, thus preventing in a measure the free admixture of breeds, it would be supposed that here we could find in greater purity than elsewhere the original sheep of that section of country. They are allied to the sheep of the mountains, but being reared in a lower country are larger. The breed longest ago remembered by the old farmers had freckled faces, with a fair proportion of wool, neither long nor short, but seem in process of time to have undergone some, although very trifling, change; for the likeness to the unimproved Southdown is yet apparent. They are long necked, have low and narrow fore quarters, are narrow and loose in the loin, steep and short in the hind quarters, and too high on the leg. They are usually without horns; the face of a dusky white or yellow, and sometimes freckled with dusky yellow; the yellow and silky faced ones having the finest wool and the wool generally approaching to the character of the Southdown. The average weight of a good Anglesea wether, at two years old, is from 16 to 18 pounds the quarter. They have much aptitude to fatten and to lay on fat inwardly at an early age. The ewes are prolific and good nurses.

Attempts to improve the old breed by crossing have not been crowned with much success. The first experiment to establish a cross between the Angleseas and the Leicesters demonstrated the fact that the native breed was more profitable than either the pure Leicesters or the cross with the Leicesters. Subsequent experiments with them and the Cotswolds have been more successful. Efforts made to improve the fleece by crossing with the Merino were only moderately satisfactory. The fleece was improved and for many years the sheep gave evidence of Merino descent by the characteristic tuft on the head, and still more by the fineness and yolkiness of the wool; but the produce of the cross was in other respects so inferior that the increased value of the fleece was not sufficient to counterbalance the loss of constitution and hardiness.

Between the sheep of the higher Welsh mountains and those of Radnor and Anglesea are many minor varieties, caused by differences of locality, feed, and treatment. A race just extinct formerly inhabited the vale of Glamorganshire. They had clean heads, long bodies, were flat-sided, and narrow on the back, and stood high on the legs. They were in these respects similar to the mountain sheep, identical in fact, but altered or increased in weight by the difference of soil and pasture. They weighed 15 or 16 pounds the quarter; the mutton was well grained and of good flavor, and the wool was improved by being closer and finer, the fleece weighing from 3 to 4 pounds.

In Caernarvon, one of the most mountainous counties in North Wales, the breed is comparatively large, on the Anglesea side of the county averaging from 14 to 16 pounds per quarter, but the natives of the hills seldom weigh more than 8 or 9 pounds, with a fleece weighing but 1 or 1½ pounds.

The ancient breed of Wales are pushed to narrower limits, and the places that once knew them, the fertile and well-cultivated farms in the country, are occupied by the improved English breeds—the Leicesters, the Cotswolds, or the Downs.

The fertility of the Irish soil, the humidity and mildness of the climate, adapt it in an eminent degree to the production of the grasses from which the island gets its pastoral name, and consequently to the rearing of sheep. It is known that, from the earliest period of the history of that unfortunate country, sheep were amongst the domestic animals, affording by their skins and fleeces covering to the inhabitants. We know not whence these sheep sprung; upon that point recorded history and rich legendary lore are silent.

These sheep, or some of them at least, were black. When, by careful and continued selection alone, this dingy hue of the native breed was changed to a whiteness which in many parts challenges competition with the choicest flocks of England, history is silent.

The sheep of Ireland now consist partly of short-wooled mountain breeds and partly of a large long-wooled race which exists, with very uniform characters, over the greater part of the country. The latter or long-wooled race, which resembled the coarser extinct breeds of the midland and western counties of England, is not now to be found in its unmixed state, but has undergone an entire change by the effects of crossing and is everywhere greatly improved. Many of these long-wooled Irish sheep found their way to America early in the present century, and we shall notice them after we have briefly treated of the mountain breeds. Of the mountain sheep of Ireland there are various breeds, with characters more or less distinctly marked, but the principal of which are the Wicklow, which is the most valuable though the least extended, and the Kerry, which is the more remarkable and the most extended.

The Wicklow Mountain sheep.—From time immemorial this breed has been an inhabitant of the mountains on the eastern side of Ireland which give it its name. These mountains rise to a considerable height, possess a humid climate, and are exposed to high winds, being admirably adapted for such a breed, and, in a severe winter, will put their hardihood to the test. Remnants only of the pure Wicklow breed now remain, the original race having been crossed by the Southdown and other breeds until it has been crossed out of its characteristics.

These sheep of the Wicklow Mountains, known in their pure state as the Cottagh breed, have an evident affinity with the sheep of Wales. They are of small size, "wild little animals, without horns," says Spooner, but of tolerably good form, and yielding excellent mutton. It has a small head, narrow face, and short, round, and pricked ears; the head and face smooth and covered with short hair, the wool extending only to the joining of the head and neck; the neck long, the general proportions good, but rather too slender; the legs small and clean and not very long; the hair of the tail remarkably coarse, even more so than in long-wooled sheep; the fleece coarse or wavy, and occasionally matted, yielding from 2 to 3 pounds a fleece, and the fiber about 2 inches in length. The faces and legs are white, but there is constant tendency to become black, as shown in the production of black lambs, which is accepted as proof that the breed, left to itself, would become entirely of that color. A local law exists that all black lambs shall be destroyed. The wool is soft and fine and used in the manufacture of flannels and other coarse fabrics, but it is always more or less mixed with hairs. The quality of the wool, however, as well as the general character of the sheep, varies with the elevation. In the lower rocky hills and vales, not over 800 feet above the level of the sea, and where the pasturage is good, the wool is more fine and less mixed with hairs, and the sheep larger. At a higher altitude, where it becomes boggy and the pasturage scanty, the sheep become smaller and wilder, and the wool coarser and more mixed with hair. In these, a ridge of bristly hairs extends like a mane along the neck and spine, thus causing the rain to shoot off their backs. Hair is likewise found in quantity on the hips and dewlaps, as in the wilder sheep of Wales; and this provision against the evils of their position is still further secured by the lambs having a sort of hairy covering on those parts which come in contact with the damp ground. Low observes:

> There is here that adaptation which is everywhere observed in this species of animals to the physical conditions of the country in which they are naturalized. The ridge of hair along the spine and on the haunches and breast causes the moisture to fall off; nay, the lambs are born with a provision against the wetness of the boggy soil, there being a large growth of hair upon the parts which are in contact with the ground when the animals repose, namely, the breast, the limbs, and the belly.

The proximity of these sheep to Dublin occasions a great demand for early lambs for a numerous and hearty population; hence, the practice of preparing lambs for the January market occupies much of the sheep-farmer's attention, and is conducted in a somewhat singular manner. The sheep of the mountains are purchased by the breeders of the lower farms and flocks formed to the number of one hundred or more, depending upon the size of the purchaser's farm and his resources in pasture. The rams are turned amongst the ewes in the beginning of June, and by the end of July the greater part of the latter are impregnated, so that the lambs are dropped in the months of December and January. This early disposition in the ewes for the ram is the joint effect of habit and of breeding. If at the end of July any of the ewes should not have been impregnated, they are put into a small barn or inclosed yard, and driven about until they are heated and fatigued; the rams are then admitted, and the ewes offer no resistance.

When the lambs are about two weeks old they are separated from the dams and placed in small pens in the lamb house or feeding es-

tablishment. The ewes are driven into this feeding house twice every day, and those whose lambs have been sold or have died are held until sucked by the remaining lambs, and then the lambs are permitted to suck their own dams. When the lamb is very young the milk of its mother will give sufficient nourishment, but after a time they are further fed with milk from the cow in addition to that of the ewes, beginning at first with a half gill and then gradually increasing to a pint twice a day, and the day is divided into equal periods and cow's and ewe's milk given alternately. In about six weeks, when they are ready for use, they fetch high prices.

The Wicklow ewes are good nurses and therefore well adapted to the kind of management required for the production of early lambs. The disposition to take the ram so early, the superiority of the mutton, and the fact of the ewes being very good nurses, stamp this breed with great intrinsic value, and should preserve and improve it. It is, however, preserved pure only in a few places. The Southdown sheep have been those chiefly employed for crossing, and are without doubt calculated on the whole to produce a race superior to the indigenous one, yet lacking some of its intrinsic qualities.

The Kerry breed.—The Wicklow Mountain sheep just described is closely related to the ancient sheep of Wales. The mountain breeds of other parts of Ireland are entirely different from any other breed of sheep in the British Islands, so much so that did we not know the great changes produced in the form and character of the species by situation, food, and climate, we might suppose them to have a distinct parentage. The west of Ireland presents us with the more ancient races of the country, mingled in blood with one another and with the imported varieties which have spread over the same tracts, but preserving in a remarkable degree characteristics indicating their distinctive breeds. Of these one stands out prominently and may be regarded as the type of several others, presenting such characters as lead us to conclude that it has remained for ages in its present state.

This breed, notwithstanding neglect and insufficient food, exceeds in size the breeds of Wales, of the Wicklow Mountains, and many of the old forest breeds of England. The horns are generally small and crooked, although some of the allied varieties of other parts have large and spiral horns. Horns are sometimes wanting in the female. These sheep are wild and restless in their habits, and they resemble, more than any other sheep of the country, in shape, eye, neck, position of head, and general aspect, the antelope or deer tribes. They fatten slowly, and have a great disposition to accumulate fat internally, and are fit for the butcher when their external appearance would indicate that they were still lean. Their mutton is of good flavor and juicy, which causes them to be greatly valued for domestic consumption. Their wool is coarse and hairy on the haunches and measurably so along the ridge on the back, but on the sides it is very short and fine. The white color of the fleece prevails, but there is a constant development of the darker shades, and the whole sheep would become black or brown were it not for the choice of breeders of those which are white.

The sheep husbandry of the mountainous and peaty tracts of Ireland is rude and extremely primitive. Often the animals are mixed indiscriminately without regard to ownership on the mountains and flat bogs, where numbers of them die from starvation and disease. They often spread over the country stealing what they can obtain,

sometimes coupled together and left to find their food as best they may, and sometimes kept in the miserable cabins of their masters where they endured discomfort and privations worse, if possible, than the master himself. This was the condition all over the west of Ireland, and from Donegal to Kerry half-starved sheep strayed in wild flocks of every age and kind together, or dragged one another in couples along, or were fastened when they could find any food. Of those of Donegal it is said they were "as fleet as so many greyhounds, were suffered to herd together and rove about without distinction wherever they could find food; and in regard to breed, it was impossible to imagine a worse."

In the mountains of Connamara and in the hands of a few gentlemen some of the native short-wooled sheep remain. The shearing, at least among the small proprietors, was singular enough, and the practice was not quite discontinued at a late day. The wool is cut as it is wanted, and one sheep is seen with one side shorn and another with a single limb clipped. When a woman wants a little wool in order to finish her work, she trips away to the mountain, claps the sheep's head between her knees, and shears just as much as she thinks will complete her task. The same sheep is often shorn three times in the year, and this operation is not confined to the summer months. It is thought, but to a considerable degree erroneously, that the animal suffers little from this singular practice. These neglected races of mountain sheep have been somewhat improved by better treatment, and in many cases on the lower mountains by judicious crossing or the substitution of superior breeds.

The Connaught or Old Irish long-wooled sheep.—The Wicklow and Kerry breeds just described are short-wooled sheep and confined principally to the mountains. The breed now to be considered, the type of the established Irish sheep, was long wooled and an inhabitant of the plains and lowlands. It was noted for its large size, but it was coarse and ungainly in shape and was disparagingly spoken of by Culley, about the close of the last century, as an ill-formed, ugly sheep, inferior to the very worst breeds of England, and nothing to recommend them but their size, which might please some old-fashioned breeders. These sheep were supported by very long, thick, crooked, gray legs; their heads were long and ugly, with large flagging ears, gray faces, and sunken eyes; necks long and set on below the shoulders; breasts narrow and short, hollow before and behind the shoulders; flat-sided, with high narrow herring backs; hind quarters drooping and tail set low; in short, they were in every respect a type of what a well-formed sheep should not be.

There still remains some of these characteristics—large heads, flat sides, narrow breasts; but the other excessively ugly points of form which placed the Irish sheep below the worst of those of Great Britain have happily disappeared. This improvement began at the commencement of this century by the partial introduction of English rams. There were reasons why the live stock of Ireland could not be improved before this time, and these reasons are found in the oppressive character of English laws, which forbade the exportation of breeding stock from England to Ireland. It is true that these laws were evaded from time to time by some enterprising persons, who smuggled into Ireland rams and ewes of English breeds, which were sold at large prices to Irish breeders.

It is a singular fact that while English sheep were being smuggled into Ireland to improve the Irish sheep, the Irish sheep were being

smuggled into the United States to improve the American sheep, descendants of English stocks.

The Roscommon sheep.—This is the old Irish or Connaught sheep improved, and is the result of crossing with the New Leicester breed, which began about the beginning of the century, and when the restrictions placed upon the importation of live stock into Ireland were removed that improvement was vigorously conducted, and the breeders of Roscommon having taken the lead in improvement, aided by the dry and wholesome nature of their sheep walks, the improved breed became recognized as the Roscommon sheep. Recognized authority on the subject of Irish husbandry admits that the first improvement effected in the old Connaught breed of sheep was caused by crossing it with Leicester rams. By this cross not only was the form of the animal improved, but the wool lost much of that coarseness which it originally possessed. The pure Leicester was tried in Connaught, but it did not succeed. It was said to want constitution to suit the wet climate of the west, and this was shown more particularly in the case of lambs of the pure Leicester breed, which were subject to scour and could not be brought through the winter without considerable loss by death. The cross, however, with the native breed succeeded admirably, and when the effects of that cross were established the Roscommon breeders evinced great skill and intelligence in so selecting their breeding flocks as to perpetuate certain desirable characteristics in the style of the sheep and the quality of both their flesh and wool. Selection has been in fact the chief means latterly employed in producing the improved Roscommon sheep. The old Connaught breed were never fattened until they were three or four years old, when they made great weight, but the mutton was coarse. In consequence of the improvement which has been made in the breed, shearling wethers are now often sold fat to the butchers, making from 25 pounds to over 30 pounds per quarter; but as a general rule the Roscommon graziers hold them over until they are thirty months old, at which age they are generally sold in Ballinasloe Fair at prices varying from three to four guineas each to Leinster graziers, by whom the sheep are kept until they are about three years old, when they make from 36 pounds and upwards per quarter. Draft ewes, fed after being cast for breeding, weigh from 34 to 40 pounds per quarter, and the quality of the mutton is unexceptionable. It must be understood that the Roscommon sheep are in general reared entirely upon grass, with the help of some hay during winter. Turnip feeding does not, as in England, form a material point in sheep farming as conducted in Roscommon, there being only one acre of turnips grown in that county to each 109 acres of area. These sheep from first to last are for the most part reared and fattened without seeing a turnip. In all cases where turnip feeding is pursued, the Roscommon sheep prove that early maturity, along with heavy weights, has become one of their characteristics; so that if turnip growing were extended in the west of Ireland it is only reasonable to believe that Connaught would produce much larger supplies of sheep than is done at present. With the pressure on the meat market which now exists, this is therefore a point which deserves to be seriously considered.*

The wool of the Roscommon sheep is soft, deep-grown, and rich, and the quality of the fleece is invariably looked upon as a material

*The Cattle, Sheep, and Pigs of Great Britain; R. O. Pringle on the Roscommon Sheep.

point in the selection of rams and ewes by the leading breeders. The fleeces of a flock generally average about 8 pounds each, but heavier weights have been obtained, running from 10 to 14 pounds. Some ewes, shorn while rearing lambs, have clipped 16 pounds of wool.

The Roscommon has now become a celebrated long-wool variety, rivaling in usefulness most of the English breeds of a similar kind; and as the old Roscommon or Connaught sheep was peculiarly gaunt, big boned, and unshapely, the transformation by a plentiful infusion of the Leicester blood has been marvelous. But, notwithstanding this marvelous and well-known improvement and the high opinion entertained of its merits by the extensive graziers of the midland and southern counties of Ireland, it was but recently that the Royal Societies of Ireland and Dublin recognized and classed it as a distinct breed. The breed is not only to be found in the county giving its name, but also in West Meath and Limerick.

The introduction of the Merino into Great Britain.—The Spanish Merino sheep, which had extended to so many countries of Europe, was late in being introduced into Great Britain. Youatt advances as a reason for this that she already possessed a clothing wool equal or superior to that of any other sheep except those of Spain; and her maritime habits and the extent of her commerce gave her easy access to the finer wools, far less necessary to the manufacturer at that period than fashion has now made them; at the same time her native combing wool was perfectly unrivaled. A few Merino sheep, however, were introduced here and there, but they had much prejudice to contend with, and their value was not duly appreciated. What private enterprise could not accomplish royalty essayed.

George III, a zealous agriculturist, resolved to make a fair and exhaustive trial of this celebrated breed on his own farms, and in 1787 measures were taken to obtain a small Merino flock. This was done clandestinely—a sort of a smuggling transaction. The animals were selected from the flocks of different individuals in Estramadura, here a few and there a few, where they could best be got, and were driven hurriedly through Portugal and embarked at Lisbon. They were landed safely at Portsmouth and taken to the King's farm, at Kew. The smuggled flock was bad; the selection had been ignorantly or carelessly made, and the animals, being taken from different flocks, presented no uniformity of character and gave no satisfaction to the royal adventurer. It was then determined to deal aboveboard, and to make direct application to the Spanish King for permission to export some sheep from one of the best flocks. This request was at once and liberally complied with. A small and choice flock was presented to George III by the Marchioness del Campo di Alange of the Negretti cabaña, esteemed to be the most valuable of the migratory flocks of Spain, and the exportation of which was expressly prohibited by law. In return for this special courtesy George III presented to the marchioness eight splendid coach horses. The little flock of Negrettis arrived in England in 1791, and was immediately taken to the royal farm at Kew, while all those previously obtained were destroyed or otherwise disposed of, because it was not considered advisable or safe to make any experiments with them.

The management of the newly imported Negrettis did not at first appear to have been very skillful nor founded on good judgment. On their first change to the moist and too luxuriant pastures of England they suffered greatly from diseases. They became affected with the foot-rot, which prevailed to a grievous extent; but above all, and to a fearful extent, the liver-rot made sad ravages among

them. Those who had their prejudices attributed this misfortune to the sheep rather than to the ignorance that caused it, and sought to clinch the conclusion in the public mind that had come to their own, that Spanish sheep would not thrive on British soil. But, by a little change of pastures, these evils were remedied, which went to prove the carelessness of the shepherd; and, after the first season, the survivors became reconciled to their new home, and their progeny appeared to be thoroughly naturalized, and remained as free from diseases as the sheep of the country.

The wool was not affected by the change of climate. From year to year it was carefully and most critically examined and compared with the best samples of Spanish wool; that of the original stock remained true to its original fineness, while in that of their descendants little degeneration could be discovered either in its fineness or its felting properties.

The Royal experiments excited a widespread interest throughout the British Kingdom, and were followed by many endeavors to cultivate the pure race. More generally, the experiments of individuals were directed towards crossing the native breeds with Merino rams, in the hope of combining the fineness of the Spanish fleece with the economical qualities of the English sheep. With this end in view many experiments were made with Merino rams to cross the Southdown, the Wiltshire, the Leicester, and the Ryeland ewes; and in some cases the experiment was reversed, and the English rams, especially of the Ryeland breed, were put to Merino ewes. Some of the most distinguished agriculturists of England, the Duke of Bedford, Lord Somerville, Mr. Coke (afterwards Lord Leicester), Sir Joseph Banks, and others, prosecuted these interesting and important experiments, and the writings of Dr. Parry and others brought the subject in a prominent manner before the country.

Some of these experiments are given. Several of the British ewes were crossed with the Merino ram and the following were some of the early results. Mr. Bartley experimented on the Wiltshires, and after a few crossings the ewes become hornless, whereas both the Wiltshire ewes as well as rams are horned sheep. In three or four crossings the progeny acquired the almost perfect shape of the Merinos; the wool increased from 3½ to 6½ pounds per fleece, and it was little inferior to that from the pure Spanish sheep.

Mr. Tollet crossed the Ryelands with the Merinos, selecting the ewes of the native breed carrying the best clothing wool. He found that the Ryeland fleece, which ordinarily weighed little more than 2 pounds, increased to 3 pounds, and its average value rose from 2*s.* to 3*s.* per pound. Dr. Parry also crossed the Ryelands with the Merinos. After the fourth cross the wool was as fine and valuable as that of the pure Merinos. The characteristics of this cross are given in the Agricultural Magazine, August, 1806:

> They are a breed of considerable bone, length, and breadth of carcass, but wanting in that rounding of form which seems to constitute the beauty of our best or most improved native breeds. They are docile to a remarkable degree, leading about very handily. Their bodies, bellies, and legs down to the hoofs, are covered with a thick elastic fur, which certainly must be a greater protection against either wet or cold than the open fleeces of most of our native sheep. The best of the wethers weigh on the average about 8½ stones, or 17 pounds per quarter; and the mutton always bore a preference in the market.

As a trial of the manufacturing worth of the wool of this sheep, a certain quantity of Dr. Parry's wool from Ryeland ewes, and

crossed by the King's and Lord Somerville's rams to the fourth generation, was selected, and an equal quantity taken from a pile of prime Leonesa Spanish wool. Both of them were dyed and delivered to the manufacturer. According to the account of the foreman of the manufactory, "Dr. Parry's wool and cloth in every state worked more kindly than the other." When finished, his cloth was the finest, and that from the Spanish wool the stoutest. The cloths were numbered and submitted to the inspection of several manufacturers and drapers, who unanimously decided in favor of the number which the Anglo-Merino bore; and the opinion of the committee was that Dr. Parry "had, in his zeal, diligence, and perseverance and activity, accomplished the grand object of producing in the British climate, and from British soil, wool equal to that usually imported from Spain; and that by so doing he had merited the warmest thanks of the country in general, and that society in particular."*

Mr. Coke experimented on both the Ryelands and the Southdowns and declared that "the cross of the Merino and the Southdown was much better than that of the Merino and the Ryeland." The high opinion that Mr. Coke had of the cross, when he made this statement, he was obliged to yield later, when he had the results of further trial before him. Then he said:

> I feel it my duty to state my latest opinion of the effects of the cross of a part of my Southdown flocks with Merino tups, and I wish it could be more favorable. From the further trial which I have made—this, the fourth year—I must candidly confess that I have reason to believe that, however one cross may answer, a further progress will not prove advantageous to the breeder.

Mr. Hose, of Melton Mowbray, put a certain number of Leicester ewes to a ram of the same breed, and an equal number to a Merino ram. The result was that the Leicester fleece weighed 7 pounds, and that from the cross with the Merino 8 pounds, and that the former brought in the market 1*s.* per pound, and the latter 1*s.* 6*d.*, being a gain of 5*s.* on the fleece. The carcass of the former, however, weighed 27 pounds per quarter; the latter only 25 pounds, being a loss of 8 pounds of mutton. Other experiments in various parts of England and in Ireland led to the conclusion that, all in all, the Merino and its cross was less valuable than the pure Leicester.

Though the crosses with English sheep were not as favorable as the most sanguine anticipated, the Merinos found some zealous and steadfast advocates, and amongst them Lord Somerville, who imported a flock, and Sir Joseph Banks. Dr. Parry recommended a universal trial of them, either pure or mixed, with the native breeds. Mr. Bartley, who made the experiment with crossing on the Wiltshires, testified that they produced wool in a much greater quantity than any species of British sheep from equal quantities of pasture and equal feed. Far from the slightest appearance of deterioration, they manifested indubitable evidence of general progressive improvement, especially in the quality and value of the fleece. They possessed an aptitude to fatten at an early period, and the quality of the mutton was excellent. They resisted the effect of cold inclement weather to a degree equal at least to the hardiest of the native breeds, being defended by a closer, heavier, and more impervious covering. They produced short wool, in no way inferior to that imported from Spain; and a single cross considerably increased

*Bath Papers, vol. 11, p. 160.

the weight of the long-wooled sheep, still retaining the suitable staple as combing wool.

Notwithstanding the great improvement made by the introduction of the Merino on the long-wooled sheep, as shown by many experiments, and their adaptability to the country in a pure state, they had much prejudice to encounter, arising from their gaunt and unthrifty form; their actual deficiency of carcass; the inapplicability of their wool to the manufactures then most in request; and the natural prejudice of the inhabitants of a wool-growing country against any rival of the sheep which they and their forefathers had, from time immemorial, successfully cultivated. This prejudice was so great, and the knowledge of the Merino so limited, that it interfered with the success attending the establishment of the King's flock. Sir Joseph Banks, one of the warmest advocates of the Merino, said:

> It was impossible to find a purchaser willing to give even a moderate price for the sheep or their wool. The shape of the sheep did not please the graziers, and the wool-staplers were utterly unable to judge of the merit of the wool, it being an article so many times finer and of more value than anything of the kind that had ever before passed through their hands.

The truth lies nearer these words of an old writer: "For the fact is, and let them lay it down as a maxim, that so long as Englishmen are fond of fat mutton they must not expect to grow fine wool."

It was not until 1804, thirteen years after the arrival of the Negretti flock, that they had been able to establish themselves in the good opinion of a sufficient number of agriculturists to render a public sale prudent. The sale in that year was well attended, many purchasers coming forward and buying the sheep at high, though not exorbitant prices. One ram sold for 42 guineas, and two of the ewes for 11 guineas each. The average price of the rams was £19 14*s.* a head, and that of the ewes £8 15*s.* 6*d.* each. In the following year, August, 1805, a similar sale took place at advanced prices. Seventeen rams and twenty-one ewes were sold for £1,148 14*s.*, being at the average of £30 4*s.* 6*d.* At succeeding sales these rates were maintained or increased. The Merino became more and more eagerly sought after and experimented with, and in the sale of 1810 thirty-three rams sold for £1,920 9*s.*, or £58 9*s.* 11*d.* a head, and seventy ewes at an average of about £37 10*s.* per head. The highest priced ram was a Negretti purchased by Colonel Searle for 173 guineas.

In the year 1811 a Merino society was established under the presidency of the distinguished Sir Joseph Banks, with the express design of promoting and encouraging the cultivation of the Merino breed. Fifty-four vice presidents were named and local committees established in almost every district or county in England, Scotland, Wales, and Ireland. This society, composed of intelligent, skillful, and influential men, pursued their talk with intelligence, spirit, and zeal. Amongst other means adopted for promoting the end in view was the offering of premiums for pure Merinos, or for the crosses with the native sheep. Premiums of 20 guineas were offered for the best pure Merino rams not more than twenty-eight months old, and 10 guineas for the second best; 20 guineas for the best ram not more than sixteen months old, and 10 guineas for the second; 10 guineas for the three best pure Merino ewes; 10 guineas for the best pen (consisting of five) of pure Merino wethers; 10 guineas each for the best pen of the first, second, third, and fourth cross of Merinos with British sheep, and 10 guineas for the best fleece. Everything favored

the purposes of this patriotic society, and in an especial degree the unexampled prosperity of the landed interests of the country, and the enormous prices of the finest class of wools, produced by the events of war.

Before the organization of the Merino society public opinion and the practical judgment of many farmers had succeeded in reducing the pretensions of the Spanish sheep and the mixed progeny to the proper standard as objects of economical culture. It was found that, however promising were the crosses at first, the progeny invariably fell short of the expectations formed. They were small, not as hardy as their British parents, and generally vastly inferior in form. Time so perfectly confirmed these views that in a few years but a very few of the mixed breed were to be found anywhere in England. The raising of them was either abandoned entirely or the breeders gradually recrossed with English blood until almost all traces of the Spanish mixture were lost.

In place, however, of efforts to engraft the Spanish upon the English stock, other breeders kept up the pure Merino breed, which was found to increase in size, in its aptitude to fatten, in its domestic disposition, and in the power of the females to yield milk, and, by attention in breeding, to improve in external form. The wool became longer and lost somewhat, though not much, of its tenuity, unless, indeed, the means were taken to secure the animals, as in Saxony, from cold, the necessary effect of which was to call forth a greater production of wool for the protection of the animals. The naturalized Merinos never acquired the hardiness of the native races and perished at once on the mountains on which the Welsh, the Cheviot, and the Blackfaced Heath breeds are acclimated. "Nevertheless," says Low, "analogy conducts us to the conclusion, that the Merinos are capable of becoming, by degrees, adapted to the climate in which they are reared."

The objections to the cultivation of Merinos in Great Britain were not that they could not be reared, inured to the cold, and improved in form, with a moderate preservation of the character of the wool, but that they did not, as a breed, equal in economical importance those which were already possessed. The wool, indeed, was the most valuable and abundant of that of any breed of sheep that England could raise; but the wool was not the only profitable produce of the sheep, and it was by a combination of the production of mutton and wool that the interests of the farmer were best served. This the English agriculturist saw, and whilst George III was endeavoring to introduce and naturalize into the kindom those sheep which produced the finest wool, they were indefatigable in their efforts to improve those breeds of sheep which they considered most profitable to the farmer, giving the greatest weight of mutton and the heaviest fleeces.

Shortly after the death of George III the remnant of the pure royal Negretti flock fell into the hands of T. B. Sturgeon, of South Ockendon Hall, Essex, and by Mr. Sturgeon and his sons they have been bred pure to the present day. The effect of food, climate, and fresh blood imported from the best flocks to be found, is seen in the increased size of the sheep, their improved form, and fine heavy even fleeces.

Many of the Sturgeon Merinos, so called, are sent to South Africa and Australia, where they are much liked. In the former country they attain, when fat, a weight of 160 to 170 pounds, live weight, when

three years old; are very powerfully built, with good constitutions; short on the leg and yielding a fine elastic wool, long, soft, and strong, weighing 20 pounds to the fleece of a ram.

England was not successful in adapting the Merino sheep to her system of sheep husbandry, and economical considerations discarded it; but in her colonies its success has been marvelous. The Cape of Good Hope and Australasia present clear and striking examples of what may be accomplished by a very few individuals of a valuable breed.

CONDITION OF THE SHEEP INDUSTRY WEST OF THE MISSISSIPPI RIVER.

By H. A. HEATH, of Kansas.

WYOMING.

The new State of Wyoming ranks high as a wool and sheep producing region. When it is considered how short a time sheep-raising has been an important branch of its animal industry, Wyoming's success is marked. The industry there now assumes to become the greatest live-stock interest instead of the least, as it has been heretofore. Stock-raisers of Wyoming, as well as those of Montana and South Dakota, realize as never before the importance of raising sheep, and that cattle are not the only profitable class of domestic animals. The depression which has befallen the cattle business set men to thinking, and they were not long in discovering that a country which will sustain cattle is not wholly unsuited for sheep. Five years of practical experience convinced them that there is more profit in sheep than there is in cattle, and stockmen seeking localities for a stock ranch also learned that one-third the capital required to stock up with cattle is sufficient to start with sheep; and this was a strong inducement to try sheep rather than cattle.

Wyoming, during its Territorial days, was noted for its live-stock interests—cattle-raising being in the lead. The best ranges were fairly well stocked with cattle or horses. Previous to 1870 the live-stock industry was of little consequence, but soon thereafter the grazing lands came into demand, and the number of animals increased rapidly every year until 1884, when it was estimated that there were about 2,000,000 head of cattle, with a few sheep and horses; and the desirable ranges were generally occupied. Many wealthy cattle companies had been formed; eastern and foreign capital poured into the Territory, and cattle speculation was the craze. It was difficult for the sheepmen to get much of a foothold, as they were ten years behind the cattlemen; besides, they lacked the financial backing of the cattlemen. They had to rely upon their own resources strictly, and had necessarily to select ranges not occupied with cattle. Since 1884 the cattle business has declined, and the sheep business advanced until at the present time there are more sheep than cattle in Wyoming, and as the State improves the number of sheep as well as horses will increase, and together they will excel the cattle business in importance. The grazing lands of the State are better suited to horses and sheep than to cattle, as they are close grazers, and much of the pasturage consists of short grass with some browsing.

Of the ten counties of the State the following are the principal sheep counties, ranking as to number of sheep in the order named:

Carbon, Uinta, Fremont, Albany, Sweetwater, and Laramie. The four remaining counties have a few thousand sheep, but cattle and horses now represent the principal live-stock interests in those counties.

The breed or class of sheep most numerous in the State are of the Merino type, mainly of Spanish blood, with a fair representation of the French. The coarse-wool Mexican sheep is strongly represented in many flocks as the basis, but has been crossed with the Merino until many of the original and objectionable qualities have been more or less eradicated. The Mexican foundation, however, has been very serviceable to the industry because of their adaptability to the country and the methods in vogue of handling sheep; however, a large number of the first sheep brought into the Territory came from Oregon and California, mainly large-bodied Merino grades. The class of sheep brought in from the States east were more or less improved, many being pure breeds. Nearly all the breeding rams were thoroughbred. During the past five years quite a number of Cotswold, Southdown, and Shropshire bucks have been used, and generally with satisfactory results. At present the Shropshire rams are much favored. The cross produces an animal which gives great satisfaction. There is probably no other State or Territory in the open range country that has uniformly so fine a class of sheep. A marked characteristic of the sheep of Wyoming is their large bodies and heavy fleeces. This is attributed largely to the climate. Owing to this characteristic the sheepmen have made more money during the last two or three years than their fellow craftsmen on the open ranges. The larger carcass gives superior mutton qualities.

The grazing land is a hilly and mountainous country and open plains. In the southeast part of the State the plains are fertile and produce buffalo, bunch, and a native blue grass in abundance, while the desert or "bad lands" of the plains, in Carbon and Sweetwater counties, produce the various kinds of sage, such as the common, sweet, salt, and black sages, together with bunch grass. During winter the sheep feed on these sages or browse on the sagebrush and greasewood among the foothills; and when water is not abundant or accessible on the plains, they have to depend on the snow for water. During summer the water is supplied by the creeks and running streams or springs, which have their source in the mountains. Timber is of course scarce and is not needed for shade, as in the warmer climates. The natural protection in winter consists of hills, bluffs, and mountains.

Sheep that are brought in from other States usually do well and become acclimated without serious loss or deterioration. This is especially true of sheep brought from the North or West, while those brought from the East usually require the first year for acclimation. After that they seem to do as well as the home-raised animals, and improved in size and weight of fleece. Notwithstanding the method of letting the sheep depend upon their own resources for feed during the winter, it is a fact that healthy and strong sheep usually come through the winter in good form and condition.

The class of rams mostly used now are full-blooded Merinos, which includes a number of the French. Heretofore, many of the flockmasters have been content to use home-grown or grade bucks; but as the methods improve and profits increase, the quality of the bucks improves. As mentioned before, the mutton breed bucks are being used with satisfactory results. The cross of the Shropshire ram on

the Merino ewe produces a hardy and profitable animal of good size, with an average weight fleece of high-priced wool. The rams used are two years old and upwards. The number of ewes given each ram varies from 35 to 75—an average of from 40 to 50 ewes. The ram remains with the flock about thirty days from the middle of December; however, some flockmasters permit the rams to run with the flock until spring or shearing time.

The average per cent of lambs raised varies according to circumstances, governed by the favorable or unfavorable location of the range. It is a rare occurrence to raise less than 75 per cent of the lambs; frequently they save as high as 80 or 90 per cent. If the ewes are in good condition and mature they seldom fail to breed, unless the rams are taken away within thirty days, when from 5 to 10 per cent fail to breed.

It is remarkable how little winter feeding is done. As a rule no grain is fed, except in rare cases, when the flock is favorably located near the railroad, or when a few choice rams or other pure-bred sheep are held where grain is accessible. The usual winter feeding consists of hay fed during a few stormy days in midwinter, not to exceed an average of a dozen days. Sheds for protection are as rare a provision as winter feeding. The flockmaster trusts to nature, and her provisions consist of the mountain sides, cañons, willow, or sage-brush, bluffs, and foothills. The severe storms come from the east or the north. The exceptional artificial shelter consists of underground stables or cheaply constructed sheds.

Very little land is owned or leased by the sheepmen. They use for the greater part Government land. The portion of the land that constitutes the home ranch is usually small in area and contains the winter corral, dipping pens, and perhaps some hay land; this small tract is frequently leased.

The main object of sheep-raising in Wyoming has been the production of wool, but the objects now seem to be both wool and mutton, and the latter, with the class of sheep now grown, is at present the most profitable. But sales tend to the decimation of the flocks, though it is fortunate that the surplus sheep can be disposed of profitably.

Sheep-shearing in this State takes place either during May or June. When a gang of sheep-shearers make their appearance in a county, a date is fixed and a suitable place arranged for the shearing, which is done on a wholesale plan. The wool is immediately sacked and taken to the nearest railroad point for storage and shipment. When the flocks are within reasonable distance of railroad towns, the sheep are driven in at the rate of 1,000 per day—that number being shorn daily by an average crew of California shearers, who are mostly employed as experts, and who receive from 7 to 10 cents per head for shearing. Where it is possible the wool is sold at the nearest railroad to local buyers. The bulk of the wool is consigned to commission houses in Chicago or Boston. A large amount of the wool has to be freighted on wagons 200 miles to reach a railroad station. The present system of disposing of wool and the long and high-priced railroad haul is a very serious difficulty encountered by Wyoming sheepmen.

The classes of wool produced are fine, fine medium, and coarse or carpet wool. The net price realized for the best Merino wool is 12 to 19 cents per pound; the coarse wool less. The average weight of the fleece for fine and fine medium ranges from 6 to 9 pounds per

sheep. Many flocks, however, average 9 to 10 pounds per fleece. The general average for the State is about 7 pounds.

The best distant market for muttons is Chicago. The best buyers for wethers are the feeders in Nebraska and the Missouri Valley. The local market is very good for a moderate supply of fat sheep, and it is constantly improving as the population increases. The proportion of the flock that is annually disposed of as feeders and stockers varies from 10 to 50 per cent. The sheepmen living within easy reach of railroads dispose of a larger per cent than those who are more distant. A conservative estimate of the number disposed of annually will not exceed the increase of the flocks under existing conditions. The best wethers are sold to Eastern feeders at the ranch, and bring about $3 per head, while the culls and aged ewes bring from $2 to $2.50 each. Occasionally shipments are made to Chicago and net the grower from $3 to $3.50 per head, after paying the high freight rates from the mountains—a grand tribute to the individual value of the sheep. The average weight of 3-year-old wethers shipped from the State can safely be placed at 115 pounds. Griff Edwards, of Rock Springs, at one time in 1888 shipped 6,300 3-year-old wethers to Chicago, and their average weight at destination was 135 pounds. This shipment, however, represents the best maximum weight, which exceeds the usual average. Taking the various classes, the range of mature wethers will run from 90 to 150 pounds.

The average cost per sheep a year, all expenses, is variously estimated from 30 cents to $1. The lowest estimates come from Albany, Sweetwater, and Fremont counties. The average annual cost per head should not be estimated at less than 50 cents. Herders and ranch hands employed are usually foreigners or Mexicans. The herders receive from $30 to $40 per month, and the ranch hands $20 to $30 per month by the year.

The principal disadvantages and difficulties encountered by the sheepmen of Wyoming are the fencing of the free range or public land by large corporations, which often includes the hay land and watering places, and especially desirable ranges. The depredations of wild animals is a serious obstacle, which demands the constant watchfulness of the herders day and night to prevent loss; scarcity of competent herders and ranch hands to properly care for the sheep; storms and deep snows; scarcity of railroads for transporting sheep and wool; impassable roads or long, tedious drives over rough or barren countries to reach shipping stations; scarcity of water in many places on the plains; and last, but not least, the present system of selling wool by consigning to Eastern commission houses, with its consequent long railroad hauls and longer freight bills, with uncertainty as to the time and amount of returns. As the profits of the business depend on the wool sales, it works a hardship on the producer to be at the mercy of his commission merchant for returns.

The local advantages of the State for sheep husbandry may be mentioned briefly as follows: It is a natural grazing country, specially adapted to pastoral pursuits. No portion of the Rocky Mountain country is better suited in every way for stock-raising than Wyoming. Although the State is located in the arid regions, yet by virtue of its characteristics of soil, rainfall, elevation, and natural food supply throughout the entire year, this comparatively dry area is specially adapted to grazing purposes, and the larger portion of the State will never be available for anything else. The large area and great variety of grazing lands permit the system of frequent

changes of range, which keeps the sheep in thrifty, and growing condition. There is an abundance of free public land, and there are no contagious diseases; hence the sheep are healthy, and the small cost of handling sheep is an important item on the credit side of the account.

Disease is practically unknown. There are exceptional complaints of catarrh, tapeworm, and an occasional case of poisoning. None of these affections are general. The only disease which may be said to be common is scab, but this is well under control, and in some counties it has been so nearly eradicated that inspectors are not needed. The stringent scab laws afford ample protection to the flockmasters. Even in infected flocks very little loss occurs, as they are cured by dipping.

Generally speaking, the sheep industry of Wyoming is flourishing, although there is something of a decline in the southeastern part of the State, owing to the fencing of the range. In localities where the business is unfettered it is looking up, and the sheepmen feel encouraged. They are making more money than any other class of stockmen; however, not many new men are engaging in the business, being deterred by the fear that further tariff agitation will result in free wool, which would kill the industry. The best ranches are already occupied by men who do not care to sell. In Johnson and Fremont counties bright prospects are reported for an increased number of sheep.

As to the best methods of conducting the business, L. C. Morrison, of Fremont County, says:

> Take a herd of 2,500 to 4,000. The herder is always with the herd; another goes with the team once a week or so to move camp, look up lost sheep, look for new range, camp ground, etc. The herd is kept along the streams or in the mountains during the summer. In November or December, when the snow begins to fall, it is taken out into the waterless plains, where the range has been unused in summer, depending entirely upon snow for water, where it remains until the snow is gone. About this time lambing begins—about the 10th of May—when the breeding ewes are put in a separate herd. Two or three extra hands are required through lambing time. A few shear in April and before lambing, though many shear in July, after lambing. I prefer to shear in April. I have been in this country eight years. In that time we have had but one very severe winter. The condition of the range being favorable but few sheep died; but if such a winter should come now the loss would be very heavy. We always are in fear of hard winters. Hay is out of the question.

In the unsettled portions of the State the nomadic range system is considered most profitable, especially from lambing time until regular winter sets in, when hay can be had and sheds provided during stormy weather. No uniform system of conducting the industry can be recommended, because portions of the State are as unlike as Vermont and Texas, and methods in vogue in Fremont County would bankrupt a flockmaster on the Laramie Plains; however, by following the plans adopted by experienced sheepmen and attending strictly to business, by vigilance and employing competent and trustworthy herders and hands, success and profit are certain.

In northern Wyoming, in Sheridan County, the method of E. B. Viall, of Beskin, is to be commended, and is as follows:

> In the first place get good sheep to begin with. Keep them tame. Keep your pens clean in winter. Keep them dry. Run them out on the range every day. I run my sheep in the mountains from July 1 until the snow drives them out. They do splendidly. There is plenty of shade, feed, and water. There is no other animal that does well in the mountains. The greatest trouble in this part of the

country is to get a good winter range where you can get hay. The trouble is scarcity of water to irrigate with. There is no trouble about the range as long as there is no snow; but to be safe in the business you must furnish hay. Last winter I fed considerable hay. Perhaps this winter, if it is a hard one, it will take 100 tons to winter my nine or ten thousand head. No one should go into the business unless he can furnish a plenty of good hay. I am now fifty-seven years old, and have had more or less experience with sheep my whole life, and I have come to the conclusion that the way to make a success of sheep husbandry is to raise the best, keep everything strictly clean, and do everything in season.

CHARACTER OF GRAZING LANDS.

In order to form a correct idea of the country it is necessary to briefly describe the physical features of the State, which are mountainous, with valleys, bold bluffs, foothills, and broad rolling plains. The mountains have a general direction from the northwest to the southeast, and often present the appearance of broken and detached spurs. Narrow valleys and wide open plains lie between mountains capped with everlasting snows and seamed with deep cañons and gorges. The chief ranges are the Yellowstone and Wind River of the Rocky Mountains in the northwest, the Big Horn Mountains near the center and north, and the Laramie and Medicine Bow or Black Hills ranges in the east. Numerous rivers and their tributaries have their head waters within the State of Wyoming.

The extent of surface of the State is 355 miles in length by 276 miles in width, giving an area of 97,883 square miles; and notwithstanding the mountainous character of the State, more than one-half of the area is considered good grazing land, available for that purpose as free public land. The State as a whole has an elevation of from 3,000 to 8,000 feet above the sea level.

The Laramie Plains, in southeast Wyoming, are the best known open range, with an elevation of 5,000 to 6,000 feet. There are no great extremes of altitude except in the Big Horn range in the northwest, and Laramie Peak in the southeast. A very large portion of the State consists of small undulating plains, and valleys running back into the hills or breaks which constitute the favored shelter and grazing grounds during stormy winter weather.

The valleys and even the desert lands, when irrigated, produce large crops of grain or alfalfa. The soil of the valleys and plains is mostly of a rich loam, although there are various qualities of soil which produce nutritious grasses that cure where they grow and furnish food both summer and winter. The grasses in the foothills and breaks are sparse, but when cured are the most nutritious of forage plants. In addition to the grass, there is other nutritious herbage suitable for browsing and grazing. The mountains are mostly covered with a timber growth of pine, spruce, hemlock, and cedar; in some of the foothills aspen, walnut, elm, ash, box-elder, hackberry, and small growth of red cedar; while along the rivers or principal streams may be found two species of cottonwood and thickets of willows.

Governor Warren states that during the past ten years not more than fifteen days each year has it been necessary to feed hay or grain to strong healthy sheep, and then only on account of deep snows which prevented them from reaching the ground. The grass is accessible and nutritious throughout the year.

NUMBER AND VALUE OF SHEEP IN WYOMING.

Regarding the value of sheep in Wyoming, it is interesting to note their high average as compared with that of many other States and Territories. According to the statistician of the Department of Agriculture, in his estimate made in June, 1889, the average value of the sheep at that time for the United States was $2.21 per head, while Wyoming sheep were placed at $2.23 a head, and the only other States and Territories west of the Mississippi River which had a higher average were Dakota, Idaho, Iowa, Minnesota, and Montana, and the excess was but a few cents. The estimate made then represented fairly the cash value of the sheep. But at the present writing (February, 1891), fully 30 per cent should be added to the average value. Favorable tariff legislation and increased demand for breeding stock have enhanced their value to that extent.

The total number of sheep in Wyoming for 1891 is about the same as in 1889. The governor of the State estimated the number then at 1,250,000, while the auditor, in his annual report, only puts the number at 459,991 on which taxes were paid; but as certain aged sheep are exempt from assessment and many owners feel that they should make another exemption to cover the number which may be lost by wild animals, from exposure, or from thieves, the auditor's report is not unreasonable; it is not expected to be accurate. Both of these local estimates are extremes, one a maximum estimate and the other a minimum. The last report of the United States Department of Agriculture estimates the number at 1,017,373. This estimate is conservative and is approximately correct, and from careful personal investigations the actual number of sheep in Wyoming on January 1, 1891, may be placed in round numbers at 1,000,000 head. The failure to show an increase over January, 1889, during the two years that have elapsed, is not owing to any decline of the industry, but is caused by the large sales of sheep to feeders, together with heavy losses in western and central Wyoming during the winter of 1889–'90, which was the severest winter ever encountered by sheepmen in that region.

Values of the animals vary as to class, as described in detail in the preceding pages. An average value of $3 per head would give a total value of $3,000,000 exclusive of the wool clip. The shipments of wool this year from Rawlins, in Carbon County, exceeded 1,500,000 pounds. A conservative estimate of the value of the wool clip for 1890 is $1,000,000.

THE WATER SUPPLY.

The entire water surface area of Wyoming is 315 square miles, and consists of the various mountain streams and lakes, with the rivers and their tributaries. The principal rivers are the North Fork of the Platte and its feeders, which drain nearly one-third of the State, the central and southeastern portion. The southwestern portion of the State is drained by the Green River and its tributaries. In the northwestern portion of the State are the affluents of the Lewis and Snake rivers. And the north and northeastern portions of the State are drained by the tributaries of the Yellowstone, the Big Horn, Powder, Little Missouri, and Cheyenne rivers. The State is one of the best watered in the mountain country with these and hundreds of mountain streams. During winter the sheep that are not located near these streams depend upon the snow for water.

The average annual rainfall in the arid region is placed at 15 inches. The cold mountains condense the moisture in the country adjacent, thereby robbing the plains of their quota, making it fit only for grazing, unless reclaimed by irrigation, which would make of it a productive agricultural country.

Numerous rivers, including the Missouri, Columbia, and Colorado, with their respective tributaries, have their head waters within the State. Among the largest rivers are the North Platte, which flows for a distance of several hundred miles through central and southwestern Wyoming, the Green in the southwest, the Snake and Yellowstone in the northwest, and the Big Horn and Powder rivers in the northeast.

TEMPERATURE AND CLIMATE.

The climate of Wyoming is healthful, mild, equable, and salubrious; cool in summer and averaging warm in winter, with but few snowstorms, and the stormy winds which usually accompany a fall of snow prevent the complete covering of the ground. Winter grazing for live stock can therefore be depended upon, and is a conspicuous feature of Wyoming. The remarkable wintering of live stock is owing to the peculiar climatic conditions and influences. These are almost the opposite, in most respects, to those of the low-lying countries of the same latitude farther east, where the soil is wet, the atmosphere heavy with moisture, and the growth of vegetation rapid, coarse, and rank. During the winters in Wyoming there are more clear, sunshiny days, with fewer storms and less snowfall, than in the country eastward. Besides, the mountain streams remain open during the entire winter, so that the stock is not deprived of drink. The clearness and dryness of the atmosphere in all seasons of the year make the air pure and bracing, a favorable condition for sheep-raising and successful breeding. This important climatic advantage is favorable to the health of live stock generally.

Another significant advantage of the winter weather is the small precipitation of rainfall or snow which takes place during the winter, and aids in explaining, to those unfamiliar with Wyoming, how it is possible for live stock to subsist on the open ranges without other food supply than the native grasses. Besides, the animals are not subjected to the chilling effects of rain and snow storms of the lower and more humid regions. The weather is cold, but is easily withstood, because of the dryness of the atmosphere. On the mountains opposite conditions prevail. There the heaviest precipitation occurs during the winter months in the form of snow. A record of the temperature has been kept at Cheyenne. For ten years the mean temperature was 59 degrees, the highest temperature about 90 degrees above, and the lowest 19 degrees below zero. The air may be said to be absolutely pure and the climate very salubrious, conditions exceedingly favorable for stock-raising.

THE RELATION OF IRRIGATION TO THE SHEEP INDUSTRY.

In view of the growing importance of the sheep industry in Wyoming, the question of winter feeding is one of great importance, and must command the thoughtful consideration of every flockmaster. As the population increases and flocks become more numerous throughout the State, it is only a question of a short time when the

present winter methods of handling sheep must be abandoned. The prudent husbandman must be prepared to adopt what may be trenchantly described as more civilized methods, assigning to the past the customs of its pioneers.

The settling up of the country under irrigation need not necessarily drive out the sheepmen, as feared, but instead it may insure the permanency and enhance the profits of the business. In some portions of the State sheepmen are now compelled to feed more or less hay or grain, or both, during midwinter, and also provide shelter. Although this is very expensive, yet they find it profitable, obviating risk of heavy losses from exposure and shortness of feed. Most of the hay and all of the grain are now shipped in, making them very expensive for feed, but when irrigation becomes more general the State will produce its own supply of feed. That time is coming. There are 40,000,000 acres of arable and grazing land in the State, one-eighth of which can be irrigated. Wyoming should furnish within herself the best markets obtainable for all kinds of agricultural products.

Under a successful system of irrigation, stock-raising and farming combined will be both practical and profitable. Crops produced by irrigation yield a larger quantity and better quality per acre than when produced otherwise. The system of letting the stock business "run itself" in the very nature of things must end sooner or later in every portion of the State. In certain localities it has already stopped, and as a result definite calculations can be made as to certain profits in the business. The land suitable for irrigation has remarkable adaptation for the construction of irrigation works, and abundant water is accessible. There is no question as to the necessity and importance of irrigation for stock-raising. It will supplement the pasture and the plains and enhance the value and usefulness of both. Irrigation has been sufficiently tested to demonstrate that by its aid all kinds of small grain and grass do well. Alfalfa will produce two crops a year, an average of about 2 tons per acre at each cutting. The average precipitation for the whole of the mountain watersheds is placed at 30 inches. The irrigable land is located in the valleys, which are narrow. The uplands bordering these valleys are suitable only for grazing and can not be successfully irrigated; hence the stock-raiser will have his winter food produced conveniently near his range. Irrigation will trench upon only a fraction of the existing grazing lands.

I am convinced that irrigation will ultimately become an adjunct which will insure the perpetuity of the sheep industry of Wyoming. The pasture land possesses great value, and when irrigated for hay land it has a value equal to, if not greater than, any corn crop in other sections of the country. The hay produced in the mountain regions is of superior quality and fineness, and of greater value per ton than that produced in the East. It is like the native grasses, having a fine fiber and is very nutritious.

PERSONAL EXPERIENCE AND COMMENTS.

The following extracts from correspondence or interviews with representative sheepmen are given here because of their pertinent relation to the industry of Wyoming. The pointers are especially valuable because they represent the observation or experience of men practically engaged in the sheep husbandry for some time.

W. D. Currier, Albany County:

Here on the Laramie Plains the sheep business is about wiped out. Six years ago there were forty sheep ranches, now there are six. Cause, no range. Parties bought the railroad land in large blocks and then fenced in both railroad and Government land and allow no one to go inside the fence. There are blocks of 50,000 and 100,000 acres so fenced here. I used to run 20,000 sheep here—now run 6,000 or 8,000, and shall have to move out next year, as they are now fencing the last of my ranges. It is a dog-in-the-manger business, as there is not one-fourth the cattle or sheep on the Laramie Plains there were six years ago.

T. J. Gorman, Uinta County:

Last winter losses were 50 per cent among sheep, depending on range. Sheep are run on Government land entirely; no leased land here. My experience is, with sheep shearing 7 to 8 pounds and wool worth 16 to 18 cents here and good mutton $3, providing a man has hay for three months each winter, makes it a safe and profitable business, otherwise unsafe and unprofitable. I have this year a clip of 3,000 pounds, fine and fine medium wool, lying in Boston and can only get 13 cents net for it, owing to a lack of demand or agitation of tariff questions. Should wool be made "free" it would drive all growers out of the business in this State.

A. Pomeroy, Uinta County:

Our usual way of conducting our shearing is by having a corral made on or near our lambing ground—on good ground; then we hire men who usually travel and do nothing else but shear sheep. We pay about 10 cents per head for the shearing. The problem then is the disposing of our wool. We always try to sell at home, for when we ship to commission men we invariably get swindled, and so rather than ship we would make a sacrifice.

D. A. Kingsbury, Johnson County:

It seems to me that the most serious obstacle, except tariff legislation, to the success of sheep husbandry is the way we have to sell our wool, through commission men. Their method of grading and accounting for sales is always very uncertain and unsatisfactory. If there could be some means devised whereby the wool-grower would receive an *honest grade* and an *honest account of actual sales* to the factories, relieving him of the enormous steals of the commission men, he might maintain himself at the present low tariff, but what with Congress "monkeying" with the tariff from year to year, thereby holding out great inducements to importers to stock up a surfeit of wool and the enormous steal of the commission men, the wool producer is in a bad box, and it is simply a matter of time when he will be a thing of the past or reduced to serfdom.

B. Sweeney, Sweetwater County:

This country will not carry much stock, not as much as many men suppose, and the hard winters with an overstock will spoil the business. There is only one way for profitably conducting sheep husbandry that I know of here; that is, keep the sheep as fat as possible in the summer on good range and let them take their chance, with good care, in the winter. Feeding is impossible here. There are some men here who have as high as 35,000 sheep; the flock is divided into bands of about 2,000 each. It will not pay to run less than 2,000. Last winter pretty nearly broke a good many sheepmen in this country, but it was an exception. Ten per cent would cover the losses for some time before, say four years. If it was not for the hard winters and wild animals the sheep business would pay yet.

D. L. Swinney, Fremont County:

I think the sheep industry would be a fair paying business if we could get a fair protection in the custom-house and could get the railroads to carry our wool and mutton to market at a more reasonable rate than we have to pay now. I think the sheep industry will be the main live-stock industry in the State in the course of time.

John McCrady, Sweetwater County:

I drove the first stock sheep that ever came into this county, in 1878, from Colorado. Have followed the business mostly ever since. Have also driven from Texas here, and one drive from California; sometimes with a profit, but not always. The only way sheep can be run in this country at a profit is on a basis of 5,000 head

or more. It does not pay to run less, for the reason that it requires the same amount of labor to run a small bunch of 500 head as 2,500. The more sheep you have the less your expense per head of running them will be. We keep them on the move all the time, never over five days in one camp; have movable camps, and never corral unless to shear and doctor them, or separate them in some way.

J. S. Woodruff, Fremont County:

Sheep are handled here in flocks of from 1,800 to 4,000: two men with each band. They have a team and wagon, tent and supplies, and go with the flock all the time; move every few days. The sheep and horses live exclusively on the range the year through. It requires about 5 acres to each sheep. The grass and sage are very nutritious, but small and thinly scattered, such as will grow on dry and barren soil with no rain. An Eastern farmer could not comprehend or catch on to our way of stock-raising only to see it. The profits are large, and the chances simply desperate. If snow comes, or a hard winter, we are helpless.

D. V. Bayne, Johnson County:

It is very difficult to make a specific statement with regard to increase of sheep, because you may unknowingly trust too much to an inexperienced or careless shepherd in lambing season, or you may encounter a bad storm at this critical time. It is difficult to make specific statements as to destruction by wild animals, because so much depends upon the guardianship of the herd. Destruction by exposure ranges from 1 per cent to 75 per cent, as feed, care, and storms vary. In my opinion sheep can be made a success here only in bands of more than 1,000, because you must protect them from wild animals, whether in the wilderness among the pines or in ten paces from your cottage door. Some men in Wyoming have done well upon the range system exclusively, but many times sheep fare better eating hay than digging in 2 feet of snow for food. At present, grades are preferable to thoroughbreds, because they are better rustlers and better mothers. With Wyoming's range facilities and healthy climate the development of her agricultural lands would make her an excellent sheep country.

Dr. Gilligan, Green River, Sweetwater County:

The local markets of the towns of this county are very good, utilizing a large number of muttons which dress an average weight of 68 pounds, or 112 pounds gross. The surplus muttons from this country go to Kansas City or Denver and Chicago. Cattle are scarce now in this country. There is not more than one now where there used to be a hundred. The cattle have been replaced by horses, mules, and sheep, for which this country is especially adapted.

W. W. Gleason, manager Warren Live Stock Company, Cheyenne:

We now have 110,000 sheep and 2,500 Angora goats. Our crop of lambs for 1890 was 25,000, and our Angora kids number 700. We turn off every year as feeders or mutton sheep our 4-year-old wethers, 5-year-old ewes, and such lambs as are unsuited by condition to run through the winter. These classes, together with the culls of different ages, are disposed of for muttons. As an experiment we will hold over one band of 4-year-old wethers and turn them off at five years old to feed for muttons. We have our winter feeding stations in Nebraska. Our wool is promptly consigned to Dewy, Gould & Co., of Boston, as soon as shorn. Our wool clips for 1889 amounted to 302,745 pounds. In preparing this for shipment we baled the wool instead of sacking and saved $1,422.81 by that method. The freight rate from Cheyenne to Boston on sacked wool is $2.47 and for baled wool $1.80 per 100 pounds.

Robert C. Morris, Cheyenne, Wyoming, United States Treasury expert:

The suitableness of climatic peculiarities, with indigenous grasses and nutritious herbage, to profitable sheep husbandry in Carbon County appears to have been recognized in a practical way much later than its adaptability to cattle growing. Ten years ago, before the division, the 22,080 square miles contained only 1,540 sheep, grazing in small flocks over the vast pasturage. The last five years have greatly increased this industry. At this time there is, within but little more than half the same area, hardly less than 200,000. An estimate based on reliable information shows the assessment enumeration to be much too low. This great increase holds no inconspicuous place among the causes of decline in the cattle business. While

the latter has been prosecuted with actual loss and dubious prospects for three or four years past, but now brightening considerably, the former has yielded encouraging returns, besides adding to capital by augmentation of numbers in rapid natural increase, notwithstanding large shipments to eastern markets. The immense flocks on the ranges must compel cattlemen to smaller holdings and more judicious care within fenced ranges for the future. And there is certain reason to fear that the sheep enterprise may be overdone. The last wool clip of the county is estimated at about 1,500,000 pounds. The sheep and their fleece are of excellent quality, largely infused with Merino and other choice blood, producing superior grades for all purposes, singularly exempt from the contagious distempers common elsewhere among these animals, especially in New England and the East. Everywhere the animals are healthy, in splendid flesh, and promise an unexampled increase in the coming season.

LAWS AFFECTING THE SHEEP INDUSTRY.

As the animal industry of Wyoming constitutes the chief business of her people, it has been necessary for the best interests of all concerned to have special laws relating to the live stock of the State. The following statutes, relating directly to the sheep industry, are included as a necessary complement to this report:

APPOINTMENT OF SHEEP INSPECTORS.

SEC. 4144. The county commissioners shall appoint a sheep inspector who shall be a citizen of the county for which he is appointed, for each county containing two thousand (2,000) sheep, who shall hold his office for two years, unless sooner removed; and any inspector may act in an adjoining county having no inspector on request of the county commissioners thereof.

INSPECTION OF DISEASED SHEEP REPORT.

SEC. 4145. It shall be the duty of the sheep inspector, whenever he has knowledge or information that any sheep within his jurisdiction have the scab or any other malignant contagious disease, to inspect said flock and report in writing the result of his inspection to the county clerk of said county, to be filed by him for reference for the county commissioners or any party concerned, and if so desired, once in every two weeks thereafter to reinspect said flock, and report in writing the result and treatment, if any, in the same manner until said disease is reported cured: *Provided*, That in case of removal of the flock 6 miles from the range of any other sheep, as hereinbefore provided, he shall only make one inspection every three months.

PERSONS BRINGING SHEEP INTO COUNTY TO REPORT SAME FOR INSPECTION.

SEC. 4146. Upon arrival of any flock of sheep within this Territory from any other county, State, or Territory, the owner or agent in charge shall immediately report them to the inspector of the county entered for inspection, and the inspector shall then inspect them and report as provided in previous section, and in case of failure from any cause of the owners or agents to report for inspection, a fine of not less than one hundred dollars shall be imposed on said owner or agent for said offense, by any court of competent jurisdiction, which fine, when collected, shall be paid into the general fund of the county treasury, and any judgment for such fine shall be a lien on such sheep; said fine to be collected by suit brought in the name of the State.

RESTRICTIONS ON HERDING DISEASED SHEEP.

SEC. 4147. The owner or agent of any flock reported by the inspector to be so diseased shall immediately herd them so they can not range upon or within one mile of any grounds accustomed to be ranged upon by any other sheep, and shall restrain them from passing over or traveling upon or within one mile of any public highway or road; and in case this can not be done he shall immediately remove said sheep to a locality, when they shall not be permitted to range within less than six miles of any other flock of sheep, and said sheep shall continue to be herded under the above restrictions until upon inspection they shall be reported to be free from disease.

OWNER TO GRANT FACILITIES FOR INSPECTION—PENALTIES.

SEC. 4148. The owner or agent or employees of any flock of sheep requiring inspection or about to be inspected shall afford the inspector all reasonable facilities for making his inspection; and for any violation of any of the provisions of this chapter, said owner or his agent or employees shall be fined not less than ten dollars nor more than three hundred dollars, and every separate day's offense shall constitute a separate offense, and the written report of any offense, made by an inspector under oath, shall be *prima facie* evidence of the commission of said offense, and any justice of the peace of the county in which offense is committed shall have jurisdiction thereof, and the inspector shall *ex officio* report all violations of the provisions of this chapter of which he has knowledge.

BOND OR OATH OF INSPECTOR.

SEC. 4149. Every inspector, before entering upon the duties of his office, shall take the oath of office prescribed by law and shall give bond to the State of Wyoming in the sum of one thousand dollars with good sureties, conditioned that he will faithfully perform the duties of his office; such bond shall be approved by the county clerk, who shall endorse upon every bond he shall approve as follows: "I am acquainted with the sureties herein, and believe them to be worth the amount of the penal sum of the within bond, over and above their just debts and liabilities."

RECORDING OF OATH AND BOND—ACTION ON BOND.

SEC. 4150. Such bond, with the oath endorsed thereon, shall be recorded in the office of the register of deeds for the county in which the inspector shall reside and may be sued on by any person injured on account of the unfaithful performance of said inspector's duties: *Provided*, That no suit shall be so instituted after more than twelve months have elapsed from the time the cause of action accrued.

INSPECTOR TO KEEP RECORD.

SEC. 4151. Every inspector shall keep a fair and correct record of all his official acts, and if required, give a certified copy of any record, upon payment of the fees thereof, and in case of the inspector's death, resignation, or removal, said record shall be deposited with the register of deeds.

COMPENSATION OF INSPECTOR.

SEC. 4152. The inspector shall receive for his services five dollars per day whilst necessarily employed in inspecting, and for the first inspection an additional fee of one cent per sheep when the flock inspected is five hundred head or less, and for inspection of large flocks five dollars for the first five hundred, one-half cent per head for the second five hundred, and one-quarter of one cent per head for the remainder of the flock, to be paid by the owner or his agent, and ten cents per line of ten words for any official report or document: *Provided*, If any person shall keep several separate flocks of sheep, and some flock or flocks be not infected with scab, the owner shall be required to pay only the fees for inspection of infected flock or flocks: *And provided further*, That when an inspection is made and the result shall show no disease, the inspector shall give the owner a written statement to that effect, and shall be paid for such inspection out of the county treasury at the rate established by this section, as before named, after his account for said inspection shall have been allowed by the county commissioners in the same manner and form as claims against the county are allowed and approved by them. The inspector shall receive ten per cent of all fines and penalties collected in cases in which he gives information of the offense, and his interest in the result shall not affect his competency as a witness; and all fines and penalties as herein provided shall be paid into the general fund of the county.

ANNUAL INSPECTION AND REPORT OF INSPECTOR.

SEC. 4153. It shall be the duty of the inspector between the tenth day of August and the tenth day of December, in each year, to visit each flock of sheep within his county, and make a written report of their condition as to scab or other malignant contagious diseases, and when he reports no disease he shall be paid by the county as provided in the last preceding section.

PETITION FOR APPOINTMENT OF INSPECTORS.

SEC. 4154. No sheep inspectors shall be appointed by the county commissioners of any counties of this Territory until they have been petitioned to make such appointment by the majority of the sheep-owners of said counties respectively.

APPOINTMENT OF DEPUTY INSPECTORS.

SEC. 4155. The inspector shall be allowed to appoint deputy inspectors when his duties are such as to require his presence in distant portions of the county at the same time. Such appointment shall be approved by the chairman of the board of county commissioners, and when so appointed and approved the official acts of such deputies, as such, shall have full force, and the inspector and his bondsman shall be held responsible therefor.

INSPECTOR MAKING FALSE REPORT—PENALTY.

SEC. 4156. Whenever a sheep inspector shall wilfully and falsely report any sheep subject to disease, he shall be subjected to a fine of ten times the amount of fees charged by him for inspecting, and if he shall wilfully and falsely report any sheep inspected by him free from disease that are thus infected, he shall be subjected to a penalty not exceeding three hundred dollars for each offense.

COMMISSIONERS MAY REMOVE INSPECTOR.

Section 4157 provides for his removal by the commissioners if found guilty of either of the offenses set forth in section 4156.

RESTRICTIONS ON DRIVING SHEEP OVER LANDS OF ANOTHER.

SEC. 4158. Every owner of sheep having scab or other malignant diseases shall have the right to drive over the intermediate ranges to his own dipping works, or to any public or private dipping works, but in so doing he shall consult the owners or occupants of said ranges twenty-four hours before reaching the nearest limits of the same as to where he shall cross the same, and in no case shall he enter another's corral or water at his troughs or accustomed watering places with his diseased sheep without the written or otherwise express consent of the owner, and he shall take every possible precaution to avoid mixing his diseased sheep with any other flock or flocks. For each and every violation of these provisions of this section he shall be subjected to a penalty of not less than two hundred dollars nor more than five hundred dollars, and shall be held liable for damages in case any other flock of sheep contract disease through his carelessness or failure to comply with this law.

PRECAUTIONS AGAINST MIXING SHEEP.

SEC. 4159. Every person driving a flock of sheep from one range to another, or through any portion of this State, shall use every precaution to avoid mixing his sheep with those belonging on the range through which he may be driving, or with sheep being driven by other persons, and a wilful or careless neglect of the provisions of this section shall subject the party so offending to civil suit for damages by the person with whose sheep his sheep may become mixed, and to a fine of not less than one hundred dollars, nor more than five hundred dollars: *Provided*, That this section be not so construed as to prevent the proper herding of sheep on their accustomed ranges.

BOUNTY FOR WOLVES, WILDCATS, ETC.

SEC. 4234. The county commissioners of the various counties in this Territory are hereby authorized and required to encourage the destruction of wolves, wildcats, lynx, bear, and mountain lion, by making payment out of the county fund to any persons who shall engage in the destruction of the several animals hereinbefore named, the sum of money as herein designated, as a bounty for the destruction of said animals, viz: For each wolf or coyote, one dollar and fifty cents; for each wildcat, twenty-five cents; for each lynx, twenty-five cents; for each bear, five dollars; for each mountain lion, five dollars. The person or persons so engaged, who may desire the compensation above named, shall present to the clerk of the

county in which the animals were killed the entire skin or pelt of such animals, together with all the paws attached, accompanied by an affidavit stating that the animal from which such skin or pelt was taken was killed in this Territory and in the county were the claim is made by the persons so presenting, and that the said animal was not killed before March 3, 1884. It shall thereupon be the duty of the county clerk to give the person or persons who shall produce the evidence hereinbefore required a certificate stating the number of animals of each kind killed, and to what sum the person or persons are entitled under this section, which certificate may be filed with the clerk of the board of county commissioners as a claim against said county, to be by him presented to the board of county commissioners at their next meeting thereafter, at which time the board of county commissioners may order a warrant drawn upon the county treasurer, as in other cases. It shall be the duty of the county clerk to cause any person presenting the skin or pelt to attach all the four paws and punch a hole in each ear one-fourth of an inch in diameter, in the presence of said clerk at the time of the presentation of the skin or pelt of every animal hereinbefore specified, and at once to destroy the same. S. L., 1848, ch. 100, sec. 1.)

COLORADO.

Colorado, the Centennial State, was made up of some parts of the original States and Territories of Kansas, Nebraska, and New Mexico. It has an east and west length of 380 miles, and is 280 miles from north to south, forming almost a perfect parallelogram. There are fifty-five counties. They are very large, and comprise an area of 104,500 square miles, or 66,880,000 acres.

There may be said to be three natural divisions of the State—the mountain ranges, occupying the central portion from north to south; the foothills, and the plains. The mountains consist of three generally parallel ranges with intervening plateaux or vast valleys, known as "parks," which are distinguishing physical features of the State. These parks are numerous, but there are four of chief importance—South Park, with an area of 12,000 square miles; San Luis Park, somewhat larger; then Middle Park; and, lastly, North Park. All these parks are walled in by high mountains, are well timbered, and exceedingly fertile.

The plains occupy one-third of the area of eastern Colorado, and extend from the eastern mountain range by a gentle fall down into the fertile plains of Kansas. The western part of the Colorado plains becomes steeper and rougher until the foothills appear. These arid plains and eastward mountain slopes have an elevation of from 5,000 to 8,000 feet, and nearly one-half of the State lies on the eastward slope of the Rocky Mountains.

The animal industry of Colorado is mainly confined to the plains, although a considerable number of live stock are raised in the mountain parks and the many forks and valleys of the mountain ranges. The mountain ranges of Colorado, owing to their abrupt and precipitous character and lofty peaks, afford but a small area of summer pasture as compared to the mountain ranges of either New Mexico or Wyoming; and sheep are about the only class of live stock for which the mountain pasturage is at all available. Picturesque mountains, however, make very poor sheep pasture.

The soil of the plains contains every element of fertility for the production of grasses adapted to this latitude, and thus nature provides range pasture suitable for live stock most of the year. The plains are not suited to general agriculture, because the records show that in thirty years the average annual rainfall has been less than

15 inches, and this, while not sufficient for producing crops, answers all practical purposes in most seasons for sustaining the growth of the native grasses. The various grades of soil represented are the gravelly, sandy, clayey loam, calcareous, peaty, and adobe. The soils are generally excellent in quality, and with sufficient moisture produce abundance of grass, and when irrigated will produce grain. The adobe soil is black, heavy, and sticky, and is usually found along the bottoms near the streams. The area of this class of soil is small. Generally the soil of most of the open range in eastern Colorado is a hard, sandy loam and impregnated with alkali.

The live stock business constitutes the chief agricultural occupation of Colorado, and is as well one of the leading industries of the State. The different branches of the animal industry rank in numbers and value in the order named—cattle, sheep, horses, and swine. Since the decline of the cattle business in the State the sheep industry has been steadily advancing, and the same is true of the horse business. There seems to be no doubt that the sheep and horse industries will become the principal live stock interests of the State. There is no class of stock more naturally adapted to Colorado than sheep, and at the present time they are the most profitable branch of the animal industry. The prices for the wool product for several years past have not been remunerative, but taken in connection with the high prices for mutton during the same period fair profits have been realized. The demand for mutton has enabled the sheepmen to find ready sale for all surplus wethers and at the same time rid the flocks of culls and aged sheep, and otherwise improve the breeding flocks. Since 1888 mutton has been a better source of revenue and profit than the wool product. And this has led to some marked changes in the method of breeding and handling sheep. Prior to the decline in the cattle business sheepmen generally bred their sheep with reference to increasing the weight of fleece without regard to mutton qualities of the animal. But now, owing to the insufficient supply for even the home demand, to say nothing of outside demand from feeders, which is growing greater every year, and in consequence of which the value of every sheep has been enhanced, a change in the system of sheep-breeding has been adopted which will increase the weight of carcass without reducing the weight or value of the fleece.

In order to secure the desired result as speedily as possible, many of the sheepmen have invested in Downs or other mutton rams to cross with the ewes, which have been bred so many years with a view to increase the weight of wool. And from this cross an animal is produced that generally meets the present requirements both as to wool and mutton. Though this experiment is fairly satisfactory, yet this system of breeding has only begun. The lambs are strong, vigorous, and hungry from the start, and there is not so much difficulty in getting the lambs to suckle as with the Merinos. They seem to thrive on any kind of range, and the Down cross requires consid erably more feed than the Merino or Mexican. Another favorite cross is the French-Spanish cross-bred Merinos. Probably the most notable and extensive experiment of this class in the State has been conducted by the Merino Stock Farm Company of Elizabeth, Elbert County. The flock of this company was established by Frank G. Willard in 1872, and consists of pure-bred Merinos. The class of rams that have been used in the past were thoroughbreds from Vermont. The present company now makes a specialty of the French-

Merino ram, and thereby get greater size of frame and carcass, better rustlers, and do not sacrifice in the quantity or quality of wool. The result of this cross on this particular flock produces a sheep which, when mature, will weigh from 100 pounds to 140 pounds gross, and shear from 12 to 15 pounds of fine wool of good length of staple. This one flock is a grand object lesson for the industry, and demonstrates its possibilities in Colorado.

The sheep now in the State of Colorado are mostly Merinos and their grades. A large proportion of the sheep in southern Colorado trace back to the Mexican base, and though this strain of blood is not esteemed highly by practical sheep-raisers, there is no reason for concealing the merits of the Mexican sheep, their adaptability to the climate, the range, and to the pioneer methods of conducting the business. It required but very little capital to get a start with sheep of this class, and by using pure-bred Merino rams the flocks were soon graded up. It is a well-known fact that the Mexican ewe, the base of many of the early sheep of Colorado, was a hardy animal, an excellent traveler of great endurance, and as a mother even excelled the best improved sheep; and these good qualities she transmitted to her produce. The average Mexican ewe has a small body and long legs, with small wool surface. There is little or no wool on the legs or bellies, and the fleece is a sort of hairy wool of little value, but the Merino cross soon obliterates the objectionable qualities. The good qualities of the Mexican ewe were conveyed to the progeny of this cross in a marked degree, making a very happy combination, which has helped the sheep industry to attain its present success, and has added generally to the importance of the animal industry of the mountain regions and arid plains.

In connection with the preceding paragraph it must be remembered that only a portion, and not all, the flocks are of the Mexican Merino sheep, because most of the American flockmasters started with good grade Merinos which they brought from either California or from the States east. Prior to 1888 the Merino ram was used almost exclusively; now small but increasing numbers of Shropshire, Southdown, Cotswold, and French Merino rams are being used.

The sheep are run in flocks of from 1,500 to 2,000 head. The average number owned by one person or firm usually consists of from one to three flocks of that size. There are some large holdings throughout the State that number as many as ten, twenty, to fifty thousand sheep, but these are the exception and not the rule. Under existing conditions the disposition of sheepmen is to run smaller and better flocks and handle them better than heretofore.

The sheep are held on the open range during the summer and frequently most of the year. They subsist wholly on the native grasses, which consist mostly of the gramma, buffalo or blue-stem, and the bunch grasses. There are several other varieties of less value. These ranges are devoid of shade or shelter in most places. Water is supplied from occasional creeks, springs, natural water holes, or wells, and in some cases when the range is controlled by the flockmaster reservoirs are constructed at convenient places. In winter the sheep are brought to the home ranch, where, in some cases, feed is provided when the adjacent range is insufficient to sustain them, or bad storms prevent grazing. The home ranch is generally located on some creek where there is good shelter and water convenient, also considerable browsing, besides abundance of grass.

The loss from depredations of wild animals is not so heavy as in

Wyoming or Texas, except in mountain "parks." The State bounty for scalps of wild animals, though it is small, has no doubt been helpful to the sheepmen and saved many times its cost of taxable property to the State, besides causing a large destruction of animals that ravage the flocks. The loss of sheep from this source varies, as the reports of the sheepmen range from 1 to 5 per cent, with an average of less than 2 per cent. The loss of sheep from exposure is much greater, ranging from 3 to 15 per cent, an average of about 5 per cent, or double that of the loss from wild animal depredations. These sources of loss grow less each year as the methods of handling sheep improve.

Outside of breeding stock very few flocks of sheep are brought into Colorado from other, especially eastern, States. Occasionally flocks are driven into the State from Oregon, California, Utah, or New Mexico, but more sheep are exported than are brought in. A few years ago a great many flocks were brought in from the States east and seemed to acclimate readily, with no ill effects to either constitution or fleece. Frequently those brought from the lower and more humid country needed the first year to become thoroughly acclimated or habituated to the systems in vogue for handling sheep on the plains. Their wool fiber becomes dryer or harsher, and in some cases appears to become coarse, but there is no serious deterioration. Many sheepmen claim that the cold and dry winters improve the staple.

Regarding breeding rams there exists some prejudice against the highly bred, well fed, and carefully housed ones raised in the east. They lack the necessary quality of constitution, and do not thrive as well as the native-grown rams. The western flockmaster is partial to home-raised rams, high grade or full blood, from two years old and upward, to use on his ewes. From thirty to fifty ewes are bred to Spanish or French Merino rams, and from fifty to seventy-five to Shropshire or Cotswold. The ewes are bred during the months of December or January; the rams remaining with them about thirty days.

The average per cent of lambs raised depends on the management of the flock, varying according to the vigilance and skill of the attendants during the lambing season. The minimum number of lambs is about 75 per cent, and the maximum number raised is about 90 per cent. Notwithstanding the short breeding season not more than 10 per cent of the ewes fail to breed.

Sheltering and winter feeding are not regular accessories of Colorado sheepmen, except when necessity demands them during severe weather. In the southern part of the State little or no provision is made for shelter or feed in the winter, while in the northern and eastern part cheap board sheds are provided, generally open to the south or east. A great many, however, use the sod or board corral, with some sheds made of poles, brush, and hay. Still others depend on the natural shelter of the rough, broken country, with deep, rocky cañons, or the native cedar groves.

The lands on which the sheep graze is usually Government or railroad lands. The Government lands are free, while the railroad and school lands have to be leased at an annual rental of 5 cents per acre or $32 per section. Some of the more valuable land costs still more. Nearly every sheepman owns some land which has water on it, also the home improvements, such as corrals, sheep sheds, and other conveniences necessary to the business. So the sheepmen, it can be said,

both own and rent land—that is, they own the water privileges and graze the sheep on Government or leased land. The sheepmen feel that they could not afford to pay Government price in order to own sufficient range, because it requires so many acres for each animal.

The principal object of sheep-raisers has heretofore been the production of wool, and that of mutton was merely incidental, but under present conditions it may safely be said that both wool and mutton are of almost equal importance to sheep-raisers. Mutton has been more profitable since 1888 than wool. The class of sheep that is desired by the practical flockmaster of Colorado to-day are sheep of good constitution and heavy fleece, of good length of staple, of clean wool, and at the same time large-bodied animals. About such an animal as would be secured by the cross of the Shropshire buck on a high grade Merino ewe is preferred.

The shearing season in Colorado usually takes place during June or July. The preliminary preparations for this work are very simple. A few loose planks are placed on the ground either in the sheds or in the corral, and enough sheep are brought in from the range for a day's work for the gang of shearers. These are generally Mexicans, especially in southern Colorado, or expert California shearers, who command higher wages, as they are more rapid and skillful. The shearers receive from 4 to 6 cents per fleece tied up. The wool is immediately sacked and disposed of as soon as possible. The local buyer generally gets the clip if his prices are at all satisfactory, otherwise it is consigned to eastern commission merchants in St. Louis, Chicago, Philadelphia, or Boston. The bulk of the wool produced grades as "fine," "fine medium," or "medium," and in southern Colorado some coarse wool is produced. The grower received from 11 to 15 cents net last year. The cost of marketing is from 3 to 5 cents per pound. The weight of the improved sheep's fleece averages from 5 to 10 pounds, while the half and quarter blood makes only from 2 to 5 pounds. The average fleece of flocks owned by Mexicans, or the large holdings of the same class of sheep by Americans, produce an annual clip of 3½ pounds, while the improved sheep will clip an average fleece of about 7 pounds.

The best market for the wool is ordinarily at home, to the local buyer, or to the representatives of eastern houses who visit the ranches during the shearing season. The best markets for sheep that are fit for slaughter are the local markets, such as Denver, Pueblo, and the mining camps and mountain towns. This demand usually exceeds the supply, owing to the fact that feeders from the corn-growing States contract for so many of the mature wethers that this double demand, while it keeps the local market short, results in giving the sheepman the top prices, a benefit which he appreciates in view of the low price for wool.

In addition to the sale of wethers, Colorado sheepmen are having many calls for stock sheep to go to Kansas, Nebraska, and Iowa, so that now most of the sheepmen annually dispose of from 15 to 30 per cent of their flocks. Most of these stock sales are made in the fall. Lambs are sold from $1 and upwards, ewes from $2.40 to $3, and the wethers bring from $3 to $3.50. These are prices realized at the ranch for ordinary sheep, and do not apply to highly improved animals. The average live weight of improved sheep sold for mutton is from 85 to 100 pounds, while the Mexican wethers range from 50 pounds and upwards.

The average expense per sheep a year varies of course in the differ-

ent counties. Free or leased range, winter shelter, feed, and other expenses enter into the account, which makes it difficult to approximate a uniform cost. The estimates given the writer by representative sheepmen of the different counties vary from 50 cents to $1 per head. Some estimate that $500 will cover the annual expenses of a flock of 1,500 sheep. The wages paid to herders is $20 to $30 per month, exclusive of board.

The local advantages for sheep husbandry in Colorado are the cheap or free ranges, the cool, dry, and healthful climate, the ability of the State under irrigation to produce the supply of winter feed when necessary, the freedom from disease, the nutritious grasses which cure before frost comes and enable sheep to graze most of the year. The area of free range is large and can be utilized all of the year except in winter, when the flocks are supposed to be located on the home ranch or farm, where the winter supply of feed is stored. The water is always pure, cool, and abundant, if not always convenient. In most portions of the State where stock is held in winter there is natural shelter. The country seems naturally better adapted to sheep than to other domesticated animals. They are uniformly healthy, and there seems to be a constant immunity from the usual affections of sheep located in the more humid regions, such as foot rot, ticks, maggots, and worms. There is always likely to be a good home market for mutton in the cities and towns, and throughout the mountain country generally. Sheepmen have the advantage of competing lines of railroads for shipping from Denver or Pueblo.

In every portion of the State where sheep are held there are of course obstacles and difficulties to be encountered. Those that are enumerated here do not all apply to any one county, but are intended to cover the State. Briefly mentioned they are as follows: Droughty summers and consequent shortage of winter feed, exorbitant freight rates, low prices for the average wools, absence of running water on the range and great depth of wells, expensive building and fencing materials, high rates of interest, adverse tariff legislation, limited range in some counties, poisonous weeds such as loco, animal depredations, incompetent shepherds, high wages, no corn crops, insufficient cheap hay, low prices of wool, inability to control free range from traveling herds or "floaters," occasional snowy winters, would-be farmers and homesteaders occupying the Government land, severe winter storms or blizzards. These constitute the principal ills of the Colorado flockmaster.

Disease of any kind among sheep in Colorado is practically unknown. Scab is the only affection that has been at all prevalent, and that is pretty well eradicated or well under control, and is of little further consequence. An occasional case of tapeworm was reported in the counties of Las Animas, Lincoln, and Arapahoe.

The sheep business in Colorado, generally speaking, has recently recovered from a decline, and in most counties may be said to be in a fairly prosperous condition at present, with a bright outlook for the future, providing there is no further tariff agitation and the country does not become too thickly settled again, as it was in 1886 in what is known as the "rain belt" in eastern Colorado, where so much of the land was taken up by homesteaders and since largely abandoned after a few years of failure in cropping, meantime keeping out stockmen. The prevalence of scab some years ago also had a demoralizing influence on the industry. The low price of wool, unsettled values generally on account of tariff agitation, together

with high freight rates to Eastern wool markets and settlers homesteading Government land had depressed the business, but favorable legislation by the Fifty-first Congress and the increased demand for mutton have checked the decline and given the industry a new stimulus. The demand for stock sheep is once more the rule in many sections of Colorado.

In regard to the best methods for profitably conducting sheep husbandry in Colorado under existing circumstances, it is well to state that the consensus of the opinions of representative sheepmen of different parts of the State is in substance as follows: First, select the best possible location for the home ranch or farm—a place where irrigation may be carried on to produce the necessary feed crops, and to have adjacent, or conveniently near, plenty of outside grazing land. Next, start with good sheep and run them in medium sized flocks. It pays better than to run large flocks of inferior sheep. Be sure to have plenty of grass and water in summer and provide abundant feed in winter, also shelter for at least three months. Change the range frequently. Keep the corral clean and have plenty of salt for the sheep. Have a competent man and dog with each flock, and bring the sheep into the corral at night. Take good care of the sheep at all times and extra care of the lambs, and when the grass dries up in the fall put the lambs on the farm or home ranch. In breeding, grade up to produce more wool and mutton. Select extra good rams, either full fleeced and large sized Merinos or mutton breed rams to breed on the ewes. Experienced flockmasters say that sheep should be bred up so that 2-year-old wethers will weigh 100 pounds gross and shear 7 or 8 pounds of wool, and that such sheep with proper management will pay 25 per cent profit above all expenses. Do not trust too much to hired help. Give the business your personal attention, and let some other man run for the legislature. As a rule it is safe to provide feed and shelter for three months of the year; especially provide feed for early spring when the sheep are weak and unable to "rustle." The aged sheep should be fattened on alfalfa for the mutton market. With good breeding, good feeding and watering, combined with eternal vigilance and good business sense, the sheep industry is profitable to the producer. A safe insurance against loss from exposure is the provision of shelter and feed.

Mr. Frank Hall, United States Treasury expert, in his report on the resources of Colorado, gives some valuable information, from which some facts are gleaned which pertain to the sheep industry of this State. The price of agricultural products in Colorado for 1889 were as follows: Corn, per cwt., 86 cents; oats, per cwt., $1,05 to $1.07; wheat, per cwt., $1.60; hay, per ton, $10 to $16.

Speaking of grasses, he says:

> The grasses, both tame and wild, are successfully grown, making great yields of nutritious hay, and, as shown by analysis, are nearly double in valuable albuminoids when compared with the same grasses in rainy sections. Timothy, orchard, and blue grass make two crops a year, producing one and a half to two and a half tons per acre. Clovers are among the best forage plants, and are admirably adapted to the soil and climate; but the greatest, best, most profitable, and useful is the alfalfa plant. It has no equal in any country, nor is there a section where it thrives more luxuriantly than in Colorado. Having once a good stand it defies all attempts to eradicate it. It makes three and sometimes four cuttings a year, averaging from one and a half to three tons an acre per cutting, and in some localities of the State it is cut each month from June to October.

With regard to the live-stock industry he says:

It is a fact that none will dispute, however, that the limit of the range cattle industry has been annually restricted for the past five years, (1) by the enormous losses occasioned by the severity of several winters; (2) by the decline of prices in the chief markets of the country; and (3) by the rapid encroachments of settlers upon the public land, which have curtailed the feeding grounds and gradually driven the herds into such places as were not readily available for farming purposes.

From the causes cited the cattle industry has not been profitable for several years; indeed many, very many owners, have been literally ruined. Scores of individuals and companies have gone out of the business altogether, and those who remain are as rapidly as possible concentrating their herds. It is a revolutionary process whereby in a few years the range cattle business will be reduced to the minimum and its place will be taken by domestic and better bred cattle upon the farms where they will be fed, sheltered, and cared for as in the eastern States, where the range industry is unknown.

The estimated wool clip of 1888 is 9,000,000 pounds. Vast improvement in breeds of cattle and sheep and in the qualities of wool produced has taken place in the past five to eight years. The better flocks of sheep have paid about 20 per cent on the capital invested. The clip per head in 1888 was a fraction over 6 pounds. Spanish Merinos bred up from Mexican ewes predominate. There are comparatively few Downs or mutton breeds in the State. The flocks are raised in many of the mountain forks and valleys as well as on the plains. All Colorado wools are shipped to eastern markets because there are no manufactories here to consume products.

In regard to the future of the sheep industry of Colorado, the *Field and Farm*, published at Denver, has the following in its issue of March 7, 1891:

The most promising branch of the live-stock business just at present is no doubt the sheep industry. Colorado now offers special inducements in this line, and hundreds of people who are not in the business to-day will sooner or later become engaged in it. The occupation of the flockmaster, which has heretofore been carried on in a nomadic and very primitive manner, will hereafter be more carefully carried out. Irrigation must, from the necessity of the surroundings, become a great factor in the future success of wool-growing on the plains.

The old and unwarranted notion about allowing sheep to go through the winter without feeding and with only the frozen grasses for subsistence has gone by, and forage has become a regular item of annual expense to the sheep raiser. Alfalfa hay has proven itself a splendid winter feed for the woolly tribes, and much of it has been consumed the present winter. Alfalfa is best grown by irrigation, and with the many farms under ditch bordering on the natural grazing areas a vast amount of this forage will be provided hereafter, and sheep will be more generally fed as the years roll by.

It does not require a great acreage of alfalfa to provide a supply of hay sufficient to carry an ordinary band of sheep through the average Colorado winter. The time is fast approaching when many of the heavy sheep ranchers far out in the arid region will build storm dams at convenient places on their ranges to conserve the rains and irrigate small tracts of alfalfa land. The three cuttings a season will furnish a very satisfactory lot of prime hay, which may be fed out in severe winter weather as the emergency of the flock may demand. Other ranchmen who make a specialty of mutton will utilize great quantities of alfalfa in preparing their wethers for the winter market, which is a most profitable one in the cities and mountain towns of Colorado.

THE NUMBER OF SHEEP AND VALUE OF THE INDUSTRY.

The number of sheep in Colorado, the product of wool, and the monetary value of this particular industry, have never been published officially except in an incidental way, and never accurately.

The local officials of the State have taken great pains to investigate the mining industries, the cattle business, and the irrigation enterprises, and have endeavored to collect all the valuable information possible regarding them for their own benefit, as well as for the edification of the general public both at home and abroad. The sheep industry, however, has been slighted; yet as a matter of fact there is no industry in Colorado that pays as large a percentage of profit on the investment or gives employment to as many persons for the same amount of capital employed. This significant statement is verified by the facts, and is an important item regarding the resources of Colorado.

The only counties in the State which did not receive taxes from sheep property during 1890 were Baca, Clear Creek, Dolores, Fremont, Gilpin, Hinsdale, Montezuma, Pitkin, and Sedgwick. The leading counties represented in the sheep industry are Arapahoe, Elbert, El Paso, Huerfano, Lincoln, Las Animas, Weld, Montrose, and Archuleta. In regard to the statement that has become current, that there are a smaller number of sheep in Colorado than there were two years ago, I have no hesitation in now saying, after fully investigating the matter, that it is a mistake. It is true that since 1888 an unusual number of sheep have been either shipped or driven out of the State, yet in this number there should be included a large number that were brought in from Oregon and New Mexico for the very purpose of selling to feeders. The increase of Colorado flocks during this period exceeded the number consumed within the State and those shipped or driven out; but these two sources of decrease together will not equal the number that have been increased by the lamb crops since 1888 by at least 100,000 head.

The report of the statistician for the Department of Agriculture for January and February, 1891, gives the numbers and values of farm animals for Colorado as follows:

Animals.	Number.	Value.	Average.	Animals.	Number.	Value.	Average.
Horses	124,052	$6,567,661	$53.75	Hogs	23,606	$126,353	$5.35
Mules	4,800	401,616	83.67	Milch cows	62,285	1,750,831	28.11
Sheep	1,819,569	4,306,555	2.37	Other cattle	1,017,465	16,046,133	15.77

Or the average for all classes of cattle is about $16.50.

The statistician's reports are ordinarily very accurate, and accepted as such; but as far as Colorado is concerned the numbers of both cattle and sheep are placed too high, and the average value of cattle is also in excess of actual value.

This report also places the average value of each sheep in the United States at $2.50, and places the average value of Colorado sheep at $2.37. On this basis the only States or Territories west of the Mississippi River that equal or exceed the average value of sheep in this State are Minnesota, Iowa, Missouri, Dakota, Montana, Utah, and Washington; and, with the exception of Utah, none have nearly so many sheep. This is certainly a creditable comparison for Colorado.

Another estimate of the number of live stock in Colorado was made by the live stock department of Atchison, Topeka and Santa Fé Railroad Company, which is as follows: Horses, 227,690; mules and asses, 13,770; cattle, 1,000,760; goats, 7,150; swine, 38,010; and

sheep, 854,800. They also estimate the number of steer cattle, from yearlings up, for sale and which can be shipped during 1891, at 300,000 head, and the number of wethers for sale and shipment during 1891 at 213,700 head.

The Colorado Bureau of Immigration, which has devoted considerable attention to collecting information regarding the resources of the State and in making exhibits of her products, in their investigations show that but little attention was devoted to sheep, the board seeming to rely on the assessors' reports mainly for information about this industry. Of the sheep on hand during 1890, they estimate that 253,774 were grown for mutton and 572,034 for wool; in all, 825,808 sheep in the State—an increase of 168,262 head over the number reported by the assessors to the auditor of the State.

In making an estimate for this report the number of sheep given by the auditor of State in his last biennial report for 1890 is taken as a basis for calculation as to the actual number. The auditor's report simply consists of an abstract of the number reported by the assessors in each county for taxation purposes, and the total number given for the State is 657,546, valued at $758,584. To this number should first be added 200,000 head, the number known to have been sold and shipped or driven out of the State before the assessor made his rounds, and this would bring the number up to 857,546 head, giving an excess of over 20,000 above the board of immigration's estimate. To this number there should be added the lamb crop of 1890, which at a low estimate is 214,454 head, and is not included in the assessors' inventory. This would bring the number up to 1,062,000 head, and to this can safely be added 60 per cent more, which gives a total number, at a conservative estimate, of 1,699,200 sheep now on hand in Colorado. The 60 per cent increase is the lowest average estimate that reputable sheepmen say should be added to the assessors' report to give the actual number, lambs not included.

The average value of the different animals of the flocks may be classified as follows: Lambs, $2; ewes, $2.75; wethers, $3; which would give a total value of the sheep of the State at about $4,462,500. The wool clip of 1890 is estimated by many at 11,000,000 pounds, but from the best information, based upon the amount left in the hands of the growers in December, 1890, and the shipments made up to that time, the annual wool clip for 1890 will not exceed 10,000,000 pounds, valued at about $1,500,000. An estimate of other property necessary for the prosecution of the business, such as ranches, ranch property, leases, etc., added to other items, would give what the sheep industry represents to the State of Colorado, which I think at a low conservative estimate to be at least $10,000,000. Further comparing the sheep industry, properly managed, with any other industry of the State, it is by far the best paying agricultural pursuit in Colorado. At the present rate of improvement, unless some unusually adverse condition or unforeseen calamity besets the industry, it will, before another decade passes, represent at least a valuation of $25,000,000.

SHEEP LAWS.

The laws relating to the inspection of flocks have been very beneficial to the industry, affording necessary protection from "floaters" or roving flocks of sheep that have no regular range or habitation. The sheep laws of Colorado are very similar to those of Wyoming, so that only such portions of the law are given here as may be of

special interest to flockmasters generally. The laws relating to live stock in general in Colorado are specially favorable and helpful to those engaged in the animal industry.

The sheep inspection law in section 1 provides that the county commissioners in every county having 2,000 sheep shall appoint a sheep inspector for that county.

Section 2 provides that the inspector shall inspect every flock of sheep which he knows or is informed has the scab or any other contagious disease, and report in writing the result of said inspection to the county clerk. If found diseased, he shall reinspect the flock every two weeks and report as before, until the same is cured. If the flock is removed 6 miles from the range of other sheep, he shall make an inspection every three months.

Section 3 provides that upon the arrival of any flock of sheep into the State the owner or agent shall immediately report them to the inspector of the county for inspection, etc.

Section 4 provides that diseased sheep shall not be herded within 1 mile of any ground accustomed to be ranged upon by any other sheep, and that they shall be restrained from passing over or traveling upon or within 1 mile of any public highway or road. In case this can not be done the sheep shall immediately be removed to a locality where they shall not be permitted to range within less than 6 miles of any other sheep, until they are reported free from disease.

Sections 5 to 13 relate to fines, duties, etc., of owners, inspectors, and others.

Section 14 provides that every owner having contagiously diseased sheep shall dip or otherwise treat the same on his own premises: *Provided*, That when he has more than one ranch or set of ranches he may drive the sheep over intermediate ranges to where his dipping works or other facilities for treating the disease are situated, but in so doing he shall consult the owners or occupants of said ranges as to where he shall cross the same, and in no case shall he enter another's corral, or water at his troughs or watering places, unless he has the written or otherwise expressed consent of the owner.

Section 16 provides that no person shall keep or herd sheep to the number of ten or more at or within 2 miles of any city, town, or village in this State: *Provided*, That the act shall not prevent any one from driving sheep to market, etc.: *And provided*, That this act shall not apply to any person who owns a stock ranch or farm within the above-described limits.

The scalp bounty law is another favorable provision for the sheepmen of the State. The amount of bounties paid out for wild animals' scalps in 1890 was $24,781. The counties which received the largest bounties were Arapahoe, Eagle, Garfield, Las Animas, Mesa, Rio Blanco, and Routt. Each of these counties received about $1,000 or more.

The law provides that every person who shall kill a wolf or coyote shall receive a premium of $1 for each such animal killed, and $10 for every bear or mountain lion. Every person claiming such premium shall produce the scalp, including the ears, entire to the county treasurer of the county in which the animal was killed, within three months after the killing. And such person shall swear to the truth of his statements.

The county treasurer shall pay all premiums, and charge them up to the State. He shall burn all scalps in the presence of a reputable

witness. Heavy fines and penalties are imposed upon any person for deception or otherwise trying to defraud the State.

In some portions of the State live stock at certain seasons of the year become poisoned from eating the loco weed. The State has in force for the eradication of the weed a law which went into effect in 1881, and since then the State has paid out in premiums on loco weed certificates the sum of $425,139.67. The least amount paid out in any one year was in 1881, amounting to $6,597.39; the largest sum was in 1884, and was $116,944.10. In 1890 the loco weed certificates only amounted to $16,910.24.

The loco law provides that any person who shall dig up, not less than 3 inches below the surface of the ground, any loco weed during the months of May, June, and July shall receive a premium of 1½ cents per pound for each pound of such weed dug up: *Provided*, That the weed shall be weighed when thoroughly dry. The claimant when producing the weed must swear that it is loco weed, and was dug up within the last two months. The county clerk must certify to weight of weeds and then burn them. All such premiums are paid out of the State treasury.

NOTES FROM PERSONAL EXPERIENCE.

The following pages contain valuable information and pertinent pointers regarding the sheep industry of Colorado. It is the expression of wool-growers in their own language, representing their views, experience, or observation on various practical subjects relating to the business of wool and mutton production. The men making the statements are practical sheepmen, representing the different sheep districts of the State.

H. C. Sherman, Sterling, Logan County:

Brains are required the same as in any other business. It requires constant care and watchfulness: eternal vigilance is the price of success. It is a losing business without such qualifications, but with them and a good location it is above an average in Colorado.

H. Giraudot, Orchard, Morgan County:

We generally sell about the same number of wethers and dry ewes as will equal the number of lambs raised. We mean to keep our number good and not increase the number of sheep in the flock. The most profitable flock to run in is a band of 1,500 head. But if the flockmaster has sufficient range to permit a change of pasture about twice or three times a month in winter, he could run double the number in the flock.

Louis D. Roberts, Arapahoe County:

Sheep are in poor demand at present. The outlook generally is not very bright under the present method of conducting the sheep business. When profits are considered, the exorbitant freight rates and our dry summers materially reduce if not absorb the profits. I am a Republican, so bred and born, but am in favor of free wool unless Congress will give us a uniform tariff as to grade and will discriminate between "wool and waste." Whenever they will let the wool duties alone, I think then the sheep business will pick up.

J. J. Bristol, Bristol, Larimer County:

The general outlook for sheep business is not encouraging. The range is overstocked and vast tracts are fenced, so that there is not the room for the business to extend. For the past six years the business has not been profitable, and nearly all the sheep have been disposed of. This section formerly supported about 75,000 sheep; now, there are not 6,000 in the county.

Dudley and Chalmers, Garo, Park County:

On account of the altitude sheep are very free from disease and put on flesh quickly in summer during the green grazing, and when properly taken care of in winter by feeding our very strong, rich hay, they will grow to good size—100 pounds for this class of sheep, which shear 8 pounds or upwards of medium and fine medium wool. We never corral with fence except during lambing and shearing season, which makes much less dirt in the wool.

Ed. West, Trinidad, Las Animas County:

I have handled sheep here for eighteen years. I consider them way ahead of any other kind of stock for making money. I have both cattle and horses, but there is no comparison for profits. "Give me more sheep." The care of them is a lonesome life, and they require good management and a live man. No "deadhead" has any business with sheep. Only about one man in five that starts in the business ever makes the sheep business a success in this country.

Walt. M. Houser, Gardiner, Huerfano County:

Will say our sheep in Huerfano County are generally of too small carcass, also shear too light a fleece. I think our model sheep should be pure, or half French and one-half Spanish Merino rams, crossed on our common Mexican grade sheep. I think when wool-growers breed to good rams and procure feed for the flocks in winter they will generally be prosperous.

George F. Hodge, Deer Trail, Arapahoe County:

Sheep can be kept in this State profitably by any man exercising good judgment and attending to his business. Grain can be got at very low rates owing to the number of railroads, and hay can be cut almost anywhere. All good sheepmen are prepared for winter, and generally come out in spring with feed to spare. For the last three winters there has not been any necessity to feed outside of the range. A sheep well summered is half wintered, and nearly all sheepmen here now understand it so.

William B. Miner, Fort Collins, Larimer County:

I have been in the range sheep business in Colorado and California, and I think it the best business in the world if properly attended to, if the man be a natural sheepman. But every man can not make money at the business, for he will not give it proper attention at the proper time. A very small per cent of the men in this section have made money at the business for the reasons I have stated.

H. Schneider, Atwood, Logan County:

Until the last five years our main dependence was wool, but since that time our surplus sheep have been sold for mutton. Had it not been for this source of revenue, owing to the prevailing low price of wool but few sheep would have been held here now. Men who have properly cared for their sheep have done fairly well; others have failed. We feed alfalfa, an excellent and cheap feed; only those who have land under ditch can grow it. I have been sheep raising here for the last seventeen years, and have been fairly successful.

John Robertson, Meeker, Rio Blanco County:

I was twenty years a Scotch farmer and stock-raiser, spent two years in West Virginia, some time in Virginia, but neither State suited me as Colorado does. Now, I can make a fairly good living, and my past practical experience is all required here. Politics do not seem to improve the sheep industry any more than any other industry. Now, I am content whether we have heavy tariff or free trade—we can't be worse than now.

N. E. Wheeler, Carr, Weld County:

The cost of running sheep varies, as some men run strictly sheep, others mixed farming, and others stock, and very few keep any records or sheep account. However, sheep are the only stock that has paid any profit for the past four years with proper handling. There is considerable hard work, great risk, and none too much pay for the sheepmen.

Edward K. Packard, Eaton, Weld County:

In ten years' experience I have lost money one year, come out even one year, and balance of time got ahead some. I like the business and have given close attention to it. I start into the winter with about 2,000, and sell mutton during the winter to make room for the increase in the spring. When a ewe gets six years old I turn her off for mutton.

R. J. Sheridan, Monte Vista, Rio Grande County:

My experience is based on six years practical knowledge in the Rocky Mountains, in an altitude varying from 7,000 to 10,000 feet above sea level. It may be useful to state that besides the great advantages in the increase of quantity and quality of wool by the grading-up process from native mothers and Merino rams, that the graded animals themselves are better able (all things else being equal) to fight the hardships of early spring than the native stock. This I attribute to their warmer and weightier fleeces. Were I to make another departure for further improvement in mutton, with the least detriment to wool, I would use Cotswold rams on my graded Merino ewes and feed and corral in spring.

John E. Law, New Windsor, Weld County:

I now have 5,000 sheep, and have increased the weight of fleece in eight years from 4 to 7 pounds. The price realized for eight clips was from 14 to 18 cents. Of late years have ewes bring lambs only at 3, 4, and 5 years old. I cull out yearly all the old ewes and sell for what they bring, 50 cents to $2 per head. Have sold the wethers in fall or winter after they are 3 years old. In this way have had only young strong sheep to winter, and by taking out of flock all lambs that do not keep up in condition, and any other weak sheep, and feeding them hay, I get the flock through the winter in good condition without much loss, if winter is reasonably fair. The ranges are now so occupied we must count on having to feed more than formerly of winters. If users of the range could as individuals have security in their occupancy of their ranges it would be a great advantage over present conditions. Now one flock eats off the range from another, so one can not so well reserve one part of his range for winter feeding while using another part for summer, without danger of his reserved feed being partly taken by some one else. My ranges are perhaps as good as the average for producing pasture. My flocks range over something like eighty sections of land, and in the spring, before the new grass comes on, the old feed seems to be almost completely cleaned up. There are a great many horses and cattle feeding on the same ranges. To sum up, from an experience and observation of a number of years, should estimate that eight to ten sections of land would be needed to support well, continuously, 1,000 head of sheep, where sheep have exclusive use of range.

Alexander Day, Pueblo:

I am fully persuaded from long experience and close observation that by proper care and handling of the cross-bred sheep in smaller numbers, there is no stock that can be handled with better results than can sheep. Alfalfa as a forage is unsurpassed by anything for sheep feed. Its rapid growth enables us to cut from 4 to 6 tons per acre. This will enable us to feed sheep very cheap in winter, and free range in summer gives us advantages over the eastern States that will in the near future be of vast importance to Colorado. At present there is a great inquiry for stockers, a thing unknown for several years, and it is only the prejudice against the brutes that keep many out of the business. It may not be out of place to say that my experience is that the demand for mutton has doubled in the United States in the last five years; and although wool may be low in Colorado, it is overbalanced in the high-priced mutton. Wool will pay the expenses and the mutton is clear profit.

J. F. Gibbs, Greeley, Weld County:

There is no doubt, and I would be glad to have you emphasize the fact, that a large part of Colorado and the plain country generally will ever be devoted to sheep raising. It can never be irrigated, reservoirs or no reservoirs. The cattlemen can not use it to advantage. Sheepmen, protected, will sink wells and raise water for their flocks. With anything like a ghost of a chance farmers will raise sheep rather than cattle everywhere. Two crops per year are better than one. A bond with a wool coupon and mutton coupon is as good a bond as any with Uncle Sam's name on it, provided we are protected against the foreign article.

W. N. Bachelder, Orchard, Morgan County:

Sheep business has been fair for the last ten years on account of the high prices for mutton. If bred for wool alone it would not have paid. There is or has been for the past four years a growing demand for feeders in Nebraska and Kansas; demand not so good this year on account of short corn crop in those States. There is good money in sheep in this State if fed alfalfa hay three months. It is excellent feed for sheep and is produced in large quantities; in fact is our best crop in Colorado.

C. G. Strang, Hugo, Lincoln County:

My experience leads me to the conclusion that the best sheep for our section of the country is a grade produced by breeding up from Mexican stock with thoroughbred Merino rams and then crossing with first-class Shropshire or other varieties of Down sheep so as to combine the fine wool of the Merino and the hardy constitution of the Mexican with the mutton qualities of the Downs. Thoroughbred sheep do not seem to be able to stand the exposure and traveling to which sheep in large herds are necessarily exposed. Sheep owners are feeding more grain and hay to their sheep and are building shelters. As a result they have increased the yield of wool and the size of the sheep. Better care and feed pay well.

William Green, Hastings, Las Animas County:

The Government would do well to make an inquiry into sheep scab and tapeworm amongst the flocks of the West. There are, I think, more important questions to sheep owners west than the tariff. The loss of wool from scab and lambs from tapeworm are very serious questions, which ought to be handled by the United States Government at once with a view to the discovery of preventives or remedies.

Rollan Sherman, Denver:

I have spent nearly twenty-five years in this State; have been engaged in sheep raising twelve years; know when the first sheep came into this part of the State; know when the first herd of cattle was turned on this range. Cattle used to get fat here in winter, twenty years ago. But the range is too short now. I have seen 1,800 Indians and thousands of buffalo and antelope here. Men have tried to farm here but failed in this section. Without irrigation it is only fit for stock and best for sheep. Give the sheep industry proper protection and this State will treble her sheep industry. I have crossed the Shropshire ram on the Merino and think it a success in the line of wool and mutton.

Charles Thurlow, Colorado Springs:

Free trade in wool may be the greatest good to the greatest number, but it means death to the wool-grower. Australians can have land at 1 cent per acre, one acre of which is worth five of ours. Wages, $40 per month; transportation to Boston, 75 cents per 100 pounds. We pay 6 cents per acre for what little land we can lease; $20 to $25 per month wages, and $2 per 100 pounds freight to Boston on wool. We want a long lease of arid lands from the Government at 1 cent per acre; then we can build shelter and make the business safe. As it is, we run for luck now. Also want a railroad rate of $1 per 100 pounds to Boston. They frequently haul wool by our doors from California to seacoast for 50 cents per 100 pounds.

TEXAS.

Sheep husbandry in Texas, like all other industries of importance in that great State, is on a characteristically immense scale. It is necessary to form some idea of the area and extent of the State before one can appreciate fully what it means to be engaged in a pastoral occupation in this portion of the great plains. The area of Texas is 265,780 square miles, or 170,099,200 acres. Its boundary lines measure over 4,000 miles. The Gulf of Mexico touches 500 miles of its southern border. Texas lies mainly between 24° and 35° north latitude, and between 17° and 30° longitude west from Washington, D. C., ranging in altitude from sea level to 5,000 feet above.

The country rises gradually from the Gulf toward the northwest until it reaches an elevation of from 3,000 to 5,000 feet in the Pan Handle and Staked Plain and that part of the State about El Paso. The rivers have their rise here and flow southeast to the Gulf of Mexico.

The eastern portion of the State is known as the timber belt, the central portion as the grain belt, and the west, with its diversified topography, is the great grazing section. The wool-producing region is mainly in the west half of the State, south of the Texas Pacific Railroad, although sheep raising is carried on in a number of counties located in the grain belt.

The climate of Texas is particularly favorable for sheep husbandry. Sheep feed out the whole year, and shelter is the exception rather than the rule. The cost of keeping in winter is not much in excess of that during the summer months. The temperature is even; sudden changes rarely occur. The nights in summer are uniformly cool. In the central and southwestern portion of the State it is rarely that the thermometer records a fall below 20°. The Signal Service reports show that for a series of years the average number of days in winter at San Antonio when the mercury goes below the freezing point is 14. The average number of clear and fair days during the year at the same place is 287. The statistics of climate at this point are fairly expressive of most of the wool-producing area of Texas, except in the higher altitudes.

There are two hundred organized and forty-five unorganized counties in Texas. Sheep are raised in one hundred and eighty-three organized counties of the State, and last year the unorganized counties reported 500,000 sheep for taxation purposes. The counties of Brazoria and Wood report the lowest number. The counties which reported less than 1,500 each last year were Archer, Austin, Bastrop, Brazoria, Caldwell, Calhoun, Camp, Collin, Colorado, Fort Bend, Galveston, Gregg, Guadalupe, Hardin, Henderson, Jackson, Liberty, Marion, Montague, Montgomery, Ochiltree, Orange, Rockwall, San Jacinto, San Patricio, Somervell, Trinity, Tyler, Upshur, and Wood. The counties which lead in the production of sheep are in the order named as follows: Webb, Encinal, Duval, Starr, Val Verde, Maverick, McCulloch, Kinney, and Uvalde. Each of these counties reported in excess of one hundred thousand head to the comptroller of the State for taxation in 1889. The counties which reported in excess of fifty thousand head were Bosque, Kimble, Sutton, Zapata, Nueces, La Salle, Bandera, Edwards, Hamilton, Coryell, Menard, Tom Green, San Saba, Coleman, Crockett, Kerr, Mitchell, Williamson, Concho, Burnet, Runnels, and Lampasas.

There are three things that the flockmasters of Texas as well as the other range States and Territories need, and that is stringent laws, rigidly enforced, to eradicate the scab and to exterminate wild animals that are destroying the flocks. In addition to these necessary State laws reasonable protection against competing foreign wools should be afforded by the General Government. Let these things be assured and the sheep industry would receive an impetus that in a few years would more than treble the present production and encourage a decided and rapid improvement of the stock.

There is no single branch of agriculture that is so poorly understood by the people at large as sheep raising, nor do they consider to what large proportions it is capable of being developed. All that has been learned in this direction in the past has been taught by

dear experience; many a worthy worker has had to abandon it, after the loss of capital invested, simply from want of proper information. It is to be hoped the present investigation ordered by Secretary Rusk, of the Department of Agriculture, will supply much that is needed in this respect. The habits of sheep, the character of soil, of grass, and of weeds, and the best way to feed, are important features that call for very careful study and require many years of constant attention on the part of the successful grower to understand. To illustrate: In Texas, in different sections, as well as in other States, there is a natural growth of weeds that cause disease, often fatal when eaten by sheep. The early beginners were ignorant of this and suffered accordingly, but after years of investigation the discovery was made. Again, the opinion was prevalent that in a warm climate, like that of Texas, there was no necessity to provide shelter for sheep in winter; and this also caused the pioneers who settled on the bleak and unprotected prairies very great losses. And yet, notwithstanding these various drawbacks, the sheep industry has made creditable progress. In the short period of twenty-four years it has developed the capacity of a sheep to produce wool, from an average of 2.68 pounds per head to an average of 6.08 per pounds, increasing the wool product fivefold and over, although the number of sheep has not much more than doubled. It is difficult to imagine what might have been the present condition had it not been for the losses of flockmasters while learning their business.

Manufacturers are responsible for the current notion that this country can not produce the necessary character of wool for making certain lines of goods. This, too, is a great mistake, because there is no kind of sheep or class of wool produced on the face of the globe that can not be successfully duplicated and even improved upon in the United States.

The greater part of the wool produced in Texas from 1870 to 1880 was of a nondescript character, but that condition does not now exist. When the tariff of 1867 gave an impetus to sheep raising there was a demand for breeding-ewes that forced prices up abnormally and led many growers to purchase the common Mexican sheep to begin with; from these they raised flocks which gradually improved from coarse-wooled sheep, shearing about 1 pound each, to fine-wooled sheep producing 5 to 6 pounds each. This was done by the use of improved sires raised in the older States, and now nearly all the base Mexican blood has been improved.

It is the opinion of sheepmen generally that, in the absence of State protection against scab, the United States Bureau of Animal Industry could very properly take hold of the matter and stamp the disease out as thoroughly as it has pleuro-pneumonia and other infectious diseases, and thus save thousands of dollars annually to the western flockmasters.

SHEEP AND WOOL VALUE AND NUMBER.

After a careful investigation, with facts from every reliable source of information and by conference with sheepmen, the figures herewith presented show as conservative an estimate as can be secured except by actual count for the close of the year 1890. The number of sheep, all ages, is 5,135,585, with an average value per head of $2.50. The production of wool for 1890, in round numbers, amounts to 30,000,000 pounds, or 5.85 pounds average per animal.

The wool clip of Texas met with ready sale and brought the highest current prices realized in the West during 1890. The spring clip is the first wool on the market and is always in good demand, while the fall clip comes in for a late market, after the bulk of northern wools has been sold. Most of the Texas wool is carried by the following railroad lines: San Antonio and Aransas Pass Railroad, from June 1 to November 30, 1890, received for shipment 5,778,328 pounds; the Southern Pacific lines for the same period received 5,428,297 pounds; and the Gulf, Colorado and Santa Fé Railroad received for shipment 9,010,677 pounds during the first nine months of 1890. The number of sheep on hand in Texas at the close of 1890 represents only a slight increase over last year; the unusually large sale of mutton sheep and stockers was about equal to the increase of lamb crop. Over 100,000 Texas sheep were received at the Kansas City stockyards during the year. Every sheepman took advantage of the demand and disposed of the most of undesirable animals.

The following pages give detailed description of the industry by districts; also a chapter on Angora goats and one on the depredations of wild animals.

NORTHEASTERN TEXAS.

Northeast Texas is not generally known as a sheep country, because it has not now the large flocks which are characteristic of the State. It is, however, somewhat conspicuous, because of the high prices realized for wool produced there. The flocks are small, ranging from 100 to 500 sheep. The flockmasters as a rule are not engaged exclusively in the business of sheep raising, but are usually what may be termed general farmers. The flocks in this section are the descendants of sheep originally brought from Missouri and Arkansas, consisting of natives or grade Merinos of fair size. As a rule they are inferior, and sheepmen who continue in the business in this part of the State must raise better stock and improve their flocks more rapidly than they have in the past. There is a tendency now to handle the mutton breeds more and to direct the breeding to both mutton and wool, not limiting attention to wool as much as has been done in the past. As the country is not adapted to large holdings, the disposition to handle more profitable sheep is certainly an encouraging step in the right direction.

This part of Texas, lying adjacent to the timber belt, has been settled a long time, yet comparatively a small area is under cultivation, although a large portion is under fence. Timber is abundant, affording grateful shade at certain seasons of the year, with here and there an open stretch of prairie. The soil is uniformly of a sandy loam. The pastures consist of native prairie grasses, with occasional fields of tame varieties. The native grasses grow in abundance, both on the open prairie and in the timber. The open prairie is smaller in area than the timber pastures, especially in Hopkins County, which is the representative sheep-raising county of northeast Texas. The timber consists principally of oak, ash, elm, and hackberry. The water supply for stock is mainly from creeks or pools during the grazing season. Excepting in very dry summer, surface water is abundant and accessible for watering stock, and wells are used very little for this purpose.

Improved sheep brought in from other States seem to acclimate quite readily and give satisfactory results for breeding purposes. The improved sheep that are now brought in consist generally of pure-bred Shropshire, Cotswold, Southdown, or Merino rams. These, with the best selected grade rams of their own raising, constitute the stock rams used by most of the sheepmen in this section. There are too few pure-bred rams in use.

The common method of allowing the flocks to run at will without a shepherd attendant accounts for too large a loss of sheep from dogs and exposure. The loss from dogs alone ranges from 5 to 20 per cent, as shown by a number of reports received from there, while the loss from wolves is small in comparison. The loss from exposure ranges from 5 to 10 per cent, and usually occurs during the lambing season, or an occasional storm. Experienced sheepmen have, however, provided shelter for winter, which consists of sheds closed on the north and open to the south, with boards or brush and straw to cover them. These afford ample protection from cold rains and severe winter weather.

Owing to the small size of the flocks, the rams, wethers, and ewes are permitted to run together the entire season, while in large flocks farther west, in the open range country, the ram is not permitted to remain with the flock much over thirty days, and the ewe and wether flocks are usually run separately. Here each ram is given from forty to fifty ewes and runs with them and the rest of the flock all the time. Only about 5 per cent of the ewes fail to breed and drop lambs, although in some cases as many as 10 per cent fail to breed. Sixty per cent is the minimum number of lambs raised, while the average is about 80 per cent, as summarized from reports received from representative sheepmen. The grazing lands here are owned by sheepmen. There is no free range excepting some unfenced land owned by non-residents, which is used in common by the stockmen during the grazing season.

The custom has been to shear most of the flocks twice each year—in the spring months, April and May, and in the autumn months, September and October. Owing to the expense of shearing twice, the number shorn in the fall is growing less from year to year. The average annual clip is about five to six pounds per animal. The bulk of the wool is a bright medium or a medium fine. The net price realized by the grower for the last four years has been about 24 cents a pound. The distributing point for the wool of this section is Sulphur Springs, the county seat of Hopkins County, where a well organized association of sheepmen is maintained. The association is made up of wool-growers of Hopkins and adjoining counties, who coöperate in selling their wool. Each member prepares his wool at the time of shearing in good marketable shape and then takes it to the temporary storeroom at Sulphur Springs, where it is sorted and graded. When the entire clip of the association is in, word is sent to the wool buyers, who bid on the various lots, and the entire clip goes to the highest bidder. The choicest grades at the 1890 spring sales brought 31½ cents, the highest price paid for wool in Texas last year. It went to a St. Louis firm (S. Bienenstock & Co.), who have been the highest bidder for this clip for several years. The members of this association claim that they produce the best wool in Texas. This is perhaps true as to the particular grade of wool, because it is not produced elsewhere in the State in sufficient quantities to attract the attention of buyers. The secret

of the high prices realized is the care in properly preparing the wool for market, the small shrinkage of their class of wool as compared with the bulk of Texas wools, and their method of selling the same in bulk to the highest bidder, thus getting the full benefit of competition and the top of the market.

The flocks of this portion of Texas are decreased annually from 20 to 25 per cent by the sale of wethers and stock sheep, the stockers going to the more extensive sheep districts of the State, and occasional sales to Northern flockmasters who desire to replenish their stock. The owners realize from $2.25 to $2.50 per head for their stock sheep. The mutton sheep or fat wethers go mainly to Kansas City or Chicago to the packers. St. Louis is receiving more than heretofore, and the indications are that markets will receive increased shipments hereafter if the sales continue as satisfactory as those of 1890. The average weight of the wethers sold ranges from 85 to 100 pounds.

The annual cost of raising sheep in northeast Texas, including all expenses, is 30 cents per head; losses from any source not considered in the calculation. Yet, notwithstanding the profit generally realized in sheep raising in this part of the State, it is a fact that the industry is gradually declining, for the reason that the prairie land is being overpastured and fenced, and tame grasses are not cultivated to an extent which will replace the native grasses and afford sufficient pasturage, so that sheepmen are reluctantly reducing their flocks rather than to hire additional pasture from their neighbors and run the risk of ravages from dogs, which are entirely too numerous in this section and add a hazardous feature to the business. These curs are the most serious drawback encountered in this section. With the exception of this difficulty, no class of live stock gives better returns for the money invested than do sheep. So the decline in sheep raising here is chargeable to dogs and a want of harmony between the flockmaster and his neighbors on the dog question.

The natural advantages of this section of the country are particularly favorable in nearly every respect for raising sheep. Good grazing continues most of the year. Stock of all kinds are uniformly healthy, and disease among sheep is practically unknown. Cases of scab among sheep are becoming very rare.

CENTRAL TEXAS.

Bosque County is the principal county of central Texas, and a representative one for this portion of the State. The sheep here are mainly high-grade Merinos, which generally shear heavy fleeces of larger average weight than any other section of Texas. The flocks generally number from 1,000 to 2,000 sheep.

The general character of the soil is known as "black waxy;" especially is this true of the level lands and the valleys along the streams. The table lands are in many places covered with brush and nutritious native grasses. At least one-half in the central part of Texas is well adapted to agricultural purposes, and it produces good crops of cotton and grain. Forest trees, live oak particularly, are numerous on the black soil, and abundance of brush grows on the upland, affording shade in summer and more or less protection from the occasional severe weather during the winter. In addition to the natural shade, there is an abundance of running water conveniently supplied by the streams and springs. During times of

drought, or when the stock is not convenient to the streams and are grazing on the upland prairies in summer, water is supplied in abundance from deep wells.

The loss of sheep from exposure or from wild animals is generally not large, yet at times it amounts to 10 to 25 per cent of the flocks. With the prudent or experienced sheepman there is little excuse for losses from exposure, but the ravages of dogs, wolves, and other wild animals is a vexed source of loss that is difficult to avoid, unless the sheepmen are numerous enough in a locality to mutually protect their interests by local regulations. Even then it does not guarantee sure and ample protection, although it reduces the amount of loss.

Sheep brought in from the north during the first year do not thrive as well, and are not in as good flesh as the home raised until they become acclimated. The wool becomes lighter in density and in color. The ewes that are brought in commonly lose a larger per cent of lambs during the period of acclimation. Sheep are so easily acclimated that if they only had special care the first season there would be no deleterious effects from the change of climate. But they are at once put in the flocks with the home-raised sheep and subject to the same treatment, which in most cases is a complete change, and they lose in condition; however, no loss of any consequence occurs from this cause under ordinary treatment. In case of pure-bred rams the treatment is different. They have better care, but many owners breed them too heavily the first year. It is a common thing to give such rams 100 ewes, so as to get even the first year. The rams in use in central Texas are principally Merinos, either high grade or pure bred, 2 years old and upward. From two to three bucks are given to every 100 ewes during the month of October, remaining with the flocks from four to six weeks. In good flocks properly handled about 90 per cent of the lambs dropped are raised, and about 10 per cent of the ewes fail to breed. Sometimes the loss of lambs is greater, but it is needless with proper vigilance and management.

Sheep run out most of the year without other shelter than such as nature provides, yet there are days during three or four months of fall and winter when shelter is absolutely necessary, and most of the prudent and experienced sheepmen have such shelter. It generally consists of a shed open to the south well covered with boards, and usually located on the south side of timber or slope. Some of the flockmasters have provided span-roofed sheds, barn shaped, which are well ventilated and can be closed up, so that perfect protection is insured against the most severe storms which may occur in winter. These sheds are also utilized during the lambing season and at shearing time.

Wool is the main object in sheep raising here, although since mutton has come into more general demand and brings remunerative prices much more attention is directed to the mutton-producing features of the industry, and the mutton qualities are considered in the selection of the breeding stock. Mutton will not become as much an object as wool with sheep raising so long as the product must be sold in distant markets. The long haul and high freight rates discourage any such tendency. Owing to the demand for mutton more sheep were sold from Texas flocks during 1889 and 1890 than ever before. These sales consisted of aged ewes and wethers equal in numbers to the increase by the lamb crop. There is at present a decided tendency, however, to breed for mutton qualities as much as

possible without sacrificing anything in the number of pounds of wool. The breeding stock is selected and bred to secure as large size and smooth bodies as possible. The small-sized and very wrinkly Merino rams are not so much in demand as formerly.

The sheep in central Texas will sheer from 6 to 9 pounds, or an average of about 7 pounds. The wool is generally sold as "light fine" or "fine medium," and some lots as "heavy fine." The wool is mostly sold at the ranch, and this season it netted the grower from 18 to 22 cents a pound. It is bought by local merchants or representatives from St. Louis houses. A considerable number of the sheepmen consign their wool to commission merchants in St. Louis, Philadelphia, and Boston. The best market for mutton in less than car lots is that of the local butchers. For car lots Chicago, Kansas City, and St. Louis are the chief markets. About one-fourth of the flocks are now regularly disposed of either for mutton or as stockers. The gross weight of sheep sold for mutton ranges all the way from 60 to 90 pounds, an animal seldom exceeding 100 pounds. The shipper, after deducting freight, yardage, feed, and wages of man in charge, realized all the way from about $3.30 to about $4.20 per 100 pounds. The stock sheep are generally bought by speculators, who pay the raiser this year from $2 to $3 per head.

Most of the flockmasters in central Texas own land on which their sheep graze; others lease State or railroad lands, paying from 6 to 10 cents per acre annual rental. Herdsmen receive wages of $20 to $25 per month, and many of them board themselves. Sheepmen of this section estimate that the average annual cost, including all expenses of handling a sheep, varies from 40 cents to $1, making the average cost range about 60 to 80 cents per head.

The natural advantages of central Texas for sheep raising may be summarized briefly: The abundance of native and nutritious grasses of many varieties, which afford pasturage nearly every month of the year; good water and plenty of it in the numerous creeks and ever-flowing springs, and when running water is not convenient a plentiful supply can be had from wells at moderate cost; short and mild winters; healthful climate, feed, cheap land, and low rent. The greatest disadvantages are long distances from markets for wool and mutton, depredations of wild animals, and too few improved sheep. Sheep are uniformly healthy. There are some cases of grub in the head, and tapeworm and sniffles are sometimes prevalent after exposure to cold rains. Scab is becoming less frequent every year. The sheepmen now understand generally how to prevent its outbreak by necessary precautions. "Animal Parasites of Sheep," which was prepared by the Bureau of Animal Industry, has been of untold value to the sheep industry of the Western plains, and it has been the means of saving many of our flockmasters considerable money. It should be in the hands of every sheepman on the range.

The industry is declining in some of the counties of central Texas and the sheep are for sale. There are several reasons assigned for this change. The price of land is advancing and an increased area is being used for farming purposes, consequently the pasturage is reduced and the feeding season necessarily lengthened, and frequently feed is scarce and high priced; therefore, common sheep are apt to become unprofitable property. In many counties where improved sheep are owned, the industry is looking up and the outlook

at present is better than it has been for years. The range land at present is worth from $1.50 to $5 per acre and increasing in value each year. Many poor men have accumulated a fair competence in the sheep business, and some of them are changing from sheep to horses, cattle, or mules, in the belief that with the same labor they can make more money with less personal application and attention; while on the other hand men have engaged in the sheep business with ample capital and have finally made a failure because they let the sheep take care of themselves and did not provide the necessary shelter or feed.

Sheepmen have demonstrated that the best methods for profitably conducting their business in this portion of the State is to start with a flock of the best sheep obtainable. The ranch should supply abundant pasturage for the year and have the necessary shelter for all purposes, either natural, sheds, or barns. It is universally the case that when a severe and unexpected storm occurs the amount of loss resulting from such exposure would provide permanent shelter. As a matter of economy, therefore, it is wise to have such provisions on every ranch. It is imperative that the breeding and handling of the stock should be done judiciously. The sheep should be fed without stint whenever the grazing is not sufficient. The animal should be kept in good condition and growing thriftily all the time from lambhood to maturity. A well-fed sheep will produce more and better wool and a larger mutton carcass than a sheep that is half starved or otherwise neglected. The sheep, of all live stock, gives more profit than any other animal for sufficient feed and pure water and careful attention. Experience shows that while it costs money and time to feed, shelter, and attend sheep properly, yet at the same time it is a judicious and profitable investment. The range used should be fenced or so secured that the sheep can graze it exclusively. It is better to have a winter and a summer range, so that each may be used only in the proper season and the flock changed every few weeks to different portions. Employ none but experienced help. Use pure-bred bucks, always giving them extra care. In central Texas feeding is necessary a part of the year, hence it is advisable to cultivate sufficient land to produce the required feed. Some flockmasters, however, do not practice this system, from belief that it is not economical. They are slow to abandon old methods and adopt others more progressive and practical, which the future success of the industry surely demands, because their brethren are successful under the old method 200 miles farther west on the open range of the unoccupied State lands, where they seldom shelter or feed, as the altitude is higher, storms rarely occur, the atmosphere is drier, and the early mesquite grass better suited to winter grazing. In central Texas the rainfall is greater and may wash the grass so that it loses its nutritious quality; but corn, oats, millet, sorghum, and cotton seed are easily produced and furnish excellent feed.

Mutton breeds of sheep are raised only on a limited scale here, but would undoubtedly do well in the hands of the general farmer who would run them in small flocks of from 50 to 100 head or even larger. The wethers could readily be sold in the local markets, or in carloads they would give much better returns than the light weights, which are now sent to Kansas City and Chicago.

WEST CENTRAL TEXAS.

Large numbers of sheep are held in western central Texas, in the region traversed by the Lampasas branch of the Gulf, Colorado and Santa Fé Railroad and the Texas Pacific Railroad, or, more accurately, that portion between 99° and 102° longitude and 29° and 32° latitude, which is conceded to be one of the best natural ranges for sheep in the United States. The sheep of this region are of Merino blood which have been bred up from the Mexican ewe basis. There are a few scattering flocks of Cotswold and Southdowns, but the Merino blood predominates in nearly every flock. Sheep are run in flocks of 1,500 head. The usual number owned by a single firm or individual is 1,500 to 15,000.

The character of the soil in the valleys is either clay or a thin black loam. The land is rolling and hilly, and the best soil produces the different kinds of mesquite grasses, also gramma grass, while on the hills the sage grass is abundant. There is considerable timber in places, as the live oak, post oak, and mesquite. Water is generally plentiful in most localities, from springs and streams, although in many places wells are the only source of supply.

The principal loss of sheep is caused by wild animals, the losses from that source far exceeding those from old age and exposure together. From exposure the loss is 2 to 3 per cent, while from wild animals it is reported as ranging from 2 to 10 per cent, with an average of about 6 per cent.

Not many improved sheep are brought in from other States, except rams for breeding purposes. They do well, and their constitution is not affected by the change. The fleece becomes lighter, with less shrinkage, in this climate. Merino rams are used almost exclusively, and are permitted to run with the ewe flock during September or October, generally remaining nearly six weeks. Early lambs are preferred, but owing to the large open ranges it is unsafe to depend upon them, on account of storms that are apt to occur in lambing time. From 2 to 3 rams are given to every 100 ewes, but farther east, where the rams have extra feed in addition to the grazing, from 75 to 100 ewes are given to each ram. Owing to the extra help and care required during the lambing season, the ewes are so bred that the lambs will all come during a period not longer than four weeks. Notwithstanding the limited season for breeding the ewes there is but a small per cent of the females that fail to breed, usually from 2 to 10 per cent, an average of about 5 per cent. The proportion of lambs that are raised varies greatly in different seasons. If the lambs are weak, or if wild animals are very numerous, or a severe storm comes on, not more than 60 to 80 per cent of the lambs are raised. Owing to the invariably mild winters, shelter of any sort is rarely provided. In the event of stormy weather the sheep are placed on a south hillside or protected in some ravine or cañon. Occasionally a plank shed is provided, and in exceptional instances may be seen a sheep barn with all the modern conveniences. Most sheepmen, however, regard such improvements as luxuries rather than necessities.

Every flock is in charge of a herder, whose constant duty is the care of the flock day and night. His duty consists in watching the sheep on the range, to see that they have water regularly, that none stray away, and to round them up at night in a favorable place, if a

regular corral is not provided, so that he can protect them from wolves or other wild animals.

Most of the land utilized for grazing is State or railroad land, and is leased by the flockmaster at from 2½ to 5 cents per acre per annum, and some sections of land are leased for $50. The land is valued at $1.50 to $3 per acre.

Not more than one-half of the number of sheep in this district are shorn twice each year—in the spring, in the latter part of April or the first of May, and in autumn again, during September and October. The shearing is mostly done by a gang of from ten to forty Mexicans, who receive 5 cents per head in addition to their board. On the arrival of a band of shearers a few loose boards are placed on the ground, and the sheep are caught and quickly divested of their fleeces, which are tied up separately and placed in sacks of 200 pounds each. The wool is immediately taken to the larger towns—railroad points, where it is stored and sold to buyers, who visit the principal wool centers in this section at such places as San Angelo, Ballinger, Albany, Lampasas, and Burnet. Very little of the wool raised here is sold at the ranch or consigned to commission houses, although some of it is, and that usually goes to St. Louis, Philadelphia, or Boston. The wool grades as a light fine or a medium fine, and this year (1890) netted the grower from 14 to 22 cents per pound. The average fleece runs from 5 to 7 pounds; that of the bucks much more.

In the eastern part of this district most of the wethers and aged ewes are sold in the local markets. The car-lot shipments are usually contracted for months in advance for the Chicago, Kansas City, and St. Louis markets, or by feeders who take them to the corn-growing States to finish them for the same markets. Owing to the prevailing high prices of mutton during 1889–'90 from 20 to 40 per cent of the flocks of this district have been disposed of either for feeders or stockers. There is nothing regular in this demand for sheep. It varies with circumstances and the law of supply and demand. The average gross weight of the sheep at the market ranges from 75 to 85 pounds.

The average annual cost of raising sheep per head varies considerably, according to location and circumstances, but sheepmen generally place it at 50 cents per head, all expenses considered. But few place the cost at 75 cents. The herders receive $20 per month, board included, and tend about 1,500 sheep each. The chief difficulty which may beset the flockmaster is the extended dry season which occasionally occurs, causing a shortage of water and grass; and constant sources of trouble and loss are the depredations of wolves, panthers, coyotes, or thieves, and prairie fires.

From 1883 to 1887 the sheep industry was constantly declining, owing to the low prices for wool and mutton, but since 1887 it has been improving each year except when farming is general and cheap range scarce. In other localities the industry is simply holding its own, and new men are deterred from engaging in the business by fear of unfavorable tariff legislation. It is the current belief that free wool would cause a general abandonment of the sheep business in the range country.

The health of sheep in this district is uniformly good, the exceptions being a few cases of scab or sometimes a case of grub in the head. It is gratifying, however, to note a probability of complete eradication of scab. By protecting the range from infected flocks

and ceasing to bring in Mexican sheep, scab will soon be a thing of the past.

Experience has demonstrated that the best methods for conducting the industry here is to run the sheep in flocks of 1,000 to 1,500 head, in charge of a competent and faithful herder; change the sheep to different parts of the range about every four weeks; have good sheep; use first-class pure-bred Merino bucks of good size and with good constitutions; give the sheep careful attention, provide convenient water in abundance, and salt regularly. In cases of storm have suitable shelter.

The following exact language from an experienced flockmaster of Shackleford County faithfully represents the true condition of the district under consideration:

> Some six or eight years ago the sheep business in our county was conducted on an extensive scale, having about 100,000 sheep in the county. Low prices of wool and mutton broke up about three-fourths of the parties in this industry, which in the main were made up of inexperienced men. We have now about 25,000 sheep in the county. The industry is controlled by experienced men who are making the business a success. Our experience is that it costs 16 cents to raise a pound of wool here; all that we obtain over that sum we regard as profit.
>
> Since we fenced our range in recent years we have had little or no trouble with scab. The only serious things we are compelled to contend with are wild animals. Our State pays a bounty of 50 cents per head for wolves. This is exceedingly low. If the bounty were increased to $2 per wolf they would be entirely eradicated in a short time and the industry would be materially benefited.

SOUTHWEST TEXAS.

The district known as southwestern Texas is the great sheep region, and contains most of the sheep of the State. There are more flocks of immense size owned here than in any other part. Large holdings are the rule; 3,000 sheep is about the minimum number, and from that upward. Many flocks exceed 10,000 head, and some number from 20,000 to 50,000. The north boundary of this district is Tom Green County, and all that scope of country between the Colorado and the Rio Grande Rivers, extending south to the Gulf of Mexico, is to be considered in this subdivision of the report.

The class of sheep found in southwestern Texas is very similar to those in other portions of the State, except that they have more of the blood of the Mexican sheep, which is the foundation of most of the flocks in this section; they have been improved and bred up by the use of Merino bucks, so that older flocks consist of what is known as grade Merinos. In the vicinity of San Antonio and in the eastern part of this district there are a few small flocks of pure-bred and grade Southdowns, Shropshires, and Cotswolds.

Nearly every character of soil is represented by the grazing lands of this region—everything from the rich arable land to the dry and gravelly highlands; also freestone lands, mesquite prairies, prickly-pear flats, limestone, and the black waxy soils of the Rio Grande Valley. There is considerable black prairie and clay land, as well as rocky and mountainous; in fact all kinds of soil and surface, from the mesquite flats and rolling prairie to hills, table-lands, and mountains. And yet all of this land can be utilized by the sheep-raiser. The open prairies and table-lands are used for summer range, and the woody or brush country and the valleys for winter range. In Menard County there is considerable black loam soil, while in DeWitt County there is a good deal of light sandy soil, as well as black

sandy, with calcareous subsoil. The grass is abundant on good soil and sparse on the poor—the rocky and hilly land. Water is supplied by running streams, natural water holes and springs, or from deep wells, some of which are bored to the depth of 200 to 300 feet. Many sheepmen dam the creeks in order to have on hand a constant supply. Others excavate reservoirs for the same purpose. In the extreme south end of this district there are many lagoons that afford water at all times, unless for a short period during a protracted drought.

In most of the counties in this section there is some timber, consisting of live oak, mesquite, hackberry, and chaparral. In some counties there is no shade whatever. The varieties of native grasses consist of the different species of mesquite, gramma, and sage grass.

The losses of sheep from wild animals in southwestern Texas are enormous, notwithstanding the constant guard of a herder. The loss would be very much greater were it not for this constant vigilance. From special reports received from representative flockmasters in the different counties embraced in this district, it appears that not a single flock escaped this depredation. The amount of loss of course varies, covering a range of from 2 to 20 per cent. The average loss in the counties of Cameron, Maverick, Bexar, Bandera, Jeff Davis, Val Verde, Presidio, Medina, and Uvalde is placed at 10 per cent. One report from Bexar County estimates the writer's loss from strays and wild animals at 20 per cent. The animal that commits most of the serious depredations is the wolf, although the mountain lion and wildcat do considerable damage. It is a significant fact, however, that those counties which have the greatest loss from wild animals report little or no loss from exposure, and *vice versâ*. The heaviest loss from exposure in this district was in the counties of San Saba, Maverick, Bandera, Llano, and La Salle.

Sheep brought into this district from other States suffer some during acclimation the first year, but if properly cared for the first winter they seldom show any deterioration either in constitution or fleece. But if they are subjected to the usual treatment the wool becomes dry and harsh, and some of the animals become debilitated, take fever, and die. This is true frequently of sheep brought from the States north and east, but rarely the case with those brought from California. The change of climate affects Merino sheep brought in from other States about the same as it does man coming from other localities. No permanent effects are noticed, yet nearly one year is required for thorough acclimation.

The class of rams in use are mainly Merino, Spanish or French, pure-breds and grades, although not many of the French rams are in use, except in an experimental way. The breeding season for this district is from September 15 to November 15, the rams remaining with the ewes from four to six weeks; however, some of the flockmasters breed their ewes during May or June. At some of the ranches where they have high-priced and well-fed thoroughbred Merino rams they breed to each from 35 to 75 ewes, but the average for rams of all classes of different ages is 100 ewes for every 3 rams. The sheepmen buy rams from eighteen months old and upward, and use them as long as they are fit for service. Occasionally middle-wool rams are used, such as Southdowns or Shropshires, but not many of the English breeds are used for improving the sheep. The climate is too warm, and they are too heavy to stand the travel necessary in grazing; besides they do not herd together in flocks like the Merino or Mexican, or their grades. The average number

of lambs varies from 50 to 80 and as high as 90 per cent. The number of ewes failing to produce lambs varies according to condition and circumstance; an average for several years would vary from 7 to 10 per cent.

There is but little feed or shelter provided in this region for sheep, except for stock rams or weak animals. In that part of the district where crops are grown and good range not abundant, some feeding is done in the winter months. The ordinary shelter is what nature provides, such as a south hillside, oak groves, ravines, bluffs, chaparral, or brush pens. Sometimes provision is made for the thoroughbred sheep by building plank or brush sheds open to the south, or placing the flock on a portion of the range having timber or brush.

The grazing lands used in this part of Texas are partly owned and partly leased. The State lands are leased at 4 cents per acre. Some of the sheepmen own part and lease the rest of the range. The value of land is placed at about $2 per acre. The most desirable ranches are often leased as high as 5 to 10 cents per acre. Owning land is coming more into favor every year, and especially now that the sheep industry is more profitable.

The main object of the flockmasters has been to produce wool—the production of mutton is incidental—but owing to the prevailing high prices for mutton since 1888, there is a manifest tendency to breed with reference to both wool and mutton, as every sheepman can spare a certain per cent of wethers and aged ewes from his flock every year.

It has been the general custom to shear sheep twice a year, during the months of April or September, or when shorn but once it is during April or May. The shearing is usually done by a gang of Mexican shearers, who have a captain or foreman that contracts to do the work at prices ranging from 3 to 6 cents per head, the amount depending on who boards the shearers. After shearing the wool is immediately sacked and shipped to the nearest market, usually San Antonio or Galveston, where it is stored for better prices or is sold on commission. The class of wool produced is "medium fine" or "light fine," excepting a small per cent of coarse wool. The prices received for this wool in 1890 varied from 13 cents to 20 cents per pound. The net price realized by the producer is about 2 cents a pound less than that. The annual clip ranges from 3 to 7 pounds, an average of 5 pounds.

Since 1888 from 10 to 20 per cent of the flocks has been disposed of annually, either for muttons or stockers. The stockers in 1890 brought $1.75 to $2.50 at the nearest shipping point, and the muttons brought from $2.50 to $3.75. The gross weight was from 60 to 90 pounds.

The average cost of maintaining and handling sheep in this district is 50 cents per head for the year, not considering the losses in the flock. In some cases the cost is as high as 75 to 90 cents per head. The Mexican herder is not a high-priced worker. Some of them work by the month for $7 in Mexican money, 2 bushels of corn, 4 pounds of coffee, 4 pounds of sugar, and a goat occasionally. The average wages range from $10 to $20 per month, and on the Mexican border still lower. In the larger holdings a superintendent has charge of the various flocks and herders, and he frequently receives $1,000 a year.

The natural advantages of this region for sheep husbandry are

the large areas of cheap grazing land, which produces abundance of grass suitable for grazing the year round; a climate dry, mild, and well adapted to the business, little or no winter; absence of snow and blizzards; plenty of water, natural shelter, cheap labor, and good local wool markets.

The disadvantages and obstacles may be briefly mentioned as wild animals, failure to enforce scab law, drought, incompetent help, tariff agitation, local favoritism to cattlemen and horsemen, thieves, and needle grass.

Diseases are not common, yet there are cases of scab, murrain, red-bladder in the coast country; screw worm and lumbriz in lambs.

The sheep industry of this district declined fully one-half from 1884 to 1888, since which time it has gained steadily, and it will continue to improve unless the tariff duties are again reduced. The number of sheep in Texas would quite possibly have been double, had it not been for discriminating State laws in favor of other stock, the abolishment of free range, unstable prices for wool, etc.

The best method for handling sheep to-day in Texas is to own the ranch, reduce the number in the flock, improve the quality, change range frequently, avoid scab, raise more lambs, and have more competent help or none at all.

DEPREDATIONS OF WILD ANIMALS.

The greatest and most discouraging obstacle encountered by the sheepmen of Texas is that omnipresent evil—the depredations of wild animals. From this cause alone the flockmasters suffer an annual loss of sheep and goats amounting to over $500,000. The increasing loss of calves, colts, and poultry are not considered in this conservative estimate; and yet it is a significant fact that bloodthirsty brutes are increasing in numbers from year to year—the coyote particularly. The small flockmasters in many counties are abandoning the business on account of wolves, and in such localities the land, instead of advancing in value, is at a standstill or is depreciating. It is a serious matter to the sheepmen, and it is hoped that the present agitation of the subject may result in prompt relief and stop the slaughter of live stock that is damaging the animal industry of the western ranges to an extent indeed alarming.

The Texas wolf and bounty law is a failure. The act in force at this writing is as follows:

> That the county commissioners of the several counties within the State may issue county warrants to the person killing in any amount not exceeding $3 for every wolf, coyote, wildcat and fox; and 5 cents for each rabbit that shall be captured and killed in the said county. No person shall be entitled to receive any bounty as set forth in section one without first making it appear by positive proof by affidavit in writing, filed with the county clerk, that the wolf, coyote, wildcat, rabbit, or fox was captured or killed within the limits of the county in which application was made. This act shall not apply to counties having a total property valuation of less than $500,000, and shall not be in force until ordered by the board of county commissioners.

The local application of the law, together with its restrictive features, greatly interferes with the intended usefulness of the act. It will not afford protection, except in wealthy counties, where ample bounty is offered. In the sparsely settled counties, where the depredations are greatest, the law does not apply; and in no county unless it is the pleasure of the board of county commissioners; and even if

they are disposed to take advantage of the act and order the law in force, they make the bounty so small, usually 50 cents per head, that unless the sheepmen themselves voluntarily increase the bounty it offers no inducement to hunt down the wolves. A movement has been inaugurated by the sheepmen to have the legislature of 1891 enact a law that will be of some service to the industry as well as increasing the taxable wealth of the State.

To give some idea of the losses a few individual cases are cited: Ira Johnson, of Travis County, had a small flock of 300 mature sheep and 40 lambs, and out of this number he lost 30 lambs and 25 sheep from wolves and dogs. The following from the Boerne *Post*, a local paper in western Texas, vividly describes the situation there:

> We learn that a gentleman leaving his ranch on the Guadalupe River, because of the depredations of wild animals, has sold out, finding it imposible to cope with his losses. Mr. Robinson, having his ranch on the Fredericksburg road, has also sold out for the same reason, and we hear of others who are determined to sell out. Kendall, like Bandera County, will soon not have a sheepman within its bounds.

A. E. Shepard, ex-president of the State Wool Growers' Association, says:

> I turned 1,500 lambing sheep into one of my pastures, and at one time counted over 500 lambs there. A short time after this I went through the flock and I had only 38 lambs left. The wolves had taken all the others; and now, from those 1,500 lambing ewes I have not more than 25 lambs left, and the wolves will soon do away with them. Besides the lambs they pick off grown sheep every day and night.

Eight flockmasters in Uvalde County, when asked as to their losses this season, counted up nearly 1,700 sheep. Mr. E. M. Kirkwood, of Kimble County, lost 300 out a flock of 2,000 head, last year. These random examples represent the universal condition of the sheep industry in every part of the State.

Almost every attempt at State legislation in behalf of the sheep industry has failed, for the simple reason that united action on the part of all States interested can not be had. If Texas should be successful in destroying wild animals, and the neighboring States do not, the evil would soon spread again, and the destruction would continue. If all could work together there is very little room for doubt that the coyote and other destructive animals would soon be extinct. If a reasonable bounty were offered, either by the States severally or the nation, for the scalp of these destructive wild animals, they would be disposed of in less time than was required to get rid of the buffalo.

The extinction of these destructive wild animals would reduce the cost of wool production fully one-half. It would beget confidence in the business and make sheep husbandry the most profitable industry in the West, besides saving the destruction of over $15,000,000 worth of taxable property that is now destroyed annually by wild animals.

ANGORA GOATS.

The Angora goat originally came from the high table-lands of Asiatic Turkey. In Texas large numbers of them have been raised within the past thirty years. Mr. W. W. Haupt, a Texas stockgrower, established a goat farm as early as 1860, and he has made it a great success. In a letter recently received from him he says: "There is no stock industry in Texas so remunerative as the An-

gora;" but like every other vocation it requires experience and special training to make it successful.

Mr. Haupt, in March, 1889, complying with a request of Mr. Henry W. Grady, of Atlanta, prepared a long and interesting article on the Angora goat, which was published in the *Southern Farmer*. In that article the author describes his method of handling this interesting little animal. Here is an extract:

I am now giving more assiduous attention to my goats than I have ever done, from the fact that I know the fleece alone is profitable aside from the meat and pelts, and the meat is as much relished as mutton and many prefer it, for the goat is the nicest, tidiest, daintiest eater of the animal family, with his face and dress always clean, for their fleece repels dirt.

Mr. Haupt began by crossing the pure-bred Angora on the common Mexican goat, and it appears from his continued experience, that while the animal itself is not thoroughly changed from the Mexican type to that of the pure-bred Turkish animal, yet, after many crosses the hair becomes as perfect as that of the native Turkish Angora goat. It appears that the change does not take place in the fiber itself, but that a new growth of the genuine Angora hair starts in the very first cross. It grows only to a short length, but in grading up the staple becomes longer; and this process continues the nearer the grade comes to the pure bred, so that after about the eighth cross the hair has displaced all of the old Mexican growth and is fine, sleek, and glossy, strong and regular as that of the original stock. The hair grows to the length of 10 to 12 inches and has a peculiar luster which makes it desirable for mixing with wool in the manufacture of fine goods. Mr. Haupt is of opinion that with proper attention the Angoras could be made permanently profitable anywhere in Texas, more especially in the hilly regions of the west and northwest. These goats are healthy and long lived. Their keeping costs but a trifle. While the sheep is subject to many diseases it seems that the goat is always in good health. As to their manner of living, Mr. Haupt says:

A goat has all the advantage of a sheep on the range. It must be good land to produce sweet grass for a sheep, as he never feeds above the ground, while a goat will take poor land with shrubs and a little grass and make his living 5 feet above the shrub range, for I have seen them stand erect and nip a leaf 6 feet above the ground. And this is a great inducement to a sheepman, that he can run about as many goats as his range will bear of sheep without further injury to the range, if he has much brush—and to the extent his brush may be destroyed is his sheep range improved.

The flesh of the goat is more than equal to that of the sheep. A kid four to six months old is sweet and juicy, and it grows better from that time on. The sheep gives but two sources of revenue, fleece and mutton, while the goat has a skin which in shoes and gloves forms an indispensable portion of the dress of a lady or gentleman. A sheep's pelt is of little value.

Mr. Haupt shears his flock twice a year, about the first of October and the first of April. He believes that a goat will produce more fleece annually with two shearings than with one. The value of the goat's hair, which, as the reader probably understands, is called mohair in the books, is more valuable in the market than the best sheep's wool. Two years ago it sold in the New York market at 33 to 35 cents per pound. It is now worth much more. A flock of Angoras with reasonable care will average about 4 pounds of fleece, and that, at 40 cents a pound, equals $1.60, which is as good as 8 pounds of wool at 20 cents.

Joseph P. Devine, of San Antonio, writes concerning the Angoras as follows:

Good grade Angoras, shearing 3 pounds of hair, pay a much better per cent than sheep. They can be herded in flocks of 2,000 to 2,500 with more facility than a sheep flock of 1,000, as they depend practically and exclusively on undergrowth and weeds. The Angora goat is an advantage to a sheep range, for, when lost or strayed from the flock, they will trail the herd and come to camp, while the sheep do the reverse. These goats are subject to no known disease, and are less liable to be killed by dogs or wolves, while at the same time utilizing large sections of land absolutely worthless for any other domestic animal. The Angora provides the only flesh man uses that is not subject to some disease.

It is very much to be hoped that goat husbandry will be studied by the stockmen of Texas and of other parts of the country, so that within a reasonable time our own markets may be supplied with mohair from our own flocks. There are now but 275,000 Angora and common goats in Texas, and that number could be multiplied many times to great advantage.

ARKANSAS.

In studying the natural resources of Arkansas in its relation to the animal industry it is surprising that every branch of live stock is not larger, better improved, and made to rank higher in importance in comparison with other and varied industries, considering the population, cheap lands, and the adaptability of the country for the raising of domestic animals. It can only be explained by the character of the population, lack of capital, the many other pursuits for which the State is adapted, and its large area of timber lands. Many avenues of industry are suggested in a State that can produce every variety of garden and field crops indigenous to the temperate zone.

According to the census of 1890 the population of Arkansas is 1,127,744, of which number 816,227 are white and 311,227 are colored. It is probably from the fact that a large proportion of the population have only moderate means that the various agricultural industries have developed slowly and been conducted in an unprogressive manner. Labor is plenty and cheap and the cost of living small, hence the people have been content with limited results, and development of any particular industry has been slow.

Arkansas wool is in rather bad repute with those who handle the wool product of the State, owing to the cockle-burs and the way the fleeces are usually packed loose in the sacks and not tied up as they should be, the reason being that the clip is usually marketed in small quantities. However, when the wool is tub-washed and clear of cockle-burs, it is readily sought by the wool dealers and by western manufacturers. The clip of the State as sold in the market generally brings a higher price than almost any other western wool; yet, at the same time, the growers of this wool probably realize smaller amounts than the growers elsewhere for similar wools, because the grower generally sells it to the local merchant from whom he has been buying supplies for months, and is almost compelled to take whatever the merchant may see fit to give him.

The sheep industry of Arkansas, although quite general, is invariably conducted on a small scale. Sheep are raised in every county

in the State, seventy-five in all. This is quite notable in view of the total number. The number of sheep in the different counties range from a few hundred as the minimum to about 14,000 as the maximum number for any one county. The counties of the State having a number in excess of 10,000 and less than 15,000 are Benton, Carroll, Madison, and Washington; counties having 5,000 and less than 8,000 are Boone, Columbia, Faulkner, Franklin, Fulton, Independence, Izard, Logan, Pope, Randolph, Sharp, and Union; counties having 3,000 and less than 5,000 are Baxter, Bradley, Clark, Cleveland, Dallas, Grant, Hempstead, Howard, Johnson, Marion, Nevada, Newton, Ouachita, Pike, Polk, Searcy, Sebastian, Sevier, Van Buren, White, and Yell; the other counties of the State have less than 3,000. The present number of sheep in the State will not exceed 275,000 head, with a current value of $550,000, which makes a very small average. The progress of the sheep industry for the past twenty years may be seen by the following table, which shows the number reported to the auditor of State for taxation purposes from 1870 to 1890, inclusive. The greatest numbers reported were for the years 1876 to 1881:

Year.	Number.	Year.	Number.	Year.	Number.
1870	167,157	1877	295,403	1884	211,046
1871	217,384	1878	322,795	1885	204,534
1872	248,087	1879	327,357	1886	211,005
1873	224,611	1880	317,565	1887	211,249
1874	223,578	1881	276,587	1888	259,914
1875	253,521	1882	243,087	1889	258,464
1876	263,987	1883	224,611	1890	232,435

About 1874 renewed interest in sheep raising was manifested, which resulted in the enactment of a dog law entitled "An act to protect and encourage sheep raising in the State." This law took effect January 1, 1876. This enactment provided that the right to own dogs of any kind within the State of Arkansas shall be deemed a privilege, and the same equal to $1 per capita for each dog kept by any citizen, or by any member of his family, or any ward for whom he was the guardian. Every person in the State who was subject by law to pay taxes was included in the provision of this act. The assessor took the list when making his rounds, and $1 for every dog was added to the personal property of the person when taxed. While this law was a very good one, and would have added immense value to the taxable property of the State, it was in force only during the year 1876. No law ever passed in the State caused so much of a sensation as did this, and at the session of the next legislature, in the winter of 1877, one of the first bills introduced was for the repeal of this dog law. Nearly every member of the legislature had prepared a bill for its repeal, so great was the pressure from the dog owners of the State. Had this act continued in force until the present time the condition of the sheep industry would be materially changed and of very much greater consequence, and the Government statistician would not have been compelled to place the average value of the sheep of Arkansas at $1.47, the lowest average value of any State in the Union, as shown in his report of the numbers and values of farm animals for January, 1891. During the year that the dog law was in force the revenues received from the whole State were $84,906. Seven counties of the State paid no dog tax whatever, and

it is a notorious fact that the majority of the dogs of the State were not listed for taxation and doubtless were not worth the dollar to the owner.

Yet, notwithstanding these adverse circumstances which have beset the industry for the last thirty years, it is safe to assume that unless the industry meets with some serious drawback not now anticipated the number of sheep will increase. From the best information obtainable, there seems to be a breaking up of old methods, and new comers from other States are now taking advantage of the cheap lands of the State, and are paying more attention to stock raising than to cotton growing. A State having so much cheap land and so prolific in its production of all kinds of feed can not long be overlooked by settlers, in view of the fact that the stock ranges farther west are fairly well occupied. There seems to be no good reason why the general farmer on the alluvial farms should not keep a limited number of medium wool sheep in connection with other live stock. They would add to the profits of his work and at the same time improve his land. On the uplands and in the hilly and mountainous regions of the State, stock raising as an exclusive pursuit would pay well and could be conducted on a much larger scale. These stockmen would enjoy the advantage of mild and short winters, and during the winter season, when necessary to feed grain, would be able to secure it at very little cost, in case they did not produce it themselves. They would also have a great variety of grains, grasses, and forage plants, corn, wheat, oats, barley, cotton, and flax being grown quite successfully. There are thirteen cotton-seed mills in the State, and in feeding value the cotton-seed meal is unsurpassed by any other stock food, considering its nutritive value and cost. Even the cotton-seed hulls are considered equal to prairie hay, and can be purchased at $2 per ton, and the meal at $16 per ton. In many portions of the State stock can be run in the open commons for nine months free of cost to the owner.

Experiments have demonstrated that both the soil and climate of Arkansas are well adapted to the growth of grasses. The rainfall is sufficient for them to attain a high state of development; the native grass grows everywhere in abundance, and the tame varieties are so easily grown that the progressive stockmen could well afford to avail themselves of them. Timothy, blue grass, red top, orchard grass, Bermuda, red and Japan clover, and alfalfa, all do well; and, in addition, such crops as millet, sorghum, and cow-pea can be grown on the land after many of the regular farm crops are harvested.

In view of these facts, there is no reason why the outlook for the animal industry should not greatly improve. The following compilation of facts from the carefully prepared reports of Internal Commerce of the United States for 1889, and the First Biennial Report of the Arkansas Commissioner of Agriculture for the years 1889 and 1890, show that the State of Arkansas, with its natural resources, possesses many advantages for successful sheep husbandry:

Arkansas is one of the southwestern States, is situated in the basin of the Mississippi River, bounded by that river on the east, by the State of Missouri on the north, by the States of Louisiana and Texas on the south, and by the Indian Territory on the west, and lies between latitudes 33° and 36° north, and longitudes 89° and 94° west, with an area of 52,203 square miles, excluding 805 square miles of estimated water surface, or 33,973,000 acres.

To show the diversified interests and general character of the lands of Arkansas, the State agricultural bureau has made this division of the area:

Timber lands, 19,000,000 acres; cultivated area, 9,500,000 acres; adapted to fruit growing, 10,000,000 acres; Government lands, 4,000,000 acres; State lands, 1,364,000 acres; coal lands, 2,500,000 acres; iron lands, 1,500,000 acres; and prairie lands, 1,800,000 acres.

Such a vast acreage necessarily implies marked distinction in topographical features. Subtend a line from the northwestern portion of Arkansas to the southeastern boundary and you find an elevation of 281 feet above the Gulf at the latter and of 2,340 at the former. Guided by the fact that elevation in all cases answers for latitude, the range of products is readily understood, and why the ribbon-cane of Drew County is such an intimate friend with 2,290,000 bushels (1889) of superior wheat, is no longer a mystery.

In the extent of her woodlands and quality of its timber, Arkansas stands very high among the States. With the exception of a few prairies in the northwestern part and between the White and Arkansas Rivers near their junction, almost all parts of the State are well timbered. North of the Arkansas River the forest consists of the deciduous-leaved species of the Mississippi Valley, developed to perfection, with here and there areas in which the short-leaved pine is admixed. The southwestern portion of the State is almost a continuous pine forest, the short-leaved species abounding on the higher grounds, while the loblolly pine occupies the lower and moister situations, with hard wood intermixed, which becomes prominent along the water courses. Extensive brakes of valuable cypress are found in the swamps along the bottoms of the Mississippi and other streams of the State.

With this great range of products, ultimate competence will inevitably follow industrious effort. Involved in this statement of acreage is the question of soil quality, that must always be an important one in a State where most of the existing wealth has sprung from agricultural products. Yield in farming operations stands for dividend on invested capital, and on this line Arkansas makes an eminently favorable showing, as per census of 1880.

About 32 per cent of the tillable land of the State is cultivated, and less than 5 per cent of the whole area can be denominated nonfertile. This estimate includes both mountain and swamp lands. Alluvial or valley soil aggregates about 6,000,000 acres. This extends all along the river courses and contains the aggregated and condensed richness of the vast areas of vegetable growth that have been accumulating for ages, rich in all mineral and vegetable elements necessary to the growth of cotton, cereals, vegetables, and fruit. Here flourish the grand cotton plantations of the State. About 16,000,000 acres are embraced in the plateau, rolling or hilly lands usually comprised in the generic term of uplands. These lands contain a great amount of vegetable mold, occasionally red from oxide of iron, a slight admixture of sand, easily cultivated and very productive. Here dogwood, hickory, maple, and pine find a congenial home, and the farmer rejoices in exuberant crops of cotton, corn, wheat, oats, fruits, and berries. Mountain soil, contradictory as it may seem when measured by the standard of other rugged States, is exceedingly rich where the angle is not absolutely precipitous. Heavily timbered, it is consequently rich in humus. All valleys and parks are fertile beyond measure. Here wheat, apples, and clover constitute a grand duplication of the most favored sections of the North. This eulogy holds good of all the mountain section. Nestling in mountain-environed plateaus are some of the most fertile prairies of the State. Prairie land is mostly confined to Prairie, Lonoke, and Arkansas Counties; level in character and productive in quality. Here timothy, clover, and herdsgrass flourish, and fruit culture rejoices in keen competition with cotton and corn. Throughout its entire extent the character of the products vary, yet, taken as a whole, no State will surpass it. The land of this State has suffered much from poor tillage, and probably not one acre in twenty is in a high state of cultivation.

The St. Louis, Iron Mountain and Southern Railway Company, entering the State in Clay County, running along the valley of Black River, crossing the White River just below the junction of that stream with Black River, running thence in a southwesterly direction to Little Rock, running thence in the same general southwesterly course to Texarkana, in Miller County (its entire length is at or near the foothills of the Ozark Mountains), divides the State into two nearly equal parts. All, or comparatively all, west of this road is hilly and broken, in many points rising to the elevation of 2,000 feet; but interspersed with these hills are extensive valleys and wide plateaus. East of this road the country north of the Arkansas River is level, with the exception of a remarkable ridge lying between the White and St. Francis Rivers, extending from the State of Missouri to Helena. Below the Ar-

kansas, with the exceptions of the bottoms on the rivers and streams, the country is gently rolling.

The records of the Smithsonian Institution for a period of many years, as summed up in the Smithsonian Contributions to Knowledge, vol. XXI, place the annual mean temperature of that part of the State lying south of the Ozark Mountains (or a line from the junction of White and Black Rivers, in Independence County, westward to Fayetteville, in Washington County) at from 60° to 64°, and thence to the Missouri line at 56° F. for the winter months. During this time the average temperature in the northern counties was from 28° to 40°, and in the southern counties from 40° to 52°. The annual mean at Helena, in Phillips County, was 61°, at Little Rock 62°, Fort Smith 60°, and at Washington, on the southwest, 65°. For the summer months the mean temperature for the time mentioned was from 76° to 80° over all of the State except in the extreme southeastern counties, where the mean was from 80° to 88°. July is generally the hottest month, the thermometer sometimes rising as high as 100°. The nights begin to grow cool about the middle of August, and the first black frost appears about the last of October.

The prevailing winds are from the south, and, charged as they are with vapors of the Gulf, we find the greatest condensation or rainfall in the southern half of the State. As the result of many years of observation the following facts have been brought out by Mr. Schott in a publication of the Smithsonian Institution: The average number of rainy days in each year for fifteen years has been seventy-five. The highest annual rainfall occurs in the southwestern counties and averages 56 inches. From Louisiana northward to a limit marked by a line from the northeastern corner in Mississippi County to the lower part of Sebastian County on the west, an average from 44 to 56 inches falls yearly, while northward, over the rest of the State, a 38-inch fall is reported. During the winter months the greatest fall (16 inches) occurred in the southwestern counties and along the Mississippi River from the mouth of the Arkansas River northward to Cross and Crittenden Counties. There was a fall of from 12 to 15 inches in the southwestern region, which may be bounded west by a line from the lower part of Poinsett County to Jacksonport, at the bend of the White River; thence southward, with a curve, passing south of Little Rock west to Mount Ida, in Montgomery County, and south to Red River. Over the rest of the State, in the north and west, the rainfall for the winter was from 6 to 8 inches. These estimates include the snow that falls during these months, sometimes to the depth of several inches. During the spring months the southern counties were found with over 15 inches of rain, while north of a line from Sevier County, Arkansas, to Little Rock, Arkansas, and Memphis, Tennessee, the fall was from 12 to 15 inches, except in the extreme northwest, where it was less than 12 inches.

During the summer months the rainfall was more evenly distributed over the State, and averaged from 10 to 14 inches, a maximum of 18 inches occurring at Helena, Phillips County, on the Mississippi River, and a minimum of less than 10 inches in the northwestern counties of the State. The autumn months were drier, the heaviest rains, more than 12 inches, occurring along the Red River on the southwest; from 10 to 12 inches over the rest of the State, except in the northwest, and in the St. Francis bottom lands on the northeast, where it was less than 10 inches.

The State is drained on the east and northeast by the St. Francis and Mississippi rivers, northern part by the White River, the middle by the Arkansas, the south by the Ouachita, and the southwest by Red River.

	Square miles.
Area drained by the Arkansas River and tributaries	11,270
Area drained by White River and tributaries	17,400
Area drained by Ouachita River and tributaries	11,800
Area drained by Red River and tributaries	4,500

The State of Arkansas was completely overrun by both armies during the civil war. Live stock of all kinds was impressed for the use of the armies; cattle, hogs, and sheep almost disappeared; horses and mules were taken for military purposes; more than one-half of the fencing around the farms was destroyed, with many of the houses. The large plantations were, with very few exceptions, abandoned, and the negroes and farm stock removed to Texas. At the close of the war the people of the State of Arkansas were without money, farm stock, or farming implements; their fences were gone, their lands overgrown with bushes and briars, and they were destitute of food and clothing. No gloomier situation ever overshadowed a people. They faced it with a calm fortitude. Upon the top of this came the sad, trying days of reconstruction and the troubles which were the logical sequence of the methods by which reconstruction was carried into effect. These are facts necessary to be known in order to clearly comprehend the rapid advance made in every material interest in the last decade. A knowledge of these facts is also necessary

in order to understand why the citizens of a State capable of growing successfully any of the cereals, grass, and live stock, have pursued the ruinous policy of growing cotton almost exclusively.

GENERAL FACTS ABOUT THE INDUSTRY.

There is at present about the same number of sheep in the State that there was about twenty years ago, and very much the same class. Taking into consideration the whole State there has not been any improvement of importance either in the breeds of sheep or in the methods of conducting the business. As a matter of fact the animal industry has not been the leading occupation of the agricultural classes, although sheep raising has been about as prominent a branch of it as any. Yet it is a significant fact that the lack of progress in sheep husbandry is not because the country is unsuited for the successful prosecution of the industry. This is clearly shown by the fact that the same number of sheep have been maintained annually for so many years without increase or decrease. It seems that the shipments and home consumption, together with the losses from various sources, have been equal to the annual increase of the flocks in the State.

The facts presented in the preceding pages regarding the climate, topography, and physical surface of the State, together with the information given concerning its natural resources, all go to show clearly that sheep husbandry can be made a success in a majority of the counties of the State.

In many respects Arkansas is particularly well and favorably suited for successful sheep husbandry. It is also evident that a very large number of representative farmers and stockmen have recently become convinced of the adaptability and profitableness of sheep husbandry as compared with other branches of animal industry and agricultural pursuits. And like the general farmers of other States, they have learned through adversity and bitter experience, that following a leading and almost exclusive agricultural pursuit is unprofitable. It is a generally accepted fact that no State can ever become wealthy or prosperous by persistently adhering to a single crop; and the cotton mania in Arkansas has been what the wheat mania was for the Dakotas. However, the cotton craze is not the only or the chief drawback and obstacle to the success of the sheep industry; but equal to it in importance is the dog nuisance. The multiplicity of the omnipresent and worthless curs has become a by-word with all who are conversant with sheep raising in Arkansas, and if the word sheep is mentioned to any one in connection with Arkansas, he invariable throws up his hands and exclaims, "Dogs, dogs, dogs!" Many, even, when asked what diseases are most common among sheep, answer, "Dogs—a fatal malady affecting the industry." If you ask them why the sheep industry is declining, the answer is, "Dogs;" or if you ask them what are the chief disadvantages and obstacles to be encountered in sheep raising in the State the answer still is, "Dogs." Therefore, to sum up briefly the reasons why the sheep industry of Arkansas has not made greater progress, or is not one of the leading industries of the State, it can be ascribed mainly to the dog pest demoralizing the business and the mania for cotton culture.

It is a remarkable fact, notwithstanding the preceding facts, that there are as many, if not more, sheep owners in Arkansas than in

any other State bordering on the Mississippi River. They probably own a smaller average number of sheep than the sheepmen of any other State in the Union. It is also significant to note that there are fewer sheep owners who make it an exclusive business than in any other State where the sheep industry is of any importance whatever. It may be said that sheep raising in Arkansas under existing conditions is purely a side issue and receives therefore only partial attention. And while there are nearly as many sheep as any other class of live stock, hogs and cattle excepted, yet the "curs" and "razor backs" are too numerous for the sheep, and there is too little live stock of any class. When the general farmer of the State awakens to the true condition of affairs and becomes more familiar with the natural resources of the State, the live stock situation will materially change; more prosperous times will come, and the wealth of the State will increase because of the profitableness of raising improved stock.

It is an unfortunate condition for the sheep industry, that sheep have had so little attention from past or present owners. Sheep raising having been made a side issue, it has been placed at a decided disadvantage, and there is little hope for the future unless this system is changed. Whenever sheep husbandry receives proper attention, according to its merits as an agricultural pursuit, it will become one of the leading interests of the State.

The class of sheep most numerous in Arkansas are usually designated as common or native sheep. There are very few pure-bred sheep, the Merino, Southdown, Shropshire, and Cotswold breeds being represented chiefly by their grades. There seems to be in some localities quite an intermingling of the blood of several breeds in the same animal. Some sheep owners graphically describe the sheep of the State as consisting of mainly the old "scrub" stock, and the "full-blooded mongrel" caused by haphazard methods of breeding and handling.

The flocks owned in the State are uniformly small, and range in number from 10 to 50 as an average. According to reports received from all the counties there are only three of them that reported flocks to exceed 50 head, and only one county reported flocks as large as 150. The flocks are too small to require the services of a herder, and as a consequence they have but little attention, being allowed to run on the commons or uncultivated and unoccupied lands which may be near the farm of the owner and furnish the pasturage for the greater part of the year. After crops are gathered the sheep are allowed to run in the fields and during the winter months are fed somewhat. There seems to be no lack of feed, because the native and cultivated grasses are nearly everywhere abundant, besides other herbage and browsing such as is common to the forest and timber lands of the State. The cultivated grasses which afford considerable pastures consist of blue grass, timothy, Bermuda grass, red and Japan clover. The supply of water is everywhere abundant and is furnished by the natural fountains, creeks, rivers, and ponds. The standing water, however, is not good during the months of July and August, otherwise the water supply is quite suitable for stock.

The annual loss of sheep from wild animals, dogs, and exposure is quite large considering the small size of the flocks. It comes from the fact that the sheep are allowed to shift for themselves and do not receive the care and attention necessary for proper protection; and with this in view it is a matter of some surprise that the average

loss is not greater. The loss from exposure is remarkably light, very few sheep owners reporting any loss from this source; the heaviest occurring among the flocks of sheep which are held in the lowlands; outside of these localities 2 or 3 per cent is the average annual loss. The heaviest loss, which is reported everywhere, is that resulting from the ravages of dogs. The reports of such losses vary from 5 to 25 per cent: the annual loss from dogs being not much less than 10 per cent of all the flocks of the State. The loss of sheep from wild animals is not widespread; the losses in counties where depredations occur average from 2 to 5 per cent. A careful, conservative estimate shows that 10 per cent of the flocks of the State could be saved to the owners with adequate protection from the ravages of dogs and wild animals. That sheep raising has continued to the extent it has, in view of this annual loss and other adverse circumstances, is certainly strong evidence of the adaptability of the State to the sheep industry.

Very few sheep have been brought into this State for many years. The few introduced by the more prosperous flockmasters for the purpose of improving their sheep have been Merinos and Shropshires.

It appears from the best information obtainable that sheep which have been brought to the State from other States north, east, or west acclimate very readily and show an improvement in the wool fiber, length of staple, and increase in weight of fleece; and in some cases the constitution of the animal was strengthened, especially those brought from the east.

Very little attention is paid to the breeding ewes. A single buck is all that is used in the average flock, and he remains with it the year round, and generally continues in service until death releases him. In most flocks the buck is of the common or native sheep, and in exceptional cases he may be a Merino, Southdown, Shropshire, or Cotswold. However, most of the ewes breed during August and September, and sometimes as late as November; and the lambing season generally covers a period of from one to three months. The number of lambs raised is variously reported from 50 to 90 per cent, with an average of perhaps about 80 per cent. It is very seldom that any of the ewes fail to breed, and were it not for the dogs and hogs the average of lambs raised would be close to 100 per cent. Most of the owners provide shelter for severe weather; it usually consists of a long, low, well-roofed shed opened to the south or east and closed on three sides.

The object of sheep raising is not confined to either wool or mutton, but includes both, and with reference to home consumption. There seems to be but little attention paid to breeding for any special purpose. The sheep are usually shorn but once a year, during April or May, although in some localities the fleece is clipped twice a year, during the months of April and October. The shearing of sheep is considered a part of the regular farm work and is done either by the owner or his hired man. The wool, if not too burry, is tub-washed and then sold to the local merchant or factory. The merchant, when he has secured enough to fill one or more sacks, sells it to some woolen mill or the cotton buyers who visit him, although a great many consign it to St. Louis wool commission merchants. It is seldom that the sheep owner ships his own wool. The bulk of the wool produced is of a medium grade and the tub-washed brings from 30 to 35 cents a pound; for the unwashed, the owner receives from 18 to 22 cents, except for the heavy, burry wool, which is sold for

whatever it will bring, and the amount is very small. The fleece of the common sheep runs from 2½ to 4 pounds, and the improved or better grade sheep considerably more, depending on the amount of improvement. The mature wethers and ewes which are disposed of as muttons are sold to local butchers, who pay from $2 to $3.50 per head or the market price per pound. About 20 to 30 per cent of the flock is disposed of in this way annually. The mature sheep range in weight from 60 to 100 pounds, with an average of not much above 75 pounds.

The average wages paid for farm labor is about $15 per month and board, or $25 without board, and by the day 75 cents; and the cost per sheep a year including all expenses varies greatly, owing to the care and attention given. The estimates reported by sheep owners range all the way from 10 cents to $1; but the average for the State is not much in excess of 25 cents per head a year.

The local advantages for sheep husbandry consist mainly of the large amount of cheap feed, long grazing season, mild climate, even temperature, good water, abundance of feed during the summer season, good local home demand for mutton, nearness to St. Louis market, and cheap labor; also the little expense required for wintering the sheep.

The local disadvantages encountered by the sheep-raisers of the State are cockle-burs and the want of legislative protection against the ravages of dogs. In some portions of the State there is too much wet weather during the winter for the comfort of the sheep. While labor is quite cheap, the men as a rule are unreliable and inexperienced in the management of sheep. Disease is practically unknown among sheep and they mostly enjoy good health until they die of old age or are disposed of as mutton to the local butchers, or made food of by the dogs and wild animals. The latter are becoming extinct, but the dogs are on the increase. There is some occasional complaint, especially in the lowlands, from foot-rot, grub in the head, or tubercle of the intestines; however, where sheep receive proper attention such affections are rare.

The sheep industry is neither declining or advancing; it is in about the same condition that it was at the close of the war. It is the belief of the best informed sheep-raisers that the sheep industry has a bright future, as the natural advantages and conditions are exceptionally favorable. But before the sheep industry advances materially methods now in vogue must be greatly improved and sheep raising made something more than a side issue. Wherever flockmasters have a sufficient number to require a herder sheep raising is quite profitable.

The most successful methods for profitably conducting the business is to use nothing but pure-bred rams, such as the Merino or Shropshire, and where it is practical to inclose a large tract of the hilly land, which is quite cheap, and to seed a portion of the cultivated land to tame grasses or forage crops, especially Bermuda grass. This Bermuda grass furnishes an unusual amount of green pasturage from April 1 to December 15. There is no question as to the profitableness of raising sheep, provided they have attention, and no other pursuit will pay so well for the money invested or the attention given. During winter provide feed, such as sorghum or the cow-pea, which is easily produced here in large quantities. It may be planted after oats and wheat have been harvested and a bountiful crop secured. Cotton seed, which is abundant and very

cheap, makes an excellent winter feed. Two or three cuttings of red clover can be secured, yielding from two to five tons per acre; millet also yields a large tonnage per acre. Another plant which furnishes more green or dried forage than anything else produced is the teosinte (*Uclousena luxuriens*). The seed, however, will not mature. Cotton seed can be bought for about $8 per ton. All kinds of grain and grasses and root crops can be produced so abundantly and cheaply that it seems a great extravagance to have this large amount of excellent stock feed go to waste, as much of it does every year. Consequently, sheep raising should be encouraged and so managed as to utilize these products. And if the sheep owners can not secure legislative enactments to protect them from the ravages of the dogs, they should try the merits of strychnine and shotguns, and in no wise stint the use of them. Briefly, the best methods are, to increase the number and improve the quality of the stock and give them proper care and attention, and prepare the wool for the market in good merchantable shape. If this were generally done by the sheepmen of the State, it would not be long until Arkansas would become especially noted for the superiority of both its wool and mutton products as well as famous for the profitableness of the industry.

PERSONAL EXPERIENCE AND OBSERVATION.

Experience is the best criterion for demonstrating the adaptability of any particular country for any branch of industry. The writer has taken pains to collect information showing what has been the experience of sheep owners as well as their observations and opinions regarding the business.

The following paragraphs represent the different sections of Arkansas and will furnish practical pointers regarding the industry which are graphic illustrations of certain features of the business such as are difficult to show briefly in any other manner. They contain much information in little space, and will bear careful perusal by those who desire pertinent information regarding the sheep industry of Arkansas.

John K. Gibson, Powhatan, Lawrence County:

The sheep industry in Arkansas has had a backset for some years past, but within a few years the people have taken an interest in the industry—prompted by the high price of the mutton, as well as by reason of the profits in the wool grown. The sheep as a scavenger for brambly and ugly thickets is beginning to be prized. Sheep will eat and destroy grass and shrubs that no other grazing animal will. I think our climate and country is well adapted to sheep raising, and it would prove a great success if handled scientifically.

Frank Fealy, Charleston, Franklin County:

In 1875 I purchased in the northern part of this State 455 sheep, and turned them out on good prairie range. The next year I sold 76 of them for mutton at $2 per head; and in 1879 I sold 210 mature sheep and 80 lambs for $700, and then quit the business because dogs were too numerous for the sheep business. During the four years I owned sheep I enriched my orchard with the carcasses of 65 worthless sheep-killing curs.

M. A. Harper, Gurdon, Clark County:

Most farmers have a few sheep and let them run out in old fields, and pay but little attention to them, letting them shift for themselves, and only feeding three or four months of the year. Some of the farmers shelter their sheep, while others do not. Sheep would do well in this State, especially in the hilly and mountain portion, but will not do so well in the bottoms or lowlands, except where the land has been generally cultivated or in tame pasture.

J. L. Bowen, Stark, Yell County:

My experience with sheep is that I lost the best opportunity I ever had when I sold out for the purpose of raising cotton, and as soon as I can make another start I will try it again. The cross of the common native sheep with full-blood Merino is the best, as you double the increase of the weight of wool and carcass. In Faulkner County, where I formerly lived, there are larger flocks than in Yell County, although we have the advantage of free range and cheap lands. Mutton and wool can be purchased cheaper here than in any place I have ever lived.

E. D. Rickey, Carlisle, Lonoke County:

I have lived here seventeen years, and previously in Ohio and Michigan. The sheep industry here practically amounts to nothing. I am about the only sheep owner that has kept good the original number I started with. Eight years ago I brought 200 young Cotswold ewes here from Elyria, Ohio, and used the best Merino bucks I could find. The first year I raised 175 lambs, but at the next shearing I only had 215 fleeces; the second year I raised 100 lambs. The largest number I ever sheared was 222 sheep. We are cursed with numerous dogs, besides we have the big black and gray wolves which secrete themselves in the swamps and bottoms. There is very little encouragement for sheep husbandry in this section, for the reason stated, together with our rainy winters; however, if the country was in a better state of cultivation, had better drainage and suitable shelter, sheep would do fairly well.

O. L. Dodd, Mountain Home, Baxter County:

I commenced with eight Merino ewes. Stock within ten years increased to 200 head of sheep, after selling each year all the mutton, wethers, and wool. I consider the sheep industry the most profitable investment that a man can invest money in in this county of Baxter.

S. M. Dyer, Dyer, Crawford County:

There have not been many sheep raised here since the war. The people turned their attention to cotton, though sheep do well here with very small cost. They make their own living in the woods, except in winter, when they are fed on cotton seed. About twenty years ago there were 2,000 sheep brought here from Ohio and herded in a swamp, and all died in the spring from some disease.

J. S. Stotts, Jonesboro, Craighead County:

There are very few sheep in this portion of the State, and those few are common scrub stock. No one makes it a business. What few sheep there are run out and no attention is given to them in regard to breeding. What wool we have brings the biggest market price. Sheep do well here, and if any one would give it the proper attention the industry would pay.

W. A. Yarnell, Searcy, White County:

I know of no better opening for the profitable investment of money by farmers of small means, say from $1,000 to $5,000, than in the stock business in the hilly or mountain region of Arkansas for sheep; and in the valleys and rich bottom lands for hogs, cattle, and horses.

J. T. Hannaford, Morrillton, Conway County:

Bermuda grass will grow well on almost any land here, and is the best permanent pasture for summer. And for winter feed cotton seed crushed with ear corn makes good feed, and I believe sheep can be pastured and fed more economically here than any other stock. On a mountain place I kept about 200 head of Merino and Shropshire sheep.

John B. Watson, Jersey, Bradley County:

The sheep industry is one that has had but little attention shown it in this county, until lately. Our people are beginning to see the profit in wool growing, and there were some few thoroughbred sheep brought in during the past two years. Sheep have but little attention paid them, but when they do the profit is good. They are allowed to graze on the commons, and often are not penned for weeks during the spring and summer except for shearing; and even with this careless way they pay a nice profit. Cotton is king here to the detriment of all other industries. But the time is near at hand when sheep will be made profitable here. I have some lambs that would sell for $2.50 now; so have some of my neighbors.

W. D. Clements, Rover, Yell County:

This is a mountainous county, the larger per cent wild lands infested with wolves; nobody engaged in sheep raising except for home use; no flock over 50, and very few that large; the average not above 10. They do well here; rarely ever diseased; live on the wild grasses with very little feed in winter. No improved sheep; all scrubs. Some Cotswolds brought in did well until killed by wolves. No mutton raised for market, but once or twice a year some one comes in and picks out the best muttons and drives to Hot Springs. All the wool grown finds a market here at home. I think with the natural advantages, together with the mildness of the climate, it could be made profitable.

A. B. Hudson, Hazen, Prairie County:

My flock has varied from 10 to 75 in number in twenty years past. A few sheep cared for here do tolerably well, but to run at large on the slushes in spring they contract colds, have a cough and running at the nose, and in summer a fly deposits a grub sometimes which works up into the head and, I suppose, kills them. I have seen them die suddenly when fat, and found these worms or maggots in the nose. I now keep but few, none but young ones; have a dry pasture; they drink but little water if dews are heavy; shelter from the cold rains in spring; watch young lambs closely for one or two days. I kill one when needed at home, and sell the balance at Hazen readily at 7 and 8 cents. Two years ago a St. Louis drummer took my wool at home at 40 cents cash. I bred last year from a graded buck. I expect to get a good one soon; will have to send off. Others have tried larger flocks here without success.

A. P. Robinson, Conway, Faulkner County:

I began with a flock of about 40 Cotswold ewes and 3 rams of same breed. I kept them within my fences and sheltered them in bad weather and at night. Hogs and dogs so depredated on me that I saved only 5 lambs next spring. I have found it impossible to guard them, and I have now about 20 ewes and 10 lambs only. Every negro in this vicinity owns about four half-starved dogs; the more of them you shoot or poison the more numerous they are. The second spring I did not save a lamb. The rams as well as some ewes died of intestinal tubercle. A neighbor of mine has had the same experience and has sold the few sheep that the dogs left him. Another neighbor, with more faith than I have, lost 15 out of a flock of 80 in one night. I believe that if sheep raising was pursued here as a business it would be a very profitable industry, but now it is merely incidental to raising cotton. This is the main product, and is rapidly ruining the country in this vicinity. I know no farms here whose cotton did not cost them 2 cents per pound more than they received for it. It is true that they were under mortgage to merchants and had to pay enormous prices for their supplies, but even at cash prices they could save nothing.

NEW MEXICO.

The Territory of New Mexico is the oldest sheep region of the United States, and sheep husbandry has been the leading branch of the animal industry ever since it was organized as a Territory, and for many preceding decades while it was a part of the possessions of Old Mexico. Since it became a portion of the territory of the United States the American flockmasters have engaged in the industry, but previous to that time sheep husbandry was carried on exclusively by the Mexican race, and to-day most of the flocks of the Territory are owned by Mexicans. The industry has suffered several periods of depression in the past, yet to-day it is the most flourishing pastoral occupation of the Territory, and has as bright prospects for the future as in any other portion of the country west of the Mississippi River.

New Mexico has been the chief source of supply for a very large portion of the flocks of Western States and Territories, notably Texas, Colorado, Kansas, Utah, Wyoming, and Nebraska. Thousands of flocks throughout the entire West have their origin in New Mexico

sheep. Those flocks have been greatly improved, so that but little trace of the original Mexican blood is now apparent. The drain of sheep from New Mexico has been constant for many years and was especially heavy from 1870 to 1880, causing a marked decrease in the number there. Since that time the flocks have gradually increased, as the outside demand ceased; however, since 1887, owing to good prices for mutton, there has been a renewed demand for sheep, but unlike the former it has been mainly for wethers instead of ewes, and has not at any time equaled the increase of the flocks. Recent demands, therefore, have not reduced the number of the sheep in the Territory, although they have curtailed the annual increase. In view of the facts mentioned, New Mexico bears an important and significant relation to Western sheep husbandry unlike that of any other State or Territory. It may be stated that New Mexico is the mother of the sheep industry of the Rocky Mountain region and the great plains. The prices realized by the New Mexican flockmasters have always been small, but this fact has enabled men of moderate means to get a start that would probably never have occurred had it not been for the cheapness of the sheep. The ewes purchased were small and inferior animals, but were capable of marked and rapid improvement, so that the purchaser was enabled to realize a good profit on his investment by the use of pure-bred bucks.

The surface of New Mexico is marked with mesas, valleys and mountains, foothills, bluffs, cañons, and mountain parks. The mountain ranges, from north to south, generally break into spurs, buttes, and foothills, diminishing in altitude and spreading into mesas or high table-lands.

In the northern part of the Territory the Culebra range looms up to the east into the Raton spur, and to the south is known, according to proximity to local towns, as Taos, Mora, and Santa Fé Mountains. To the west is the Conejos and Tierra Amarilla ranges. Southeast of the old city of Santa Fé and east of the Rio Grande a broken range runs south, variously known as the Placer Mountains, the Sandia, Manzana, Oscura, Jumanes, Fra Cristobal, Caballo, San Andres, and Organs, the latter crossing the southern border of the Territory near El Paso. To the east of the above range is a series of high table-lands, reaching to the mesa known as the Llano Estacado, or Staked Plains, and broken by the low mountains and peaks named on the maps as the Gallinas, Jicarillas, Carrizo, Capitan, Sierra Blanca, Guadalupe, Jarilla, Hueco, and Sacramento.

On the western side of the Rio Grande, from the isolated peak near the northern boundary known as the San Antonio Mountain, another broken range extends south, known locally as Pateca, Valles, Jemez, San Mateo, Ladrones, Oso Magdalena, Socorros, Gallinas, Southern San Mateo, Pinos Altos, Burro, Black, and Mimbres ranges, and the Florida Mountains near the southern border.

Farther to the west, and near the Arizona line, appears the continental divide, composed of mountains and peaks variously known as Tunicha, Chusca, Zuni, Datil, San Francisco, Escudilla, Tulerosa, Luera, Mogollon, Pyramid Steins, Animas, and Peloncillo. These mountains, equally distributed as they are, furnish a large water supply, a great amount of timber, and are excellent for stock during storms.

The mesas and table-lands in the northern part of the Territory are generally about 6,000 to 6,500 feet above the sea level. In the central portion of the Territory the mesas attain an elevation of

about 5,000 feet, and in the south about 4,000 feet. The fall of the Rio Grande, from the northern border of the Territory to the point where it cuts the New Mexico, Texas, and Chihuahua boundary, is about 3,500 feet. The ranges generally rise from 2,000 to 5,000 feet above the mesa and high table-lands.

The Rio Grande is the largest river of the Territory. It rises in southwest Colorado, at an elevation of 11,900 feet, flows centrally and southerly through the Territory, mainly through a broad valley, and furnishes abundant water to irrigate all the land available throughout its entire length in the Territory. The annual rise of this stream takes place in May or June, when the deep snows in the high mountains about its head are melted and sent down by numerous tributaries into the main river.

The northeastern portion of the Territory is drained by the Canadian River emptying into the Arkansas in the Indian Territory. The principal tributaries in New Mexico are the Vermejo, the Cimarron, and Mora Rivers, all with fertile valleys and affording large supplies of water.

Next after the Rio Grande, the Pecos is the most important river in the Territory. It rises in the high mountains west of Las Vegas, where it is fed by the everlasting snows, and flows southerly through the eastern part of the Territory a distance of about 300 miles. The principal tributaries are the Vaca, Gallinas, Salado, Tecolote, Hondo, Panasco, Seven Rivers, Black, and Delaware. The upper portion of the river has many fine valleys of considerable extent in the mountains and foothills, and further south the water can be taken out for irrigation and distributed over a vast extent of country.

The northwestern portion of the Territory is drained by the Rio San Juan, with the following tributaries: Pinos, Navajo, Animas, La Plata, and Manco. The Puerco of the West, the Zuni, and Tulerosa Rivers are in the central west.

The Rio Mimbres, Rio Gila, and San Francisco are in the extreme southwest of the Territory.

Numerous small streams, arroyas, and springs are to be found all over the Territory.

New Mexico has an average breadth of 335 miles; length of eastern boundary, 345 miles; length of western boundary, 390 miles; the whole covering an area of 122,444 square miles. By geographical divisions, it is bounded on the north by the State of Colorado, on the east by the public domain and the State of Texas, on the south by the State of Texas and the Mexican States of Chihuahua and Sonora, and on the west by the Territory of Arizona.

If we calculate the area which is covered by mountains (where timber, however, is valuable and the sides are, as a rule, covered with the most nutritious grasses) at about 14,125,203 acres, and arid or barren lands at 3,610,793, there is left a total of 38,640,446 acres of irrigable, agricultural and grazing lands.

The present principal agricultural districts are: The Rio Grande Valley from the thirty-seventh parallel of north latitude to the southern boundary of the Territory; the Pecos Valley; the Canadian River section situated in the northeastern corner of the Territory and drained by the Canadian and its tributaries; the sections watered by the Colorado and Gila Rivers, embracing a strip on the western line of the Territory varying from 50 to 100 miles in length.

Although much of the central portion of the Territory is occupied by broken mountain ranges and elevated mesas, a very large part can either be irrigated or used for grazing cattle and sheep.

The mesas and table-lands in the northwestern part of the Territory are generally about 6,000 feet above sea level. In the central portion of the Territory such mesas attain an elevation of about 5,000 feet, and in the south about 4,000 feet. The ranges generally rise from 2,000 to 5,000 feet above the mesas and plains.

For some of the foregoing facts regarding the physical surface of the country the writer is indebted to the 1889 report of Internal Commerce of the United States.

Governor Prince, of New Mexico, in his report for 1889, states that sheep owners met with considerable losses both in the winters of 1887–'88 and 1888–'89, the number being reduced by that cause and by sales to parties outside of New Mexico from 1,749,150 in 1887 to 1,339,790 in 1888. The high price of wool during the present season has done much to make up for such losses, and has given a new impetus to the business. Wool which brought from 12 to 14 cents in 1888 sold for 18 to 20 cents in 1889, a difference that has brought a large amount of ready money into the hands of the sheep-raisers. The grade of sheep and quality of wool are constantly improving, with satisfactory results. And in his report for 1890 he says that no industry in New Mexico is more prosperous than that of sheep raising. Not only has the favorable legislation of Congress enhanced the price of wool to an extent which yields gratifying profits to the owner, but the demand for sheep for mutton has also greatly increased, causing a corresponding advance in prices.

PAST HISTORY OF THE INDUSTRY.

The pastoral occupation of sheep raising has been a leading live-stock pursuit in New Mexico with its people since the early settlement of this country and long before it became a Territory of the United States. There is, therefore, much of historic interest attached to the industry in New Mexico.

The age of any particular live-stock industry in a country does not necessarily indicate perfection of methods or a superior class of stock. The live stock of any country either improve or retrogade, and the history of the sheep industry of New Mexico is a striking illustration of the fact. New Mexico has fortunately outlived the period of retrogression and is now endeavoring to attain greater improvement and a higher state of excellence, with every prospect of success. Time, patience, and perseverance will accomplish this necessary and important achievement for the sheep industry of this Territory. There were many extenuating circumstances for imperfections of the past as well as the present condition of the sheep industry.

It is unfortunate that there are no accurate statistics regarding the early sheep industry of this Territory. We can only judge from the well-known energy and scientific acumen of the old Spaniards that the first sheep were brought to the present Territory of New Mexico toward the end of the seventeenth century or the beginning of the eighteenth. It is known that Santa Fé was permanently founded by the Spaniards in 1605. And from a general knowledge and observation of the flocks during recent years it is evident that the first sheep which the pioneer settlers brought with them to this country from northern Mexico must have been of good quality, since continued in-breeding for over a century only reduced the wool of Mexican sheep to a quality appropriate for carpet and blanket stock.

It is only since 1855 that the better grades of sheep have been gradually introduced to this Territory, until now, when every sheep owner, however small, usually endeavors to obtain the best rams his means will permit.

Regarding the past history of the industry, Hon. F. A. Manzanares, president of the bureau of immigration, and a sheep owner, says:

For over two hundred years the people of New Mexico have been more or less engaged in the sheep business. It has ever been found profitable, and in former years it was only owing to the constant wars with the savages of the Territory that much difficulty was experienced in caring for the sheep, not unfrequently attended with loss of life, more especially at the murderous hands of the Navajoes, whose rapacity had no limits, and whose favorite prey was the indefensive lamb. These Indians were, as they are now, very industrious and great workers of wool, hence their cupidity for the fleecy prey. The famous Navajo blankets are made by them, as were also made by the Mexican people some elegant and durable blankets and wool cloth, which created but a limited consumption of wool in the Territory. It was not until our disastrous civil war advanced the price of wool to a fictitious height that New Mexican wools found their way to the eastern markets, and their high prices continuing after the war, became a great stimulus. The depredating Indians having been permanently suppressed, the wool industry in the country has been successfully carried on until the cattle began to supplant the sheep, a circumstance which has resulted in more detriment to the masses, and especially the poor, than most of us are willing to admit. Nevertheless, the fact stands of record and the vast importance of the sheep business and its encouragement will be plainly shown by the following statistical totals, in connection with the fact that when the sheep were more numerous and generally distributed there was less want among the people than there is to-day when fewer sheep are owned in the Territory.

From 1860 to 1870 there was a steady increase in the number of sheep, at which latter year it is safe to estimate the number at 3,000,000 head, and it was about that time that a general and urgent demand sprung up from outside the Territory and continued for the ten years following, the result of which was decreasing instead of increasing the number (as a natural consequence would indicate) of sheep, owners as a rule selling freely to Colorado and Texas, so that in 1880 there were, according to the census of that year, only 2,088,831 sheep. From that time, the heavy demand having ceased, again an increase of nearly 100 per cent took place from 1880 to 1887, when a fair estimate would place the number at about 4,000,000 head.

Further information on this subject and about the early drives of sheep has been compiled for the Report of Internal Commerce by Hon. T. B. Mills, of Las Vegas, the United States Treasury expert, as follows:

Sheep were brought into the Territory from the southern Mexican States in the early settlement, and after the Indian rebellion in 1860 and the resettlement of the country sheep raising became the leading industry. The breed, which was likely originally Merino from Spain, degenerated by inattention to a very inferior class as respects wool, making a good mutton however. Previous to the annexation to the United States large herds were annually driven to the southern market from this Territory, principally for mutton meat. The wool was of but little value and was almost solely used in the Territory for the manufacture by the people of blankets, coarse cloth, and bed mattresses. Knives were used in shearing, and the first sheep-shears were brought into the Territory and used in 1854, by John L. Taylor, a native of Urbana County, Ohio. The first blooded Merino sheep were brought in, driven across the plains in 1859, by George Giddings, from Kentucky.

Sheep raising has been a prominent industry since the annexation, and the drives to the surrounding States and Territories have been large and numerous.

In the Tenth Census, under the head of meat production, it is stated:

Drives into California began about the year 1852 for mutton and for stock. Colonel Chaves, of New Mexico, was one of the chief movers in the beginning; also the Luna family. Through the courteous interest of these gentlemen in the matter referred to the following close estimates have been prepared:

Sheep driven from New Mexico into California in 1852, 40,000 (some sold as high as $16 per head); sheep driven from New Mexico into California in 1853, 135,000 (sold

from $9 to $12 per head); Colonel Chaves himself drove in 1854 (the total drives that year) 27,000; total sheep drive in 1855, 19,000, total sheep drive in 1856, 200,000; total sheep drive in 1857, 130,000. Sheep brought about $3.37 per head in these last years. In 1858 and 1859, Indians troublesome, small number driven; in 1860, business ceased, total number of sheep driven from New Mexico into California from 1852 to 1860, inclusive, 551,000.

From Colonel Stoneroad and Colonel Chaves, both of New Mexico, we have the following records of sheep driven from California to New Mexico in more recent years:

In 1876 Colonel Stoneroad took 10,000 sheep from Merced County, California, to Puerto de Luna, New Mexico. His route was up San Joaquin Valley to Bakersfield and along the railroad to Tehichipa Pass, in the Sierra Nevada; thence to Cottonwood, on the Mojave River, where the desert begins; thence downstream to a point much below sea level. Here comes the real desert trail from the "Sinks" to Union Pass through the Blue Ridge Mountains of Arizona, about 150 miles, with very little water. The whole distance, about 1,600 miles, consumed seven and a half months. Others (Pinkerton, Carpenter, and Cosner Brothers, who were robbed and murdered) drove 16,500.

In 1877, by same route, Stoneroad, Hugo Zuber, Captain Clancy, McKeller, Robinson, and Curtis took 12,500; other flocks, say, 5,000; 1878, Booth and Clancy took 4,000.

All the above were grade Merinos, such being very scarce in New Mexico. They cost $2 per head in California, and were worth in New Mexico $3.50.

It is estimated by men conversant with the subject that from 1876 to 1878 there were annually driven out of New Mexico to Wyoming, Kansas, and Nebraska 350,000 head of sheep. This annual drive rather increased in number than otherwise until 1883 to 1885, when the number reached nearly 1,000,000 head per annum, driven principally to Texas. At that time cattle were considered the best investment, and sheep-raisers disposed of their herds in order to go into the cattle business. The average price realized for the sheep, which were all Mexican, was $1.50 per head.

GENERAL FACTS ABOUT THE INDUSTRY.

To secure reliable data concerning the details of the sheep industry has been a task of more than ordinary difficulty, for the reason that so many of the flockmasters actually engaged in this pastoral occupation care very little about literature of this or any other kind unless it is in the Spanish language, and even then it is doubtful whether they would take sufficient interest to coöperate with any representative of the Bureau unless he was conversant with the Spanish language. Owing to the general indifference, unwillingness, and too often the inability of the Mexican flockmaster, the writer had to rely mainly on the American sheep owners, together with a few of the public-spirited and educated Mexicans, for the information presented in this report.

It is a recognized fact worthy of note that the success achieved in the way of improvement of the native sheep by the American grower has had a stimulating influence on the Mexican sheep owner. He has been incited to emulate the example of his more skillful and enterprising American neighbor who has realized higher prices for his wool as well as for his wethers. This success has induced many native sheep

owners to use better bucks as well as to improve their methods of sheep husbandry. The native Mexican makes progress slowly, but there is no doubt that in the future he may become a fairly prosperous sheep owner although he may be a decade or so behind the more progressive American flockmaster. The Mexican flockmaster possesses some peculiar advantages over the American. He is by nature better adapted to the isolated pastoral pursuit than the American, because of the traditions and customs of his ancestry, hence the life of tending the flocks is a natural occupation which he is contented to follow. Again, he will handle the flocks with very much less expense than the American. The Mexican is naturally conservative and deliberate. He should not be called lazy or indifferent, for it is an accepted fact or maxim in the West that a lazy or indifferent flockmaster is a failure in connection with the sheep industry, and it can not be truthfully said that the Mexicans as a class are failures. In respect to cheapness of handling sheep and adaptation by nature as well as choice to the business, the Mexican has the advantage and will unquestionably remain an important and necessary adjunct to the sheep industry of New Mexico either as an owner, "major domo," or herder. It is evident from the natural condition of affairs in New Mexico that the sheep business will always be conducted principally by the Mexican growers, though not so exclusively as in the past, and he will be benefited by the object lessons given him by the experienced American flockmaster.

The thriving condition of the sheep husbandry in New Mexico at the present time may be attributed largely to the American flockmasters' achievements. They handle mostly the California Merino, or what is called improved sheep, *i. e.*, sheep bred up by crossing fine Merino rams on Mexican or native ewes. Another cause for the present flourishing condition of the industry in New Mexico is the very large demand for sheep to drive to Kansas and Nebraska and other parts of the corn belt for feeders. This comparatively new feature of the industry, together with the improved wool product, has made the sheep business of recent years the most profitable live-stock pursuit in the Territory. It has also had a beneficial effect on the flocks, which will result in still more rapid improvement as well as a larger per cent of increase and less loss from exposure. Owing to the large demand for feeders the flockmaster is able to dispose of his old sheep, both wethers and ewes, as well as such lambs as are unfit to withstand the treatment of existing methods of handling sheep by the average flockmaster in New Mexico.

It is a notable fact that New Mexico, taking into consideration the whole Territory, is better adapted in every way for sheep than for any other class of stock. Outside of Texas there is no State or Territory west of the Mississippi River where the business can be conducted so cheaply as in New Mexico, and where the total cost per head a year will be as low as in this Territory. Yet there is perhaps no other State that raises such a small per cent of lambs as are raised here in proportion to the number of breeding ewes. This fact, however, is no fault of the country or climate, but it is owing wholly to the character of sheep handled and the methods in vogue.

The number in a flock, or, as commonly designated, a "partida," is usually from 2,000 to 3,000 head of ewes, in charge of a "major domo" and a herder. These two men as a rule take charge of the flock for six months at least, and graze them on the public land. They are furnished with provisions and a tent, which are carried on

two pack burros as they move along with the sheep from place to place as in the judgment of the men in charge is most advisable, taking into consideration the character of range, fresh grass, convenience to water, etc.

The number of sheep owned by one person or firm in New Mexico varies from 500 to 50,000. The counties having the largest individual holdings are Valencia, Bernalillo, San Miguel, Lincoln, and Rio Arriba, while the holdings in Eddy, Taos, and Colfax Counties are reported smaller. It is needless perhaps to state that in those counties where are found the largest holdings the sheep show less improvement and consequently are not so profitable to handle. These large holdings have a greater per cent of annual losses from the usual causes as well as a smaller per cent of increase. These large herds are mainly the property of Mexican owners. The families of wealthy Mexicans, known as the Pereas and Oteros, are said to be the largest sheep owners in New Mexico, and are accredited as owning together about 500,000 sheep in Bernalillo and adjoining counties. The American owner generally prefers, if he has had previous experience, to handle a smaller number and have a better quality of sheep.

From the foregoing some might infer that sheep raising in New Mexico was hazardous and unprofitable, but it must be remembered that the present condition of the flocks is due to the old established custom among Mexican people of giving or putting out their sheep on shares, in the care of industrious men, who willingly pay a yearly rental of 20 to 25 per cent or more to the owner, as they in person or members of their family attend to the sheep. The profit thus derived compensates the renter for his time and labor, and after a few years he becomes an owner and in turn leases his surplus flocks. This system has been in vogue so long that neither owner nor renter feels disposed to entail the additional and temporary expense necessary to improve the flocks by using pure-bred bucks. At present, however, there is a more marked tendency to improve the sheep than usual.

The pasture lands of New Mexico consist mainly of the vast treeless plains, which have very little shade, but are fairly well covered with gramma grass. Here the sheep are grazed during the summer, and depend for drink on the rivers or surface water from rain. In the winter the sheep are taken to the foothills or mountains, where natural shelter and bunch grass or salty sage is more abundant, and for water the sheep eat snow. The manner of pasturing sheep has undergone no changes. From the character of the country flocks have to move about to keep on fresh grass, which, owing to its peculiar short growth, is particularly adapted to sheep or goats. Other classes of stock are gradually giving way to sheep, owing to the peculiar ranges with scanty moisture. For three years the grazing lands received hardly sufficient moisture to renew the annual growth of grass until the winter of 1890–'91 and last spring, when there was an excess of rain, and to-day the ranges are in splendid condition.

The annual loss of sheep from the depredations of wild animals and exposure has been considerable in the past, but is likely to be proportionately less hereafter, on account of reducing the number and improving the stock as well as the methods of management. Owing to the constant attendance of a herder the loss in general from wild animals is not as large as the average losses from exposure. From wild animals the average loss is reported all the way from 3 to 7 per cent, while from exposure incident to the methods of handling the loss ranges from 4 to 10 per cent. From all sources, including

occasional bad winters, the average loss does not exceed for the whole Territory 10 per cent annually.

Very few sheep are brought into New Mexico from eastern States except breeding rams, and they must have extra care and feed in order to render much service, at least until they become acclimated. They can not subsist on the public range like the native sheep, but their offspring do well. The wool loses oil, owing to the dry climate.

The rams mostly in use are pure-bred Merinos and their grades, especially among the American owners and the enterprising of the Mexicans, while a very large number of flockmasters are content to use the improved Mexican rams. The rams in use are two years old and upward; and in the northern part of the Territory the rams are turned in with the ewe flock at least thirty days. Each ram is given from 40 to 50 ewes, and in some cases with pure-bred rams 100 ewes are given. The number of lambs raised depends somewhat on the season, and varies from 65 to 85 per cent, or a general average of about 75 per cent.

Very little land is owned by the sheep owners outside of watered lands, as they depend almost wholly upon the public land for grazing. But the day is not far distant when it will become necessary to own a home ranch, where a sure habitation may be had, and where the breeding rams and weaker sheep may have better attention, and where some shelter and feed may be provided when necessary. As a rule no feed or shelter has been provided except in individual cases where the flocks are small and improved.

Shearing takes place during May or June, except on the Lower Rio Grande or southern New Mexico, where they shear twice a year, during May and October. But the system of shearing twice a year is declining and will largely become obsolete in time, especially when scab has become eradicated. The cost of shearing is about 1 cent per pound and is done principally by Mexicans, who receive their board and from 3 to 5 cents per head. The bulk of New Mexico wool is sold in the grease to the local buyer, and the larger proportion of the clip of the Territory is handled at Las Vegas and Albuquerque. The fleece of the common Mexican sheep averages about 2 pounds, the improved Mexican 4 pounds, and the Merino and fine medium from 6 to 9 pounds.

Of the wool produced in the Territory last year, about 75 per cent was one-fourth and three-eighths improved Mexican in about equal quantities. Fifteen per cent was fine and the remaining 10 per cent consisted of coarse or blanket cloth and carpet wool. In this estimate the Navajo Indian wool is not considered, as the larger proportion of it is carpet and blanket and the remainder medium. Of the coarse wool one-third is black. The wools of the Territory for 1890 netted the grower from 12 to 16 cents. The cost of marketing the clip in the East is placed at 4 cents per pound. The bulk of the clip of the Territory is bought by local buyers as soon as sheared and by them sent to St. Louis, Chicago, Philadelphia, or Boston. There is probably no other State or Territory, excepting perhaps Arizona, where so little wool is consigned to distant markets by the grower as in New Mexico.

It is stated by the wool buyers who handle most of the Territorial wool that the general improvement of the wool product dates back only about three years, and it is astonishing how marked the improvement has been in so short a time. Carpet wool is rapidly disappearing, as a result of better breeding and the mutton demand. Sheep owners readily discovered that it was more profitable to dis-

pose of the sheep for mutton than to keep them to produce carpet wool.

The demand for wethers and stock sheep is active and the buyers take them here on the ranch, at the nearest shipping point, or drive them to Kansas, Nebraska, and other States north and east. Fully 25 per cent of the flocks is now readily disposed of in this way each year, either to feeders in the corn-growing States or to sheepmen from the north and east.

The following extracts from the correspondence received from representative sheepmen in the various sections of New Mexico will serve to give a correct idea of this phase of the industry:

In Socorro County last year, during August and September, the feeders purchased the wethers three years and over on the trail, paying the sheep owners from $1.80 to $2.50 per head, and the average weight was about 90 pounds. Another correspondent from Rio Arriba County says that mature sheep sold for mutton average 115 pounds and bring $1.50 to $1.75 per head. A Colfax County sheep owner says that about one-eighth of the flock is disposed of annually to Kansas and Nebraska feeders at from $2 to $2.50 and the average weight is 85 pounds.

A report from Taos County says that every fall one-fourth of the flock is disposed of as mutton or stockers at about $1.50 per head, and that the 2-year-olds and over, sold to butchers in Denver, Pueblo and Leadville, dress 40 pounds. A Chaves County owner states that about one-third of the increase of the flocks is sold each year at home for $2 per head after shearing, and the average weight is 90 pounds. A prominent Mexican sheepman from San Miguel says that the male portion of the flock is sold each year wherever the market is best, but usually sold at or near Las Vegas to eastern buyers, and the average price for 1890 was $2 per head and the average weight 95 pounds. An Eddy County sheep-raiser states 25 per cent of the flock is disposed of annually to the buyers at home for $2 to $2.25, and the mutton sheep average from 75 to 90 pounds.

It is a matter of some surprise to note how cheaply sheep are handled in New Mexico. Wages paid herders and the men in charge of flocks run from $15 to $25 per month, with board. The average cost per sheep a year, all expenses, is variously estimated from 25 to 60 cents. An American owner of perhaps the best improved flock in New Mexico places the cost at 60 cents per sheep a year. The correspondence of the writer with sheepmen regarding the annual cost in several counties is summarized as follows:

San Miguel County, 30 cents by Mexicans and 60 cents by Americans; Eddy County, 30 to 40 cents; Colfax, 50 to 60 cents; Chaves, 35 cents; Taos, 45 cents; Rio Arriba, 30 cents; Socorro, 30 cents; Valencia, 25 cents; Bernalillo County, 30 cents. Mr. F. A. Manzanares, of Las Vegas, an extensive wool merchant and sheep owner, in an article on "Sheep and Wool in New Mexico," gives a liberal estimate of the actual expenses for a flock of 2,500 sheep as follows:

Pay of two men and their provisions, etc	$720
Pay of extra help and provisions during lambing season	150
10 per cent losses, including meat for hands	650
	1,520

According to this estimate, which includes the annual losses from all sources, the cost would be 60 cents per head, or omitting that item, about 35 cents.

In briefly enumerating some of the local advantages of New Mexico for sheep husbandry, the most apparent and far-reaching are the general adaptability of the climate and grazing land for sheep; free range on Government land; abundant low-priced labor; extensive areas of fair to good grazing lands which can not be utilized for any other purpose, owing to their altitude and irreclaimably arid nature; the prevalence of the native gramma grass, which covers most of the plains, stands dry weather as no other grass does, and although of short growth is extremely nutritious and sweet. Remarkable as it is, this grass possesses this quality throughout the entire year, enabling stock to subsist on it the year through. The supply of water, whether from running streams, wells, or even from reservoirs, is pure. The natural healthfulness of live stock in this Territory is a decided advantage. Disease is unknown, with the excep-

tion of scab, and this, with improved methods of sheep management and the enforcement of the new scab laws, can be eradicated.

The climatic conditions are specially favorable for the animal industry, and sudden changes of temperature are unknown. The weather may truly be said to be both stable and equable. There are no extremes of either heat or cold, making the climate a sort of happy medium, a fortunate condition, in view of the existing methods of conducting the industry without shelter and no particular habitation. The days are usually quite warm, but the nights are delightfully cool and invigorating.

The chief disadvantages and obstacles encountered by the flockmasters of New Mexico are enumerated by them as few in number but far-reaching in their effect and of serious consequence to those engaged in the industry. Scab is commonly mentioned as the chief drawback by most sheepmen. Though it is easily cured, yet, owing to the go-as-you-please system with flocks, there is no reasonable prospect of immunity from it, or has not been until the last legislature early in 1891 enacted a stringent law which is published in this report. Under its provisions sheep owners have better protection and its rigid enforcement will thoroughly eradicate scab from the flocks of the Territory. Another source of inconvenience which interferes with the development and improvement of the range for the accommodation of the sheep is the land laws, which prevent flockmasters from acquiring range which they should control to place the business on a better and more permanent basis. A disadvantage in some counties is the late date at which grass starts in the spring. So many lambs come before the new grass is well started that the ewes do not nourish them well, because of short supply of milk. And in the northern portions of the Territory occasional snowstorms occur during the lambing season. Still worse difficulties are the long dry seasons and scarcity of natural water supply accessible on so much of the grazing lands; for owing to the unfavorable land laws of the Territory the sheep owners do not feel like incurring the expense of making reservoirs or putting down wells. The chief drawbacks to the industry are the poor quality of the sheep and the primitive methods of conducting the sheep industry. Especially is the slow progress of improvement due largely to the old custom of having sheep kept on shares, as neither the owner or renter will incur the expense of improving the flocks. The owner frequently runs the flocks as a side issue to some other business, and while he realizes 20 per cent as a yearly income on the sheep investment he is content with the old system.

The present outlook for the sheep industry of New Mexico is unusually bright, especially since the tariff has been settled. Buyers are numerous, looking for stock sheep as well as muttons for feeders. The supply of fresh grass and water is now abundant and the protracted dry period of 1888–'89 and 1890 is at an end. The recurrence of another such extended dry spell is not soon anticipated, and should it occur again sheep owners feel that much of the irrigable land which is rapidly being developed will produce such heavy crops of alfalfa that the feed problem will be solved. The extensive areas of alfalfa and their increase every year will be of great benefit to wool-growers, enabling them to select the old and inferior ewes and feed them for the market, thus withdrawing from their flock all undesirable ewes and only breeding the best.

It has been demonstrated by the experience of practical flockmasters that the best methods for profitably conducting sheep hus-

bandry in the Territory is for the owner to have personal supervision of his flocks, or if the management of the flocks must be left to hired help, to be sure that they are capable, honest, and faithful. It will not do to intrust the flocks with herders who are employed because they can be hired cheaply. The sheep should be kept free from scab, run in medium-sized flocks, and be kept on good fresh grass, and in nowise should the regular supply of salt or water be stinted. Flockmasters have been very neglectful in the matter of a regular and adequate supply of water and salt for the sheep. This must be avoided or profits sacrificed in proportion to the amount of neglect.

When it is at all practicable, every sheep owner should have a permanent ranch where feed and shelter are provided, when such requirements are necessary. He should manage to have green feed for sheep during the lambing season. When the range is short of water and it is necessary to pasture such lands, as is frequently the case, the sheep owner should provide water by means of tanks, reservoirs, or artesian wells, whichever is the most feasible. Reservoirs are easily constructed at the head of a ravine or in some other natural location, by which a large area of water is stored up for use instead of going to waste. These reservoirs conserve the water from the melted snow and rain, and enable the farmer and stock-raiser to utilize it for their needs during the hot dry season. The writer knows of an extensive sheep owner that has twenty of these simply constructed reservoirs on his grazing lands, and their first cost is insignificant compared to their permanent value.

In many portions of the Territory artesian wells may be sunk advantageously and furnish flowing water in abundance. The great difficulty in securing these necessary and valuable improvements and conveniences is the cost in time and money, together with the land laws which discourage improvements of this kind and interfere with ownership or control of the land. In addition to these difficulties the disposition of the flockmaster in the past has been averse to putting any money into the business except for stock alone. It is gratifying to note that representative sheepmen are aware of the importance of these improved methods of management.

It is a difficult matter to lay down or establish rules for the general guidance of sheep husbandry in the Territory, owing to the prevailing conditions and concomitant circumstances which have a controlling effect; and the changeable climate and seasons in different portions of New Mexico have to be taken into consideration. As a rule, however, the mountain ranges are utilized from May to October and the prairies and mesas or plains during the winter. In brief, the best methods applicable to any portion of the Territory are, to rid the flock of scab, kill the wild animals, keep fewer and better sheep, use better bucks, dispose of undesirable ewes to the feeders, give the sheep better care, employ reliable and competent help; and provide all the necessary shelter, water, feed, and salt. In general, improve on the past traditional customs, as practical judgment dictates, and there need be no apprehension or misgivings as to the permanence, profitableness, or future of the sheep industry of New Mexico.

NUMBER AND VALUE OF SHEEP.

It has been quite difficult to obtain any reliable data from the Territorial records of New Mexico by which the exact number of sheep owned in the different counties of the Territory can be computed. The reports of the assessors are wholly unreliable as to exact

numbers, and therefore had no consideration in making up this estimate. But, taking the lowest reliable estimate of the wool clips of 1890 of 9,000,000 pounds, which, at an average of 3 pounds per head, would give us three millions of sheep shorn during 1890, and to this number adding the number of lambs raised during the year would augment the number to four millions, which is approximately correct and as near the exact number as it is possible to determine without an actual count. Taking four millions of sheep as the number owned in New Mexico, the different classes and their respective values are as follows: 1,000,000 lambs at $1.50 per head, value $1,500,000; 2,000,000 ewes at $2 per head, value $4,000,000; and 1,000,000 wethers at $2.50 per head, value $2,500,000; or a total number of 4,000,000 sheep with a present value of $8,000,000.

The Atchison, Topeka and Santa Fé Railway Company, through its live-stock department, prepared at the close of 1890 a statement of the live stock in the Territory of New Mexico, January 1, 1891, showing the different classes of stock in the different counties. It is given here in order to show the relative importance of the sheep industry to other branches of the animal industry. Their statement places the number of wethers for sale and shipment during 1891 at 698,500, or 3,000 carloads. The agents of the company made up their estimate by conferring with the various owners of stock in each of the counties and then summarized the fairly accurate results as follows:

County.	Sheep.	Cattle.	Horses.	Mules.	Goats.	Burros.
Bernalillo	800,000	65,000	6,500	775	25,000	3,500
Colfax	200,000	165,000	7,500	350	27,500	3,750
Doña Ana	100,000	78,000	5,600	320	7,500	4,500
Grant	20,000	221,000	8,000	375	15,800	500
Lincoln	400,000	500,000	17,650	750	35,000	2,500
Mora	200,000	65,000	4,500	275	25,000	3,500
Rio Arriba	125,000	30,000	1,250	275	25,000	3,500
San Juan	125,000	50,000	3,000	275	9,000	4,500
Santa Fé	90,000	5,400	1,000	175	9,000	2,500
San Miguel	500,000	175,000	7,500	600	12,500	4,500
Sierra	10,000	115,600	5,500	270	9,000	1,000
Socorro	97,800	241,000	7,500	570	10,000	1,500
Taos	125,000	3,400	1,500	325	7,500	2,800
Valencia	700,000	95,000	3,750	475	27,000	3,000
Total	3,492,800	1,809,400	80,750	5,810	244,800	41,550

THE ADVANTAGES OF IRRIGATION.

When large acreage is under irrigation and extensive crops of alfalfa are raised, it must be of great benefit to wool growers and practically put the percentage of loss at a minimum, as it will enable the flockmaster to select out the old and undesirable ewes and feed them for the market, and only breed the best.

It is indeed a favorable condition for the animal industry of the Territory that irrigation enterprises are now receiving so much attention. The further development and success of irrigation is of paramount importance to stockmen. It has been demonstrated that under irrigation at least three good crops of alfalfa can be produced in a season and frequently four crops. Alfalfa is unsurpassed as feed for sheep, and alfalfa produced by irrigation in the arid regions is much superior as a stock food to the same crop produced on the rich fertile soil of the lower altitude and more humid country of the States farther east. The alfalfa produced in the high arid region of

New Mexico is not so coarse and watery and is more nutritious. The crop can also be kept through the winter with less damage and usually in better condition than in the agricultural country east.

There is not a single county in the Territory where irrigation farming may not to some considerable extent be followed successfully. This fact is evident from the success already achieved in every county of New Mexico. Some counties will naturally have larger areas than others; but this will be equalized by a general distribution of products raised so that every county can assuredly find a home demand for all the alfalfa or other crops it will produce. At present the land irrigated and producing crops is but a little more than 1 per cent of the entire area of the Territory. This percentage does not include all of the area under ditch. The water supply of New Mexico, taking the Territory as a whole, is comparatively well distributed, nearly all the counties in the Territory having their small rivers, and some of them large ones. Perhaps no other portion of the Rocky Mountain region offers better opportunities for the construction and profitable operation of large irrigating canals or systems of ditches, on account of the abundance of water and of the great extent of arable mesa land, than do some of the counties of New Mexico.

The success and further development of irrigation means not only a profitable undertaking for those engaged in the production of crops and always giving them an exclusive home market for all that they will ever be able to produce, but it means a great deal more for the animal industry which is now and will always continue to be the leading enterprise of the Territory. And it also insures and encourages the growing of better stock by improved methods, and correspondingly larger profits. It will put the animal industry on a permanent basis. Live stock will increase greatly in value if not in numbers. In fact irrigation is an agricultural advantage that insures a bright outlook for the sheep industry of New Mexico. It is a necessary adjunct to future success, and without which a serious decline would be certain.

NAVAJO INDIAN FLOCKMASTERS.

A report on the sheep industry of New Mexico would be incomplete without at least a brief mention of what the Navajo Indians are doing in sheep husbandry. In truth these Indians may be said to be the pioneer flockmasters of the Great West, for according to old Spanish records the Navajos were engaged in sheep raising during the sixteenth century and have continued their pastoral pursuit ever since by primitive methods.

The Navajo Reservation is located in the northwestern portion of New Mexico, one-half of the reservation extending into Arizona. The Indians now number 17,000, and are said to be increasing. They are credited with owning live stock as follows: Sheep, 800,000; horses, 250,000; mules, 600; burros, 1,000; cattle, 5,000, and 250,000 goats. They are now endeavoring to exchange horses for cattle and sheep. The Indian agent, C. E. Vandever, estimated their wool product for 1889 at 2,000,070 pounds, and the value of their manufactured blankets that year amounted to $39,000. Their wool blankets are considered quite an industrial curiosity, and are sold in the East at very high prices. The looms used are quite crude and primitive, and a great deal of time is consumed in the manufacture of the blankets.

The sheep subsist through the year on the grazing lands; during the summer are pastured on the plateaus, and in the winter in the

valleys. The climatic conditions are quite favorable, and contagious diseases and epidemics are unknown. Neither shelter nor feed is ever provided for sustaining the flocks during winter.

The wool product is handled mostly at Albuquerque, and in 1890 amounted to about 2,000,000 pounds, mostly carpet wool. Messrs. Eisman Bros. estimate that 35 per cent of the clip is straight carpet, 25 per cent blanket, and the remainder coarse, medium wool. At least one-third of the wool is black. Their sheep are larger in size than the bulk of NewMexican sheep, and dress from 60 to 70 pounds.

The flocks belonging to these Indians vary in size from 300 to 4,000 head, and ewes, wethers, and bucks are run in the same flocks together throughout the year. They have no regular period for lambing, but lambs come at all seasons of the year. Shearing takes place at any time from March to May. These Indians seem to have little desire to improve their flocks, and when good bucks are given them by the Indian agents they are very apt to barter them for other stock. The Navajo Indians are about the only flockmasters that seem to be content to grow carpet wool.

PERSONAL EXPERIENCE AND OBSERVATIONS.

In the following pages are given the experience and observations of practical sheep owners and others who are identified with the industry and are qualified to speak authoritatively on the subject under consideration. Different sections of the Territory are represented, and various pertinent questions relating to the industry are briefly treated. Coming from men practically engaged in sheep raising in New Mexico, these are valuable points well worthy of consideration:

Troy Bros., Raton, Colfax County:

Our only real scourge, or at least the worst, is the scab, and until we can have protective legislation preventing its spread by nontaxpaying, floating Arab flocks, we will always have trouble. A liberal bounty on animals would reduce our losses, but the scab, scarcity of water, and difficulty to restrain floating herds, does more to retard the improvement and investment in the industry than all else.

The Jaffo-Prager Company, Roswell, Chaves County:

We find sheep raising in this country a very profitable business. We think we get a larger per cent of lambs than other sections from the fact that the Pecos Valley produces such an abundance of salt grass, regardless of rainfall, that there is always a certainty of having good lambing. Alfalfa is raised to a considerable extent, on which sheep, and particularly rams, do well.

Thomas Gardner, Seven Rivers, Eddy County:

My own experience in sheep raising is that five years ago last December I started with 2,000 head of sheep, and I have sold $11,000 worth of sheep and have 3,000 head to-day, and my experience is that with proper care sheep raising is more profitable than any other stock; that if the sheep business is not conducted properly, it is the most losing business there is.

Hon. F. A. Manzanares, Las Vegas:

The sheep industry in New Mexico has always been a constant and sure source of gain and prosperity, notwithstanding the difficulties attending the care of sheep, in former years, by the merciless ravages of the Navajo and Apache Indians, and latterly the restricted and overcrowded ranges; but at present matters and ranges to sheepmen are more satisfactory, and the herds are reduced to a proper number, and we sincerely hope that this useful industry will from this time onward receive the good attention and impetus it deserves, in which event it will bring prosperity to a larger number of people than any other live-stock industry in the Territory.

Ferd. Meyer, Costilla, Taos County:

My experience extends only over the San Luis Valley, and it would be very difficult to lay down or establish rules for the general guidance of sheep husbandry. We simply make the most of circumstances controlled by a very changeable climate and seasons. We can never profit this or next year from what we know seems to have been previously. As a rule the mountain range is utilized from May to October, and the prairies during the winter months, when the snow on the ground enables us to reach the mid-prairie, which, owing to want of water during summer, can not be pastured over. Large numbers of sheep at fair prices were bought and taken to the border States to feed for market while hay and grain were low. We do not look for buyers for the next twelve months, owing to failure of surplus crops in Kansas in 1890.

R. F. Hardy, Las Vegas:

A steady demand for muttons resulted in bringing buyers from all of the feeding States to New Mexico in search of stock. Seven hundred and fifty thousand head, in round numbers, were sold and driven from the Territory last year. A remarkable feature of the trade has been the selling of ewes for breeding purposes to the farmers of Kansas, Iowa, Wyoming, and Minnesota. It has been discovered that the New Mexico sheep are usually hardy and prolific, and for this reason our flocks are purchased as foundations for breeding by the sheepmen of the older States. Importations of sheep this year were limited to the bringing in of a considerable number of fine bucks from Vermont, Pennsylvania, Ohio, and other States. Numbers can not be given accurately, but it is evident that our sheepmen are more progressive and are grading up their flocks with the best blood that money can buy.

Daniel Troy, Raton:

The history of the industry for this portion of our Territory for the last fifteen years has shown a steady improvement in the care and quality of our sheep, while at the same time the number of sheep raisers has been gradually decreased by the closing out of small owners, augmented by the increased demand for mutton sheep for the last three years. In proportion to the improvement in the quality of our sheep, so also is our wool improved in quality and average yield per head, so that the decrease in quantity of wool is much less in proportion than is shown in the number of sheep. Improved sheep demand improved care, with expensive improvements for their protection, and fairly paid, clothed, and fed American labor. A decrease in prices for Territory wools can not sustain these conditions long, even though we have the advantage of free grass, a good climate, and every requirement except good protective legislation to foster and protect the industry.

The *Stock Grower*, Las Vegas:

The Australian system might be tried in New Mexico. There is plenty of rainfall to grow any crop if properly distributed. At times there is not enough moisture in the ground to bring the dews, and the result is drought. The Australian plan is to make artificial lakes or reservoirs in every hollow; from one to a dozen on every farm. These reservoirs act as catch-basins for the surplus rainfall in the spring and fall, and during the hot months in summer the water in these ponds is absorbed, and brings rain. The rain-belt farmers can accomplish the desired result if they adopt this plan, and the work to each individual or farmer would be comparatively nothing. It is clear to any mind that lakes of water scattered over the plains in this manner would be beneficial.

NEW LAWS RELATING TO THE SHEEP INDUSTRY.

One of the greatest difficulties that has beset the flockmasters of New Mexico has been the careless indifference of management regarding scab. Those flockmasters that used the proper precautions were often handicapped by the slip-shod sheepmen, so that it became necessary to move them by legislative enactments. The scab law, if enforced, as no doubt it will be, will drive disease entirely out of the country, as it exists in a very mild form and is easily cured.

Another source of loss common to the plains and mountain regions is the depredations of wild animals. An act was passed last winter by the Territorial legislature to encourage the destruction of wolves and lions.

The following laws will be quite beneficial to the sheepmen, will give a new impetus to the industry, insure rapid improvement of the breeding stock, and encourage better methods of management:

[For the prevention of scab, etc.]

SECTION 1. That henceforth any and all persons, company, or corporation owning or holding stock on shares, such as sheep, goats, etc., that may pasture any sheep or goats within the limits of this Territory, is hereby required to comply with the requirements of the following sections in this act.

SEC. 2. That it shall be the duty of any person, persons, company, or corporation, who shall either own or have any sheep or goats on shares, to dip all of said stock within the first day of June and the last day of November, and use in said process all the ingredients required to effect the cure of scab or any such malady. The bathing process, or dipping shall be executed in the usual manner heretofore in use by all owners of sheep.

SEC. 3. Any person, persons, company, or corporation, party or parties, having sheep on shares, who shall fail to comply with the requirements and provisions of this act, shall be guilty of a misdemeanor, and upon conviction thereof, shall be punished by a fine of not less that fifty dollars, and not more than three hundred dollars, and the costs of the prosecution of all matters and things required in the said case.

SEC. 4. That, upon the affidavit of two competent persons, the justice of the peace or any other court of competent jurisdiction shall issue a writ or summons against any person or persons, company, or corporation, who has been reported to said court as having infringed against the requirements and provisions of this act, and said person, persons, company, or corporation shall be tried as now provided in such cases.

SEC. 5. Any person, persons, company, or corporation, who are owners or having interest in woolen stock, who shall receive any damage through the neglect of any person, persons, company, or corporation of dipping their sheep, as provided in section 2 of this act, said person, persons, company, or corporation so being damaged by the malady of scab in their flocks, shall have a right of action, and shall be able to recover from the parties owning said stock, not having been dipped as provided in section 2 of this act: *Provided, however*, That the party so offended shall give thirty days' notice to any person, persons, company, or corporation that has not complied with the requirements and provisions of section 2 of this act, to comply with the same as provided; and if, after such notice, parties so notified fail to comply, then and in that event the parties so offended shall have a right of action against the parties so failing.

SEC. 6. Any funds collected from fines or penalties as provided in this act shall be paid into the general treasury of the county where such offence is committed.

SEC. 7. That all acts and parts of acts in conflict with this act are hereby repealed, and this act shall be in full force and effect from and after its passage.

Approved, February 26, 1891.

[Bounty for wild animal scalps.]

AN ACT to encourage the destruction of wolves and lions.

SECTION 1. Whenever in any county of this Territory a petition signed by not less than one hundred persons, payers of taxes in such county, shall be presented to the board of county commissioners of the county, asking for such an order as is hereinafter described, it shall be the duty of the said board immediately to make an order and spread the same on the record of their proceedings, to the effect that there shall be paid from the county treasury for each mountain lion, and each large gray wolf, or lobo, killed within the county, a sum of money not exceeding seven and one-half dollars, upon proof of the killing as hereinafter provided.

SEC. 2. Any person applying for the payment to him of the money so ordered to be paid, shall file with the county clerk a statement in writing, under oath, describing the animal or animals killed, and setting forth when and where each one was killed, the residence of the applicant, and that the animal or animals were killed within the county. Such statement shall be accompanied with the scalp of each animal, including the ears and the skin of the face down to the tip of the nose. The county clerk shall keep a record of all such statements received by him, in a book kept for the purpose by him in his office, and shall present all such statements and scalps to the board of county commissioners as soon after they are received by him as said board shall be in session.

SEC. 3. At each session of the board of county commissioners all such statements shall be taken up and passed upon the same as other claims against the county; and if said board shall be satisfied of the truth of any such statement, and such statement is accompanied by the number of scalps necessary to substantiate its averments, said board shall order the claim paid like any other county indebtedness. All scalps presented with any statement shall, immediately after the claim is passed upon, be destroyed by or in the presence of the board, and such destruction shall include the cutting of each scalp in at least two pieces, separating the ears.

SEC. 4. Any board of county commissioners making such order as is provided for in the first section of this act is authorized, when in the opinion of the board it may be necessary, to levy a special tax, not exceeding one-half of one mill on each dollar of taxable property in the county, for the purpose of raising funds from which to make the payments provided for in this act.

SEC. 5. When any such order as is provided for in section one of this act shall be made, a copy thereof shall be printed in some newspaper published in the county not less than six times in each year in which it remains in force, and at least one copy in each such year shall be posted up in some conspicuous place in each precinct of the county.

SEC. 6. Any false swearing in making oaths to the statements required by this act shall be perjury.

SEC. 7. This act shall be in full force from and after its passage.

Approved, February 17, 1891.

[About killing stock.]

AN ACT relating to the killing of animals.

SECTION 1. Any person killing, or causing to be killed, any bovine cattle or sheep, for his own use or for the use of others, or for the purpose in whole or in part of sale or exchange, is hereby required to keep in his own possession, unchanged and unmutilated and in condition to be easily inspected and examined, all hides and pelts of such animals, including the ears, for the period of thirty days after the killing; and shall at any time while such hides or pelts remain in his possession permit the same to be inspected and examined by any sheriff, deputy sheriff, or constable, or by any board or inspector, or other officer authorized by law to inspect any hides and pelts, or animals, whether dead or alive: *Provided, however*, That the provisions of this act shall not apply to the killing by persons engaged in public round-up of animals for use in connection with the making of such round-up.

SEC. 2. Each violation of the provisions of this act shall be punished, in the discretion of the court in which a conviction is had, by a fine of not less than twenty-five nor more than one hundred dollars, or by imprisonment not exceeding three months, or by both such fine and imprisonment.

SEC. 3. Inability or refusal to show such hide or pelt to any proper authority within said period of thirty days, or a refusal to so show it at any time thereafter while remaining in the possession of the person by or for whom the animal was killed, shall be conclusive evidence of a violation of the provisions of this act, and shall be competent evidence to go to the jury upon the trial of any indictment against such person or persons for the larceny of any animal or animals, or for the receiving of stolen property. No conviction, however, under such indictment shall be had on such evidence alone, but such evidence must be corroborated by other independent evidence, which, if standing alone, would tend to connect the accused with the commission of the offense charged.

SEC. 4. Upon any prosecution for a violation of the provisions of the first section of this act, the defendant shall be allowed, after verdict, to submit to the court evidence of any facts tending to excuse or explain his inability or refusal to show any hide or pelt, and the court shall consider such evidence in fixing his punishment; and in cases where such evidence, in the opinion of the court, is sufficient to justify it, sentence may be indefinitely suspended.

SEC. 5. All laws and parts of laws in conflict with this act are hereby repealed, and this act shall be in force from and after the first day of April, 1891; but this act shall not be construed as repealing or in any manner changing the provisions of sections 71 to 75, both inclusive, of the Compiled Laws of 1884.

CONDITION OF THE LIVE-STOCK INDUSTRY OF WISCONSIN.

Hon. J. M. RUSK,

Secretary of Agriculture:

SIR: I have the honor to submit herewith a report upon the animal industries of the State of Wisconsin. It embodies the essential facts elicited from a careful survey of the State during the latter part of 1889 and the first eight months of 1890. All the counties in the State were visited; representative farmers, dairymen, and stock-raisers were interviewed and their methods examined. From the voluminous notes thus taken the accompanying report was drawn.

Respectfully,

SAMUEL W. CAMPBELL.

HUDSON, WIS., 1890.

THE SOUTHEASTERN COUNTIES.

The counties of Kenosha, Racine, Walworth, Rock, Green, Dane, Jefferson, Waukesha, and Milwaukee constitute the southeastern portion of the State, and are nearly alike in soil, climate, and general topographical features. The soil is, for the greater part, a strong fertile loam, diversified by deposits of gravelly drift, with clay subsoil, the whole resting on limestone. The surface is gently rolling, the low, rounded hills being fertile and productive to the summits. The intervales, where they are not occupied by lakes or marshes, are of rich black soil, well adapted to the growth of grasses and cereals. The water supply is abundant and pure. A region of such natural resources, inhabited by an enterprising and intelligent population, is the natural home of improved live stock and advanced dairying. The animal industries here, as elsewhere, have changed with the changing exigencies of the markets. While beef and wool commanded good prices there was much activity in feeding and fattening beeves, and in raising Merino sheep. The heavy decline in the prices of beef and wool brought serious losses upon the feeders and wool growers, and turned the public attention to dairying, horse breeding, and the larger breeds of mutton sheep.

HORSES.

An important part of the animal industry in this section of Wisconsin consists of the business of importing, breeding, and rearing horses. In Janesville alone there are no less than six establishments devoted to the importation, sale, and breeding of horses; and many other renowned breeding farms are situated in various parts of the

counties named above. In addition to the large business of these establishments it is the very common practice of farmers to raise colts as a part of the regular business of the farm. American road and trotting horses formerly received more attention than any others. During recent years, however, there has been great activity in the business of importing and breeding draft and coach horses. Clydesdale, English Shire, Suffolk Punch, Percheron, French Coach, Cleveland Bay, and Hackney horses are bred in various parts of the region, both on farms and in large establishments devoted wholly to the business. At the same time the interest in the breeding and rearing of light and fleet road horses remains undiminished, and the district is the home of many renowned trotting sires.

CATTLE.

The leading branch of the cattle industry in this part of Wisconsin is dairying. The low prices for beef during the last few years have had a very discouraging effect upon the business of breeding for the fat stock market. There are still some fine, pure-bred herds of Shorthorns and other beef strains of cattle, but the output of fattened beeves has not brought profitable returns in recent years. There is perhaps no part of the United States wherein dairying is carried on with a higher degree of intelligence, skill, and success than in Wisconsin. Jerseys, Guernseys, Holstein-Friesians, Shorthorns of milking strains, and the grades of all those breeds make up the better class of the dairy herds, though here as elsewhere the "native" is still largely in the majority.

SHEEP.

Wisconsin for many years held a conspicuous position among the wool-growing States. There are still in the southeastern section many choice flocks of pure-bred Spanish Merinos and two associations of breeders organized and maintained to promote purity of breeding and general success. But the fluctuations of the wool market have in recent times impaired, if not wholly destroyed, the profits of wool growing, and the stud flocks of Merinos have been maintained by the sale of choice breeding animals to other parts of the world. Meantime the steady demand and good prices for choice mutton and lambs, together with improved skill in mutton sheep husbandry, have greatly increased the interest in the heavier breeds of sheep. Cotswolds, Leicesters, and the various classes of Downs have been quite largely introduced and find here every condition for success.

SWINE.

Wisconsin has never been essentially a hog-raising State. With its pure and abundant water supply and natural adaptation to the growth of the best grasses, fitting it more specially for pastoral than for agricultural industry, no attempt has been made to compete with the prairie States in the magnitude of corn growing and the business of fattening swine. Still, great numbers of pigs are raised and fattened here, but it is incidental to dairying rather than as a separate industry. Of breeds the Poland-China is largely the favorite, but Berkshire, Chester White, and Essex are also raised.

PRACTICAL NOTES.

Large numbers of farmers in every county were visited, and notes taken of their operations and methods. Of these the following are selected as representative of the whole. The methods pursued and the results are so well illustrated in these typical instances that a full transcription of all the notes is needless:

J. R. Yide, Wilmot, Kenosha County, has a farm of 480 acres, all improved, and valued at $50 per acre. His live stock comprises 16 horses, grade Percheron, Cleveland Bay, and American roadsters of Hambletonian blood; 68 grade Shorthorn cattle; 250 sheep, partly registered Merinos, the others grades; and 80 Berkshire hogs. He keeps his horses on corn silage and tame hay, with unground oats and corn, the grain rations being sometimes mixed, but not generally. Breeds for spring colts, as he thinks he can get more work from the brood mares while they are suckling their foals than while they are carrying them. The colts are suckled from four to five months, being kept in stable during the day when the dams are at work. The youngsters are fed oats and bran in sufficient quantities to keep them in thriving condition.

The cows are fed shorts morning and evening, with corn silage and cut hay once a day. Hay, corn fodder, and straw are fed to young cattle. Breeds exclusively for the dairy, raising none but the choicest of the calves, with this object in view. All others are vealed, or killed as soon as the mother's milk is fit for use. Those to be reared are taken from the mothers when two days old, and then fed on new milk for ten days. After that they are given sweet skim milk, warmed and mixed with ground flaxseed. As soon as they learn to eat they are given all the oats and shorts they will take. Breeds with a view to having calves come in the fall, so as to have the milk for winter dairying. This is found advantageous, as the greater part of the work comes when there is little else to do on the farm, and dairy products bring better prices than in summer.

Sheep are pastured in summer and kept through the winter on whole oats and corn fodder. Sows and pigs are given the run of pasture in summer, and in winter are fed shorts and the offal from the dairy and house; those destined for slaughter are fattened on corn. Rears but one crop of pigs yearly, which are bred from young and old sows. Good brood sows are kept until they are two or three years old.

Mr. Yide finds no profit in feeding for beef at such prices as have ruled during recent years. Dairying affords a small profit, as do horses, sheep, and swine. Estimating the business as a whole the annual profit is about 4 per cent on the capital invested. He pays $20 dollars per month and board for farm labor, which he claims is more than the present prices for farm products will justify, and leave any profit for the farmer above bare rent of the land. Success under the present conditions requires economy, close personal attention, good care, good feed, and breeding only from the very best stock. His market is Chicago. Horses average $100 per head; cows $30 per head; beef cattle 2½ cents per pound, live weight; sheep, $2.50 per head for ewes, mutton 4 cents per pound, live weight; hogs 3½ cents per pound, live weight.

Uihlein Brothers, Truesdall, Kenosha County, have 657 acres, all improved, valued at $65 per acre. Their business is the breeding of road and draft horses and Devon cattle. They have 142 horses and mares, old and young, of which 100 are trotting-bred, and 42 registered Percheron and Clydesdale; also 10 head of registered Devon cattle. They breed with a view of having the foals dropped in May and June, while the mares are on fresh grass. The mares are not worked while in foal, but are kept in medium flesh, and given plenty of exercise. The foals are suckled six months and then weaned. From three months to a year old they are fed all they will eat of ground oats and bran, separately. Uihlein Brothers estimate their profits at 8 per cent. Their success is attained by keeping choice breeding stock; with strict personal attention, economy and good care and food for the animals. They find their market at Kenosha, their best horses selling from $500 upward.

H. S. Durand, Racine, Racine County, has a farm of 145 acres, all improved, and valued at $200 per acre. His farm stock includes 6 grade Clydesdale horses and 22 registered Jersey cattle. Breeds for spring foals, which are suckled six months and fed, before and after weaning, on oats and bran, care being taken that they are kept thriving. His cattle are fed mangle-wurzels, cut up and mixed with bran and shorts, together with corn fodder and hay. Calves are dropped at all times of the year, but preferably in autumn. They are taken from the mother when two days old, and for two months are fed on new milk. For the next four months they are fed sweet skim-milk, warmed, with bran and shorts, and at the end of that time they are

turned to pasture, supplemented by whole oats, bran, and shorts. The business has proved very successful, which fact he attributes to breeding only choice stock, and to judicious care and management. Horses bring an average of $150 each; 2-year-old Jersey heifers $100 to $150 per head; heifer calves $50; and male calves $25 per head.

Isaac Ellsworth, Racine, Racine County, has a farm of 320 acres, all improved, and valued at $75 per acre. It is stocked with 29 horses, road and grade Percheron; 60 head of high-grade Shorthorn cattle; 100 sheep, grades of different breeds; and 15 Poland-China hogs. Breeds for spring foals, which are suckled four months. Before and after weaning they are fed oats and bran, with the best clover hay. Brood mares are kept in medium flesh while carrying their foals; not worked, but given sufficient exercise for health, and special care is given to their management and feeding. His cattle have the run of pasture in summer, and are kept during the winter on unshelled corn and clover hay. Beef being the object, his calves are dropped in spring and allowed to run with their mothers all summer, or until they wean them. After weaning they are fed the same as the older cattle. Sheep in winter are fed clover hay, unground oats, and bran. His market is Racine. Horses bring from $40 per head for common colts, to $500 each for high-grade Percherons, from pure-bred sires; cattle 3 cents per pound, live weight; sheep average $4 per head. He finds profit in horses and sheep, but none in cattle, since the demoralization of the markets for beef. "Success requires a better market than we have to-day," he remarks, but adds that with a fair market, proper breeds, economy, and personal attention, money may be made by stock raising in Wisconsin.

C. M. Clark, Whitewater, Walworth County, has 400 acres, all improved, and valued at $75 per acre. He has 24 trotting-bred horses and mares, of which 12 are registered; 60 registered Short-horn cattle; 125 Merino sheep; and 40 Poland-China hogs eligible to registry. Feeds his horses 4 quarts of unground oats each, three times per day, and wild hay. Keeps his brood mares in medium flesh and does not work them. Breeds both for spring and fall foals, which are allowed to run with their dams, and partake of their food. As soon as they are weaned the youngsters are fed whole oats and bran, with timothy hay. Feeds his cattle shocked corn, the ears and fodder cut up together. Calves are dropped in all months of the year, and suckled twice a day for six months. They are taught to eat whole oats and bran as soon as they are old enough. Sheep are fed in winter on clover hay and unground oats. Lambs are yeaned about the middle of April. Raises two crops of pigs a year, which come in spring and fall. Breeds from old sows, which are kept from five to six years. Swine, old and young, are fed on shorts and house slops, and those destined for slaughter are finished on corn. The horses sold last year averaged $600 each; cattle 3 cents per pound, live weight; sheep $5 per head; hogs 3½ cents per pound, live weight. He makes a profit of 8 per cent on the capital invested. He regards the conditions for success as being principally in the breed, in a fair demand, good care, personal attention, and hard work.

C. K. Gibbs, Whitewater, Walworth County, has a farm of 160 acres, all improved, and valued at $100 per acre. His stock consists of 8 trotting-bred horses; 60 head of cattle, of which 5 are registered Jerseys, the rest grade Jerseys, except a few Shorthorns; and 40 Poland-China hogs. Feeds his horses corn and barley ground together, clover hay, corn fodder, and barley straw. He has no silo as yet, but believes in them. Breeds for September foals, so that they may be suckled during the season in which no work is required of the mares. After being with dams all winter the foals are weaned in spring, when they can run on fresh grass. This keeps them in growing condition, and they do not feel the loss of the mother's milk. The mares while in foal are worked gently and kept in good flesh and condition. Cattle are fed shocked corn, ears and stalks together, corn meal, barley straw, and hay. Breeds for both fall and spring calves. All male calves except the choicest are vealed, and most of the heifer calves are raised. They are taken from the cow as soon as the milk is fit to use and fed on a mixture of new milk and sweet skim-milk for ten days. At the end of that time the ration is wholly of skim-milk, to which are added oats and bran as soon as they are old enough to eat, these being increased as growth progresses. Breeds only one crop of pigs yearly, which come in April. Keeps only young sows. Feeds brood sows and pigs on shorts, with milk and slops from the house. His market is at Milwaukee and Chicago. Horses average $175 per head; cows $35 per head; hogs 3¼ cents per pound, live weight. He makes a profit of 7 per cent on the capital invested. In his opinion success depends upon keeping the best breeds of stock, personal attention, and good markets.

Seymour Brooks, East Troy, Walworth County, has 350 acres, all improved, valued at $45 per acre. His farm live stock consists of 20 trotting-bred horses, of which 10 are standard; 25 Shorthorn cattle, part registered, the rest grades; 250 Merino sheep, of which one-half are registered; and 10 Poland-China hogs.

His horses are fed corn silage, hay, and corn fodder, with whole oats, unshelled corn, and bran. Aims to have foals dropped early in May. Works the brood mares while they are carrying their foals, but not when suckling them. Feeds his cattle bran and shorts, corn silage, hay, and corn fodder. Has abandoned feeding for beef, and pursues dairying instead. His calves are mostly dropped in autumn, and taken from the cow as soon as the milk can be used, fed new milk for three weeks, and afterwards skim milk, with gradually increasing rations of bran, to which whole oats are at length added. The sheep are fed corn silage and straw in the morning, and hay with oats or corn at night. Lambs are dropped in April. Raises only one crop of pigs a year, which are farrowed in April. Brood sows are kept until three or four years old. Makes an annual profit of 7 per cent.

F. W. Fratt, Whitewater, Walworth County, has 1,168 acres of land in various parts of the county. He has 40 horses, of which 6 are registered trotting bred, and the rest roadsters and grade Percherons; 50 registered Guernsey and 30 grade Guernsey and Jersey cattle, and 12 Poland-China hogs. Breeds for spring foals, and works the mares until they are heavy. Never stables the colts, but provides sheds in which they and their dams can take shelter at pleasure. Has calves come at all times of year. His greatest obstacle is the long, cold winter. Makes a profit of 6 per cent a year. Horses average $150 a head; cattle $100 a head.

Galbraith Brothers, Janesville, Rock County, have 520 acres, all improved, and valued at $80 per acre. They are large importers and breeders of draft and coach horses. Their stock comprises 150 registered Clydesdale, English Shire, Suffolk Punch, Cleveland Bay, and Hackney horses, and 25 grade mares of the same breeds; 35 registered Hereford cattle and 35 grades, and 60 Chester White swine. Feed their horses unground oats once a day, and bran, steamed barley, and chopped hay once a day, with daily rations of clean timothy hay. Breed to have the foals dropped in May and June. Work the brood mares, keeping them in good condition and not fat. Their cattle are kept on straw and corn, and fattened on corn and barley ground and mixed. Breed exclusively for beef, allowing the calves to run with the mothers about four months; feeding them when weaned ground barley and corn with bran, and marketing them when three years old. Raise only one crop of pigs a year, breeding from young sows, and marketing when 10 months old. They make sales of horses to all parts of the country, prices ranging from $50 to $5,000 each. Fat cattle sell at 3½ cents per pound, live weight; hogs the same.

Bowles, Hadden & Co., Janesville, Rock County, have 90 imported horses, of which 50 are registered Percherons, and the rest registered Clydesdale, Shire, and French Coach. They feed cut hay, ground oats and bran mixed together and dampened with cold water in summer and warm water in winter, whole oats and long hay. Prefer to have foals dropped in spring, but have some in autumn. Do not believe in working brood mares, nor in keeping them fat, while carrying foals. They find the climate, grasses, and water admirably well adapted to the business, and the profits satisfactory. Horses sell at an average of $1,500 each.

Reid Brothers, Janesville, Rock County, are importers of heavy draft horses. They have 50 imported horses, of which 25 are registered Clydesdales and 25 registered English Shires. They feed four times a day, beginning at 5 o'clock in the morning. Two of the rations consists of cut hay with ground oats and bran, wet with cold water, one of whole oats and bran, and one of boiled hay, barley, and bran. They also give uncut timothy hay. They aim to have foals dropped about the middle of May, so that the mare may have a few weeks on fresh grass before foaling, believing that this is beneficial to both mare and foal. Breed the mares the tenth or eleventh day after. They advocate gentle work for brood mares, and keeping them in fair flesh, but not fat. Their sales are mostly made in various parts of the Northwest. Imported stallions sell on an average for $1,200.

J. I. Case, Racine, Racine County, is the proprietor of the "Hickory Grove Stock Farm" of 500 acres, "the home of Jay Eye See." It is devoted to the breeding and rearing of trotting and road horses, of which there are 150 on the farm, old and young, all registered and the descendants of Dictator, George Wilkes, and other noted sons of Hambletonian 10. The principal food for mature animals is clean timothy hay and whole oats, with a bran mash three times a week. For young colts the feed is chiefly bran and oats scalded. All are fed at regular hours three times a day, and in extremely cold weather the chill is taken from the drinking water. In summer all but the stallions are given the run of pasture. The colts are suckled five months and fed grain separate from the dams, as soon as they are old enough to eat. The foals are dropped in the spring. The profits and expenses of such a business can not be gauged by those of ordinary farming, as the animals reared here are designed mainly for pleasure driving.

William Lysaght, Monroe, Green County, who was once one of the most successful stock-raisers of the State, has to some extent withdrawn from active enter-

prise in that direction, and farms only 100 acres of choice land, all improved, and valued at $200 per acre. He has 16 standard-bred trotting and grade Percheron horses; 8 registered and 8 grade Shorthorn cattle; and 12 cross-bred Berkshire-Poland-China swine. His horses run to grass in summer, except those required for work, which are fed a mixture of corn and oats. All are fed good timothy hay with corn and an occasional bran mash in winter. Aims to have foals dropped from the 10th to the 15th of May. They are suckled from four to six months, the mares being brought to the stable for that purpose once each in the forenoon and afternoon. The sucklings are fed grain as soon as they learn to eat. He cuts and shocks his corn before frosts, and feeds it ears and all to the cattle, finishing them off with shelled corn during the last two months before marketing. Breeds for spring calves and has one cow suckle and raise two calves, the other cow being thus released for dairy purposes. The calves are taken from the cow and weaned at five months, after which they are fed oats and bran. His hogs are kept on pasture in summer, and follow the cattle in winter. Breeds from both old and young sows, raising only one crop of pigs a year, which are farrowed late in April or early in May. Turns them off fattened, at sixteen months of age. He formerly found the business profitable, but not during recent years of low prices.

Patrick McNulty, Monroe, Green County, has 500 acres, all improved, and valued at $60 per acre. He has 12 grade Percheron horses; 160 Shorthorn cattle, of which 2 are registered, the rest grades; 50 Poland-China hogs, and 6 sheep. His methods are very similar to those of Mr. Lysaght, and like him he has felt the pressure of low prices for beeves.

P. H. Austin, Johnstown Center, Rock County, has a farm of 2,400 acres, all improved, and valued at $75 per acre. His live stock consists of 30 grade Percheron and Clydesdale horses; 290 grade Shorthorn cattle, and 175 Poland-China hogs. Keeps his horses on hay and oats, with an occasional addition of corn in winter. Breeds for spring colts, and works the brood mares before and after foaling, breeding them the eighth or ninth day after they drop their foals. The foals are suckled five months, running and feeding with the dams until weaned. Feeds cattle corn in the ear, chopped up, finishing off with shelled corn a few weeks before they are marketed. Beef being the object, he has the calves come in spring and allows them to run with their mothers, except a few which are raised on new and afterwards skim-milk, with oats. Sells all fat stock at three years old. Raises only one crop of pigs a year and never keeps a sow after she is three years old. The business was formerly profitable, but has recently been quite otherwise, involving a loss of over $1,000 last year, on account of low prices for beeves.

A. Ludlow & Son, Monroe, Green County, have a farm of 1,750 acres, all improved and valued at $60 per acre. The soil is a rich clay loam, rolling enough for drainage, and blue grass grows naturally on it as heavy as in Kentucky. They have large barns and sheds, sufficient to comfortably shelter all their stock. This consists of a registered Clydesdale stallion and 69 grade horses and mares of that breed; 50 registered and 400 grade Shorthorn cattle, and 200 cross-bred Berkshire-Poland-China swine. Their methods of feeding, care, and management are very nearly similar to those of Mr. Austin, described above.

W. H. Jacobs, Madison, Dane County, has a farm of 700 acres, all improved, and valued by him at $75 per acre. His stock consists of 19 grade Clydesdale horses; 155 head of registered Shorthorn cattle, and 70 registered Berkshire swine. The cattle are fed rutabagas, cut up, dampened, and mixed with a chop made of equal parts ground oats, corn, and bran. For forage they are given corn fodder in the morning and hay at night. Mr. Jacobs has not yet built a silo, but has great faith in the system as an economizer of food. His calves are dropped at all times of the year, but he prefers September and November. The calves are raised for beef, except such choice heifers as show extra qualities for the dairy. All are suckled three times a day for the first month and then only twice a day until weaned. As soon as they are old enough to eat they are fed the root and meal rations above mentioned, beginning with a little at a time and gradually increasing with the growth of the calf, which is weaned at the age of six months. His theory and practice are based on the idea of keeping the stock growing from the first and never allowing it to want for food. He breeds heifers at two years old. He raises two crops of pigs yearly, which are farrowed in April and August, weaned when eight weeks old, and sold at any time after. The business yields him a profit of about 8 per cent. Has met with no local obstacle or diseases, but finds the climate, grass, water, and other conditions all that he could wish for health and success. Sells his pure-bred Shorthorn bulls at an average of $115 per head; cows at $250; pigs $20 each.

Leslie & Burwell, Cottage Grove, Dane County, are proprietors of the Oak Hill and Spring Brook farms, which contain in all 400 acres of land, all improved, and valued at $75 per acre. They have 1 registered Percheron stallion and 17 grades of

the same breed; 75 registered and 15 grade Aberdeen-Angus cattle, and 80 pure-bred swine, Berkshire and Chester White. Their methods of breeding, feeding, and management are very similar to those pursued by Mr. Jacobs, except that they raise only one crop of pigs a year.

R. B. Ogilvie, Madison, Dane County, has a farm of 200 acres, all improved, and valued at $100 per acre, and 50 registered Clydesdale horses and mares. Breeds for spring colts, which are suckled six months, and taught to eat a little at first but gradually increased rations, so that when weaned there will be no interruption to their growth. Brood mares are not worked, but like all the other stock except stallions are pastured in summer and fed very little grain when grass is plentiful. The stable food consists of corn fodder or hay, cut, dampened with cold water in warm weather or hot water in winter, and mixed with crushed oats or barley. His mature horses bring an average price of $1,000 per head. He finds the business fairly profitable and asserts his belief that he will yet export pure-bred Clydesdales to Scotland.

A. O. Fox, Oregon, Dane County, has 965 acres of land, valued at $40 per acre. His live stock includes 75 horses, of which 8 are standard-bred trotting stock, 6 registered French Coach, and the rest grades; 7 Shetland ponies; 110 head of Shorthorn cattle, of which 12 are registered, the rest grades; 50 head of registered Shropshire sheep, and 120 cross-bred Berkshire Poland-China swine. Breeds for foals to come in April, May, and June. Does not work brood mares, but lets them run out both winter and summer, and keeps them in fair flesh while carrying their foals. Feeds colts five times a day, the first at 5 o'clock in the morning, the ration consisting of one part wheat bran and two of ground oats, beginning with a pint at each feed and increasing as the young animal grows. Mature horses are fed unground oats, varied occasionally by unshelled corn, with hay and oat straw. Cattle are fed corn silage, hay, shocked corn, bran, and shorts, the latter fed dry. Breeds for spring calves, and gives two to one cow, which suckles them twice a day. Meantime they are taught to eat a mixture of unground oats and bran, and are weaned at the age of six months. Raises only one crop of pigs a year, which come in April, are weaned when eight weeks old, and turned off at eight months to a year old. Swine are fed a chop of ground oats, corn, rye, and barley, with slops from the house, and finished for market on whole corn. Sheep when not at pasture are fed clover and timothy hay, oats and bran. Finds his market partly at home and for the rest in Chicago. Horses average $200 each; cattle 4 cents a pound, live weight; hogs 3½ cents a pound, live weight; registered sheep $25 to $100 per head. The business is fairly profitable.

T. L. Hacker, Cottage Grove, Dane County, has 200 acres of improved land, valued at $40 per acre, and makes a specialty of breeding choice Jersey and Guernsey cattle. He raises about thirty head yearly, breeding only from registered stock, which he selects with a special view to the largest butter records. Feeds his young stock on clover, bran, oats, and other nitrogenous foods, which keeps them growing without laying on fat. If the latter is avoided while they are growing they are less liable to become unduly fat when in milk and highly fed. Bull calves are sold when less than a year old, and heifers come into profit at 2 years of age. The calves are reared on skim-milk and oil meal; and the butter product from the herd more than pays all the expenses, leaving the young stock clear gain. Cows in milk are fed clover hay and fodder corn, with about 10 quarts of bran and 2 of oil meal; or ground oats and corn, in the proportion of 2 of oats to 1 of corn. His butter finds ready sale in the local market at 25 cents a pound through the entire year. All surplus young stock is sold to various parts of the Northwest, bull calves bringing an average of $50 per head, and heifers of all ages, from weanlings to mature cows, sell at an average price of $90 per head. The most serious obstacles to success he has had to encounter are milk fever and abortion, though losses from these causes are less frequent than formerly, as they are now better understood.

H. C. Adams, Madison, Dane County, has a farm of 72 acres, valued at $300 per acre, upon which he keeps a herd of 25 registered Jersey cattle, selected for individual excellence as well as pedigree. Aims to have cows come in at all times of year except July and August. In summer, while the cows are at pasture, they are fed 4 pounds each of bran or shorts per day, and in autumn are given corn silage and cured corn fodder. In winter the forage is accompanied by varied rations of wheat bran, shorts, corn meal, oatmeal, rye bran, malt sprouts, and on rare occasions a little linseed meal. The daily grain feed varies from 6 pounds to 15 pounds, according to individual digestive capacity. During the coldest weather the drinking water is warmed to blood heat. Calves are raised on skim milk, warmed and fed three times a day in regular quantities, to which are added hay and whole oats as soon as the calf is old enough to eat. No local diseases or other serious obstacles have been encountered, and the business pays a profit of 15 per cent yearly.

G. Klein, Fort Atkinson, Jefferson County, has a farm of 220 acres, valued at $50 per acre. His specialty is importing, breeding, and raising Clydesdale horses, of which he has 50 registered and 36 high-grade horses and mares. Breeds for both spring and fall colts, preferring the latter. Works his brood mares gently, keeping them in fair condition. Feeds his horses on whole and ground oats, boiled barley, and an occasional feed of carrots. His business pays an estimated profit of 20 per cent a year, his sales being made in all parts of the Northwest. Horses of his own raising sell for an average of $200 to $300 each.

James McPherson, Fort Atkinson, Jefferson County, has a farm of 225 acres, valued at $50 per acre. His main business is dairying, with horse raising and swine feeding as incidentals. His stock consists of 6 grade Clydesdale horses and mares; 60 Shorthorn cattle, of which 3 are registered, the rest grades; and 36 Poland-China swine. Breeds for spring colts and works the brood mares. Has the colts suckled six months, and after weaning feeds them oats and bran. Pastures his cattle during the summer, with daily rations of bran. In winter they are given a feed of cut cornstalks mixed with bran at 5 o'clock in the morning; corn silage at 8 o'clock, and the same in the evening. Strict attention is given to feeding and milking at regular hours every day. Breeds exclusively for the dairy, vealing all the male and inferior heifer calves. The most promising heifer calves are taken from the mother as soon as the milk is fit for use, fed new milk for three weeks, and then kept on sweet skim-milk, with oats and bran as soon as they are old enough to learn to eat them. Raises two crops of pigs yearly, which come in May and September. Keeps good brood sows until they are 5 or 6 years old. Feeds the brood sows and growing pigs on bran, with the offal from the dairy and house, fattening them on corn. His market is Fort Atkinson. His horses sell at an average of $125 per head; cattle at 2 cents a pound, live weight; hogs 3¼ cents a pound, live weight. He milked 30 cows last year, which brought an average return of $75 each. The business pays a profit of 6 per cent on the capital invested. Success requires hard work, economy, and careful handling. The obstacles have been abortion, and the difficulty of hiring help.

H. Merriman, Fort Atkinson, Jefferson County, has a farm of 150 acres, valued at $50 per acre, on which he keeps 2 registered road horses and 11 common ones; 30 head of registered Jersey cattle and 15 grades of the same breed, and 20 Berkshire swine. His methods are very nearly similar to those of Mr. McPherson, reported above, and like him he has met with losses from abortion, which he regards as the most prevalent trouble in this county.

G. E. Gordon, Koshkonong, Jefferson County, has 493 acres, worth $50 per acre, and rents 100 acres in addition. His specialty is breeding Guernsey cattle, of which he has 120 head, all pure bred and registered. He also has 11 horses, of which 2 are Kentucky-bred saddle horses, the rest grades or common. Feeds his cattle corn silage, mixed with ground oats in autumn and early winter, and bran later on into the spring. To give variety they are fed cut straw and hay mixed with ground oats and bran, steamed. Breeds with a view to have calves come in about equal numbers every month of the year. Takes the calf from the mother in from twenty-four to forty-eight hours from birth, and feeds it new milk for one week. Afterwards for the next five weeks it is fed with sweet skim-milk and oatmeal gruel. When old enough to eat they are fed limited rations of grain, with timothy hay and corn silage, but never allowed to run to grass until they are 6 months old. He raises about 60 calves a year. Bull calves bring from $50 to $100 each; yearling bulls $100 to $150; heifer calves $100 to $150; yearling heifers $100 to $200; cows from $100 to $200. The conditions for success are good pasture, dry, well-ventilated stables, and well-bred stock.

George Harding, Waukesha, Waukesha County, has a farm of 290 acres, all improved, valued at $200 per acre. His stock consists of 10 grade Percheron horses; 65 registered Shorthorn cattle, and 100 registered Cotswold sheep. The winter feed of his horses is composed of corn silage, whole oats, roots cut up and mixed with the other foods, and oats cut partially green, cured, and fed unthrashed. He does not regard corn silage as a perfect food, but it is economical, and if fed in combination with other materials is eminently satisfactory. Oats, if cut before the grain is fully ripe and fed straw and all, make a very excellent food. Breeds for autumn foals, which, if kept warmly housed in winter, he regards as the best of any, as they reach the right age when weaned in spring to turn on fresh grass, which makes up for the loss of the mother's milk, and the growth is unchecked. Another important advantage from this method is that the brood mares are in better condition to work at the season when farmers most need their labor. He works his brood mares while they are carrying their foals, keeping them in medium flesh, and allows them to suckle the foal five months. After being weaned the foal is fed a mixture of oats and bran. In winter the cattle are fed corn silage, hay, straw, and ground

oats, barley, and bran mixed. The silage is made from northern corn, cut and put up just when the kernels are glazed. He finds this the most satisfactory of anything he has tried. Breeds with a view to have calves come at all times of the year, but preferably in the fall. Has the calf suckled twice a day for six months; meantime it is fed bran and oats as soon as it learns to eat, and then silage. They are kept apart when feeding, so that each calf has its proper share of food. Milch cows are fed cut hay mixed with bran, shorts, and ground rye. Sheep are fed bran and oats, besides their coarse forage, and in the coldest weather corn is given in place of other grain. A month before yeaning time the ewes are fed roots and clover hay in place of corn. Lambs come in March and are kept well sheltered, as it is not dry cold from which they are as likely to suffer as exposure to wet. Ewes are kept as long as they breed well. The business pays a fair return for the labor and outlay, but not on the capital represented in the land, which, by reason of its proximity to a popular health resort, is held above its agricultural value. He thinks it would pay a profit of 8 per cent on land that was not artificially enhanced in value. Besides the direct returns from stock raising is the great advantage that it maintains and increases the fertility of the soil. Horses such as he raises average $150 each; cattle at one year old and upward, $120 per head; pure-bred Cotswold lambs, $20; yearlings, $25. He has encountered no serious obstacles from diseases or other causes, but with excellent soil, water, and climate his stock is maintained in good health.

James Welch, Waukesha, has a farm of 240 acres, all of which is improved, and valued at $60 per acre. It is stocked with 6 horses, common or native; 29 head of grade Holstein, Shorthorn, and Jersey cattle; 21 Merino sheep, all eligible to registry; and 90 Poland-China swine, of which 23 are registered. Breeds for both dairy and beef, the calves coming at all times of year, but winter is preferred. They are suckled twice a day for two weeks, then taken away from their dams and fed new milk for an equal time. After that they are kept on sweet skim-milk warmed, with gradually increasing rations of corn meal and oats mixed. The general winter feed of the cattle consists of cornstalks, shocked corn, tame and wild hay, and for grain chopped rye and bran or shorts. The sheep are kept in winter mainly on clover hay. No grain is given them until near yeaning time, which comes in April, when the ewes are fed whole oats. Brood sows are fed shorts mixed with slop from the house and dairy, care being taken that it is not fed sour. After farrowing, the sows are allowed to run in white clover and blue grass pasture. Large litters of pigs are weaned at the age of 8 to 10 weeks; smaller ones are given longer time. Extra good brood sows are kept as long as they do well. He estimates that the business pays a profit of 25 per cent yearly. He sells his young horses for an average of $125 each; dairy cows $30 per head; beeves 2½ cents a pound, live weight; pure-bred pigs, 6 to 12 weeks old, $10 to $25 each; sheep, common grades, $3 per head; registered Merino $5 to $10 per head. Has encountered no diseases or other serious obstacles.

Peter Davy & Sons, Monterey, Waukesha County, have a farm of 200 acres, improved, and valued at $50 per acre. Their business is mainly the importation and breeding of Galloway cattle, of which they have 50 head, all registered, and a part are of their own importation. The principal food material is corn silage, made from northern corn, cut as soon as the kernels are glazed. To this are added straw, roots, and bran. Breed for spring calves, which are suckled morning and evening for five months. As soon as they learn to eat they are fed roots and unthrashed oats cut up and mixed with bran. The senior partner has been engaged in importing and breeding Galloways since 1870, and regards the breed as one of the best for beef in an extreme northern climate. He finds sale for pure-bred Galloways in all parts of the country, calves at 6 months old selling for $50 each; yearlings $75 to $100; 2-year-old heifers at $200.

C. T. Bradley, Milwaukee, Milwaukee County, has a farm of 600 acres, all improved, and valued at $200 per acre. He has 125 trotting-bred horses, mostly descended from Hambletonian 10, and registered; 100 Jersey cattle, of which one-half are registered, the others grades; and 50 Berkshire swine. The horses, when not at pasture, are fed on tame and wild hay, with oats and bran mixed, and whole corn in winter. Breeds to have foals dropped as near the first of January as practicable. They are suckled five months, meantime sharing the food of the dam. After weaning they are kept on fresh pasture and fed oats, care being taken to keep them in thriving condition, without check to growth. The brood mares, when carrying their foals, are kept in medium flesh with sufficient exercise for health. After foaling they are fed all they can digest to keep up a full flow of milk for the foals. Cows are bred to come in at all times of year, the aim being to have an equal number of fresh cows the year through. The calves are taken from the mother when 1 or 2 days old, and fed on new milk for ten days. Skim-milk is gradually

added until the ration is wholly composed of it. As soon as they are old enough to eat they are fed with ground oats and corn, bran or shorts, with timothy and clover hay, unthrashed oats, or other forage. The hogs are kept on refuse from the dairy and house, soft corn and other coarse food, and fattened on corn. Raises two crops of pigs yearly, mostly from young sows, though extra breeders are kept for several years. Horses sell at various prices, according to pedigree, style, and speed, a phenomenal trotter bringing as high as $12,000 after it has made a good record. Calves sell from $25 to $100, according to quality and pedigree; yearlings and cows up to $250; hogs 3½ cents per pound, live weight. He thinks if he could devote his entire attention to the business it could be made fairly profitable; as it is, his attention being mainly required by other affairs, the returns from the stock farm are not sufficient, above cost and expenses, to pay interest on the investment.

Charles Cupples, Milwaukee, has a farm of 200 acres, valued at $500 per acre, upon which are 100 registered and high-grade Jersey cattle. His methods of feeding, breeding, and care are very nearly like those described above. With present prices for stock and dairy products he finds it difficult to make enough to pay interest on the value of such high-priced land near the city.

Rust Bros., North Greenfield, Milwaukee County, have a farm of 200 acres, valued at $200 per acre. They have 50 registered Holstein cattle, a few high-grade Jerseys, and 100 Poland-China swine. Their methods are quite similar to those last mentioned. Their principal profits are found in the sale of milk to the city, and very little in raising stock to sell.

THE RIVER COUNTIES.

That section of Wisconsin which lies along the Mississippi River and its tributaries has greatly diversified topographical features. The surface in many parts is uneven and hilly, while in others there are level tracts, and all parts are intersected by the valleys of streams which furnish an abundant supply of pure fresh water. The soil is mostly of rich clay loam, except in the river bottoms, where it is sandy. The region when first settled was mostly forest or brush prairie. As the country became subdued and cultivated the leading agricultural interest was grain raising, which in time was diversified by cattle feeding and wool growing. But within the present decade all these branches of industry have met with severe checks. Repeated crops of wheat have been destroyed by chinch bugs; the rapid and continuous decline in the price of beef has not only destroyed the profits of feeding cattle, but involved serious loss to those engaged in it; and the competition of cheap western lands and of foreign wool growers has rendered the keeping of Merino sheep for the wool alone anything but a profitable business on high-priced agricultural land. But the pushing, wide-awake farmers, instead of supinely sitting down and bemoaning their losses, began to change their methods to meet the new conditions. The production of wheat and beef have been, to a large extent, superseded by dairying and the breeding and raising of heavy draft and light harness horses, while the swine industry is still maintained as an incidental branch. Merino sheep, except choice stud flocks, are being largely replaced by English long-wooled and Down breeds. The rich river bottoms have proved to be well adapted to the growth and success of Lincoln, Cotswold, and Leicester sheep, and the hilly pastures, fertile and well covered with nutritious grasses, furnish all the conditions needed for the Shropshire and other Downs. These changes, however, have been very gradual, and many farmers still maintain their fine Shorthorn and Hereford herds, in the belief that the depression in prices is temporary. Of the notes taken in visiting hundreds of farmers in the fourteen counties under present

consideration the following are transcribed as representative of the whole:

Stephenson & Son, Darlington, La Fayette County, have a farm of 190 acres, valued at $60 per acre. Their stock includes 6 Clydesdale horses, grades; 11 head of Shorthorn cattle, of which 3 are registered, the rest grade; 22 Poland-China swine, and 18 registered Cotswold sheep. Breed for both spring and fall foals; work the brood mares gently when with foal, keeping them in medium flesh. Feed their cattle hay with ground oats and corn; breed for both dairy and beef; and have no special time for calves to come. They are kept away from the mother from birth; fed for three weeks upon the mother's milk and afterwards on sweet skim milk with shorts or bran and unground oats. Their sheep are fed on hay, oats, mangel-wurzels, and carrots. Raises one crop of pigs a year. Horses bring $125 each; cattle, 2 to 4 cents a pound; hogs, 3½ cents a pound, live weight; sheep, 4½ cents a pound, live weight. The business returns a profit of 20 per cent a year. The greatest obstacle to success is the long, cold winter.

Martin Brothers, Darlington, La Fayette County, have a farm of 475 acres, all improved, valued at $30 per acre; 12 grade Clydesdale and Shire horses; 40 pure bred and grade Shorthorn cattle; 75 pure-bred Poland-China swine; and 90 grade Cotswold sheep. Their methods are similar to those of Messrs. Stephenson & Son, detailed above.

Rogers & Orton, Darlington, La Fayette County, have 508 acres, valued at $55 per acre; 18 horses, grade Shire, Clydesdale, French Coach, and American road; 85 Shorthorn cattle, of which 4 are registered, the rest grades; 570 Cotswold, Down, and Merino sheep; and 45 Poland-China swine. Have hitherto bred for spring colts, but think fall is the better season and intend to change. Feed their cattle corn ensilage, and bran. Breed for both beef and dairy, having spring calves for the former and autumn for the latter. Are endeavoring to abandon beef for the dairy as fast as practicable. Raise two crops of pigs yearly and keep a brood sow as long as she is profitable. Make an annual profit of 20 per cent.

Thomas Butery, Darlington, La Fayette County, has a farm of 160 acres, all improved, and valued at $50 per acre. Has 6 grade Shire horses, 30 registered Shorthorn cattle, and 70 Poland-China swine. Breeds for spring foals, and feeds his horses hay and whole oats. Feeds his cattle hay, cut cornstalks, with meal, bran, and shorts. Breeds for both spring and fall calves. Beef being the exclusive object, the calves are suckled night and morning for five or six months, taking all the milk of the cows. Raises only one crop of pigs a year, feeding old and young on ground feed of corn, oats, and barley or rye. Estimates his profits at 10 per cent a year.

W. W. Birkett, Darlington, La Fayette County, has a farm of 210 acres, all improved; 8 grade Percheron and Shire horses; 8 registered Hereford cattle, and 57 grade Herefords and Shorthorns; and 80 Poland-China swine. He pursues the same methods as those described above.

G. W. Stevens, Wiota, La Fayette County, has a farm of 270 acres, all improved, and valued at $50 per acre; stocked with 11 grade Clydesdale and Morgan horses; 38 Shorthorn cattle, of which 6 are pure bred and the rest grades; 115 Chester White hogs; and 77 grade Shropshire sheep. Breeds for spring colts, and does not work the brood mares, but keeps them in fair flesh, and aims to have them on fresh grass some weeks before they drop their foals. Feeds the cattle corn and oats alternately. Breeds for beef only, and lets the calves run with their mothers four to six months, except a few which are fed apart. Raises only one crop of pigs a year, which are farrowed in April or May. After the pigs are weaned they are fed slop with rye and oats; and as cold weather approaches corn is added. They are kept until 12 months old or more. Breeds entirely from young sows, never keeping them for more than one litter each. Store sheep are fed oats, and those to be fattened, corn. Finds the business fairly profitable. Has no obstacle but the long, cold winters and low prices. Horses average $150 each; cattle 2 cents per pound; hogs 3½ cents; sheep 4 cents, live weight.

E. O. White, Shullsburg, La Fayette County, has a farm of 240 acres, valued at $45 per acre. His stock includes 16 horses, of which one is a registered Clydesdale stallion and one standard-bred road stallion; 50 Shorthorn cattle, of which 10 are registered, the rest grades; 80 Poland-China hogs, and 30 Shropshire sheep. He follows the same methods of breeding and feeding as those of Mr. Stevens.

T. Carrier, Boscobel, Grant County, has a farm of 400 acres, all improved; 8 grade Percheron horses; 75 grade Holstein cattle, and 182 grade Oxford Down sheep. Breeds for spring colts; works the brood mares while in foal, keeping them in fair flesh. Feeds his cattle corn fodder and ears cut up together, straw, hay, and bran. Breeds for spring calves, which are kept apart from the mothers from the first; feeds mother's milk two to four weeks, after which they are reared on skim milk, bran,

and unground oats. Sheep are fed tame hay, whole oats, and corn. Has a very high opinion of the Holstein breed for the dairy. Finds the business fairly profitable.

Smith Bros., Lancaster, Grant County, have a farm of 240 acres, all improved. It is stocked with 12 Hambletonian horses, 120 head of cattle, of which 5 are registered Herefords, and 60 grades of the same breed, the rest grade Shorthorns; and 80 grade Berkshire swine. Breed for beef alone, the calves coming in spring, and are allowed to run with their mothers until weaned. Raise one crop of pigs a year, and keep brood sows four years. Make no profit.

James Treloar, jr., Lancaster, Grant County, has 290 acres, of which 200 are improved. Has 11 horses, common stock; 50 Shorthorn cattle, of which 6 are registered, the rest grades; and 175 Poland-China hogs. Follows the same methods as are detailed above. Finds the business fairly profitable, but can not name the percentage, as he has never kept any account.

Thomas Tormey, Fennimore, Grant County, has two farms, containing 960 acres, of which 800 are improved. He has 14 grade Percheron and Clydesdale horses; 140 head of cattle, of which 40 are registered Shorthorns; and 180 Poland-China hogs. The horses are fed hay and oats, to which corn is added in winter. Aims to have mares foal in spring, after having been two or three weeks on fresh grass; lets them suckle the foals from five to six months. Stables the yearlings, but the second and third year they are turned to straw stacks, and forced to rough it in winter. Cows in milk are fed corn fodder chopped with the ears and mixed with oats, bran, or shorts. This is varied by rations of corn at the rate of one bushel daily for every twenty head of cattle, in addition to hay, corn fodder, and straw. Breeds for both beef and the dairy, having calves come every month in the year. Lets the calves take the mother's milk twice a day for five to seven months, and then weans them. Never crosses breeds, believing that each breed is best if kept pure. Keeps store hogs on corn, shorts, and offal from the place, and fattens on whole corn in warm weather, and corn and oats, ground and cooked, in winter. Raises only one crop of pigs yearly, which come in spring and are sold the following winter. Makes it a point to feed pigs liberally and push the growth as fast as feed and care can do it. The business has paid 3 per cent profit yearly, but doubts whether the present year will show any profit at all. The greatest obstacles are low prices and long, cold winters. Horses average $150 each; cattle 2 cents per pound; hogs 3½ cents a pound, live weight,

J. C. Kirkpatrick, Rewey, Iowa County, has a farm of 1,000 acres, all improved, valued at $50 per acre. He has a standard-bred registered stallion and 34 other road horses, 100 grade Galloway and Shorthorn cattle, and 300 Poland-China hogs. His experience is similar to that last above described. Finds the business profitable, but can not tell how much profit there is in it, never having kept accurate accounts.

Ross Bros., Mineral Point, Iowa County, have 2,900 acres, of which 2,400 acres are improved. They have 10 roadster and 7 grade Percheron horses; 160 registered Shorthorn cattle, and 40 Poland-China hogs.

G. H. Harker, Dodgeville, Iowa County, has a farm of 1,900 acres, all improved, valued at $25 per acre; 16 common horses; 270 grade Shorthorn cattle; and 70 Poland-China hogs. The statements of this and the former as to methods and results are almost exact repetitions of the preceding two.

James Spensley, Mineral Point, Iowa County, has a farm of 480 acres, valued at $40 per acre. He has 5 "native" horses; a registered Guernsey bull at the head of a herd of 150 grade Guernsey and native cattle; 35 Poland-China hogs, and 8 sheep. Feeds the cattle hay and corn fodder, bran, shorts, and corn meal, with considerable quantities of mangel-wurzels and rutabagas. Breeds only for the dairy, having the calves come from October to March. The calf is taken, when 2 weeks old, from the mother and fed skim-milk and whole oats. Raises only one crop of pigs a year, and keeps brood sows as long as they continue to be profitable. Has encountered no diseases, but the stock has been exceptionally healthy. Makes a profit of 10 per cent a year. Horses sell at $100 each; cows, $30 per head; hogs, 3½ cents per pound, live weight.

John I. Hayes, Viroqua, Vernon County, has a farm of 400 acres, of which 260 are under cultivation, with large substantial buildings sufficient to shelter all his stock. The latter includes 11 horses, of which one is an imported Percheron stallion and one a registered French Coach stallion; 180 grade Holstein and Shorthorn cattle; 70 Poland-China swine, and 200 Shropshire and Cotswold sheep. Breeds for spring foals, and allows them to run with the dams four months before they are weaned. Purchases his cattle at 2 years old and upward, as he thinks he can buy them more cheaply than he can raise them. Has 80 head now fattening on corn shipped from Iowa. Feeds ensilage and hay and finishes for the market with corn. Feeds his hogs milk, bran, and shorts, and lets them follow the cattle. Raises one crop of

pigs a year, which are farrowed in April or May. Believes in feeding pigs well and keeping them growing right along until they are marketed at 8 to 12 months old. Feeds sheep silage and hay, with oats for ewes and shelled corn for the others once a day. Does not believe there is any money in beef cattle at present prices, as beef can not be made for less than 4½ cents per pound and pork for a cent a pound less. There is some profit in horses, hogs, and sheep. Sells horses for $100 to $200 each; cattle, 2½ to 4 cents a pound, live weight; hogs, 4 cents a pound; sheep, 3 to 3½ cents a pound.

I. W. Smith, Viroqua, Vernon County, has a farm of 400 acres, of which 375 are improved. He has 13 grade Percheron and Clydesdale horses, 45 head of grade Shorthorn cattle, 75 Poland-China hogs, and 220 sheep, Merino and Cotswold grades. Keeps his horses on hay, whole oats, and corn and oats ground together. Feeds cattle hay, straw, and chop feed of oats and corn. Breeds for beef, and aims to have calves come in July. Rears one crop of pigs yearly, which are farrowed in July. Has encountered no local obstacles or diseases; has good water, good shelter, uses economy, and keeps the best breeds; but does not regard the business as remunerative. Horses sell at from $75 to $200 each; cattle 2½ cents per pound, live weight; hogs 4 cents per pound; sheep 3 to 3½ cents per pound.

Norman L. James, Richland Center, Richland County, has a farm of 372 acres, all improved. He has 16 horses, part grade Percheron and the rest road horses; 130 head of Shorthorn and Red Polled cattle, part being full bred and the others grades; and 30 Berkshire swine. Breeds for both spring and fall foals; works brood mares carefully, keeping them in fair condition before and after foaling, and has the foals suckled four months. Feeds cattle corn silage, timothy and clover hay, and bran. Thirty-five pounds of silage, 10 pounds of hay, and 6 pounds of bran constitute one day's ration for a cow. He is breeding his Shorthorn cows to a pure-bred Red Polled bull, with excellent results for milk and butter. Breeds for dairy purposes only, having the calves come in September and October. Takes the calf from the mother when it is 2 days old, feeding it for two or three weeks on mother's milk, and after that on sweet skim-milk and grain. Feeds hogs shorts with the slops of the dairy and fattens them on whole corn. Raises two crops of pigs yearly, which he markets when 7 or 8 months old. He makes a yearly profit of 15 per cent on the capital invested. Sells his horses at an average price of $155 each; hogs, 3¾ cents a pound, live weight; butter, which goes to New York, averages him 25 cents a pound.

H. T. Bailey, Richland Center, Richland County, has a farm of 720 acres, of which 400 acres are improved. His live stock consists of 50 horses, of which 1 is an imported registered Clydesdale and 1 a registered trotting stallion; 51 grade cattle, Shorthorn and Jersey; 40 Poland-China swine; and 350 cross-bred Cotswold-Merino sheep. Feeds his horses timothy hay and oats, with occasional rations of ground oats, corn, and bran mixed. Aims to have foals dropped in May, so that the dams may have fresh grass a few weeks before, as he regards it very beneficial to both mare and foal. Works the mares enough for wholesome exercise and maintains them in medium flesh. Feeds the youngsters liberally on oats and bran mixed, until they are a year old, and whole oats the ensuing year. Feeds cattle on bran, shorts, hay, and straw, fattening on corn. Breeds for both beef and dairy, having calves come in spring and fall. Raises two crops of pigs yearly, having them farrowed in April and September. Turns off the former at 8 months and the latter at 1 year of age. Keeps brood sows as long as they are profitable, sometimes eight years. Feeds his sheep oats, bran, and clover hay, and has lambs yeaned in May. Makes an annual profit of 8 per cent on raising stock, which requires personal attention, good feed, and good breeds. Horses bring an average of $125 each; beeves, 2½ cents per pound, live weight; and sheep 3 to 5 cents per pound, live weight. The greatest obstacles to success are the long cold winters.

Lemuel Akey, Twin Bluffs, Richland County, 540 acres, all improved; 15 grade Percheron horses; 40 head of grade Shorthorn cattle; 55 Poland-China hogs and a flock of cross-bred Shropshire-Merino sheep. His experience is similar to that last narrated.

G. J. Carswell, Lone Rock, Richland County, has a farm of 660 acres, of which 450 are improved. His stock includes 5 horses; 2 registered and 10 grade Devon cattle; and 30 Poland-China hogs. Breeds for fall and spring calves, for dairy purposes only. Those which are to be reared are suckled from four to six weeks, after which they are fed on whey and dry bran or shorts. Raises two crops of pigs yearly, feeding them on bran, shorts, and dairy refuse, and fattens them on corn. Makes a yearly profit of 5 per cent on the capital invested. Has formerly found the business more profitable, and hopes the bottom has been reached and the market will recover soon. Beeves sell at 2 cents a pound; hogs 3¾ cents a pound, live weight.

J. A. Carswell, Lone Rock, Richland County, has a farm of 240 acres, all improved; 26 cattle, of which 14 are registered Devons, the others high grades; and 150 Poland-China swine. Has a silo, but has abandoned the use of it—the only instance of the kind in the State which has been reported.

F. E. Carswell, Lone Rock, Richland County, has a farm of 310 acres, all improved; 4 horses; 70 head of Devon cattle, of which 14 are registered, the others high grades; 40 Poland-China swine; and 20 registered Cotswold sheep. He feeds largely of corn silage. He and his brother, last named, pursue the same methods as their father, G. J. Carswell, except that they breed and sell quite a number of registered cattle, which adds to the profits of the business.

H. L. Eaton, Dixon, Richland County, has a farm of 170 acres, of which 130 are improved; 3 horses; 45 grade Devon and Holstein-Friesian cattle; and 45 Poland-China and Berkshire swine. He feeds his cattle on corn silage, with ground oats, bran, and shorts. Breeds for dairy purposes only, having the calves come in September; feeds them new milk for the first three weeks, and afterwards sweet skim milk, bran, shorts, and ground oats. Raises two crops of pigs yearly, and keeps brood sows as long as they are profitable breeders. Feeds the pigs on the refuse of the dairy and fattens with corn. Finds the business profitable, but has no definite figures at hand.

E. W. Fish, Reedsburgh, Sauk County, has a farm of 120 acres, of which 100 are improved. It is stocked with 8 road horses, 20 Shorthorn cattle, 40 Poland-China swine, and 10 Cotswold sheep. The mares are bred for fall colts, and worked lightly nearly all the time. They are found to do better thus than when turned out to grass and allowed to remain idle. Cattle are fed bran and shorts, corn fodder, and oat straw. Of the calves some are dropped in the spring and others in the fall. Two crops of pigs are farrowed yearly, one in March and one in September. They are fed on bran and shorts and fattened on corn. Brood sows are kept until 4 years old. There is a profit of 4 per cent yearly, except in raising and feeding cattle for beef. His stock is free from disease, though there has been great mortality among foals in the vicinity, 50 per cent of those dropped this year being either dead or crippled. He attributes this to the want of exercise in the sires. His market is Reedsburg, Chicago, and Milwaukee. For horses he realizes an average of $200; cattle $25 per head; sheep $3 per head; hogs 4½ cents per pound, live weight. Twenty carloads of horses have been shipped from Reedsburg during the last twelve months, some going to Pennsylvania and others to New Jersey.

L. M. Fish, Reedsburg, Sauk County, has a farm of 340 acres, of which 250 are improved. It is stocked with 20 registered and 60 grade Shorthorn cattle and 150 Poland-China swine. Cows are bred both for spring and fall calves. Has two crops of pigs yearly. Finds some profit in raising pigs, but none in beeves.

John Slaven, Reedsburg, Sauk County, rents a farm of 240 acres, 3 miles from the village, upon which he breeds and rears draft and coach horses. He has 5 stallions, all pure-bred and registered, of which 3 are Percheron, 1 imported Clydesdale, and 1 Cleveland Bay, besides grade mares.

J. W. Gale, Reedsburg, Sauk County, has a farm of 140 acres, of which 100 acres are improved, stocked with 25 road horses of Hambletonian blood. Breeds for spring foals, and does not work the mares. The business is fairly profitable. The animals are pastured in summer, and in winter are given a daily ration of hay with corn meal and shorts, and one of cut corn fodder and straw mixed with corn meal and shorts. The corn is withheld from mares while suckling their foals, and oats fed instead.

W. M. Wright, Reedsburg, Sauk County, has a farm of 80 acres, all under cultivation, on which he keeps 42 Poland-China swine. In summer they are given the run of a clover field, and are fed shorts and corn. In winter the clover hay is cut, cooked, and mixed with shorts and meal, and they are found to thrive as well upon this as on the fresh clover pasture. Only one crop of pigs is raised yearly, which are farrowed in May and June. The earliest are sold for breeding purposes, the others are fattened and turned off in February and the succeeding summer. He finds the business fairly profitable.

R. A. Morley, Baraboo, Sauk County, has a farm of 360 acres, all improved, and stocked with 11 grade Percheron horses; 57 Shorthorn cattle, of which 30 are registered; 57 Poland-China hogs; and 82 Merino sheep. The horses are pastured in summer, and at other times fed oats, corn, bran, oil-meal, carrots, and hay. The foals are dropped both in spring and fall, there being no choice, except that the latter enables the mares to perform more work in the busy season. In winter the cattle are fed corn ensilage, hay, bran, shorts, ground oats, oil-meal, and corn. Calves come at all times of year. Two crops of pigs are farrowed yearly and all are fattened and marketed when 9 months old. They are raised on milk mixed with bran, shorts, and corn meal, and finished for market with corn. Sheep are fed on

corn, oats, roots, and hay. Mr. Morley finds the business profitable, but is not prepared to state the exact percentage of profit. Horses sell at $150 to $200 each; cattle $35 per head; sheep $3 each, and hogs 4 cents per pound, live weight.

R. S. Kingman, Sparta, Monroe County, has a farm of 125 acres, all improved. He makes a special business of breeding Jersey cattle, of which he has a herd of 60 registered animals. When they are not at pasture they are given one feed daily of corn silage, mixed with a small amount of ground oats and bran, and another feed of clover hay. He values this system of feeding very highly, as it enables him to maintain twice as much stock on the same land as by the old methods. In cold weather the drinking water is warmed to 60 degrees F. The calves are dropped in the fall, and the cows kept in a full flow of milk all winter, which continues after they are turned on fresh grass in spring. They are allowed to run dry for six weeks. Dairying is subordinated to breeding, and the cows are kept in condition to bear the healthiest calves. The latter are fed new milk until 4 weeks old and then skim-milk with ground oats until 5 months old. The business affords a profit of 20 per cent a year on the capital invested. This is realized through his system of feeding silage; by turning out dairy products that command the highest prices, and by keeping only choice stock. A cow which will not yield an average of 350 pounds of butter a year and bear a good calf is quickly disposed of. Has been free from animal diseases and encountered no serious obstacle except an occasional case of abortion, which he attributes to the consumption of smutty grain. His surplus stock finds a home market at from $40 to $150 per head.

David Wood, Whitehall, Trempealeau County, has a farm of 560 acres, of which 340 are under cultivation. His stock consists of 6 grade Percheron horses; 40 grade Shorthorn and Jersey cattle; and 6 Poland-China swine. Feeds his horses on corn silage, hay, and grain; the cattle corn silage and clover hay, with bran, shorts, corn, and oats ground together. Has the calves dropped in autumn. The only part of the business he finds profitable is dairying. His stock is free from disease, but the long, severe winters and high prices of feeding stuffs, compared with the relatively low price of beeves, leave no margin for cattle feeders.

D. L. Holcomb, Arcadia, Trempealeau County, has a farm of 145 acres, of which 125 are under cultivation. His main business is raising and fattening swine for the market. His live stock consists of 7 horses, 4 cows, and 135 pure-bred Poland-China swine. He raises only one crop of pigs a year, which are farrowed in May, and are kept until 18 months old. All the swine are given the run of a clover field in summer, and in winter are fed clover hay, cut and steamed, with corn meal. In autumn they are fattened on corn in the ear. No disease or other unfavorable condition has been encountered and the business has proved fairly remunerative. His market is Chicago, where he realizes 4½ cents per pound, live weight.

James Gaveney, Arcadia, Trempealeau County, has two farms, containing 760 acres, of which 620 are improved. His stock comprises 32 grade Percheron and American road horses; 195 grade Shorthorn and Red Polled cattle; and 165 Poland-China swine. Foals are dropped in spring. Calves are dropped both in spring and fall, for the purpose of having fresh cows at all times for dairying purposes. The swine are given the run of clover pasture in summer, and at other times are kept on milk, bran, and shorts, and fattened on corn. Raises two crops of pigs yearly, which is done advantageously by means of the continuous supply of refuse from the dairy. Mr. Gaveney finds stock raising in conjunction with dairying the most profitable system of farming. His stock has been free from disease, and the most serious obstacle he has encountered are the long cold winters and the early frosts, which barely allow corn to ripen. Horses sell from $200 to $300 each; cattle $30 per head; hogs 3½ cents per pound, live weight.

G. C. Lambertson, Whitehall, Trempealeau County, has a farm of 500 acres, 300 improved, and stocked with 8 grade Percheron horses, 40 head of grade Jersey and Shorthorn cattle, and 40 Poland-China swine. His experience is similar to that of Mr. Gaveney, detailed above.

H. C. Stratton, Whitehall, Trempealeau County, has 480 acres, all improved. His stock consists of 8 grade Percheron horses; 37 grade Shorthorn and Jersey cattle; 40 Shropshire sheep, and 80 Poland-China swine. All classes of his stock are fed largely on corn silage, with oats and bran. Calves are dropped in September for winter dairying. Has raised only one crop of pigs a year, but will hereafter have two. The stock has never been troubled with any disease, and the most formidable obstacle encountered has been the ravages of wolves. His dairy products bring an average return of $53 per cow every year.

George G. Hitchcock, West Salem, La Crosse County, has a farm of 160 acres, all improved; 10 grade Percheron and Clydesdale horses; 50 head of grade Shorthorn cattle, and 28 Poland-China swine. Hitherto the mares have been bred for spring colts, but, with a view to having them work better in the busy season, he will aim

to have autumn foals. Cows calve in the fall, for winter dairying. They are fed daily 30 pounds each of corn silage, 6 pounds of ground oats and barley, and as much hay as they will eat. Pigs, while growing, are given the run of a clover pasture, and are fattened on corn in the ear. Only one crop of pigs is raised yearly, which are farrowed in spring and kept until 18 months old. The business returns an annual profit of 10 per cent.

Phillip McConnel, West Salem, has a farm of 260 acres, all improved. It is stocked with one pure-bred English Shire stallion, 9 grade Percheron horses; 50 grade Jersey and Shorthorn cattle; and 40 Poland-China swine. His methods and the results are very much like those of Mr. Hitchcock, above described.

H. F. Bolles, West Salem, has a farm of 250 acres, of which 200 are improved. It is stocked with 10 grade Percheron and Shire horses; 30 grade Holstein and Jersey cattle, and 54 Poland-China hogs. His experience is much like that of the last two detailed.

C. C. Elwell, La Crosse County, has a farm of 180 acres of which 140 are under cultivation. His specialty is raising swine, of which he has a herd of 90 pure-bred Poland-China. They are fed bran, shorts, oats and corn ground, potatoes and several ears of corn each, morning and night. For drink they are given a thin gruel of water, shorts, and oil-meal. Only one crop of pigs is raised yearly, and sows are kept until 4 years old. His sows last spring averaged 11¾ pigs each. Finds the business profitable.

Archibald Martin, Buffalo County, has a farm of 200 acres, of which 180 are under cultivation. His stock consists of 6 grade Clydesdale horses, 28 grade Shorthorn cattle, 82 grade Lincoln sheep, and 12 Poland-China swine. The sheep are fed on whole oats, timothy and clover hay, and roots. In winter they are sheltered in a warm barn. The lambs are yeaned in February and the ewes are fed plentifully of roots to promote a full flow of milk for the lambs. He finds stock raising more profitable than grain farming. His sheep suffer somewhat from the ravages of dogs and wolves.

Henry Brown, Augusta, Eau Claire County, has a horse-breeding farm of 380 acres, clay soil, sufficiently rolling for good drainage, and watered by a small running stream. His stock includes 47 horses, of which 13 are pure-bred Percherons and Clydesdales and the remainder grades of 50 per cent and upward. Among them are 2 imported Clydesdale stallions, which cost $5,500, 2 brood mares of the same breed, which cost $2,500, and 2 Percheron stallions, which cost $4,200. He feeds in the usual manner with bright hay, clean oats, and an occasional bran mash, but with the least possible amount of grain to brood mares. In haymaking he alternates layers of hay with those of straw in the mow and stack. He finds the business profitable, and has encountered no diseases or other serious obstacles. He urges the use of the best pure-bred males attainable, whether the females are pure-bred or not, and favors the appointment by national or State authority of commissioners to take charge of all males used for breeding purposes, licensing only those of proper standard, and prohibiting the use of others.

O. Works, Augusta, Eau Claire County, has a farm of 220 acres, all under cultivation. He is very thorough and systematic in his farming. During the last five years he has made an almost exclusive specialty of raising and fattening swine for the market. At present he has added dairying and the rearing of dairy stock, in conjunction with which he continues to pursue the swine industry, raising about 100 grade Poland-China swine every year. He has substantial pens, clean, warm, and well ventilated, and uses only the choicest pure-bred males attainable. His brood sows are three-fourths Poland-China, as he has found such grade sows more prolific, more active, careful mothers, and better milkers than pure-bred ones. When one of them proves to be profitable he keeps her as long as she continues to breed well. He rears two crops of pigs a year, having the earliest farrowed about the 1st of March, and weaning them when they are 5 weeks old. He feeds twice a day, the first ration consisting of milk with shorts, ground barley or ground oats, and the second of milk with corn meal or corn in the ear. In summer all the swine have the run of a large clover pasture. Never allows the food to ferment and sour, but feeds it while sweet and fresh. Corn alone is fed for fattening the last three weeks before the hogs are turned off. Finds the business profitable; has paid off a mortgage of $1,500, brought up the farm in fertility, and is engaged in building a creamery with earned surplus. Sells his fat hogs in Eau Claire at 3½ to 5 cents per pound, live weight.

J. H. Dennison, Bridge Creek, Eau Claire County, has a farm of 200 acres, upon which he has hitherto raised and fed Shorthorn cattle for beef. But the decline in the prices has been so great as to destroy all profit in the business, and he has abandoned it for that of raising Jerseys for the dairy, which he hopes in time to make successful.

Albert Smith, Eau Claire County, has a farm of 440 acres and another of 280. He raises horses, cattle, sheep, and swine on both places. He has 26 grade Clydesdale mares, which he breeds to a pure-bred imported Clydesdale stallion; 56 head of grade Shorthorn cattle, which are bred only to a registered Shorthorn bull; 37 Poland-China swine, and 200 cross-bred Shropshire-Cotswold sheep. In addition to abundant pasture for all classes of stock, the food for the horses is chiefly hay and oats, with occasional bran mashes; for the cattle and sheep hay, corn fodder, straw, ground oats, and corn mixed with 20 per cent of bran or shorts, and for hogs shorts and corn. Breeding animals are fed very little grain and are not allowed to become fat. The young come in spring, but he thinks it is quite as well for colts and calves in the fall. Finds it profitable in all branches except the cattle, but thinks raising and feeding beeves, while present prices prevail, calls for a substantial bank account. He thinks no part of the country is more healthful for stock than this.

M. S. Bell, New Richmond, St. Croix County, has farmed in Wisconsin nineteen years, during the last five of which he has made stock raising a specialty. He has a large herd of Holstein-Friesian cattle, of which 16 are pure bred, the rest grades. He finds them useful for both milk and beef, and the climate seems to be well adapted to them. He also raises draft horses, and has 3 stallions, one of which is a pure-bred English Shire, which weighs 1,950 pounds, and cost $1,700. He remarks: "Since the chinch bugs have rendered wheat raising a failure, we are passing the line from grain production to stock raising and dairying, and will succeed if farmers will have patience, handle only good stock of the breeds best adapted to the country, and take proper care of it. My experience with horses is about the same as with cattle. This section calls for heavy draft horses, which always bring good prices. They are as easy to raise as common plugs."

Charles L. Day, Troy, St. Croix County, has made sheep husbandry a specialty for the last ten years, but has added swine raising to the former business. He has 320 acres, upon which he keeps on an average 175 sheep, 100 hogs, with cows and horses enough for farm use. The sheep are all Cotswolds, pure bred or grades. After trying other breeds he finds these the most satisfactory. They are large, the fleeces average 11 pounds each, and the lambs come rapidly into condition for market, which is quite a point for farmers, as early lambs bring good prices. They are fed on clover hay, with corn and oats alternately in winter, and pastured in summer. He has warm, comfortable quarters accessible from the pasture, in which the sheep and lambs can find shelter from storms. They endure cold uninjured if kept dry. Has never had any disease among them. The swine are pure-bred Poland-China, and they have been equally free from disease. Mr. Day remarks: "There is more money in raising sheep and swine than there ever was in grain farming the best season for it that Wisconsin ever saw. With grain husbandry the cost of machinery and labor takes all the profits. Since I have been engaged in stock raising the profits have come to me. When the new States are settled and the ranges cut up into farms, Wisconsin will have nothing to fear from competition in that quarter."

Charles Bradley, Hudson, St. Croix County, has on his farm a flock of about 75 Cotswold sheep, the fleeces of which averaged at the last shearing 12 pounds each. His experience fully confirms that of others—that stock raising is much more profitable here than grain production.

Ezra A. Glover, Troy, St. Croix County, has 720 acres of land, upon which he keeps 140 Shropshire sheep and 200 Poland-China swine, besides a herd of Hereford and Holstein-Friesian cattle. Never had any disease among them until last year, when he lost 40 lambs with goitre, and the present year he has lost 50 more from the same cause.

A. W. Stites, Troy, has a farm of 160 acres, upon which he keeps a flock of 180 Shropshire sheep, besides the last spring's lambs. He feeds largely of roots, with hay. Has had no disease in his flock since 1885, when he lost all his lambs by goitre. He finds a ready market at St. Paul and Stillwater, Minn., as well as at home, and the business is fairly profitable.

Homer Rider, Baldwin, St. Croix County, has 400 acres, upon which he breeds French draft horses and mutton sheep. He has an imported French draft stallion, which weighs 1,890 pounds and cost $2,000, and 20 grades of the same breed. The foals are dropped in spring, though he admits that autumn foals are as good, if not better, provided the dams are not required to work during the ensuing winter. His flock of sheep and lambs numbers 322 of Cotswold-Shropshire cross. Finds the business fairly profitable, realizing quicker returns from the sheep than from any other class of stock. Has had no diseases among either sheep or horses, and regards the climate and other local conditions very favorable for stock raising. He also keeps 12 cows, and sells the milk to a cheese factory at 70 cents per 100 pounds, but the profits are not equal to those from sheep. His horses find a home market at $200 to $265 each; sheep sell in St. Paul at $4.85 per head; wool averages 23 cents per pound.

Hon. James Hill, Roberts, St. Croix County, has 1,280 acres. His business is mainly breeding and raising cows and dairying, with swine husbandry as an incidental. He also breeds horses in a more limited way. Has 3 pure-bred Ayrshire bulls, 5 full-blood cows, and 158 grade cows and 72 grade heifers of the same breed; 170 swine, cross-bred Poland-China with Suffolk; 37 native mares and colts, the former of which he is breeding to a full-blood French draft stallion. As he breeds wholly for the dairy the calves are dropped in the fall; only the heifers are raised, the males are given away. Feeds corn silage and hay, with bran or shorts, and finds he can feed nearly as cheaply in winter as he can pasture in summer. Raises two crops of pigs a year, giving them the run of a clover pasture, with daily rations of skim milk in summer. In winter bran and shorts are fed with the milk, and he fattens on corn. The foals are dropped in spring, but he contemplates changing this to have them in the fall. Taking the business all in all, with labor, and colts from the horses, dairy products and surplus heifers from the cattle, and swine kept mainly on the refuse of the dairy, it is fairly profitable. Has had no disease among his stock of any class.

William Miller, Menomonee, Dunn County, has a farm of 4,400 acres. He has been engaged in farming the last fifteen years, during the last four of which he has been president of the Dunn County Agricultural Society. Since the failure of the wheat crop he has devoted much attention to stock raising, making a general business of horses, cattle, sheep, and swine. He has 25 grade Clydesdale horses, 48 grade Hereford cattle, 54 grade Shropshire sheep, and 96 Poland-China and Chester White swine. He fed the latter last winter on clover hay cut and steamed, and mixed with a little meal, and found it an excellent food. He raises two crops of pigs yearly, and as they consume the refuse milk of the dairy, they cost but little more to keep through the winter than in summer. He thinks there is more profit in a diversified animal industry, which embraces all classes of farm animals, than in making a specialty of any one.

A. C. Sherburne, Menomonee, has a farm of 720 acres of which 480 are improved. He raises horses and swine, having at present 24 of the former and 130 of the latter. His experience with sheep has been rendered discouraging by the presence of goitre among the lambs. A flock of 40 ewes lost every lamb from this cause for three successive years. They changed hands and farms without success and finally the entire flock was sent to the butcher. Many farmers in that neighborhood lost considerable numbers of lambs at the same time, but since then there has been no recurrence of the disease.

T. W. McCaulay, Dunnville, Dunn County, has a farm of 300 acres near the Menomonee River. The soil is very sandy. Has a herd of 59 native and grade Holstein cattle, with a pure-bred Holstein bull at the head; and 35 cross-bred Poland-China and Berkshire swine. He feeds mainly on corn silage and hay, with bran and shorts. Has the calves dropped from the first of January to May. Formerly bred and fed for beef, but the condition of the markets rendered that unprofitable and he turned his attention to dairying.

Theodore Louis, Louisville, Dunn County, has 160 acres of sandy land, of which 100 acres are improved. He has for the last fourteen years made a specialty of breeding and fattening swine. He has 3 full-blood Poland-China boars, 17 brood sows, 16 shoats, and 88 spring pigs, all pure-bred Poland-China. Sows with their pigs run in a clover field during the day, but have a feed every morning of one bushel of potatoes, steamed and mixed with shorts, to each family of sow and pigs, and at night 9 pounds of soaked corn, fed on the floor, so that they will eat slowly enough to masticate it. The pigs are turned into a field of peas as soon as the peas are matured enough for table use. Last winter he fed clover hay, cooked and mixed with corn meal. He raises only one crop of pigs yearly, which are farrowed in April, kept growing from the first, fattened on ear corn and disposed of late in autumn or winter. He keeps his brood sows until they are 5 years old, then fattens them. Mr. Louis has been eminently successful. Fourteen years ago he was heavily in debt, with a barren, run-down, sandy farm; now he is free from debt and prosperous; the farm is in the highest state of cultivation, and bears heavy crops of corn, oats, and peas. He has made $1,800 in a single year off the 100 sandy acres. He is an acknowledged authority on swine raising and has lectured during the last three winters at farmers' institutes, both in Wisconsin and Minnesota.

Sherlock B. Wales, River Falls, Pierce County, has a farm of 160 acres, of which 140 are under cultivation. He raises grade Merino sheep, having at present 180 sheep and 80 lambs. When not at pasture they are fed corn, oats, and all the hay they will eat. He makes it profitable, and the sheep have brought his farm up to a high state of fertility. In 1879 lost all his lambs by goitre, but has had no disease of any kind since.

THE MIDLAND COUNTIES.

The portion of Wisconsin stretching across the State from the shore of Lake Michigan to the limestone region bordering on the Mississippi, and north of the southern two tiers of counties, presents a wide diversity of soil and surface conformation. The eastern part, from Lake Michigan to and including Dodge, Green Lake, and the southern part of Columbia counties, contains some of the best farming land in the State. Westward of this is the great cranberry swamp region of Wisconsin. The surface, where it is not swamp, consists of an unproductive sandy soil. The portion embraced in Waushara, Waupaca, and Chippewa counties is the so-called "potato belt" of the State, so peculiarly well adapted to potato growing that it has become the leading industry there, some farmers devoting 40, 50, or 60 acres each to that crop. Throughout the midland region, except in a few of the southern townships, the animal industries are yet quite undeveloped. In the sections originally heavily timbered or swampy, the farms are generally small. The labor and cost of fitting them for agricultural and pastoral purposes has been much greater than in the more highly favored regions of prairie and oak openings. These conditions naturally modify the animal industries of the section.

As in other parts of the State, the cattle industry here is changing from beef to dairy, competition with western ranges and other influences having depressed prices of beef cattle below the actual cost of production by the methods followed in farming communities. Of equine stock heavy draft horses are in special favor, as they find ready sale in the lumber and iron regions farther north. Swine are reared and fed mainly in conjunction with dairying. Sheep husbandry, which has never attained very large proportions here, has hitherto been limited mainly to wool growing. More recently, however, the larger breeds of sheep have been introduced and received with decided favor, sharing attention with the Merinos, for which the older settled parts of Wisconsin have long been famous.

Large numbers of farmers were visited throughout this part of the State. From the copious notes taken the following extracts are condensed:

Burnham Bros., Waupun, Fond du Lac County, have a farm of 960 acres, all improved, valued at $50 per acre. Their stock consists of 60 Percheron horses, one a registered stallion, the others grades; 378 grade Shorthorn cattle; 3 registered Aberdeen-Angus bulls, and 175 Poland-China swine. Half their foals are dropped in spring, the rest in the fall. By this arrangement they are enabled to avail themselves of the work of one-half their brood mares at all times of the year. They have better success with both mare and foal when the former is worked than if allowed to run idle. The mares are kept in fair flesh but by no means allowed to become fat. Their horses are fed on corn silage, hay, straw, and whole oats. The cattle are bred and reared with a view to beef alone, the calves being dropped in spring and allowed to run with the mother five months. The food for the cattle consists of corn silage, hay, straw, bran, shorts, and roots. Two crops of pigs are raised yearly and each is allowed to run with the mother nine weeks before weaning. Brood sows are kept until 2 years old. All the swine are given the run of a clover pasture in summer and fed on corn in winter. They find a ready market at home and in Milwaukee for all they can raise. Horses average $150 per head; cattle $33 per head; hogs 4 cents per pound, live weight. They find the business profitable, yielding 15 per cent a year on the capital invested. The long, severe winters are the greatest obstacles they encounter. They hold that farmers generally would find their business more profitable if they would build and use more silos and keep only good stock.

Chester Hazen, Ladoga, Fond du Lac County, has a farm of 200 acres, upon which he conducts a profitable business of raising draft and road horses, pure-bred dairy cattle, and dairying, with swine industry as an incidental branch. He has a registered Clydesdale stallion, 15 standard-bred road horses, 15 graded same; 25 registered and 15 grade Ayrshire cattle; and 50 Poland-China swine. The brood mares are kept in fair flesh and not worked. The foals are dropped in spring. The usual food consists of timothy hay and whole oats mixed with bran. Calves are dropped in March and April, and fed, after the first week, on skim-milk, and as soon as they are old enough to eat are also given oats. Raises two crops of pigs yearly, which are turned off when 8 to 12 months old.

A. Atwood, Waupun, Fond du Lac County, has 350 acres, all improved, valued at $50 per acre. He has 12 grade horses by Percheron and Morgan sires, and 60 head of grade Ayreshire and Shorthorn cattle. Foals are dropped in May and are suckled four months. He raises calves for both beef and dairy purposes, taking them from the mother when three days old and rearing them on skim milk and oats. The business is profitable in all departments except feeding for beef. He asserts that there is an actual loss on every beef animal sold at present prices.

Michael Fitzgerald, Oshkosh, Winnebago County, has a farm of 80 acres, on which he raises light harness horses. He has 21 horses and mares, mostly of Hambletonian strains. He aims to have the foals dropped in spring and does not work the brood mares, but keeps them in medium flesh and lets them run on grass two weeks before foaling. He claims that the fresh grass restores the system to a healthy condition, after the mares have been housed all winter. The colts are suckled five months and taught meanwhile to eat grain. He does not find the busness profitable, the obstacles being the high price of land, incompetent help, long, severe winters, and low prices. His market is Oshkosh. Horses average $200 per head.

Stillson Bros., Oshkosh, have a farm of 500 acres, all improved, valued at $100 per acre. Their stock includes 30 grade horses, Percherons and American roadsters; 75 registered Shorthorn cattle; and 120 Poland-China swine. In summer the horses are fed whole oats, and in winter they are kept on wild and tame hay cut and mixed with corn and oats ground together. In extremely cold weather this is fed dry, but is scalded at other times. The brood mares are worked; drop their foals in spring and suckle them six months. The youngsters are fed oats, carrots, and an occasional ration of bran. The cattle are pastured in summer, and in winter are fed on hay, straw, and corn and oats ground together. The calves are dropped in the fall and are raised both for dairying and for beef. The swine are given the run of clover pasture and fed on ground rye, barley, whole corn, and the refuse of the dairy. Only one crop of pigs is raised yearly. They are farrowed in spring, pushed as rapidly as possible, and disposed of as soon as they are made to average 200 pounds each. The business affords a yearly return of 8 per cent, but the profits have fallen off every year. Horses 4 years old and well broken bring from $200 to $250 each; cattle 2½ to 3 cents a pound, live weight; and hogs 4 cents a pound, live weight.

A. Sandford, Oshkosh, has a small farm and rents some additional land, upon which he breeds and raises road horses. He has 12 horses of Hambletonian and Morgan blood, two of which are Hambletonian stallions. The horses are fed cut hay, mixed with ground oats and corn, either wet or dry; whole oats, and corn. The foals are dropped in autumn, run with the mother all winter, and when weaned in spring are turned on fresh grass, with small rations of grain. Has no disease or other local obstacles to contend with.

Charles Radford. Oshkosh, has a farm of 160 acres, valued at $70 an acre, and makes a specialty of breeding Percheron horses. He has 37 horses and mares, of which 5 are registered Percherons and the other high grades. He breeds for spring foals, keeps the mares in medium flesh, and works them while carrying their foals, but not while suckling them. He estimates his profits at 7 per cent annually on the capital invested.

G. W. Washburn, Oshkosh, has a farm of 160 acres, all improved, valued at $100 per acre. The farm is equipped with snug, warm stables, and the appliances for dairying by the most approved methods. He has a herd of 30 Jersey cattle, of which 20 are registered and the rest high grades, and 100 Poland-China swine. His calves are dropped in the fall with a view of having fresh cows for winter dairying. The cows run to pasture through the summer, and in winter are kept in full flow of milk on rations of corn silage with ground oats and bran. He finds great advantage in winter dairying when all the cattle, old and young, are provided with warm shelter. Only one crop of pigs is raised yearly. These are farrowed in the fall, so that the sows may have the milk from the dairy while suckling the pigs. In summer the entire herd of swine have the run of clover pasture, and those destined for

market are fattened on corn. He finds the business profitable, notwithstanding many obstacles, among which are the long cold winters, low prices for farm products, etc.

L. M. Nash, Portage County, has a farm of 520 acres, valued at $30 per acre, of which 380 acres are improved. His stock consists of 10 Clydesdale horses; 70 head of Shorthorn cattle, of which 10 are registered, the rest grades; 70 Cotswold sheep, and 100 Victoria swine. Aims to have foals dropped late in spring, after the mares have been several weeks at pasture. The foals eat with their dams, and are halter-broken while suckling, and are trained to harness when 2 years old. Cattle when not at pasture are fed clover, hay, and silage mixed with ground oats and corn, with some bran. The calves are dropped in spring, the best heifers raised for the dairy, and the steers for beef. They are taken from the mothers as soon as the milk is fit for use, fed on new milk for two weeks, and after that on skim-milk, to which are added gradually increasing quantities of ground oats. In cold weather the drinking water is warmed. The sheep and lambs are wintered on clover hay and whole oats, and the lambs are yeaned during the last half of April. Raises two crops of pigs yearly, which are fattened and turned off when 8 to 9 months old. His horses sell for an average of $150 each; beeves at 2½ cents per pound, live weight; sheep and lambs, $3 to $5 per head; hogs, 3½ cents per pound, live weight.

Edward Grover, Amherst, Portage County, has a farm of 240 acres, valued at $40 per acre, of which 140 acres are improved. His stock consists of 5 grade Percheron horses; 34 head of Jersey cattle, of which 5 are registered and the rest grades; 33 grade Southdown sheep; and 14 grade Poland-China swine. Feeds his horses hay and straw, with whole oats and bran. Brood mares are worked gently and kept in fair flesh, but not fat. Foals are dropped in spring and suckled six months. The foal is shut up while the dam is working, and the latter brought in at regular intervals to suckle the foal. Handling and training the sucklings begins when they are 3 days old. They are harness-broken when a year old, and at 2 years old learn to draw light loads. Cattle are kept at pasture through the summer, the grass being supplemented with bran, and later in the season with oats and peas sown together and cut green, as well as green corn. The winter rations consist of clover and timothy hay, corn fodder, alone or chopped up with the ears. The calves are dropped in the fall, the cows thus being fresh for winter dairying. The calf is taken from the mother when 2 days old, fed for two weeks on new milk, and after that with warm skim-milk, to which are added oil meal gruel or boiled oatmeal. As soon as the calf is old enough to masticate it is fed, in addition to its regular milk rations, with hay or unthrashed oats. When not at pasture the sheep are fed corn fodder, clover hay, and oats, and given the run of a straw stack. A single crop of pigs is raised yearly, and brood sows are kept as long as they are profitable. After being weaned the pigs are fed on oats and peas, fattened on corn, and turned off when 8 to 9 months old. The business has proved fairly profitable. The principal obstacles are severe winters, occasional droughts in summer, and depressed markets. Horses sell from $100 to $200 each; sheep, $4 per head; hogs, 3½ cents per pound, live weight.

George W. Fleming, Amherst, has a farm of 340 acres, of which 240 are improved. His stock consists of 21 horses, of which one is a registered Percheron stallion and one a road stallion; 10 common cattle; 30 Cotswold sheep; and 10 Poland-China swine. His experience is mainly like that detailed above.

W. W. Crane, Weyauwega, Wapauca County, has a farm of 300 acres, of which 270 acres are improved, upon which he keeps 28 high-grade Percheron horses; 40 native or common cattle; and 7 Poland-China swine. His horses are fed timothy and clover hay with oats in summer, and in winter oats and corn with an occasional bran mash. Foals are dropped in spring after the mares have been a few weeks on fresh grass. Handling and training begins early with the sucklings. The young are broken to harness when 2 years old, and set at regular but moderate work when 3. Finds it cheaper to buy 2-year-old steers than to raise them. Fattens them on oats and corn, equal bulk, ground together, and timothy hay. Raises one crop of pigs a year, which are farrowed in April, weaned at 6 weeks old, and with the brood sows fed on wheat middlings made into slop. The pigs are fattened on corn and turned off at eight months. Horses pay a profit of 25 per cent, swine somewhat less, and beeves are fattened at an actual loss.

W. H. Reas, Weyauwega, has a farm of 65 acres, valued at $50 per acre, upon which he keeps 17 Morgan horses and 3 grade Shorthorn cows. The brood mares are worked moderately while heavy, drop their foals in spring, and suckle them through the summer. The sucklings are handled and trained from the time they are a few days old and halter-broken while following the dam. After weaning they are fed whole oats and bran.

David Parish, Waupaca, Waupaca County, has 350 acres, valued at $35 per acre,

of which 250 are improved. His stock consists of 12 trotting-bred horses; 25 head of grade Holstein cattle; and 25 hogs. His system of feeding and management is similar to that described above. The drought of the last three years and low prices have destroyed all profit, but he lives in hopes of better times.

H. Crane, Weyauwega, has a farm of 220 acres, valued at $50 per acre, of which 110 acres are improved. He buys steers and pigs in the fall, feeds and fattens them during the winter, and disposes of them the following spring and summer. He feeds the steers corn and lets the hogs follow them. He finds no profit in this system and is changing to the business of raising horses.

W. B. Bartlett, Eagle Point, Chippewa County, has a farm of 160 acres, upon which he pursues the combined business of horse raising, dairying, and incidentally with the latter that of feeding and fattening swine. He does not breed horses, but purchases young horse stock at 3 to 6 months old and keeps them to 3 or more years and sells them as working horses at Chippewa Falls. The farm is level, the soil is a clay loam, and has a supply of pure living water. The stock consists of 15 horses; 20 registered Jersey and 10 registered Shorthorn cattle; and 40 Poland-China swine. The calves are dropped in autumn and early winter. After being taken from the mother they are raised on skim-milk, to which ground feed is added as they grow older. The food of the cattle consists of hay, corn fodder, wheat, bran, shorts, and corn meal. All are fed liberally summer and winter, that the cows may yield all the milk of which they are capable and the young develop and mature as rapidly as possible. The herd of 16 Jerseys, which were milked last winter, averaged 300 pounds of butter each during the year, and some of them were heifers with the first calf. The butter was sold at Chippewa Falls, at 25 cents per pound. At the head of the herd is kept the best bull attainable. The horses are kept on the usual rations of hay and oats, with an occasional feed of bran or carrots. The hogs are kept on the refuse from the dairy and fattened on corn. The business has proved profitable on the whole, but Mr. Bartlett thinks the best paying branch of it is the horse raising. Has had no diseases or other obstacles to encounter.

Thomas Emerton, Cook's Valley, Chippewa County, has a farm of 300 acres, 200 of which are improved. He devotes himself mainly to breeding and feeding for beef and mutton. He has 70 head of grade Shorthorn cattle, and 200 grade Cotswold and Shropshire sheep. Besides good pasture he feeds hay, bran, shorts, and corn meal. Finds profit in the sheep, but none in the cattle at present prices. He thinks this will be a great sheep region after the wolves are exterminated and the owners of dogs are made legally responsible for their ravages.

Arthur Ford, 9 miles from Chippewa Falls, has a farm of 400 acres, where he is raising horses, cattle, sheep, and swine, using only pure-bred males for breeding purposes.

J. H. Woodruff, 6 miles from Chippewa Falls, has 420 acres, of which 300 are improved. He has a registered Jersey bull, and a herd of grade cows, and is grading up his stock.

Capt. Clark, Cadotte, Chippewa County, has an imported Percheron stallion and some grade mares, and is doing much to improve the horse stock.

Lutz Bros., Grand Rapids, Wood County, have a farm of 200 acres, valued at $20 per acre, of which 80 acres are improved. The farm is managed as an auxiliary to their brewery, the brewer's grains and other by-products furnishing a large part of the food material for the stock. The latter consists of 10 grade Percheron horses; 45 head of cattle, of which 12 are registered Jerseys and Holsteins, the rest grades; 6 sheep, and 30 Poland-China swine. The young of all classes are dropped in spring.

B. F. McMillen & Bro., Wood County, have 200 acres, mostly improved, valued at $40 per acre, upon which is a commodious barn. They have purchased grade draft and road mares and pure-bred stallions, and propose to make a business of horse breeding.

G. N. Lyman, Ripon, Green Lake County, is the proprietor of the "Spring Glen Farm" of 460 acres, all improved, and valued at $70 per acre. He has 50 Percheron horses and mares, one being a registered Percheron stallion, the rest high grades; 14 registered Red Polled cattle; 30 grade Shorthorn and Red Polls, and 275 Cotswold sheep. He works the brood mares gently; has the foals dropped in spring and suckled from four to five months. The cattle are fed corn silage and hay, with bran. He regards the silage as the best food material he ever used. The calves are dropped in the spring and are all raised, the heifers for the dairy, the best pure-bred males for stock purposes, and others for beef. The sheep when not at pasture are fed principally on clover hay, with whole oats for the ewes and corn for fattening. The business is fairly profitable. No diseases or local obstacles have been encountered. Horses bring from $150 to $200; beeves 2½ to 3 cents a pound, and sheep 4 cents a pound, both live weight.

William N. McConnell, Ripon, has a farm of 160 acres, all improved, and valued at $60 per acre. His business is mainly that of breeding registered Jersey cattle and Merino sheep, dairying, wool growing, and incidentally swine feeding. In 1876 and 1877 he purchased 6 Jersey calves for $800, and in 1882 he paid $1,000 for 2 Jersey cows. He has sold from his herd stock for which he has received $4,000, and has now 30 head of registered Jerseys. He has received in all $900 in premiums awarded at agricultural fairs above all the expenses of exhibiting. Besides his Jersey herd he has 130 Merino sheep and 15 Yorkshire swine. He raises large crops of roots, which, with hay, corn fodder, oats and corn ground together, constitute the winter feed of the Jersey herd. The calves are dropped in the fall with a view to winter dairying. The choice bull calves are sold for breeding purposes, and those not up to the standard are vealed. Only one crop of pigs is farrowed yearly, reared on the by-products of the dairy, fattened on corn, and disposed of when a year old. Whole oats are the only grain fed to the ewes. Mr. McConnell has been very successful, not having encountered any disease or other local obstacle. His market is Ripon. Registered Jersey cattle sell at an average of $175 per head; Merino sheep, $4.50 per head; hogs, 4 cents a pound, live weight.

John C. McConnell, jr., Dartford, Green Lake County, has a farm of 597 acres, all improved. His herd of 30 registered Jersey cattle were originally a part of the herd of William McConnell. He has also 10 grade Percheron horses; 575 grade Merino sheep; and 100 Poland-China swine. His methods and experience are similar to those of William McConnell.

Thomas F. McConnell, Ripon, has 700 acres, all improved, valued at $55 per acre. His stock consists of 15 grade Percheron and Hambletonian horses; 30 head of Jersey cattle, of which 7 are registered, the rest grades; 700 Merino sheep, of which 300 are registered; and 15 Yorkshire swine. He has his foals dropped in spring and calves part in spring and a part in September. Has no special system of feeding, but keeps the stock, when not at pasture, on hay, straw, oats, and corn. The business is fairly profitable.

Charles McConnell, Ripon, has a farm of 600 acres, all improved. It is stocked with 25 grade Percheron horses; 10 common or native cattle; 20 hogs; and 500 Merino sheep, of which 300 are registered, the balance grades. He feeds mainly with corn, silage, and clover hay, and finds the business profitable. He has recently joined with Thomas F. McConnell and another in purchasing a herd of 45 registered Galloway cattle.

W. A. Miller, Ripon, has 260 acres, all improved; 16 grade Percheron and Morgan horses; 500 grade Merino sheep; and 250 Poland-China swine. He works his brood mares while they are carrying their foals; has the foals dropped in spring and suckled six months. He raises two crops of pigs a year; keeps the brood sows until two years old, then fattens and sells them. He makes a yearly profit of 7 per cent. Horses sell on an average at $125 each; sheep, $2.50 per head; hogs, 3½ cents a pound, live weight.

F. G. Miller, Green Lake, Green Lake County, has 770 acres, all improved; 30 grade Percheron and Morgan horses; 70 head of grade Shorthorn cattle; and 150 Poland-China swine.

P. W. Miller, Green Lake, has 825 acres, all improved; 30 Percheron horses, one a registered stallion, the rest grades; 100 head of grade Shorthorn cattle, and 100 Poland-China swine. The methods and general experience of both the last named two are very nearly similar to those of W. A. Miller.

Thomas & Workman, Ripon, have a farm of 320 acres, all improved. Their stock consists of 40 road horses, of Hambletonian and Morgan blood; 20 head of grade Shorthorn cattle; and 15 Poland-China swine. The grain food of their horses is of oats, barley, and corn, mostly fed whole but occasionally ground, and bran, the latter being largely fed to brood mares and their sucklings. They work their brood mares; breed them to foal in spring, and suckle the foals from four to six months, according to the condition of mare and foal. The cattle are bred entirely for dairy purposes and fed cut corn fodder, hay, straw, and ground corn, rye, or barley, mixed dry with the fodder. They make a yearly profit of 7 per cent.

E. C. Smith, Markesan, Green Lake County, has a farm of 380 acres; 17 Percheron horses, of which one is a registered stallion, the rest grades; 65 grade Shorthorn cattle; and 150 Poland-China swine. He breeds for spring colts; works the brood mares before and after foaling, but confines the foals away from the mothers while they are at work. He feeds his cattle corn fodder, with the unhusked ears, and lets the hogs follow the cattle. Raises only one crop of pigs a year. Makes a profit of 5 per cent a year.

L. B. Phelps, Markesan, has a farm of 1,015 acres, all improved and in a high state of cultivation. He breeds horses, sheep, and swine, but buys young cattle, fattens them, and sells them as beeves. His stock consists of 14 horses, 90 head of

cattle, 400 grade Merino sheep, and 110 Poland-China swine. The cattle are fattened on corn and corn meal, with hay; the hogs follow them and are fed corn besides, and the sheep on hay, straw, barley, and oats. His profits are lighter than formerly, but he thinks he realizes 7 per cent a year on the capital invested.

M. Adams, Dodge County, has a farm of 160 acres, all improved. His stock includes a registered Jersey bull and 12 grade Shorthorn cows, 220 grade Merino sheep, and 17 Berkshire swine. The calves are mostly dropped in the fall, with a view to winter dairying. The cows are wintered on hay, with corn and oats ground together and mixed with bran. The sheep are wintered on clover hay and oats. The hogs have the run of clover pasture in summer, and are fattened on corn, with the by-products of the dairy. Raises only one crop of pigs yearly, which are farrowed in April, pushed to maturity as rapidly as possible, and marketed the following December. The profits are 10 per cent a year. His market is at Columbus and Waterloo. Cattle average $30 a head; sheep, $2.50 a head; hogs, 4 cents a pound, live weight.

Webster & Andrews, Danville, Dodge County, have a farm of 365 acres, all improved, valued at $50 per acre. Their specialty is the breeding of road and draft horses, pure-bred Shorthorn cattle, and Poland-China swine. Their stock consists of 34 horses, one-half of which are roadsters, the others draft; 2 imported Shorthorn bulls; 75 head of registered Shorthorn cows and young cattle, and 55 Poland-China swine. The brood mares are worked enough for exercise while in foal and kept in good condition. The foals are dropped in April and May and suckled seven months. The grain ration consists of whole oats, with a small proportion of corn, which is fed in summer only to work horses, but in winter to all. The fodder is well-cured clover hay. The cattle in summer have the run of clover and blue grass pasture, supplemented by rations of mill feed. In winter they are fed corn cut up with the stalks and hay. Breed to have calves dropped in April, and allow them to run with the mother seven months, meantime feeding them a chop of oats and corn ground together, gradually increasing the daily amount, so that their growth is not checked by weaning. Raise one crop of pigs yearly, which are farrowed in May and allowed to suck until the mother weans them. All the swine are given the run of clover pasture in summer and fed corn and slops in winter. One-half are kept to the age of 13 months and the other half to 18 months before they are disposed of. The business on the whole yields a profit of 10 per cent yearly. Horses 4 to 5 years old sell at the farm for an average of $200 each; cattle, $100 per head; hogs, 3½ cents a pound, live weight.

George Warren & Sons, Fox Lake, Dodge County, are proprietors of the "Laurel Hill Stock Farm," of 400 acres, all improved, and valued at $50 per acre. Their stock consists of 100 horses, of which 8 are registered Cleveland Bays and 50 grades of same breed, 2 registered English Shires, and the balance grade draft horses; 30 head of cattle, of which 4 are registered and the others grade Shorthorns; and 65 Poland-China swine. They maintain silos, and corn silage forms a considerable part of the food for all kinds of their stock, including swine. The principal grain food of the horses is whole oats, with occasional feeds of bran, and these, with the silage and sound timothy hay, make the horse rations. They breed for spring colts and keep the mares in medium flesh, working them enough for healthy exercise. Breed cattle both for beef and the dairy; take the calves from the cows at birth and feed them whole milk for the first four weeks, and after that warm skim-milk, to which oats and bran are gradually added. Raise two crops of pigs yearly, allowing them to run with the mother until she weans them of her own accord. Keep good brood sows four years, and in case of exceptional excellence even longer. They make an annual profit of 20 per cent on the capital invested. In 1889 they sold $14,000 worth of horses off the farm. They regard as requisites of success a good farm, well-bred stock, and personal attention to the business. Have had no diseases to contend with, the greatest obstacle being the long cold winters. They sell their horses at the farm for an average of $200 each; cattle, $40 per head; hogs, 3½ cents a pound, live weight.

James Gamble, Fox Lake, Dodge County, has a farm of 420 acres, all improved. It is stocked with 21 grade Shire and Cleveland Bay horses, 60 grade Shorthorn cattle, and 85 Poland-China swine. Keeps his brood mares in medium flesh, works them gently while in foal, and lets them suckle their foals four to five months. The horses are given their oats whole. Breeds cattle both for beef and dairy purposes, having the calves dropped in spring and taken from the dam the first week after birth, and brought up on skim milk. Raises only one crop of pigs yearly, which are farrowed in spring and suckled three months. After being weaned the pigs are fed on shorts and the slops from the dairy, fattened on corn, and turned off at 9 to 12 months of age. Finds the business somewhat profitable, but not largely

so. Has no disease or other serious obstacle, except the long cold winters. Finds a home market, at an average of $125 to $200 each for horses; 3½ cents a pound for cattle and 3¾ cents a pound for hogs, both live weight.

John Schroeder, Hartford, Washington County, has a farm of 220 acres, of which 135 are improved, and the whole is valued at $125 an acre. He has two common farm horses, 38 head of grade Shorthorn cattle, and 20 Chester White swine. He feeds his cattle corn silage, with which he mixes bran for cows and young stock, and corn meal for beeves. Has the greater part of the calves dropped in spring; takes them from the mother when 2 weeks old, and feeds them new milk two weeks, then on warm sweet skim-milk with shorts and small quantities of oil cake. Raises two crops of pigs yearly; feeds them slops from the dairy, with corn and cob meal. They are turned off when 8 to 9 months old, averaging about 200 pounds each. Breeds his sows young, but keeps extra good breeders until they are 4 years old. Finds the business profitable, but can not tell to what extent, as he has never kept any accurate accounts. Has had no local obstacles or diseases to encounter, and finds this county exceptionally healthy. His market is at Hartford. Horses bring $100 to $150 each; beeves 3½ cents per pound, live weight; cows $20 to $40 per head; hogs $3.35 per 100 pounds, live weight.

Jacob Schroeder, West Bend, Washington County, has a farm of 160 acres, valued at $60 per acre, of which 140 acres are improved. His stock consists of 4 grade Clydesdale horses; 30 Holstein cattle, partly registered and the rest high grades; 15 Chester White hogs, and 50 Shropshire sheep. Breeds and raises cattle both for beef and the dairy, raising all the calves. They are dropped mostly in spring, taken from the mother as soon as the milk is suitable for use, fed on new milk for ten days and then on sweet skim-milk, to which oatmeal is added, a little at first, but gradually increased until the milk ration is wholly withdrawn. All the cattle are fed corn silage, with hay and unthrashed oats, great care being used to keep the young stock growing right along without check. Brood sows and pigs are fed shorts and slops from the dairy, mixed and fed before it has time to ferment and sour. The last month or six weeks before they are marketed they are finished off on whole corn. Raises two crops of pigs yearly, spring and fall, and keeps brood sows until they are 3 to 4 years old. Feeds his sheep whole oats and corn with clover and timothy hay. The lambs come from the middle of April to the first of May. Finds the business profitable, but is unable to state the amount of profit. Horses sell at $100 to $125 each; cattle 2½ to 3 cents per pound, and hogs $3.35 per 100 pounds, both live weight.

William Hale, Mauston, Juneau County, has a farm of 220 acres, of which 140 are improved. His farm stock consists of 7 grade Clydesdale horses; 25 grade Shorthorn cattle; 23 Poland-China hogs; and 23 Cotswold and Shropshire sheep. Pastures his horses in summer, and feeds them oats and straw in winter. Breeds for spring colts. His cattle, when not at pasture, are fed tame hay, corn fodder, with oats and corn ground together. Has the calves dropped in autumn for winter dairying. Raises two crops of pigs a year, the first litter coming about the middle of March and the second in September. The spring pigs are fattened and marketed in December, the latter ones are kept ten months; the former return the most profit. All the swine stock have the run of clover pasture in summer. The sheep are kept on pasture during the summer and fed hay and oats in winter. The lambs come in spring. Estimates his yearly profits at 10 per cent. Has had no diseases or local obstacles to contend with. Horses bring from $100 to $200 each; beeves 2 to 2½ cents a pound, hogs 4 cents a pound, and sheep 3 cents a pound, all live weight.

Samuel W. Smith, Juneau County, has a farm 3 miles from Mauston, containing 360 acres, of which 280 acres are under cultivation. He has 20 horses, grade Percheron, Clydesdale, and Hambletonian; 30 grade Shorthorn cattle; 25 Poland-China hogs; and 30 Oxford-Down sheep. Feeds the horses, when not at pasture, on whole oats and hay. Breeds for spring colts. Keeps the brood mares in fair, healthy condition and allows them to suckle the foals four months. Winters his cattle on hay and straw, with oats and corn ground together, bran and shorts. Breeds for fall and winter calves, and raises the best heifers for dairy purposes and other calves for beef. Feeds them during the first four weeks of their lives on new milk as it is drawn from the cow, and after that on skim-milk and oats. Feeds the swine principally with shorts, potatoes, and the slops from the house. Raises two crops of pigs a year, spring and fall, disposing of the former just before winter and keeping the latter longer. Winters the sheep on oats with clover and timothy hay. Lambs are weaned in May. Makes a profit as high in some years as 25 per cent, and in the unfavorable year, 1889, it amounted to 10 per cent. His market is at Mauston. Horses average $150 each; cattle 2½ cents a pound, and hogs 4 cents a pound, live weight; sheep $5 per head.

A. C. Parkinson, Columbus, Columbia County, has a farm of 50 acres, upon which he keeps 45 head of horses. One is a registered Clydesdale, one registered English Shire, and some are excellent roadsters. He feeds whole oats morning and noon, and ground oats with bran in the evening, and in winter some corn on the ear, and also carrots three times a week, with tame and wild hay. The colts and yearlings are kept mainly on clover hay. He breeds his mares with a view of having the foals come in May. Keeps the mares in medium flesh, not too lean, as that would be weakening, nor so fat as to imperil both foal and dam. Works them sufficiently for healthy exercise, and seeks to have them two weeks on grass before they foal. Mr. Parkison makes a yearly profit of 10 per cent on the capital invested. Has had no diseases to encounter. He regards it a serious mistake for farmers to breed to any but the best pure-bred sires. Market, Columbus. Prices depend entirely upon the horse, ranging from $200 to $2,000 each.

E. Fairbanks, Columbus, Columbia County, has a farm of 200 acres, all improved; 20 grade French draft horses, 18 high-grade Shorthorn cattle, and 150 Merino sheep. Feeds his horses whole oats with an occasional bran mash. Breeds for spring colts. Keeps the mares in fair condition, and works them enough for healthy exercise. Has the foals suckled five to six months, teaching them meanwhile to eat grain. Keeps the cattle on pasture in summer, with extra feeds of bran, and winters them on hay, corn meal, and bran. Calves come in February and March, and are raised for dairy and beef. Winters his sheep on clover hay, whole oats and corn, and has the lambs yeaned about the first of May. Finds the business profitable, to the extent of 10 per cent a year. The greatest obstacle is the long cold winters, involving the necessity of expensive barns and heavy grain feed. Market, Milwaukee and Chicago. Horses bring $100 to $200 each; cattle average $50 and sheep $4 per head.

J. W. Leffingwell, Columbus, Columbia County, has a farm of 470 acres, all improved, valued at $50 per acre. He has excellent barns, sufficient to shelter all his stock, and a half-mile track on the farm. He has 60 horses, of which 5 are trotting-bred stallions, the balance road mares and geldings. He feeds whole oats, with a ration of bran three times a week; and for fodder, timothy, clover, and wild hay. Has the foals come in March and April. Finds that the brood mares which are lightly worked have the best success. Keeps all brood mares in good flesh, and allows them to suckle their foals five months, the youngsters being meanwhile accustomed to eating grain, so that at weaning they are kept growing right along. Thinks the business affords a profit of 7 per cent a year on the capital invested. Long cold winters are the most serious obstacles encountered. Market, Columbus. Prices range according to the quality of the horse, from $125 as high as $5,000, the latter price being obtained for a trotter of extraordinary speed.

L. S. Wright, Fall River, Columbia County, has a farm of 200 acres, all improved. His stock includes 15 grade Percheron horses, 25 grade Shorthorn cattle, 40 Poland-China hogs, and 125 grade Merino sheep. Feeds his horses whole oats and hay, with occasional feeds of bran and corn. Breeds for spring foals, and works the brood mares, keeping them in medium flesh. Feeds the cattle corn and stalks cut up together, mixed with a small addition of bran. Breeds for spring calves, which he raises for beef. Gives his hogs the run of a clover pasture during summer. Feeds with corn and slops and fattens on corn. Raises only one crop of pigs yearly, which are farrowed as early in spring as the season is warm enough to afford safety. Breeds mostly from young sows, keeping none for a second litter except some extraordinary breeders. Feeds his sheep whole oats, clover hay, and corn-stalks, and has the lambs come in April. He finds no profit in either grain or stock while prevailing prices are as low as they were last year.

V. F. Brossard, Fall River, Columbia County, has a farm of 240 acres, all improved. On it he keeps 12 grade Clydesdale horses; 40 grade Shorthorn cattle; 200 grade Merino sheep, and 40 Poland-China hogs. The stable feed of the horses consists of oats, whole or ground together with corn, and hay. Breeds for both spring and fall foals, and is thereby enabled to secure more work from his brood mares, which he keeps in good flesh and condition. Has a part of his calves dropped in March and others in September. After the calf is three days old it is kept away from its mother and fed at first with new milk, which is soon replaced by sweet skim milk fed warm, with an admixture of flaxseed cooked to a thin gruel. Rations of whole oats are added as soon as the young animal will eat them, a few at first and gradually increased until it can maintain its growth without check on oats and hay or pasture alone. The cows and young stock are kept through the winter on hay, cornstalks and chop of corn and oats ground together; and fattening steers are fed whole corn. Gives his hogs the run of clover pasture through the summer, to which are added slops and light feeds of corn. Raises quite large crops of roots, which are fed to all the stock. Raises two crops of pigs yearly, which are weaned

when 6 weeks old, kept growing right along, fattened and turned off for slaughter at 18 months old. Feeds the sheep hay and dry cornstalks with some roots and grains, then on whole corn and oats. The lambs are yeaned in May and weaned when 4 months old. Makes a profit, one year with another, of 15 per cent on the capital. The most serious obstacles are the long winters and occasional outbreaks of hog cholera. His market is at Columbus and Little Falls. Horses bring $100 to $200 each; cattle 2½ cents per pound, hogs 3½ cents per pound, and sheep 4 cents per pound, all live weight.

THE NORTHERN COUNTIES.

The northern section of Wisconsin, embracing about two-fifths of its area, was originally covered by a heavy forest growth, mainly of pine, with an occasional intermixture of deciduous trees. Though a ceaseless onslaught upon this forest growth has been maintained for years, much of it still remains, and lumbering is the leading industry, save in those limited parts where rich and productive iron mines are worked. Throughout the region are townships containing farms more or less cleared, but they are generally small, and very few are yet sufficiently improved to admit of modern methods of farming. To clear away the timber, remove the stumps, and prepare the land for farming by the aid of improved implements is a work involving much labor, cost, and time. The settlers in this region are mostly immigrants from Europe, whose original capital was mainly their own hardy muscles, industry, and frugality. To carve their farms out of this wooded wilderness, meanwhile earning a subsistence for themselves and their families, was the work of a generation, and it will yet be many years before the breeding of pedigreed stock to any large extent may be expected here. In a few places wealthy lumbermen and mill owners have introduced draft stallions with a view of breeding and raising heavy horses for use in their business. With this rare exception the animal industries of this region are yet in an undeveloped state.

CONCLUSION.

On the whole the animal industries of Wisconsin may be regarded as being in an advanced and hopeful condition. The present and a few preceding years have been marked by unusual depression in all agricultural pursuits. Yet even in that period all the animal industries of Wisconsin save beef-producing have continued to advance in magnitude and improve in methods. Much of this is due to the salubrious climate and fertile soil, while the influence of the farmers' institutes and other means of agricultural education is seen in the improved methods and the general increase of intelligent effort. In fact, nearly if not all the reports of success come from those who have kept up with the march of improvement. Those who have used pure-bred sires for all classes of stock; maintained silos and fed silage in judicious connection with other food materials; kept their swine in summer on clover pastures, supplemented by food suitable to promote growth rather than fat; reared their calves on skim-milk prop-

erly reënforced; and in other ways intelligently pursued modern and advanced systems, are enabled to report yearly balances on the right side of the account. On the other hand, those who have jogged along with scrub stock and haphazard ways report discouraging losses. Every farm visited was an object lesson, and every experience related, whether of success or loss, is full of instruction.

THE CHICAGO HORSE SHOW OF 1890.

By GEORGE A. MARTIN.

The second annual exhibit of the American Horse Show Association of Chicago was held in the Exposition Building at Chicago from the first to the eighth day of November, inclusive, 1890. For several years previous to 1889 an annual horse show was held in conjunction with each recurring fat-stock show at Chicago, under the auspices of the Illinois State Board of Agriculture. But the equine department of the combined show attained such magnitude and importance that it was decided to provide for it as an independent exhibition. In 1888 the American Horse Show Association was organized, its stockholders being among the foremost business men of Chicago and the adjacent country. Its first exhibition was held in 1889, and the second is the one under present consideration. Compared with the horse show of the previous year, there was a decided falling off, both in the number of entries and in the attendance of spectators. The entries numbered 819 in all, of which 254 were of gentlemen's turnouts, including vehicles, etc., saddle horses, hunters, mares, and geldings kept for private use, in harness and under saddle. The remaining 555 entries, of strictly breeding stock, comprised mainly coach, hackney, and heavy draft horses and ponies. No classes were provided for thoroughbreds, and the show of trotting-bred horses was very limited in numbers. The average quality of the coach and draft horses was notably good. Details of the exhibits and the awards are given below.

COACH HORSES.

French Coach.—In this lot sixty-five animals were entered by the following exhibitors: W. L. Ellwood, De Kalb, Ill.; John Virgin, Fairbury, Ill.; A. E. Brown, Delavan, Wis.; Singmaster Brothers, Keota, Iowa; Bowles, Hadden & Co., Janesville, Wis.; Rockdale Farm, Lake Forest, Ill.; Leonard Johnson, Northfield, Minn. Mr. S. D. Thompson, of Chicago, was the judge.

In the class for aged stallions there were eleven entries as follows: By W. L. Ellwood: Intrepide 645, brown, 4 years old; by Agnadel, dam Newton by Newton. Imperial 600, dark bay, 4 years old; by Utrecht, dam Rosette by Dragon. Isly 280, black, 4 years; by Calas, dam Negrette by Phare. Handsome 369, dark bay, 5 years old; by Aristocrat, dam La Petite by Newton. Bosphore 310, dark bay; by Bosphore, dam Feu de Joie by Seducteur. Intrepide 386, brown, 4 years old; by Regret, dam Marzette by Sir Edwin Landseer. By John Virgin: Agnadel II 693, bay, 4 years; by Agnadel, dam Volante by Jarnac. By A. E. Brown: Fagat, bay. By Singmaster Bros: Gamin 229, bay. By Bowles, Hadden & Co.: Interessant, bay. By Rockdale Farm: Elvin, bay; by Usquebac, dam Malvina. The contest for the first prize was very close between Intrepide 645 and Gamin. The latter is a large, handsome horse of imposing appearance, and winner of the first prize at the Iowa State Fair. The brown has not the size and weight of his rival, but is

finely finished and perfect in action. At length the blue ribbon was fastened to Intrepide and the red to Gamin. Imperial was awarded the third prize, and Isly commended.

Of stallions 3 years old there were eighteen entries, and the following seventeen were present. By W. L. Elwood: Grand Seigneur 605, dark bay; by Acquila, dam Bosnie by Conquerant. Neptune 627, bay; by Elbourg, dam Lisette by Gardez Vous. Jourdan 607, dark bay; by Qu'en Pensez Vous, dam Rosette by Seduisant. Java 634, dark brown; by Vautrain, dam Rosnette by Rosny. Labin 639, bay; by Siroc, dam Parfaite by Nectar. Jaffa 110 bay; by Hector. Jadis 576, bay; sire Eclaireur, dam M'lle de Cricqueville by Interprete. Junot 582, bay; by Espoir, dam Mentor by Telemaque. Joyeux 633, bay; by Cherbourg, dam Virginia by Omega. By John Virgin: Trouvere II 698, brown; by Trouvere, dam Papillonne by Quia. Union 699, black; by Union Jack, dam Cheri by Josaphat. Young Aristocrate 700, bay; by Aristocrate, dam Tempete by Extase. By Singmaster Bros.: Jaques 707, brown bay. By Bowles, Hadden & Co.: Janson 740, chestnut; by Banyuls, dam Parquette by Uzerche. By Leonard Johnson: Captain 651, brown; by Utrecht, dam Cocotte by Seduisant. Leonard 630, bay; by Sorcier, dam Coquette by Ignore. Delaware 648, bay; by Delaware, dam Julie by Conquerant. It was no easy task to properly place the awards among such a large and remarkably fine class of young stallions, most of which had already won high honors in other exhibitions in this country or in France. After a long and careful inspection five were selected, and finally the awards were made to them as follows: First, to Grand Seigneur; second, to Captain; third, to Janson; Neptune was very highly commended, and Young Aristocrate was commended.

The class of stallions 2 years old comprised only five entries, as follows: By W. L. Ellwood: Karical 586, black; by Colporteur, dam Coquette by Brodick. Kava 589, dark bay; by Acquila, dam Anisette by Irlandais. Saturn 612, bay; by Cherbourg, dam Jacqueline by Jactator. Kedive 632, chestnut; by Fataliste, dam Adolphus by Urus. By Leonard Johnson: Voltaire 302; by Acquila, dam Perle. The first award was to Kedive, second to Kava, third to Saturn. Voltaire was afterwards given first prize in class for American bred stallions.

Only three yearling stallions were shown, of which W. L. Ellwood entered Lassay 623, brown; by Coq-a-l'Ane, dam M'lle de Lassay; and Loriot 622, bay: by Favori, dam Frilius. John Virgin's entry was Sultan 697, sorrel; by Kapirat, dam Favorite by Regenerateur. First was awarded to Loriot, second to Sultan, third to Lassay.

In the classes for females, W. L. Ellwood was the sole exhibitor. The awards were as follows: Mares 4 years old or over: First to Isoline 293, bay; by Stade, dam Urgent by Norman; second to Hermine 307, bay; by Rivoli, dam Australienne by Quidet; third to Esperance 618, bay; by Baptiste Lemore. Mares 3 years old: First to Jean 292, bay, by Acquilla, dam Floride by Hippomene; second to Javelotte 614, dark bay, sire Apis, dam Ebene by Stade. Mares 2 years old: First to Cedrillonette 615, bay, by St. Rigoner, dam Eclantant by Racolend; second to Kirch 610, bay, by Reussi, dam Sarah by Conquerant; third to Lydian Monarch 617, brown, by Echo, dam Fanfare. Yearling mares: First to Pollox 616, brown, by Don Quichotte, dam Neustria by Normand; second to La Valliere 621, brown, by Hardy, dam Sultane by Quinola; third to Mermaid 342, brown, by Acquila, dam Floride by Hippomene. Jean and Mermaid were awarded the prize for two colts under 4 years of age, the produce of one mare.

German Coach horses.—The Hanoverian and Oldenburg horses of Germany were until recently little known in this country, save to German-Americans who have seen them in the Fatherland. Within the last three or four years they have been brought here by enterprising importers, and have received ready recognition as a valuable and useful addition to American horse stock. In form, action, and general style the German coach horse is somewhat similar to the Hackney and French Coacher, but larger and heavier. The breed was well represented at the Chicago Horse Show, both in numbers and quality. The exhibitors were: Oltmanns Bros., Watseka, Ill.; Bowles, Hadden & Co., Janesville, Wis.; Springer & Willard, Oskaloosa, Iowa; Wabash Importing Co., Wabash, Ind.; Huisiga Bros., Monticello, Ill.; Singmaster Bros., Keota, Iowa. Mr. S. D. Thompson was the judge.

Eight notably fine animals were shown in the class for aged stallions. The awards were as follows: First to Oltmanns Bros., on Lucas III, brown; second to Springer & Willard, on Solon, black; third, Bowles, Hadden & Co., on Hannibal, brown; highly commended Oltmanns Bros.' Graf Edward; very highly commended Huisaga Bros.' King William.

Stallions 3 years old appeared in even larger numbers than the senior class, and the honors were awarded them as follows: First to Oltmanns Bros., on Cæsar, bay; second to same, on Wuterish; third to Bowles, Hadden & Co., on Pluto; very highly commended Singmaster Bros.' Cato, black.

The display of stallions 2 years old was uncommonly fine, no less than nine youngsters appearing in the show ring and every one a good one. The first prize

was awarded to Springer & Willard, on Tilly, bay; second to Oltmanns Bros., on Jupiter, bay; third to same, on Wrangel, brown; another Tilly, black, shown by Oltmanns Bros., was very highly commended. The only yearling stallion shown was by Oltmanns Bros., whose Hussar, a handsome black colt, was worthily awarded the first prize.

In the classes for females only six mares were shown, two each in three classes, and all by Oltmanns Bros. The awards were as follows: Aged mares, first to Anna, sorrel; second to Elsie, bay. Yearling mares, first to Watsekaspraud, bay; second to Queen. American bred mares 3 years old and over, first to Mollie, bay; second to Nellie, bay. Special prize for American bred stallion 2 years old and over, first to Oltmanns Bros., on Lucas IV.

Cleveland Bay.—There was a large and remarkably fine exhibit of these English coach horses. In England the Cleveland Bay and the Yorkshire Coach horse are bred separately, each class having a record society and a stud book. But in the United States no such distinction is made. The American Cleveland Bay Breeders' Association admits to registry stallions having five and mares having four successive crosses by sires recorded in either the Cleveland Bay or the Yorkshire Coach horse stud book of Great Britain, or the Cleveland Bay stud book of America. Many of the animals shown in the Cleveland Bay classes possessed an infusion of thoroughbred blood which would have marked them as Yorkshire Coach horses in England. The following were the exhibitors of Cleveland Bays: Stericker Bros., Springfield, Ill.; George E. Brown, Aurora, Ill.; Cleveland Bay Horse Company, Paw Paw, Mich.; Door Prairie Live Stock Association, Door Village, Ind.; Banks & Closser, La Porte, Ind.; Ezra Brackett, South Monterey, Mich. Mr. S. D. Thompson acted as judge.

Of aged stallions only two were entered: Stricker Bros.' Lord Chief Justice 472, aged 4 years, by Competitor (101), dam by The Admiral (471); and George E. Brown's Gloster 26, aged 9 years, by British Splendour (376), dam Jolly by Wonderful Boy (534). The first prize was awarded to Lord Chief Justice, which horse had already taken first honors at the Illinois State Fair for three successive years as 2-year-old, 3-year-old and 4-year-old; Gloster took second.

In the class for stallions 3 years old, six horses were entered, all of very superior merit. Two were of such conspicuous excellence that it was difficult to choose between them. They were Stericker Bros.' High Cliffe 555 (841), dark bay, sire Mr. Streeter by Fidius Dius, dam by Sportsman; and George E. Brown's Eclat 486, bay, sire Lord Stanfield 635, dam Lady in Waiting 384, by Barnaby. The former had sharp, buoyant action, resembling that of a Hackney rather than the long sweeping stride of Eclat. After very mature consideration High Cliffe was awarded first and Eclat second. The white rosette, the badge of the third prize, was fastened on the Cleveland Bay Horse Company's Earl Cleveland 524, sire young Recruit 2575, dam Adelaide 117. This is the fifth time that High Cliffe has been exhibited, and never without taking high honors. In 1889 he was first at the Chicago Horse Show; in 1890 first and sweepstakes at Rockford, Illinois; first at Illinois State Fair, and first at St. Louis. The other horses entered in this class were as follows: By Stericker Bros., Perchance (1000), sire Fidius Dius (107), dam Bonnie Bess (132) by Salesman; by Door Prairie Live Stock Association, Oakwood Prince 282, sire Selby 91, dam Princess 34, by Liberal (255); by George E. Brown, Escort 339, sire Gloster 26, dam Undine 4, by County King.

Stallions 2 years old. In this class there were ten entries, but only eight of the animals were present in the show ring. The first prize was awarded to George E. Brown's Hapsburg 509, sire Gloster 26, dam Trinket 5, by County King (110); second to Stericker Bros.' Sequah 753, sire The Gentleman (1210), dam by Splendour (446); third to the same exhibitors' Prince Henry 709 (1442), sire Luck's All (1114), dam Victoria by Favorite. The other horses exhibited were as follows: George E. Brown's Rillington Warrior 719 (1028), sire Sportsman, jr., dam by Emperor (387); Stericker Bros.' Ingmanthorpe Baron 754 (1362), sire Baron Rothsay (981), dam by Stonewall Jackson (457); Door Prairie Live Stock Association's Thornburg V 534, sire Fidius Dius (107), dam Thornburgh Fancy by Wonderful Lad (914).

Of yearling stallions five were brought into the show ring. The first prize was awarded to Stericker Bros.' Patrician 708, sire Beverly (986), dam Dewdrop 4, by Lord Penzance II (272). As a weanling in 1889 and a yearling in 1890 he took first at Sangamon County Fair and Illinois State Fair. The second prize went to George E. Brown's Conquest, by Fidius Dius (1592), dam Faithful Lady by Caustron 79; and third to the Cleveland Bay Horse Company's Prince of Wales II 740, sire Prince of Wales 371, dam by Cyrus 113. In England this colt had taken the sweepstakes gold medal both in 1889 and 1890, at the Yorkshire show. The other colts shown were the last-named exhibitor's Laurel Chief 610, sire Chief Secretary 590, dam Lady Limington 30; and Banks & Closser's White's Progress 682, sire Captain Sikes, dam by Emperor. This colt took the first prize of his class at the Indiana State Fair, 1890.

Of mares there were five in the aged class; of fillies one 3 years old, two 2 years old, and five yearlings. The first prize for aged mares went without hesitation to Stericker Bros.' Dewdrop 4, aged 4 years, by Lord Penzance II 272, dam by Normandie; the second to the Cleveland Bay Horse Company's Lady Sessions 118, by Dalesman, dam Adelaide 117; the third to the same exhibitors' Adelaide 117, by Luck's All (189), dam by Anglo-Saxon. George E. Brown's Jewel 5, by Cock Robin 1, dam by Marion 2, was highly commended; and Stericker's Snowdrop 5, by Lord Penzance II 272, was commended. George E. Brown's Portia 95, by Sportsman (299), was the only 3-year-old mare shown, and well worthy of the first prize, which was awarded to her. Of fillies 2 years old, the winner of first honors was the Cleveland Bay Horse Company's Hilda 183, by Young Recruit (675), dam Stella of Commondale 259. The second went to George E. Brown's Amelia 114, by Gloster 26, dam Maud by Emperor. The five yearling fillies were all winners. The first prize was unhesitatingly awarded to the Cleveland Bay Horse Company's Queen Bee 184, by Duke of Hamilton 265, dam Stella of Commondale 259. This filly was the winner of the first prize at Michigan State Fairs in 1889 and 1890, and also at Detroit fair in 1890. The second went to Banks & Closser's Empress III 171, (332), sire Ingmanthorpe (845), dam by Newton, 216. The third was taken by Stericker Bros.' Princess Ida, by Royal Stuart 146, dam Maritana 74, by Competitor 101. Ezra Brackett's filly Beauty 159, was commended, and Bell 158, was highly commended.

The first prize for two colts of either sex, the produce of one mare, was awarded to the Cleveland Bay Horse Company, on Stella of Commondale's Hilda and Queen Bee. The second was taken by George E. Brown on Undine's Escort and a filly foal. The first for American bred mare 2 years old and over was awarded to Stericker Bros., on Dewdrop; second to Cleveland Bay Horse Company's Lady Sessions; third to George E. Brown's Jewel. For stallion with three of his get, the prize was won by George E. Brown, on Gloster, with Escort, Hapsburg, and another. American bred stallion—first to Escort by Gloster, second to Prince Laurel, third to Oakwood Prince.

Hackneys.—These natty and high-stepping horses were represented by excellence of quality rather than by large numbers. The exhibitors were: W. E. Truman, Bushnell, Ill.; McDowell Bros., Fairbury, Ill.; Stericker Bros., Springfield, Ill.; Burgess Bros., Wenona, Ill.; Galbraith Bros., Janesville, Wis.; Moorehouse & Pepper, Toronto, Canada; Bowles, Hadden & Co., Janesville, Wis.

Five superb animals appeared in the class for aged stallions. There were as follows: Burgess Bros.' Star of the Ferry, black; Stericker Bros.' Saxlingham Fireaway, brown; Truman's Majestic, bay; Bowles, Hadden & Co.'s Pretender 30; and McDowell Bros.' Royal Mail II, red roan. The first, second, and third prizes were awarded in the order named above; Pretender was highly commended, and Royal Mail II was commended.

Only two stallions 3 years old were shown—Truman's Advance, brown, which took first prize; and Truman's Nice George, brown, second.

Five colts appeared in the ring for stallions 2 years old. The first prize went to Stericker Bros.' Sidney; second to the same exhibitor's Voltaire; and third to Truman's Fireaway. Truman's Nice Victor was highly commended. The other animal in this class was McDowell Bros.' McDowell (2574). No yearling colts were shown. No entries were made in the classes for females except that for aged mares and for American bred mares. Of aged mares, Truman's Elizabeth took first, Truman's Mary second; Moorehouse & Pepper's Variety III third; Bowles, Hadden & Co.'s Pretender III was very highly commended. Galbraith Bros.' Dresden China, 6 years old, was passed over, though she had received fourteen first and three second prizes in 1890. For American bred mares, Moorehouse & Pepper took first and second on Nellie and Variety III.

Coach horses other than French, German, and English.—Stallion 4 years old and over, Blair Bros. took first on Monte Cristo; 3 years, first to Oltmanns Bros. on American Boy; 2 years and under 3, same exhibitors took first on Lucas IV, a son of their prize-winning Lucas III; mare 4 years old or over, Moorehouse & Pepper's Nellie, first, same exhibitors' Lucy, second; mares 3 years, first to W. L. Ellwood on Denzy E; 2 years, first to Oltmanns Bros. on Mollie; second to same on Nellie; yearling fillies, first to Oltmanns Bros. on Tony; second to same on Victoria; two colts, the produce of one mare, first to Oltmanns Bros. on Nelly and Victoria.

Sweepstakes for Coach stallion of any breed.—The special prize—plate worth $100, offered by the Palmer House—called out a notably large and fine display of coach stallions. Many of the prize-winners of the various classes were brought into the show ring, and after a careful examination the plate was awarded to W. L. Ellwood's Intrepide; second prize to Singmaster Bros. on Gamin; third to Stericker Bros. on High Cliffe.

DRAFT HORSES.

Clydesdales.—The exhibit of Clydesdales was undoubtedly the largest and finest ever brought together in the United States. The younger classes were particularly notable. The entries were made by the following exhibitors: Galbraith Bros., Janesville, Wis.; Robert Holloway, Alexis, Ill.; R. B. Ogilvie, Madison, Wis.; Singmaster Bros., Keota, Iowa; N. P. Clarke, St. Cloud, Minn.; Abner Strawn, Ottawa, Ill.; Door Prairie Live Stock Association, Door Village, Ind. Edward W. Charlton, of Duncrieff, Ontario, was the judge.

The first prize for aged stallions was awarded without much hesitation to R. B. Ogilvie's invincible McQueen 3513 (5200), bay, 5 years old; sire MacGregor (1487) by Darnley (222), dam Bet of Bellamack (5506) by Lothian Tom (1211). For second prize the contest lay between Galbraith Bros'. Go Ahead and N. P. Clarke's MacKay. The former is 5 years old, sire St. Lawrence (3220), dam Haughhead Bell (288) by Young Campsie (929). He was a prize-winner in Scotland; second at the Chicago Horse Show in 1888; third at the same show in 1889. MacKay 4525 (5194), bay, 5 years old, was sired by MacGregor and is therefore half brother to McQueen, dam Nelly (702) by Dandy Jim (221). This was his first appearance in an American show ring. After careful inspection the red rosette was fixed on MacKay and Go Ahead awarded third. R. B. Ogilvie's Marmion (6074), bay, 4 years old, sire Lord Marmion (2620), dam Jess of Newton, was highly commended. N. P. Clarke's Senator 4531 (7248), brown, 4 years, sire Scotch Pearl (2949), dam Bessie (1498) by Newstead (559), was commended. The other horses shown in this class were as follows: By Singmaster Bros.; King of the Topsmans 1119 (2205), chestnut, aged 10 years. By Galbraith Bros.: Laird of Ladyton (5131), bay, age 5 years; sire Darnley (222), dam Nell of Ladyton (4555) by Old Times (579). He was a prize-winner in Scotland. Rawlinson (4664), brown, age 6 years; sire Garnett Cross (1662), dam Ann of High Ersock (1189) by Admiral (5). This horse was also a winner in Scotland. By N. P. Clarke: Senator 4531 (7248), brown, aged 4 years; sire Scotch Pearl (2949), dam Bessie (1498) by Newstead (559). First at Iowa State fair, 1890, and sweepstakes at Minnesota State fair same year.

In the class of stallions 3 years old a somewhat sensational interest was given by the presence of Macara, the horse which won the first of his class and champion honors in the Royal Show, Plymouth, England, 1890, beating the famous Prince of Kyle. Macara (7991), brown, was sired by MacGregor (1487), dam Violet of Ellerton (5362) by Tam O'Shanter (857). He was awarded the first prize. The second went to Galbraith Bros.' Columba 4543 (6621), dark bay; sire Young Duke of Hamilton (4122), dam Rosie of Grougfoot (7605) by Sportsman (817). He was first at the American Horse Show, Chicago, in 1889, after having taken four first and a champion prize in Scotland. The third was awarded to N. P. Clarke's Topsman 5275, bay; sire MacGregor (1487), dam Topsy (8858) by Young Pride of Scotland (1368). The choice for third prize was strongly contested by Galbraith Bros.' Unco Guid; sire Knight of Ellerslie (3737) by Prince of Wales (673); dam by Young Champion (934). The horse was highly commended. Commended: Prince Ferdinand; sire Prince of Wales (673), dam Heather Bell II (3138) by Doncaster (238).

Of stallions 2 years old only five were brought into the ring out of a large list of entries. The awards were as follows: First to N. P. Clarke, on Second Choice 8244, bay; sire Chastler (4291), dam Jean by St. Mingo. Second to R. B. Ogilvie, on McRobbie, bay; sire MacGregor (1487), dam Sally of Gorslingwood by Matchem. Third to Robert Holloway, on Homer (5015), brown; sire McCammon (3818), dam Gipsey (4422) by British Empire (1599). (Second as a yearling at Illinois State Fair, 1889, and first at same fair 1890.) Highly commended: Abner Strawn's Prince of Clyde II 5008, bay; sire Prince of Clyde (5259), dam Bell (4761) by Farmer Boy (2097). (Third at American Horse Show, Chicago, 1889; first at St. Louis, 1890.) Commended: Door Prairie Live Stock Association's Rothesay 4009, bay; sire Duke of Rothesay (4974), dam Poppy by Young Pointsman (2529).

Of the six yearling stallions shown four were American bred. The first prize was awarded to Col. Holloway's Prince of Quality, by Cedric (1087), dam Jenny Roy (2248) by Darnley (222). (This colt took first of his class at Illinois State Fair, 1890.) Second to R. B. Ogilvie's McHappy, brown; by McQueen (5200), dam by Lord Lyon. Third to Col. Holloway's Handsome Prince, bay; by Cedric (1087), dam Handsome by Farmer Boy (2097). (Since sold to Parker Bros., Wyoming.) The other colts of this class were: Col. Holloway's Prince Regnant, brown; by Cedric (1087), dam Lady Mary (780) by Young Lord Lyon (994). Galbraith Bros.' Treasurer (5537), bay; by Lord Ailsa (5974), dam Kilmory Maid (8707) by MacLean (2991). N. P. Clarke's McCrummond (5266), bay; by MacGregor, dam Lily of Highbourg (2725) by Strathclyde (1538).

For aged mares the first honors were taken by N. P. Clarke's Dora McGregor

2951, brown; sire MacGregor (1487), dam Dora (499) by Gleniffer (361). Second to R. B. Ogilvie's Lizzie; sire His Royal Highness, dam Maggie. (Winner of two first and a third prize in Scotland.) Third to Col. Holloway's May Belle (7381), bay; sire Craigie (2039), dam Bell (1335) by Crown Prince (207). (First at International Fair, Buffalo, N. Y., 1889, and several Canadian fairs; and second at Illinois State Fair, 1890.) Mr. Clarke also exhibited Judy 3956, bay, 4 years old; sire MacGregor (1487), dam Nelly (702) by Dandy Jim (221). Only three mares were entered in the class for 3-year-olds, and the awards were as follows: First to Robert Holloway's St. Cuthbert's Maggie (3427), brown; sire St. Cuthbert (3219), dam Maggie Mar (640) by Grand Turk (1148). (First in her class at Illinois State Fair, 1888, 1889, and 1890, and at Chicago in 1889.) Second to N. P. Clarke on Beauty 5563, brown; sire MacNeilage (2992), dam Mammie of Fortacres (2983) by Prince David (643). Third to same exhibitors on Queen of Meadowlawn 5286, bay; sire MacPherson (3825) by MacGregor (1487), dam Polly Craig by Darnley (222). In the class for 2-year-old fillies Robert Holloway was without competition. The awards were made to his three as follows: First, to Match of Whitefield 5019, bay; sire Henry Erwin of Drumflower (4440) by MacGregor (1487), dam Belle of Whitefield (2620) by Lord Lyon (489). (Third at Illinois State Fair, 1890.) Second, to Minuet 4095, bay; sire Cedric (1087), dam Minnie Tarbroech (2986) by Tarbroech (2489). (Second at Illinois State Fair, 1889; first at same, 1890.) Third to Cherry Sweet 4092, bay; sire Cedric (1087), dam Cherry Ripe 2023 by Sovereign (1535). The class for yearling fillies was strong both in numbers and quality, no less than nine promising young things being led into the show ring. The special attractions were R. B. Ogilvie's Lass o'Gowrie and Lass o'Gowrie III, both sired by McQueen, the former out of Farwell by Prince Charlie, the second out of Queen of Lyons by Security. They were so nearly alike that it was only after mature inspection that the first prize was given to the former and the second to the latter. Third went to N. P. Clarke's Victoria MacGregor 5289, bay; sire MacGregor (1487), dam Jess (1236) by Prince of Kelvin (656). (Third at Kilmarnock, Scotland.) Highly commended: Same exhibitors' Lady Muir 5562, bay; sire Darnley King (2717), dam Gip (8910) by Glenamond (2128). Commended: Robert Holloway's Myrtle, bay; sire Cedric (1087), dam Lady Mab (1578) by Lord Colin Campbell (1475). (First at Illinois State Fair, 1890.)

In the class for mares with sucking colts, first was awarded to N. P. Clarke on Lillie MacGregor and foal by Stanley Prince; second to Robert Holloway on Jennie Roy with Jennie June, by Cedric; third to R. B. Ogilvie on Bessie Wilson with a colt named Roxbury by McQueen.

The three entries of two colts under 4 years old, the produce of one mare, were all made by Robert Holloway, and the awards were as follows: First to Cherry Sweet and Prince Charming, out of Cherry Ripe, both by Cedric; second to St. Cuthbert's Maggie and Maggie Cedric, out of Maggie Mar; third, to Jennie Dear and Prince of Quality, out of Jeanie Roy.

The class for stallion showing three of his colts out of different dams brought out a fine display. The first honors were readily awarded to R. B. Ogilvie on McQueen and his yearlings McHappy, Lass o'Gowrie and Lass o'Gowrie III; second to N. P. Clarke on Chastler with Kyles of Bute, Second Choice, and Ascog Chief.

The special prizes for American-bred stallion were awarded as follows: First to R. B. Ogilvie's Earl of Rockford 4186, gray; sire Dandy Lyon 2928 (2714), dam Beauty of Rockford 2252, aged 2 years, by Lord Balfour (2240); second to Abner Strawn's Prince of Clyde II 5008, aged 2 years, bay; sire Prince of Clyde (5259), dam Bell 4761, by Farmer's Boy (2097), (third at Chicago, 1889, first at St. Louis, 1890); third to Rothesay, 4009, previously described.

On American bred mares, Robert Holloway took first on St. Cuthbert's Maggie, and second on Minuet.

The special prizes offered by the American Clydesdale Association for the best five American bred Clydesdale colts of either sex 2 years old or under, went as follows: Gold medal to R. B. Ogilvie on the McQueen colts McHappy, Lass o'Gowrie, Lass o'Gowrie III, Prince of Gowrie, and Roxbury; second to Robert Holloway on the Cedric foals Prince of Quality, Handsome Prince, Prince Charming, Minuet, and Cherry Sweet.

Shires.—This valuable and popular breed was well represented by horses entered by the following exhibitors: Burgess Bros., Wenona, Ill.; Galbraith Bros., Janesville, Wis.; Bowles, Hadden & Co., Janesville, Wis.; W. E. Truman, Bushnell, Ill.; Blair Bros., Aurora, Ill.; Jackson Horse Company, Jackson Center, Pa.; Vaughan & McKee Bros., Washburn, Ill.; McDowell Bros., Fairbury, Ill.; George E. Brown, Aurora, Ill.; Rockdale Farm, Lake Forest, Ill. William E. Pritchard, Ottawa, Ill., was judge.

The class of aged stallions was largely filled as to numbers, but the average was hardly up to the high standard of some previous shows in the same place. Still there were many notably good horses, and the winners were richly entitled to the honors awarded them. First was Galbraith Bros.' Nabob 2152 (2850), chestnut, aged

9 years; sire Rutland Champion (2490), dam Smiler by King Tom, a son of Honest Tom (1105). (Nabob took the first prize as a suckling at the Bedford, England, Agricultural Society Show, 1881; third at Shire Horse Show, London; first at Royal, Shrewsbury; first and champion at Staffordshire Show, all in 1884; medal at Tamworth, 1885; second at Wolverhampton, second at Cardiff, both in 1886; second at Shire Horse Show, London, 1887; highly commended at same show in both 1888 and 1889; cash prize, medal, and special prize as best animal of any breed at Staffordshire Show, 1889, and fourth at Chicago, same year). The second prize went to Burgess Bros.' Blagdon Briton 2843 (4876), gray, 6 years old; sire Lincolnshire Lad II (1196), dam Beauty (Richardson's) by Silver (2016). (A prize-winner in England, and second at Wenona Union Fair, 1890). The third place was awarded to Galbraith Bros.' Cheslyn Hay (3961), bay; sire Nabob (2850), dam Smiler by Pride of England (1770), (first at Bedford, England; third at London Shire Horse Show, both in 1884). Highly commended: Burgess Bros.' Sir Robert 1655 (8216), red roan, aged 5 years; sire Thumper (2145), dam Smart by Heart of Oak (1005). (First at Illinois State Fair, and second at Iowa State fair, 1890.) Commended: Bowles, Hadden & Co.'s That's Him 1551, roan, aged 4 years; sire Maharajah (3207), dam by Master of Arts (1500). (Winner of first prize at Blackpool, England, 1886 and 1888; third at same show, 1887; highly commended at American Horse Show, Chicago, 1889.)

The exhibit of stallions 3 years old was remarkably fine in numbers and quality. A full list of horses and exhibitors is appended. By Burgess Bros.: Knowle Light of the West 3208 (9733), bay; sire Naughty Tom (2853), dam Terra by Thumper II (2501). (Winner of two first and one second prize in England; first at Illinois State Fair and Wenona Union Fair, 1890.) Knight of the Ferry 3207 (10410), bay; sire Maharajah (3207), dam by Sir Colin (2202). (Second at Illinois State Fair, 1890.) Dunsmore Merryman 3206 (7145), brown; sire Canute (2736), dam by Blacklegs (146). By W. E. Truman: Carlton Ivo (9049), gray; sire Lincolnshire Lad II (1365), dam Virgin by Fortrey Samson (2426). (Third at Illinois State Fair, 1890.) Carlton Sorrel (9067), chestnut: sire Champion (4955), dam Charity by King Charles (2443). Rambling Boy (8073), bay; sire Mepal Wonder (3227), dam Queen by Stanton (2065). (Second at Bedfordshire, England, Show.) By Galbraith Bros.: Goth 2148 (7286), bay; sire Garnet (2787), dam by Cardinal (2407). (Second at Leyland, England, 1888; fourth at American Horse Show, Chicago, 1889.) By Blair Bros.: Magna Charta II 2107 (7646), brown; sire King John (5150), dam Smart by Lincolnshire Tom (1367). Guarantee, bay; sire Trade Mark (2940), dam by Black Peacock (3466). By Geo. E. Brown: Moulton Marquis 2825 (7839), bay; sire Marquis (3854), dam by Thumper (2136) by Waxwork (2298). Walworth, bay; by Holland Major 275, dam Bonnie Doon 360, by Lincolnshire Tom (1367). By Bowles, Hadden & Co.: Roll Call (3134), gray; sire I'm Here (4483), dam Ickleford Blossom by Bay Lincoln (2528). By Vaughan & McKee Bros.: Hutton Lad 3084 (9633), brown; sire Jupiter (2602), dam by Farmer's Delight. Washburn Emperor 3087, bay; sire Time Present, dam by England's Glory. Mirfield Friend 3086 (7744), brown; sire Farmer's Friend by What's Wanted (3232), dam by Ploughboy. The awards were as follows: First to Knowle Light of the West; second to Goth; third to Moulton Marquis. Highly commended: Guarantee. Commended: Dunsmore Merryman.

Of stallions 2 years old the display was still more notable in average quality than that of the preceding class. The following is a full list of entries in this class:

By Burgess Bros.: Wonder of the Ferry 3214, bay; sire British Lion (3493), dam Smiler by Wonder of the West (2371), (second at Illinois State Fair, 1890). Hardy Canute II 2246 (9521), black; sire Canute (2736), dam Sulby Smiler by Great Britain (977), (first at Illinois State Fair and Wenona Union Fair, both in 1890). Havelock (1883), black; sire Startler (4708), dam Lady Beaconsfield (477) by Beaconsfield II (2529). By Galbraith Bros.: Cannock Perfection 3164 (8990), brown; sire King Charming (3166), dam Whitefoot by Samson IV (2494), (winner of third prize in England, 1890). Carlton Victor 2144 (9074), chestnut; sire Royal Sandy (3993), dam Myrtle by Sir Roger (2026), (first at Blackpool, England, 1888; winner of prizes in England, and first at American Horse Show, Chicago, 1889). Cannock Albert 3161 (8964), bay; sire King Charming (3166), dam Diamond by Pride of England (1770). Burton Wedger III 3160 (8935), brown; sire Shenton (3307), dam Burton Jewel by Waxwork (2314). By George E. Brown: Royal Rex 2852 (10315), bay; sire True Briton (2684), dam Beauty by Honest Tom (1111). By McDowell Bros.: Dale Prince (9176), brown; sire Majestic, dam Blossom. Ely's Boast, bay; sire England's Boast, dam Grand Duchess by Swallow. Fearless, brown; sire Student (3331), dam Star. By Rockdale Farm: Royal Quality 2012 (8130), brown; sire Royal Albert (1885), dam Bonny by William the Conqueror.

The special attraction of this class was the recently imported Cannock Perfection, which was generally declared to be one of the best specimens of the breed ever exhibited in this country. He was very easily awarded the first prize, and afterwards in the grand display of Shire horses he took the sweepstakes as the best Shire horse

of any age in the show. To return to the 2-year-old class, the second place was given to Carlton Victor; third to Hardy Canute; Cannock Albert was highly commended; and Wonder of the Ferry was commended.

The class of yearling stallions was not numerous, only four being shown. The first prize was awarded to George E. Brown's Conservative 2784, chestnut; sire Elcho 264, dam Countess by Honest Lad (1057). The second was awarded to Burgess Bros. on Wenona Albert 3209, bay; sire Lothair 836 (5184), dam Wenona Maid by Hand's Samson 447 (5100). Third to George E. Brown on Moulton Julius, bay; sire English Oak (2771), dam Smiler by Ploughboy (1744). The fourth colt in this ring was Galbraith Bros'. Grove Enterprise II 3374, brown; sire Lincoln Chief (3809), dam by Lancaster (2607).

The classes for females were not as numerously filled as those for stallions. Of aged mares only four were present in the show ring. First was awarded to Burgess Bros.' English Trust 3217, bay, aged 4 years; sire Endymion (3073), dam English Trimmer by Champion 450. (First at Illinois State Fair, 1890.) Second to J. H. Truman's Frisky, chestnut, aged 6 years; sire Boro Champion (2537), dam Violet by Champion 450. (First at Indiana State Fair, 1890; third at Illinois State Fair, 1890.) Third to George E. Brown's Axtel 377, bay, aged 5 years; sire Lord Randolph (3830), dam by Lincolnshire Tom (1367). The fourth and unplaced mare was Burgess Bros.' Lady Byron 472, bay; sire Nonpariel 2857, dam by Newstead (1632).

The sole entry in the class for mares 3 years old was Burgess Bros.' Darling 1662, bay; sire Masher 423 (3218); dam Lady Byron 472. (First at Illinois State Fair, 1889 and 1890, and second at American Horse Show, 1889). The blue ribbon was awarded without hesitation, as it would have been in the face of very strong competition.

Of fillies 2 years old three were shown, and the prizes were distributed among them as follows: First to Burgess Bros. on Wenona Princess 1899, bay; sire Lothair 836 (5184), dam Princess 476, by Coleby Active 860 (501). (First at Illinois State Fair, 1889 and 1890, and at American Horse Show, 1889.) Second to Burgess Bros. on Orphan Girl 1897, bay; sire Lothair 836 (5184), dam Lady Parsons 471, by Wellington 2319. Third to W. E. Truman on Flower III bay; sire Helindon Emperor (2799), dam Flower II by Thumper (2410). (Sweepstakes at Canton, Ill., 1888; first at Indiana State Fair and second at Illinois State Fair, both in 1890.)

Only one yearling filly was exhibited—Burgess Bros.' Wenona Violet 2934, bay; sire Lothair 836 (5184), dam Black Bess 479, by Rival 2885. She was awarded first prize.

For mare and sucking foal Burgess Bros. took first on Lady Byron 472, and her foal, Wenona John by Lothair 836. Second, to Geo. E. Brown on Axtel 377, and her foal. Of American bred stallions Burgess Bros.' Havelock was first and Geo. E. Brown's Walworth second. For American bred mares, all three prizes went to Burgess Bros.—first on Orphan Girl; second on Darling; third on Wenona Princess.

For the gold medal offered by the American Shire Horse Association for the best group of not less than four stallions of ages from yearling upward, there were three entries and the awards were as follows: First to Burgess Bros. on Blagdon Briton, Knowle Light of the West, Hardy Canute II, and Wenona Albert. Second to Galbraith Bros. on Nabob, Goth, Cannock Perfection, and Grove Enterprise. Third to Geo. E. Brown on Holland Major, Moulton Marquis, Royal Rex, and Conservative. The sweepstakes for Champion Shire stallion was awarded without hesitation to Galbraith Bros.' Cannock Perfection.

Suffolk Punch.—This breed, though one of the oldest of heavy agricultural horses in England, has only very recently been introduced to this country. Of the sixteen entries in the American Horse Show, all but two were by Peter Hopley & Co., Lewis, Iowa. The other exhibitors were Galbraith Bros., Janesville, Wis., and Billinghurst & Small, Ashton, S. Dak.

In the class for aged stallions only one animal was entered, but it was of such preëminent excellence that he would have stood well to win the first honors in the face of very sharp competition. The stallion shown was Peter Hopley's Culford (1910), foaled 1886; sire Wollon's Chieftain (1354), dam Peggy by Vicker's Prince (1228). (Highly commended at Royal Show, Windsor, 1889; second in his class at American Horse Show, same year.)

For stallions 3 years old the first prize was awarded to Billinghurst & Small, on Sir John (1835); sire Capon's Tom, dam Maggie by Crisp's Cupbearer. Second to Peter Hopley & Co., on Connaught (2143); sire Gobbett's Star of Bawdrey (595), dam Bragg by Stanford's Prince (1141). (highly commended at Woodbridge, England, Spring Show, 1890). Third to Galbraith Bros., on The Drummer (1892); sire Wolton's Diadem (1553), dam Tumly Maggy by the Duke of Hamilton's Statesman (657).

In the classes for younger stallions and females Peter Hopley & Co. were without competition, taking all the prizes, as follows: For 2-year-old stallions: First to

Druid (1917), sire Smith's Prince of May (1586), dam Depper (1141) by Duke of Hamilton's Statesman (657); second to Bashful Lad (1944); third to Planter (2053). Yearling stallion (only one entry), first to Bell Boy (2112); sire Prince of May (1586), dam Hasketon Bell (1233) by Abbott's Samson (1096), (first at Iowa State Fair, 1890). Aged mares: First to Chorus (2101); sire Capon's Bar None, dam Sprite (second at Royal Show, London). Second, to Bragg (2332), aged 7 years; sire Mumford's Punch, dam Doughty by Conqueror (first at American Horse Show, Chicago, 1889). Mare, 3-years-old: First to Smart (1967); sire Prince of May (1586), dam Diamond (1968) by Field Marshal 1106 (only entry). Mares, 2 years old: First to Daffodil (2360), sire Garrett's Cupbearer, dam Daisy; second to Emoline (2376), sire Smith's Prince Mag, dam Empress by Ball's Emperor. Yearling fillies: First to Mirth (2766), sire Catchpoles, dam Merrylegs by Field Marshal; second to Jessie (2781), sire Smith's Blazer, dam Tot by Smith's Field Marshal.

Percherons.—The display of these horses was strong in numbers and excellent in average quality. The exhibitors were: W. L. Ellwood, De Kalb, Ill.; Singmaster Bros. Keota, Iowa; Bowles, Hadden & Co., Janesville, Wis.; Leonard Johnson, Northfield, Minnesota; H. A. Briggs, Elkhorn, Wis.; Ezra Stetson & Sons, Neponset, Ill.; Henry Metz, Polo, Ill.; Rufus B. Kellogg, Green Bay, Wis.; Robert Holloway, Alexis, Ill.; F. J. Jolidon & Son, Elvaston, Ill.; J. P. McWilliams, Dwight, Ill.; Door Prairie Live Stock Association, Door Village, Indiana. S. D. Thompson, secretary of the American Percheron Horse Breeders' Association, was the judge.

The class for aged stallions was well filled, thirteen animals having been entered, of which all but one appeared in the show ring. The first prize was awarded to W. L. Ellwood's Seducteur 8850 (7057), gray; sire Fenelon (38), dam Rosalie (5688). The second prize was taken by Leonard Johnson's Gilbert 5154 (461), gray, foaled March, 1882; sire Brilliant 1271 (755), dam Sophie (7694) by Favora 666 (725). (First at Percheron Show, France, 1886; first at Chicago, same year; four prizes, including sweepstakes, at Minnesota State Fair, 1887; two first prizes at Chicago Horse Show, same year; first and three sweepstakes at Minnesota State Fair, 1888; gold medal for best Percheron stallion of any age at Chicago Horse Show, 1888 and 1889; first at Wisconsin State Fair, 1889; grand sweepstakes for best draft stallion of any age or breed with five of his colts, at Minnesota State Fair, 1889 and 1890.) The third prize was awarded to H. A. Briggs's Kirsch 7196 (10441), black, aged 5 years; sire Confident 3647 (397), by Brilliant 1271 (755), dam Julia (19440) by Mardelay Vinault. (Second at Wisconsin State Fair, 1890.) Highly commended: H. A. Briggs's Louis 6337 (2430), black, aged 8 years; sire Jupiter, dam Calino by Decibe. Commended: Bowles, Hadden & Co's. Bordeaux 13784 (11603), light dapple gray, aged 6 years; sire Cheri (7702), dam Bibi (11602) by Prosper (893).

Stallions 3 years old were out in force, no less than twenty being led into the show ring. The blue ribbon was awarded to Leonard Johnson's Tripoli 11110 (20034), black; sire Gilbert 5154 (461), dam Brilliante (6852) by Brilliant 1899 (756). The second prize was taken by Rufus B. Kellogg on Baccarat 11327 (18639), black: sire Monarque (2428), dam Marquise (16480) by Papillon (379). Third to Leonard Johnson on Bel Oiseau 13096 (12605), gray: sire Gilbert 5154 (461), dam Poule (6893) by Vaillant. Highly commended: W. L. Ellwood's Emir 13064 (32202), gray; sire Hercule (5955), dam Bijou (17358). Commended: W. L. Ellwood's Victor 8703 (14420), brown; sire Vermouth (5574), dam Brebis (8858).

The class for stallions 2 years old was, like the preceding ones, notable both for numbers and high quality. Fourteen handsome and well-bred colts were shown, of remarkably uniform excellence. The awards were as follows: First to W. L. Ellwood's Albatross 13062 (30051), gray; sire Seducteur (7057), dam Elise (6959). Second to Bowles, Hadden & Co.'s Fedor 13788, black; sire Bogador (5944), dam Biche by Vermouth (5497). Highly commended; Singmaster Bros.' Muscovite 11681 (18830), black. Commended: J. F. McWilliams' Lagadere II 13173 (19178), dark gray; sire La Fayette 10290 (1637), dam Lisette 11935, by Vidocq 1917 (1084).

In the class for yearling stallions eight were shown, all of them black. The first prize was taken by H. A. Briggs's Kirsch II 11873: sire Kirsch 7196 (10441), dam Jeannette 7203 (11977), by Champeaux 6218 (12248.) Second to Dillon Bros. on Eli. Third to W. L. Ellwood on Seducteur; sire Seducteur (7057), dam La Belle France. Highly commended: F. J. Jolidon & Sons' Distere (22688); sire Picador II 5606, dam Sophie (13153). Commended: J. P. McWilliams's Troubadour 13177 (22836); sire Phœnix 8849 (6983), dam Soudan (21303) by Pierre (7874).

Of aged mares only three were exhibited, and the prizes were distributed among them as follows: First to W. L. Ellwood's Rosa Bonheur 11324 (10382), black: sire Confident (397), dam Pauline (4855). Second to Leonard Johnson's Charlotte 11012 (1631), gray; sire Chartrain (1405), dam Celestine (1628) by Brilliant 1271 (755). Third to W. L. Ellwood's La Pie 6842 (11322), gray; sire La Grange 1334, dam Rosalie (11391).

Mares 3 years old were represented by four, of which the winner of the blue

ribbon was F. J. Jolidon & Sons' Allouette 8009 (11698), black; sire Vermouth, 5497 dam Charmante (11697). Second, W. L. Ellwood's Camelia 1343 (31277), gray; sire Mourett (7183), dam Biche (23388). Third, W. L. Ellwood's Ida 13082 (15116), black; sire King of Perche (6738), dam Bijou (15115). Highly commended: W. L. Ellwood's Fancy (11891), gray; sire Favori (405), dam Bichette (2368).

Five fillies were shown in the class for 2 years old: F. L. Jolidon & Sons took the first prize on Caemena 9863 (8426), black; sire Sultan (4713), dam Castile (16345) by Picador 5606. Second to W. L. Ellwood on Dalila 13081 (32866), gray; sire Malakoff (8275), dam Rustique (29112). Third to Dillon Bros. on Stella, sire Extrador. Highly commended: Rosa 13180 (22517), black; sire Phœnix 8849 (6983), dam Laura (6943) by Boisjolie (1329), both owned by J. P. McWilliams.

Of yearling fillies five were shown, all of them of fine quality and breeding. The awards were as follows: First, Leonard Johnson's Cantiniere 13104 (32352), gray; sire Archimede 11411 (7222), dam Biche (13074) by Narbonne, 1334 (777). Second, same exhibitor's Ariane 13114 (30761), gray; sire Brilliant III 11116 (2919), dam Brilliante (17600) by Lagrange 3065, (1334). Third, same exhibitor's Amanda, 13113 (33603, black; sire Brilliant III 11116 (2919); dam Pauline (23812) by Clement 1965 (936). Highly commended: Rufus B. Kellogg's Tulipe Noire 13132 (30323), black; sire Astrakan 6362, dam Bijou (21677) by Vermouth (5426). Commended: Same exhibitor's Platine 13134 (22953), black; sire Archimede (7222), dam Colotte (21716) by Passe Partout (1402).

The only entry for mares with sucking colt was W. L. Ellwood's Rosa Bonheur and foal, to which the first premium was awarded. For sire with three of his get out of different mares, first was awarded to W. L. Ellwood's Seducteur and his string of three; second to Dillon Bros.' Papillon and colts; third, H. A. Briggs's Kirsch and family. For American bred stallions, first to W. L. Ellwood's Rambler 3907; second to Ezra Stetson & Sons' Conquest. Of American bred mares, the first prize went to W. L. Ellwood's Fancy 11891; second to Dillon Bros.' Stella.

Belgians.—The exhibit of this breed was fairly good as to numbers, considering how recent was the first importation, and all agreed that in quality it was the best show of Belgians ever seen in this country. The exhibitors were: Degen Bros., Ottawa, Ill.; Wabash Importing Company, Wabash, Ind.; Miller Bros., Ancona, Ill.; F. J. Jolidon & Sons, Elvaston, Ill. The judge was William E. Pritchard, Ottawa, Ill. Of aged stallions seven competed, and the awards were as follows; First to Degen Bros.' Sultan 406, roan, 4 years old, sire Gerfant, dam Bouquetier (first at Brussels, 1888; first at American Horse Show, 1889); second to Jolidon & Sons' Lambert 474 (792), black, aged 5 years, sire Cæsar 63, dam Baronne 1107 (prize winner at Brussels International Show, 1888); third to Wabash Importing Company's Pierrot, roan.

Six fine horses were shown in the ring for stallions 3 years old, and the prizes went as follows: First, Jolidon & Sons' Prince Royal (2968), sire Brilliant II, dam Colerette; second, Degen Bros.' Clarot 404, bay, sire Vainqueur, dam Fanny (third at Illinois State Fair, 1890); third, Degen Bros.' Michael Ange 407, sire Hercule, dam Masse (second at Illinois State Fair, 1890).

In the class for stallions 2 years old, there were four entries, all of them by F. J. Jolidon & Sons, who took all the prizes, to wit: First, Pluton 493 (2662), bay, sire Annibal (123), dam Sieze (4629), (first at La Harpe, Ill., 1890); second, Annibal 461 (2508), bay, sire Annibal (123), dam Mina (1973); third, Paul, 494 (2516), bay, sire Jules (90), dam Fanny (499).

Five yearling stallions competed. Degen Bros. took first prize on Tudor 405, gray, sire Mercure, dam Bannier (first at American Horse Show, Chicago, 1889, and at Illinois State Fair, 1890); Jolidon & Sons took second on Cheri (3944), bay, sire Mina (1334), dam Charlotte (1247); and third on Niril (3984), bay, sire Geifant (466), dam Charlotte (4623).

Of aged mares only three were shown: First prize was awarded to Degen Bros.' Bella 51, roan, sire Annibal (123), dam Coquette; second and third to Wabash Importing Company, on Pauline and Brillantine. In the class for mares, 3 years old, Jolidon & Sons took first on Fatima 60 (1541), black, by Oscar 68, dam Lysa (813) by Stevens; second and third to Degen Bros. on Jollie 50, black, sire Hercule, dam Nanne (first at Illinois State Fair, 1890), and Cenciere 53, bay, sire Brillant, dam Morette (first at American Horse Show, 1889; second at Illinois State Fair, 1890). Both the fillies, which alone appeared in the class for 2 years old, were shown by Degen Bros. The blue ribbon was attached to Belle et Bonney 46, bay, sire Mercure, dam Charmante; and the second to Camee 54, bay, sire Brilliant, dam Cerpinne. The former was the winner of the first premium in her class at the Illinois State Fair, 1890; the latter was first in her class at the American Horse Show, 1889, and second at Illinois State Fair, 1890. Dragonetta and her foal, exhibited by the Wabash Importing Company, were without competition in the class for mare with suckling colt, and received the first prize.

French Draft.—The exhibit of this breed was highly creditable both in numbers and quality. Though the entries were not as numerous as in some other lots, they were sufficient to fill nearly every class, and the exhibitors were men who have made wide reputations as importers and breeders. Among them were the following: John Virgin, Fairbury, Ill.; Singmaster Bros., Keota, Iowa; Springer & Willard, Oskaloosa, Iowa; S. Noble King, Normal, Ill.; Miller Bros., Ancona, Ill.; Bowles, Hadden & Co., Janesville, Wis.; Wm. M. Loehr, Bloomington, Ill. The judge was Col. John Hope, of Brantford, Canada, but the female classes were judged by L. W. Mitchell, Wooning, Ill., Col. Hope not having arrived when they were called.

Ten horses appeared in the class for aged stallions, and the awards were as follows: First to Springer & Willard on Favori 7039 (1511), black, aged 4 years; sire Ragot, dam Rosine. Second and third to Singmaster Bros., on Romeo VII 5901; gray, and Milton 5527, gray.

Stallions 3 years old were still more numerously represented than their seniors, no less than eleven appearing in the show ring. First prize was awarded to Springer & Willard's gray Hercule (6990), sire Paul, dam La Rousse. Second to same exhibitors on Vainqueur 6350, black, sire Monarque (36), dam Margot (172). Third to Bowles, Hadden & Co.'s Indomptable 7505 (1368), gray; sire Favori, dam Joyeuse. Another Hercule, also owned by Springer & Willard, was highly commended. He was the black Hercule 6211.

Ten stallions were shown in the class for 2 years old, and the awards were as follows: First to Springer & Willard's Daniel, gray; second to same exhibitors' Courrier, gray; third to John Virgin's Dozule, black.

The class for yearling stallions was represented by five, to which the awards were as follows: First to Dillon Bros. on Condé; second and third to S. Noble King on Luther and Knickerbocker, both black and sired by his renowned stallion, King's Europe 4040. Highly commended, Miller Bros.' Bijou.

Of aged mares five were shown, and the following were the awards: First and second to Dillon Bros.; the blue ribbon going to Minnie B., gray, aged 6 years; sire Hero, dam Evalena B. by Tacheau (winner of four prizes in 1890 at State fair). The red rosette went to Ida Volgare, gray, aged 9 years (winner of two prizes in 1889 and six in 1890). Third to Miller Bros. on Prudente 7049 (742), dapple gray, aged 5 years; sire Audacioux, dam La Ronanne.

Only two mares were shown in the class for 3 years old, and both of them by Dillon Bros. The first prize was awarded to Wade, bay; sire Extrador 2423, dam Ida Volgare. Second to Fantasma, gray; sire Extrador 2423, dam Lorelie.

Three 2-year-old fillies came into the show ring, viz: Dillon Bros.' Stella, gray, and Estelle, black, both sired by Extrador 2423; and S. Noble King's Capitola 6373, brown; sire King's Europe 4040; dam Rhoda by Valone. First was awarded to Stella; second to Capitola; third to Estelle.

The only yearling filly shown was Dillon Bros.' Modessa G., gray; sire Papillon 756, dam Modesty G. by St. Laurent. The blue ribbon was awarded on the merits.

The single entry made for mare with sucking colt was Wm. Loehr's Lady Rustique 4061, and foal by King's Europe 4040.

In the class for stallions with three of his get by different dams, S. Noble King entered King's Europe 4040, black, with Luther, Knickerbocker, and Capitola; and Dillon Bros. entered Extrador and three fillies. First was awarded to King's Europe and second to Extrador.

For American-bred stallion, first was awarded to King's Europe; second to Singmaster Bros.' Keota Sultan; third to Dillon Bros.' Roto. For American-bred mare, first to Dillon Bros. on Minnie B.; second to Miller Bros. on Viola; third to Dillon Bros. on Wade.

American Trotters.—The inducements offered failed to bring out a large display of trotting-bred horses, only 36 being entered of all ages and classes. For standard trotters the first prize went to H. C. Graves & Son's Sandwich 11818, bay, 16 hands high, aged 5 years; sire Lord Russell by Harold 413, dam Rosabella by Belmont. Second to Hon. J. N. Huston on Jubilee de Jarnette, bay; sire Jubilee Lambert (2:25), dam Lady de Jarnette (2:28). Third to D. Vance & Son on Alaric 3393; sire Fairy Gift, dam Utility by Forest Mambrino. Fourth to Dr. A. Owen on Altar Boy 7073; sire Billy Wilkes 2938, dam Flocee by Louis Napoleon.

Of aged stallions only two were shown. First was awarded to J. W. Swanborough, on Hambletonian Prince 9716, bay sire Menelaus 226, dam by Sorrento. Third to J. W. Day, M.D., on Kaiser 2209; sire Geo. Wilkes 519, dam by Dictator 113.

For stallions 3 years old, first to C. E. Lyle on McGregor Wilkes; sire Robert McGregor, dam by Red Wilkes. Second to Leach Bros. on King Rex 10787; sire Sirene, dam Molly by Sweepstakes 298. Third to Dr. A. Owen on Altar Boy 7073.

For 2 years old stallions Hon. J. N. Huston took first on Casmin de Jarnette, bay; by Jubilee de Jarnette. For yearling stallions, first was taken by C. T. & F. E. Lee on Sable Guy 11552, sire Sable Wilkes, dam by Guy Wilkes. Second to Granger Smith on Phallum 10882; sire Phallas (2:13¼), dam by Happy Medium 400. Third to Hon. J. N. Huston on Achille, brown; sire Centigrade by Sultan, dam by Strader's C. M. Clay, jr.

In the female class only seven were shown in all, three 2-year-olds and four yearlings. Of the former the first prize went to John Brennock on Flossie McGregor; sire Bonnie McGregor, dam Aggie B. Second to F. M. Huffaker on Mono B, bay; sire Monon 4071, dam by Kentucky Prince 2470. Third to P. C. James on Oma, bay. First for yearling fillies to P. C. James on Rosamond; second to Hon. J. N. Huston on Virginia Hickson, sire Centigrade, dam by Blue Bull. For two colts the produce of one mare, first was taken by John Brennock on Aggie B.'s Flossie McGregor and Rosewood. Second to P. C. James on Oma and Rosamond.

For pair to pole, any age: First to Isaac Monroe on Free Trade and Tariff. Pair to pole, under 5 years, first to John Brennock. Special prize, plate for best mare or gelding any age to be driven to road wagon: First to A. Spaulding on Bert Bashaw, black gelding, by Green's Bashaw; second to D. W. Mills on Prince M., bay gelding, by Hambletonian Prince.

Shetland Ponies.—The large and fine collection of these diminutive pets indicated quite clearly the increasing importance of pony breeding in this country. The principal exhibitor was Capt. J. Murray Hoag, of Maquoketa, Iowa. Other exhibitors were: Robert Lilburn, Emerald Grove, Wis.; W. W. Benson, Chicago; W. E. Truman, Bushnell, Ill.; Moorehouse & Pepper, Toronto, Ontario; W. E. Hagans, Elmhurst, Ill.; Dr. A. Owen, Chicago, Ill.; J. J. Gore, Chicago; John C. & James C. Burke, Chicago; Thomas Golly, Oak Park, Ill.

The awards were as follows: Aged stallions: First to Capt. J. Murray Hoag, on Moir, jr., chestnut; sire, the prize winner Moir (which was sold to parties in Colorado for $1,300); second to Robert Lilburn on Tom Thumb; third to E. W. Benson on Prince. Stallions, 3 years old: First to Capt. Hoag on Eureka; second to E. W. Benson on Cap; third to Robert Lilburn on Sir Buck. Stallions 2 years old: First to Capt. Hoag on Howard B. (only entry). Yearling colt: First to Capt. Hoag on Elderim. Stallion under 1 year old: First to Capt. Hoag on John M.

Aged mares: First to Robert Lilburn on Ida; second to Capt. Hoag on Fashion. Mares 3 years old: First to Robert Lilburn on Lady Londonderry; second to Capt. Hoag on Gem. Fillies 2 years old: First to Capt. Hoag on Heroine. Yearling filly: First to Capt. Hoag on Ida. Under one year: First to Capt. Hoag on Jessie.

Single-driving pony in harness: First to Capt. Hoag on Moir, jr.; second to Robert Lilburn on Sir Buck; third to John C. and James C. Burke on Countess. Pair in harness: First to J. J. Gore on Jim and Vent; second to Capt. Hoag on Nip and Tuck; third to W. E. Hagans on Puss and mate. Tandem team: First to Capt. Hoag on Nip and Tuck; second to J. J. Gore on Jim and Vent; third to W. E. Hagans on Gen. Bird and mate. Four-in-hand team: First to Capt. Hoag; second, W. E. Hagans. Single pony under saddle: First to Capt. Hoag; second to Moorehouse & Pepper; third to J. J. Gore.

Stallion and three of his colts: First to Capt. Hoag on Sparkle and three of his colts, all black and white, like the sire. Largest and best display of Shetland ponies of any age or sex: First to Capt. Hoag.

Shoeing Contest.—A special purse of about $200 was made up to be given in prizes for best work in shoeing draft horses. The shoeing was not done in the presence of the judges and spectators, but the horses were led, already shod, into the show ring. The competitors were: James Pollock, Alexis, Ill; Alexander Hogg, Bushnell, Ill.; William Watson, Cedar Falls, Iowa; James Rogers, De Kalb, Ill.; James Gardner, Janesville, Wis. Of the shod horses two were Clydesdales, two Shires, and one Percheron. The first prize was awarded to James Pollock, second to Alexander Hogg, third to William Watson, and fourth to James Rogers.

Of the evening displays which constituted the spectacular part of the show it is not deemed necessary to make any report. Displays of handsome turnouts in the show ring were attractive features, which helped to fill the seats during the evenings with spectators, who cared little for breeding stock. The competition in many of these classes was decided more by the style of the vehicle and the handsome liveries of the coachmen and footmen than by the quality of the horses. Such matters are not deemed to be of sufficiently permanent interest to require any record in this report.

IMPORTANT REPORTS FROM INSPECTORS AND CORRESPONDENTS.

OUTBREAK OF A CUTANEOUS DISEASE AMONG CATTLE.

In the latter part of August and early in September, 1889, a cutaneous disease appeared among cattle in many localities not very remote from Washington. Soon thereafter the Bureau of Animal Industry was in receipt of letters from many correspondents in Pennsylvania, Delaware, Maryland, Virginia, and West Virginia, all giving information as to the outbreak, and each agreeing as to the most prominent symptoms of the disease. Among others asking advice and assistance were the following-named gentlemen: Joseph B. Metcalfe, Prince William County, Va.; G. G. Gregg, Round Hill, Va.; J. S. Ware and H. L. D. Lewis, Berryville, Va.; Thomas W. Timberlake, Milldale, Va.; George W. Halmer, Woodburn, Va.; A. B. Shreve, Shelton Hall, Loudoun County, Va.; George H. Carter, Stephens City, Va.; D. G. Mead, The Plains, Va.; Isaac C. Hoge, Hamilton, Va.; Thomas H. Simonds, Drum Point, Md.; Henry Macald and C. C. Halloway, Pylesville, Harford County, Md.; William Shallcross, A. L. Quillan, C. W. Wharton, George B. Taylor, William M. Frazier, F. Hopkins, C. Rogers, Benjamin Hudson, and John Frazier, Kent County, Del.; Peter K. Mossburg, Lucian Walters, Thomas D. Darby, E. James, W. L. Dearborough, Montgomery County, Md.; William J. Greyson and William G. Lee, Cecil County, Md.; J. M. Severson, Kent County, Md.; and Dr. W. W. Brown, Kabletown, W. Va.

Veterinary inspectors of the Bureau were directed to visit many of the localities indicated by the above-named correspondents, for the purpose of determining the nature and cause of the disease, and if found to be of a contagious character to give such advice as would prevent its further extension. On the 4th of September, Dr. W. H. Wray forwarded the following report of the results of his investigations of two different outbreaks of the disease:

In accordance with your orders of August 22, 1889, I proceeded forthwith to Catharpin and Round Hill, Va., for the purpose of investigating a reported outbreak of disease in cattle at those places. On the 23d of August, I visited the herd of J. B. Metcalfe, at Catharpin, Prince William County, Va., where I found 6 steers, 2 cows, and 1 heifer in the following condition: No. 1, a red and white steer, with dry, ulcerated condition of the nose and cleft of the left fore foot (recovering). No. 2, red roan steer, ulcers on the nose and cleft of the left fore foot. No. 3, a spotted steer, large patches of skin on the sides, flanks, and hips dry, cracked, ulcerated, and sloughing off. No. 4, a red and white cow, ulcers of the nose, ankles, fetlocks, and udder; teats of dark purple color, dry and cracked; the skin across the hips has sloughed off, leaving a cicatrix resembling a burn. No. 5,

a brown and white steer, cicatricial tissue on pad of the nose. No. 6, a red steer, ulcerated nose, congested conjunctiva, and serous discharge from the eyes. No. 7, a red and white steer, cicatrice on the nose, skin on the right shoulder dry and cracked. No. 8, a black and white heifer, ulcer on the nose, conjunctiva of both eyes congested, large patches of skin and cellular tissue from the ankles and fetlocks (left side) sloughing off, with large ulcers on the right thigh and hock. The ulcers were very fœtid and full of maggots; temperature 101° F. No. 9, a red cow, convalescent.

The history of this outbreak is as follows: On August 11, 2 steers and 1 cow were noticed to be acting dull and stupid. One of the steers had both hind and one fore leg slightly swollen, with small swellings along the abdomen. The other steer had large ulcers and sloughing of the skin and flesh from the nose, flanks, and feet; ulcers very fœtid and full of maggots. This animal died on August 21. The cow is convalescent. The balance of the herd was found affected with a serous discharge from the nose and eyes and sore feet on August 12. All the above-mentioned animals have been running together in the same inclosure. There are six head in an adjoining field that have not been affected. The animals in both fields drink from the same stream, the healthy ones up stream from the sick. While at Mr. Metcalfe's I heard that a neighbor named H. F. Lynn, who lived one-half mile distant, had some cows. I went there after finishing at Mr. Metcalfe's and found 11 head, 9 in one field, affected as follows: No. 1, a red cow, with small ulcers on the nostrils, teats purple and cracked. No. 2, a red roan cow, small ulcers on the nose, conjunctiva congested, teats purple in color and cracked. No. 3, a red cow, small ulcer on the nostrils. No. 4, a roan cow, a small ulcer on the pad of the nose. The remainder were in good health. The history of this outbreak was thus given: Mr. Lynn first noticed the red cow running at the nose and eyes on the 15th of August. As soon as the ulcers began to form the owner commenced greasing the parts with carbolized vasaline. The animals on this place have, so far, been affected in a very mild form. I left Catharpin that evening for Round Hill, Va., arriving there the same night. Here I at once hunted up Mr. G. G. Gregg and made arrangements for a visit to his herd in the morning. On the 24th of August, in company with Mr. Gregg, I drove to his farm 3 miles from town, where I found 15 head of steers and heifers, 9 of which were affected in different stages the same as those at Catharpin. There had been no deaths, and all are recovering. Cattle in adjoining field not affected. I was informed by Mr. Gregg that Mr. Nichols, who lived at Purcellville, 2 miles distant, had a number of sick cows. On going there I found 15 cows, 5 of which were affected in a very mild form, the same as those at Catharpin and Round Hill. Five had recovered and 5 had escaped entirely. Cattle in the next field were not affected. Although the majority, and in some instances all the cattle in one field, will be attacked, the disease does not seem to be of a contagious character, as it does not spread beyond the field where it originates. In cases where the nose is affected, the pad will assume a purple color; in two or three days the discolored portion will become dry, crack, and slough off, with superficial ulcerations around the nostrils. In those that are affected on the body and legs the skin over different sized areas will become dry. In a few days cracks will form across the dried surfaces in all directions. These cracks extend completely through the skin, and in aggravated cases quite deeply into the cellular tissue. The cracking is followed by an ichorous exudation and sloughing of the skin and cellular tissue. The areas affected vary in size from a silver dollar to 3 feet in circumference. In those that have the teats affected the udder appears to be healthy. The teats will assume a purple color, dry and crack; the epidermis will peel off, leaving them very sore and difficult to milk. There are no constitutional symptoms, as the pulse, respirations, and temperature are normal. In the worst cases I only found a temperature of 102° F. The animals do not cease ruminating. As the ulcerations and desquamations do not resemble any heretofore described skin affection that I am able to find in human veterinary literature, for the want of a better name I have designated the malady desquamative dermatitis.

On July 25, in company with Drs. Armstrong and Clement, I visited the herd of J. F. Bohanon, at Millstone Landing, Md. We found three cows suffering with the same malady as described above. As one was very sick we purchased her, made a post-mortem examination and found all the internal organs healthy. Since then there have been outbreaks of the same malady in Worcester, Dorchester, and Frederick Counties, Md. I have seen about 150 cases during the past two months, and have heard of only two deaths. It is a question whether these died of the disease mentioned. I have put the affected animals under mineral tonics internally, with carbolized ointments externally, with good results.

On the 15th of October, 1889, Dr. W. H. Rose, veterinary inspector at Philadelphia, Pa., made the following report of an examination of cattle suffering with the disease in Delaware County, Pa.:

I visited Media, Pa., to-day, to investigate the reported outbreaks of so-called epizoötic aphtha in this section of Delaware County. I saw Dr. Webster at Media, who claims to have treated 20 herds of cattle affected with the disease, numbering in all 120 animals. He describes the local lesions as being characteristic of said disease. All of his cases recovered. Dr. Huidekoper visited this place a short time ago and pronounced the disease eczema epizoötica, as seen in Europe. I have no evidence on hand at this date to form an opinion, and I write you these lines in order to receive your instructions before I make a further search into the matter. I am told that this trouble has existed in Montgomery and Berks counties for the past four or five weeks.

On the 19th of October Dr. Rose made the following report:

Your letter of instructions of the 18th instant was duly received. Will endeavor to find cases of recent development of cattle disease. I am sorry to have you confine my researches in Delaware County alone, for the same trouble has existed in Berks and Montgomery counties. The trouble has subsided to a great extent, especially in Delaware County.

I saw Dr. Thomas Young at Media, yesterday afternoon, who claims to have had about 80 cases in 30 different herds of cattle. Dr. Young says that "mouth lesions were absent in his cases when the feet were affected."

The trouble seems to have been of an endemic nature, for the disease existed in all parts of the county at the same time. I can find no traces of its origin, and there seems to be no visible source of contagion. In some herds only one animal was affected, and in several instances individual herds remained exempt from the trouble while herds on both sides of adjoining farms were affected. Sheep and swine remained insusceptible on the premises where cattle were affected.

The mortality has been very slight and recovery rapid in most instances. Abortion among pregnant animals has been rare. The treatment has been local in most cases.

Dr. Webster used a lotion composed of zinc, iodine, myrrh, and aloes, without internal treatment, and lost no cases.

Dr. Young used sulphur internally and lost no cases. Some of them, however, had extensive sloughing of tongue and extremities, exposing the ligaments of joints and muscular portion of tongues.

Dr. Huidekoper used saliva from an affected cow upon the mucous membrane of 2 healthy pigs at the University Veterinary Hospital, but produced no lesions in either pig after one week's experiment. Both pigs, however, had variable temperature (internally), ranging from 99° to 103° F.

There has been no shipment of imported cattle to any part of this country where the trouble existed. No sheep or swine were affected, and the disease existed in some herds of cattle where no sheep were kept on the premises.

Dr. F. W. Patterson, an inspector for Maryland, gives the following results of an examination made on October 20:

A letter from John T. Nelson, Black Horse, Harford County, Md., caused me to visit his farm to-day. I found on his place 15 head of cattle, viz, 12 cows, 1 bull, and 2 calves. Of these 11 were sick. One cow heavy with calf, the bull, and two calves seemed to be in health.

These cattle have been in good health all summer, the cows giving milk. On last Tuesday, the 15th instant, Mr. Nelson discovered that eleven cows were sick, though some three or four days before he had noticed some pimples on several of the cows' teats, which, when broken, discharged a thin, yellowish fluid. The eleven cows were attacked almost simultaneously. They commenced licking their teats and udders and were almost constantly thus employed. The skin on the teats turned almost black and became dry and hard. It soon cracked open and is now peeling off. The inflammation extended to the udders, small pustules covering their whole surface, and now the skin is dry, hard, and cracked. The flow of milk is nearly suppressed. The nose in almost every case was ulcerated on the pad and usually extending some inches above it. The skin on the pad was cracked open and peeling off, leaving an ulcerated surface red and with a yellowish discharge from the ulcers. There were small ulcers on the gums. In some cases small pustules were found along the neck to the shoulder, and in one case they were all over the back, and in another all over the belly.

In all the cases there was much discharge from the eyes. The veins in the conjunctiva and sclerotic much injected with blood and the lids and eyes of a dark brown color. The skin around the eyes was peeling off. In nearly every case the external vulva was ulcerated, dry, hard, cracked, and peeling off, leaving the surface raw and angry looking, as is the case with the pad of the nose and the teats. In some cases I saw the cow place her nose upon a cold stone and hold it there as if seeking relief from heat or itching. I saw them also, when licking the teats, take hold of them and bite them as though they would tear them off, and Mr. Nelson kept one or two in stalls to keep them from injuring themselves.

At this date there did not seem to be much fever. The highest temperature was 103½, and that only in one case.

I have described these eleven cows as one, for they were affected so nearly alike that it is not worth while to give a description separately.

For some time before, and at the time of taking sick, they were in a meadow pasture field, mowed this year. The ground is very high and dry and supplied with good spring water. When they were taken sick the owner feared that perhaps something in the field had poisoned them, and they were put in a wheat stubble field where young clover was very rank. This clover caused active movements of the bowels. Some common "mill feed" has been used all along.

Inquiry failed to find any other cases in this part of the country. Mr. John R. Jackson, living about 2½ miles from there, about four weeks ago bought a lot of steers at Stewartstown, Pa. (said to have come from Ohio), and on getting them home they were nearly all seen to have sore noses, with the skin on the pad cracked and peeling off, leaving a raw, sore surface. These steers all got well.

This is all that I could learn. This disease is, to me, a new one, and this is the first that has appeared in this part of the State.

Several additional reports were received in October from Dr. W. H. Rose, relating to outbreaks in Pennsylvania. The first bears date of October 22, 1889, and is as follows:

I obtained the following information from Mr. Rhoades in answer to many questions. He fed the milk of affected cows to his pigs, and they remained in good health. The calves of affected cows, fed from their teats, failed to develop the disease. His family used the milk from these cows before Dr. Webster's first visit and they have suffered no illness. Then, too, Mr. Rhoades's herd got among Samuel Pancoast's (a neighbor's) herd, when the former herd was sick, and no evidence of the same trouble has shown itself in Pancoast's herd.

Mr. Rhoades has a low, swamp pasture field, and Mr. Pancoast's is high and free from mud pools.

Rhoades', Hugh's and Keady's herds are 2 miles at least from each other, and they have never been together.

The following report from the same inspector bears date of October 24:

I saw Dr. Broadhead at Media, Delaware County, Pa., to-day, and he claims to have treated about thirty cases of what he calls sporadic aphtha. He had no cases with feet affected, and all of them have recovered. Some of the herds of cattle numbered 40 and 50 head each, and 4 head was the greatest number affected in any herd that he treated. I can not find any cases in this section of Delaware County at the present time, for the trouble seems to have subsided since we have had a few pleasant days. Inclement weather has again set in, however, and if it continues any length of time we may expect to find recent cases of the same trouble.

On the 26th day of October Dr. Rose made the following report:

I visited Dreibelbis, Berks County, Pa., to-day, to consult Dr. P. K. Dreibelbis about the reported outbreak of aphtha in said county. We visited a few herds, where he had treated the disease, but all affected cattle had recovered. He claims to have treated about eighty cases in Berks County, and has not lost a single case. He saw no foot trouble among them, and could not say that all of them had mouth lesions, for he has been too busy to examine every animal. The trouble originated here about one month ago, and seems to have subsided for a time. Dr. Dreibelbis claims to have noticed an internal temperature of many cases which registered no higher than 103° F. Will return to other parts of Berks County next Tuesday and try to find recent cases of said trouble.

After a more thorough investigation as to the cause and extent of the disease, Dr. Rose forwarded the following report, dated November 1, 1889:

I have succeeded at last in finding very recent outbreaks of disease among cattle in Berks and Lehigh counties, Pa., which some of the veterinarians have pronounced *contagious foot-and-mouth-disease*. I can not agree with them, however, nor can I give you the correct cause of the epidemic. I have failed to trace contagion from one herd to another, although the majority of cattle owners in these two counties have purchased one or two animals at sales that were shipped from the Buffalo drove-yards. Some of them were gathered from farms in Steuben County, N. Y., by dealers and sold at Virginsville, Berks County, and Steinsville, Lehigh County, Pa., last August, and the farmers are of the opinion that these animals brought the disease, because the trouble originated here at Steinsville on September 30 last, in a herd of cows (four head) belonging to Albert Christ. Mr. Christ claims that his cows were exposed to a sick ox last August which was purchased at the sale. All of his cows were taken sick on or about September 30. One of them died and three recovered. (From reliable information I am led to believe that this animal died from the effects of heroic treatment, which set up enteritis.)

The ox was not exposed (directly) to these cows; was simply driven past the premises where Christ's cattle were pastured en route to another farm, and placed in a large herd on the premises of a distant neighbor, where it died soon after its arrival. None of the exposed cattle where the ox died have assumed any sickness up to date, fully two months after its death. Since Christ's four cows were taken sick other herds have developed the same trouble. Some herds have assumed the same trouble without exposure to the disease unless it is volatile, for it has shown itself rarely where no animals have been purchased during the past six months and the water courses have run from the healthy cattle towards the affected animals. However, most of the affected herds have one or two new arrivals from Buffalo on the premises which were there one or two months before any sickness appeared. Strange to say these new comers in most instances remain insusceptible to the disease until the latter part of the outbreak.

There have been fully two hundred cases of this trouble in these two counties, and it still exists in all parts. It is mild in character and needs very little treatment to bring the animals back to health. Some cases have relapse and linger a long time, yet the mortality is very slight. I find all of this affection in the low lands of both counties, under high hills where vegetation is rank. Running streams have constantly passed over the meadow lands where decaying grasses and plants have developed noxious properties. The farmers in this whole section of country have raised considerable rye this season, and in most instances the cattle have fed from the rye stubble, which contains more or less ergot. In fact, every owner of affected cattle will admit that he fed animals in the rye fields prior to their illness. This theory will not hold out in all cases, however, for some of the cattle were only two days in such fields; but most of them had from one to six weeks feeding of rye stubble. Then, too, the symptoms do not warrant ergotism in its true sense. There is no gangrene of extremities, either dry or moist, but the following symptoms give indications of a febrile disease: The internal temperature of each case varies from 102° to 103°F. In most cases the temperature will not exceed 104°F. Constipation prevails in most cases with dark fæces, almost black in color, and ball shaped. Diminished lacteal secretion in most cases, and spasmodic raising of posterior extremities towards the udder in some bad cases. I have found no foot lesions in any case, and the universal appearance of affected animals can be described as follows:

Most of the cattle in some herds have roseolæ of all four teats; external surface of upper lip and the Schneiderian membrane without a similar condition of membrane of fauces and tongue. No vesicles are found in the latter regions; simple bright red patches similar to what you would observe when irritants have been taken into the mouth. After a short time a vesicle forms on the external surface of upper lip fully 1 inch in diameter, which soon ruptures, leaving a very thin, raw surface, entirely different from the characteristic vesicle of foot-and-mouth disease. I have seen no vesicles in the mouth, and I have examined fifty animals in this region. The teats, however, change from vesication to rupture, leaving a corrugated surface which slowly desquamates unless pulled off in mass by attendant. If the animal continues to improve the redness of all parts passes off, except the eschars on teats, which resume a dark red color. I have found one cow in a few herds with no other indications than the reddened teats. These recovered two months ago, and no other animals in said herds have shown any illness up to date. Occasionally I found a few cows in some herds with reddened and swollen appearance of

vulva without vesication. White-haired animals seem to have more cutaneous eruptions than those of other colors. All cases have a thin, yellow serum over cutaneous surface of body. I should have mentioned a staring coat, reddened or congested condition of conjunctiva, followed by discharge from both eyes, with yellow deposits in inner canthus.

I can not look upon this trouble as being contagious, for the incubative stage (if such there be) is too long; that is to say, from the time the new comers entered the native herds, from one to two months, before symptoms were perceptible.

Mr. C. M. Castleman, of Clarke County, Va., writing under date of November 2, 1889, gives the following description of the disease as it appeared among cattle in that vicinity:

It is a skin disease. The cows' bags and bodies are perfectly raw; the hide peels off in great flakes. My feeding cattle are now being attacked by the disease. I learn of many other cases in the neighborhood. The situation is very alarming to stock owners. Nothing of the kind has ever been known here before. It appears among all ages and every condition—both calves and aged animals alike suffer. The cows milk nothing but corruption.

The disease prevailed to a very wide extent in Pennsylvania. On the 6th of November Inspector W. H. Rose investigated an outbreak in Franklin County, in that State, the results of which are embodied in the following brief report:

I to-day investigated another outbreak of eczematous eruption among cattle near Roxbury, Franklin County, Pa. Mr. Solomon Gabener, of said place, has 9 cows, 1 bull, 2 heifers, 2 calves, and most of them have been affected. The farm is situated in a valley one-fourth mile from high mountains, but the pasture field where his live stock grazed is hilly and well drained.

I find no vesicles in the mouth or on the feet of his cattle, but the same lesions can be seen as those found on the cattle in Berks and Lehigh Counties.

Three of Mr. Gabener's cows are protracted cases, and large patches of cuticle have peeled off their bodies in many places, varying in size from 3 to 12 inches in diameter. These patches are bare, without ulceration, and a new cuticle has formed, which is nonsensitive when touched. Mr. Gabener says that abscesses formed, which broke and discharged before the cuticle peeled off.

I failed to trace any source of contagion to this herd, for Mr. Gabener claims to have bought no cattle this season, and says the first cases developed about five weeks ago. None of his cattle have died.

Mr. James McLean, of Shippensburg, Pa., who owns the farm, purchased twenty steers three weeks ago which came from West Virginia. They remained in the field where Gabener's cows pastured about two weeks, when one of his steers contracted the same trouble in a mild form. Since that time four more of his steers have become affected. A white steer has a cyst on left hip; the contents consisted of a yellow, viscid serum.

I have heard of other outbreaks 1 and 2 miles from this place, and have decided not to visit them without further orders from you, for I can do them no good.

On November 19, 1889, Dr. F. W. Patterson, an inspector for the State of Maryland, reported that he had examined, under instructions from the Bureau, herds of cattle affected with the disease, belonging to the following-named residents of that State: Herd of Thomas J. Donahue, Kent county; Mrs. A. Hawkins, Baltimore County; Phillip Timmons, Worcester County.

The Department having been notified of the existence of a serious outbreak of the disease among cattle in the State of Delaware, Dr. W. H. Wray, of the Maryland corps of inspectors, was directed to visit the locality and report the results of his investigation. His report, which bears date of November 23, 1889, is as follows:

Pursuant to your telegram of the 18th instant, I left Baltimore the following morning for Felton and Milford, Kent County, Del., for the purpose of investigating a cattle disease that was raging at those places. I arrived at Felton early the same afternoon, and on inquiry found the disease was raging among cattle on several different farms that are located between Felton and Milford. The first farm we visited was that of Armwell L. Quillan, about 4 miles from Felton. Mr. Quillan

owned 6 cows and 5 steers. Two of the cows were affected with cutaneous ulcers on the nose; teats of a dark purple color, the skin on them cracked and commencing to peal off. I next visited the farm of C. W. Wharton, about one-half mile from Mr. Quillan's. Mr. Wharton had 5 cows and 2 calves. Two red and 2 white cows had ulcers on the nose; the teats dark purple. From Mr. Wharton's we went to the farm of George B. Taylor, about 3 miles distant. Mr. Taylor owned 6 cows. One red and white cow had discolored teats and ulcers on the right side; 1 yellow cow had discolored teats. From Mr. Taylor's we went to the farm of William M. Frazier, 1 mile distant. Mr. Frazier has 9 cows; 1 red cow had discolored teats. We next visited the farm of Frederick Hopkins, opposite Mr. Frazier's. Mr. Hopkins had 15 cows and 2 steers; both steers had ulcers on the nose, and 1 Jersey cow had discolored teats. Mr. Hopkins stated that 12 others had been affected with discolored and sore teats so badly that it was impossible to milk them. One cow that was about 14 years old was sick eight or ten days with the same disease, and died in convulsions. From Mr. Hopkins's place we went to that of C. P. Rogers, 2 miles distant. Mr. Rogers had 8 cows in his herd, every one of which had been affected with discolored teats. All had apparently recovered.

November 20 we first visited the farm of Benjamin Hudson, 13 miles from Felton, on the Milford road. Mr. Hudson had 7 cows and 1 bull. One red and white cow had discolored teats and ulcers on the nose; a large patch of dry cracked skin on the withers, and 2 red cows had discolored teats. From Mr. Hudson's we went to the farm of John Frazier, one-half mile distant on the same road. Mr. Frazier had 13 cows. One black and 1 Jersey cow had discolored teats. As the diseased animals were all affected in a very mild form, and no deaths that I could hear of, I did not deem it necessary to proceed any further, although I could hear of the same malady affecting the cattle for miles around. The same malady is very prevalent throughout the State of Maryland.

The first case of the kind that was brought to my notice was on the farm of J. Frank Bohanon, at Millstone Landing, St. Mary's County, Md., on July 25, 1889. Mr. Bohanon had 3 cows, 3 steers, and 1 bull, all of which had been affected with either the ulcers on the nose or sore teats, and several cows with both. One red and white cow had large circumscribed ulcers on the nose, large patches of skin on the back, sides, and hips, dry, cracked, and peeling off in places; large and extensive sloughing of the skin and celiular tissue of the legs below the knees and hocks. The animal was very thin; temperature 102°, and scarcely able to walk. I purchased the animal, and in company with Drs. Armstrong and Clement slaughtered her and made a post-mortem examination. The internal organs of the abdominal and thoracic cavities, also the blood, appeared to be in a normal condition. Since then I have seen a large number of cases in the States of Maryland, Delaware, and Virginia, and must acknowledge that I do not know the etiology and pathology of the disease, neither can I find any description of such a malady in any of our text books.

The malady is no respecter of the bovine race, as it affects males and females of all ages, breeds and colors, and occurs in the lowlands as well as in the highlands.

The first symptoms usually presented are obstinate constipation and uneasiness, with loss of appetite, very little fever, as the temperature in the most aggravated cases does not exceed 103° F. In a few days, in some cases, cutaneous ulcers will appear on the nose around the nostrils and on the pad; in others, especially milch cows, the teats will assume a purple color and look as if painted with the tincture of iodine. This discoloration will become darker until the teats become almost black. In others the skin in patches will become dry; a slight ichorous exudation occurs; the part affected will crack and slough off. In aggravated cases an animal may be affected with all the above described lesions and the sloughs involve the skin and cellular tissue. After a part sloughs off it heals readily, the cicatrix resembling that of a burn. The discoloration of the teats does not extend to the udder only in very aggravated cases. At first I thought the disease was of an anthracoid character, but after slaughtering several animals, and the post-mortem examinations not revealing any abnormal condition of the spleen and blood, I abandoned that theory. As constipation is the primary symptom, I have now come to the conclusion that it is not purely a skin disease, as several others besides myself at first thought it was, but is a disease affecting the digestive organs, and the eruptions on the skin and the discoloration of the teats a secondary occurrence due to the disturbance of the digestive organs or to some interference of the capillary circulation, possibly caused by some fungus that has grown on the pastures, due to the wet season.

No deaths have been reported, neither have I heard of any that could be traced directly to the malady. In all cases I have prescribed linseed oil, to be followed with sulphate of iron, chlorate of potash and sulphur internally, with carbolized vaseline to the excoriated surfaces, with good success, as all cases so treated have made rapid recoveries.

The disease had become so widely extended in Delaware and the bordering counties of Maryland during the latter part of November that the Chief of the Bureau directed Drs. Theobald Smith and F. L. Kilborne, who are connected with the experimental work of the Bureau, to visit the different localities of the outbreak and make an investigation as to the cause of the disease, the extent to which it was prevailing, etc., and report the results to the Department. The report submitted by Dr. Smith is as follows:

In the outbreaks of the cattle disease investigated by Dr. Kilborne and myself in December, 1889, in Kent and Queen Anne counties, Md., the disease in nearly all cases attacked the teats or papillæ of the udder. In a few cases there was extensive sloughing of the skin on the back. In other cases the muffle was covered by a thin scabby layer, and in one or two animals there was a pasty discharge on the outer angle of the eyes (catarrhal conjunctivitis).

The disease of the teats was nearly healed in all but one case when we saw it, although a dry slough still adhered in several cases. In the latter (Loyd's cow) the teats were covered by a reddish-brown, leathery membrane, which could be peeled off by using a little force. The surface of the teat beneath this membrane was of a bright red color, the under surface of the membrane very finely pitted. Sections of this membrane, which had been hardened in Müller's fluid and alcohol, were carefully examined under the microscope. The membrane proved to be the true skin with the overlying epidermis attached. The different parts were easily distinguished. The true skin was represented by the papillary body and some of the subjacent connective tissue. The papillary body was very thoroughly infiltrated with round cells, and the infiltration extended even into the lowest ranges of cells in the epidermis. Portions of the dry, leathery membrane still attached to the teats in recovered cases were also preserved. On account of the very dry condition not much could be learned from them. They were, however, shown to be the skin of the udder, as in the case just mentioned. The udder disease, therefore, must be regarded as some inflammatory affection of the skin of the teats by which its nutrition is cast off. The result is the complete necrosis of the skin, which comes away *in toto* as a slough.

The sloughs on the back were also preserved. Sections from the dry, mummified pieces were examined under the microscope and found to be made up of the skin, in which were embedded the hair follicles. The necrosis had thus involved the entire depth of the skin. The sloughs were too far mummified to give more information than this.

I have looked over the records of veterinary medicine to identify, if possible, this disease with some form already known. I have not found any description that will apply to the symptoms and lesions above recorded. It seems probable that the cause for the skin disease is internal and not external (*i. e.*, due to local irritation). It is also probable that the internal disease thus manifesting itself in gangrene and sloughing of the skin is due to food, modified in some unknown manner by the peculiar meteorological conditions prevailing during the summer and autumn of 1889. This theory is strengthened by the fact that contagion does not seem to play any part in the spreading of the disease.

The pastures of the region visited were quite invariably clover. This precludes the ingestion of ergotized food, and ergot can not, therefore, be considered the cause of the gangrene of the skin. Exclusive feeding on clover has, according to some European observers, given rise to a disease among horses manifesting itself by a swelling of the anterior part of the head, stomatitis, and inflammation and gangrene of those parts of the head and limbs covered with white patches. How far the feeding is actually to blame for this disease can only be positively determined by careful, prompt experimentation should the disease appear another season.

Dr. Kilborne's report, submitted December 14, 1889, is as follows:

In accordance with your verbal instructions, in company with Dr. Theobald Smith, I spent the past three days investigating the outbreaks of cattle disease in Delaware and Maryland. Our investigations were confined mostly to Kent and Queen Anne counties, Md., on the eastern shore of the Chesapeake Bay, where, as far as we could judge from reports at hand, the outbreaks were not recent and virulent.

The first outbreak visited was on the farm of Perry Othoson & Bro., 3 miles east of Sassafras, Kent County, where they have 25 head of cattle, including calves, yearlings, and one bull. All have been sick except five or six. The bull, calves, yearlings, dry and milch cows were all affected alike, except the cows in milk, which had the udder more seriously affected. The disease first appeared three weeks ago.

Mr. Othoson reports the first symptoms noticed as uneasiness, moving about, lying down and getting up, and off feed, all of which last from two to four days. The lesions then appear on the teats and nose, which become dark colored. They are followed by the formation of a thick black crust or scab. These scabs crack and slough off with more or less bleeding, ending in recovery in two to three weeks. There was no sloughing of skin except on nose and teats. The eyes of a few were affected.

The above cases all nearly recovered except one old spotted cow, which had been sick only about a week. General condition poor; said to have fallen away very rapidly during the past three days. Rectal temperature only 101.2° F. A purulent discharge from both eyes, but especially the right. The lower lids and conjunctiva reddened and swollen. The entire surface of the muffle covered with a thick, dry, dark-colored scab; teats nearly covered by similar scabs, which are quite firmly adherent. On several of the recovered cases small scabs are still visible on the nose and teats.

Pasture a clover sod of second year; soil a heavy loam, moderately dry. The cattle watered from a well.

Adjoining the Othoson farm was that of Mr. A. B. Price, with twenty head of cattle, only six or seven of which have been sick. The disease first appeared three to four weeks ago. The herd comprises natives and Holsteins, about half and half, the disease affecting mostly the Holsteins. A bull calf suffered the most severely, the nose being still scabby. All the others have recovered. Mr. Price noticed uneasiness and costiveness as first symptoms, followed by the lesions on the nose and teats similar to those of the Othoson herd.

Pasture same as on the Othoson farm. The above two herds have been in adjacent pastures, but have not been in contact with any outside cattle. No other herds in this immediate neighborhood were affected.

Mr. William Shallcross, 1 mile south of Sassafras, had 17 cows and 1 bull. Three cows died the last week of October after being sick only a few days. At autopsy by the farm hand in each case the only trouble noticed was impaction of the "maw." Nine other cows sickened soon after, but all now nearly recovered. Only cows in milk affected. Three dry cows, the bull and only one milch cow not affected. This outbreak was at first attributed to some poisonous principle in the wheat bran which was fed to all the cows in milk, but not to the bull and three dry cows. We learned, however, that other parties feeding bran from the same had no trouble.

The first symptom noticed was costiveness, followed by uneasiness, moving aimlessly about, picking of the feet, kicking at the belly, and rapid loss of flesh for first few days. The animals would refuse all food for several days. All that were sick had the nose and teats more or less affected. Only one noticed running at the eyes. There was no marked sloughing of skin except on nose and teats. One roan cow only was shedding cuticle on hips while recovering, as if from effects of a mild blister. The cattle had not been in contact with any others. None of the neighbor's cattle diseased. Pasture during the summer was on clover sod with a little timothy, on heavy, dry soil, and on wheat stubble seeded to clover for four to six weeks before taken sick.

At Massey we saw Mr. Thomas J. Donahue, who, with his son James on an adjoining farm, have had several cows sick with the same general symptoms and lesions. Now all had nearly recovered. They lost one cow with the disease. These two herds were visited by Dr. Patterson November 19, at which time they had several cases in the earlier stages of the disease. (See Dr. Patterson's report for symptoms, which were usually severe for this section.)

Mr. Liston Pennington, about 2 miles east of Wilmington, has 6 cows, including 2 dry cows, all of which were affected alike. The disease first appeared five or six weeks ago. Now all nearly recovered.

The first symptoms were looseness of the bowels, in some cases amounting almost to a diarrhea. Great uneasiness, lying down and getting up, turning around, looking at or even licking the udder, kicking of hind feet forward, striking udder and belly, and lowing as if for calf. The first external symptoms were slight swelling with heat and extreme tenderness of the udder, so that milch cows, usually very gentle, would kick viciously when you approached to milk or handle the udder, often kicking even before the udder was touched. This stage passed off in three or four days, and was immediately followed by skin of teats and whole of the muffle turning purplish or almost black, and becoming thick, dry, and scabby. Sometimes would bleed quite freely at the outset from the muffle by the cracking of the skin. The removal of the crusts from the teats, as by milking, would cause considerable hemorrhage, after which a second crust would be readily formed. No costiveness noticed at or before the outbreak. The eyes were affected in only one or two cases. Along with the first symptoms there were also complete loss of appetite and sudden suppression of milk flow, the animal frequently remaining dry after

recovery. Also sudden and considerable loss of flesh, which is not readily regained. Urine high-colored, reddish, almost as if bloody in some cases. One cow was still scabby over left half of vulva quite similar to, but not as deep as that on the nose. We had previously noticed slight sloughing from vulva in two or three isolated cases in other affected herds, but not as well marked as in this case. Mr. Pennington's cows had not been in contact with any other cattle for several months.

Pasture during summer a clover sod, and wheat stubble seeded with clover during past two months. Soil a heavy loam, moderately dry.

A Mr. Newmann, next adjoining Mr. Pennington, had two cows slightly affected with the same symptoms and lesions. These two were the only herds affected in this immediate vicinity.

We next visited Mr. Thomas P. Sudler, near Sudlersville, Queen Anne County. Here we found 10 cows, 3 with calves 3 to 5 weeks old, and 7 New York State calves which had been received nine weeks ago. These calves when received were very thin, and all suffering from severe colds. They were the first to show symptoms of the disease a week or ten days after arrival. Two of these calves died about three weeks ago. The other 5 are still all more or less affected, one being very sick, weak, and thin, with a temperature of only 100.7°. Skin scurfy generally. Nostrils inflamed and swollen so as to be nearly closed. Slight mucopurulent nasal discharges. A purulent discharge from eyes, and also from eyes of two other calves, the lower lid and conjunctiva being red and swollen.

Several of the cows were taken sick about the same time as the calves. Eight of the ten have been sick, but now all are nearly recovered except one severe case. The first symptoms noticed were costiveness; the fæces passed in small balls, with more or less difficulty; dullness; lying around, but uneasy, especially with hind feet. The urine dark-colored, reddish, especially with the calves. All the cows suffered considerable loss of flesh.

The first cow taken sick nearly recovered from a mild attack, and then had a second attack worse than any of the other cases. This cow was very thin and run down generally, although said to have been in good condition before the disease appeared. She has also gone dry, and lost several patches of skin by sloughing (the only case in this herd); one patch the size of the two hands on the withers and extending down to the elbow on the left; one on each flank; another over lumbar spines, and slightly on rump, the sloughing being superficial, only the cuticle, which was like parchment.

The three native calves, 3, 4, and 5 weeks old, respectively, were not affected, although the calves continued to suck the cows, all three of which were diseased, one so badly that the calf had to be taken off for twenty-four hours, the cow refusing to allow the calf to suck because of the soreness of the teats. These three calves were kept in the stable, and had not been on the pasture.

Pasture same as all the others, clover sod during summer, and on wheat stubble seeded to clover when taken sick. Soil a heavy dry loam.

Mr. George Hazel, adjoining Mr. Sudler, had two New York calves sick with same disease; but none of his native cows were affected.

Mr. John Smith, also adjoining, has three or more sick in a herd of eighteen. Has no New York calves.

Mr. Sparks's (across the road) herd only slightly affected.

The last place visited was that of Mr. Buck Lloyd, south of Sudlersville, where we found fourteen head of cattle, all having been affected except one, including a 2-year-old bull, still quite sick. This animal was dumpish, lying down most of time apart from the other cattle. Nose well covered with a dark slough.

The disease first appeared about three months ago, and was supposed to have been the first outbreak in the county. A spotted cow, the first animal attacked, has had three attacks during the three months. She would nearly recover, only to be followed by another attack with the reappearance of the sloughs on the nose and teats. After the second and third attacks she suffered extensive sloughing of the skin from over whole region of withers, and extending down 12 to 14 inches on each side; a large patch over left hip and extending down to stifle, and another large patch in right flank. The repeated sloughing in this case, one slough following another from the same region, has apparently destroyed nearly or quite all of the deeper layers of the true skin. The present secondary sloughs also appear to be more of an exudative character, and not simply thickened and dried cuticle, as in the case of the primary slough already noted. The nose was still scabby, but the teats were nearly healed. She was also still scabby around the left eye, both eyes having been quite badly affected.

The last cow attacked, and the most satisfactory case we were able to examine, was an old spotted cow which was taken sick the Wednesday night or Thursday morning before, having therefore been sick only two or three days. Temperature

to-day (December 14) at noon only 101.4° F. Now off feed and dull, following a period of uneasiness similar to that already described. Fæces apparently normal. Urine high-colored, reddish. Redness and cracking of the skin on the vulva. The whole surface of the teats of a dark purple or reddish-brown color, the cuticle thickened, cracked, and sloughing, leaving a deep bright-red raw surface, which bleeds freely on the removal of the slough. (Several other cases had bled considerably, especially when milking.) Nose dry, the muffle nearly as dark-colored as the teats, the cuticle thickened and cracking, with slight hemorrhage at border of each nostril.

This was the first case on which we were able to ascertain the nature of the primary slough. The sloughing cuticle from the nose and teats was quite pliable, while on all the older cases previously examined it was dry, hard, and rather brittle, when broken having the appearance of dried exudate, rather than a sloughing of the skin. Judging from the above recent case the previous dry sloughs from nose and teats were all secondary. The usual thick, dry slough would undoubtedly have been soon formed after the sloughing of the cuticle in this case. (See note on specimens of both primary and secondary sloughs collected and examined microscopically by Dr. Smith.)

In general, the animals usually recover slowly after one or two weeks, the lesions on the nose and teats healing quite readily. But from the deeper and more extensive sloughing of the skin from the back and side recovery is very slow, often requiring from six to ten months. The animals also regain the lost flesh slowly.

We found no inflammation or ulcers in the mouth or about the feet; in fact no true ulceration whatever, the lesions being due to infiltration and sloughing of the skin, followed in the severer cases by exudation and secondary sloughing.

As to the cause of the disease, it is apparently due to local causes. There was no history or evidence of contagion, only isolated herds being attacked, with no apparent cause for the discrimination.

We also examined the pastures quite closely but could find nothing unusual. Owing to the lateness of the season and dried condition of the pastures perhaps little or nothing could be expected from such examination. The wheat straw and stubble as far as examined were clean, bright, and nearly free from rust.

Judging from the history, character, and general nature of the disease, I am inclined to the opinion that the outbreaks are due to the unusually wet season, but whether directly or indirectly through a fungus or other deleterious agents that have grown on the pastures because of the wet season, I can not say. The latter is perhaps the most plausible.

The only history of a similar disease that I have been able to find is one described by Dr. James Law in his "Farmers' Veterinary Adviser," under the head of "Malignant catarrh of cattle." The outbreaks of 1875, then described by Dr. Law, and those of the present season, are in my opinion due to similar if not to the same causes. The essential symptoms of the outbreaks of the two seasons are, as far as I can judge, the same, varying in severity and from incidental to local causes. Even the symptoms of different outbreaks of the present season, as reported by inspectors from different sections, differ as much as do the descriptions of the outbreaks for 1875 and 1889.

Dr. A. M. Farrington, Assistant Chief of the Bureau, visited and inspected a number of herds suffering with the disease during the latter part of November, 1889. On the 30th day of this month he submitted the following report:

As directed, I visited Castleman's Ferry, Clarke County, Va., to investigate the disease affecting Mr. C. M. Castleman's cattle, and arrived November 6, 1889. The milch cows, seven in number, were the animals most seriously affected. When examined they were pasturing upon a field on the side of a hill facing north on an old sod covered with rather short grass. They presented the following symptoms:

No. 1, a white cow soon to calve; showed no lesions. Temperature 103° F.

No. 2, a white cow, had a strip of dead scurf skin 2 inches wide extending along the spine from the withers back to the root of the tail. A few small red spots about the size of a pin's head were seen on the fore teats. This cow was giving milk, and was the only one of the herd whose milk could be used. Temperature 102.5°.

No. 3, red and white cow, had lesions on the fore teats only. Temperature 102.9°.

No. 4, white and red cow, very poor, was the first one attacked, and was the worst case in the herd. Temperature 103.3°. Nearly all of the skin of the back, from the withers back to the root of the tail, was dead, dry, and hard, and separated from the dermis. Large patches in the same condition were also seen in each flank. The teats and portions of the udder were covered with similar patches. The cow was chewing her cud, and did not appear to suffer from the extensive skin lesions.

No. 5, red and white cow, the second one attacked, showed the following lesions: The front and back quarters of the left side of the udder were hard from previous inflammation; the teats were very sore and covered with hard scabs; the dead epidermis extended in one continuous patch from the middle of the spine back to the root of the tail and the points of the hips on each side; the entire surface of the ears was covered with whitish scabs and a few scabs around the muzzle. Temperature 104.5°.

No. 6, roan cow, had a dry, hard patch of dead skin about 5 inches square in each flank; also on the left side over the surface of the ribs. The ears were devoid of hair and covered with red-colored scabs. The teats were sore and covered with scabs, excepting the left front teat, which was not affected.

No. 7, a speckled red and white cow, had large patches of dead scurf skin in each flank. Under these patches the new hair was commencing to grow. On the lower half of the sides of the animal were small bare spots where white hairs had grown. Where the skin was covered with red hair it remained intact. Small scabs existed on the ears. All of the teats were affected, some of them, however, having isolated patches about one-half inch across, surrounded by healthy skin. Temperature 102°.

A white bull calf which had run in the same pasture with the cows had small scabs around the eyes and the nose.

These cattle were eating well or chewing their cuds, and did not appear to suffer pain from the extensive excoriations of the skin. They were first noticed as affected about the middle of September. The malady advanced so rapidly that by the middle of October the udders of the cows had become so affected that no milk could be sent to the creamery from the farm.

In an inclosure near the barn was a grade Holstein bull that had recently taken the disease and seemed at present to be suffering more than any of the other cattle upon the farm. The bull had been among the other cattle all the time they were affected, but had only recently been attacked.

On the inner canthus of the eye and on the lower eyelids was a collection of thick yellowish matter. In each flank was an irregular scab of black, hard, leathery cuticle, dead and devoid of hair. These spots were formerly covered with white hair, and wherever there was black hair it remained undisturbed. The animal stood with its head down and its back arched, and presented a very dejected appearance.

In the barnyard were six 2-year-old steers, which the owner claimed had been affected with the malady but had recovered; only one at this time gave any evidence of having had it. This one had a few scabs upon each side, but otherwise was healthy. Two oxen were said to have had the disease, but appeared healthy now.

These cattle had been pastured on lowland meadows that had been overflowed, on wheat stubble, on clover fields, and on old meadows, but the kind of pasture did not seem to make any difference either in bringing on or suppressing the disease. The progress of the disease on this farm did not indicate that it was contagious, or that the food eaten had an influence in developing it. The cattle were exposed to the rain storms and had been fed on grass, except a few ears of corn occasionally which the owner had recently been feeding, as the cows were getting very poor.

The next animal examined was a cow at the farm of Maj. L. D. Lewis, near Berryville, which was taken four days before. It showed the following symptoms:

Eyes with a thick yellowish discharge from each; the muzzle covered with a purplish red thin crust; the teats were sore so that it gave the animal much pain when milked, but there were no evidences of inflammation in the udder. Temperature 102°. This cow had pastured constantly with a herd of nine others, but none of them were affected. The appetite was good and the cow was giving a good quantity of milk.

The same day (November 8), I examined three cows belonging to Dr. McGuire, of Castleman's Ferry. The night before the cows showed no indications of the disease. When seen the temperature was normal, 102°, and appetite was good. A yellowish white discharge escaped from the corner of the eyes. The muzzle was puffed and swollen and of a purplish-red color. Irregular blisters containing a yellowish liquid covered the teats. These animals had been pastured upon lands which had been overflowed by the Shenandoah River, on clover fields, and on old fields. so that neither one of these kinds of foods could be credited with causing the affection. No other cattle in this neighborhood were known to be affected.

It was learned that near the town of Round Hill, Loudoun County, several herds were affected with this disease.

One of these was the herd belonging to Mr. V. V. Purcell, which consisted of six cows and one bull. Mr. Purcell stated that the animals were first attacked about seven weeks ago, and after a few weeks had nearly recovered, but upon the return of the wet weather the disease had developed a second time.

The first indication of any disorder noticed was that the teats were sore and the animal evinced pain when milked. The eyes became inflamed, and a yellowish discharge exuded from the corners. The muzzle was inflamed and covered with a crust. In about one week's time other cattle were affected. In the pasture the animal would go apart from the herd, would stand and shake its head, would stamp its feet, and then walk around as if very uneasy. Some of the cows, according to Mr. Purcell's statement, would slobber at the mouth. In fact, two cows showed only these symptoms.

The cows at present were very sorry looking objects, were very poor, and with patches of dead skin, the edges of which were curled up and becoming detached, giving the appearance of a very ragged animal.

The cows gave no milk, the teats and udders having been so badly diseased that the milk had dried up. In one instance several abscesses had formed in the udder, had burst, and were now open running sores. One cow from this herd was bought and sent to the Veterinary Experimental Station at Washington for future examination and research.

This herd was exposed to all the severe storms of the season, not being housed even during the night. They received no food except what was obtained from a clover pasture. These animals were separated by an ordinary fence from a herd of Jerseys belonging to another owner, yet the latter herd failed to contract the disease, showing that the disease is not contagious in the ordinary use of the term, and that in pastures lying in nearly the same conditions the disease is not always developed.

The next herd of cattle affected was about 3 miles distant, belonging to Mr. William Osborn. Between these two herds there had been no communication. The animals in each case had been raised upon their respective farms and no outside cattle had been introduced. Mr. Osborn said that his first experience with the disease was about two months ago, when his herd of 23 steers were attacked. Their noses first became sore; their eyelids also became swollen, so that in many cases the lids were closed. The skin began to peel off in various places over the body. In consequence of the sickness the cattle would not graze, and they showed a falling off in flesh of at least 200 pounds to each steer. They would begin to recover, and then at the recurrence of a period of wet weather the disease would reappear. The exposure to the rain would make the cattle itch. None of his milch cows had been attacked. A yearling calf had been both among the steers and the cows, showing that the cause of the malady cannot be conveyed from the diseased to the healthy cattle. The steers were pastured upon a clover field and the cows upon an old blue-grass pasture.

At the time of my visit there were no acute cases of the disease. Several steers had quite deep erosions on the muzzles where the scabs had existed, and after recovery the depressions were still visible. The ears of many were bare, the hair having all disappeared. Deep cracks were seen in the skin around the eyes. These steers were all of a deep red color. They had apparently recovered and were gaining in condition. One animal had a scab or portion of dead skin about 6 inches square on the point of the hip, and another had his eye nearly shut from the effect of the disease. One calf was thin in flesh, and showed evidence of having had the disease.

The next herd examined was at Purcellville, about 3 miles east of Round Hill, owned by Mr. Charles Nichols, and consisting of 15 milch cows. Nine of them had been affected with the disease. They were attacked about the middle of August. Five or six cows were attacked at first, and gradually the others became affected, but had now quite recovered. Mr. Nichols stated the symptoms of the disease as observed by him to be as follows: The cows would kick and stamp their feet as if in pain. The eyes were not very much affected. The parts attacked were the skin upon the back and the teats. One cow had but one teat affected; it became hard and leathery. The amount of milk given by the cows decreased considerably, but they were now giving their usual quantity. These cows were pastured in a field adjoining the one where the steers of Mr. G. G. Gregg were pastured and examined by Dr. W. H. Wray in August as being affected with this disease. Other people in the vicinity whose herds were said to be more or less affected with the malady were Mr. Lewis Taylor, Mr. George W. Holmes, Mr. Townsend Fraser, Mr. Matthew Monroe, and Mr. J. H. Jenkins.

Mr. William B. Lynch, of Leesburg, was reported to have had the disease among his store cattle a year ago. The cattle had, however, recovered, become fat, and were sold, and no further difficulty had been experienced.

No deaths from the disease were reported, but it created great inconvenience, especially among herds of milch cows, often causing complete loss of the value of the cow as a milker. So far as observed it is not a contagious disease, and seems to

arise spontaneously on certain farms. The specific cause of the disease is not evident, nor the peculiar conditions which develop it. The owners have various theories to advance, the most prominent of which is the feeding upon clover fields; but this theory is not tenable, for the malady is seen to arise as well among cattle pastured upon blue-grass fields or upon old sod where there is a mixture of many varieties of grasses.

There is, however, one factor that is prominent, which is the exceptionally wet weather that has prevailed this season. The condition of the fodder must necessarily be changed by the great amount of moisture in which it is grown. Whether the excessive moisture also develops a peculiar germ or a species of fungus that the animals take into their systems with their food and which produce the singular appearances described, remains for future investigation to show.

The herds in all cases were unprotected from the cold rain storms of the season, and were not given additional food to enable them to withstand the severe exposure. This is true, however, of cattle over a large extent of territory, yet in only a limited area are the cattle attacked with the malady.

The treatment advised was to give additional food in the form of ground grains, as corn meal, crushed oats, and oil meal, and to give tonics, as powdered gentian, ginger, and carbonate of iron. When first attacked the animal may become constipated, and in such case purgative doses of Epsom salts, Glauber's salts, or raw linseed oil should be given. Vaseline, sulphur ointment, or zinc ointment was advised, to be applied to the scabs to promote their healing.

On December 4, 1889, Dr. Farrington submitted the following additional report:

In the latter part of November, Mr. A. B. Shreve, Goresville, Loudoun County, Va., reported to this Department that a new disease prevailed among cattle in his locality. Though none of his animals were affected with it he feared they might become so, and desired an investigation by the Department. Accordingly I was sent to look into the character of the affection. The nearest affected herd was one belonging to Mr. Henry Peacock, situated about 3 miles from Mr. Shreve's. Mr. Peacock had 15 head of cattle, all of which had had the disease or were suffering from it at the time. The first animals were taken in September, and they had been becoming sick gradually ever since. One cow and two calves had died since the malady first appeared. At the time of my visit six cows showed signs of the disease. They were the first to become affected, and the earliest indication was that the cows had sore teats, then the muzzle became sore, inflamed, and dark purple in color. The animals would stand and shake their heads as if in pain.

The cattle stood in the barnyard, exposed to the cold rain storm that was prevailing, their backs arched, heads drooping, and patiently suffering from the inclement weather. Their only food was a few cornstalks placed in a feed rack. The stronger animals would keep the weaker ones from the rack and prevent their getting a proper supply of feed.

The lesions were nearly the same as those observed in previous outbreaks of this disease. The skin around the nostrils was cracked and peeling off. Dry scabs were seen around the eyes and a thick yellowish deposit occurred in the inner corner. Pieces of skin had become dead and detached in various places over the back and sides, while underneath the detached portions was a black dry scab. These dark scabs also occurred upon the teats.

Horses and hogs were kept in the same yard, but showed no indications of disease. The animals were all raised upon the farm and no strange animals had been in the vicinity. No other cattle in the neighborhood were examined, but other farmers were said to have the disease in their herds.

Mr. David Conrad, about 1 mile from the above, was said to have lost two calves from the affection. Mr. Sidney Titus, whose farm joins Mr. Peacock's, stated that two of his cows had the disease but had recovered. Mr. Robert Ryan, whose farm is about three-quarters of a mile from Mr. Peacock's, was said to have had the disease among his cattle.

The disease did not appear to spread, and no alarming trouble was apprehended. The owners were advised to use mineral and vegetable tonics, and to feed ground grain in liberal quantities.

DISEASES AMONG SWINE.

Mr. Charles E. Clark, of New York City, who is interested in hog raising in the West, writes, under date of March 23, 1889:

From personal observation on the farm, day after day for a fortnight at a time, I made up my mind that a healthy hog could be tied by the side of one dying with "cholera" and kept there for three days without danger, provided that the healthy one had no opportunity of eating a particle of anything while in proximity of the sick one. Of course, if the latter was lying in a dusty place, or on old straw which had become infected, then the well hog might acquire the disease by inhalation. To express my conviction in a homely way, it seems to me that the hog usually "eats" the infection, and rarely "breathes" it. Again, we have both in Missouri and Iowa, where I have some interests, a disease we call "measles," or "red measles," which in its malignant form is so generally fatal that it will destroy a whole herd.

Mr. William Shallcross, Odessa, Del., writing, under date of August 10, 1889, addressed the Department as follows:

We have hog cholera in its worst form. Over one hundred hogs have died in this vicinity, and diseased hogs are being shipped to the Philadelphia market. Our State has made no legal provision in view of hog cholera.

Mr. J. T. Budd, Middletown, Del., under date of August 11, 1889, reports an outbreak of hog cholera in his section with losses of large numbers of hogs. He adds:

I am of opinion that shipments are made to cities of large numbers that may be diseased.

Mr. Joshua Dewar, Millwood, Clark County, Va., writes under date of August 24, 1889, as follows:

The hogs are dying here by the thousand of a disease of the throat and lungs. The throat swells and the windpipe fills with white mucus, or something of the kind.

Mr. W. H. Hidley, Leipsic, Ohio, writes under date of October 7, 1889, as follows:

I had on my farm 300 Poland-China hogs, registered or entitled to registry. But the hog cholera came and proved very disastrous. I made some post-mortem examinations until satisfied as to the character of the disease. A very bad practice prevails of shipping away all the hogs of a herd as soon as an outbreak of disease appears. The liability to infection is thus scattered all along the line of railroad by which the exposed hogs are sent to market. It is easy to see how extensive this evil may become on a line stretching hundreds of miles.

Dr. A. W. Clement, inspector for the Bureau at Baltimore, reports, under date of September 30, 1889, as follows:

As stated in my preliminary report, I visited Centerville on September 24, in accordance with your instructions, and at the house of Mrs. M. B. Emory, at Bloomfield, found a large female hog which had just died. The autopsy showed intense redness and swelling of the lymphatic glands, which had the usual mottling on section characteristic of hog cholera. There was also very extensive necrotic pneumonia. The spleen was considerably enlarged and somewhat soft. There were no lesions in the liver or kidneys. In the cæcum were two small areas; one, the larger, with a very superficial necrosis, the other much smaller, with the necrosis deeper. These were the only lesions to be found in the alimentary canal. From the very extensive lung lesions, together with the slight not very characteristic intestine lesions, I do not feel prepared to make a diagnosis of hog cholera, but think it may be a probable swine-plague infection. Returned to Baltimore that night without being able to get further autopsies; found, however, that the pigs in that vicinity were dying fast, the farmers losing from 5 to 50. It was the general opinion among farmers that this disease differed from ordinary hog cholera.

I returned to Centerville on the afternoon of the 26th. On the morning of the 27th visited the farm of Joseph Simons, about 6 miles from Centerville, where

a large number of hogs were said to be very sick. On arrival found two dead. Autopsy revealed no lesions whatever.

In the afternoon I visited the farm of Mr. William Watson, in the other direction from the village, about 4 miles distant. He had some pigs which were quite sick. We did not think best to kill any. He has lost about fifty. Visited several other farms in his neighborhood, but did not find any dead pigs or any liable to die immediately. On nearly every farm, however, a greater or less number of pigs were sick.

On the morning of the 28th, we visited the farm of Dr. De Coursey, in another direction from Centerville, 12 miles distant. He had informed us that he had lost some pigs and was anxious that we should see the herd. On arrival did not find any dead, but one which was very sick he allowed us to kill. The autopsy revealed very extensive exudative pleurisy, which on the right side was encysted. Both lungs were solid. There was extensive pericarditis. The lungs, on section, showed lesions very closely resembling those of tuberculosis. The lymphatic glands at the base of the lungs were involved, however. In the intestines there were one or two necrotic areas, but in each area was embedded the head of an echinorhynchus; otherwise the stomach and intestines were normal.

On the morning of the 29th I again visited the farm of Joseph Simons and found a hog dead. The autopsy revealed typical extensive button-shaped areas of deep necrosis through the intestines, infarcts in the spleen, swelling with reddening and mottling on section of the lymphatic glands. There were no lung lesions. Another hog, very sick, he allowed us to kill. At the autopsy found no swelling or redness of the lymphatic glands. There was extensive purulent peritonitis. The abdominal cavity contained about three pints of dirty grayish yellow fluid, very offensive. The intestines were attached to the walls of the cavity and the coils of the intestine to each other. These adhesions were easily broken down. The thoracic organs were normal. The intestine, on section, showed a large number of necrotic areas, and in nearly every case these were associated with echinorhynchus. In some cases these areas had completely perforated the wall of the gut, and were pressing out the peritoneal covering.

In the afternoon we visited the farm of Mr. Holliday, in another direction from Centerville, about 8 miles distant. He had lost about sixty hogs. One which had been dead and buried twenty-four hours we had dug up. The autopsy revealed pneumonia with extensive pleurisy and pericarditis; lymphatic glands swollen, reddened, and on section mottled. There were no other lesions. Intestines normal. Cultures were made from all these cases except the first and the last, that of Mrs. Emory and of Mr. Holliday. I can not express an opinion until the cultures have been examined, except in the case of one of Mr. Simons's pigs, in which the lesions were those typical of hog cholera. The liver in all the pigs examined had *Sclerostoma pinguicola* (Hassall) in abundance. In some cases the portal vein at the base was partly filled with a thrombus in which the worms were embedded. They were present in all cases in the smaller branches of this vein.

The farmers are getting rid of their hogs, shipping them mostly to Philadelphia. Many have died on the road. I would advise that some means be adopted to prevent this shipment.

SPLENIC OR TEXAS FEVER.

Under date of January 15, 1890, Mr. C. P. Johnson, secretary of the Illinois State Board of Live Stock Commissioners, writes as follows:

I have the honor to transmit herewith the following resolution and recommendations, which were unanimously adopted by the Interstate Conference of State Boards of Live Stock Commissioners, State Veterinarians, and other boards having in charge the extirpation of contagious diseases among domestic animals, in convention assembled in Springfield, Ill., December 18 and 19, 1889:

"*Resolved*, That this conference recommend that, to guard against the introduction of splenic or Texas fever by the transportation of Southern cattle, the Department of Agriculture be requested to make its regulations applicable to cattle shipped from south of the southern boundary of the States of Kansas and Missouri, west to the northeast corner of the Territory of New Mexico; such regulations to be in force from the 1st day of March to the 1st day of December in each year, as

set forth by the Department proclamation in relation to splenic fever of July 3, 1889.

"The conference also recommends that said Department provide rules for cleansing and disinfecting all cars used in the transportation of animals.

"Your committee are pleased to report that the existing regulations regarding the transportation of Southern cattle have been of great and material benefit during the past season, there having been a much less loss from splenic fever than in former years among cattle in Northern States: and express the hope that the cordial coöperation of National and State authorities will altogether prevent the appearance of this disease among Northern cattle."

Under date of February 11, 1890, Mr. Charles H. Baker, secretary of the National Live Stock Exchange, Chicago, writes as follows:

I have the honor to hand you herewith a copy of a resolution adopted at a meeting of the executive committee of the exchange, held the 8th instant:

"Whereas the cattle interests, North and South, require concerted action among all parties interested, producers, consumers, feeders, exporters, railroad companies, stockyard companies, and commission merchants; and

"Whereas such a result will have to be obtained, first, by a common and fixed infection line; second, by requiring all railroad companies transporting cattle from such scheduled district 'during the infection season' to set aside a portion of their feed yards for the exclusive use of the cattle from said district en route to the different markets; third, by requiring the stockyard companies to set aside a section of their yards for the exclusive use of cattle coming to market from the scheduled district during the infection season; fourth, that the railroad companies be required to cleanse and disinfect all their cars delivering cattle from the scheduled district at 'terminal points,' *i. e.*, the markets, before allowing them to be reloaded with stock, and we recommend that such disinfection be done under the direct supervision of the local live stock exchanges, by a United States officer designated by the Bureau of Animal Industry before the cars leave the stockyards, in order to secure uniform service and proper disinfection: and

"Whereas, the scheduled districts as established by the United States Government and the districts established by several of the governors of different States differ from each other: Therefore,

"*Resolved*, That it is the sense of the National Live Stock Exchange that the 'north line of the scheduled district should be established by the United States Government at the south line of Kansas, and that all cattle raised south of said line, even if loaded in Kansas, north of the south line, shall be considered as coming from such scheduled district.'"

We believe if this is carried out under proper inspection that it will practically do away with the danger of splenic fever.

Mr. Baker writes again, under date of February 20, 1890, as follows:

We are satisfied that the "fever troubles" during the past year (1889) were to a large extent caused by the shipment of southern Texas cattle during the spring months into the Cherokee Strip to points north of the line established by the Department, from which points they were in the course of a few months forwarded to the various markets—Chicago, Kansas City, and St. Louis—and as the freight bills of the railroad companies transporting these cattle to said markets showed them to have originated in a nonscheduled and noninfected district, they were in many instances, notably at Kansas City, yarded among native cattle, the results of which prove that the cattle originated in a district in which there were cattle affected by the "fever," the railroad company's billing to the contrary notwithstanding. In view of the foregoing we believe that the only way to guard against an outbreak of the "fever" is to make the south line of Kansas the dividing point, at least so long as cattle are brought from southern Texas into the Indian Territory in the spring, grazed a few months, and then placed on the Northern markets.

We are satisfied that if the line should be placed on the south boundary of Kansas, the strict sanitary regulations of that State, together with the aid which would be rendered by all southern Kansas cattlemen, would effectually prevent a recurrence of last year's methods of marketing southern Texas cattle. Should there be no cattle taken from southern Texas into the Panhandle, we do not think there would be any trouble caused by establishing the line across said Panhandle at about the same place the Illinois line was established last year; that is to say, follow the southern line of Kansas to 100° longitude, then south to about 34° latitude, then west to the New Mexico line.

We are satisfied that there would be no loss to owners of Texas cattle by an order

requiring all cattle from Texas and the Indian Territory to be yarded in a division of the stockyards provided at this market for their exclusive use, as such cattle are invariably sold here for immediate slaughter.

Hon. Lyman U. Humphrey, governor of the State of Kansas, writes as follows, under date of February 27, 1890:

I have the honor to inclose to you a copy of preamble and resolutions adopted by the Live Stock Sanitary Commission of Kansas on the 10th day of February, 1890, and respectfully request a careful consideration of the same.

The preamble and resolutions referred to are as follows:

Whereas the State of Kansas has, on account of its very large cattle interests and also its particularly exposed position, geographically, an especial interest in preventing any outbreak or spread of Texas or splenic fever, or other infectious cattle diseases; and

Whereas the State, through its Live Stock Sanitary Commission, so long as there were any appropriations by the State legislature to defray the expenses, did recognize the above fact and did employ inspectors whose duty it was to prevent the introduction into the State of any cattle capable of communicating any infectious disease whatever; and

Whereas the Legislature made no appropriation that was available for this purpose for the years 1888, 1889, and 1890, and thereby the aforesaid inspectors could not be retained at the expense of the State; and

Whereas the Kansas City Stockyards Company, the Atchison, Topeka and Santa Fé; Missouri Pacific; Chicago, Rock Island and Pacific, and the Missouri, Kansas and Texas Railroad Companies did at our request assume and have met the expense of five inspectors up to December 1, 1889, and this without any law or power from our board to compel them to do so; and

Whereas these inspectors were appointed by and received their authority from our board, and it was attempted by paying them through the State treasurer to relieve the several companies furnishing the money from censure by a portion of their patrons who owned cattle south of the danger line, and this secret, notwithstanding the precautions taken, has become known to such an extent as to materially injure the companies named; and

Whereas the inspectors appointed, as above explained, have, notwithstanding the especially exposed position of the State, been so uniformly successful in determining the origin of the cattle which received permits from them to enter the State of Kansas that we have for the past two years been almost clear of Texas fever, although the number of cattle imported for feeding purposes is greater than ever before; and

Whereas the plan and system adopted by these men, of inspecting entirely by brands, in the knowledge of which they are especially expert, and giving no credence to any statements or history not agreeing with the origin shown by the brands; and that they have thus demonstrated absolutely that this is the only way to inspect against Texas fever with any guaranty of success; and

Whereas the expense and onus of this inspection has in the past fallen entirely upon the State of Kansas and certain corporations hereinbefore named, while the benefits accruing from it have been directly shared by all other States and markets in the Missouri Valley and indirectly by all States and markets in the United States, since the industry can not be protected locally without benefiting it generally; and

Whereas the necessity for protection is greater than ever before, owing to the greatly increased numbers of cattle being fed this winter, the majority of which will when marketed be what is termed export cattle; and

Whereas the inspection under authority of the State of Kansas carries no weight in adjoining States or in European markets, whose rules differ more or less from those adopted by the Kansas Live Stock Sanitary Commission, and is at the same time a source of jealousy and disputes between this and other State authorities; and

Whereas this system of local inspection is in force in but very few of our States, and thereby the impression is created in the other States and abroad that it is an evidence of the existence of disease rather than a desire to keep it out; and

Whereas, if the Government of the United States should assume and control this inspection there would be great advantages gained for the cattle industry, as follows: First, the permits issued by the inspectors would be indisputable and would be accepted in all of the States and also in Europe. Second, the inspectors could, through advices from the Department of Agriculture, at all times guard against the introduction of other diseases as well as splenic fever. Third, national inspection instead of State inspection would everywhere be accepted in the light of preventing the introduction of disease rather than an attempt to eradicate it.

Fourth, the high authority of the inspection would be a pledge of impartial and honest work and it would beget a confidence and respect that would tend to raise values to the producers and generally benefit the live-stock industry. Fifth, many thousands of cattle are shipped direct from the ranges to the feeding grounds north of the established quarantine line, which could be more closely watched by the inspectors through advice from the Department agents who are traveling in the range territory much of their time: Therefore, be it

Resolved, That it is the sense and the opinion of the Live Stock Sanitary Commission of the State of Kansas, that the inspection of all cattle being moved across the quarantine lines established by the United States Government should be made by inspectors appointed by and under salary from the Government.

Resolved, That we are most thoroughly satisfied from our experience of the past two years that the inspection against the introduction of splenic fever should be by the brands of the inspected cattle and by men who are especially expert in the reading of and knowledge as to the origin of such brands.

Mr. Watson Pickrell, inspector for this Department, reports as follows, under date of June 15, 1890:

I have been in Kansas City, St. Louis, East St. Louis, Bloomington, and Chicago. At Kansas City everything was working satisfactorily; the inspectors examine every carload of cattle received from any railroad that has connection with the scheduled district. Each car is labeled "Southern cattle," and the waybill of all cattle shipped from any point south of the schedule line is stamped accordingly. The railroads claim to clean and disinfect every car that has been loaded with Southern cattle, and there is no reason to doubt that they are doing it well. I do not think there has been an error committed yet in mixing cattle at Kansas City, nor do I think there will be, so long as the inspectors continue to perform their duty as they are doing now. The greater part of their work has to be done at night or in early morning. The authorities of the Union Stockyards at St. Louis and the National Stockyards at East St. Louis are using every precaution to keep the schedule cattle isolated from Northern cattle. * * * The people in the small towns near St. Louis have complained of the butchers going to St. Louis, buying Southern cattle and driving them through the streets to the slaughter-house. Alton alone claims to have had sixty milch cows die of Texas fever last year through infection by butcher's stock. Both stockyards at St. Louis agree to furnish steamboats, with each shipment of cattle a certificate showing where the cattle were shipped from, and the Illinois authorities say they will require every boat with cattle to show where they came from before they will permit them to unload.

Inspector Samuel H. Pierce writes from Chicago as follows, under date of July 1, 1890:

The receipts of Southern cattle in this market for the month of June were 82,220 head. The railroads are fully complying with the regulations both in cleansing and disinfecting their cars and stamping their waybills. So far as it is possible to ascertain, the Southern cattle are kept separated at the feeding places along the lines of the various roads.

ANTHRAX OR CHARBON.

Early in June, 1890, an outbreak of anthrax was reported to the Department as having occurred in the Yazoo bottoms of western Mississippi. In response to numerous urgent requests from the infected district, Dr. W. H. Wray, an inspector for this Bureau, was dispatched thither. He reported as follows, under date of June 25, 1890:

Pursuant to your orders of the 14th instant, I proceeded forthwith to Yazoo City, Miss., for the purpose of investigating a disease called "charbon" that was raging among the cattle and mules of that county.

I arrived at Yazoo City Tuesday morning, the 18th instant, and was met by Prof. G. C. Creeman, of the Agricultural and Mechanical College of Mississippi, and Dr. John W. Conaway, of the Experiment Station of Missouri. We joined forces, procured a team and started at once for Silver Creek bottoms, 35 miles from town,

going via Lake City. Every plantation en route was inspected. The first place at which we stopped was Tokeba plantation, where we found one mule affected with swelling of the abdomen, sheath and forearms; pulse 48; temperature 101½° F.: animal in good flesh and spirits, with a ravenous appetite. The swelling of the abdomen was first noticed about ten days before. At the time of my visit it extended over the whole surface, was quite hard to the touch, and would pit upon pressure, but there was no fluctuation or emphysema. There were 18 mules on this plantation, of which 4 were affected, the symptoms differing very little from the above. The drinking water for all the stock on this plantation is procured from pumps.

The next plantation visited was El Dorado, on which 74 mules are kept. Fifteen of them were affected with swelling of the abdomen, but all were recovering. After an examination of the sick animals on this place we proceeded to Deerfield plantation, on Wolf Lake, where we found 32 head of mules and 2 horses. Nine of the mules and 1 horse were affected, but all recovering. Mr. J. T. Blunt, the owner of this plantation, stated that his animals had been affected every year regularly during the summer months, the disease always appearing after a drought and affecting the same animals year after year in a mild way. As soon as a case appears it is treated with nitric acid. Mr. Blunt has not lost a case in several years. The stock on this plantation procure their drinking water from the lake.

We stopped for the night at Lake City, which is situated on the east shore of Wolf Lake, and is composed of a store and three negro huts. We procured entertainment with the proprietor of the store. On the morning of the 19th instant we left Lake City at daybreak, crossed the lake by means of a rope ferry, then going through almost impassable swamps and muddy roads, reached Anchorage plantation, 12 miles from Lake City, about noon. Here we found 54 head of mules, of which 12 had been affected; 10 died and 2 recovered. The sick animals on this place had been treated with Mangan's Louisiana Charbon Cure, except the two that recovered, which were treated with nitric acid. As there were no sick animals at this place, all having died or recovered, we proceeded to Green Hill plantation. Here we found 94 head of mules. Fourteen had died on this place and 4 are now sick, affected with swollen abdomen. One ox and one cow had also died. I held a post-mortem examination on the cow, which was yet warm, having died recently. The blood was in a fluid condition, not coagulating on exposure to the air, very dark in color. The stomach, intestines, heart, and lungs were apparently healthy. The spleen was very much enlarged, the capsule being dark blue and the internal portion disintegrated, very soft and black in color. The lymphatic glands of the abdomen were enlarged; the liver covered and full of petechial spots; bladder healthy, and urine of normal color but cloudy. There was no external swelling or enlargement on the body of the animal, but from the appearance of the spleen and the fluid condition of the blood, the cause of death was due to the septic condition of the blood—possibly anthrax (charbon). The mules first affected on this plantation were those used by the negroes going from place to place at night after their day's work was finished.

From this place we went to that of Andrew Smith (colored), where we found 2 mules affected. One of them was recovering, the other had a pulse of 52, thready in character, temperature 103° F., swelling of the sternum and axillary region. These mules have been running at large along the banks of Silver Creek. We then proceeded to West Bank plantation, the property of W. H. Lambeth, where the first mule of the present outbreak was affected. This animal was taken sick about the middle of May and allowed to run at large up and down the banks of Silver Creek, coming in contact with a number of mules, cattle, and hogs, until it died, about ten days after the disease was first noticed.

We proceeded from this place to Mr. Gales's plantation, 7 miles distant, where we found the carcass of a mule that had died a few hours before our arrival. The neck of this animal was much swollen from the throat to the chest. According to the history given by the owner the animal suffered severely from suffocation, due to the œdema of the glottis. With the exception of the swelling of the throat and the cellulitis, the lesions found resembled those of the cow, sections of which, also the blood and urine, I forwarded to the Department by express for further investigation. The cases that are affected in the throat invariably prove fatal, while only a few of those which have the abdomen affected are so. There is doubtless a septic condition of the blood, probably induced by the presence of *Bacillus anthracis*. Before my arrival Professor Creelman had prescribed chlorate of potash and muriate of iron internally and bathing the enlargements with a solution of carbolic acid strong enough to act as a counterirritant. The majority of the mules thus treated are making a good recovery. About 100 mules have died during the present outbreak. The mules in this section of the country are worth on an average about $150 per head.

I recommended sinking wells on the different plantations, to insure a supply of pure drinking water for the stock during the droughts which are so prevalent in that region during the summer months; the removal of healthy animals to non-infected fields or districts; the burial of dead animals and giving to all exposed ones chlorate of potasium and muriate of iron internally; also washing the bodies with a solution of bichloride of mercury, one part to one thousand parts of water.

From the reports that were in circulation about Yazoo City it appears that charbon has been raging in the Yazoo bottoms ever since 1868, when it spread over a large extent of country; was very fatal, affecting all domestic animals. Ever since 1868 the disease has raged with more or less severity. The disease follows a drought and develops in a low, swampy section, where the animals are compelled to drink stagnant water, and is apparently spread by contagion. In 1881, after a long drought, charbon developed in a mild form on a plantation located on Silver Creek and spread from 12 to 15 miles in both directions, only a small number of animals being affected and the death rate small. Silver Creek is about 40 miles long; the plantations on both sides front on the creek; the animals owned on the various plantations are allowed to run at large up and down its banks. When the owners discovered that charbon had broken out among their mules they started with them for the hills east of Yazoo City. About 400 head of them were driven from Silver Creek over both roads to the hills, thereby spreading the contagion along both roads. It was the general report en route, both going to and returning from Silver Creek, that no cases had been noticed on any of those plantations until after their mules had come in contact with those from the creek. Doses used in outbreak of charbon at Yazoo City: Chlorate of potash, 2 drams; muriate of iron, 1 teaspoonful, twice a day; carbolic acid solution, externally, 1 part to 8 parts of water.

James A. Walrath, inspector of the Department, reports as follows, under date of June 19, 1890:

Pursuant to your order of June 17, to investigate cattle disease on the farm of D. M. Druce, Mexico, N. Y., I started on the evening of the above date and arrived in Mexico the following afternoon. Being met at the depot by Mr. Druce, we proceeded to his farm, some 3 miles south of the village.

The history of the outbreak as given by Mr. Druce is about as follows: Seventeen cows and a calf have been kept on the farm, running during the day in a low piece of meadow land, covered by a rank growth of grass. It has been the custom to turn them out of this pasture at night into a field on the hillside. Saturday afternoon one of the cows was found dead. The next day they were again turned into the meadow and two more were found dead before night. Thinking that they perhaps were eating some poisonous weed, the owner kept them in the upland pasture on Monday, where another died and several more were observed to be sick. Tuesday scarcely any in the herd were well, though no deaths took place. Upon my arrival Wednesday all were much better, none of them refusing food. All that had manifested any symptoms of disease were tested by the thermometer and in only one instance was there any fever, the temperature of one cow standing at 103°.

The cow that had died on the hill pasture was exhumed and a post-mortem examination made, but owing to the heat and dampness no very positive lesions could be made out. An exudation of blood into the pericardiac sac and a thickening of the tongue were the most prominent.

A diagnosis of anthrax was made, and the owner advised to discontinue the use of the meadow as a pasture.

PNEUMONIA AMONG HORSES.

Dr. A. W. Clement, an inspector of the Bureau, was directed, in the latter part of November, 1890, to visit and inspect a number of horses in the town of Front Royal, Va., which were suffering with a disease which it was feared might be contagious. The following report, addressed to the Secretary of Agriculture, gives the results of Dr. Clement's investigation:

Your letter of the 24th instant, asking for detailed report of investigation of disease among horses in Virginia, reached me on the 25th, and would have received immediate attention but for the fact that the shipments of cattle to England have occupied all of my time for the past three days.

In accordance with telegraphic instructions I left Baltimore early on the morning of November 19, and arrived at Front Royal about 3 o'clock in the afternoon of the same day. I was met at the station by a Mr. Davis, at whose solicitation, I understood, the mayor of the place had communicated with the Secretary. Mr. Davis informed me that a very serious disease had broken out among the horses there, the nature of which they did not understand. Some three or four animals had died and eight or ten that he knew of were sick. I went with him to see his animal, a valuable driving mare, and found the following conditions: The animal was taken sick the day before; up to that time she had done her work as usual. The symptoms presented were as follows: Pulse 80, and scarcely perceptible; respiration 40, and very short; abdominal muscles tense; temperature 105° F; extremities cold, ears cold; mucous membranes of the nose hyperæmic; considerable thick mucous discharge from both nostrils; submaxillary lymphatic glands not enlarged; conjunctivæ hyperæmic; some watery discharge from the eyes; on percussion a dull note over the entire surface of the left lung; on auscultation an absence of respiratory murmur over the same area; right lung gives clear respiratory murmur.

This was the only animal sick in that stable at the time, and I did not learn that any others had been sick. At another stable I found a pair of driving horses presenting symptoms similar to the above, though not so severe. Several others had been sick in this stable but had recovered.

I learned that an animal which died and was cut open had its "chest full of water."

The stable in which these horses were confined had the boarding on the sides put together in a very loose manner, as much as an inch of space separating them, so that the cold air could blow directly upon the animal. I advised the owners to close the cracks and to procure veterinary attendance.

I prescribed stimulants and nourishing diet in place of the aconite with which they had been treating them.

I did not pursue the investigation further, as to my mind there was no question that the animals were suffering from pneumonia, so commonly met with in practice.

CONDITION OF THE LIVE-STOCK INDUSTRY OF NEBRASKA.

Under date of September 8, 1890, Mr. H. J. Harwi, an inspector of the Bureau of Animal Industry, submitted the following report on the live-stock industry of that portion of Nebraska adjoining northwestern Kansas:

The live-stock industry of that portion of Nebraska adjoining northwestern Kansas, comprising 150 miles east and west and about 90 miles north and south, is in the same condition relative to breeds, grades, and prices as in northwestern Kansas.

This section has enjoyed an abundant corn crop each year for the last ten years. It is well watered and heavily timbered along the streams. The native grasses are the buffalo and blue-stem, the former rapidly yielding to the latter. Corn is the chief product, and is extensively raised. Cornfields of 100 acres and more are very common.

The natural advantages for sheltering stock consist of bluffs, draws, and heavy timber, and are invaluable. Very slight expense will provide comfortable shelter for any number of animals. The failure to provide shelter is the exception and not the rule, hence ordinarily the mortality is very small.

The corn crop this year is comparatively a failure, and sells at 60 cents per bushel, as against 10 cents per bushel in October, 1889. The feeding of cattle, hogs, and sheep is the leading resource, and has been very profitable. About 33⅓ per cent of the cattle annually fed in this section are grown here. The remainder are furnished principally from the ranges of western Kansas and Colorado. About all the hogs fed are grown here; few come from the adjoining portion of Kansas. Colorado and Utah supply the mutton sheep. Scarcely 25 per cent of these are grown here.

The capitalists and banks of the cities of Omaha and Lincoln, Nebr., advance money at 10 per cent interest per annum to the feeders to buy stock for feeding, thereby crowding the industry to such an extent that the corn is nearly all consumed each year. Corn of the 1889 crop is very scarce.

The horse, cattle, and sheep rangers in some localities of northwestern Kansas annually (about November) drive to this section to take advantage of the shelter and cheap feed, and remain until about April 1. Cornstalks generally sell at from

10 to 20 cents per acre, and as a rule the corn is not gathered very closely, so that on an average not less than 3 bushels of nubbins remain. This year, however, cornstalks sell at from $1 to $4 per acre. An average straw stack sells at from $8 to $15. All the coarse forage this year is being saved.

Well water for cattle is preferable. Especially is this true in blizzards. The ice-cold water aids to chill them, so that some will almost famish for water before they will drink from a stream. The well water is not so cold, is relished better, drank more freely and regularly, and possibly reduces the risk in running cattle in cornstalks. To water regularly is very essential in feeding cornstalks. Quite a number of cattle died last season while running in stalks, so that a large acreage remained unpastured. Range steers wintered here on stalks and properly sheltered command from $2 to $5 per head more than those wintered scantily on the range. This clearly portrays the absolute necessity and value of comfortable shelter and good feed properly fed, for without it one blizzard frequently stunts a whole herd to such an extent that they never mature nor develop as nature intended, which certainly affects their value to a marked degree.

Stock growers take but little care of their cattle, and do not seem to realize the injurious effects of improper care and attention; besides, they breed prematurely, which naturally impairs the quality and prevents the offspring from properly maturing and developing. The breeding from immature stock is one of the most serious drawbacks to the industry. Generally very little attention is paid to this subject by the growers, yet they can not reconcile themselves to the fact that it is due to breeding too young, and from stock that has not matured. Fully 50 per cent of the stock growers engage in the business without experience. They breed for numbers—quality is a secondary consideration. During the winter they run the cattle on grass. They have an aversion to feeding, until compelled so to do to prevent starvation. They seem to be entirely unable to comprehend the necessity and the profitableness of keeping cattle thriving and growing the entire year. They prefer to sell their feed. They stunt their cattle by starvation and neglect. They console themselves with the fact that cattle will fatten readily on the buffalo grass during the spring and summer, and be in good condition for market in the fall. The result is that the cattle thrown upon the market by these amateur growers are inferior, not matured or developed—in fact, "scrubs" compared with cattle having had the proper feed and care. They demoralize the market, and are to a very great extent responsible for the present depression. The low prices will probably have the wholesome tendency to limit the number to the amount of feed and requisite attention. The number of corn-fed cattle from this section this year will be small.

SHEEP.

There are very few sheep in this section. But few are grown here. The number for wool growing has increased about 33⅓ per cent, while the mutton sheep has decreased about 10 per cent. Nearly all have been marketed that were in any condition whatever for market. The present drought and failure of the corn crop affects sheep husbandry less than any other branch of the live-stock industry. Sheep consume a greater variety of plants than any other domestic animal. Thus they are provided with food from the range when it is barren of sustenance for all other stock. They consume all the refuse from feeding horses and cattle, hence the actual expense of keeping sheep through a dry season and resulting crop failure is not as great proportionately as that of any other stock.

No disease has prevailed among sheep. About the only loss has been occasioned by wolves and dogs.

HOGS.

About 40 per cent of the hogs have been marketed for slaughter, of which number 20 per cent were not in condition for market. About 20 per cent have been shipped to eastern Nebraska, Iowa, and Missouri, as stockers. About 75 per cent of the August and September pigs have been and will be destroyed on account of the scarcity of corn. Stock hogs are cheap and can be bought at any price. The growing and feeding of hogs hitherto has been very profitable. Corn as a rule was cheap, varying from 10 to 20 cents per bushel.

No disease has prevailed to any alarming extent. Scattering cases of cholera have been reported. January 1, 1891, will scarcely find one-third as many hogs here as did January 1, 1890.

HORSES.

There are very few horse growers who make it a business in this section. The farmers view with favor the French and English draft horses. It is very doubtful whether the number of horses at present is any greater than a year ago. This is due to the scarcity of feed. As a rule the farmers keep the best and highest grades and sell the others. No disease has been reported.

CATTLE.

About 50 per cent of the number of cattle bought last spring for feeding this fall will be roughed through the winter. The remainder have been or will be thrown on the market as stockers, with few for slaughter. Compared with 1889 about 20 per cent will be fed. The market here and in northwestern Kansas declined 15 per cent during the month of August. No disease has prevailed. The Shorthorn cattle are largely preferred among the feeders.

DETERIORATION OF AMERICAN CHEESE.

It would seem from a recent report of the cheese committee of the Home and Foreign Produce Exchange (limited) of London, that American cheeses were waning in popularity "because of a distinct deterioration from the earlier standards." The report of this committee, which is issued from Hibernia Chambers, London Bridge, S. E., March, 1891, is as follows:

At the opening of a new cheese season we think it may be useful to record some experiences of the American cheese trade in 1890-'91.

For some years past the United States product has been waning in popularity on the London market, relatively because of the advance in the Canadian make, both in quality and quantity, positively because of a distinct deterioration from the earlier standards.

To find a factory which, week by week, fulfills the requirements for a choice article is now the exception.

It is a matter of universal complaint here, that the American supply has not come up to these essential conditions, with the result that losses and disappointments have been numerous.

The goods have on arrival only too often proved to be either porous in the make and with an excess of moisture or, on the other hand, tight and leathery, in both cases developing bad keeping qualities.

The moist loose cheese becomes ill-flavored rapidly, while the tight poor cheese goes wrong in flavor before the curd has had time to break down and become mellow. There have also been complaints of color flying badly.

Earlier in the season the cheese was shipped too green, and consequently, during the summer months at least, suffered seriously in transit, the natural development being arrested and the cheese spoilt.

More careful attention to strong well-fitting boxes and good cooperage is also desirable.

It is, however, only fair to say that the late made cheese from all sections was on the whole very good for October make.

We do not presume to instruct practical makers as to the causes and remedies; it is our duty simply to indicate those points where improvement is needed, and to trust to the abundant energy and skill of the dairy farmers of America that they will make a strenuous effort to recover their lost prestige.

We would point out that their interest is the same as ours. A good product not only commands the full market value, but makes the business crisp and pleasant to all concerned.

We plead the importance of this trade, and the large extent of the interests concerned on both sides of the Atlantic, as an excuse for troubling you with these remarks.

By order of the committee.

G. J. ACOCKS,
Secretary.

HORSE BREEDING IN NEW JERSEY.

Hon. J. M. RUSK,
Secretary of Agriculture:

SIR: Comparatively little attention had been paid in this State to the breeding of standard or registered horses until the year 1866, in which year was formed the New Jersey Association of Trotting Horse Breeders. For a number of years previous to this time Col. E. W. Conover, of Middletown, N. J., and Mr. H. N. Smith, of Trenton, N. J., had bred trotting horses, and although they were indefatigable in their efforts, they had not attracted the attention their labors deserved. In March, 1886, the following circular was issued:

DEAR SIR: You are cordially invited to attend a meeting to be held at the Trenton House, Trenton, N. J., on Saturday, March 20, 1886, at 10 o'clock a. m., the object of this meeting being the formation of a State Breeders' Association for the purpose of developing and improving the breed of the trotting horse. It is desirable to secure a large attendance at this meeting, as officers for the ensuing year will be elected. In case you are unable to attend, please signify your desire to become a member by addressing A. V. Sargeant, Raritan, N. J.

This circular was signed by the Fashion Stud Farm, Trenton, N. J.; John S. Clark, New Brunswick; Mount Pleasant Farm, Finderne; Col. E. W. Conover, Middletown; Elias A. Wilkinson, Newark; Matthias Plum, Madison; E. G. Doolittle, Montclair; R. F. Shaen, South Orange; William Force, Flemington; R. Cadugan, Bayonne; R. B. Konover, Trenton; William F. Kidder, East Orange; Joseph Ballantine, Somerville; and A. V. Sargeant, Raritan.

Mr. Sargeant was principally instrumental in calling this meeting, and the result was the formation of the New Jersey Association of Trotting-Horse Breeders. The organization of this association awakened a lively interest in its object, and there have since been yearly meetings, attended by persons interested in trotting stock from all over the country. At these meetings there are contests of the speed of the products of the various stud farms in the State. Additional interest was lent to these contests by the fact that there were a number of competitors, the contests differing from those held in the West, where one remarkable colt carries off all the honors. The breeders in New Jersey seem to have attained the best results by in-breeding with thoroughbred mares.

The following gentlemen are at present engaged in breeding standard horses in this State:

Mr. H. N. Smith is the owner of the Fashion Stud Farm, in Trenton, Mercer County. He breeds about fifty head a year. One of the products of his farm as a yearling made a record of 2:41 at a meeting of the Breeders' Association, the best record for yearlings in this part of the country. The colt was subsequently sold to Mr. John S. Clark, of New Brunswick, N. J., who owns a breeding farm in Kentucky. As a 2-year-old this colt got a record of 2:25. The name of the colt is Presto; he is by General Washington, he by General Knox, dam Lady Thorne.

Col. E. W. Conover died about two years ago, and his son, Mr. William H. Conover, succeeded him in the management of the stud farm in Middletown, N. J. He breeds about 6 head a year, and

among his stock is the stallion Chandos, by Strathmore, sire of Santa Claus, dam by Almont.

Mr. A. V. Sargeant, of Raritan, N. J., will breed about twelve head this year. He is the owner of the stallion Kernwood, by Wedgewood, by Belmont, he by Abdallah 15, he by Hambletonian.

Mr. A. B. Darling, of Darlington, Bergen County, breeds about twenty head a year. He is the owner of Starlight by Kentucky Prince, and of Wellington by Kentucky Prince.

Messrs. Disston & Kilgour have a stud farm at Woodstown, Salem County, and breed about twenty-five head a year. They own Benton by General Benton, and Mambrino Pilot by Clark Chief.

Mr. W. J. Keys, of South Branch, breeds several colts every year and is the owner of Luke Fleet by Smuggler, and Fiddler Ford by Volunteer Clay.

Mr. W. N. Burgess, of East Lynne Farm, in Hunterdon County, breeds twelve colts a year and owns the stallion Egypt by Rysdyk, and Four Aces by Administrator.

Mr. E. E. Bergen, of Somerset County, breeds six colts a year and is the owner of Rintoul by Mambrino Dudley.

Mr. S. C. Mount, of Manalapan, owns the stallion Magenta by Electioneer, and uses him for breeding purposes.

Mr. E. G. Doolittle, of Montclair, Essex County, has just added his name to the list of breeders of trotting stock in this State.

MARKET VALUE OF HORSES.

In considering this subject carriage horses first attract our attention. Of this kind of horses we find that New Jersey uses the New York or Kentucky bred horses as distinguished from what is known as the western bred horse.

The free shoulder action of the New York and Kentucky horse, working from the knee upwards, makes this animal more prized than its western brother. In addition to this the New York horse has the advantage of being accustomed to the climate of New Jersey. The New York horse as a rule is not as fine as the Kentucky animal, but he is hardier and will last longer.

A team of New York or Kentucky horses in New Jersey is worth from $1,500 to $2,500. The Western horses, whose action seems principally from the knee down, bring from $600 to $1,000.

The Percheron or Norman draft horses are used exclusively in this State for heavy trucking, and bring from $500 to $700 a team, according to weight.

The farmers of New Jersey depend almost altogether on the West for a supply of horses to be used on the farm, few of our farmers paying any attention to breeding. Those horses sell from $350 to $450 per team.

The West also supplies the horses used by the various horse-car lines in this State, and these animals sell on an average of $135 each.

Driving horses for family use come from all parts of the country, a number being received every year from the South and the West, in addition to those which are bred here or come from New York or Kentucky. They bring from $250 to $400 each according to speed.

The general utility horses, used for delivery wagons and similar purposes, come nearly all from the West and are worth about $175 each.

Respectfully submitted. H. ROMAINE.

PATERSON, N. J., *January* 1, 1890.

OUTBREAK OF DISEASE AMONG CATTLE IN MISSOURI.

Hon. J. M. RUSK,
Secretary of Agriculture:

SIR: In compliance with your telegram of the 10th instant, I started on Thursday morning, the 11th instant, for Missouri, to investigate an outbreak of disease existing among cattle of that State.

I was directed to report first to Dr. D. E. Salmon, Chief of Bureau of Animal Industry, at Washington, D. C.

On my arrival there I was handed the following circular letter of Dr. Paul Paquin, State veterinarian of Missouri:

FOOT-AND-MOUTH DISEASE.

At the outset I beg stock owners not to be alarmed at this heading, and the newspapers not to raise a scare by incomplete explanations of this letter, or inaccurate descriptions of the disease I am about to explain, or partial explanation of my opinion.

Heretofore much damage has been done our stockmen, farmers, and our market centers just because of rash, unjustifiable, incorrect publications, and by ridiculous excitement, aided perhaps by unscrupulous speculators.

Some years ago a panic was created in the live-stock centers because of an outbreak of ergotism in Kansas, which had been termed foot-and-mouth disease. The error was very unfortunate, but had there been no error and had it been the true foot-and-mouth disease of Europe, why such excitement? It is the mildest epidemic affection of stock known, and the death rate scarcely rises to 10 per cent in the most virulent outbreaks, and not one-half per cent in the ordinary. The only serious damage that it does cause is in reducing the flesh and stopping the milk. Here it does hurt to the amount of several dollars per head. It is to prevent such possibilities and limit the trouble that I write and explain publicly a now prevalent malady attacking the mouth and feet of cattle in several counties of our State, and creating consternation among farmers and stockmen.

My object is to explain what to do, and I emphatically declare that there is absolutely no need of alarm in the slightest degree. Now if some wise man or knowing character does not feel called upon to scare the people, all will be benefited who are suffering and none will suffer who are free.

It is our policy to destroy all contagion and infection quietly and without publication. But in this instance we are taxed beyond our capacity. The demands for advice are too frequent, and the trouble too much scattered, and erroneous notices have already been published. We can benefit all and the whole State only by general public work.

I respectfully request every paper of the State to copy this in full—preface and all—so that every community may be informed of its duties and how to prevent losses.

IT IS A MOUTH-AND-FOOT DISEASE.

The disease I refer to now prevails among cattle in several counties. The symptoms are as follows: The cattle appear gaunt and gaunter day after day for want of food. If examined, the nose may be found hot, dry, and sometimes wine-color in patches. Blisters appear on the inside and on the margin of the lips, which become more or less raw and bleed easily. The pad (upper-jaw gum corresponding to the front teeth of lower jaw) also presents blisters, which soon break, form a thick, yellowish, cracked, soft crust. Sometimes the tongue is blotched or blistered, but rarely. There is much drooling of stringy, watery matter from the mouth, and the odor is anything but agreeable—often very fetid indeed. Those yellowish crusts slough out after a few days and leave raw surfaces or sores. There is occasionally a peculiar smacking of the lips.

In a few cases complications arise by which gangrene—rotting in fact—of the gums extend to the jawbones or teeth, and in a few instances the teeth become loose and even drop off.

Most of cases become lame and stiff from the same lesions breaking in the feet—the cleft particularly. Occasionally, also, blisters and consequent results—scabs, crusts, and even raw sores—occur on the udder. In three or four these appeared on the neck, the belly, the back, and about the root of the tail. Uncommonly there is diarrhea. The malady runs its regular course in an average of about eight days. The shortest course I have noticed was five and the longest eleven. There are irregular or complicated cases which last much longer. Fever, more or less intense, keeps up most of the time. The type is very mild, death rate being, so far as I can learn, less than one in two hundred.

PREVENTIVE AND CURATIVE TREATMENTS.

(1) Separate all the sick and suspicious from the healthy stock, leaving the former where the disease began and putting the healthy in a new pasture or lot.

(2) Wash the mouth twice a day with a solution of borax or alum, or both combined, *i. e.*, a wash composed of, say, a tablespoonful or more of pulverized borax and alum to a pint of water.

(3) Watch very closely the healthy stock and separate every new case as gauntness appears or any suspicious symptom may present itself, such as lameness, stiffness, dullness, dry nose, difficulty in taking food, etc.

(4) Persons attending to such diseased stock should not visit pastures or places occupied by healthy stock, whether on their own property or at their neighbors. All who have healthy stock should abstain from visiting diseased stock.

(5) Buckets and other articles used for diseased stock should not be used for anything else unless washed and scalded.

(6) Stock from infected herds should not be shipped to market or moved from the infected grounds, and none should be allowed on highways.

(7) It is prudent to keep sheep and perhaps swine away from the infected herds.

(8) Persons with sore or chapped hands should handle disease carefully and wash clean after dressing cases.

It will pay to follow strictly all these measures of precaution. Some of them may appear unnecessary, but they are all based on rational hygienic principles that should not be transgressed. In bad or complicated cases, in which the feet are much affected, a daily wash with a copperas solution will be a great assistance.

Feed: The lips usually become so sore that the cattle can not pick any food. This is what causes such extreme gauntness and failing in flesh as characterizes the malady. When death occurs it is rarely due to internal lesions, but seems generally caused chiefly by starvation during the fever. To avoid such results feed the stock gruel, and push ears of corn into the mouth directly under the grinders, when the patient will chew and eat them.

Now is this the European foot-and-mouth disease? I confess I am not yet positive. It corresponds exactly with authoritative descriptions of it. But this much is certain, it is an epidemic affection of mouth and feet in cattle, and it is new to me. I know it is neither simple aphtha, nor simple eczema, nor ergotism. I am familiar with all of these.

We are now engaged in tests with a view to solve the question of infection and contagion. But we deem it necessary to instruct the people at once and not wait for the result of these experiments.

The number of letters received concerning this disease precludes the possibility of official visits to all, so it is urged that stock owners follow the directions given here and quarantine their own diseased stock. They will find it profitable to themselves and the country.

Any citizen having this affection among his herd will kindly report to me at once, giving township, county, nature of disease, number of cases, number of deaths, and stating if any other animal than cattle took the disease.

Again, I ask all papers interested in the welfare of their community to please copy in full.

Your humble servant,

PAUL PAQUIN,
Missouri State Veterinarian.

STATE VETERINARIAN'S OFFICE,
Columbia, Mo., September 4, 1890.

The great importance of verifying or negating the only plain inference of this somewhat remarkable document as early as possible caused the Secretary to order me to go to St. Louis, Mo , at once, where, by arrangement by telegraph, I was to meet Dr. Paquin.

I left Washington via Pennsylvania Railroad on the evening of September 11, and on my arrival at the Southern Hotel, St. Louis, Mo., on the morning of September 13, I found Dr. Paquin in waiting for me.

At 9:30 a. m. of the same day we started for Old Monroe, Lincoln County, Mo., to visit cattle reported sick at that place. We had to drive from Old Monroe station to Chain of Rocks, about 6 miles distant.

Went first to the farm of E. R. Williamson, who has a herd of 16 head, consisting of cows, calves, and steers. Three weeks ago he bought 8 of these animals in the immediate neighborhood; the rest he has raised on the place.

The first case of sickness occurred six weeks ago (three weeks *before* the purchase above referred to) in a milch cow. This cow appeared stiff, and the owner, thinking she was "foundered," paid but little attention to her. In about two weeks she calved naturally and at term. Her calf has been with her ever since and remains perfectly healthy. Upon examining the mouth of this cow I discovered the remains of abrasions of the dental pad and the first two bars of the inferior maxilla.

Another cow, one that has been on the premises for years, is now convalescing. The mouth presented appearances similar to those above described. There are no evidences that the feet or legs of either of these cows have been affected. No other animals on the place are or have been sick, though all have been running with these two cows. A calf, six months old, has been in the habit of eating food that was chewed and dropped by one of the sick cows and shows no signs whatever of any illness.

G. W. Pollard, living about one-quarter of a mile from Mr. Williamson, has a herd of 35 head, all of which he has raised. He is positive that they have not come in contact with any other cattle. Two of his cows that were taken sick about four weeks ago are now well. A red-roan cow, 7 years old, was noticed to be indisposed on the morning of September 12. The milk secretion is lessened and the cow appears somewhat dull and listless. She is disinclined to move, but is not lame. The temperature is 103° F., respiration 20, pulse 60. Upon examining the mouth I found reddening and congestion of papillæ of lips and tongue; there is slight excoriation of dental pad and first bar of under jaw. There is no discharge of saliva, no movement of jaws, and no smacking of the lips. The remainder of the herd, young and old, do not show the slightest departure from health. The sick cows have not been separated from the healthy ones.

There are about one hundred similar cases reported in this (Lincoln) county, but all are mostly recovered. In the majority of instances only one to four animals of a herd were affected; and I can not find a single instance where the feet have been affected. The only cases of death reported have been in young stock or grown animals, where no attempt was made to keep up their strength by feeding. The appetite is never lost, but there is an inability to eat unless the food is placed well back in the mouth; when this is done they chew the food and swallow it without difficulty.

We returned to St. Louis on the evening of September 13, and started on morning of September 14 for Columbia, Boone County, Mo., arriving there about 4 o'clock p. m. of the same day. Went at once to see some of the "town cows" that had been sick, but could not find any diseased at this time. Monday morning, September 15, I procured a team and with Dr. Paquin visited some affected herds in the neighborhood of Columbia.

F. W. Smith, who lives a short distance out of Columbia, has a very fine herd of 70 head of Herefords. The first case of this disease was noticed by him three weeks ago. Since then he has had seven others attacked. According to Mr. Smith, the animals are noticed to be dull, cows lose their milk secretion for about two days, the mouth is sore, and there is difficulty in cropping grass, etc. The duration of the disease, he says, is from four to six days. He has not noticed any lameness nor any sores on or about the feet or legs. Three of his cows are at present affected, two of which, however, are rapidly recovering. One of these had an eruption upon the udder, which is now covered with hard, dry, brownish scabs. The third one of these cows was noticed "beginning" September 14. Her temperature is 102.9° F., respiration 22, pulse 60, bowels natural, and she continues to eat and drink. The muzzle is dry, harsh, and of a brownish color; the dental pad and first two bars of inferior maxilla are denuded of mucous membrane, as is also the tip or apex of tongue. The papillæ of the mouth are reddened, enlarged, and congested, and bleed upon friction. There is a slight mucous discharge from the nose and an increased flow of saliva. Mr. Smith has not lost any cattle from this malady. He asserts that if they are in long grass they manage to get enough to eat and require no treatment. If the grass is short he feeds them by pushing solid food well back in the mouth or by giving gruel, etc. His cattle have all been together, and from careful observation he is certain that the disease is not contagious.

David Guitar, living about 1 mile from Mr. Smith, has one steer similarly affected.

Warren A. Smith, of Woodlandville, about 10 miles from Columbia, Mo., reports that he has had ten or twelve cases in all, the last being so mild as to be scarcely perceptible, and that in two or three days after the attack they were apparently well. A neighbor of his had about the same number affected, and they are now all well.

Mr. W. A. Smith, in describing the first cow attacked, says:

The first thing I noticed wrong was her failure to milk, refusing to eat, had blisters or sores on teats and udder, also at the root of the tail, extending to the udder and flank—all attended with a stiffness. On examining I found that the front gums, or the gums corresponding with the front lower teeth, were raw and very sore, making it impossible for her to feed herself. I then began giving green corn, placing it up in her jaws so far as not to interfere with the sores on the gums. She commenced to improve as soon as I fed her awhile in this way, and I now think

she is perfectly well. The calf following this cow had the same disease, but I am sure it did not lose a pound of flesh. All my other cattle came through all right, with but little loss of flesh, because I at once fed and cared for them as I should.

Dr. Paquin kindly informed me that from the reports to him up to date the following counties of Missouri are, or have been, affected, giving the approximate number of cases as follows:

Counties.	Cases.	Counties.	Cases.
Audrain	100	Marion	6
Boone	93	Pike	16
Cole	3	Randolph	19
Howard	15	Saline	3
Johnson	6	St. Charles	27
Lincoln	100	St. Louis	2

The animals were mostly milch cows, though bulls, steers, and calves were also affected.

The governor of Missouri, having asked for an early report of our investigations, Dr. Paquin sent him on the evening of September 15 the following letter:

To his excellency Governor D. R. FRANCIS,
Jefferson City, Mo.:

SIR: I beg to report to you the result of further investigations carried on by me, in conjunction with Dr. Charles B. Michener, inspector of United States Bureau of Animal Industry, respecting the present outbreak of disease among cattle in several counties of this State. We find by observation and careful inquiries as to the history of the cases, that by no possibility can this disease be identical with European foot-and-mouth disease. We are also led to believe that this disease is not contagious, but that it is due to like causes or conditions that are now operating quite generally throughout the State. The foods (grasses, etc.) may probably be affected with some form of fungus that is producing this trouble. This, however, is not definitely ascertained as yet.

We are united upon the following facts:

(1) That the disease in question is not foot-and-mouth disease.
(2) That it is not contagious.
(3) That there is not the slightest cause for alarm among our stock owners.

Respectfully,

PAUL PAQUIN,
State Veterinarian.

I concur in the above report.

CH. B. MICHENER, V. S.,
Inspector, Bureau of Animal Industry.

That this disease is not eczema epizoötica, or foot-and-mouth disease, is borne out by the following facts:

(*a*) It is not contagious. Often only 1, 2, or 3 animals of a herd are affected; in only two instances could I learn of as many as 50 per cent being diseased.

(*b*) It does not follow the course of the movement of cattle, but appears simultaneously at many different and secluded parts of the State, missing many herds and attacking others.

(*c*) In all instances I was assured that *by no possibility* could the affected animals have been in contact, mediate or immediate, with the virus of foot-and-mouth disease.

(*d*) The symptoms, course, and termination of this affection do not conform to those of foot-and-mouth disease.

(*e*) Lameness, with lesions of the feet and legs, is the exception.

(*f*) So far the disease has resisted all attempts to reproduce it by inoculation with the saliva or other fluids, etc.

I have intimated, in my concurrence with Dr. Paquin's report to

Governor Francis, that this disease is one due to eating some irritative substance or substances. That this fungus—ergot, or whatever it may be—is taken up by the act of grazing, is indicated by the fact that the anterior part of the mouth only is affected in the great majority of cases. In rare instances the poisonous agent is taken in quantities sufficient to produce general symptoms and lesions of the udder, teats, etc.

Until a more careful and thorough examination of the different grasses and foods is made to discover the exact nature of the agent causing this trouble, we must refer to it as a noncontagious form of irritative stomatitis, due to some unknown parasite or fungus affecting the food.

Very respectfully,

CH. B. MICHENER, V. S.,
Inspector, Bureau of Animal Industry.

BROOKLYN, N. Y., *September* 22, 1890.

GLANDERS AMONG HORSES AND MULES IN TEXAS.

Hon. J. M. RUSK,

Secretary of Agriculture:

SIR: In obedience to the order sent me from your Department, authorizing me to investigate an outbreak in glanders in De Witt County, Tex., reported to you by Hon. V. Weldon, of Cuero, the county seat of said county, I beg to submit the following report:

The commission, dated Washington, October 21, arrived on the 26th, and I left Dallas for Cuero on the 28th, and arrived the next day at 3 p. m., after a ride of 422 miles.

De Witt County is situated in southwest Texas, and is composed of rolling prairie, divided by the Guadalupe River; contains very little timber, with numerous small streams of clear water. The country is thinly settled; farming is done only on a small scale; the business is principally stock raising; the ranches varying in size from 1,000 to 25,000 acres or more, and all divided up by wire fences, so that stock do not range indiscriminately, as at one time, when the country was all open.

Cuero, the county seat, is situated near the geographical center of the county on a level prairie, and has about 3,000 inhabitants. It is built about 3 miles from the Guadalupe River, which is its principal source of water supply, by means of a system of water works established about two years ago.

On my arrival I was met by the Hon. V. Weldon, and by him introduced to other leading citizens and stockmen of the county. I found upon inquiry that quite a number of horses and mules throughout the county had died in the last three or four years, and that the disease was considerably on the increase; that there had been until lately quite a diversity of opinion as to what the disease really was, some believing it to be glanders, others arguing that it was only a bad form of distemper, while still others thought it some other disease; all the time horses and mules kept dying off, and all apparently of a somewhat similar disease, and the opinion began to gain ground that it had its infection in and around Cuero. This belief became so strong in the minds of a number of horse owners that they believed it unsafe to take their stock to Cuero, and it then began to show its effects upon the retail trade of Cuero. This feeling of danger to the stock interest was increased by the reports of merchants in the adjoining towns. It was then that the citizens of Cuero and vicinity became fully alive to the situation of affairs, and saw the necessity of doing something. A meeting of the citizens was called, and the matter fully discussed; a committee was appointed to devise ways and means to arrest the disease in question. The first act of the committee was to raise a fund by public subscription to defray the expenses of a competent veterinarian to come and investigate the disease and define its char-

acter and advise the best means of stopping its ravages. They employed Dr. A. R. Bolkom, of San Antonio, a reputable veterinarian of extensive experience both in Texas and other States. Dr. Bolkom at once recognized the disease as glanders, and by a number of post-mortems demonstrated the presence of glanderous ulcers in the nasal chambers; the tubercles in the lungs; also the farcy eruptions on the skin. After staying some two or three days, and condemning and killing a number of animals, the doctor returned home.

A number of diseased animals still remained alive, the owners refusing to have them killed, and there being no law to compel them to do so; and the quarantine law of Texas being a very loose one, the condition of affairs seems to be worse instead of better. The greater number of the leading citizens believed it to be glanders, and knowing well their commercial interests were being hurt, wished to have the disease eradicated, and argued that if it was not glanders it was equally as bad a disease and ought to be stamped out; while others would tell of their long life in Texas, their great experience with stock, and that no such a disease was ever known or could exist in a climate like Texas. Then the owner of a glandered horse that did not wish to have him killed, from a pecuniary point of view, argued that this man's lifelong experience with stock in Texas, even if he could not read or write, was, in his opinion, worth a great deal more to him than any imported book-taught veterinarian, and would positively refuse to destroy his animal or take the proper care of him.

This was about the state of things when I reached Cuero. My first statement to the citizens' committee was, that I knew Dr. Bolkom personally, and knew that he was amply able to recognize glanders when he saw it, as I had seen him tried in a case I saw with him in the city of San Antonio a year ago; but before committing myself to any opinion on the subject, I would examine the diseased animals myself, which I immediately proceeded to do. My first inquiry was, where did the majority of the horses and mules in Cuero, and also those coming into the city from the country, get their daily supply of water? I was shown a public watering-trough that would hold about 75 gallons, situated near the center of one of the principal streets, and also near the heart of the city. It was supplied by a pipe from the waterworks, though at the present time was not in use, but had been so up to the time of Dr. Bolkom's visit, he having pointed it out to them as the chief source of infection, an opinion which I found after investigating a little further to be absolutely correct. I was then conducted to a livery stable where the disease was said to exist. It was the property of Mrs. Olsen, and was managed by Mr. Miller. I afterwards learned that some 15 mules and horses had died here of the prevailing disease. I was shown two horses with blankets on, although the thermometer stood about 85° in the shade. I inquired the reason for it, and was informed by the manager of the stable that they had been sick but were now improving fast and would soon be well. Upon making an examination I found one just developing an acute case of glanders; the other had assumed the chronic form. From the stable I passed into a yard attached to the stable, in which there was a number of horses running loose. In this yard was a water trough. Among this lot I found one with glanders and farcy; these, together with a mule belonging to the same stable, I had destroyed the next day. I was then informed there were some suspicious cases at large on the commons. I procured a conveyance, and accompanied by a number

of citizens went in search of them, and was rewarded by finding two well-developed cases in the chronic form. We returned to the city and found the owners, who agreed to have them destroyed. The next day I obtained the names of some parties believed to have diseased animals in their possession, a short distance in the country. I visited them but found nothing suspicious. When I returned to the city, in company with a number of citizens, I had all those found diseased the day before taken about 3 miles to an out-of-the-way place, where no animal would go near them but wolves and buzzards, and had them killed. They all showed unmistakable signs of glanders. On Friday I visited Cheapside, a small place consisting of a post-office and store. There was a tournament and political speaking going on, and about 200 horses and mules were present; none showed any signs of glanders. Dr. Millner, a practicing physician located there, said he had lost six horses since spring, and the last one he had killed about ten days before, as it could not live much longer. He did not know what was the matter with them, but believed it to be glanders; they all contracted it from one; that fact he was sure of. After further inquiry, he stated that he was familiar with the health of the horses in his vicinity, and he only knew of one other suspicious case at the time, a horse belonging to Mr. Pate Terry. We found Mr. Terry on the ground, and as we stated the object of our mission he accompanied us to his place, about a mile and a half distant, where we found his horse diseased with glanders in the chronic form, and Mr. Terry had him destroyed. Not hearing of any more suspicious cases we returned to Cuero, having driven about 35 miles, making inquiries of every one and examining a large herd of range horses belonging to Bennett Bros., but without finding any more cases. On Saturday I went to Yorktown, about 25 miles distant. On the way we called on Mr. Fred. Brown, who was reported as having some diseased horses. I found none diseased, but he informed me that last year he lost over 20 head with what he believed to be glanders, and that one of his tenants had lost 6 head, all that he had, this spring; and another had lost 2 head, all that he had; and they believed they died of glanders; and the symptoms, as given by them, certainly indicated glanders.

At Yorktown there was a political gathering and public speaking, and a great many people and horses were present. I did not find or hear of any suspicious cases, but heard of several cases that died in the winter and spring in Missouri Valley; but at the present time there were no suspicious cases in the vicinity. Not being able to trace any disease, we returned to the city pretty well tired out, after a 40-mile drive under a hot sun and over a road that was anything but pleasant.

On Monday I was told of a horse, belonging to Mr. M. Baker, that was suspicious. Upon examination it proved to be affected with glanders, and was immediately destroyed. A Mexican also drove a pair of horses into the city from the Bates ranch, and one had glanders, and was taken possession of by the marshal and afterwards destroyed. Tuesday being election day, I remained in the city and examined a large number of horses without finding any cases. On Wednesday Sells Bros.' circus showed in Cuero, and the whole population of the entire country for 30 miles around came in to see the show. There were estimated to be a thousand horses and mules in the city that day. I made a very careful examination of them, and

found three cases, one of which was immediately destroyed; the other two were turned over to the marshal. One of them was owned by a man in the adjoining county, and was slipped off by the owner, when Marshal Benjamine notified the officers of that county to look after the case; and the other was taken back to the former owner by the party in whose possession we found it, and has since been killed. On Thursday I visited Mr. Ryan's ranch, which was reported to have diseased animals on it, but I found none there.

I met Mr. McCrab, of Thomaston, who was also reported to have sick horses on his ranch, but he positively denied having any sick animals at the present time. His ranch being some 10 miles distant I did not visit it owing to such assurance. I then visited Mr. Burns's ranch. Not finding anything I drove to Mr. Bonner's and examined his horses and mules, he being reported to have the same disease among his stock which had killed that of others, and also to have had it himself, and to be able to cure it. I found no disease among his stock, but on the neighboring ranch I found a well-defined case of glanders in a mule in the possession of Spencer Spriggs. He had it destroyed the next day. On Friday, hearing of three suspicious cases, I visited Mr. Louis Burns, jr.'s, ranch and two neighboring ranches, and found one developed case in the chronic form, and immediately had it killed; on post-mortem examination the lungs showed a mass of tubercles. On Saturday I visited Mr. Wooford's ranch and saw three head that were exposed to a horse believed to have glanders, which had since been killed, but they showed no symptoms of the disease; and on returning to the city I went to Mr. Lackey's ranch, but found no glanders. On Saturday I followed up some false alarms, but found no cases. On Monday I visited the ranch of Mr. Braoh in company with Mr. J. Miller, and examined two horses that the former had removed from the city about three weeks previously. They were found to be glandered, and he agreed to have them destroyed the next day. This was the last case I could hear of. I returned to the city. It being past train time I prepared to leave for home, which I did the next day.

There were numerous rumors of cases in the neighboring counties, where it no doubt exists; but there were no reports of serious attacks, and as I was only commissioned to inquire into and report on the outbreak in De Witt County I had to consider my investigation at an end.

In summing up I wish to thank the citizens of Cuero for their assistance in ferreting out and having destroyed all cases of glanders to be found in De Witt County .

In Texas, there being no law to compel the destruction of animals with glanders, and as a great many of the cases were found in the hands of a poor class of people, such as Mexicans and negroes, who are quite ignorant of the nature of the disease, having bought or traded for them while diseased, they seemed to think that as long as they could eat, drink, and work, a little discharge from the nose amounted to nothing. To get glandered stock belonging to this class of people destroyed quietly, without causing an open rupture, required some policy.

There are a great many horses and mules raised here every year, and consequently there is a great deal of common distemper every season. In the fall and winter the days are hot and the nights very cool, and in consequence colds and catarrhal discharges are common in horses in this locality. These, of course, as a rule, get well. When

glanders get into a locality where these conditions are common, owners, not being able to distinguish the difference between the different diseases, are in consequence led astray, and argue that the one horse is sick the same as the other, and as the one got well the other may also.

Out of the seventeen cases I found, sixteen were in the chronic form. Most of them were in fair condition, being worked or ridden, which might be due to the mild climate, but which made the disease all the more treacherous. I believe its spread in the locality was due principally to the public watering place. On the open range I do not think there is as much danger of spreading the disease, as there most of the stock is watered at ponds, a great many of which are made artificially in low places to catch and hold surface water, and are termed tanks. They are seldom drunk to the bottom, where the discharge of glanders generally sinks, and when dropped on the grass where the animal is grazing it is destroyed in a short time by flies and insects, or the rains wash it off the grass and into the earth.

In regard to the resolutions passed at a mass meeting called by the mayor and other prominent citizens of San Antonio at the instigation of a half dozen horse dealers, declaring that there was not a case of glanders in the State of Texas, nor in their belief has there ever been one in the State, and these statements indorsed by two veterinary surgeons practising in the city of San Antonio and published in the San Antonio *Express*, I will say that in the four years I have practiced in Texas I have seen a good many cases, and I know that it exists to a considerable extent throughout the State. I have seen over 25 cases in the city of Dallas. One stockman in Grayson County lost 375 out of 530 odd head of horses. The contractors of the Fort Worth and Denver Railroad (Cary & Jones) lost 33 head in 1887. A party living near Bryan, Brazos County, lost 44 head in 1888. A number died and others were killed in the Sherman street-car stables in 1887. A suit was brought in the courts of Fort Worth, and judgment rendered for the plaintiff. The ground upon which said suit was brought was glanders. In this case some 300 out of 450 animals died and were killed for glanders. I have seen and know glanders to exist in ten different counties in north Texas. I have condemned horses for glanders several times, but owing to the loose laws of the State regarding contagious diseases I could do no more, and the owners have spirited them away to some distant point and traded them off. I condemned a mare for glanders, a well-marked case in the chronic form, in April, 1888. She was traded to a shipper of horses in a neighboring county, who was warned that she had glanders. His reply was, that he did not care. He put her in with a carload of horses, and shipped her to a neighboring State. I was forbidden by the owners to go on a farm in Dallas County, this spring, to examine some horses believed by the neighbors to have glanders. The parties interested, when they could not get the horses examined, applied to the county judge, prosecuting attorney, and grand jury, and they all decided that according to the law nothing could be done. These horses have since been taken out of the county and traded off.

Another party in this State took a drove of horses, about 100 in number, to a certain county in a neighboring State and sold them. In about two months he returned with another lot, and 36 of the first lot had died from glanders. He had to shift his base and hunt another market. I could go on and multiply these, and I am prepared to furnish the names and dates and can easily substantiate all

the statements I have here named by facts and witnesses beyond contradiction.

Now I do not believe in creating any unnecessary alarm in saying there are ten cases when there are only five. I feel that I am as much identified with the interest of the State of Texas as any other citizen. I do not believe it is right to deny facts, especially in connection with a disease of the character of glanders, when by the proper laws and officers to enforce them it can be completely stamped out. The neighboring States believe, know, and assert, that there is glanders in Texas. The State veterinarian of Indiana a year ago considered the propriety of asking the governor to quarantine against all Texas horses coming into that State on account of three distinct outbreaks of glanders directly traceable to the importation of Texas horses. The State veterinarian of Illinois had the same question under advisement for the same causes. They know that we have no laws whereby we can systematically arrest the spread of any contagious disease; that we have no State funds to apply to the eradication of any such cases, and no authorized officers to take cognizance of any contagious disease whatever.

We know we have glanders here; so what is the use of denying it. Denying facts is only misleading to the ignorant, and does the State more damage by allowing the disease to still further spread.

Very respectfully,

WM. FOLSETTER, M. D., V. S.

DALLAS, TEX., *November* 15, 1890.

REGULATING THE TRANSPORTATION OF SOUTHERN CATTLE.

Hon. J. M. RUSK,
Secretary of Agriculture:

SIR: By your direction, April 1, 1890, I assumed control of the yarding and "routing" of all cattle that have arrived at the Kansas City stockyards, from April 1 to December 1, 1890. With the aid of the assistant inspectors stationed at the different railroad yards, I have yarded all cattle that have come since March 15, 1890, from any point south of the line described in your order in the west side division of the Kansas City stockyards.

Assistant Inspector Howard Rhoades, at Argentine, Kans., inspected and routed, via Atchison, Topeka and Santa Fé Railroad, 8,998 cars containing Southern cattle. Of these 7,674 cars were billed to Kansas City and 1,324 cars consigned direct to Chicago. Three thousand three hundred and ninety-seven cars were billed from stations that are from 1 to 75 miles north of the Department quarantine line. Assistant Inspector Anderson M. Hunter, at Parsons, Kans., on the Missouri, Kansas and Texas Railroad, inspected and marked Southern cattle on the waybills of 8,500 cars of cattle, 5,840 of which were consigned to Chicago, 1,458 cars to St. Louis, and 1,202 cars to Kansas City stockyards.

Assistant Inspector Charles E. Collins, at Herington, Kans., on the western division of the Chicago, Rock Island and Pacific Railroad, inspected and "directed" 1,830 cars as "Southern cattle." Of these 1,412 came to Kansas City, 411 cars went to Chicago, and 7 were shipped to Omaha. Two hundred and fourteen cars of these cattle were billed from north of the quarantine line. Having no competent United States inspector for the Missouri Pacific Railroad, it was thought best to leave it in charge of Joseph Bruser, inspector for the State of Missouri, who had orders to coöperate with and report to the inspector of the Bureau of Animal Industry at Kansas City, Mo. Mr. Bruser did good service by designating 1,045 car loads as "Southern cattle." Eight hundred and three carloads were consigned to Kansas City, and 242 cars for Chicago. Three hundred and eighty-two cars were billed from stations in Kansas.

July 15 Assistant Inspector Thomas W. Oshel reported for instruction, and on the 15th of September he was assigned to a station at Springfield, Mo., on the St. Louis and San Francisco Railroad, it being believed that many cattle were run that way to avoid the inspection at Kansas City. Assistant Inspector Oshel's report shows these rumors to be well founded, by his marking "Southern cattle"

on the waybills of 886 carloads of cattle consigned to St. Louis. Fifty-one cars were from stations north of the thirty-seventh degree north latitude.

Received from other railroads 33 cars of Southern cattle, making in all a total of 21,292 carloads of Southern cattle that have passed under our observation.

Col. A. J. McCoy, assistant inspector, did valuable service for the Bureau of Animal Industry in superintending the cleansing and disinfecting of stock cars, and in making known the regulations and wishes of the Bureau of Animal Industry to managers of the different railroads doing interstate business at this point. The inspectors here miss his wise counsel, and in his death the Bureau has lost a faithful officer.

It has been a very hard matter to get the railroads here to clean and disinfect in a satisfactory manner the cars that brought in Southern cattle, to say nothing of getting them to clean and disinfect cars that had been used for carrying Northern cattle, when used again to transport "feeders" or "export cattle."

In the general inspection of the yards during the season I found at various times 49 cars of cattle that were yarded in the wrong "division." These cattle were removed, and the pens and chutes cleaned and disinfected.

To inform you of the condition of the Kansas City stockyards during the past season, it would only be necessary for me to state that of the 70,000 Northern and Western cattle that have been shipped from these yards into the State of Kansas, not one animal has died of Texas fever.

Southern Texas cattle have been driven north of the southern boundary line of the counties of Childress, Hall, Briscoe, Swisher, Castro, and Parmer, in the Panhandle of Texas, since March 15, 1890, in violation of the regulations of the Department of Agriculture. These cattle caused Texas fever in Castro, Randall, Potter, and Hutchinson counties, Texas.

In all cases where parties allowed native cattle to run on the same range with Southern cattle, the assistant inspectors were instructed to "route" all such native Panhandle cattle as "Southern cattle." The railroad companies transporting cattle from the "West-side division" of the Kansas City stockyards, invariably marked the waybills "Southern cattle."

There were five outbreaks of Texas fever in Missouri and Kansas from cattle that were brought from Texas in February, 1890, causing the loss of more than 400 native cattle. Two cars of these Texas cattle passed through the Kansas City stockyards.

Respectfully submitted.

ALBERT DEAN,
Inspector.

KANSAS CITY, MO., *December* 12, 1890.

PLEURO-PNEUMONIA IN GREAT BRITAIN SCOTLAND. AND IRELAND.

Hon. James D. Reid, United States commercial agent at Dunfermline, Scotland, writing under date of November 21, 1890, speaks as follows of the prevalence of pleuro-pneumonia among cattle in Great Britain, Scotland, and Ireland, and the efforts made to suppress the disease.

PLEURO-PNEUMONIA.

With the opening of the present month a portion of the Scottish press has devoted an unusual space to pleuro-pneumonia among cattle, respecting which data more or less instructive have been given. Occasional brief reports on this subject have gone from this agency on the existence of the disease in this region. The facts now given may be already well known and familiar. Yet I deem it to be my duty to transmit the larger details now given from official sources, inasmuch as these are made the basis of legislation on a subject affecting a large and important American traffic:

Scotland.

Year.	Outbreaks.	Diseased slaughtered.	In contact slaughtered.	Compensation paid.
				£ s. d.
1886	233	956	1,093	10,808 2 5
1887	321	1,364	2,333	22,565 19 6
1888	213	561	3,851	20,479 8 5
1889	239	866	3,492	19,221 5 10
Grand total				73,074 16 2

As all these animals were slaughtered by order of the national authorities appointed by Parliament, who decide through competent experts the extent of contact which required slaughter, compensation is made to owners in each case at a fair valuation, after deducting salvage for such portions of each animal as can be sold. Except in cases of tuberculosis the flesh of animals seized with or exposed to pleuro is not regarded, strange as it seems to the common sense, as necessarily unhealthy, and many eat it without hesitation. But it loses in value and is sold at low prices as "lean meat." Such sales, together with the sale of the hides, etc., are regarded as salvage, and deducted from the price of the animal in a state of health. The total compensation paid for slaughtered animals in Great Britain and Ireland during the years 1886, 1887, and 1888, was £163,935 15*s* 7*d*., or about $800,000, as follows:

	Outbreaks.	Compensation.
		£ d. s.
England	930	81,240 9 11
Scotland	867	53,863 10 4
Ireland	764	28,735 12 10

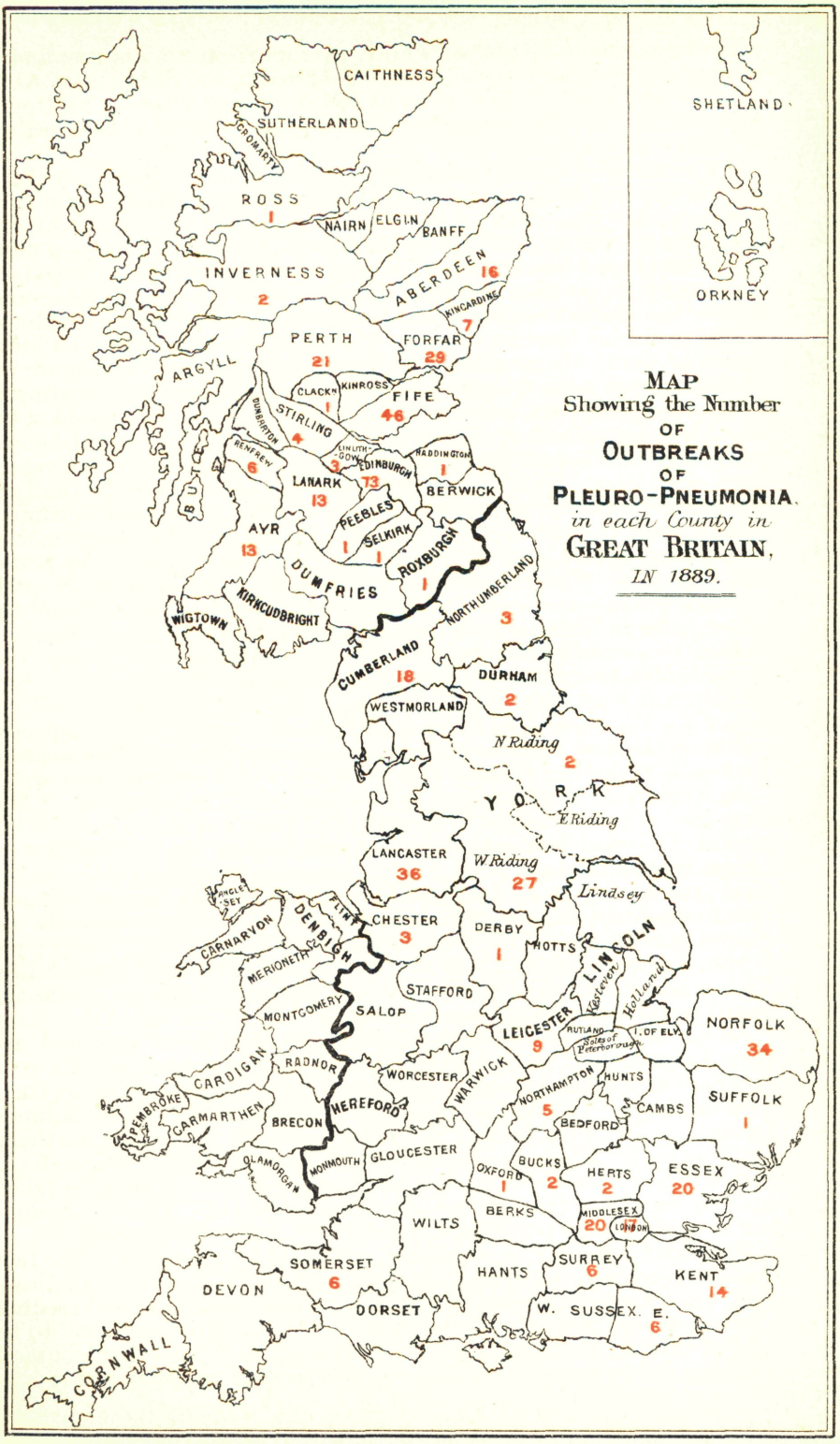
Wales seems to be almost wholly exempt from the disease, and it appears, in Scotland, to be largely confined to the districts of Aberdeen, Perth, part of Ayr, Fife, and Midlothian, where it has found development chiefly among the large dairies for which these regions are more or less noted.

Two classes of pleuro-pneumonia exist which require the skillful knowledge and diagnosis of a well-informed veterinary surgeon to distinguish. One class of the disease is sporadic, is not at all epidemic or infectious, and has no germ. Many cattle have been needlessly destroyed because of want of proper recognition of this fact. Especially, it has been thought, has this been the case in England, where the skilled veterinarian devotes his time chiefly and almost solely to horses, leaving the care of oxen and other cattle to a lower grade of skill. In Scotland this is not so. As more and more the Scotch farmer finds it necessary to add cattle raising and feeding to his means of support, he not only seeks carefully veterinary aid of the best kind, but more and more seeks knowledge of his own, until now a very large number of Scotch farmers have themselves no mean veterinary education. This is now operating more and more effectually in the energetic stamping out of cattle diseases and to proper discrimination in their treatment. The real danger is from the pleuro caused by floating germs, against which treatment has become very active and vigorous. The animal attacked is at once killed, and all cattle exposed are at once separated. Appended hereto will be found the latest rules in force in this burgh, which show the importance attached to summary treatment in order to extirpation. Only two animals attacked with pleuro were slaughtered in 1889 in this burgh, although at least 1,600 milch cows graze around Dunfermline. Were it not for the occasional avarice of farmers who sell their suspected cattle on the first evidence of illness, mixing them with the healthy for readier sale, the disease, it is believed, would soon disappear.

In conversation with one of our best informed veterinarians I find that one source of danger to the essential health of milch cows is the almost universal forcing process by stimulating food. The law requires that milk shall be of a certain consistent quality to be fit for food, and as almost all large milkers produce milk thin in proportion to quantity, highly stimulating food is given to produce the required conditions. This does not necessarily produce disease; yet it must more or less induce it. It certainly shortens animal life. This is admitted. Yet the practice is likely to continue, since the result is more productive and profitable.

So far as I can ascertain, the cattle exported from Scotland are from herds in northern counties where pleuro is unknown. There is nowhere any development of pleuro where herds are kept up by their own increase. The disease comes from the introduction of animals foreign to the home herd. So far as is known to me, the northern cattle exporter allows no addition to his breeders from foreign stock. Hence exported cattle from reputable cattlemen can usually be relied upon as free from taint unless afterwards exposed. The accompanying map shows the points and numbers of outbreaks in 1889.

The chief difficulty in stamping out pleuro-pneumonia is the fact that the germ requires sixty days to develop actual disease. It follows that, except where herds have been rigidly separate and no breeding allowed except in the herd, no animal can be positively said to be free of disease until separated for sixty days from other contact. This has led to an opinion by our most skilled veterinary surgeons


SHETLAND
ORKNEY
MAP
Showing the Number
OF
OUTBREAKS
OF
PLEURO-PNEUMONIA.
in each County in
GREAT BRITAIN,
IN 1889.
CAITHNESS
SUTHERLAND
CROMARTY
ROSS
1
NAIRN
ELGIN
BANFF
INVERNESS
2
ABERDEEN
16
KINCARDINE
7
PERTH
21
FORFAR
29
ARGYLL
CLACKN
1
KINROSS
1
FIFE
46
STIRLING
4
DUMBARTON
RENFREW
6
LINLITHGOW
2
EDINBURGH
3
HADDINGTON
1
BERWICK
LANARK
13
PEEBLES
1
SELKIRK
1
ROXBURGH
1
AYR
13
DUMFRIES
KIRKCUDBRIGHT
WIGTOWN
NORTHUMBERLAND
3
CUMBERLAND
18
DURHAM
2
WESTMORLAND
N Riding
2
Y O R K
E Riding
LANCASTER
36
W Riding
27
Lindsey
ANGLESEY
CARNARVON
DENBIGH
FLINT
CHESTER
3
DERBY
1
NOTTS
LINCOLN
MERIONETH
STAFFORD
MONTGOMERY
SALOP
LEICESTER
9
Kesteven
Holland
RUTLAND
Soke of Peterborough
I. OF ELY
NORFOLK
34
CARDIGAN
RADNOR
WORCESTER
WARWICK
NORTHAMPTON
5
HUNTS
CAMBS
SUFFOLK
1
PEMBROKE
CARMARTHEN
BRECON
HEREFORD
BEDFORD
GLAMORGAN
MONMOUTH
GLOUCESTER
OXFORD
1
BUCKS
2
HERTS
2
ESSEX
20
WILTS
BERKS
MIDDLESEX
20
LONDON
17
SOMERSET
6
HANTS
SURREY
6
KENT
14
DEVON
DORSET
W. SUSSEX
E.
6
CORNWALL

here, that if the American Government would order the separation of cattle for export for a period of sixty days before official inspection, prior to their shipment, the British Government would not require, as now, the slaughter of all imported cattle within ten days. Could this be done it would greatly benefit Scotland by supplying healthy breeders, and greatly enlarge the American trade.

In Scotland there is a marked absence of confidence in the skill of both English and American inspectors of cattle. How far this is justified by the facts is not to me known. In England it seems probably true, from reasons already given. Nevertheless, as the Scotch are a thoroughly practical people and agricultural prosperity becomes more and more identified with stock raising, I can not doubt that the employment of a certain number of Scotch inspectors by the American Government would be a wise act, and might lead to the annulment of the existing law requiring slaughter of all animals within ten days of their arrival at a British port.

STAMPING OUT PLEURO-PNEUMONIA.

Recurring to the efforts to extinguish this troublesome disease, no doubt seems to exist that could the means sought to be employed be thoroughly executed it could be successfully extirpated. But here avarice steps in and delays success. To present this clearly the following excerpt from official reports is given:

In order that pleuro-pneumonia may be stamped out promptly, something beyond the action of the central authority is absolutely necessary, viz, coöperation on the part of the stock owners. It has been proven that outbreaks are often due to the movement of infected cattle from markets or sale yards. The dealer is thus the active agent in disseminating the disease. He, in turn, is supplied with infected cattle by farmers and cow keepers. If stock owners all over the kingdom would agree to give immediate notice of an outbreak of disease among their cattle, instead of sending the sick animals to a butcher, and those which have been herded with them to a distant market, the extinction of pleuro-pneumonia would be an affair of a few months instead of being, as now, prolonged indefinitely.

The reports add the following important statement:

No difficulty has ever been experienced in dealing with known centers of disease, and the slaughter order passed in 1888 has been found perfectly effectual in stamping out the disease wherever it has been properly applied. Since the passage of the act, disease has not been spread from infected premises except in two or three isolated cases, while a long list of cases is reported in which the disease was spread from markets and sale yards, by cattle sent for sale from premises on which the disease had not been reported to exist. The history of pleuro-pneumonia for some years proves that the disease is spread from unreported and unsuspected centers by the movement of diseased and infected animals.

The truth is that, in effect, the notification of an outbreak (under present regulations) means ruin to the farmer. Even with compensation granted him he gets no more for his animals from the local authorities, perhaps less, than he gets from butcher dealers; he has to wait longer for his money, and has to submit to harassing restrictions. The report therefore concludes:

It would be entirely useless to argue from an ethical standpoint on matters of trade. But taking the lower ground of expediency, it may be suggested that a continuance of the system referred to will not only embarrass the central authority, but will be damaging to the interests of the cattle traders themselves, by forcing the authorities to impose restrictions on the movements and sales of cattle, which might be dispensed with if those who demand that pleuro-pneumonia shall be stamped out at the cost of the country would offer assistance instead of a self-destructive opposition.

In Scotland there are 227 veterinary inspectors, of which number 197 are members of the Royal College of Veterinary Surgeons, 23 are qualified as holding the the veterinary certificate of the Highland and Agricultural Society of Scotland, and 7 others. Inspectors, chiefly of the police force, 126.

This report might be greatly extended were it deemed desirable, the sources of information being abundant, although requiring discriminating labor which would be gladly given. The following results will present themselves to most readers of the data of this pestilential disease:

(1) That no expense should be spared by governments necessary to stamp the disease out.

(2) That concealment of disease should meet severe punishment.

(3) That no part of an infected or exposed animal should be allowed to be sold as human food, no matter how healthy such food may be asserted to be.

(4) That no animal should be allowed to leave any country for a foreign port until after sixty days rigorous separation.

(5) That animals should not be allowed to be brought to local markets for sale except from contiguous farms and under oath that no actual or suspected disease exists thereon.

The following is a sample of the general testimony on this subject: In Cumberland the disease was not only spread from the sale yards, but also from the premises of farmers and dealers. Fifteen such outbreaks in Cumberland, Northumberland, and Edinburg, involving the slaughter of 38 diseased and 291 healthy cattle, were traced. Ten of these were traced to two farms on which outbreaks immediately connected were reported in January, 1889, but from which the cattle had been moved in November, December, and beginning of January and sent to sale yards, where the disease finally appeared. In the consular district of Fife, on a dealer's premises, pleuro-pneumonia was discovered towards the end of July, but prior to this he had sold cattle which proved the cause of disease on eleven different premises, on which 24 diseased and 68 healthy cattle were afterwards slaughtered.

The following entries appear under the head of "Diseases in animals landed from abroad during 1889:"

Port.	Cargoes.	Animal.	Number.	Diseased in these eighteen cargoes.
Baltimore, Boston, Norfolk, and New York.....	18	Cattle.	8,162	47

LOSSES DURING TRANSIT.

From the United States there were imported into the ports of Bristol, Glasgow, Hull, Liverpool, and London, 748 cargoes. These cargoes brought 292,653 cattle and 18,691 sheep. Of these animals 7,014 cattle and 983 sheep were thrown overboard during the voyage, 425 cattle and 37 sheep were landed dead, and 47 cattle were so much injured as to oblige them to be slaughtered at the places of landing.

CONDITION OF THE ANIMAL INDUSTRY OF KANSAS.

Hon. J. M. RUSK,
Secretary of Agriculture:

SIR: In compliance with your instructions I have made an investigation into the condition of the live-stock interests of Kansas, and beg leave to submit the following report of the results of my examination:

NORTHEASTERN KANSAS.

The territory of northeastern Kansas covers about one-third of the State, and includes thirty-one counties, bearing the following names: Atchison, Brown, Clay, Cloud, Dickinson, Doniphan, Douglas, Ellsworth, Franklin, Geary, Jackson, Jefferson, Jewell, Johnson, Lincoln, Leavenworth, Marshall, Mitchell, Miami, Morris, Nemaha, Osage, Ottawa, Pottawatomie, Republic, Riley, Saline, Shawnee, Wabaunsee, Wyandotte, and Washington.

While Kansas is well adapted to stock raising generally, this particular part of the State leads in natural advantages. The difference in climatic conditions between the northern and southern portions of the State are not very marked, the distance between the north and south lines being only 200 miles. A difference of a few degrees covers the range of temperature, and ten to fifteen days that of the seasons. Montgomery County farmers, in the south, are eating bread from new wheat when those of Nemaha, in the north, are in the fields reaping.

Northeastern Kansas is well watered, the surface is rolling and therefore naturally drained, and the soil is suited to the growth of tame grasses. Red clover and timothy are easily raised and are quite as certain as other crops. Wheat, corn, oats, and barley grow well in every county. The temperature is about that of Maryland, long summers and the winters mostly mild. About all the land is occupied, the population of the thirty-one counties amounting to 503,321, and the farms are generally in good condition. The soil is rich, and the farmers always have plenty of grain and hay, with abundance of good water to supply all the stock they raise, besides feeding large numbers brought in from other States to be fed for market. There is but little disease among farm animals here. Excepting a few cases of what is commonly termed hog cholera, there is nothing in this line to report.

A great many animals are raised in this district, though disease thinned the swine herds two years ago, and the decline in the prices of wool in 1885 and 1886 frightened wool growers into selling most of their sheep. A disposition is manifest in some quarters to reduce the number of cattle because of low prices. Some farmers are actu-

ally selling cows with this object in view. It is generally believed, however, that there is and will be profit in horse raising.

There is an evident determination among the people to grade up their stock. A great many pure-bred cattle are found on the farms, and several well-known importers and breeders have market for all their surplus breeding animals among their neighbors.

Improvement in the breeds and breeding of horses has not been as general as in other classes of stock, not because of lack of interest or enthusiasm, but because of the greater expense attending the raising of pure-bred horses. A stallion of recognized merit costs $1,500 and upwards, while a good bull can be had for from $100 to $500. It has been found convenient, occasionally, for a few farmers to join in the purchase of a stallion and thus a whole neighborhood is served. There is a demand for good horses. Farmers want to improve their own stock, first, because good horses are capable of rendering more and better service than inferior ones, and are more pleasant to handle; and second, because they are more valued in market and cost no more to feed or house. Scrub horses are bought and sold on the farms at prices ranging from $50 to $100, while good grades go readily at $150 to $200. The general rule that "it pays best to raise the best" is recognized. With the excellent facilities which farmers of this district have for raising the best horses, with good markets east and west, added to the prospect of the establishment of a cavalry station at old Fort Riley, horses are particularly desirable animals to raise.

Oats, wheat, and timothy can be grown on every farm; springs of pure water abound in many localities, and good water is found everywhere a few feet below the surface of the ground. Kansas City, just across the Kaw, is a good market for all classes of stock, and this whole region is tributary to it. Denver, only a little way beyond the line in Colorado, is rapidly growing into a market for good horses.

The opening of Indian Territory and the settlement of No Man's Land will open a new market there, while growing commercial relations with Mexico and the establishment of a deep water harbor on the Gulf will extend our interests in those directions.

Horses.—The general farmer now recognizes horse raising as an important branch of husbandry. In this portion of Kansas but little attention has been devoted to it heretofore, except by breeders who made it a specialty; but while cattle and grain remain generally unprofitable, the attention of the agriculturist is directed to horse raising as a source of profit on the farm, and each succeeding year more and better horses are likely to be raised. There is now a general demand for imported and pure-bred draft as well as standard-bred stallions for breeding purposes, and the grades produced from that class of sires are promptly taken by buyers for other markets. In nearly every county in this district may be found pure-bred Clydesdale, Percheron, English Shire, French Draft, French Coach, Cleveland Bay, and standard-bred stallions for service at prices that pay the owners well for the investment. Farmers see that it is folly to breed even the common mares to any other than pure-bred stallions, for the demand of both local and distant markets is for either grade draft or roadsters, and buyers are numerous, while inferior horses are not sought after; besides, they are unprofitable for the farm because they lack size, weight, strength, action, and endurance. The raising of horses formerly was to supply the farms with

work animals, but now that distant markets in the Northwest, East, South, and West demand more and better horses, farmers here are encouraged to compete with their brethren elsewhere in those inviting fields.

Grades from pure-bred Clydesdale, Percheron, English Shire, French Draft and Coach sires find ready buyers at from $100 to $200 each. Farmers are not agreed as to the value of the cross from the heavy breeds on common mares, some preferring to breed to the standard-bred trotter, claiming that this cross gives better satisfaction as a general purpose horse or horse for all work; hence both classes of grades are being produced. And this is an important matter. Kansas lands are not hard to work, and Kansas roads are nearly always in good condition and fit for quick movement in travel and transportation. Is a heavy, special purpose horse needed in such a case, or is a more active horse of good size and appearance, with readiness of movement and qualities for endurance, a more suitable beast for the farm? And after that question is determined, if it be decided in favor of a more active horse, shall we breed to the French or German Coach, English Hackney, Cleveland Bay, or to the standard-bred trotter, and in either case will we get a horse for the plow or carriage?

Common horses meet with slow sale, the local market prices ranging from $75 to $125. Our best markets for grade from standard-bred or English and French draft sires are Boston, New York, and Philadelphia, although some of our shippers made satisfactory sales in St. Louis, Chicago, and Denver. The large cities want streeters, roadsters, and matched pairs of coach and carriage horses.

The number of horses in the district covered by this report March 1, 1889, was 307,508, an increase of 22,000 over 1888. The number of mules and asses was 33,468, a slight increase over the preceding year. There is a scarcity of suitable brood mares fit to breed to pure-bred draft or standard-bred stallions; that is, the proportion of mares in comparison with a number of suitable sires is small, although as fast as they can be raised the number is increased.

Every year shows marked improvement in this respect. The demand increases. The present year buyers from a distance have covered this entire territory and secured most of the surplus horses suitable for market, and at present it is impossible to pick up a carload of horses suitable for market without consuming a great deal of time and covering a large territory.

The crops produced as an adjunct to horse raising are corn and oats, and native and tame grasses. Oats are regarded as the best natural feed for horses, but corn, wheat bran, and barley may be used profitably occasionally, with well-cured timothy hay. I desire to call special attention to mule raising as a very important matter to our farmers, on account of the steady demand at Kansas City and St. Louis markets. They want mules weighing 1,100 pounds and upwards. The demand greatly exceeds the supply. It costs the farmer but little more to raise a good horse or mule for market than it does to raise a steer, and the net profits are many times greater, under existing conditions. This portion of Kansas is especially well adapted to profitable horse raising, and can successfully compete with any other section of the Union. It possesses all the advantages of a reliable agricultural region, producing regularly and bountifully all the cereals and tame grasses. There is abundance of good water, the farms have natural drainage, and the climate is particu-

larly favorable to live stock on account of the long grazing season and the short and mild winters.

Diseases are not common among horses, and there are no epidemics or contagious diseases. Cases reported have resulted from exposure or lack of intelligence in feeding.

Cattle.—With a few exceptions this district of Kansas is occupied by a class of general farmers who are largely engaged in the cattle business; not exclusively, but in connection with other farm operations. They raise steers, heifers, and cows.

There is very little local demand for fat stock. It is mostly shipped to Kansas City, part going to Chicago, at prices which have ruled for some time in those markets. Net returns to farmers here are about these: On common fat stock 2 to 2½ cents per pound, and on grades 3 to 3½ cents per pound; cows, 1 to 2 cents.

There is scarcely any demand for half-breeds of any grade or class, owing to the low prices for fat stock. More cows are being fed for market than ever before. There is a general disposition to reduce the size of herds or to quit the cattle business. The cattle industry, from a beef standpoint, is not profitable at present prices. This is true especially of inferior or scrub animals, and the only class of beef cattle that can be handled without loss must be pure bred or grades, which must be handled economically and fed judiciously to realize any profit whatever.

In the district covered by this report, 307,122 milch cows and 692,728 other cattle were reported to the assessors as on hand March 1, 1889, which was a decrease of 10,000 milch cows and an increase of 36,426 other cattle since March, 1888. This makes the supply large for the demand, yet the surplus is readily taken at the Kansas City market, but at such discouraging prices that cattlemen can not afford to continue in the business much longer and escape bankruptcy, unless prices advance. Cattle generally are remarkably free from disease and feed is abundant at low prices; yet with these favorable conditions the outlook promises so little that cattlemen are utterly discouraged.

During the past two years fully a half million cows have been thrown on the Kansas City market, largely from Kansas. The receipts of cattle at that market for the first ten months of this year aggregate 988,717 head, an increase over the same period for 1888 of 157,829. Our stockmen do not assent to the idea that the low prices are wholly caused by overproduction, for the reason that all the stock sent to market is consumed, and the consumer pays as much now for his beef as he did when prices for cattle were much higher. The margin between the producer and the consumer is too wide, and the disheartened cattlemen anxiously clamor for the reason of it. Many of them attribute it to the manipulations of the "beef combine." Unquestionably the present methods of handling our cattle product fail to give the stock raiser the benefit of a fair and square competition in the markets. The law of supply and demand has become largely modified by artificial means. The range of prices for the three years last past has been below the cost of production.

The cattle business here has been confined mainly to the production of beef until recent years. Especially during the past two years the dairy industry has been making rapid strides, consequently good dairy cattle are more in demand than usual. Nearly every county in this district has one or more creameries, which generally

are profitable enterprises, and with their continued growth and success we may expect increased demand for dairy cattle. The continued depression of the beef industry has a tendency to hasten the development of the dairy business. A matter of special importance to the cattle interest, as it is represented on Kansas farms, is the raising and feeding of large numbers of cattle on Indian lands and on the public lands belonging to the Government. To raise cattle in that way costs little, for there is no rental charge on the lands, and no taxes are assessed against the occupants. It is free cattle raising, and the animals are sold in the open market in competition with others produced by farmers on their own individual lands at great expense. It is an outrage on the rights of men who buy their own lands and pay taxes on them. This practice ought to be suppressed at once and without any ceremony.

Swine.—The number of swine reported for this district on March 1, 1889, was 777,492 head, an increase over last year of more than 100,000 head. This shows to what extent they are raised. Nearly every farmer is a hog raiser to some extent. The hogs are sold principally in the Kansas City market. The range of prices has for some time been from 3 to 4 cents per pound. The pure-breds most in demand are Poland-China and Berkshire, with an increasing demand for Chester White, Essex, and Yorkshire. The first two named are largely in the lead. Hogs have been remarkably free from disease in this district for nearly two years, although hog cholera or some other plague is reported in five counties. The supply is not equal to the demand, either for stock hogs or those fed for market. Stock hogs readily bring from 5 to 8 cents per pound.

The net cost of production, feed, shelter, and care is about $2 per 100 pounds, although many breeders with the good class of hogs, and at present prices of corn, claim that they can produce a 250-pound hog for $3.50. Hog raising is the chief source of income for many farmers in this district. This is a good hog country. Natural conditions are favorable and grains are grown abundantly. Good clover pastures and cheap mill products are found in every neighborhood.

The common adulteration of lard with cotton-seed oil works a hardship to the hog raiser, as the packers sell this lard compound to dealers, which they too often retail as pure lard. The greatest drawback, however, to hog raising is occasional outbreaks of cholera or some other plague. The cross recommended as the most profitable one for the farmer is that of the Poland-China or Berkshire boar on sows of other grades or breeds. It is not advisable to make any cross of pure breeds, but most of our farmers use either the pure-bred Berkshire or Poland-China boar on their grade herd with satisfactory results.

Sheep.—Sheep husbandry in this district has not been a prominent industry except in the counties of Ellsworth, Mitchell, Lincoln, Ottawa, Saline, and portions of a few other counties. The number of sheep in the State has fallen off nearly one-half from March 1, 1888, to March 1, 1889. The decrease in this particular district for that period has only been 15 per cent. March 1, 1889, the number of sheep on hand was 67,618. Somewhat improved prices for wool during two years past, and increased prices for mutton, have induced a disposition among farmers to go into sheep husbandry in a small way; this is true particularly of those farmers who have some knowledge of the business. The classes of sheep mainly on hand are Merinos and their grades, but the demand now is for Shropshires

and Cotswolds as well as Merinos. The present demand is far in excess of the supply. The range of prices for common sheep is from $2 to $4 per head. Breeders and feeders are looking everywhere for sheep and meeting with poor success, because sheepmen in other States are not disposed to part with their flocks. The object is to secure as much medium wool as possible and at the same time a good mutton carcass. Heretofore fine wool has been the main object and large flocks the rule in the sheep industry in Kansas; but now the business is looking up and from an entirely different standpoint. Radical changes in methods are likely to be effected, with a view to secure both mutton and wool. The general farmer can handle a few good sheep as well as other stock. The outlook for this particular industry is bright indeed. The only drawbacks are dogs and wolves. Kansas City is now an excellent market for mutton, yet not more than one-twentieth of the mutton sheep received this year at that market came from Kansas, and what was received was of rather poor quality. The sheep that produce medium wool are the most desirable mutton for the markets, and bring the top prices.

Many persons who have not specially informed themselves regarding the sheep industry of Kansas suppose that the business is practically defunct. The facts, however, reveal a very encouraging condition of affairs. Sheep husbandry is evidently on the eve of a renewed prosperity. More pure-bred Cotswolds and Shropshires have been purchased by sheepmen of the State during the past two years than ever before, and this year there have been more purchases of pure-bred Merinos than for three years past. Thus does everything point to a new and prosperous epoch in the sheep business of Kansas. And it is a fortunate change; for while our farmers had over 1,000,000 sheep in 1884 they had less than 400,000 in 1888, the decline following the season of low prices which began in 1884.

SOUTHEASTERN KANSAS.

This section of my report covers the southeastern one-third of Kansas, comprising the following named counties: Allen, Anderson, Bourbon, Butler, Chase, Chautauqua, Cherokee, Coffey, Cowley, Crawford, Elk, Greenwood, Harper, Harvey, Kingman, Labette, Linn, Lyon, Marion, McPherson, Montgomery, Neosho, Reno, Rice, Sedgwick, Sumner, Wilson, and Woodson.

The natural conditions here are somewhat different from those of the northeastern portion. The soil is not so well adapted to the growth of clover, and timothy hardly does as well on new soil, but the experience of farmers shows that by deep culture of lands which have been long broken the best quality of clover and of tame grasses may be grown abundantly. Corn grows as well here as there; wheat not so well, though there is plenty of it. While there are not as many large streams in this portion of the State there are quite as many small ones; neither are there as many surface springs, though there is as general a diffusion of water. The timber in this section is chiefly found along the water-courses in narrow belts. There are some broken patches along the hills and ridges, but they are small and scrubby, affording little protection to stock. It may be said, therefore, that the natural advantages for stock raising are in some respects better in northeastern Kansas than in this part. Still, the difference is not so great as in any manner to incline the people here to doubt that they have the best stock country in the world.

Farmers are fast learning the advantages of raising improved stock. There are now many first-class animals of all the different classes, and grade as well as pure-bred animals are rapidly increasing. Horses are found to be in demand for Eastern markets; cattle are always in demand, though now at discouragingly low prices; hogs were thinned out two years ago by disease; sheep were greatly diminished by the panic of low prices in 1884; but it is encouraging to know that in all departments of stock raising there is a better feeling, so far as improved breeds are concerned, and as to sheep husbandry there appears to be new life coming. It will be noted in the following pages that, as to sheep especially, farmers are very hopeful. The only serious drawback is in the low prices which farmers are compelled to receive for what they have to sell, not only animals but every farm product as well. There is much real anxiety about this among all classes of farmers here. A meeting of stockmen is called for the 8th of January, at Topeka, to consider this matter. It appears to be the general belief that Congress must come to the farmer's rescue. The regulation of interstate commerce being intrusted to that body exclusively, the trade in live stock being interstate commerce, it comes within the provisions of Congressional action.

As to markets, the indications in this part of the State are better than in either of the other parts, as the State has been divided for the purposes of this report. Kansas City, Mo., and Kansas City, Kans., are really one and the same city, about 90 per cent of the business being done on the Missouri side of the line. There are laudable efforts at Topeka, Atchison, and several other points to establish local packing houses, but they have a hard fight on their hands with the wealthy and long established concerns at Kansas City, which is just at the northeastern corner of Kansas. The city of Wichita, in Sedgwick County, of this southeastern district, has now in operation two large, well managed packing establishments, which have begun to attract fat cattle, hogs, and sheep to that point as a market, and it is confidently believed that the people within the range of this point will find a growing and profitable market for all their fat stock at this place. At Hutchinson there have also been located two packing houses, which, if properly managed, will have all the business they can handle. It is evident that farmers are beginning to see the importance of local markets for their fat animals. The loss caused by long transportation exceeds the profits on sales in many cases. In this respect the outlook is favorable with the excellent and abundant facilities for stock raising which are everywhere existing in this part of the State. All else that the people need, in order to do a profitable business in the animal industry, are paying prices for what they have to sell.

Horses.—The raising of horses in this portion of Kansas until recent years was confined mainly to producing a supply for ordinary farm uses and for the saddle. Mustang, Texas, or Indian ponies were in common use, especially by cattlemen, but as general farming became more prevalent their places were supplied with common horses. Mares were bred to grade stallions of almost every description, simply because horses were needed.

Horse raising was not regarded as an important factor of the animal industry, but rather as an adjunct to the then great cattle raising business or general farming. The present, however, reveals an entirely different condition of things relating to the rearing of

horses. To-day it is the most promising branch of animal industry, and if present conditions continue it will lead all other classes of live stock business in the near future. Each succeeding year there is an increased demand for improved horses, both pure-bred draft and standard-bred roadsters. In every county of this district may be found imported stallions of the Clydesdale, Percheron, English Shire, and French Draft breeds, as well as standard-bred stallions. There are at least ten of this class of stallions now to one six years ago. The demand for imported horses now is greater than ever before, especially for pure-bred stallions and good grade mares for breeding purposes.

Since the horse raising business has developed into its present importance intelligent farmers and breeders see the folly of breeding their common mares to grade or "plug" stallions simply because they are cheap. Breeding to pure-bred stallions has been highly satisfactory. Especially is this true of the second cross, which produces a horse that is desirable in every market. The demand is greatly in excess of the present supply.

The number of horses in the hands of farmers and breeders on March 1, 1889, in the district covered by this section of my report, was 269,886, an increase of more than 8,000 head over the preceding year. The larger part of these are work animals used on the farm and the remainder stallions and roadsters.

The number of mules and asses on hand March 1 number only 38,242. The raising of mules in this district, properly conducted, is a very profitable branch of the live-stock industry, as they can be raised more cheaply here than anywhere else in the entire country, and the nearness of the Kansas City and St. Louis markets is a particularly favorable feature. Local conditions are all good—cheap land, plenty of native grasses and other cheap food, abundance of pure water, short mild winters, and healthful climate generally. Mule raising will become more extensive and profitable in the near future.

In this district there is a surplus of light horses, of about 850 pounds weight, that meet with slow sale at prices ranging from $30 to $85. Grade draft horses sell readily at $150 to $200 to buyers from Eastern and Southern markets. During the present summer over $10,000 worth were sold from Fulton, a small village in Bourbon County. These buyers want horses weighing 1,100 pounds and upwards. Several carloads of common horses shipped from Peabody and Marion, in Marion County, the get of grade stallions and the choicest of that class, brought from $80 to $125 recently. Good style roadsters are also in demand for distant markets, and buyers pay from $150 to $250 for them. Small scrub horses are practically unsalable at home; in fact the demand for anything in the line of draft horses under 1,100 pounds is not worth mentioning. Buyers ask for well-shaped horses from 1,100 pounds upwards. Good animals of that weight are scarce, except in localities where they have had time to make the second cross with improved sires. The improved draft breeds are generally preferred by the average farmer, because they have now been well tried and bring more money in the market with the least cost in raising and always meet with ready sale. Roadsters are popular and profitable for the experienced horseman, but for the farmer they are more expensive to develop and handle.

The English Shire horse is quite popular at present with many breeders of draft horses on account of his heavy bone, good feet,

grand action, style, pluck, endurance, and of his crossing so well on the native mares. A prominent Kansas importer and breeder of all classes of draft breeds gives as his opinion that the "English Shire is the most popular now, although the Percherons are clearly preferable for many reasons. They stand bad weather better, possess better feet and action, are less liable to sickness, and are better 'general purpose' horses. The Shire possesses more size and stronger limbs, but in no other respect is it here considered the equal of the French draft breeds."

As a result of much correspondence and many personal interviews, I find that no one class of improved draft breeds has a general marked preference over all others. It is much a matter of fancy. Stallions of the Clydesdale, Percheron, English Shire, and French Draft breeds all give general satisfaction in crossing with the native mares. They produce an animal that sells readily at remunerative prices to buyers from distant markets.

There is also a growing demand for French Coach and Cleveland Bay horses. During three years past there has been a greatly increased demand for horses produced by breeding good style common mares to standard-bred stallions, and such horses are sought by buyers from Denver, St. Paul, Kansas City, St. Louis, Chicago, and Eastern cities; besides, many farmers in Kansas prefer this class of horses for general purposes. The fact that each of these various classes of horses has its devotees among the breeders and farmers who find either class profitable to raise, indicates that Kansas will soon produce a great variety of improved horses on a scale that will make this an inviting field for buyers and add materially to the prosperity and wealth of the State.

The unanimous response of those engaged in raising improved horses, as to the profitableness of the business, is that it pays better, properly managed, than raising any other class of stock. Except under exceptional circumstances, it will not be advisable to raise horses on a large scale, as the expenses would exceed the profits; but the general farmer will find it profitable to raise horses with other classes of live stock and consume the farm products on the farm, instead of shipping them away. The cost of raising a colt will be the service fee of from $15 to $25, and $1 a month for keep until it is three years old, which would make the entire cost from $51 to $61. After three years it will pay for its keeping by its work, and this service increases its value to the buyer. If the dam is a choice common mare of good size, the buyer will pay from $100 to $200 for the produce as form, quality, style, and weight are considered in determining the price.

There is a divided opinion among breeders and farmers as to the best cross on the common mares to produce the most desirable farm horse. Many are of the belief that one cross of the full-blood Percheron, Clydesdale, or English Shire will answer. Some favor breeding an individually good mare in size, style, and action, weighing 1,200 pounds, to a 1,200 pound standard-bred trotting horse; while others favor for first cross the Percheron and for the second cross the Cleveland Bay or Coach horse.

The natural products of this district include all the grains and tame grasses as well as an abundance of prairie hay. Wheat is grown regularly and cheaply; bran is always plenty, and oats, bran, and prairie hay are considered the best regulation feed; for winter, corn mixed with bran and oats. More tame grass pastures are needed

for early spring and late autumn grazing. Prairie hay is generally preferred for horses. It is less liable to produce heaves than clover and tame grasses. Colts do well on corn fodder, especially for a change; the same is true also of idle brood mares. As fast as the native grasses disappear their place is supplied with tame grasses, which do well. The general health of horses in Kansas is uniformly good, and there are no epidemics or contagious diseases within her borders. The only complaints are occasional cases of distemper or colic, the latter probably caused by injudicious diet. The local disadvantages and difficulties to be encountered in rearing horses are not sufficient to discourage the industry in any way, but I deem it best to mention some of them. Some localities do not raise enough large horses to induce buyers to come after them. They want a carload in a neighborhood. There is not enough tame-grass pasture to lengthen the grazing season, which makes too long a period of dry feeding. Another disadvantage which should be mentioned is the dangerous barb-wire fence. The greatest difficulty in the way of the growth and success of this business is the present stringency in money matters and the ruinously low prices for farm and animal products generally. When farmers are free from debt to a reasonable extent and can spare the money, the "plugs" will have to go, and in their stead improved horses of all classes will be raised in such numbers and at such prices as will enable Kansas horsemen to successfully compete with the world.

Cattle.—This part of Kansas has always been distinctively a cattle-growing country, and that branch of the live-stock business still leads. On March 1, 1889, the milch cows numbered 265,060 and other cattle 689,384, making a total of nearly a million cattle in this district alone, a decrease of 13,753 milch cows and an increase of 33,751 other cattle over the preceding year. Practically, every farmer here is a cattle raiser to some extent; besides, there are numerous cattlemen who breed and feed beef cattle exclusively. All the improved beef breeds are well represented, the Shorthorns in the lead, however. Many of the farmers raise grades, but the larger portion of the cattle for market are native or Texas cattle graded up. Pure-bred or grade Shorthorn, Hereford, Aberdeen-Angus, or Galloway bulls are used to cross on the native and Texas cows.

The present demand for beef cattle is for feeding steers of any age, but mainly two or three years old; and calves of either sex are in demand. This class of cattle is wanted now to consume the large crops of corn, hay, and fodder, which can not be sold in the markets at any profit to the producer. The following is the range of prices: Dry cows, $15 to $25; steer calves, $6 to $10; heifer calves, $4 to $8; yearling steers, $14; 2-year-old steers, $20 to $25; 3-year-old steers, $25 to $35.

The best fat cattle go mainly to the Kansas City market, although many shipments are made to Chicago and St. Louis, and bring net returns of from $2 to $3.50 per 100 pounds. Fat cows and heifers bring from one-fourth to one-third less. The local demand for fat cattle is insignificant, less than the home consumption, because dressed meat is shipped in from packing houses to supply this want, excepting what few fat cows are slaughtered by the local butchers, who pay from $1.50 to $2 per 100 pounds. There is also some local demand for fresh milch cows, especially in the vicinity of creameries, which, during the past two years, have been established in nearly every county.

The dairy industry is attracting the attention of our farmers more than ever before, and as a result there is a large demand for good dairy cattle, both pure breeds and grades. The Holstein-Friesians are having a large sale in the State, and the same is true of Jerseys. The raising of dairy cattle has not become general, being confined principally to such counties as have established creameries or which are in the vicinity of the larger towns and cities, where there is a local demand for dairy products. Most farmers prefer the beef breeds, but as there is a disposition to reduce the size of beef herds or quit the business entirely on account of the low prices of cattle on foot, we may look for a still greater increase of dairy cattle hereafter.

Until the past four years cattle raising for beef purposes was the most profitable branch of the live-stock industry, but at the present time, with abundance of cheap feed and almost every local advantage in favor of successfully raising the animals, with no disease, difficulties, or disadvantages worthy of mention, there is no disguising the great depression and decline of the cattle business. The cost of producing beef cattle is as much, if not more, than the price they will bring in the market when fat.

There is no question as to an oversupply of inferior cattle, but not of good, heavy, fat cattle, and it is the conservative opinion of experienced feeders that this latter class should bring at least $1 per hundred pounds more than the present prices, provided the old law of supply and demand regulated the market. But as the great beef packers do not bid against one another they control the price of live cattle as well as dictate the price which consumers shall pay for dressed beef, and that is almost the same now as it was when the feeders received from $1 to $2 more per hundred for their cattle on foot. Many breeders are of opinion, however, that there is actually no overproduction, for the reason that every animal that reaches the market is readily sold at some price and is consumed.

From careful estimates it costs $3.50 per hundred pounds to prepare a good steer for the market at thirty months, cost of feeding and care considered; but as few breeders mature their animals at that age, it is safe to estimate the cost of production at almost $4 per hundred pounds. This, of course, applies to cattle raised according to civilized methods, where feed, shelter, and care are considered, and does not apply to the range business or where the animals subsist on Government land—free range. The range cattle are produced for much less.

Farmers who raise cattle in southern Kansas feel unable to compete with the cattlemen on the Cherokee Strip and in the Indian Nation, who practically have free range, and they urge that the Government should charge for pasturing on its lands, or, what would be much better, prohibit it altogether in the interest of legitimate cattle raising. Many stockmen are of opinion that the profits of the business might be increased were it not for powerful combinations controlling the markets and contracting prices at their pleasure for cattle on foot, and at the same time maintaining such prices for the dressed meat that the poorer classes of people are prevented by the high price of beef from using it, and seek other meat or do without. This belief is so universal that I deem it worthy the careful consideration of the Department. It is to be hoped that something may be done to relieve the depression of this important industry, which is so well adapted to this part of the country, possessing, as it does, all the natural advantages for cattle raising—cheap grass, cheap grain,

cheap keeping, good water, mild and dry winters, and a climate unexcelled for producing healthy stock.

Swine.—The number of swine in this district, while covering about the same area as that of the northeastern district of Kansas, is about 100,000 less. The number reported in the hands of farmers March 1, 1889, was 668,952, an increase over 1888 of 105,787, which was as great an increase as was made in the northeastern district during the same period; consequently the ratio of increase was greater in this district. The quality of the stock is of a very high character. Swine raising is a leading industry, and nearly every farmer raises hogs to some extent; and it has been his chief source of revenue for two years past, because the prevailing prices of $3.25 to $4 per 100 pounds, or even higher, have been profitable for the producer. Kansas hogs command the top prices in the market, because they are uniformly of the best quality received at any market. The surplus of fat hogs above the local demand for home consumption is shipped mainly to Kansas City, St. Louis, and Wichita markets. The latter is a new market, and is located in Sedgwick County, Kansas, in the heart of the Arkansas Valley. The Wichita live-stock market is favorably situated at one of the best railroad centers in the State, and at a city with a population of 40,000, the third in rank in the State. The first year's business for this market closed November 30, 1889, and during that period 117,411 hogs were received, and fully 95 per cent of them were slaughtered and dressed at the packing house of the Jacob Dold Packing Company, located there. Francis Whittaker & Sons have recently established a packing house plant at Wichita, with a capacity of 1,200 to 1,500 hogs daily. Both of these packing houses are doing a fair business now, and when this market becomes better known they can undoubtedly run at their full capacity. Their business so far has been confined mainly to pork packing, but they have facilities for preparing dressed beef and are now supplying the local demand for that product. During the year just closed they have been able to pay within 10 cents per hundred of Kansas City prices, which, with the saving in shrinkage and small per cent of dead hogs, has done much to popularize this market among breeders and shippers. The showing made for this market the first year, without especial drumming up of trade, is creditable. The bulk of the consignments so far received have come from the adjacent territory within a radius of less than 50 miles. The capacity of the Wichita stockyards has been enlarged somewhat this fall, and they will now shelter 6,000 hogs and 3,000 cattle.

The pure breeds mostly in demand are Poland-China and Berkshire swine, although there is an increased demand for other improved breeds, but the number is small comparatively. Scrub swine have practically become extinct, as most of the hogs in the hands of the farmers are high grades, and Kansas swine are much better improved generally than any other class of live stock, consequently more profitable.

Hogs are generally in healthy condition, although there are cases of reported cholera in several of the counties of this district.

The demand for stock hogs greatly exceeds the supply. Farmers have so much corn and other feed on hand that it commands a price so small that feeding it to stock is more profitable. There is also an active demand for pure-bred hogs, and our breeders are constantly adding to their breeding herds from other States, so as to be able to supply the local demand.

The cost of producing hogs ready for market, value of feed, shelter, and care considered, is variously estimated at from 1, 1½ to 3 cents per pound for winter feeding, and in summer time probably one-third less. At the present price of corn, 15 cents, many estimate that 2 cents per pound will cover the cost of production of pork, and if coarser food is mixed with corn, or if hogs are allowed to follow the full-fed cattle, the cost is still further reduced, and most of the cattle feeders are compelled to let swine follow in order to make a profit on cattle.

Some of the local advantages favorable to the swine industry are cheap feed, good water, mild climate, short winters, cheap millstuffs, naturally drainable soil, and long, growing summers. The principal difficulties and disadvantages may be summed up as follows: Occasional outbreaks of swine plague, which seems to prevail every few years in the form of an epizoötic; lack of fences and the high price of lumber; high freight rates, and ignorance as to the proper mode of handling swine.

Sheep.—The number of sheep in the hands of the flockmasters in this district is small as compared with other classes of live stock. In some counties there are no flocks whatever, yet at the present time there are twice as many as are on hand in the district covered by my report for northeastern Kansas. On March 1, 1889, the number reported was 136,816, a decrease of 57,262 over the preceding year. This decrease was caused by the strong demand for mutton, which commanded a good price, and feed being plenty and cheap many of the flocks were culled and the inferior ewes and wethers were sold.

There is now great inquiry for sheep, both for feeding and breeding, and a hundred times as many would be taken if they could be supplied from any source whatever. The outlook is bright. Those handling sheep find them quite profitable for wool and mutton. The feeling among sheepmen for the past three years has been one of growing confidence, not of the enthusiastic kind, nor because there has been a wonderful amount of money made in the business, but more because of the depression and uncertainty in cattle and other stock. The increase in the demand for mutton and the success sheep feeders have met with for the past three years, with a slight increase in the price of wool, have led sheep handlers to think that after all their lot is a bearable one, as compared with that of men who handle other stock. The general opinion of experienced wool growers is that unless the tariff is dabbled with to the detriment of the business an era of prosperity is at hand.

The principal sheep-raising counties in this district are Butler, Cowley, Woodson, Sedgwick, Sumner, Reno, and Lyon. The class of sheep are the Merino and their grades. The smooth-bodied Merinos of large size are more in demand on account of their mutton qualities. Many breeders think that the best cross on the grade Merino ewe to produce the most profitable sheep for both wool and mutton is either the Shropshire or French Merino ram, though some favor the Cotswold. The most experienced sheep handlers in this district believe that good high-grade Merinos are by far the best sheep for this part of the State. The main object should be to breed for both wool and mutton, instead of for wool alone. Sheep always pay some profit to the farmer, and disease in this climate is almost unknown. The amount of capital required to handle sheep is not large as compared with other stock. The principal difficulties to be

encountered in sheep husbandry in Kansas are the ravages of dogs and wolves, and this is unquestionably the greatest drawback to the business.

The demand for mutton has greatly increased, both for home consumption and also for the Kansas City market, and it will require a very large increase in the flocks of Kansas to be able to supply this important demand. The sale of pure-bred rams this season has been much larger than in years, and it is gratifying to be able to report that this important industry for Kansas has outlived the depression which has affected it so long.

THIRD DIVISION OF THE STATE.

That portion of Kansas included in this section of my report, which is about one-half of the State's area, is in many respects different from the eastern portion of the State. In the first place, its altitude is greater, being on an average of 2,500 to 3,000 feet above sea level. This of itself gives to the region a peculiarly rare and dry atmosphere. The soil generally is a rich sandy loam, more especially upon the uplands. There is no timber except what has been grown in recent years by the settlers. The surface of the country is rolling, but the absence of timber is noticeable everywhere, except a few stray trees along the water-courses. The crops raised here are those better adapted to a dry climate and light atmosphere, such as sorghum, Kaffir corn, millo maize, rice corn, broom corn, and different varieties of millet and plants of that character. Sorghum is grown largely by some of the farmers for forage. It makes good hay, and the seeds when well ripened afford good feed for all classes of stock. The nonsaccharine varieties of sorghum above mentioned are being grown more extensively every year for stock feed. The stocks are lower, with larger foliage than the saccharine varieties of sorghum, and they are quite certain to mature even in this dry region; in this respect having an advantage over corn, which experience has demonstrated to be an uncertain crop. The experience of farmers is, that these newer crops are about as serviceable in the production of milk, butter, cheese, and meat, as corn, the old stand-by, which Eastern farmers have always believed to be the only pork and beef producing feed. The native grass here is chiefly the buffalo, with some other varieties, as the gramma grass. These afford excellent pasturage during all the growing months, and retain much nutriment even through the winter. Some farmers feed nothing to their animals during the coldest weather, letting them pick what they can on the open prairie, though it is a very unprofitable practice indeed. All in all, western Kansas can not be favorably compared with the eastern part of the State for purposes of general agriculture. Wheat grows here; so do corn and oats and barley; but they are not certain crops, because of the lack of moisture, the rainfall in this region being not more than 20 inches annually, while in the eastern portion of the State it averages more than 36 inches. But while this is true, the lighter crops above mentioned are taking the place of corn as forage crops, and farmers are fast coming to the conclusion that they can raise quite as good cattle, horses, swine, and sheep here as can be produced anywhere in the world. Proof of the correctness of that conclusion is seen all over this district, showing that stock growing will in the end be the leading industry of western Kansas. With irrigation this would be somewhat changed.

The rainfall, as we now have it, is sufficient for the growth and sustenance of stock, equal, acre for acre, with eastern Kansas and Missouri, and it is already demonstrated that western Kansas will succeed without irrigation as a stock-growing region.

The counties included in this division are as follows: Barber, Cheyenne, Clark, Comanche, Decatur, Edwards, Ellis, Finney, Ford, Garfield, Gove, Graham, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearney, Kiowa, Lane, Logan, Meade, Morton, Ness, Norton, Osborne, Pawnee, Phillips, Pratt, Rawlins, Rooks, Rush, Russell, Scott, Seward, Sheridan, Sherman, Smith, Stafford, Stanton, Stevens, Thomas, Trego, Wallace, and Wichita; 46 in all.

Horses.—This district has been famous for years as part of the great grazing region of the plains, or the buffalo grass country. Until recent years it was an open plain of public domain, unoccupied except along the streams, where were located the great cattle and occasional sheep ranches, with almost unlimited open and free range for stock. These ranches, during the past few years, have had to give way to the sturdy homesteaders, who desired the public land for homes and farms.

The number of horses in this district last spring, in the hands of farmers, was 130,839 head, besides 17,368 mules. Many ranches are being started, or are already established, for the exclusive raising of horses or mules for the market, and as a consequence pure-bred stallions are more in demand than heretofore. Some of these ranches get the cheap Colorado mares, which are active and unbroken animals of great endurance and hardiness. These are bred to Percheron or other draft stallions, and from this cross are raised mares of sufficient size to breed to either jacks, draft, or standard-bred stallions. Some go to Iowa and other States east and buy their brood mares. In this way they raise a marketable horse that pays well for the raising and meets with ready sale at Denver or the Eastern markets. There seems to be a divided opinion as to which class of stallions is best or most profitable, the improved draft horse or the roadster, to produce horses suitable for the local demand as well as for the markets, but the popular drift seems to be toward a trotting-bred sire of good size and substance, about 16 hands high, with pure trotting action, to breed to the grade mares, which will produce a horse of 1,100 to 1,300 pounds, suitable for either the road or farm work. The roadster horse is more easily kept, grows better in the pasture without grain, and is considered better adapted for this region than the draft horse. At present there is a surplus of small ponies and bronchos, which have little value except for saddle purposes.

In the eastern part of this district, where horses are raised more extensively and of a better class, suitable animals are readily taken by buyers for Eastern markets every spring, fall, and summer. This shows that the demand is sufficient to justify the farmer in raising more good horses. Excepting in a few localities horse raising as a leading industry has only begun. Farmers in this district have progressive ideas about profitable horse raising, but their environments are such that they are unable, except in rare cases, to carry them into practice. Yet in several of these counties may be found creditable American trotting stallions, as well as representative specimens of the Percheron, Clydesdale, and Shire horses.

Practically there is no local market for the class of horses mostly on hand, excepting for good brood mares, and they are very much in demand by such farmers as are able to buy. The country is so

new that, with the exception of the more eastern counties, where horse raising has been engaged in for some time, none have been sold to dist nt markets. To these counties buyers from Denver and Eastern cities come every season and buy all the suitable animals at prices remunerative to the farmers.

During the past year, corn, wheat, oats, and rye were grown in every county. There are also grown every year, as sure crops, Kaffir corn, millo maize, millet, sorghum, and alfalfa. Root crops, such as beets, turnips, and carrots, are easily grown in nearly every county, and furnish excellent feed. There is no question whatever of the ability to produce certain crops every year suitable for stock food, and when horse raising has been made a special business it can not fail to be profitable.

A farmer in Finney County, who is making horse raising a specialty, says that the cost per head per year does not exceed $4. One breeder in the eastern portion of this district, who has been breeding light harness horses (roadsters) for some time, disposed of all of his surplus to Kansas parties at the following prices: 13 head of sucking colts, both sexes, for $2,075, an average of $159.60; 8 yearlings for $1,125, an average of $141.63; 7 head of 2-year-old horses, fillies, and geldings, for $1,330, an average of $190; 4 head of 3-year-old fillies for $670, an average of $167.50; 2 4-year-old mares, half bloods, in foal, for an average of $140; and 2 aged mares, one for $505 and the other for $190, an average of $347.50. During 1889 nearly 50 carloads of draft horses were shipped from Salina to New York and Pennsylvania. These horses weighed from 1,200 to 1,500 pounds, and netted from $100 to $150 each. This illustrates what may be expected of the horse business for this district whenever farmers are better able to buy and improve their farms.

The general health of horses is exceptionally good. No epidemics of any kind whatsoever; the only complaints known are distemper and colic. The greatest difficulties to be encountered in horse raising in western Kansas is the poverty of farmers, incident to the developing of a new country; the high price of lumber; too much barb-wire fence, and the lack of tame grass, although in the Arkansas Valley alfalfa is being grown under irrigation in immense quantities. This, with rye pasture and that excellent forage plant, sorghum, is doing much to compensate for the lack of tame grass. A disadvantage, however, is a smaller per cent of foals as compared with eastern Kansas.

Cattle.—Cattle raising in western Kansas has been thus far the principal live-stock business for every county of this district, although the raising of sheep in certain localities has been carried on to some extent. The farmers who have made money in western Kansas are those who have raised cattle.

During the past few years settlers have taken up the Government land, and they have, of course, driven out the large cattle ranchmen, who did a profitable business on the free Government range. Now the extensive cattle ranches are few; the herds are more numerous and of smaller size. Every farmer who has the means raises a few cattle. In fact, about the only source of revenue for the farmer, in most of the newer counties, has been the sale of cattle. The country has been settled long enough to demonstrate something of the system to be followed, which is very different from that of the eastern half of the State. Corn is not a sure general crop; consequently feeding cattle for market is not common in all of these counties. The busi-

ness is limited mainly to raising steers for buyers from eastern Kansas. The principal cattle-raising counties in this district are Barber, Ellis, Osborne, Phillips, Rooks, Russell, Smith, and Stafford, which lead as to numbers, although some cattle are raised in every county.

The number of milch cows on hand March 1, 1889, in this district, was 143,304, an increase of nearly 8,000 head over the year 1888; and the number of other cattle reported is 318,957, an increase of more than 30,000 over 1888. The total number of cattle of all classes in the hands of farmers, March, 1889, was 462,261 head, which is about one-half the number given in either of the other districts, although the area in this is equal to both of the others. In other words, one-fourth of the cattle in the State are spread over the western half. It requires more than double the acreage of pasture of buffalo grass to sustain an animal that it does of the blue-joint or tame grasses farther east.

The class of cattle most salable to eastern feeders are 2-year-old steers, at prices ranging from $18 to $22. On account of so much cheap corn in eastern Kansas, feeders are picking up all classes of cattle at the following prices: Calves, $5 to $8; cows and heifers, $12 to $20; yearling steers, $10 to $15; 2-year-old steers, $18 to $22; 3-year-olds and over, $20 to $27. Fat cattle are sent mainly to the Kansas City markets.

The cattle mostly raised in western Kansas are natives. The pure breeds in demand are the Shorthorn, Hereford, Aberdeen-Angus, and Galloway. Those farmers who make cattle raising much of a business use pure-bred or grade bulls altogether.

Shorthorn bulls are more numerous than the other breeds, although the Hereford and the polled bulls of the Aberdeen-Angus and Galloway breeds are great favorites, as their grades give satisfaction and have the reputation of being good "rustlers" and hardy animals.

Under existing circumstances, cattle raising can not be said to be profitable, although it is the main source of income to the farmer. There is no disease of any consequence. The only loss of stock is occasioned by neglect and want of food and shelter during the storms of winter. On account of free grazing and the shortness of winter it is estimated that cattle can be kept the year through on grass alone, at a net cost of $3 per annum per head. Since the large ranches were crowded out farmers engaged in raising cattle have had the decline in price to contend with, much to their disadvantage. The feeder who buys 3-year-old steers to feed for six months makes about as much as the breeder does on his three years' labor, notwithstanding the present depression and other difficulties that beset the cattleman. No profits, however, can be made by those who bought cows a few years ago at $30 per head, the same class of cows bringing at this time $12 per head.

If the farmer is situated so that he can handle them cheaply, some profit can be made by raising young cattle for the corn feeders of eastern Kansas. Cattle raising might be a profitable business in western Kansas were it not for the prevailing low prices.

The supply of cattle is in excess of the local demand, except in certain localities, where young steers are hardly equal to the demand, and heifers go begging. Most of the she cattle are shipped to the Kansas City market for whatever price can be secured, generally netting the owner from $8 to $12 for yearlings, and from $10 to $20 for cows. The bulk of the cattle are shipped to the Kansas City market, and net about $12. The prevailing price for wintering stock

in this district is 75 cents to $1 per month per head for a period of not to exceed five months, and 20 cents per month for pasturing during the other seven months. This would make the cost $6.40 per annum, interest and loss not considered. The past three years have been exceedingly favorable; losses on the open range have not exceeded 2 per cent. Many cattlemen do not pretend to feed at all, except during storms, but let their stock graze all winter; in such cases they can produce a 3-year-old steer at a cost of $10, for which they realize $15 net on an average. But many of the cattlemen seem unable to produce a steer 3 or 3½ years old for the amount generally realized in the beef market during the past four years. Consequently to realize any profit under these conditions they have to grow young steers to sell to the feeder in the corn producing districts, which furnish a much nearer market than the beef marts. A good showing under this method is made from the facts and figures of a bunch of 100 cows in Meade County, which cost the owner as follows: 100 cows at $12, $1,200; 4 bulls at $25, $100; making the total cost $1,300. The cost of keeping this lot of cows and bulls and 78 calves one year was $350, and $44 taxes, making a total cost of $394. The 78 calves sold at 1 year old as follows: 38 steers at $13 each brought $494, and 40 heifers at $10, $400 more; or $894 realized on the produce of 100 cows and 4 bulls; which amount, less the cost of corn and taxes, $394, leaves a balance of $500 in favor of the owner for his stock investment.

I find that very few stockmen entertain the idea of overproduction, but are practically unanimous in the belief that the "beef combine" controls prices, and demand that it shall be wiped out of existence. They desire that the packing houses remain and do a legitimate business and permit the law of supply and demand to prevail, for now it does not appear to have any influence.

To summarize the changes suggested to increase the profits of cattle raising in this district: Curtail the supply, which is being done at a tremendous rate; abolish the beef combine's absolute control of prices, but not the packing houses; raise a better class of improved stock; reduce freight rates, and provide feed and shelter for stock during winter.

The local advantages for cattle raising for this district are the cheap range land and buffalo grass for grazing on an average of ten months each year; nearness to the corn-producing and feeding districts; the natural, healthful, and abundant grazing regions of the country; usually open, dry, and mild winters; cheap feed, and cheap labor.

The common disadvantages are those peculiar to a new country—lack of convenience; too much business done on borrowed capital; starting with scrub cattle; occasional wind storms, with lack of feed and shelter; the herd laws in many of the counties, which compel stockmen to inclose their herds or fence their ranges; high price of lumber; lack of tame grass and corn; high freight rates, etc.

Sheep.—The number of farmers engaged in sheep husbandry is comparatively small. Probably no other class of stock has so much prejudice to contend with as sheep, yet if properly handled and consisting of the breed or grades most profitable for the markets, there is no stock that will yield more profit to the grower for the amount of money invested. But as so few of our farmers are familiar with sheep husbandry they are not inclined to engage in it. It is true that the average farmer and the cattlemen hate sheep, and they do

not seem to forget the fearful reverses attending the demoralization of the sheep business of the country during 1883, when the duty was reduced on wools. The opinion of experienced sheepmen is, that if wool was placed on the free list it would practically obliterate and destroy the wool industry of this country.

The principal sheep counties of this district are Comanche, Edwards, Finney, Gove, Graham, Hodgeman, Meade, Norton, Osborne, Pawnee, Phillips, Rooks, Russell, Seward, Sheridan, Stafford, Trego, and Wallace. The counties which show an increase over the preceding year are Comanche, Finney, Hamilton, Kiowa, Lane, Norton, Phillips, Scott, Seward, Trego, and Wichita. The total number of sheep reported in all the counties of the district, in the spring of 1889, was 86,948, a decrease of 35,000 head from the preceding year. It will be seen by a comparison with the other districts of the State that this district has one-third of the sheep of the entire State.

The 25 per cent decrease in the number of sheep in the entire State as compared with 1888, is not caused by the unprofitableness of sheep, but quite the reverse. The steady demand and good prices for mutton at Chicago and Kansas City made it profitable to feed sheep for the market, and thus decreased the flocks very much in excess of the increase from lambs. As cheap feed was plenty as well as fine buffalo grass pasture, on which sheep thrive so well, they were in prime condition for the market at almost any time of the year, and the prices realized for mutton made the business profitable, regardless of the wool. And it is this mutton feature that has stimulated the sheep business. From both a mutton and wool standpoint it has a bright outlook. The main trouble with the industry in the past was, that wool seemed to be the only object. Sheep were run in extensive flocks, and with many of the wool growers the practice was to see how nearly they could starve their sheep and yet have them live. But the sheep industry is getting upon an entirely different basis; the objects being both mutton and wool, so that the business may not collapse so suddenly again should the tariff on wool be tampered with.

The few men who have continued in the sheep business in the district are in better condition financially than other classes of live-stock raisers. Many farmers are now anxious to engage in the business, and would do so at once could they only secure sheep at a reasonable price, which it is impossible to do unless they are shipped from other States.

The sheep now on hand in this district are mainly Merino grades, which bring from $2.50 to $4 per head. The supply is inadequate to the demand for either ewes or wethers. Feeders are very anxious to get sheep to feed for the Kansas City and Chicago markets, which do not at present get one-twentieth of their supply from this State. The demand for both mutton and wool breeds is better than it has been for years. The class of sheep most profitable to raise in this district is the Merino grade, bred to large-size Merino or Shropshire rams, although some breeders prefer the Southdown or Cotswold.

Western Kansas seems especially adapted to the sheep business, for no other portion of the country can equal it for health of the animals or cheap production of wool. There are cheap land, good grazing for ten months of the year, and the sure production of suitable, cheap feed in abundance for wintering sheep; freedom from burrs, foot rot, and diseases incident to sheep.

Swine.—In western Kansas hog raising for market is not yet a general industry, although every year there is considerable increase over previous years as to the number raised.

Swine generally do well; disease is not known to any serious extent. In the southern half of this territory pigs can be raised at any month of the year. There is a much larger demand for stock hogs this fall than ever before known, on account of the large amount of 12½-cent corn, but not enough stockers at 5 cents per pound to supply the demand. Kansas City is the chief market for those shipped, although in the northern counties a number have been shipped to Omaha on account of the branch lines of the Burlington and Missouri River Railroad which extend into this territory. Some shipments have also been made to Denver.

The pure breeds preferred are Poland-Chinas, Berkshire, and the same class for crosses, although some prefer the Duroc-Jersey and Chester White for crossing on their Berkshire or Poland-China grades.

The cost of production is variously estimated at from 2 to 3½ cents per pound, everything considered.

The advantages for swine raising may be mentioned briefly as follows: Dry climate and healthful atmosphere, freedom from disease, and pure water. The difficulties to be encountered are the long distance from markets and consequent shrinkage in shipping, occasional hot and dry winds, lack of shelter owing to high price of lumber, uncertain corn crops, practically little or no tame grass, and the unsuitableness of buffalo or native grass for hog pasture. Where alfalfa is grown hog raising may be made fairly profitable. In Edwards County there were raised over 30,000 head the past season. One farmer in Garfield County states that spring pigs dressed nearly 200 pounds at 8 months, while farther north, in Logan County, a farmer sold four hogs, 13 months old, weighing on an average 416 pounds.

The principal crops grown this season are wheat, rye, barley, corn, oats, and sorghum, with prices for feed stuff ranging as follows: Corn 12 to 14 cents per bushel; oats 10 to 15; rye 30, and bran $5 per ton. Hogs require but little care; a wind-break and ordinary shed for shelter from storms in winter and heat in midsummer is about all they need.

Western Kansas is not destined to become a profitable hog raising country, except in favored localities where corn is grown regularly, in dairy or irrigated districts. There will no doubt be hogs raised in every county for local demands, provided the big packers are not able to supply their dressed meats cheaper than the farmer can produce it; however, what surplus is raised will find a ready market at Denver and other points in Colorado, Texas, and New Mexico.

H. A. HEATH,
Inspector.

TOPEKA, KANS., *December*, 1889.

CONDITION OF THE LIVE-STOCK INDUSTRY OF COLORADO AND WYOMING.

Hon. J. M. RUSK,
Secretary of Agriculture:

SIR: The following is a report of my investigations of the several branches of animal industry for the present year in the States of Colorado and Wyoming.

COLORADO.

The State of Colorado, which thirty years ago was known only as a large portion of the Great American Desert, whose resources were wholly unknown and whose possibilities were not even suspected, stands to-day as one of the largest stock-growing States north of Texas and west of the Missouri River. A section which but a few years ago was believed to be almost entirely barren, its arid lands beyond reclamation, now stands before the country with a record for stock growing which would be hard to excel. Thirty years ago, when the first hardy adventurers invaded the lands supposed to belong alone to the "children of the forest," but where no forests existed, the only cattle found in this far Western State were the bisons, which ran wild and ranged from Texas on the south to the southern lines of British Columbia on the north. These roamed in vast herds, but they are now practically extinct, that race, like the Indian, always moving toward the setting sun.

Plains which a few years ago were supposed to be wholly useless and worthless have been reclaimed from rude nature and to-day are among the most productive sections in the Rocky Mountain region; and Colorado owes her prosperity as much to the almost wonderful reclamation of these supposed worthless acres as to the remarkable and inexhaustible mineral resources which have from the first made this State an object of interest and admiration.

It is difficult to educate a people against the traditions of their early geographical training. The maps of even twenty years ago barely afforded a conception of what might exist west of the one hundredth meridian, as about all that could be depended upon was the report of the "Pathfinder," John C. Fremont, who had made his way to the top of the Continental Divide and left an indestructible mark on its crest, and

the survey of Hayden, which to a certain extent was in the interest of mineral lands. Later came the adventurous immigrant who desired to improve his condition in the far West, and with him came the family in the "prairie schooner," which assisted in making Colorado what it is to-day. Where no lumber existed the "prairie schooner," a large wagon with canvas cover, was the first protection which many of the early immigrants to Colorado enjoyed. Those who came in that way were the first in this country to demonstrate the fact that grass could be made to grow even in the midst of apparently burning sands, if sufficient water could be afforded to sustain the succulent roots. They planted under great disadvantages and the first results were dismal failures. Winter was fast coming on and the wolf was literally at the door. Wild game then roamed over the plains at will, and the hard pressed farmer had to depend upon that for food. Fuel, such as had been used in eastern homes, could not be obtained; no wood grew except along the banks of the running streams, and that was willow or cottonwood, which afforded but little warmth. But the plains were covered with "buffalo chips," and these served for fuel to the early settlers, as they had to the prospector who crossed the plains to California ten years before a settler located in the wilds of Colorado. During the first few years of Colorado's existence as a Territory the whole eastern section, from what is now known as Sedgwick County on the north to Baca County on the south, adjoining the territory of New Mexico, was one vast natural cattle range with but few herds. This section is watered by the Platte River and its tributaries on the north, with the Arkansas and tributaries in the south. Both of these principal streams have their rise on the Continental Divide and are fed by the melting snows which remain through the year upon the tops of the lofty peaks of the Rocky Mountains.

But it was not until the present system of irrigation was devised and successfully put into operation, that the hardy farmer was enabled to secure a crop from the sandy soil. His herds of cattle which had been grazing on the commons were by degrees gathered around the corrals and true domestication commenced, which process is still going on.

When Colorado became a State in the Union less than one-tenth of the acres of land now included within its limits were believed to be available for agricultural purposes, while the other nine-tenths were regarded as mountainous sections of no practical value to man or beast. But since the discovery of the remarkable mines at Leadville and other sections of the State, in 1878, the tide of immigration has steadily set in toward Colorado, and the census of the present year shows 410,975 persons.

While the immigration to the State has been large, such increase is not wholly due to the remarkable mining deposits, which have no doubt attracted thousands of good citizens to Colorado. It may in a great measure be attributed to the peculiar conditions which present themselves to the people of the East and other sections of our common country and the Old World, who believed they saw in the future of this State an opportunity to improve their condition. Dotted with mountains whose lofty peaks are covered with perpetual snow, interspersed with valleys whose verdure is equal to the famed region of the Nile, there is such a combination of natural sequences in Colorado as can rarely be found elsewhere. Twenty years ago there was hardly a paying farm in the State, and the farmer or "ranchman" who owned 50 head of cattle was counted among the

"well to do." Two decades, however, have worked the most wonderful development in this section, and to-day nearly a half million people find homes here.

To-day a hundred "cattle kings" have their residence in Colorado, and their vast herds can be found in nearly every section of the State, but not confined in their range to State lines. From Texas and New Mexico on the south to Wyoming on the north many of these herds feed, and hence the difficulty in accurately placing to the credit or debit of each State or Territory what should be placed there. Of the sixty-seven millions of acres in Colorado there are not less than twenty millions which are recorded as mountainous and wholly unfitted for stock-growing purposes. Perhaps this estimate is not too high when all circumstances are taken into consideration, but any person at all acquainted with the Rocky Mountain region will admit that much of the territory which was denominated as arid twenty years ago has proved to be very productive under the manipulations of modern science, and much of the territory called mountainous is simply an elevation above sea level, but not necessarily above the point of cultivation. The system of irrigation which is peculiar to Colorado has enabled the farmer to utilize the water from the mountain streams, which until within the past few years practically ran to waste and was lost in the Gulf of California or the Gulf of Mexico. Now these elevated plateaus, several thousand feet above sea level, have been converted into the most valuable farming and grazing lands to be found in any portion of the United States, and all from a proper use of the water from the melting snows on the mountain tops. No fertilizers of any kind are used or required, while bountiful crops are produced each year where irrigation prevails, and there is never any fear of drought nor dependence upon clouds and rain.

According to the report of the recent committee sent out to investigate the matter of irrigation as applied to the arid lands of the West, Colorado has the best system known. This system prevails extensively in the northeastern section of the State, where some of the finest farms in the country are to be found, a section which twenty years ago contained but few farms of any kind, and was covered over with wild cattle and horses, buffalo, deer, antelope, and other wild animals.

The first real settlement in that section was made by what was known as the "Greeley colony," in 1871, under the direction of N. C. Meeker, who was murdered by the Indians at the White River Agency, in the western part of the State, in 1879. This colony was made up mostly from persons whose homes were in the far East, and during the first two years of its existence many privations and hardships were endured.

When the State took its place in the Union in 1876, that section was known as Weld County, one of the largest in the State, its territorial area being 8,000 square miles. This is greater than the entire State of Massachusetts, which has a population of nearly two millions of people, while according to the census just completed that section, which has during the past four years been divided into seven counties, has a population of 25,273 as against 5,003 in 1880, a gain of upwards of 400 per cent. The region is traversed by the south fork of Platte River, one of the principal tributaries of the Missouri, and is almost wholly devoted to agriculture and stock raising. Some of the finest improved cattle, horses, sheep and swine, to be found in

the West are located in what was formerly Weld County. The principal immigration there has been from the outlying States of Kansas, Nebraska, and Iowa, and consisted almost wholly of agricultural population. The system of irrigation which prevails there has been highly improved during the past few years, and thousands of acres of arid lands have been reclaimed and converted into highly productive agricultural and grazing farms. The system is being extended very rapidly, and with the reservoirs to be erected for the purpose of storing up the waste waters from the mountains during the winter season and early spring, large portions of the State which are now comparatively valueless will be brought under cultivation, and sufficient land will be reclaimed from the desert to support a population greater than now exists in the State of New York.

Those counties lying directly south of the last named sections as far as the New Mexico line have the same character of soil, and are susceptible of equally as great improvement. As irrigating facilities are extended the land will be rapidly taken up and the portion of the State which is now very largely devoted to range purposes will be converted into highly productive agricultural and stock farms.

Colorado differs materially from the States in close proximity to the Mississippi and Missouri rivers, in that there are no extensive forests, except in the mountainous regions, and most of these are entirely different from the nut forests of the East. There are few places for swine to feed except in the inclosures of the ranch, and for that reason scarcely any but the improved breeds can be found in the State; this is also to a great extent true of cattle, horses and sheep. As the range disappears and farms take its place, the extensive herds, droves, and flocks can no longer be retained, and the ranchman sets himself to improve the breed and lessen the number. One well-bred milch cow takes the place of several inferior ones, and the profit to the farmer is increased by the change. A range horse which commands from $30 to $60 gives place to a thoroughbred worth three times the amount, and the farmer expends but little more in its care and support. Merino sheep are fast supplanting the Mexican hybrid, and a finer grade of wool at but little more expense is the result, while the returns to the farmer are nearly doubled.

Colorado is divided by the Rocky Mountains into two great divisions, the one traversed by the rivers which discharge their waters into the Gulf of Mexico, and the other by those which flow toward the Pacific Ocean. A large portion of the arable and grazing lands lie east of the mountains, and this section also contains the greater number of all kinds of stock animals, as well as the principal portion of the population and wealth of the State.

The table below shows the number of each kind of domesticated animals on the Atlantic slope of the State, while the one immediately following shows the number west of the mountains, or what is known as the Pacific slope:

ATLANTIC SLOPE.

Counties.	Cattle.	Horses.	Sheep.	Swine.	All other animals.
Arapahoe	23,179	13,119	13,237	2,279	1,500
Boulder	17,353	6,190	460	715	544
Bent	18,325	2,500	1,100	175	216
Baca	29,867	1,850	3,500	300	675
Cheyenne	1,557	350	4,500	75	35
Clear Creek	1,151	490	129	7	306
Costilla	10,911	2,800	14,600	350	2,085
Custer	12,078	3,169	250	600	175
Conejos	1,975	3,550	13,500	500	560
Chaffee	8,575	1,450	1,350	560	300
Douglas	17,000	3,700	275	500	160
Elbert	22,050	3,784	77,700	136	60
El Paso	36,500	7,951	57 158	450	475
Fremont	20,641	2,900	.....	275	100
Gilpin	1,341	530	.....	.....	121
Huerfano	11,493	4,462	51,954	550	5,406
Jefferson	15,746	4,619	40	602	192
Kit Carson	2,339	1,950	5	584	225
Kiowa	3,000	1,250	3	186	180
Larimer	49 662	16,170	11,087	1,508	437
Logan	20,080	3,175	16,632	476	116
Lincoln	9,527	750	53,324	32	55
Las Animas	41,600	9,000	64,554	528	7,568
Lake	1,261	1,099	3	1	171
Morgan	8,334	2,163	26,429	213	65
Otero	18,177	5,251	5,900	154	103
Phillips	2,595	1,638	711	1,032	263
Prowers	1,150	12,175	85	.....	250
Pueblo	19,550	5,000	13,500	500	586
Park	25,087	3,100	30,000	75	1,225
Rio Grande	8,791	2,785	10,800	350	354
Sedgwick	2,799	901	.....	450	57
Saguache	27,500	4,520	11,278	378	1,000
Weld	15,271	36,511	45,995	1,699	482
Washington	2,790	1,251	5,500	347	131
Yuma	4,426	1,521	4	1,017	190
Total	514,681	173,624	555,583	17,604	26,368

PACIFIC SLOPE.

Archuleta	3,900	790	29,300	90	118
Delta	17,900	2,816	10	785	385
Dolores	450	520	.....	30	199
Eagle	10,175	2,150	1,500	50	100
Grand	11,874	1,900	2,750	.....	35
Garfield	24,500	3,200	1,250	200	350
Gunnison	13,153	2,480	4,564	105	370
Hinsdale	1,290	301	.....	18	110
La Plata	20,641	2,650	4,600	250	270
Montrose	37,750	3,450	15,000	550	400
Mesa	32,625	4,000	7,120	900	340
Montezuma	8,531	1,508	.....	65	210
Ouray	3,850	1,450	.....	175	850
Pitkin	3,975	1,325	25	110	1,350
Routt	46,768	11,153	11,000	60	150
Rio Blanco	45,460	4,800	5,300	100	90
Summit	1,450	500	2,600	12	125
San Miguel	9,150	950	5,702	20	670
San Juan	48	66	.....	.....	274
Total	290,490	46,009	90,121	3,520	6,396

The foregoing table does not comprise all of the stock which is owned in Colorado. Thousands upon thousands of cattle and sheep range over the borders of New Mexico, Wyoming, and Utah, and other thousands in western Nebraska, Kansas, and Texas, the owners of which live in Colorado, and it is exceedingly difficult to prevail upon these extensive stock proprietors to give anything like a fair answer to the question of how many cattle, sheep, or other animals they possess. These figures were obtained from the officials in the several counties whose duty it is made by law to ascertain as

nearly as possible the actual number of each kind of animal possessed, and from the stock associations scattered throughout the State. While there may be some discrepancy between the foregoing figures and the actual number of each kind in the State, they are believed to be as nearly accurate as it is possible to get them under existing circumstances. It will be observed, from a comparison of the two sections, that the preponderance in each class named is largely on the eastern slope of the mountains, where more than two-thirds of the arable lands in the State are to be found.

The elevated plateaus on the western slope border upon the Territories of Utah, New Mexico, and the new State of Wyoming, and it is doubtless true, as is generally asserted, that more than a hundred thousand head of cattle and three times as many sheep find ranges in those sections the owners of which live in Colorado. So long as it is cheaper to feed cattle and other animals upon the public domain these large cattle ranges will exist, and it will be next to an impossibility to ascertain, either through the public officials or the owners themselves, the correct numbers that constitute their enormous flocks and herds which find their sustenance, in the main, upon the public lands of the United States.

The cattle herein specified comprise all kinds, not only those which subsist principally upon the owners' ranges, but those confined within inclosures, including milch cows and oxen.

The number of milch cows is yearly increasing as population flows in. New industries have been created within the past two or three years in the form of creameries and cheese factories, all of which do a thriving business and add materially to the wealth and prosperity of the State. As yet no special attention has been paid by public officials in the direction of separating pure-bred stock from range cattle, and in but few localities is any attempt made to ascertain the number of milch cows, the whole herd being lumped together and returned as "cattle," and valued upon a general average, so that it is almost useless to attempt to collect any data upon which an approximately correct statement could be based either as to the number or value.

The present census of the United States now being completed will furnish a much more reliable statement as to the number of farms, the various kinds and number of cattle, horses, sheep, and other animals than was shown by the census of ten years ago, for the reason that comparatively but few farms existed as farms, the ranchman occupying as much of the public domain as he desired, in many instances as many as 20,000 acres, and no record whatever was kept of his flocks and herds.

The column headed "other animals" includes goats, mules, asses, and burros, but is made up principally of the first two, there being 12,000 goats, about 11,000 mules, and the balance in asses and burros, the two being in fact the same animal under different names. This is the noted pack animal of Colorado, and is found principally in the mining regions, where the narrow mountain trails make this sure-footed animal the only means the miners have for transporting their supplies to camp, and the products from the mines to the railroads or ore furnaces and reduction works. Long lines of them may be seen in the principal mining camps distant from railroad facilities, heavily loaded with mineral and directed by a single person, all plodding along in single file, and as sure-footed as a mountain goat.

Goats are found principally in the southern tier of counties along the line of New Mexico, where there was formerly a preponderance of Mexican population, the counties of Las Animas and Huerfano alone having 9,000, while Saguache, Costilla, and Conejos contain nearly all the balance. The five counties last named will also be seen to have large numbers of cattle and sheep, there being 93,427 of the former, and 154,786 of the latter, and this number is asserted to be less than one-half the actual number that should be accredited to that section. Persons well posted in the sheep industry, and who are fully acquainted with the sheep region, affirm that one single owner in Las Animas County possesses more sheep than is credited to the entire county, and there are several other large growers in the same section. This is explained by the fact that the Territory of New Mexico is but a few miles south of Trinidad, the metropolis of southern Colorado, and there these immense flocks feed most of the time; but as the owner lives in Colorado the probabilities are that the tax collectors of New Mexico are no richer for the presence of flocks of sheep, which cover whole counties, and Colorado derives but small benefit in proportion to the number owned. According to the census of 1880 there were 746,443 sheep in Colorado, as against 625,704, as shown by the foregoing table.

In arriving at a conclusion as to the profit from this industry, the fairest statement that can be made of the expense of sheep raising is the following, from one of the largest as well as one of the most successful sheepmen in Colorado or the West. F. D. Wight, of Trinidad, has probably the largest number of sheep belonging to one man or firm in Colorado. His flock are not confined exclusively to this State, but range over the northern part of New Mexico as well, and as he is one of the most practical business men in the State, his figures are entitled to more than ordinary consideration. In speaking of his flocks he says:

They are high grades from Mexican mothers; they retain their herding qualities, their hardy rustling qualities, their adaptability to the range, and can live where anything can on the range. They have actually lived where antelopes have in some instances frozen or starved to death. During seven years I have culled and sold 16,000 head from the herds. I have never sold a sheep unless it was a cull. Five thousand old wethers culled and sold last fall brought $2.40 per head delivered on the range, and averaged, live weight, 118 pounds each. At the same time I culled and sold 3,000 old ewes from the herds, which brought $1.50 per head delivered on the range. The year before I sold 1,000 old ewes which brought $2 each on the range. Three years before I culled 4,000 old wethers which averaged 120 pounds each and sold for $2.50 per head on the range. The herds there now are all young, or of the most profitable ages; large, well formed, never have been allowed to deteriorate; have always been kept free from scab and disease of every kind. The flocks have not their superiors for durability or profit as range sheep in North America. The wool clip has always sold for from two to three cents per pound more than any other range clip within my knowledge.

Coming as the foregoing does from a gentleman who has had sixteen years' experience in sheep raising in this State, it furnishes a better idea of this branch of our animal industry than can be obtained in any other manner.

But that the people of the country may have further evidence of the wonderful resources of this Rocky Mountain region, I quote the following from the *Denver Republican*, whose representative, accompanied by an inspector from the Department of Agriculture of the United States, and also by the editor of the *Field and Farm*, the leading agricultural paper of the State, visiting one of the principal sheep ranges in eastern Colorado, Elbert County, and inspected some

improved stock in that section. The flocks are the property of a company known as the Merino Stock Farm Company, and number many thousand. The flock in question is a cross of the French and Spanish Merino, and is reported to be one of the finest to be found in Colorado or elsewhere. The report says:

After examining a large number of yearlings and this season's lambs of this cross, the visitors were convinced that it produced a stronger and larger sheep than the straight Spanish sheep. One yearling ewe of this cross, a good representative of the flock, was caught and placed on the scales, which were turned at 116½ pounds. Lambs but 4 months old were found to weigh 70 to 85 pounds each, or from 5 to 10 pounds heavier than Spanish lambs of the same age. One ram was parted out and exhibited as a representative sheep, a 5-year-old, a straight Spanish, which has yielded 40½ pounds of wool at one clipping the present season. Several ewes were shown that had yielded 18, 20, and 22 pounds this season. The average spring clip has been upwards of 12 pounds per head.

These sheep are well kept, herded in small flocks, sheltered in sheds in winter, and fed hay and some grain. From these flocks are marketed annually about 1,000 bucks from one to two years old, which bring from $10 to $16 each.

It will be seen from the above that these flocks differ from those of Mr. Wight, in the fact that they are handled differently during the cold of winter. Mr. Wight says: "Since I began, sixteen years ago, sheep or lambs have never had a spear of hay or kernel of grain." This may be accounted for by the fact that where the flocks of Mr. Wight feed, in the northern part of New Mexico, the temperature is much milder than in Elbert County, the latter being situated 150 miles farther north, where the chilly blasts from the lofty mountain peaks, whose summits are always covered with snow, sweep down over these elevated plateaus with much greater severity and longer duration than in New Mexico. The latter is also a better watered section naturally, and consequently more fertile and prolific.

Elbert County, which contains about one-fourth as many acres as the whole State of Rhode Island, has at present nearly one hundred thousand sheep within its borders.

It will be seen from these two statements that the sheep industry is being profitably pursued in Colorado, even with the many severe drawbacks which occasionally attend the prosecution of the stock-growing business upon these elevated plains in the very heart of the continent. An unheralded, unexpected hailstorm, blizzard, or waterspout, such as are known only in mountainous countries, frequently destroys immense numbers of sheep and decimates herds of cattle and droves of horses, but the perseverance of the stock growers seems equal to any emergency, and these important industries are not permitted to lag or fall behind.

According to the census report of 1880 the spring clip of wool in Colorado for that year amounted to 3,197,310 pounds, while that of the present year, by those who are recognized to be well informed upon the subject, is estimated to be more than three times that amount. The prices during the past year have varied from 16 to 22 cents per pound, depending entirely upon the grade.

CATTLE.

Ten years ago there were found in Colorado by the census enumerators a total of 346,839 head of cattle of all kinds. It will be seen from the foregoing table that there are now no less than 810,000.

While the cattle ranges have been seriously curtailed by cutting up the public domain into farms, the number of cattle has multiplied

and the quality has improved to a remarkable degree. The common range animal has been supplanted with the best improved breeds known to the stock grower, and it is safe to say that in many portions of Colorado may be found as fine herds of improved cattle as can be found in any of the older States of the Union. It is only within the past two years that any attention has been given to the matter of ascertaining the location and number of improved cattle, and that question is still in its incipiency, and the information afforded from these sources is neither accurate nor at all satisfactory. The legislature of 1889 created a new bureau, to be known as the "State Immigration Bureau," and it was made a part of the duty of said bureau to accumulate information in relation to the kind, number, and value of all the various classes of domestic animals pertaining to the animal industry of the State; but up to the present time nothing has been done in that direction which is of any appreciable value, or that would afford any satisfaction if compiled in any form.

In 1880 there were reported from the United States Census records 28,770 milch cows in the State, while, according to the most reliable figures to be ascertained, there are now upwards of twice that number, and the dairy products of the present year, in all their various forms, will more than quadruple the amount reported ten years ago. The butter and cheese made at the several creameries in the State compare favorably with the best eastern products and command as good prices. The introduction of alfalfa during the past few years has worked a wonderful change in these formerly arid lands, particularly since the irrigation has been so extensively introduced throughout the State; and where it was difficult ten years ago to raise grass enough upon the farm to properly feed the family cow and the team necessary to perform the yearly farm work, now a herd of a hundred head are comfortably and easily provided for. Three, and in many places four, cuttings can be harvested each year, each cutting amounting to from 1 to 3 tons to the acre, and averaging in value from $8 to $11 per ton on the farm. These elevated lands seem to be particularly well adapted to this plant, and large crops are harvested every year.

Nearly every breed known to the cattle grower may be found in this State, many of them having been imported direct from foreign countries. Opinions differ as to the choice of breeds, some excelling in one section of the State where others fail to come up to the expected standard. The Jersey has its advocates in almost every section of the State, while the Holstein is highly valued in the upper and central portion. The Galloway does remarkably well west of the continental divide, and is looked upon as one of the best breeds for that section, where the grass is different from that upon the eastern slope. Cattle are distributed between three sections of the State, viz, the middle, eastern, and western portions as follows: Central portion, 242,392; eastern, 280,000, and the western portion 287,608. It is interesting to note the difference in the number in these several sections in 1880, when that portion west of the main range of mountains was scarcely known except in a few localities. Ten years ago there were only 26,125 cattle on the western slope of the mountains in Colorado, and 17,500 of those were in La Plata County, at the extreme southwestern corner of the State, and 4,000 more were in Routt County, in the northwestern corner. That same territory now contains 115,541, as listed in Colorado, with perhaps an equal num-

ber across the Wyoming and Utah lines that are not counted as belonging anywhere.

Aberdeen-Angus cattle are found in all sections of Colorado, and some very fine herds may be seen in the northern and eastern parts of the State. These cattle thrive remarkably well, and the growers who have been consulted upon the subject express themselves as well satisfied with the past, and have great hopes for the future of this industry in the State so soon as the General Government has taken steps to utilize the vast volume of water which yearly wastes itself away into either ocean. Once the reservoir system is established in Colorado the present arid lands will become the most productive in the country, and where 100,000 range cattle would now find difficulty in subsisting upon the scant vegetation, 1,000,000 of superior bred cattle could exist, with enough forage left to supply thousands of horses, sheep, and swine.

HORSES.

This branch of animal industry has kept pace with the others in the State, and the improvement in the stock has been equally as great as that in cattle, particularly in the northeastern and eastern portions of the State.

The horses reported by the census officials in 1880 were mostly range stock, the improved breeds being confined wholly to the large cities and towns, which were few and far between, the total number of animals being but 42,257 as against 219,624 as shown by the preceding table, an increase of more than 500 per cent during the past ten years. Dividing the State into three sections, the eastern, central, and that part west of the Rocky Mountains, and the census of 1880 shows the horses of Colorado to be distributed as follows:

Taking the eastern tier of counties which border upon Nebraska and Kansas as the eastern portion, there were 15,750 horses in that territory. The central part comprises all that lies between the eastern tier of counties and the main chain of the Rockies, and contained 18,325 head; while the western portion, lying west of the continental divide, contained only 2,575 head. Taking the same division at the present time, and in the eastern part there are 66,562; in the central 104,479, and west of the chain, 48,493. A large portion of the horses on the western slope are known as range horses, and especially is this the fact in Routt, Summit, Garfield, Eagle, and those counties immediately contiguous to the Utah line. Routt County, according to the official count of the United States census for 1880, had only 297 horses within the county lines, while to-day there are not less than 18,100 within the same territory, and were it not for the presence of the Ute Indians in the immediate vicinity of the western lines of these counties there would doubtless be more than double the number found there. If an Indian will steal any one thing sooner than another it is a horse; and the stock growers of that section, realizing the stubborn fact, keep only as many horses upon the range as they can protect from these "wards of the nation."

In the San Luis Valley is a section of the State consisting of four counties watered by the Rio Grande River and its tributaries lying between the Sangre de Cristo and the main range, viz, Costilla, Conejos, Rio Grande, and Saguache—a section of country reclaimed during the last five years, which had formerly been considered worthless for agricultural purposes, but devoted almost exclusively

to the range. The animals on it were principally sheep. The census of 1880 showed 29,925 cattle and 4,083 horses, where there are at present 59,000 cattle and 13,500 horses. An apparently vast sandy plain, 50 by 100 miles in extent, where little vegetation could be found except sage brush and cactus, has been converted by irrigation into a productive country such as is rarely found, and the crops for the present year are mammoth in proportions. The animal industry in that section has been constantly improving and a better grade of stock is continually being introduced.

Among the improved herds of horses recently introduced into the State is the Percheron draft horse, many stallions having been imported direct, and as fine in quality and appearance as can be found anywhere in the country. Reports from various sections of the State where these animals have been introduced are to the effect that they are well adapted to this climate and altitude, and flourish as well as, if not better than, in the lower altitudes and humid atmosphere in the Mississippi Valley and along the Atlantic and Gulf coasts. One animal of this breed will do as much work as two or three of the ordinary range animals, and the expense of feeding is very little larger.

The Clydesdale, Shire, French Coach, and Hackney horses are claiming the attention of horsemen in some localities, as is also the Cleveland Bay. Mr. Jesse Harris, of Larimer County, an extensive importer of various breeds, claims the Cleveland Bay as the best general utility horse for this western country.

SWINE.

No other branch of the animal industry of this State has made more radical improvement in the breed than the swine industry. When Colorado became a State the only hogs known were the long, lank species which accompanied the pioneers across the trackless plains, living upon such food as they could find, after consuming the scanty refuse of the campers they followed. The roots which they could unearth and consume were few and far between, and the pork of the early days of Colorado's history, when the nearest trading post was on the banks of the Missouri more than 600 miles away, was exceedingly lean and unsavory, even to those who had been bred upon "hog and hominy." Ten years ago there were only 7,656 swine in the entire State, and these were chiefly of the character just alluded to, and were confined to the eastern and central portions of the State.

In the eastern tier of counties bordering on Kansas and Nebraska lines there were found 2,666 in 1880, where there are now found no less than 9,343, showing an increase of more than 400 per cent; while in the central portion there were 4,845 by the census of 1880, as against 8,222 in 1890, an increase of nearly 100 per cent. West of the great continental divide, ten years ago, when the United States census was taken, only 145 swine were found in a territory greater than the great State of Indiana; at present there are 3,224. Ten years ago the valleys of the Grand and Gunnison rivers were practically unknown, and were occupied to a great extent by wild Indians. In one section alone, known as the "Gunnison country," only 10 hogs were found by the census men in 1880, where there are now 2,599 in the same region. That section has grown very rapidly since 1885, and is recognized as one of the most fertile portions of the State. The public lands have been largely taken up

by actual settlers, who have located their farms solely for agricultural purposes, and where, only three or four years ago, the country in the valleys of the Grand and Gunnison rivers was almost a barren mesa, there are now found some of the most productive farms in the State.

It is observed that wherever civilization has gone in Colorado the improved breeds of swine have immediately followed, and the more intelligent the settler the higher the grade of this useful and profitable animal is found to be.

During the past few years those diseases in swine which have so sorely afflicted other sections of the country have been practically unknown here. Hog cholera is not heard of so far as I have been able to ascertain, and other diseases, if any exist, are never reported or made known.

The pork industry of the State is fast growing, and instead of depending wholly upon adjoining States for this food, as has been the case until during the past three or four years, Colorado now produces a fair supply for home consumption, of a quality second to none in the far West. Much of this pork is slaughtered and packed in this State, there being several large packing establishments in Denver and other places, and the prices obtained are remunerative and entirely satisfactory to the stock growers.

Like all other domestic animals, the swine seem to thrive in this dry climate better than in the moist climate and low altitudes of the East.

CONCLUSION.

Having visited nearly every section of the State and consulted with stock growers in person, and with the officers of many of the associations organized in the interest of these important industries, I am satisfied that the live-stock industry in Colorado is in a prosperous and progressive condition, and with proper countenance and protection from the national and State authorities, will continue to thrive and improve as civilization advances toward this far western State.

WYOMING.

The new State of Wyoming, which was admitted into the Union during the present year, lies in the Rocky Mountain region between the forty-first and forty-fifth parallels of north latitude, and the one hundred and fourth and one hundred and eleventh meridians of west longitude. Its characteristics are similar to those of the other States in this section, its distinguishing features being, like those of Colorado, the extensive elevated plateaus and table-lands, at an average altitude of upwards of 6,000 feet above sea level. These vast elevated plains comprise millions of acres of as productive land as can be found in any section of the globe, the only thing necessary to reclaim them being a system of irrigation like that which is being carried on so successfully in Colorado and other Western States.

So long as Wyoming remained under Territorial government it was difficult, and in fact almost impossible, to attract the attention of capitalists to the development of the agricultural resources of the Territory, because it seemed more profitable and less expensive to graze vast herds of cattle, horses, and sheep upon the public

domain free of cost, than to fence in a tract of land and devote the same to the production of crops.

Until within the last three or four years Wyoming has been almost wholly devoted to the live-stock industry, and all portions of the State were covered with vast numbers of cattle, horses, and sheep, from the sale of which colossal fortunes have been realized.

To illustrate the peculiar productiveness of the soil of Wyoming, the following facts, which have come to my knowledge from reliable parties who were fully cognizant of the same, are given as they were furnished to me:

In 1858, when a United States force under Col. Albert Sidney Johnston was ordered to Salt Lake City with troops to subdue the Mormons, a party of Government freighters, Messrs. Russell, Majors and Waddell, who had many times before crossed the vast sandy plains west of the Missouri River, started with a long train from Fort Leavenworth, in Kansas, loaded with Government supplies and bound for Fort Douglas, at or near Salt Lake. It was rather late in the season when the journey began, and after many unexpected and unavoidable delays the caravan arrived at a point near where the small town of Bordeaux, Wyo., now stands; and concluding it would be impossible to reach the fort during the winter, in consequence of snow, they went into camp. In a brief time they began to run short of feed for their stock, and it was determined to drive the cattle on the Chugwater Creek, a small stream but a few miles away, and leave them to "rustle" for themselves, with little hope of ever seeing them again, as it was feared they would either die from starvation, and their bones would be found in the spring, or the Indians would slaughter them for beef. The winter was unusually severe, but when spring came and the freighters went out on the Chugwater they were more than glad to find in the immediate vicinity of where they left them some three or four of their cattle in splendid condition. They began to search for more, and in a few days found nearly every hoof they had turned out early in the winter, and all fat enough for beef. This was the first intimation any one ever had that cattle would live and flourish through the winter without being fed or sheltered on the upland plains at the very base of the cold and bleak Rocky Mountains. The news soon spread, and early in the 60's a man named Phillip Mendall took up a ranch on Lone Pine, near the Little Laramie, and concluded to try the experiment. He purchased all the foot-sore, worn-out cattle from passing freighters, turned them out on the range, and found that they did remarkably well through the winter; but in early spring the Indians made a raid upon him and captured almost his entire herd.

When the foregoing facts (and they are fully authenticated) became known, herds were driven into that section to feed upon the public domain. The early herds were composed almost entirely of the Texas Longhorns, but after a few years stockmen began to import pure-bred bulls, and to-day in no section of the West are there better breeds or more prosperous herds.

But the Wyoming of ten years ago was not the Wyoming of to-day. Then the Territory was sparsely populated, the principal inhabitants being Indians and Government troops, whereas to-day there are thriving, prosperous towns springing up all over the State, and the animal industries are conducted on an entirely different basis, with equally as good if not better final results.

Wyoming is liberally supplied with streams and a large portion of the land is admirably adapted to agricultural purposes and is rapidly being taken up by actual settlers. As immigration increases, the size of the numerous large herds which have hitherto roamed all over the Territory diminishes and the quality improves. A few years ago the only fencing of any importance was that of the huge foreign corporations, whose cattle fed upon the public lands which these companies had fenced in, and in many instances thousands of acres had been seized by foreign capitalists, which were inclosed with barbed wire fence, and within these inclosures their herds and flocks fed without expense to themselves and with comparatively little danger from loss by estrays.

The number of domesticated animals listed in the several counties for taxation does not represent the actual amount of live stock that

belongs to the residents of Wyoming—or rather the number which should be actually credited to the State—for tens of thousands, both of cattle and sheep, that should be counted and credited to Wyoming, may be found across the borders of Utah, Dakota, and Montana, while their owners are residents of Wyoming. Well-posted citizens place the number of cattle and sheep in this State at nearly double the number returned by the several county officials for assessment, and the value at nearly 100 per cent above the taxable valuation put down by the county assessors.

Table showing the number of cattle, horses, sheep, swine, and other domestic animals in the State of Wyoming in 1890.

Counties.	Cattle.	Horses.	Sheep.	Swine.	Other animals.
Albany	28,364	8,574	37,009	250	138
Carbon	43,312	8,439	150,020	177	141
Crook	71,962	9,159	2,341	337	101
Converse	73,849	5,789	4,233	102	143
Fremont	75,919	10,613	60,317	530	313
Johnson	68,075	8,086	5,037	292	190
Laramie	89,742	15,031	38,542	152	272
Natrona	27,575	2,384	37,389	13	94
Sheridan	27,991	5,983	1,155	788	155
Sweetwater	7,670	2,613	34,226	75	119
Uinta	17,012	4,852	105,904	65	147
Weston	51,198	2,085	1	54	96
Total	582,669	83,608	476,374	2,835	1,909

The average assessed valuation per head of the cattle in Wyoming, which includes not only the range cattle but also the fancy breeds of every kind, is about $11; of horses, $30; of sheep, $1.50, and of swine, $5.

A glance at the map of Wyoming will show that the live stock is distributed very unevenly over the State. Laramie County, which lies in the extreme southeastern corner of the State, in the valley of the north fork of the Platte River along the lines of Colorado and Nebraska, heads the list in the number of cattle and horses; while Carbon, another valley county to the west of Laramie, and Uinta on the extreme western frontier, bordering upon Idaho and Utah Territories, in the rich and fertile valley of the Green River, lead in the sheep industry, the former being credited with 150,000 and the latter 105,000. Fremont County, in the southwestern section, in the valley of the Sweetwater, is also a large cattle and sheep country; while Johnson, in the northern central part, watered by the Big Horn and Powder rivers and their tributaries, and Crook, in the northeastern corner, are great horse counties, and have some of the largest and most excellent herds in the State.

During the past three or four years attention has been paid to improving the breed in all kinds of live stock, and the fine bunches of animals found in all portions of the State compare favorably with those found in any section of the Rocky Mountain region.

As will be seen from the table there are but few swine in the State, little attention having as yet been devoted to that branch of the animal industry; but as the State is settled up and the extensive cattle ranges are divided up into small farms of a few hundred acres, the raising of swine will form no inconsiderable branch in the live-stock business. The column marked "other animals" shows the number of mules, asses, and goats, and is almost wholly confined to the first named. Mining is not carried on to any great extent in Wyoming outside the coal mines, these being in the vicinity of the

railroads. The "burro," the ordinary pack animal in mountain countries, is rarely seen.

In Uinta County cattle are bred up more than in any other portion of the State. They are handled with greater care, being generally corralled and fed during the winter months. The firm of Beckwith, Quin & Co., of this county, have the finest herd of graded cattle in the State, and all winter they have men riding on the range driving in cattle to be fed and sheltered. The same firm have upon their extensive, well-watered ranches, herds of horses of the best improved stock. In Uinta County Shorthorn bulls seem to be the rule, though there are many Herefords and some Galloways. Beef steers from this section average as high as 1,200 pounds on foot, and bring better prices than at any time since 1885. The shipments this year from Uinta County have been greater to Chicago than to Omaha, which is the reverse of former years. The inroads made by sheep in Uinta County during the past few years have compelled the cattlemen to reduce and improve their herds, the same being the case in some other portions of the State. The appearance of sheep in some localities of the State and the dry season which occasioned a shortage in grass during the last year have compelled a number of cattlemen to drive whole herds out of the State into Montana, and others will follow next year.

Last winter was the severest ever known by cattlemen in Wyoming, the mortality being far greater than in any former year, reaching from 25 to 40 per cent, although in a few localities it is reported as high as 50 per cent. Mr. A. H. Reel, one of the largest cattle owners in the State, estimates his loss by death of cattle last winter, on the range, at $200,000, and his estimate is corroborated by others well posted in the matter.

HORSES.

The horse industry of Wyoming does not differ materially from that of Colorado, the close proximity of the two States seeming to rather necessitate the same breeds and the same methods of handling. Percheron, Norman, Cleveland Bay, Clydesdale, Hambletonian, and Shires are the favorite breeds. Range broncho mares are bred to these stallions and the offspring is regarded as of superior quality for general use, and the prices received for the grade stock far more than compensate for the cost of importation.

SHEEP.

It is claimed, and with every evidence that I have thus far seen of being sustained, that this State has no ordinary or common sheep, every flock being graded up with Spanish or French Merino, or both. How far an actual test would prove this assertion is almost impossible to ascertain with the present imperfect means of transportation from one portion of a State to another, the area of which is almost twice as great as the State of New York.

The first sheep brought to the State was in 1871, by Messrs. Homer & Sargent, and the success which followed this introduction induced others to follow. D. R. Castidy came in with a flock in 1873, and turned it loose on the range, where he succeeded beyond his most sanguine expectations. His range was on Cooper Creek, about 30 miles west of the present site of Laramie City, on the Union Pacific Railroad.

The sheep industry has been constantly increasing since the early days, and it is believed by those engaged therein that Wyoming yet affords an excellent field for future operations.

East of the Platte River flocks are better cared for than in the western portion of the State, being corralled and carefully herded at night as a protection from wolves and coyotes.

During the summer months the flocks are herded in the mountains, where the grazing is of the most excellent and succulent nature, and where there is a bountiful supply of water. There they remain until snow begins to fall, when they are taken to the plains (or river bottoms) for the winter. Strange as it may seem to the casual observer, there is plenty of water in the mountain sections of the eastern part of the State in the summer, when many of the streams on the plains show but little or no water at all, and in the winter the reverse of this is true. The explanation is simple. In the summer the melting snows on the mountain tops flow down to the plains rapidly and are absorbed by the sandy bottoms of the streams, or are taken up by the hot sun and dispelled. In the winter the mountain streams are all frozen over until they reach the plains. Here the water comes in contact with the icy bottom of the creeks, and plenty is afforded for stock without any effort on the part of the stock grower, except to occasionally break the ice which forms on the surface of the streams.

In this section one herder is usually required for 3,000 sheep, and one foreman for every 15,000, the foreman having charge of the herders and being held responsible for the proper performance of their duties. The herders receive from $30 to $40 per month, and "found," while the foreman receives from $10 to $15 per month more. The wages paid foremen and herders in Wyoming range from 25 to 30 per cent more than is paid in Colorado. These herders each have a covered camp wagon, fitted up with a stove, spring bed, table, and carpet in the bottom, together with other appurtenances necessary for camp life. They are provided with flour, sugar, coffee, bacon, beans, butter, cheese, tea, dried apples, prunes, and canned goods, and when they desire fresh meat they kill a mutton.

Every branch of the live-stock industry in this State seems to be upon a safe and prosperous basis, and little, if any, complaint is made in regard to the Government interference with private and individual rights of citizens upon the public lands. The State is yet in its "swaddling clothes," but those best acquainted with its former history, and thoroughly conversant with its resources, predict a bright future.

From all that I have been able to learn by personal observation and visitation, and from the reports made to me by those fully informed by reason of long residence and years of experience in the various branches of the live-stock business, I am convinced that the State of Wyoming has nothing to fear in comparison with any other portion of the Rocky Mountain region.

CONCLUSION.

In concluding this brief report of the animal industries of this far-off, practically unknown State, I desire to express my thanks to the citizens of every portion of the same for the kindness and courtesies extended to me, and for the valuable information afforded to enable the preparation of this statement of the conditions of affairs as they exist.

J. F. M. McNEELY,
Employé, Bureau of Animal Industry.

SILVER CLIFF, COLO., *December* 6, 1890.

EXHIBITION OF THE VERMONT ASSOCIATION OF ROAD AND TROTTING HORSE BREEDERS.

Hon. J. M. RUSK,
Secretary of Agriculture:

SIR: The exhibition was held at Rutland, August 26, 27, and 28, 1890, under the auspices of the Vermont Association of Road and Trotting Horse Breeders, and according to the opinions expressed by all present it was the most successful exhibition ever held in Rutland. Six years ago the first exhibition was held by this association, since which time one has been held every year. The number of horses on exhibition this year was 800, the largest in the history of the association. The descendants of the Morgan family of course predominated, but there were also on exhibition animals of other well known strains, representing the great families of Hambletonian, Mambrino Chief, American Star, Clay, George Wilkes, Electioneer, Almont, Belmont, Dictator, Happy Medium, Mambrino Patchen, and others which play such important parts in the breeding of the fast light harness horses of the present day. Horsemen had gathered from all sections of the country, and their visit was certainly worth their time and trouble.

These annual exhibitions have stimulated to a great extent the breeding of horses and the love of horseflesh in Vermont. At no time in its history has the State been so well equipped with stock for successfully breeding the high type of roadster and trotter as it is to-day, and the results of the future must be superlatively great.

It is a noteworthy fact that the calls made upon the breeders of the State to-day are for inbred Morgans, and that the supply is not equal to the demand.

Following is a partial list of exhibitors and horses exhibited:

W. W. Moore, Shoreham.—The 4-year-old Gillig, 2:23½; the son of Aristos and Alice by Pearsall. Mr. Moore has one 2-year-old filly, the first foal ever sired by Gillig. This is Sue Gillig, dam by Waltham; 2d dam by Victor Von Bismarck (sire of Edgemark, 2:16). Rupert Gillig, (own brother to Sue Gillig) and Aristo Gillig, dam Lady Herbert by Waltham, 2d dam by Hambletonian 10, were started in the yearling race and gave an excellent account of themselves. Neither had received a long course of preparation, and what they showed was done naturally. Like Gillig the colts show remarkable leverage power in their make-up. They have wide hocks, great bone and stifles, and are put up all round for business. Mr. Moore's other exhibits include Alice, 18 years, the dam of Gillig, with a bay filly by Homestead, son of Nutwood and Arabella, 6 years, sister in blood to Gillig, being by Lambertus, own brother to Aristos (sire of Gillig), dam Alice, with a filly by Homestead. Mr. Moore is anticipating great results from the union of the blood of Homestead with that of Gillig in either way of crossing.

E. R. Brayton, Alburg Center.—The exhibit from the home of Goodwin's Hambletonian (sire of Onawa, 2:22¼) this year consisted of the 3-year-old bay gelding E. R. B., by North's Walkill by Winooski (sire of Grand Isle, 2:24¼), dam by Row's Black Hawk; Vermont Onaway, black gelding, 4 years (own brother to Fanchon), raised by Mr. Brayton, and sold by him to George K. Russell, of Bellows Falls, by Goodwin's Hambletonian, dam by Harry Knox; and the 4-year-old bay gelding Seth, by Goodwin's Hambletonian, dam by Earthquake (sire of Rex, 2:22¼).

N. A. Litchfield, Hydeville.—Bessie C., gray filly, 2 years, by Valley Chief.

S. H. Smith, Castleton.—Eva S., 6 years, by Aristos, dam by Addison Patchen, and her splendid big yearling bay filly, Walkill Maid, sired by Albany Walkill.

Alton Green, Pawlet.—Jennie K., bay filly, 2 years, by King, son of Aristos, dam by Blackstone.

E. F. Clark, Falmouth Stock Farm.—Roland, 2:28, was shown in excellent condition, and he has no better representative than the fast filly Hattie C., dam by Thomas Jefferson; her 7-year-old brother, Falmouth, and the brood mare Comfort, dam by Mohawk Chief; Guy Kohl, the 3-year-old son of Guy Wilkes, 2:15¼, dam by Steinway (sire of the pacing mare Cricket, 2:10).

G. H. and S. A. Baker, Rutland.—George H., 5 years, by St. Julien, dam by Gen. Putnam.

Dr. Ed. Whipple, Danby.—Oriole, 4-years, by Aristos, dam by a son of General Sherman; Mina B., chestnut filly, two years, by King Aristos, dam by Gen. Sherman.

Guy M. Bentley, Rutland.—Mack, the 5-year-old son of Thought, dam by Billy Ring, the son of Young Columbus.

Charles M. Ballard, White River Junction.—Factory Boy, 2:24¼.

H. W. Keys, Newbury.—Verdant, by Hamlin's Almont (sire of Belle Hamlin, 2:12¾), dam by Hamlin's Patchen, 2d dam by Dictator (sire of Jay-Eye-See, 2:10); a filly by Mambrino King (sire of Prince Regent, 2:15); Gracie, 9 years, by Arthurton (sire of Arab, 2:15), dam by David Hill, jr., 2d dam by California Dictator, and her offspring, a filly by Alcazar, 5102, 2:20¼, son of Sultan. Gladys is a mare by Solicitor, dam by Hermit son of Pilot, jr., and the colt by her side was Red Mack, son of Red Wilkes; Edgale, 4 years, by Egbert, dam Sue by Thorndale. Aside from the foregoing, the farm was represented by Knox, 4 years, by Eastern Boy, 2:29½, and a yearling colt by Eastern Boy, dam by Solicitor.

W. C. Danyew, Middlebury.—The chestnut stallion New Goldmine 12451, by Daniel Lambert 102, dam the standard bred mare Belle by Ethan Allen 860, 2d dam Nell by Black Hawk 5. Mabel W., 2 years old, is the last of the get of the renowned Daniel Lambert. The imported horse British Splendor sired her dam, and her 2d dam was by old Black Hawk. William, a bay gelding, 5 years, by Lambertus, dam a Morgan mare. The 4-year-old gelding Johnny, by Harvester, son of Daniel Lambert, dam by Black Bill son of Black Lyon.

C. B. Hall, Leicester.—Leicester, 2:27, by Deucalion, 2:22, dam Lady Winship, 2:23¼, by H. B. Winship, 2:20¼. His colts are uniformly fine and handsome. The exhibitors of them at this meeting were: C. E. Capron, Leicester: Early Leicester, 1 year, dam by Beecher. B. H. Alden, Leicester: Daisy, suckling, dam by Goodells' Patchen. Frank E. Chandler, Leicester: Daniel Leicester, suckling, dam by Beach's Columbus. H. N. Morse, Leicester: Suckling, dam by a son of Black Lyon. L. M. Baker, Forestdale: Suckling, dam by De Long's Ethan Allen, and another out of a mare by Abraham. Walter Thomas, Salisbury: Suckling, dam by young Columbus, jr. Ed. Thomas, Salisbury: Suckling, dam by De Long's Ethan Allen. M. A. Munroe, Middlebury: Suckling, dam by Motion 1544, 2:29. W. S. Kingsley, Middlebury: Suckling, dam by Abraham. Patrick Spring, Orwell: Suckling, dam by Harris's Hambletonian. E. E. Stickney, East Shoreham: Suckling, dam by Little Mack. John Fisk, Leicester: Suckling, dam by Winthrop Morrill. C. B. Hall: Yearling filly, full sister to the colt from the Abraham mare, owned by Mr. Baker (this mare is Topsy, 9 years, full sister to Brightwood, pacing record 2:19¼, and her dam was the dam of Lady Pritchard, 2:21); also the yearling filly Nellie Bly, dam by De Long's Ethan Allen. Harrison H. Williams, Brandon: Two sucklings by Leicester, one out of Bessie M. by Lambertus, and the other out of Topsy by Freeman Sherman. Rollin Wood, Brandon: Suckling. B. W. Williams, Leicester: Suckling, dam by Ben Franklin.

W. W. Burr, West Rutland.—Belle B., bay filly, by Albrough 5857, dam Susan by Highland Grey; shown with its dam.

Patrick Spiring, Orwell.—Addison Prince, black colt, 2 years, by Addison Lambert, 2:27, dam by Sherman Black Hawk.

C. H. Holbrook, Brandon.—Tom, gelding, 5 years, by young Columbus.

Ed. Thayer, Brandon.—Duke, chestnut gelding, 6 years.

H. S. Gibbs & Co., Pittsford.—Kate, 8 years, by Redpath, with chestnut colt by her side by Ben Fish, son of Ben Franklin; Richard D., chestnut gelding, 2 years, by Franklin Boy by Ben Franklin, dam by Redpath; Aristene P., brown filly, 1 year, by Aristos, dam Kate (a beauty); Iris G., black filly, 1 year, by Aristos, dam by Billy Ring.

H. C. Bloomer & W. H. Startup, Proctor.—Flora B., brown filly, 1 year, by Aristos, dam Black Mag by Warner Horse, dam by Derby Bashaw; also Black Mag with filly, foal Ray B., by Leicester, 2:27.

S. F. Kelly, Rutland.—Jessie K., brown filly, 3 years, by Ben Franklin, dam by Blackstone.

D. G. Hathaway, Tinmouth.—Daniel H., chestnut colt, 4 years, by Lambert Chief, dam by Blackstone.

Samuel Culver, Indian Valley Stock Farm, Pawlet.—The black stallion George W., 6 years, by Alcantara, 2:23, dam Minnie by Broken Leg, by Hambletonian 10; Thorndike, bay colt, 2 years, by Almont Star, son of Almont, dam Minnie (the dam of George W.).

Henry Kingman, Pittsford.—Morning Star, bay colt, 1 year, by Almont Star, dam by Woodburn Pilot, 2d dam by Churchill Horse. Its dam Topsy was shown with a black filly by Aristos at her side,

F. D. Barton, Vergennes.—The bay colt Homestead, 4 years, by Nutwood, 2:18¾, dam by Pancoast (sire of Patron, 2:14¼), 2d dam by Hambletonian 10, 3d dam by Seely's American Star. J. A. Tappen, of Panton, exhibited a yearling filly out of a mare by Rusher, son of Daniel Lambert. Homestead's stable companion is Wilkes McGregor, bay horse, 5 years, by Robert McGregor (sire of Bonnie McGregor, 2:13½), dam by George Wilkes.

J. A. Tappen, Panton.—Besides the Homestead filly mentioned above, Mr. Tappen exhibited an own sister to her, a suckling, and the 5-year-old mare Mona, by Star Ethan.

J. H. Holmes & Son, Charlotte.—Malchoir, 4-year-old record, by Winooski 701, dam by Walkill Chief 330; Dixby H., by Malchoir out of Jennie by Honest Abe; Maggie H., brown filly, 4 years, by Nero 6555, dam by Honest Abe (shown by Messrs. Holmes, though she is the property of George W. Fletcher of Middlebury); Belle Lapham, brown filly, 2 years, the oldest of the get of Malchoir (her dam was by the Ames horse, son of Black Hawk); Tilly H., brown filly, 1 year, by Nero, dam Kitty Clay by Claybrino.

G. A. Haskins, Middletown Springs.—The second stallion to bear the name of George Wilkes, jr., both living, is the property of this gentleman. His dam was by Gilbreth Knox, 2:26¾, son of General Knox. Two sucklings by him were exhibited, one from a Blackstone mare and the other out of a mare by Flintstone, son of Blackstone.

H. B. Brown, West Rutland.—Maud B., chestnut mare, 5 years, by Waldo, dam by General Sherman.

James Battles 2d, West Rutland.—Jimmy B., gray horse, 6 years, by Highland Grey, dam by General Sherman; Frank H. jr., bay colt, 4 years, by Frank H., son of Ben Franklin, dam by General Sherman.

E. E. Stickney, East Shoreham.—Charlie K., brown colt, 3 years, by King, dam by Thomas Jefferson.

H. M. Perry, East Shoreham.—King, black horse, foaled 1875, by Truesdall's Hambletonian, son of Hambletonian 10, dam by Paprarie, thoroughbred. Mr. Perry had on exhibition also the 4-year-old mare, Anna K., by King, dam by Robert R. Morrison; Darkness, black gelding, 5 years, by King, dam by Addison by Black Hawk; Prudie K., black filly, 2 years, by King, dam by Arthur Allen, son of De Long's Ethan Allen; Abram K., brown gelding, 4 years, by King, dam by Broken Leg; King's Best, black filly, 5 years, by King, dam by Broken Leg; and Miss King, a suckling, by King, dam by Abraham.

G. A. Cutting, East Shoreham.—Dan D., bay gelding, 4 years, a pacer, by Addison Lambert, dam by Arthur Allen.

Charles Dosirare, East Shoreham.—Magnet, 2 years, by King, 2:40, dam imported mare.

S. Y. Felton, Orwell.—St. Julien, the 12-year-old son of Aristos, together with the inbred Lambert Aristos Chief, chestnut horse, 5 years, by Aristos, dam by Abraham, and a 6-year-old gelding, by Ben Franklin, dam by Abraham.

E. P. Johnson, Sudbury.—Columbus, brown horse, 4 years, by young Columbus, jr. 6429, dam Sally by General Sherman, second dam by the Adams horse; Daniel Garthwait, chestnut colt, 2 years, by Garthwait, dam a Morgan mare.

L. H. Bromley, West Rutland.—Albrough 5857, 4 years, by Electo, dam by Almont Mambrino.

T. E. Kiely, East Poultney.—No name is better known in western Vermont than that of Highland Grey, that game and gallant trotter of a dozen or fifteen years ago, and still vigorous despite his twenty-three years. The family show of Highland Grey's stock was the following: William O. Reardon, Tinmouth: John L. Sullivan, black horse, 7 years, dam by Frank Howard by Hill's Black Hawk. Dwight Taylor, North Rupert: Highland Grey, jr. 5698, gray horse, 8 years, dam by Ed. Sherman; Grey Lock, 2 years, a full brother to him. F. S. Hill, Wallingford: Highland Prince, bay colt, 1 year, dam by Charles Prado. E. Keily, East Poultney: Ivanhoe, 8 years, by Highland, dam by a son of Beggart's Rattles and dam; gray gelding, 8 years, s. t. b. by Darkey. Harry E. Hawkins, Calais, showed a speedy representative of the old horse, dam by Holabird's Ethan.

A. J. Stow, Weybridge.—Kilrain, a 3-year-old, sired by Daniel Lambert, dam Lucy by Foot's Black Hawk, by Vermont Black Hawk.

C. M. Sherman, North Clarendon.—Among the stallions of Hambletonian blood that have been brought into Vermont is Mr. Sherman's horse, Col. Egbert 2849. The dam of Col. Egbert was Maisie (dam of Delineator, 2:18) by Shelby Chief, second dam by Pilot, jr., third dam thoroughbred. There was a show of Col. Egbert's foals made by the following. W. H. Dunston, Rutland; Nellie Egbert, bay filly, 2 years, dam by Hannibal. Edward Dalton, North Dorset: Grey Egbert, gray gelding, 4 years, dam by Highland Grey. W. P. Clark, Wallingford: Wires, bay colt, 2 years, dam by Black Prince. C. M. Sherman, Van Hoozer: Bay colt, 2 years, owned in Albany, N. Y.

E. R. Sherman, Danby.—Sherman Aristos, brown horse, 6 years, by Aristos, dam by Ed. Sherman, by General Sherman; 4-year-old bay filly Aristina, by Aristos, dam by White Lip by General Sherman.

W. P. Clark, Wallingford.—In addition to the bay colt Wires, described above, Mr. Clark exhibited a 3-year-old colt by Ben Franklin, out of a dam by Wires.

M. A. Munroe, Middlebury.—Dick, 3 years, by Motion, 2:29, dam by Abraham.

John Utton, Morrisville.—Ex-Governor G. W. Hendee's gelding, Conemaugh Wilkes, record 2:33¼, a 4-year-old, by Abdallah Wilkes, dam by Harry Allen; Ben Hawk, chestnut stallion, 6 years old, by Ben Franklin, dam Kitty by Red Jacket; Allen Wilkes, 6-year-old, son of Mambrino Wilkes, 2:28¾, owned by George H. Reed, of East Dorset; Little Ned, 5-year-old gelding, by Smuggler, dam by Green's Bashaw, owned by Utton & Geary.

H. E. Seward, Rutland.—Goldfinder, brown colt, 5-years, by Frank H., 2.27½, by Ben Franklin, dam by Butler's Ethan Allen.

F. S. Hale, Rutland.—Dan M., black colt, 2 years, by Roland, dam by Ben Franklin.

J. E. Tennien, Pittsford.—Nickwacket 7124, bay colt, 3 years, by Garthwait, dam by Daniel Lambert, second dam by Churchill Horse.

W. S. Bailey, East Hardwick.—Helen M. and Lambert B., the latter with a record of 2:30.

F. H. Farrington, Brandon.—The 3-year-old Castaway 11260, by Ansel, 2:20, son of Electioneer, dam Sally Hamlet by Hamlet 160, sire of seven in the 2:30 list, second dam Sal (dam of Coaster, 2:26¼) by Canada Chief (sire of the dams of three 2:30 performers). Nellie H., chestnut mare, by Ben Franklin, dam Jennie (the dam of Hiram H., 2:33¾) by General Sherman, was shown with a colt by Deucalion, and her 2-year-old chestnut filly Riches, by Viking, 2:19¼.

H. T. Cutts, Orwell.—Star Franklin is now at the head of Brookside Stud; a full brother to Bell Girl, 2:49¼, winner of the 2-year-old breeders' stakes of 1888, of H. H. Franklin, 2:34, winner of the 4-year-old stakes of last year. He is bred in the famous Morgan-Hambletonian lines that have produced by his own sire May Bee, 2:24, Belle Franklin, 2:28¼, Dynamite, 2:27, and many other winners; a combination too that was so conspicuous on the turf of last season in the trotters Nelson, 2:10¼, Jack, 2:12¼, Alcyone, 2:27, Gene Smith, 2:15½, etc. Other exhibits made by Brookside were: Maxey 6530, chestnut horse, 5 years, by Ben Franklin, dam Kitty Cook by Gen. Sherman (owned by S. F. Smith, Shrewsbury); Lord Franklin, brown colt, 2 years, by Ben Franklin, dam Mattie Millis, 2:38½, by Tom Thumb, son of Ethan Allen 43; Lady Phelps, chestnut filly, 3 years, by Ben Franklin, dam by the Lapham horse, son of Vermont Black Hawk; Bertha, bay filly, 2 years, by Ben Franklin, dam Pet by Gen. Sherman; Dot, brown filly, 3 years, by Ben Franklin, dam by Blackstone (owned by Justice Batchelder, Wallingford); Mirandia, bay filly, 2 years, by Ben Franklin, dam Maggie G. Middleton, 2:20¼ (owned by J. M. Forbes, Boston).

A. J. Ketcham, Leicester Junction.—Ben Franklin, jr., 5 years, is a handsome son of Ben Franklin, dam a mare of Black Hawk and Hambletonian blood.

B. Andrews, Cambridge, N. Y.—Frank C., 1 year, by H. H. Franklin, 2:34, dam by Dolan; and his sire, H. H. Franklin, by Ben Franklin, dam by Mott's Independent.

Dorman & Mason, Swanton, Vt.—Star Ethan, foaled 1874, by Daniel Lambert, dam by Churchill horse.

Cedar Meadow Stock Farm, Fair Haven.—Victor Wilkes, 2:29½, by Victor Von Bismarck (sire of Edgemark, 2:16), dam Mattie Wilkes by Colonel Wilkes, son of George Wilkes, second dam Kate by Yankee Boy, jr. Contestor Wilkes won the yearling race at the breeders' meeting in 1889, when he established the Vermont record for yearlings by trotting in 3:13½. He was the first colt Victor Wilkes ever sired. His dam was by Daniel Lambert; second dam by Blackstone. This year Jumbo Wilkes, a 2-year old, went to Boston and won the 2-year-old stakes at the New England breeders' meeting, trotting in 2:49¼. His dam is by Gen. Sherman. The farm's show of yearlings included Juno Wilkes, by Victor Wilkes, dam by Daniel Lambert, and Titan Wilkes, full brother of Jumbo Wilkes, Ruth Wilkes, 2 years, by Victor Wilkes, dam by Daniel Lambert, was also exhibited. Joe Alcyone, 3 years, is a son of Alcyone, 2:27, by George Wilkes, dam Nellie Lambert by Daniel Lambert, second dam by Woodburn Pilot, and he is a member of this stable. So too is the 3-year-old filly Alcyone Maid, by Alcyone, dam by Young Columbus.

Sherman A. Hemmingway, Bridport.—Clay Franklin, 2 years, by Ben Franklin.

J. Hastings, Brandon.—Mary P., 8 years, by Redpath, dam by Churchill horse; and Black Jack, 5 years, by Woodburn Pilot, dam by Killington.

A. Ingles, Swanton.—Aldorado, 3 years, by Messenger Wilkes 2:29¾ (sire of Palm, 2:28¼), by Red Wilkes, dam by Daniel Lambert.

W. H. & F. M. Partch, Brattleboro.—Clay Lambert 4799, 6 years, by Motion, 2.29, dam by Cassius M. Clay.

Silas H. Soule exhibited the brown stallion Meteor, 7 years, by young Rix, grandson of Black Hawk, dam Peacock, second dam by Old Buckskin by Sherman Morgan.

John R. Bliss, Brattleboro.—George R., 2 years, by Clay Lambert 4799, dam by De Long's Ethan Allen.

R. M. Conant, Richmond.—Franklin B., 2 years, by Ben Franklin, dam by Billy Bowlegs 11975.

Col. L. G. B. Cannon, Burlington.—Sister, 2:25¾, by Ethan Allen 474, dam by Brownell's Ethan Allen, with a suckling colt by Homestead, son of Nutwood, and a yearling filly by Homestead, dam by Adonis.

Deerfield Stock Farm, Brattleboro (L. F. Pettee, New York, proprietor).—The 3-year-old filly Senorita, by Mambrino King, dam by Hamlin's Almont, second dam by Dictator; Chimes Belle, a bay suckling, by the Electioneer stallion Chimes 5348, out of Electa by Almont Dictator 4175; Maud C., 6 years, is a mare by Gambetta, dam Ethel; Dr. Titus, 1 year, by Grandee, son of Hambletonian 10, dam by Administrator; Grace Sheridan is a 6-year-old mare by Phil. Sheridan, dam by imported Saladin.

E. F. Brownell, Burlington.—Alcander 6617, by Alcantara, dam by Abdallah Prince; Col. Crombie, bay colt, 2 years, by Alcander, dam Kitty, 2:30, by Billy Bowlegs; owned by F. J. Flanagan, Burlington. Annacander, chestnut filly, 2 years, by Alcander, dam the dam of Grand Isle, 2:24½, has shown quarters in 41 seconds, and last June took a record of 3:01; she is owned by W. E. Allen, of Winooski. Geo. M. is a bay gelding, 2 years, by Alcander, dam s. t. b. by Gideon, second dam by General Knox; he is the property of G. M. Delaney, of Burlington. Col. S., bay gelding, 2 years, is a son of Alcander, dam by Walkill Chief; he is owned by H. C. Smith, Burlington. Russell, 2 years, by Alcander, dam by Earthquake; owned by Thomas Russell, Burlington. Brownell, by Alcander, out of Rhea by Winooski, second dam Laura Williams, 2:24½, third dam the Stone mare. A 2-year-old bay gelding, by Alcander, dam by Steele's Walkill Chief (sire of Joe B., 2:26½); is owned by B. H. Porter, of Colchester. A bay filly, 1 year, by Alcander, dam by Winooski, is the property of Frank Collins, Colchester. Luna Wilkes, yearling bay filly, by Alcander, dam by Patchen a son of the brood mare Princess (dam of Arthur Wilkes, 2:22½); is owned by H. C. Thorpe, Charlotte. The last in the string is the yearling bay gelding McGinty, by Alcander, dam by the Sexton (thoroughbred).

George K. Russell, Bellows Falls.—During the past year Mr. Russell has added to his possessions the colt Elcano 8377, by Mansfield, 2:26, by Messenger Duroc out of the celebrated Green Mountain Maid, that has produced seven with records of 2:30 or better, and is also the dam of Electioneer. The dam of Elcano was Fairy, full sister to Sweepstakes, that has sired sixteen in the 2:30 list, and Independent, that has sired three in the list. Elcano was bred at Stony Ford, and it was for the purpose of securing the prized blood of Green Mountain Maid that he was purchased. Mansfield, his sire, is the sire of the great campaigner Dawson, 2:19¼, to which crack performer Elcano is almost brother in blood. Bay Wilkes 2453, by Bourbon Wilkes 2345, son of George Wilkes, dam Bourbon Lass, by Mambrino Patchen. Bourbon

Wilkes, his sire, has placed eleven in the list and his full brother Favorite Wilkes, 2:25½, is likewise siring extreme speed. The second dam of Bourbon Wilkes was by imported Bonnie Scotland. Mr. Russell has a yearling filly, dam by C. W. Mitchell, son of Aristos. C. F. Henry, of Chester, shows one by Bay Wilkes out of a Morgan mare. George T. Witherell, Westminster, has a bay colt, dam by Bayard, second dam by Abdallah Prince. C. D. Welch, Rutland, exhibits a yearling out of a Hamlet mare. H. L. Warner, Ludlow, shows a yearling by a son of Volunteer. Dr. A. Kilburn, Rutland, exhibited a bay filly, dam by C. W. Mitchell. Mr. Wilmoth also has in his string the 5-years-old stallion John Porter, by Aristos, dam s. t. b. by Hamlet. Another exhibit by Mr. Russell was the 5-years-old mare Fanchon.

R. K. Hamilton, Fair Haven.—Inahorn by Matterhorn, dam by Gen. Sherman, and Altha by Ben Franklin, dam by Blackstone. She is a 4-years-old, has trotted to a race record of 2:40¼, and can show to beat 2:30. H. D. Noble is a 5 years-old, brother to Altha, and he has gone in 2:40¼. Jerryhorn is a yearling by Matterhorn, dam Jennie by Daniel Lambert, jr. The only other animal exhibited by Mr. Hamilton was a 3-years-old chestnut mare by Lambert Chief, dam by Ben Franklin.

Black Hawk Stock Farm, Bridport.—Hattie L., by Motion, and the young stallion Ambition 2860. Hattie L. had just arrived from Mystic Park, where she was timed three heats below 2:30 in her race against the Seer, 2:20¼, by Onward, 2:25¼, one of the sons of George Wilkes, and his dam is by Hero of Thorndale 549 (sire of the dams of four in the list) 2d dam Abutilon (dam of Combat, sire of Brown, 2:18¾, at 4 years), 3d dam Minna (dam of Kentucky Wilkes, 2:21½), by Red Jacket.

F. S. Hale, Rutland.—Hulda B., daughter of Ben Franklin.

J. E. Post, Rutland.—Surprise Franklin, 3 years, by Ben Franklin, dam by Blackstone.

Nelson O'Donald, Benson.—A 2-year-old filly by Lambert, dam by Ben Franklin.

Bingham & Phipps, Rutland.—George Lambert, 4 years, by Daniel Lambert, dam by Smith's Mambrino Patchen.

Ballard Bros., Georgia.—An exhibit of large inbred Morgans. There were six of them, four brothers and two sisters, all from the same dam and by the same sire, Son of Allen, by Star Ethan.

Shelburne Farm, Shelburne.—The exhibit from this establishment included a collection of imported Hackney horses and a lot of French Coachers and trotting-bred stock. Much curiosity centered about the Hackneys, which were imported last June by the proprietor of the farm, Dr. W. S. Webb. The importation was made with hope of improving the roadster stock of Vermont, and Dr. Webb is confident that the venture will be successful. The trotting-bred specimens from the farm included Almont Wilkes 2131, bred and raised at Fairlawn, Lexington, Ky., and bought at the closing-out sale of the Gen. Withers estate last spring. He was foaled in 1882. His sire was Almont 33, sired by Alexander's Abdallah 15, the son of Rysdyk's Hambletonian 10; 1st dam (the dam of Iona, 2:17½; Alpha, 2:23½) Annabel by George Wilkes 519; 2d dam by Jesse Pepper, by Mambrino Chief; 3d dam by a thoroughbred son of Virginian by Sir Archy, son of imported Diomed. The other stallion from the Fairlawn farm was Ormond 2154, which made a record last season of 2:27½. Ormond is a son of Happy Medium 400 (sire of Maxie Cobb, 2:13¾), dam Queen Lizzie, by Mambrino Chief 11, grandam by Crusader son of Sir Archy. Maiden Fair is a 3-year-old bay filly, by Happy Medium.

W. R. & Charles Sanford, Orwell, exhibited the black French Coacher, Carnot, 497.

Castleton Stock Farm, Castleton.—From the home of Morgan Ethan, 2:29¼, there came the 4-year-old stallion, Melvill, by Melrose 2819 (sire of T. F. S., 2:19½), dam Lady Pine (trial, 2:32½) by Robert Fulton, son of a thoroughbred; Bonus 10090, 2-year-old, by Morgan Ethan, dam Agra by Sir Walkill 1547 (Bonus paced a half in 1:26 as a yearling). Coanza, bay filly, 1 year, by Morgan Ethan 10089, dam Kittie Maxwell by Stewart's Messenger. The Only Child, black gelding, 3 years, by Sir Clay; and Highland Morgan by Highland Gray, dam by Ti Boy. Castleton Farm is the property of J. K. P. Pine.

W. H. & E. S. Minor, Brattleboro, showed the 4-year-old stallion Sir Onward, by Onward, 2:25¼, dam s. t. b. thoroughbred.

A. B. Manchester & Sons, West Randolph.—From Valley Farm there was Solicitor 1025, by Belmont 64, dam Blandina (dam of Swigert, sire of twenty-four in the 2:30 list; of King Rene, sire of nine in the list; and of Abdallah Pilot, sire of three in the list; also the sire of Messenger Chief, the sire of Maud Messenger, 2:16 and six others in the list), by Mambrino Chief 11; second dam, the Burch mare (dam of Rosalind, 2:21¼).

D. W. Prime & Son, Brandon, showed Rex, bay horse, 5 years, by Ben Franklin, dam by Green Mountain Black Hawk; Pandora, bay mare, 4 years, by Ben Franklin, dam by Blackman's Idol; Ino, 5 years, and Urda, both full sisters to Pandora;

and Prinhac, 2 years, by Viking, 2:19¼, out of Urda. The 3-year-old bay colt, Kerson, by Clay Wilkes, dam by Bowman's Clark Chief, was also shown.

John P. Williams, Shrewsbury, exhibited the 5-year-old chestnut gelding Harry Cutts, by Ben Franklin, dam by Holabird's Ethan Allen, with a 3-year-old full sister; and a 4-year-old bay gelding, by St. Julien, out of the above-named dam.

E. D. Hinds, Pittsford.—Thirteen head were exhibited this year by Mr. Hinds, largely the get of his stallion Garthwait, by Alert, son of Hambletonian 10, dam Trusty by Marlboro and Redpath, now in his twentieth year, by Gen. Sherman, dam by the Churchill horse. The head brood mare on the Hinds estate is Jennie H., by Benedict Morrill. She is 22 years old and is the dam of Redspot, and of Belle of Fordway by Alcyone. Snowflake, 5 years, by Waldo son of Messenger Duroc, out of Jennie F., was also shown.

M. C. Ridlon, Chippenhook, showed the bay colt Don Aristos, 3 years, by Aristos, dam by Gen. Sherman.

C. M. Hazen, West Hartford, had his 2-year-old colt Messenger Wilkes, by Mambrino Wilkes. 2:28¼, dam by Brattleboro by Young America 247, by Grey Messenger, 155.

Harry R. Lawrence, of Brattleboro, brought to the fair Valkyrie, 1 year, by Viking, dam Sunrise (trial 2:28½) by Kent; second dam by Flying Hambletonian.

Dr. E. F. Preston, Brandon, showed Daniel Garthwait, 2 years, by Garthwait, dam by the June horse.

H. Wescott, Fair Haven.—Lady Patchen by Mountain Boy, and Lucifer, bred in the same fashion.

A. Kilburn, Rutland, had a couple of colts: Harry, 1 year, by Victor Wilkes, dam by Defiance; and Alta, bay filly, by Almont Star, dam by Modoc.

F. H. Holden, Pittsford.—Laura Wilkes, by Mambrino Wilkes, 2:28¼, dam Jane Ayer by St. Julien, son of Aristos, was shown by Mr. Holden, together with the brown mare Loretta F., 2 years, by Maxey, son of Ben Franklin, dam by a son of the Bixby Creamer.

J. A. Burchard, Shoreham, had Arthur B., 4 years, by Aristos, dam a thoroughbred mare.

H. S. Town, Montpelier, made exhibition of Auctioneer stock, led by his stallion Engineer, 2:38¼, by Auctioneer, dam by Doge's Morrill, that went a half over Rutland track at the breeders' meeting last year in 1:14. The first colt he ever sired, owned by L. D. Nute, of Marshfield, was shown. It was the 5-year-old bay gelding Ben Hur, dam by Judge Brigham, son of Jay Gould; is a light bay 5-year-old gelding by Auctioneer, dam Mogna Girl, 2:44, by Niagara Chief, son of Toronto Chief. Dr. J. L. Lyon, of New Haven, Conn., had in this exhibit a 3-year-old gelding by Auctioneer, dam by Mambrino Chief, jr. Joe White is the property of Joseph Battell, treasurer of the Vermont association. He is a son of Daniel Lambert, and his dam was Draco. (Sire of the dams of Royal Fearnaught 1501, sire of Silverthread. 2:15½, and eleven others in the 2:30 list, and of Young Rolfe, sire of Nelson, 2:10¼.)

Fair View Farm, the property of Lester Fish, of Rutland, is known as the home of Aristos 711. Aristos is just two decades old and his record is 2:27¾. Next to Aristos the most conspicuous animal in the Fish string was the brood mare Empress, by Bay Lester. She is the dam of R. D. F., 2:24¾; Tamerline, yearling, half mile record, 1:33½; Waldemar, bay colt, by Almont Star; Parnassus, by Wilkes Spirit, by George Wilkes, and she was shown with a foal at her side by Aristos. Hambletonian stallion Nutmont 2,206, by Nutbourne, son of Belmont (whose sons have contributed Edith R., 2:17¼; Dick Smith, 2:17½; Pamlico, 2:16¾; Manager, 2 year old pacing record 2:19½, out of Miss Russell, the dam of Maud S., 2:08¾; Nutwood, 2:18¾; Cora Belmont, 2:24½, and Russia, 2:28). The dam of Nutmont was Strubo (full sister to Stephen G., 2:20½), dam by Knickerbocker; second dam by Volunteer 55 (sire of St. Julien, 2:11¾); third dam s. t. b. by Vermont Black Hawk 5. Fred Wilkes was sired by Red Wilkes, and his dam was Black Princess, by Mambrino Patchen 38 (full brother to Lady Thorn, 2:18¼, and sire of fourteen in the 2:30 list, and of the dams of nearly forty others, including Grey Wilkes, 2:15½; Baron Wilkes, 2:18); 2d dam by Star Davis, son of imported Glencoe; Wauco 10055 is by Abdallah Wilkes 7562, dam by Clark Chief 89 (sire of the dams of Phallas, 2:13¾; Majolica, 2:15; Wilson, 2:16¼, and 8 others in 2:30); 2d dam by Pilot, Jr. 12 (sire of the dams of Maud S., 2:08¾, and Jay-eye-see, 2:10); 3d dam thoroughbred. The fourth representative is Saxon, 2:22½, of the get of Abdallah Wilkes.

E. C. Ryder, Weybridge, exhibited the 2-year-old bay colt New England, by Deucalion 222, dam by Daniel Lambert; 2d dam by Black Hawk.

Ledgewood Stock Farm, Rutland, E. Bowman, proprietor, exhibited the bay stallion Ned Wilkes 3644, by Alcantara 729, dam Rose by Knickerbocker 200; 2d dam Lady Denton by American Star 14; 3d dam by Mambrino Chief 11. Captain Wilkes, chestnut colt, 3 years, by Ned Wilkes, dam Katrina by Daniel

Lambert; 2d dam s. t. b. by Abdallah; also the bay colt George Efner 1087, 5 years, by Hamlin's Almont, jr. 1829, dam Fringe (trial 2:22) by Princess; 2d dam Favorita (dam of Camlet, the dam of Cyclone, 2:23¼, sire of Dr. Sparks and Gillette) by Abdallah, 15; 3d dam by Mambrino Chief.

The bay colt Berwick, 3 years, by Ned Wilkes, dam by Lambert Chief, owned by W. H. Valiquette, of Rutland, was also shown.

Respectfully submitted.

HELMAS ROMAINE.

PATERSON, N. J., *September* 24, 1890.

INFECTIOUS ABORTION OF MARES.

Hon. J. M. RUSK,
Secretary of Agriculture:

SIR: I herewith submit my report of investigations in relation to infectious abortion of mares, extending from November, 1890, to March, 1891.

We have reliable accounts of widespread epizoötic or infectious abortion among domestic animals as early as the third century before the Christian era, and later, when veterinary science began its rapid advancement in Europe, outbreaks of this malady were frequently observed and recorded, and from the early part of the present century the disease has been widespread throughout the continent, proving often a serious scourge to agriculture, and engaging the attention of many of the ablest veterinarians in France, Germany, Italy, Belgium, England, and other countries.

Recorded observations in those countries where infectious abortion has been rife indicate that it is most common in cows, less so in ewes, and quite rare in mares.

There is little to show from what time and to what extent this disease has prevailed among the live stock of the United States, but it has evidently been frequently seen from an early date among cows, and more rarely among ewes.

The prevalence of abortion among mares in this country appears to be of much more recent date. It has only been during the past eight or ten years that it has prevailed extensively in the Mississippi Valley, but in this brief period it has proven a veritable scourge to horse breeders. It first engaged general attention about 1886, gradually increasing in virulence until it reached its climax in 1889 and 1890.

It is exceedingly difficult to estimate with any degree of accuracy the losses from this scourge in a given area, but it was certainly quite enormous.

In McLean County, Ill., one of the richest draft horse breeding districts in America, there were reported for the year of 1888 five thousand living foals, and it is quite safe to say that, aside from other causes of loss, not less than one-half as many foals perished from infectious abortion as lived. In several townships, where horse breeding constitutes one of the principal agricultural pursuits, the losses from this malady alone reached fully 75 per cent, while in other more fortunate townships the disease was comparatively rare or wholly unknown.

Other horse-rearing areas in Illinois and adjoining States have suffered similarly. The disease has quite naturally attracted the most attention and probably found the most favorable habitude on extensive breeding farms, where large numbers of highly bred mares

are kept solely for breeding purposes. In such herds it has proven a very serious scourge, not infrequently causing a total loss of foals for one or more years, producing occasionally diseases or sequelæ (metritis, obesity, etc.) which prevent future conception, and in some instances cause the death of the mare.

Little of value has been recorded in connection with this disease as it appears in mares, and in fact the observations and experiments with it in cows and ewes are in most respects quite meager and indefinite.

These observations in relation to the disease in cows and ewes are rendered of still less value by the fact that there is no evidence of identity of the infectious abortion of mares, cows, and ewes, but on the contrary, recorded clinical observations are strongly opposed to such conclusions; for although abortion has frequently ranged over a wide area in one species of animal, which was habitually associated with other species on the same farms with the same food, water, housing, and other environments, yet it appears that the disease has not been simultaneously observed in two different species in the same community.

We are constantly forced to the conclusion, in our present state of knowledge, that while infectious abortion as it appears in the different species of domestic animals is clearly analogous, or generically identical, it is specifically distinct. In our investigations, therefore, we could be guided only by such inferences as could be drawn from the imperfect observations and experiments recorded in relation to the abortion of cows and ewes.

The disease has long been recognized as infectious by a large number of careful observers.

Fleming (Veterinary Obstetrics, 205) notes that since the latter part of the last century contagion or infection has been regarded by many as the leading factor in the causation of epizoötic abortion, and cites many clinical facts in the history of this disease, especially in the cow, which goes as far toward establishing its transmissibility as can well be done except by direct experiment. He quotes, among others, Zundel and Rodloff, who fully believed the malady due to the intravaginal introduction of some form of microörganism.

Franck (*Thierärtzliche Geburtshilfe*, s. 256 to 258) insists upon the infectious character of the disease, and supports his position with clinical and experimental facts to demonstrate the existence of a fixed contagion which gains admission to the uterus through the vagina. He quotes from the *Sachsischen Jahrsbericht* (1872, s. 134) an observation by Johne, where in a large dairy stable with short stalls and shallow gutters, without proper fall to admit of due drainage, that the first cow at the head of the drain on one side of the stable aborted, followed in a few weeks by the second, then the third, and so on in unbroken order the entire length of the row; while the opposite row, with ordinary passage way between the two, remained free from the disease for some time, but it finally made its appearance in the cow nearest to the junction with the drain from the affected row, and thence extended in regular order along the drain.

The infectiousness of the malady, the fixed virus and mode of infection, were further demonstrated by Johne, who effectually prevented the further spread of the disease by the application of disinfectants to the tail, perineum, and vulva of pregnant cows.

Franck cites Rodloff also, who relates an outbreak in which the

disease raged in a portion of a dairy establishment, while other parts, from which the cows could not come in contact with those affected although having the same food, water, housing, etc., remained healthy.

In the Report of the U. S. Department of Agriculture for 1883, Dr. D. E. Salmon relates an extensive outbreak among cows in New York, and supports the theory of infection.

Professor Nocard, in a report to the Department of Agriculture of France (*Receuil de Med. Veterinaire*, 15 September, 1886), after an extended study of abortion in cows, concluded that it is transmissible, and advises the employment of prophylactic measures, which in his hands have apparently accomplished good results, and by which it would appear that the morbid material gained access to the gravid uterus through the vulva.

M. Lebat, clinical professor at the Toulouse Veterinary School (Vet. Jour., vol. XXVIII, p. 402), reports investigations in relation to an outbreak of infectious abortion in a flock of ewes which was successfully checked by the local application of antiseptics to the vulva of the remaining pregnant animals, thus at the same time indicating its transmissibility and mode of infection.

The vulva-vaginal mode of transmission is further supported in opposition to the theory of a constitutional infection of the parent animal by the clinical history of the disease. In all animals there are few, if any, premonitory signs of the approach of abortion, or such symptoms as do occur are rather those due to the decomposition of the dead fœtus and preparations for its expulsion. The marked changes in the parent are usually due to the sequelæ of the abortion. As a general rule, also, one attack of an infectious disease confers immunity in the future, but this does not prove true in case of infectious abortion in any of our domestic animals, and the parent which has once aborted is equally liable with other pregnant animals of the same species to subsequent attacks.

On the other hand, we have several infectious diseases in animals, such as cholera in hogs and the so-called "pinkeye" in horses, which produce abortion in pregnant females, at the same time conferring immunity against future abortions from the same cause along with the immunity of the parent.

The period of incubation has not been definitely ascertained in any animal. Prof. Nocard records one case in a cow of an incubative period of six weeks, while Braner, in experimental transmission of the disease in the cow, gives a period of twelve to fifteen days; and Labat, in his apparently successful prophylactic measures among ewes, suggests an incubation of four or five days.

The etiological moment in the production of the disease has not been identified in any animal, some holding that it is due to a specific microörganism, while others consider it probable that the disease arises from an unusual multiplication and increased activity of some one of the many forms of organic life usually found in the vagina.

The latter theory is based upon what, in our present state of knowledge, might be termed spontaneous generation or evolution, by which germs which normally exist in the vagina or uterus in a harmless form may, under certain conditions, become pathogenic and give rise to a malignant disorder, and thus an accidental abortion followed by retained and putrefying placenta may give rise to infectious abortion which may spread throughout the herd or even

over a wide area. No strong proof has yet been adduced in support of such a conclusion, and our experiments, as will be seen later, are strongly opposed to such a theory; besides, it is a well-known fact that occasional accidental abortions occur in almost every herd of pregnant animals, and yet the infectious disease remains unknown in the same species of animal over a large area for a great number of years.

With the above related scanty knowledge of this malady the study of abortion in mares was undertaken.

The protracted and widespread prevalence of the disease in central Illinois led us to suppose that abundant material of undoubted virulence and reliability could be readily obtained close at hand, a presumption which was not, however, supported by subsequent developments.

Several outbreaks of an apparently reliable character were located in October, 1890. One of these, upon which we largely relied for material for our experiments, was in the herd of Mr. Walter Strawn, of Strawn, Ill., who had on his farm twenty-three supposedly pregnant, mostly full-blood and high-grade French draft mares. Several of the more choice individuals had been exhibited by Mr. Strawn at a fair, September 1 to 5, and on September 24 one of these, a 4-year-old mare, aborted, followed on the next day by a 3-year-old.

No further accidents occurred until October 18, when other abortions followed, until by October 23 there had occurred, to Mr. Strawn's positive knowledge, not less than seven abortions, all being full-blood mares and of the number exhibited at the fair.

At this stage prophylaxis was attempted by the attending veterinarian by means of general and local disinfection, with the result that no further losses occurred. These mares were kept on luxuriant, well-drained, blue-grass pasture, and had plenty of pure well water. Other similar outbreaks, from which it was hoped to obtain material, were located about the same date, but most of them ceased as abruptly as the above.

There were purchased, as experimental animals, one Texas mare, brought to Illinois in 1889, which had raised a healthy foal in 1890 by a native stallion, and was again in foal by same sire, and sixteen unbroken Texas mares (three of which were later returned to seller as barren) brought direct from that State from a herd free from abortion.

The experiments were conducted in the city of Bloomington on premises suitably equipped with box stalls, and were supplied with abundant light, air, food, and water for the maintenance of health, where they were under constant observation. These experiments and their results are best shown in the subjoined table:

No. of mare.	Date of exposure.	Source of material.	Method of exposure.	Result.	Notes.
1	Nov. 11, 1890.	Fœtus and membranes from herd of John Snyder, Canton, Ill.; aborted Nov. 10.	By introduction of placenta into vulva and leaving fœtus and membranes in stall.	None	
	Dec. 16, 1890.	Fœtus and envelopes from herd of R. Scales, Clinton, Ill., expelled Dec. 15, being the second abortion among 3 pregnant mares.	Same as Nov. 11.	None	Fœtus and envelopes were quite putrid when obtained.
	Dec. 25 to 29, 1890.	Mare from herd of C. Yoder, Normal, Ill.; aborted Dec. 24.	Introduction of utero-vaginal discharges direct to vulva of experiment mares and cohabitation till Dec. 29.	None	
	Feb. 9, 1891.	Herd of E. A. Vittum, Canton, Ill.	Introduction of utero-vaginal discharges from mare aborted Feb. 7; into vulva, and cohabitation with aborted and pregnant mares till Feb. 24.	None	Sold in foal Apr. 24.
2	Nov. 15, 1890.	Same as No. 1, Nov. 11.	Same as No. 1 of Nov. 11.	Accidental abortion Nov. 18 from violence in handling.	Died from accident Dec. 10.
3	Nov. 19, 1890.	No. 2	Cohabitation in same stall with No. 2.	None	
	Dec. 16, 1890.	Same as No. 1, Dec. 16.	Same as No. 1 of Dec. 16.	None	
	Dec. 25 to 29, 1890.	Same as No. 1, Dec. 25 to 29.	Same as No. 1 of Dec. 25 to 29.	None	Dropped healthy foal about Apr. 10.
5		Entered Nov. 15	As control animal.	Died from epilepsy Dec. 20.	
6	Jan. 13, 1891.	Chas. Yoder, mare aborted night of Jan. 12–13, being the last of three pregnant mares to abort.	Immediate transfer of utero-vaginal discharges and shreds of retained placenta into vulva.	Aborted Feb. 21. Infection the only assignable cause.	Exhibited no signs of ill health except during labor and 4 or 5 hours subsequently.
7	Jan. 13, 1891.	Same as No. 6	Same as No. 6.	None	Dropped healthy foal about Apr. 10.
8, 9	Feb. 4 to 14, 1891.	W. P. Buswell & Sons herd at Neponset, Ill., where abortion had been common a few days previously.	Cohabitation with recently aborted and with pregnant mares.	None	Sold in foal Apr. 24.
10	Feb. 24, 1891.	No. 6, 3 days after aborting, and Wm. Thompson's mare 1 day after aborting.	Introduction of utero-vaginal discharges into vulva.	None	Dropped healthy foal about Apr. 10.
11	....do	....do	....do	None	Sold Apr. 24 in foal.

No. 4 proved barren and was returned; Nos. 12–15 unused.

The material used in the exposure of No. 1 on November 11, and No. 2 on November 15, was of doubtful value, although infectious abortion existed at the time in that vicinity, while that used December 16 on Nos. 1 and 3 was apparently good, the fœtus being derived from the second mare which had recently aborted without apparent cause out of three pregnancies.

The source of material for exposures of Nos. 1 and 3 of December 25, and Nos. 6 and 7 of January 13, was thoroughly reliable.

Mr. Amos Yoder, of Towanda, McLean County, Ill., had, in autumn, 1890, twelve pregnant mares which began aborting without

apparent cause about October, and the disease continued into mid-winter, when but three animals remained pregnant. None of these mares were worked; all were in first-class general health; and the weather being exceptionally fine they were not stabled, but allowed to run in a stalk field, where they had abundant food free from ergot; and no cause other than infection could well be suggested.

Mr. Charles Yoder, of Normal, Ill., son of the above-named gentleman, residing some 10 miles distant from him, had three pregnant mares, all grade draft, in excellent general health, and having good food and care, among which the disease appeared after association with animals from the infected herd of his father. In the country intervening between the two farms, and in the vicinity of the latter, no other outbreaks of abortion could be found, although in a rich breeding district.

The first abortion in Mr. C. Yoder's herd happened about November 10, the second on December 24, and the third and last pregnant mare aborted during the night of January 12–13. The second of these mares was brought to the experiment station on December 25, and kept in contact with Nos. 1 and 3 until December 29, when, in addition, the utero-vaginal discharges were transferred by introducing the hand into vagina of aborted mare and withdrawing as much of the lochia as possible and inserting it into vulvæ of experimental animals.

The third mare was procured within a few hours after aborting, while portions of putrid placenta remained, and a copious purulent uterine discharge existed; and on the same date Nos. 6 and 7 were exposed by the transfer of placental shreds and uterine discharge into the vaginæ. From this exposure was obtained the only apparently positive results of the series, in the abortion of No. 6, thirty-nine days after exposure.

The exposure of Nos. 1 and 3 by cohabitation in herd of Mr. E. A. Vittum, Canton, Ill., was, so far as could be seen, of a thoroughly reliable character.

During October and November, 1889, Mr. Vittum lost through abortion six foals out of eight pregnancies, and in same herd of mares the disease reappeared in autumn of 1890, one mare aborting in November and another on night of February 6–7, 1891. With these mares, along with several remaining pregnant ones, Nos. 1 and 3 were placed. Mr. Vittum's mares were not worked, and had wintered mostly on blue grass pasture; they had not had access to cornstalks. No abortions occurred in this herd after experimental mares came in contact with them. On an adjoining farm a brother, Mr. J. T. Vittum, lost by abortion four foals out of seven pregnancies.

One of the largest outbreaks discovered during our work was that on the farm of W. P. Buswell & Son, at Neponset, Bureau County, Ill., in whose herd Nos. 8 and 9 were kept from February 4 to 14. Messrs. Buswell & Son had, in autumn of 1890, twenty-five supposedly pregnant mares, used exclusively for breeding, consisting of full blood and grade draft animals, with a few that were trotting bred. All were in good condition and had abundant food, in which a careful personal inspection failed to reveal any cause for abortion. The food and water were essentially the same as had been in use for years on the same farm without heretofore producing evil results, and essentially the same as neighboring herds were using with impunity. On December 15 it was discovered that a mare, which had previously been a reliable breeder, had aborted, and upon the dis-

covery being made she was isolated. Early in January, 1891, some eight or nine mares aborted during a period of forty-eight hours. Several more scattering abortions occurred, the last known being January 30, or five days prior to placing the experimental mares in the herd, after which there were no further miscarriages, there remaining some twelve mares apparently pregnant. During the outbreak Messrs. Buswell & Son sold a pregnant mare to a neighbor, and this aborted soon after the transfer.

Another mare belonging to Messrs. Buswell & Son, but kept on another farm, was driven upon the infected premises and then returned to farm where usually kept, and after the lapse of several weeks this, too, aborted.

It will thus be seen that, notwithstanding the reliability of some of the material used, no positive results were obtained except in case of No. 6. Exposures from this animal soon after abortion failed to perpetuate the disease.

Regardless of these negative results it seems impossible to avoid the conclusion that there is a true infectious abortion among mares. The outbreaks already cited present strong clinical evidence on this point, and many more outbreaks might be cited prior to the beginning of our work in which the origin of the disease was distinctly traceable to the introduction into a herd of a pregnant mare from a farm where the disease existed.

Breed, food, water, stabling, work, or other environments exert no visible effect on the origin, course, or termination of the malady. Horse breeding in central Illinois is largely devoted to heavy draft horses, but occasional mares of lighter breeds associated with herds of draft animals show no immunity, and the few herds of trotting-bred mares kept in this locality are as prone to suffer as the heavy draft.

The food allowed breeding animals in central Illinois is quite uniformly of a high class and liberal in amount, and the disease occurs alike in mares on first-class blue grass, clover, or timothy pasture, on cornstalks, or still later in the season, when fed exclusively an grain and hay of the best quality and either allowed to run at large or comfortably housed.

The period of gestation seems to be without material influence. In the summer of 1889 abortion broke out in the herd of Mr. Danforth, of Washington, Ill., consisting of full-blood Clyde and high bred-trotting stock. The first notice taken of anything being wrong was the return of œstrum in mares supposedly two or three months pregnant, and the mares being at pasture the expelled fœtuses escaped detection, until in some the period of gestation had considerably advanced, when the size of the fœtuses led to the discovery that abortion was rife in the herd.

It appears certain, from this and other similar instances, that infectious abortion may originate at any stage of pregnancy, although in the earlier periods the expulsion of the fœtus is likely to be overlooked by the breeder.

The meagerness of positive results in our experiments is not readily explainable. From the first the outbreaks of the disease upon which we relied for material were very few in number, in spite of diligent search, and in those found the usual virulence seemed to be wanting, although evidently of the infectious type.

Except in the C. Yoder outbreak the malady abruptly disappeared when a loss of little more than 50 per cent had been reached. During

the period of experimentation the weather was unprecedentedly warm, clear, and dry, rendering it practicable for mares to remain on pasture or in stalk fields, thus avoiding their close crowding in stables, a well recognized factor in promoting the virulence and spread of infectious disorders.

The rarity and benignity of the disease was more likely due to one of those periodic remissions so common in most infectious disorders, the causes of which are not well understood.

In addition to these considerations there is one more possibly quite important factor which may have defeated our purposes. A careful review of the tabulated record will show that, with one exception (that of No. 7, which was the stable companion of No. 6 from date of exposure until some days subsequent to abortion), all exposures were made some time after the process of abortion was complete. In those instances where mere cohabitation was relied upon no abortions occurred while experiment mares were in the affected herds.

In the present state of our knowledge we can not estimate the effect of this condition. In most, if not all of those cases where the disease has been clinically traced from an affected to a healthy herd, the bearer has been a pregnant mare, which has later aborted.

Can it be that the virulence of the disease ceases immediately after the abortion is complete?

The abundant negative results have served well to contradict the popular belief that the presence of noninfectious freshly aborted, or of putrid fœtuses and membranes, or of recently aborted animals, is fraught with great danger to pregnant mares, or that such conditions are sufficient to generate infectious or epizoötic abortion.

The direct insertion into the vaginæ of pregnant mares of putrid utero-vaginal discharges, placenta, etc., has likewise been shown to be free from danger to the life of the fœtus. It has also been learned that the danger to the life of the fœtus from manual exploration of the vagina has been greatly overestimated.

Very respectfully,

W. L. WILLIAMS, V. S.

BLOOMINGTON, ILL., *June* 30, 1891.

LAWS OF THE STATES AND TERRITORIES FOR THE CONTROL OF CONTAGIOUS ANIMAL DISEASES.

Laws of the States and Territories, for the control of contagious and communicable diseases of domestic animals, not heretofore published in the annual report of this Bureau, will be found below.

CALIFORNIA.

AN ACT to amend sections four hundred and four hundred and one of the penal code of the State of California, relating to contagious diseases among animals, and to renumber said sections.

SECTION 1. The people of the State of California, represented in senate and assembly, do enact as follows: That section four hundred of the penal code, relating to contagious diseases among animals, is hereby amended so as to read as follows:

"SECTION 402. Any person who shall knowingly sell, or offer for sale, or use, or expose, or who shall cause or procure to be sold or offered for sale, or used, or exposed, any horse, mule, or other animal having the disease known as glanders or farcy, or who shall bring, or cause to be brought, or aid in bringing into this State any sheep, hog, horse, or cattle, or any domestic animal, knowing the same to be affected with any contagious or infectious disease, shall be guilty of a misdemeanor."

SEC. 2. Section four hundred and one of the penal code, relating to contagious diseases among animals, is hereby amended so as to read as follows:

"SECTION 402½. Every animal having glanders or farcy shall at once be deprived of life by the owner or person having charge thereof, upon discovery or knowledge of its condition; and any such owner or person omitting or refusing to comply with the provisions of this section shall be guilty of a misdemeanor."

Approved, March 10, 1891.

CONNECTICUT.

AN ACT authorizing the governor to accept provisions of an act of Congress relating to the Bureau of Animal Industry.

SECTION 1. *Be it enacted by the senate and house of representatives in general assembly convened,* That the governor is hereby authorized to accept on behalf of the State, whenever in his judgment it shall be for the best interests of the State for him so to do, the rules and regulations prepared by the Commissioner of Agriculture under and in pursuance of section three of an act of Congress (approved May 29, 1884) entitled "An act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," and to coöperate with the authorities of the United States in the enforcement of the provisions of said act.

SEC. 2. Upon the acceptance of said rules and regulations by the governor as hereinbefore prescribed, the inspectors of the Bureau of Animal Industry of the United States shall have the right of inspection, quarantine, and condemnation of animals affected with any contagious, infectious, or communicable disease or suspected to be so affected, or that have been exposed to any such disease, and may enter any grounds or premises for these purposes. They may call upon sheriffs and constables to assist them in the discharge of their duties in carrying out the provisions of said act, and it shall be the duty of sheriffs and constables to render such assistance when so called upon.

Approved, May 16, 1889.

FLORIDA.

AN ACT to create and establish a State board of health.

SECTION 1. *Be it enacted by the legislature of the State of Florida*, That the governor shall, within twenty days after the passage of this act, appoint three discreet citizens of the State of Florida, who shall be confirmed by the senate, and who shall, after taking and subscribing an oath before some person competent to administer oaths, faithfully to perform the duties of their offices, constitute the State board of health.

SEC. 2. It shall be the duty of members of said board to convene in the city of Tallahassee, upon a day to be named by the governor, not more than ten days from the date of their appointment. It shall be the duty of said board, at their first meeting, to elect one of their number as president of said board. At the same meeting it shall be the duty of said board to designate and employ a physician, who shall be an expert in the diagnosis of yellow fever, smallpox, cholera, and other infectious diseases, and who must be a person of recognized ability and skilled in hygiene and sanitary science, and a graduate physician of a recognized and reputable medical college, which said person shall be known as the State health officer. The State health officer shall be the executive officer of the board and secretary of the same, and shall hold the office until removed by the board for just cause.

SEC. 3. The term of office of each member of the board of health shall be four years from the date of his appointment, or until his successor is appointed and qualified, and the term of employment of State health officer shall be four years from the date of his appointment, or until his successor is appointed and qualified: *Provided*, That should any member of the said board be and remain absent from the State for ten days after any disease has been declared epidemic, the governor may declare his office vacant and proceed to fill the same by appointment, and should the health officer be and remain absent from the State for five days after his attention has been called to the presence of any disease in the State the board of health may declare the office vacant and proceed to fill the same by designation and employment of a suitable person to perform the duties thereof.

SEC. 4. It shall be the duty of every practicing or licensed physician in the State of Florida to report immediately to the president of the board of health, by telegram or in the most expeditious manner, every case of yellow fever, smallpox, or cholera that comes within his practice, such telegram to be paid for out of the funds to be provided for the expenses of said board of health.

SEC. 5. Any practicing or licensed physician who shall fail to report to said president any such case, in the manner provided in the preceding section, shall be guilty of a misdemeanor, and upon conviction thereof shall be fined in a sum not less than $100 nor more than $1,000, or by imprisonment in the county jail for not less than three nor more than six months.

SEC. 6. Any person or persons who shall falsely or maliciously disseminate or spread rumors or reports concerning the existence of any infectious or contagious disease shall be guilty of a misdemeanor, and, upon conviction thereof, shall be punished as provided by section 5 of this act.

SEC. 7. It shall be the duty of the several judges of the circuit courts of this State to give in charge to the grand juries of their respective courts, sections 4, 5, and 6 of this act at each term thereof, and it shall be the duty of the grand juries of the said several courts specially to investigate in their respective counties the offenses therein specified, and to present impartially all offenders against the same.

SEC. 8. In the several counties of this State where county criminal courts of record exist, or may hereafter be established, it shall be the duty of the county solicitor of the said several courts to present and prosecute all offenders under sections 5 and 6 of this act.

SEC. 9. It shall be the duty of the president of the board of health, immediately upon the receipt of information that there is any case of yellow fever, smallpox, or cholera in any portion of this State, to order the State health officer by telegram, if he is not at hand, to proceed immediately to said place, and there to investigate the said reported case or cases of yellow fever, smallpox, or cholera, and to report to the said president by telegram the results of his said investigation; and said State health officer shall have power, and it shall be his duty, to declare said infected point to be in quarantine, and to place any and all such restrictions upon ingress or egress thereat as, in his judgment, shall be necessary to prevent a spread of the disease from the infected locality; and it shall be the duty of the said State health officer, when he shall have declared any city, town, or other place to be in quarantine, to so control the population of said city, town, or other place, and make such disposition of the same as shall, in his judgment, best protect that population and

at the same time prevent a spread of the infection among the same. The sheriffs and constables of the several counties of this State, and the police officers of all the cities and towns of this State, shall be under the control of the said State health officer to enforce and carry out any and all quarantine regulations that he may prescribe, which said regulations shall be immediately published in the most practicable manner in the several counties, cities, towns, or other places where quarantine may be established; and said State health officer shall make immediate report of his actings and doings in the premises to the president of the board of health, and from time to time, so long as quarantine shall continue.

SEC. 10. It shall be the duty of the governor of this State, whenever called upon by the State health officer so to do, to furnish the said officer with all requisite means to enforce whatever quarantine regulations it may be necessary, in his judgment, to prescribe, including such armed force from the militia of the State as in the judgment of the governor may be required, upon information furnished by said officer.

SEC. 11. The board of health shall have power, and it shall be their duty at all times, to impose upon all railway and navigation companies, and upon all individuals who may own or operate steamships or other vessels plying between any of the West Indian, South American, or any other foreign ports and the ports of the State of Florida, such restrictions and regulations as to inspection, quarantine, and sanitary rules as in their judgment may be necessary to protect the health of the people of this State, and which may not be in conflict with the acts of Congress already passed or that may hereafter be passed, and do not amount to an absolute interruption of commerce with said foreign ports: *Provided*, That whenever any case of yellow fever, smallpox, cholera, or other infectious disease shall appear, or be developed among the passengers, officers, or crew of any such steamship or other vessel, said steamship or other vessel shall be ordered in quarantine for such time and under such regulations as may be prescribed by said board of health: *Provided further*, That should said board of health at any time be convinced that yellow fever, smallpox, cholera, or other infectious disease exists in any foreign port, in such form that the landing of any steamship or other vessel hailing from said infected foreign port, at any of the ports of Florida, will put in peril the health of the people of said State, it shall be the duty of said board to put all and any such steamships or vessels, their crew, passengers, and cargo, in quarantine for such time and under such rules and regulations as may be prescribed by said board of health: *Provided further*, That said board of health shall charge and receive from such vessels undergoing inspection or sanitation, as provided in this section, such fee or fees as said board may prescribe.

SEC. 12. The State board of health shall have general supervision of the public health of the State of Florida, and shall have power to make, promulgate, and enforce such rules and regulations as may be necessary for the preservation of the same. It shall be the duty of the State health officer, between the first of November and the first of May, of each and every year, and oftener if deemed necessary by the board, to visit all the cities and towns, or other points where two or more railroads meet, in the State of Florida, which, in the judgment of the board, it may be necessary for him to inspect, and to thoroughly investigate the sanitary condition of said cities and towns; and he shall have the power, and it shall be his duty, to condemn in any of said cities or towns any sidewalks, pavements, buildings, wharves, or other things that in his judgment shall be likely to produce or cause the spread of epidemic diseases; and he shall give notice to the mayor and council of such city or town, or other authority, to repair, remove, cleanse, or remedy the same within thirty-six hours, and if the same shall not be done, as so required, it shall be his duty to have the same done himself, and the expense thereof shall be paid out of the health fund hereinafter provided, and be afterwards assessed as a tax upon the assessable property of said city or town, to be assessed by the county assessor upon notification by the health officer of the amount, and collected by the county collector at the next annual assessment and collection thereafter, said amount so realized to be replaced in the health fund of the State by the proper authorities: *Provided*, A list and memorandum of property to be condemned shall be made and valuation placed upon the same by three disinterested freeholders, one to be selected by said health officer, one to be selected by the owner of the property or his agent, and the third to be selected by the two freeholders already selected, before being condemned or destroyed, and the value of any private property that may be condemned and ordered to be destroyed by the health officer, shall be paid to the owner thereof out of any funds provided and appropriated for the expenses of the State board of health, upon the certificate of said health officer that said property was so destroyed, approved by the board of health and endorsed by the president of the board.

SEC. 13. It shall be the duty of said State board of health, at their first organization, herein provided for, to formulate such rules and regulations for the preserva-

tion of the public as, in their judgment, they may deem necessary, and to meet upon the first Monday in May, A. D. 1890, and upon the corresponding day annually thereafter, to formulate such additional rules and regulations for the preservation of the public health as their experience may suggest; and they shall have the same published in such place and in such manner as they may deem best to give greatest publicity to the same, and it shall be the duty of the State health officer to attend all meetings of said board of health, and act as secretary of the same. The president of said board of health shall have power to call meetings of said board at any time and at such place as he may designate, to take measures for the public safety.

SEC. 14. The State board of health shall have the power, after close personal inspection, to modify or abrogate any or all quarantine regulations after they may be established by said health officer. The State board of health shall have the power, by and with consent of the governor, when the occasion demands it, to call upon the General Government for such aid as the necessities arising out of any epidemic may require.

SEC. 15. Any person who violates, disobeys, omits, neglects, or refuses to comply with any quarantine regulations which may be established by the State health officer, or any of the rules and regulations which may be adopted by the State board of health, as hereinbefore provided, that may be duly promulgated by said State health officer, or the said board of health, shall be guilty of a misdemeanor, and upon conviction thereof shall be fined in a sum not less than $100 nor more than $1,000, or by imprisonment in the county jail for not less than one nor more than six months.

SEC. 16. The State health officer shall receive a salary of $3,000 a year, to be paid quarterly, upon his requisition, approved by the president of the board of health, out of the fund hereinafter provided, together with his actual traveling expenses, while engaged in the discharge of his duties as State health officer. The members of the State board of health shall receive a per diem of $6 for each day of actual session, with mileage to and from their homes to the place of meeting, by the nearest and most practicable route, at the rate of ten cents per mile.

SEC. 17. There shall be designated and employed by the State board of health an assistant State health officer, who must also be a physician of experience and skilled in the diagnosis of infectious and contagious diseases, and who shall be subject to the orders and instructions of the State health officer, and, in case of sickness or disability of the State health officer, he shall succeed to the duties of the office for the time being of the State health officer. The assistant health officer shall receive $15 per diem for each day that he is engaged in actual service under the directions of the State health officer, and 5 cents per mile for every mile traveled in the performance of such service, and shall hold appointment until removed for cause by the State board of health.

SEC. 18. The State health officer, before entering upon his duties, shall take, before some person competent to administer oaths, an oath to faithfully perform the duties of his office, and enter into a bond, with good and sufficient securities, in the sum of $10,000, payable to the president of the board of health, said bond to be approved by the said president, conditioned for the faithful discharge of his duties. Said bond to be prosecuted by the attorney-general for any neglect of duty or abuse of power herein conferred, and if said bond should be forfeited, all such amounts collected from such prosecution shall be placed to the credit of the before named health fund by said president of the board.

SEC. 19. All expenditures of the board of health shall be certified by the president of the board, and he shall make an annual report to the governor of all such expenditures, in a clear and concise statement, together with any special observations, recommendations, or facts that he may present, that would be conducive to the health and sanitary conditions of the State, and such annual statements shall finally be submitted by the governor to the State legislature, when in regular session convened, and shall be published like other reports of State officers; and the president of said board shall hold for inspection properly certified vouchers for such expenditures, a copy of which shall be furnished the comptroller, who shall not draw his warrant on the treasurer without the proper certificates and vouchers.

SEC. 20. That there shall be annually levied and collected upon the assessable property of the State a tax of not more than half a mill, the revenue derived from which assessment and collection shall constitute a special fund to be used for public health purposes of the State.

SEC. 21. The State board of health shall have general supervision and control over such county boards of health as the legislature may establish.

SEC. 22. That this act shall take effect from and after its approval by the governor.

SEC. 23. That all laws and parts of laws in conflict with the provisions hereof be, and the same are hereby, repealed.

Approved, February 20, 1889.

ILLINOIS.

AN ACT to coöperate with the United States in the suppression and extirpation of pleuro-pneumonia.

SECTION 1. *Be it enacted by the people of the State of Illinois, represented in the general assembly*, That the governor is hereby authorized to accept, on behalf of the State, the rules and regulations prepared by the Commissioner of Agriculture, under and in pursuance of section 3 of an act of Congress, approved May 29, 1884, entitled "An act for the establishment of a bureau of animal industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," and to coöperate with the authorities of the United States in the enforcement of the provisions of said act.

SEC. 2. The inspectors of the Bureau of Animal Industry of the United States shall have the right of inspection, quarantine, and condemnation of animals affected with any contagious, infectious or communicable disease, or suspected to be so affected, or that have been exposed to any such disease, and for these purposes are hereby authorized and empowered to enter upon any ground or premises. Said inspectors shall have the power to call on sheriffs, constables, and peace officers to assist them in the discharge of their duties in carrying out the provisions of the act of Congress, approved May twenty-ninth, eighteen hundred and eighty-four, establishing the Bureau of Animal Industry; and it is hereby made the duty of sheriffs, constables, and peace officers to assist said inspectors when so requested; and said inspectors shall have the same powers and protection as peace officers while engaged in the discharge of their duties.

SEC. 3. All expenses of quarantine, condemnation of animals exposed to disease, and the expenses of any and all measures that may be used to suppress and extirpate pleuro-pneumonia, shall be paid by the United States, and in no case shall this State be liable for any damages or expenses of any kind under the provisions of this act.

SEC. 4. Any person violating any order of quarantine made under this act, or any regulations prescribed by the Commissioner of Agriculture for the suppression of pleuro-pneumonia, shall be guilty of a misdemeanor, and upon conviction shall be punished by a fine of not less than $100 nor more than $1,000, or by imprisonment for not more than six months, or by both such fine and imprisonment.

Became operative by expiration of time, June 28, 1887.

INDIANA.

SELLING DISEASED ANIMALS.

SEC. 2070. Whoever kills, for the purpose of sale, any sick, diseased, or injured animal; or who sells, or has in his possession with the intent to sell, the meat of any such sick or diseased or injured animal, shall be fined not more than five hundred dollars nor less than fifty dollars, to which may be added imprisonment in the county jail not more than six months.

Code of Indiana.

KANSAS.

AN ACT to amend sections 6771, 6773, 6774, and 6775 of the general statutes of Kansas, 1889, entitled "An act relating to stock."

SECTION 1. *Be it enacted by the legislature of the State of Kansas*, That section 6771 of the general statutes of 1889 be, and the same is hereby, amended so that the same shall read as follows:

"SECTION 6771. No person or persons shall, between the first day of February and the first day of December of any year, drive or cause to be driven into or through any county or part thereof in this State, or turn upon or cause to be turned or kept upon any highway, range, common, or pasture within this State, any cattle capable of communicating or liable to impart what is known as Texas, splenic, or Spanish fever. Any persons violating any provisions of this act shall, upon conviction thereof, be adjudged guilty of a misdemeanor, and shall for each offense be fined not less than five hundred dollars nor more than two thousand dollars, or be imprisoned in the county jail not less than thirty days and not more than one year, or by both such fine and imprisonment."

SEC. 2. That section 6773 of the general statutes of 1889 be, and is hereby, amended so as to read as follows:

"SECTION 6773. Whenever the live-stock sanitary commission shall determine that certain cattle within the State are capable of communicating or liable of imparting Texas, splenic, or Spanish fever they shall issue their order to the sheriff or any constable of the county in which said cattle are found, commanding him to take and keep such cattle in his custody, subject to such quarantine regulations as they may prescribe, until the first day of December next ensuing, on which date they shall direct such officer to deliver said cattle to their owner or owners or his or their agent. Before any cattle so held shall be delivered as aforesaid there shall be paid to said live-stock sanitary commission all the costs and expenses of taking, detaining, and holding said cattle; and in case such costs and expenses are not paid on the first day of December the said officer shall advertise, in the manner as is by law provided in cases of sales of personal property on execution, that he will sell such cattle, or such portions thereof as may be necessary to pay such costs and expenses, besides the expense of such sale. And at the time and place so advertised he shall proceed to sell as many of said cattle as may be necessary to pay off such costs and expenses and the expenses of sale, and shall forthwith pay over to the live-stock sanitary commission any amount so received in excess of the legal fees and expenses of such officer. And any officer performing any of the duties enjoined in this section or in the next preceding section of this act shall receive the same compensation therefor as is prescribed by law for similar services; and in case such fees can not be collected by the sale of such stock they shall be paid by the county in which such cattle were held."

SEC. 3. That section 6774 of the general statutes of 1889 be, and the same is hereby, amended so that the same shall read as follows:

"SECTION 6774. Any person or persons who shall drive, ship, or transport, or cause to be shipped, driven, or transported, into or through any county in this State any cattle liable or capable of communicating Texas, splenic, or Spanish fever to any domestic cattle of this State shall be liable to any person or persons injured thereby for all damages that they may sustain by reason of the communication of said disease, or Texas, splenic, or Spanish fever, to be recovered in a civil action in any court of competent jurisdiction, and all parties so injured shall have a first and prior lien to all other liens for such damages on the cattle communicating the disease of Texas, splenic, or Spanish fever."

SEC. 4. That section 6775 of the general statutes of 1889 be, and the same is hereby amended as follows:

"SECTION 6775. In the trial of any person charged with the violation of any provisions of this act, and in the trial of any civil action brought to recover damages for the communication of Texas, splenic, or Spanish fever, proof that the cattle which such person or persons are charged with shipping, driving, or keeping, or which are claimed to have communicated the said diseases, were brought into this State from south of the thirty-seventh parallel of north latitude, shall be taken as prima facie evidence that such cattle were, between the first day of February and the first day of December of the year in which the offense was committed, capable of communicating and liable to impart Texas, splenic, or Spanish fever, within the meaning of this act, and that the owner or owners or person or persons in charge of such cattle had full knowledge and notice thereof. If the owner or owners or person or persons in charge of said cattle, shall show by such certificate or certificates, as shall hereafter be designated by the live-stock sanitary commission of the State, that said cattle had been kept since the first day of December of the previous year west of the twenty-second meridian of longitude west from Washington, and north of the thirty-fourth parallel of north latitude, the provisions of this section shall not apply thereto."

SEC. 5. Original sections 6771, 6773, 6774, and 6775 of the general statutes of 1889 are hereby repealed.

SEC. 6. This act shall take effect and be in force from and after its publication in the official State paper.

Approved, February 25, 1891.

MAINE.

AN ACT to extirpate contagious diseases among cattle.

SECTION 1. That for the purpose of facilitating and encouraging the live-stock interests of the State of Maine, and for extirpating all insidious, infectious, and contagious diseases, now or that may be among cattle and other live stock, and especially tuberculosis, the governor of the State is hereby authorized and required, immediately after the passage of this act, to appoint a board of cattle commissioners consisting of three persons of known executive ability, who shall be charged with the

execution of the provisions of this act, and who shall be known and designated as the State of Maine cattle commission, and whose powers and duties shall be those provided for in this act, and whose tenure of office shall be at the option of the governor. The compensation of said commissioners shall be at the rate of three dollars per day during the time they are actually engaged in the discharge of their duties as commissioners. The said commissioners shall respectively take an oath to faithfully perform the duties of their office, and shall immediately organize as such commission by the election of one of their number as president thereof, and proceed forthwith to the discharge of the duties devolved upon them by the provisions of this act.

SEC. 2. That it shall be the duties of the said commissioners to cause investigation to be made as to the existence of tuberculosis, pleuro-pneumonia, foot and mouth disease, and any other infectious or contagious disease. And such commissioners or their duly constituted agent are hereby authorized to enter any premises or places, including stockyards, cars, and vessels within any county or part of the State in or at which they have reason to believe there exists any such diseases, and to make search, investigation, and inquiry, in regard to the existence thereof. Upon the discovery of the existence of any of the said diseases, the said commissioners are hereby authorized to give notice, by publication, of the existence of such disease, and the locality thereof, in such newspapers as they may select, and to notify in writing the officials or agents of any railroad, steamboat, or other transportation companies, doing business in or through such infected locality, of the existence of such disease; and are hereby authorized and required to establish and maintain such quarantine of animals, places, premises, or localities, as they may deem necessary to prevent the spread of any such disease, and also to cause the appraisal of the animal or animals affected with the said disease, in accordance with such rules and regulations by them, as hereinafter authorized and provided, and also to cause the same to be destroyed, and to pay the owner or owners thereof one-half of their value, as determined upon the basis of health before infection, out of any moneys appropriated by the legislature for that purpose: *Provided, however,* That no appraised value shall be more than two hundred dollars for an animal with pedigree recorded or recordable in the recognized herdbooks of the breed in which the animal destroyed may belong, nor more than one hundred dollars for an animal which has no recordable pedigree: *Provided further,* That in no case shall compensation be allowed for an animal destroyed under the provision of this act, which may have contracted or been exposed to such disease in a foreign country, or on the high seas, or that may have been brought into this State within one year previous to such animal's showing evidence of such disease; nor shall compensation be allowed to any owner who in person, or by agent, knowingly and willfully conceals the existence of such disease, or the fact of exposure thereto in animals of which the person making such concealment by himself or agent is the whole or part owner.

SEC. 3. That the said commissioners are hereby authorized and required to make, record, and publish rules and regulations providing for and regulating the agencies, methods, and manner of conducting, and the investigations aforesaid, regarding the existence of said contagious disease; for ascertaining, entering, and searching places where such diseased animals are supposed to exist; for ascertaining what animals are so diseased, or have been exposed to contagious diseases; for making, reporting, and recording descriptions of the said animals so diseased or exposed and destroyed, and for appraising the same, and for making payment therefor; and to make all other needful rules and regulations which may, in the judgment of the commissioners, be deemed requisite to the full and due execution of the provisions of this act. All such rules and regulations, before they shall become operative, shall be approved by the governor of Maine, and thereafter published in such manner as may be provided for in such regulations; and after such publication such rules and regulations shall have the force and effect of law, so far as the same are not inconsistent with this act and other laws of the State or United States.

SEC. 4. That any person or persons who shall knowingly and willfully refuse permission to said commissioners, or either of them, or their duly constituted agent, to make, or who knowingly and willfully obstruct said commissioners, or either of them, or their duly constituted agent, in making all necessary examinations of and as to animals supposed by said commissioners to be diseased as aforesaid, or in destroying the same, or who knowingly attempts to prevent said commissioners, or either of them, or their duly constituted agent, from entering upon the premises and other places hereinbefore specified, where any of said diseases are by said commissioners supposed to exist, shall be deemed guilty of a misdemeanor, and upon conviction thereof, or of either of the acts in this section prohibited, shall be pun-

ished by fine not exceeding one hundred dollars, or by imprisonment not exceeding ninety days, or by both fine and imprisonment, at the discretion of the court.

SEC. 5. That any person who is the owner of, or who is possessed of any interest in any animals affected with any of the diseases named in section two of this act, or any person who is agent, common carrier, consignee, or otherwise is charged with any duty in regard to any animal so diseased, or exposed to the contagion of such disease, or any officer or agent charged with any duties under the provisions of this act, who shall knowingly conceal the existence of such contagious disease, or the fact of such exposure to said contagion, and who shall knowingly and willfully fail within a reasonable time to report to the said commissioners their knowledge or their information in regard to the existence and location of said disease, or of such exposure thereto, shall be deemed guilty of a misdemeanor, and shall be punishable as provided in section four of this act.

SEC. 6. That when the owner of animals, decided under the provisions of this act by the proper authority to be diseased, or to have been exposed to contagion, refuses to accept the sum authorized to be paid under the appraisement provided for in this act, it shall be the duty of the commissioners to declare and maintain a rigid quarantine as to the animals decided as aforesaid to be diseased or to have been exposed to any contagious or infectious disease, and of the premises or places where said cattle may be found, according to the rules and regulations to be prescribed by said commissioners, approved by the governor, and published as provided in the third section of this act.

SEC. 7. That no person or persons owning or operating any railroad, nor the owner or owners or masters of any steam, sailing, or other vessels within the State, shall receive for transportation, or transport from one part of the State to another part of the State, or to bring from any other State or foreign country any animals affected with any of the diseases named in section two of this act, or that have been exposed to such diseases, especially the disease known as tuberculosis, knowing such animals to be affected or to have been so exposed; nor shall any person or persons, company, or corporation deliver for such transportation to any railroad company, or to the master or owner of any vessel, any animals, knowing them to be affected with, or to have been exposed to, any of said diseases; nor shall any person or persons, company, or corporation drive on foot or transport in private conveyance, from one part of the State to another part of the State, any animal, knowing the same to be affected with, or to have been exposed to, any of said diseases. Any person or persons violating the provisions of this section shall be deemed guilty of a misdemeanor, and upon the conviction thereof shall be punished by fine not exceeding the sum of two hundred dollars, or by imprisonment not exceeding six months, or by both fine and imprisonment.

SEC. 8. That it shall be the duty of the several county attorneys to prosecute all violations of this act which shall be brought to their notice or knowledge by any person making the complaint under oath, and the same shall be heard in any supreme judicial court having jurisdiction in the county in which the violation of this act has been committed.

SEC. 9. That the said commissioners are hereby authorized to appoint or elect one of their number as secretary of said board, who shall receive a reasonable compensation for his services during the time in which, under the provisions of this act, the services of the said commissioners shall be required. The said commissioners shall make and preserve a full record of all rules and regulations promulgated under the provisions of this act, of all payments hereinunder incurred, and all other transactions performed by said commissioners in the discharge of their duties, as herein provided; and the said commissioners shall, on or before the first Wednesday in January of each year, during their continuance in service, and at other times as they may deem conducive to the public interests, or as they may be required so to do by the governor of the State, report to said governor full and accurate accounts of their expenditures and other proceedings under the provisions of this act, and of the condition of said diseases, if any, in the State, to be communicated by him to the legislature. Whenever the functions of said commission shall be suspended or terminated it shall turn over to the secretary of state all its books, papers, records, and other effects, taking his receipt therefor, and he shall remain the custodian of the same until such time as the functions of said commission may be restored.

SEC. 10. That the commissioners shall have power, and are hereby authorized, to employ skilled veterinarians, and such other agents and employés as they shall deem necessary to carry into effect the provisions of this act, and to fix the compensation of the person or persons so employed, and to terminate such employment at their discretion; and they are authorized out of the moneys by this act appropriated, to make such expenditures as may be needed for the actual and necessary traveling expenses of themselves and their said employés, stationery, expenses of disinfect-

ing premises, cars, and other places, destroying diseased and exposed animals, and paying for the same, and such other expenses and expenditures as they may find to be actually necessary to properly carry into effect the provisions of this act.

SEC. 11. That the moneys appropriated by this act shall be paid over to the secretary of said commission, from time to time, as the same may be found to be needed, upon requisition made by the said commissioners, and shall be disbursed by the said secretary of said commission only upon vouchers approved by said commissioners or a majority of them. The said secretary shall, before entering upon the duties of his office, take an oath to faithfully discharge the duties thereof, and shall enter into a bond to the State of Maine, with sureties to be approved by the treasurer of state, in such sum as he may designate, for the faithful accounting of all moneys received by the said secretary of the commission under the provisions of this act.

SEC. 12. That for the purpose of carrying into effect the provisions of this act, the sum of five thousand dollars, or so much thereof as may be necessary, is hereby appropriated out of any moneys in the treasury not otherwise appropriated.

SEC. 13. That all acts and parts of acts inconsistent or in conflict with the provisions of this act be, and the same are hereby repealed.

Approved, February 14, 1889.

MARYLAND.

AN ACT to amend article fifty-eight of the code of public general laws, title "Live stock," by the addition thereto of another section, to follow section eighteen of said article, and to be numbered section nineteen.

SECTION 1. *Be it enacted by the general assembly of Maryland*, That article fifty-eight of the code of public general laws, title "Live stock," be amended by the addition thereto of a new section, to follow section eighteen of said article, and to be numbered section nineteen, and read as follows:

"SEC. 19. That all hogs and other domestic animals dying of any contagious or infectious disease, shall be buried at the depth of at least three feet, or be burned at the discretion of the owner, and any person or persons permitting any dead hogs or any other domestic animals having died of any contagious or infectious disease, to remain unburied upon his or their premises for the space of three hours, prior to sunset of said day, after he has discovered the same, shall be guilty of a misdemeanor, and upon conviction thereof before any justice of the peace, shall be fined not less than ten dollars for each offense, or imprisoned in the county jail for not less than ten days, or be both fined and imprisoned, in the discretion of the justice."

SEC. 2. That this act shall take effect from the date of its passage.

Approved, April 3, 1890.

MINNESOTA.

AN ACT to amend title sixteen (16) of the penal code of Minnesota relating to cruelty to animals.

SECTION 3. *Be it enacted by the legislature of the State of Minnesota*, That any agent or officer of the "Minnesota society for the prevention of cruelty," or of any society duly incorporated for that purpose, may lawfully destroy, or cause to be destroyed, any animal found abandoned and not properly cared for, appearing in the judgment of two reputable citizens, called by him to view the same in his presence, to be glandered, injured, or diseased past recovery for any useful purpose. When any person arrested is, at the time of such arrest, in charge of any animal, or of any vehicle drawn by or containing any animal, any agent of said society or societies may take charge of such animal and of such vehicle and its contents, and deposit the same in a safe place of custody, or deliver the same into the possession of the police or sheriff of the county or place wherein such arrest was made, who shall thereupon assume the custody thereof, and all necessary expenses incurred in taking charge of such property shall be a lien thereon.

SEC. 14. Whoever, being the owner, or having the charge of any animal, knowing the same to have any infectious or contagious disease, or to have been recently exposed thereto, sells or barters the same, or knowingly permits such animal to run at large, or knowing such animal to be diseased as aforesaid, knowingly permits the same to come into contact with any other animal, or another person, without his knowledge and permission, shall be fined not more than one hundred (100) nor less than twenty (20) dollars, or imprisoned not more than thirty (30) days.

SEC. 19. All acts, and parts of acts, inconsistent herewith are hereby repealed.

SEC. 20. This act shall take effect and be in force from and after its passage.

Approved, April 24, 1889.

MISSISSIPPI.

AN ACT to provide for the prevention and suppression of contagious and infectious diseases among live stock.

SECTION 1. *Be it enacted by the legislature of the State of Mississippi*, That the governor is hereby authorized to accept on behalf of the State the rules and regulations prepared by the Commissioner of Agriculture, under and in pursuance of section 3 of an act of Congress, approved May 29, 1884, entitled "An act for the establishment of a bureau of animal industry, to prevent the importation of diseased cattle and to provide for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," and to coöperate with the authorities of the United States in the enforcement of the provisions of the said act.

SEC. 2. That the inspectors of the Bureau of Animal Industry of the United States shall have the right of inspection, quarantine, and condemnation of animals affected with any contagious, infectious, or communicable disease, or suspected to be infected, or that has been exposed to any such disease, and for these purposes are hereby empowered to enter upon any grounds or premises. Said inspectors shall have the power to call upon sheriffs, constables, and peace officers to assist them in the discharge of their duties in carrying out the provisions of the act of Congress, approved May 29, 1884, establishing the Bureau of Animal Industry, and it is hereby made the duty of the sheriffs, constables, or peace officers to assist such inspectors when so requested; and said inspectors shall have the same power and protection as peace officers while engaged in the discharge of their duties.

SEC. 3. That all expenses of quarantine, condemnation of animals exposed to disease, and the expenses of any and all measures that may be used to suppress and extirpate pleuro-pneumonia, shall be paid by the United States, and in no case shall this State be liable for any damages or expenses of any kind under the provisions of this act.

SEC. 4. That if any person violating any order of quarantine made under this act, or any regulation prescribed by the Commissioner of Agriculture for the suppression of pleuro-pneumonia, shall be guilty of a misdemeanor, and upon conviction shall be punished by a fine of not less than $100 nor more than $1,000, or by imprisonment for not more than six months, or both such fine and imprisonment.

SEC. 5. That this act shall be in force from and after its passage.

Approved, March 6, 1888.

MISSOURI.

STOCK WITH CONTAGIOUS DISEASE TO BE RESTRAINED.

SEC. 351. No farm stock of any kind whatsoever, such as horses, mules, cattle, hogs, sheep, or other domestic animals, being affected with any contagious disease, shall be allowed to run at large upon the public commons, highways, or other uninclosed lands, the owner knowing such stock to be so affected.

Code of Missouri.

NOT RESTRAINED, PUNISHMENT.

SEC. 352. Any person or persons owning or having in charge stock, such as has been described in the preceding section, and who shall allow said stock to run at large upon the public commons, highways, or other uninclosed lands, shall be deemed guilty of a misdemeanor.

Code of Missouri.

FRAUD IN REGISTERING CATTLE, HORSES, ETC., A MISDEMEANOR.

SEC. 353. Every person who by any false pretense shall obtain from any club, association, society, or company for improving the breed of cattle, horses, sheep, swine, or other domestic animals, the registration of any animal in the herd register, or other register of such club, association, society, or company, or a transfer of any such registration, and every person who shall knowingly give a false pedigree of any animal, upon conviction thereof shall be guilty of a misdemeanor.

Code of Missouri.

NEVADA.

AN ACT to prohibit the bringing of diseased animals within this State, and to prevent the selling of diseased animals, poultry, fish, game, and other articles, by butchers, merchants, and others, to the general public.

SECTION 1. *The people of the State of Nevada in senate and assembly do enact as follows:* That from and after the passage of this act it shall be unlawful for any person, persons, company, or corporation to bring, or cause to be brought, or aid in bringing into this State, any sheep, hog, horse, or cattle of any kind affected with any contagious or infectious disease.

SEC. 2. No person shall bring, expose, or offer for sale, or sell in any city, town, or hamlet within this State for human food, any

(1) Blown, meager, diseased, or bad meat, poultry or game; or

(2) Unsound, diseased, or unwholesome fish, fruit, vegetables, or other market produce.

SEC. 3. No person shall bring, expose, or offer for sale, or sell in any city, town or hamlet within this State—

(1) Any sick or diseased animal; or

(2) The flesh of any animal which, when killed, was sick or diseased, or that died a natural or accidental death.

SEC. 4. No person shall slaughter, expose for sale, or sell, or bring or cause to be brought into any city, town, or hamlet, within this State, for human food, any calf unless it is in good, healthy condition and four weeks of age.

SEC. 5*a*. Any article or animal that shall be offered or exhibited for sale, in any part of this State, in any market or elsewhere, as though it was intended for sale, shall be deemed offered and exposed for sale, within the intent and meaning of this act.

SEC. 6. Any person or persons who, in violation of the preceding sections of this act, shall bring within this State, city, town, or hamlet, slaughter or sell, or expose for sale any article or animal (therein prohibited from sale) which is unfit or unsafe for human food shall forfeit the same to the authorities.

SEC. 7. It is hereby made the duty of any policeman, constable, sheriff, or any peace officer, or any member of any board of health to forthwith remove any of the above named articles or animals at the expense of the owner or owners, as the case may be, in a manner that will insure safety and protection to the public good.

SEC. 8. Any person, persons, company, or corporation who shall violate any of the provisions of this act shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not exceeding three hundred dollars nor less than twenty dollars, or by imprisonment in the county jail not more than sixty days nor less than five days, or by both such fine and imprisonment.

Approved, March 10, 1891.

NEW HAMPSHIRE.

AN ACT to constitute a State board of cattle commissioners.

SECTION 1. *Be it enacted by the senate and house of representatives in general court convened,* That for the purpose of facilitating and encouraging the live-stock interests of the State of New Hampshire, and for extirpating all infectious and contagious diseases, especially tuberculosis, that now are or may be among cattle, a State board of cattle commissioners is hereby created, to consist of the secretary of the State board of agriculture, the master of the State grange, and the secretary of the State board of health, who shall be charged with the execution of the provisions of this act, whose powers and duties shall be those provided for in this act, and whose compensation shall be fixed by the governor and council. Any vacancies occurring in the board from any cause shall be filled by appointment by the governor and council. The said commission shall respectively take an oath faithfully to perform the duties of their office, and shall immediately organize as such commission by the election of one of their number as president thereof, and proceed forthwith to the discharge of the duties devolved upon them by the provisions of this act.

SEC. 2. That it shall be the duty of the said commissioners to cause investigation to be made as to the existence of tuberculosis, pleuro-pneumonia, foot-and-mouth disease, and any other infectious or contagious diseases among cattle. Any such commissioners, or their duly constituted agent, are hereby authorized to enter any premises or places, including stockyards, cars, and vessels, within any county or part of the State in or at which they have reason to believe there exists any such disease, and to make search, investigation, and inquiry in regard to the existence of

said diseases therein. Upon the discovery of the existence of any of the said diseases, the said commissioners are hereby authorized to give notice by publication of the existence of such disease and the locality thereof, in such newspapers as they may select, and to notify in writing the officials or agents of any railroad, steamboat, or other transportation company, doing business in or through such infected locality, of the existence of such disease; and are hereby authorized and required to establish and maintain such quarantine of animals, places, premises, or localities as they may deem necessary to prevent the spread of any such disease, and also to cause a disinterested appraisal of the animal or animals affected with the said disease, in accordance with such rules and regulations by them as hereinafter authorized and provided, and also to cause the said animals to be destroyed, and to pay the owner or owners thereof one-half of their value, as determined upon the basis of health before infection, out of any moneys in the treasury not otherwise appropriated: *Provided, however*, That no appraised value shall be more than one hundred dollars for an animal killed: *And provided further*, That in no case shall compensation be allowed for an animal destroyed under the provisions of this act, which may have contracted or been exposed to such disease in a foreign country, or on the high seas, or that may have been brought into this State within one year previous to such animal's showing evidence of such disease; nor shall compensation be allowed to any owner who in person, or by agent, knowingly and willfully conceals the existence of such disease, or the fact of exposure thereto in animals of which the person making such concealment, by himself or agent, is in whole or in part owner.

SEC. 3. That the said commissioners are hereby authorized and required to make, record, and publish rules and regulations providing for and regulating the agencies, methods, and manner of conducting the investigations aforesaid regarding the existence of said contagious diseases; for ascertaining, entering, and searching places where such diseased animals are supposed to exist; for ascertaining what animals are so diseased, or have been exposed to contagious diseases; for making, reporting, and recording descriptions of the said animals so diseased, exposed, or destroyed, and for appraising the same, and for making payment therefor; and to make all other needful rules and regulations which may, in the judgment of the commissioners, be deemed requisite to the full and due execution of the provisions of this act. All such rules and regulations, before they shall become operative, shall be approved by the governor, and thereafter published in such manner as may be provided for in such regulations; and after such publication said rules and regulations shall have the force and effect of law, so far as the same are not inconsistent with this act and other laws of the State or the United States.

SEC. 4. That any person or persons who shall knowingly and willfully refuse permission to said commissioners, or any one of them, or their duly constituted agent, to make, or who knowingly and willfully obstructs said commissioners, or any one of them, or their duly constituted agent, in making all necessary examinations of and as to animals supposed by said commissioners to be diseased as aforesaid, or in killing the same, or who knowingly attempts to prevent said commissioners, or any one of them, or their duly constituted agent, from entering upon the premises and other places hereinbefore specified where any of said diseases are by said commissioners supposed to exist, shall be deemed guilty of a misdemeanor, and, upon conviction thereof, or of any of the acts in this section prohibited, shall be punished by fine not exceeding one hundred dollars, or by imprisonment not exceeding ninety days, or by both fine and imprisonment, at the discretion of the court.

SEC. 5. That any person who is the owner of, or who is possessed of any interest in any animal affected with any of the diseases named in section two of this act, or any person who is agent, common carrier, consignee, or otherwise is charged with any duty in regard to any animal so diseased or exposed to the contagion of such disease, or any officer or agent charged with any duties under the provisions of this act, who shall knowingly conceal the existence of such contagious disease, or the fact of such exposure to said contagion, and who shall knowingly and willfully fail, within a reasonable time, to report to the said commissioners their knowledge or their information in regard to the existence and location of said disease, or of such exposure thereto, shall be deemed guilty of a misdemeanor, and shall be punishable as provided in section four of this act.

SEC. 6. That when the owner of animals, decided under the provisions of this act by the proper authority to be diseased, or to have been exposed to contagion, refuses to accept the sum authorized to be paid under the appraisement provided for in this act, it shall be the duty of the commissioners to declare and maintain a rigid quarantine as to the animals decided, as aforesaid, to be diseased or to have been exposed to any contagious or infectious disease, and of the premises or places where said cattle may be found, according to the rules and regulations to be prescribed by

said commissioners, approved by the governor, and published as provided in the third section of this act.

SEC. 7. That no person or persons owning or operating any railroad, nor the owner or owners or masters of any steam, sailing, or other vessels within the State, shall receive for transportation or transport from one part of the State to another part of the State, or bring from any other State or foreign country any animals affected with any of the diseases named in section two of this act, or that have been exposed to such diseases, especially the disease known as tuberculosis, knowing such animals to be affected, or to have been exposed thereto; nor shall any person or persons, company or corporation, deliver for such transportation to any railroad company, or to the master or owner of any vessel, any animals, knowing them to be affected with or to have been exposed to any of said diseases; nor shall any person or persons, company or corporation, drive on foot or transport in private conveyance from one part of the State to another part of the State, any animal, knowing the same to be affected with or to have been exposed to any of said diseases. Any person or persons violating the provisions of this section shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by fine not exceeding the sum of two hundred dollars, or by imprisonment not exceeding six months, or by both fine and imprisonment.

SEC. 8. That it shall be the duty of the several county solicitors to prosecute all violations of this act which shall be brought to their notice or knowledge by any person making the complaint under oath; and the same shall be heard in the supreme court.

SEC. 9. That the said commissioners are hereby authorized to appoint or elect one of their number as secretary of said board, who shall receive a reasonable compensation for his services during the time in which, under the provisions of this act, the services of the said commissioners shall be required. The said commissioners shall make and preserve a full record of all rules and regulations promulgated under the provisions of this act, of all payments and expenses hereunder incurred, and all other transactions performed by said commissioners in the discharge of their duties as herein provided; and the said commissioners shall, on or before the first Wednesday in January of each year, during their continuance in service, and at other times as they may deem conducive to the public interests, or as they may be required to do by the governor of the State, report to said governor full and accurate accounts of their expenditures, and other proceedings under the provisions of this act, and of the condition of said diseases, if any in the State, to be communicated by him to the legislature. Whenever the functions of said commission shall be suspended or terminated, it shall turn over to the secretary of state all its books, papers, records, and other effects, taking his receipt therefor, and he shall remain the custodian of the same until such time as the functions of said commission may be restored.

SEC. 10. That the commissioners shall have power, and are hereby authorized, to employ skilled veterinarians and such other agents and employés as they may deem necessary to carry into effect the provisions of this act, and to fix the compensation of the person or persons so employed, and to terminate such employment at their discretion; and they are authorized to make such expenditures as may be needed for the actual and necessary traveling expenses of themselves and their said employés, stationery, expenses of disinfecting premises, cars, and other places, destroying diseased and exposed animals, and paying for the same, and such other expenses and expenditures as they may find to be actually necessary to carry into effect properly the provisions of this act.

SEC. 11. That at any time, should it become an actual necessity to declare a quarantine against any or all animals entering within the borders of the State, for the public health and safety, it shall be the duty of said commission to confer with the governor and council, and they may adopt measures to prevent the spread of infectious and contagious diseases in the State, to remain in force until the safety of the State and the approval of the commission and the governor and council allow the repeal of said measures of quarantine.

SEC. 12. That all bills and expenses incurred under the provisions of this act shall be approved by the commission and audited by the governor and council, and the expenditures shall not exceed ten thousand dollars in any one year, to be paid from the State treasury, on the order of the governor, out of any moneys not otherwise appropriated.

SEC. 13. That chapter 93, laws of 1889, and all other acts and parts of acts inconsistent with this act are hereby repealed.

Approved, April 7, 1891.

NEW MEXICO.

AN ACT to prevent the introduction of diseased cattle into New Mexico.

WHEREAS the fact has become well established that cattle imported into the Territory of New Mexico from ranges in any part of the State of Texas south and east of a line commencing at the northwest corner of the county of Wichita; thence running due south along the western line of Wichita and Archer counties to the northeast corner of Throckmorton County; thence due west to the northwest corner of said county; thence due south to the southwest corner of Throckmorton County; thence due west to the northwest corner of Shackelford County; thence due south to the southwest corner of said county; thence due west to the northwest corner of Taylor County; thence along the north line of Nolan and Mitchell counties to the northwest corner of Mitchell County; thence due south to the southwest corner of said Mitchell County; thence due west along the south lines of the counties of Howard, Martin, and Andrews, to a point where the southeast corner of the Territory of New Mexico and the southwest corner of the county of Andrews, in the State of Texas, meet; thence due west along the south boundary line of the Territory of New Mexico to a point where the monuments marking the boundaries between the State of Texas and the Territory of New Mexico, and in the State of Chihuahua in the Republic of Mexico, and erected by the boundary commission stand and are in place at the date of enactment of this law, and more particularly the counties of El Paso, Presidio, Pecos, Tom Green, Crockett, Mitchell, Shackelford, Throckmorton, Archer, and Wichita, in the State of Texas, and all the counties east and south of the counties hereinbefore mentioned and situated in the aforesaid State of Texas; also that part of the Republic of Mexico lying north and east of the Mexican Central Railway to the twenty-sixth degree of latitude; thence on said line to the Rio Grande, at any time from the 15th day of March to the 15th day of November of each year, will communicate to and infect cattle then grazing or living on ranges in said Territory upon or through which such imported cattle shall then stray or be driven with a certain fatal disease, commonly known as Texas or splenic fever; and

WHEREAS the fact has become well established that such imported cattle, so as aforesaid communicating such Texas or splenic fever, never show any symptoms of the disease from which the same may be determined by inspection thereof; and

WHEREAS certain other contagious and infectious diseases, and particularly contagious pleuro-pneumonia, have been and are existing an epidemic among the cattle in certain localities within the United States and beyond the limits of said Territory: Therefore, for sanitary purposes only—

SECTION 1. *Be it enacted by the legislative assembly of the Territory of New Mexico,* That the word "cattle" used in the preamble of this act, and wherever used in any of the sections or provisions of such act, shall be understood and construed as bovine cattle only, and shall not relate to or include any other kind of domestic animals.

SEC. 2. A sanitary board consisting of three practical cattle raisers and owners, one to be appointed in and for each district, said districts to be as follows: District number one to be formed by the counties of San Miguel, Mora, Colfax, Taos, and Rio Arriba; district number two, of the counties of Bernalillo, Valencia, Socorro, Sante Fé, and San Juan; district number three, of Lincoln, Dona Ana, Sierra, and Grant counties, the limits of each as now constituted hereby—is created, to be known as the cattle sanitary board of New Mexico. The term of office of each member of said board shall be two years from and after his appointment, and until his successor shall have been appointed and qualified. Each of the members of said board shall be nominated by the governor of the Territory and appointed by and with the advice and consent of the legislative council. In case of any vacancy in the membership of said board from death, resignation, or otherwise, the governor shall fill such vacancy by appointment, and the appointee shall hold such office only during the unexpired term of the office so becoming vacant.

SEC. 3. A majority of the members of said sanitary board shall constitute a quorum, authorized to transact all business properly coming before them under the provisions of this act.

SEC. 4. Said sanitary board is hereby authorized and required to adopt and publish such quarantine rules and regulations as may be necessary to carry into effect the provisions of this act relating thereto and not inconsistent therewith, for the purpose of preventing the introduction into said Territory or the spreading therein of Texas or splenic fever, contagious pleuro-pneumonia, or any other contagious or infectious disease affecting cattle.

SEC. 5. It may be the duty of said board, and they are authorized, to employ some competent veterinary surgeon, who shall be a graduate in good standing of some

recognized college of veterinary surgery and science, and when necessary to bring him to their aid for the inspection of live cattle having or suspected of having some contagious or infectious disease, or for the examination of any cattle that shall have died or shall be suspected of having died of some such disease, as well as for consultation as to the most practical and effective method of stamping out or preventing the spread of any such disease among cattle within said Territory, and for the performance of any other service within the line of their duties or of his profession as said board shall determine and when and where they shall direct. The said board shall fix the compensation to be paid to said veterinary surgeon at a salary not to exceed the rate of one thousand five hundred dollars per annum and his actual and necessary traveling expenses in the performance of his duties. Such compensation shall be paid by said board out of the fund hereinafter provided for and at such time as shall be specified in the contract therefor with said veterinary surgeon.

SEC. 6. It shall be the duty of said board to provide suitable books, in which they shall cause to be entered true and itemized accounts of all receipts and expenditures by them or under their direction, and specifying what for; also an entry therein of all cattle (if any) imported into the Territory in violation of any of the provisions of this act, so far as the same shall come under their supervision or to their knowledge, and to this end said board shall require said veterinarian (or they may employ a secretary) to perform such work, who shall act as its secretary and make the proper entries in said books and write out its reports required as hereinafter provided. Said books and all entries therein shall constitute a public record, and at all reasonable times shall be open for examination by any and all parties interested.

SEC. 7. It is and shall be unlawful for any person, persons, company, or corporation to drive, convey, transport, or aid therein, or to cause or procure to be driven, conveyed, or transported into the Territory of New Mexico, during any time in each year between the 5th day of March and the 1st day of November, any cattle from any part of the State of Texas south and east of a line commencing at the northwest corner of the county of Wichita, thence running due south along the western line of Wichita and Archer counties to the northeastern corner of Throckmorton County; thence due west to the northwest corner of said county; thence due south to the southwest corner of Throckmorton County; thence due west to the northwest corner of Shackelford County; thence due south to the southwest corner of said county; thence due west to the northwest corner of Taylor County; thence along the north line of Nolan and Mitchell counties to the northwest corner of said Mitchell County; thence due south to the southwest corner of said Mitchell County; thence due west along the south line of the counties of Howard, Martin, and Andrews to a point where the southeast corner of the Territory of New Mexico and the southwest corner of Andrews County, in the State of Texas, meet; thence due west along the south boundary line of the Territory of New Mexico to a point where the monuments marking the boundaries between the State of Texas, the State of Chihuahua in the Republic of Mexico, and the Territory of New Mexico, and erected by the United States boundary commission, stand and are in place at the date of the enactment of this law, and more particularly the counties of El Paso, Presidio, Pecos, Tom Green, Crockett, Mitchell, Shackelford, Throckmorton, Archer, and Wichita, in the State of Texas, and all counties east and south of the counties hereinbefore mentioned, and situated in the aforesaid State of Texas, and that part of the Republic of Mexico lying north and east of the Mexican Central Railway to the twenty-sixth degree of latitude; thence east with said line to the Rio Grande. This section is designated to operate only as a quarantine regulation against the introduction of Texas or splenic fever, and shall not be operative against any railroad company or corporation in transporting cattle from the aforesaid prohibited district in the State of Texas and the Republic of Mexico entirely through and beyond the limits of this Territory by rail: *Provided*, That such cattle are not unloaded while in transit through the Territory, except into secure quarantine stockyards, provided by such company or corporation, and used exclusively for that purpose: *And provided further*, That during such transit through the Territory, while such prohibition is in force, such cattle shall be so securely confined that none of them shall get loose either from the cars or any such quarantine stockyards and go upon the grounds outside thereof.

SEC. 8. Whenever it shall come to the knowledge of said board or of said veterinarian that any contagious or infectious disease, other than fever covered by this act, and the nature of which is known to be fatal to cattle, has become epidemic or exists in any locality or localities in any State or Territory beyond the limits of this Territory, they or either of them shall immediately communicate the fact to the governor of the Territory in writing, and thereupon, or when the governor shall

have otherwise good reason to believe that any such fatal disease other than Texas fever so exists or has become epidemic, the governor shall immediately issue and publish by a general proclamation such rules and regulations as the board may adopt, specifying such localities, and thereby prohibit the importation therefrom into this Territory of any cattle except under such restrictions and safeguards as the board may deem proper and shall specify for the protection of cattle in this Territory. Any person, persons, company, or corporation who, after the publication of such proclamation, shall knowingly receive in charge any cattle the importation of which into this Territory shall have been so prohibited, or shall drive, transport, or in any manner convey the same to and within the limits of this Territory, or shall knowingly cause or procure the same to be driven, transported, or conveyed into such Territory, in violation of such proclamation, or shall violate any of the provisions of section seven of this act by driving, conveying, or transporting or aiding therein, or causing or procuring to be driven, conveyed, or transported into this Territory any cattle which are thereby declared to be unlawful, shall be deemed guilty of a misdemeanor, and, upon conviction, shall be fined not less than one hundred dollars nor more than five thousand dollars for each and every offense, and shall also become liable in a civil action for any and all damages and loss sustained by any person, persons, company, or corporation by reason of such importation of such cattle.

SEC. 9. After the issuance and publication of any proclamation by the governor, as provided by this act, and while such proclamation shall continue in force, or while the prohibition against the importation of cattle from certain parts of Texas and Mexico, as specified in section seven in this act, shall be in force, or either of them, it is and shall be unlawful for any person, persons, company, or corporation to drive or transport or cause or procure to be driven or transported into this Territory any cattle that by any direct or circuitous route might have come from any place or district covered by such prohibitions, or either of them, without first having obtained a certificate of health from said veterinarian or a permit in writing from said board through any of its employés under such rules and regulations as such board shall prescribe and publish for the information of the public. Any person failing to comply with this provision after due notice shall be deemed guilty of a misdemeanor, and, upon conviction, shall be fined not less than five hundred dollars nor more than five thousand dollars, and shall also be personally liable for all loss and damages sustained by any person or persons by reason of the introduction of any contagious or infectious disease from the cattle so unlawfully imported into this Territory, and during the issuance of said proclamation and the enforcement of this law all cattle desiring to enter the Territory must submit to an inspection, nor shall they be permitted to enter the Territory until a written or printed permit is issued by a member of the board, the veterinary surgeon, or an inspector appointed by said board. Any person may require the person in charge of the cattle to produce for his inspection the permit, and any person refusing to produce said permit at any time within a year from the time the cattle were driven in shall be held to be guilty of the violation of this law and shall be subject to all the penalties provided by this section.

SEC. 10. To aid in the enforcement of the quarantine provisions of this act, for the sanitary protection of cattle in this Territory, and in ferreting out and detecting any violations thereof, it shall be the duty of said board, and they are hereby authorized, to employ for that service, in addition to said veterinarian, as many other competent and discreet persons, from time to time as emergencies may arise, as in their judgment they shall deem necessary for that purpose, and shall fix their compensation, which shall not exceed $2.50 per day each while in actual service and in their actual and necessary expenses while in performance of their duties as may be agreed upon, and to direct them as to what duties they are to perform, as well as to when, where, and how such duties shall be performed. All such persons respectively so employed shall make true reports in writing to said board of their doings under such directions.

SEC. 11. Whenever said board, during the continuance in force of any prohibition against the importation into this Territory of cattle under any of the provisions of this act, shall have good reasons to believe or suspect that any such cattle against the importation of which such prohibition then exists, have been or are about to be driven, conveyed, or transported into this Territory, in violation of any such prohibition then existing and then in force, it shall be the duty of said board, either by its own members or through said veterinarian or through one or more of such persons then in their employ, as provided by this act, or through any or either of them, as circumstances shall seem to require, to thoroughly investigate the same, and to this end they may examine, under oath or affirmation, any person or persons in charge of such cattle or any person or persons cognizant of any facts or circumstances mate-

rial to such investigation, as to any and all facts connected with the driving or transportation of such cattle, including the place or places from which said cattle or any of them have been driven or transported; the places or districts through which they or any of them have been driven or transported; the length of time, and where they or any of them have remained, fed, or grazed at any designated place or district; what contagious or infectious disease of cattle, if any, they or any of them have been exposed to and when and where, and as to any other facts or circumstances material to such investigation, and reduce such testimony to writing in all cases, where the certificate of health or the permit in writing herein provided for shall be refused. To this end the members of said board, said veterinarian, and all other persons as aforesaid so in the employ of said board through whom any such investigation shall be made, hereby are, and each of them is, authorized to administer all oaths and affirmation required in any such investigation. If any such investigation is made by such veterinarian, and thereupon he is satisfied that such cattle are free from all contagious and infectious diseases specified in this act, and will not communicate any such disease to any cattle in this Territory, he shall deliver to the person in charge of such cattle a certificate of health to the effect that such cattle are healthy and entitled to pass into the Territory; otherwise he shall refuse the same; and if such investigation shall be made by any other person or persons authorized as herein specified to make the same, and thereupon he or they shall be satisfied that such cattle will not transmit to the cattle in this Territory any cattle disease specified in this act, and that the facts and circumstances attending their transportation warrant the presumption that such cattle are not from that part of the State of Texas or the Republic of Mexico, the importation of cattle from which shall then be prohibited under this act, then he or they shall give the person in charge of such cattle a written permit to pass the same into the Territory; otherwise such permit shall be refused.

SEC. 12. It shall be the duty of said board to make all useful rules and regulations respecting examinations and investigations for the granting or refusing of certificates of health and permits provided for in the next succeeding section of this act, and give ample publicity thereto, so that all persons, companies, and corporations who may desire to drive or transport any cattle into the Territory may be conveniently advised of what will be required to obtain any such certificate or permit during the existence of any prohibition to the importation of cattle into the Territory under this act, and when, where, and to whom applications therefor may be made.

SEC. 13. Every person, company, corporation, or their or either of their agents or employés, having in charge cattle destined for introduction into this Territory during the existence of any prohibition against such importation, under this act, of cattle, may make application for said certificate of health or permit to the proper person designated at the place nearest to the proposed point of entrance into the Territory, specifying in such application the time and place where and when such cattle will be ready for inspection, and the circumstances of their importation investigated, which place shall be beyond the boundary lines of the Territory. Such application shall be made at least ten days before the time specified for such inspection. Any person, corporation, or their or either of their agents, having cattle in charge to be driven or transported into this Territory from any place in another State or Territory, may have such inspection and examination at such place before starting with such cattle as he shall so elect, provided he shall pay all expenses of such inspection and investigation, including per diem and traveling expenses of the person or officer making the same and designated for that purpose by said board.

SEC. 14. Whenever any cattle shall be driven or transported into the Territory without obtaining a certificate of health or permit by the person in charge thereof, in any case where such certificate or permit is required by the provisions of this act, and if such cattle shall have been inspected and an investigation had in relation thereto and such certificate or permit refused, as required by this act, then such cattle may be seized and securely held in quarantine under such reasonable rules and regulations as shall be prescribed therefor by said board, and as they may deem necessary to guard against other cattle becoming affected with any cattle disease covered by this act; and they shall be held in quarantine for such length of time as such board shall in their opinion deem necessary for the sanitary protection of cattle in this Territory. And if such cattle shall not have been so inspected and an investigation had, then the same shall take place wherever the cattle may be found, and they may be seized and held for that purpose and a certificate of health or permit granted or refused, as the case may require, and if refused, the cattle may in like manner be held in quarantine. All the necessary expenses of quarantine and inspection under the provisions of this section shall be paid by the owner or owners of such cattle.

SEC. 15. All expenses incurred in and by the inspection and quarantine of cattle under the preceding section (section 14) of this act, shall be a lien on such cattle to secure the payment thereof in favor of said board, as an indemnity for the expenses so incurred; and all loss and damages incurred and suffered by any person, company, or corporation, by reason of any cattle disease covered by this act, disseminated among or communicated to cattle in this Territory by cattle driven or transported into such Territory in violation of any of the provisions of this act, shall be a lien on the cattle so unlawfully imported in favor of the person, company, or corporation so incurring or suffering such loss or damage thereby. All liens covered by this section shall take precedence and priority over any other lien or encumbrance on any such cattle existing at the time of their unlawful importation as aforesaid, or at any time subsequent thereto. All such liens shall subsist and become effective as security for ultimate payment without any other act or proceeding whatever, and after judgment any such lien may be foreclosed by sale of the cattle on execution.

SEC. 16. In order to enforce the 14th and 15th sections of this act the board or any member thereof, or any one they may authorize, shall seize any cattle that may come into this Territory during the enforcement of this law without first having obtained a permit. After the seizure such cattle shall be held in close quarantine until the board is satisfied all danger has passed, and either of the parties above named and empowered to make the arrest may call on any party within a reasonable distance to assist in making the seizure of said cattle, and any one refusing to so assist shall, upon complaint and proof of such an officer to the justice of the peace, be fined not less than twenty-five nor more than one hundred dollars, or be imprisoned in the county jail not to exceed three months. When the board is satisfied that there is no further danger from the seized cattle, they may render a bill of costs to the owner or claimant, and upon the payment of the sum release such cattle; or they may advertise such cattle in a public newspaper for at least two weeks and then sell them to the highest bidder, retaining only enough to satisfy all expenses incurred; or they may turn loose such cattle on the range or return them to the place of entry. All persons who are summoned to assist in seizing said cattle shall be allowed a reasonable compensation for such service, not to exceed two dollars per day for man and horse, or four dollars per day for a man and team of two horses, nor shall any person be required to assist in the seizure for more than ten consecutive days.

SEC. 17. In all cases of contagious and infectious disease covered by this act, other than Texas or splenic fever, existing or becoming epidemic on premises previously quarantined, as provided by this act, said board is authorized and empowered to cause the slaughter of cattle upon such premises which are known to be so diseased or have been exposed to such disease, when said veterinarian shall decide that the same is necessary for the sanitary protection of other cattle, and shall so advise such board and said board shall be of the same opinion, and shall order such slaughter to be done; provided, however, that no such cattle shall be slaughtered that have no disease nor have been exposed to any disease, except Texas or splenic fever. Such slaughter of cattle shall be done under the superintendence of said veterinarian or board, who prior thereto shall notify the nearest justice of the peace and deliver to him the order therefor; such justice shall thereupon select and summon before him three cattlemen of the neighborhood, who shall have no interest in the cattle to be slaughtered, to act as appraisers of the value of such cattle, and administer to each of them an oath to make a true, faithful, and impartial appraisement of the value of the cattle to be slaughtered, without prejudice against or favor to any one. Thereupon said appraisers shall inspect such cattle and make such appraisement thereof. They shall also return to each justice certificates of their valuation of each animal so appraised, containing an accurate description thereof, with brands, earmarks, wattles, age, sex, color, and class as near as may be; one of such certificates to be filed with the justice, one to be delivered to the owner of the cattle to be slaughtered, and one to be transmitted to the said board by said justice. The fees of justices of the peace for services herein provided shall be the same as for similar services as fixed by law, and said appraisers and all necessary employés for the slaughter of animals and destruction of their carcasses, as provided by this act, shall receive three dollars per day and their necessary expenses while engaged therein, all of which shall be paid by said board upon their order. Such veterinary surgeon shall also superintend the destruction of the carcasses of each animal and each part thereof, which shall be by burning the same to ashes.

SEC. 18. In making such appraisement said appraisers shall consider the effect of the disease on the value of each animal and the certificate of such veterinarian or board as to the probable fatality of the same. All claims for indemnity to owners of cattle slaughtered, as provided by this act, shall be presented to said board and

passed upon by said board and allowed and paid upon its order to the extent of the appraised value of the animals slaughtered, as herein provided, and owned by such claimant, provided such animals are such as the slaughtering of which an indemnity is allowed under this act, and the proceedings in regard to such slaughter and appraisement have been regular. Such application shall be accompanied with the certificate of appraisement delivered to such owner.

SEC. 19. Owners of cattle appraised and slaughtered as herein provided shall be entitled to indemnity therefor to the extent of such appraised value except in the following cases:

First. For animals belonging to the United States.

Second. For cattle brought into the Territory in violation of any of the provisions of this act.

Third. For cattle that had the disease for which they were slaughtered or had been destroyed by reason of exposure to the disease at the time of their arrival into the Territory.

Fourth. For cattle which the owner or claimant knew to be diseased or had notice thereof at the time they came into his possession.

SEC. 20. In case epidemic or contagious disease (not Texas or splenic fever) may become known to the board to exist within the Territory, and the board may deem it necessary to use more money than the present assessment (one-half of one mill on each dollar) may yield, then they may summon the governor, treasurer, and auditor of the Territory to meet as a Territorial cattle sanitary board, at the governor's, treasurer's, or auditor's office, in the city of Santa Fé; and if this board upon meeting shall determine it to be to the best interests of the cattlemen of the Territory to do so, they may order a levy not to exceed one-fourth of one per cent of the assessable value of cattle within the Territory, or they may issue bonds in the denomination of one hundred dollars, bearing interest not to exceed eight per cent, payable annually. Interest and bonds are payable at the First National Bank of Santa Fé, N. Mex. Said bonds shall run from five to eight years and are payable at any time after five years. The bonds will be signed by the president of the cattle sanitary board and by the treasurer of the Territory, and by the latter registered in a book to be provided by the cattle sanitary board, which book shall be continued in the possession of the treasurer of the Territory and his successors. The governor of the Territory will preside at all meetings of the Territorial cattle sanitary board, and a record of each meeting will be made by the treasurer of the Territory and also by the secretary of the cattle sanitary board. The bonds shall be sold at the highest obtainable price. Whenever the Territorial cattle sanitary board may think best they may order a levy not to exceed one-eighth of one per cent of the assessed value of cattle within the Territory, and continue said levy yearly until a sufficient sum is realized to pay said bonds with the yearly accruing interest. Said levy shall constitute a sinking fund for the payment of said bonds and for no other purpose. Said sinking fund shall be deposited with the Territorial treasurer, who shall give a good and sufficient bond, to be approved by the governor, for a sum equal to the bonds and interest. The levies provided for by this act shall be made by the several county commissioners of the different counties at the expense of such counties making such levies. The Territorial treasurer shall pay said bonds in their numerical order. Notice of payment will be posted in the First National Bank of Santa Fé, N. Mex., sixty days before payment. The bonds when paid shall be destroyed by the treasurer and auditor of the Territory and a record of the same made by the treasurer. It shall be the duty of the governor to demand of and cause to be executed a bond by each of the members of the cattle sanitary board to the Territory of New Mexico with two or more sufficient securities, and in such sum as will cover the amount which may be raised and collected by the aforesaid levies, conditioned for the faithful disbursement of said moneys. In the event that either of said members do not execute said bonds within twenty days, his or their office will be vacant, and the governor will at once fill such vacancy and require the two bonds provided for in this act.

SEC. 21. The compensation of said veterinary surgeon and of all other employés by or under said board, and in the first instance all other expenses incurred by or under said board, as provided by this act, shall be paid by said board or upon its order out of the funds hereinafter provided for, such board taking or causing to be taken proper vouchers for all moneys so expended by them.

SEC. 22. In the aggregate amount of money to be expended by said board in any one year, they are hereby limited to the amount actually provided for that year under this act, as near as they can estimate.

SEC. 23. Hereafter, each year, it shall be the duty of the county commissioners of each county in the Territory, at their first meeting after the return of the assessment of the property for taxation by the county assessors, respectively, to levy a

special tax of one-half (½) of one (1) mill on each dollar of the appraised value of all cattle in their county, to be known as the cattle indemnity fund. Such special tax shall be collected in the several counties and paid to the Territorial treasurer in the manner provided by law for the collection and payment to such treasurer of other Territorial taxes. Such fund shall be kept separately by such treasurer, and shall be used exclusively for the payment of indemnity claims for cattle that shall be slaughtered, and for fees, salaries, wages, costs, and expenses provided under the provisions of this act, and shall be paid out by such treasurer on the order of said board. All moneys shall be assessed, levied, and collected at the expense of the several counties, and where the commissioners of any county shall neglect or fail to make said levy, they shall become personally responsible to the cattle indemnity fund in an amount equal to twenty-five per cent of the levy.

SEC. 24. Said veterinary surgeon before entering upon the discharge of his duties shall take and subscribe an oath, before some officer authorized to administer oaths, to well and impartially perform all professional duties assigned him; and each member of said board before entering upon the discharge of his duties shall take and subscribe an oath to faithfully and impartially perform his duties to the best of his ability, and execute a bond in the penal sum of five thousand dollars to the Territory of New Mexico, with two or more sufficient sureties, conditioned for the faithful disbursement of all moneys. Such bond shall be approved by the governor, and each of said oaths and bonds shall be filed with the Territorial auditor.

SEC. 25. The members of said board shall receive no compensation except their actual and necessary expenses while in the performance of their duties, and for such expenses they may be reimbursed out of said indemnity fund.

SEC. 26. It shall be the duty of such board, and they are hereby required, during the first week in December of each year, to transmit to the governor a report of their doings under this act, containing a detailed account of all the receipts and expenditures of money by them, together with such other facts within the line of their duties as may be of public interest. Any such report shall be transmitted by the governor to the next legislative assembly.

SEC. 27. The act of the legislative assembly of the Territory of New Mexico, approved February 10, 1887, entitled "An act to prevent the introduction of diseased cattle into the Territory of New Mexico, and to prevent the dissemination of disease therein," and to repeal an act entitled, "An act to prevent the introduction of diseased cattle into the Territory of New Mexico, approved March 19, 1884," is hereby in all respects repealed, except section 26 of the said act, approved February 10, 1887, providing for the repeal of the act approved March 12, 1884, and all other laws and parts of laws in conflict herewith are hereby repealed.

SEC. 28. This act shall be in force and take effect from and after its passage.

Law by limitation, February 28, 1889.

AN ACT in relation to live stock.

SECTION 1. *Be it enacted by the legislative assembly of the Territory of New Mexico,* That in addition to the powers and duties now conferred and prescribed by law to be exercised and performed by the sanitary board created by an act of the legislative assembly of this Territory, entitled "An act to prevent the introduction of diseased cattle into New Mexico," which became a law on the 28th day of February, 1889, the said sanitary board shall have and exercise the powers and shall perform the duties prescribed by this act.

SEC. 2. In the exercise of the powers and performance of the duties conferred and prescribed by this act, the said sanitary board shall and may make all necessary rules and regulations respecting the inspection of cattle intended for shipment or to be driven beyond the limits of this Territory; and also respecting the inspection of hides and slaughterhouses in this Territory, and for the government of all employés of said sanitary board.

SEC. 3. It shall be the duty of said sanitary board to cause to be inspected the brands and earmarks upon the cattle shipped or driven out of this Territory, and to cause to be kept and preserved a true and correct record of the result of such inspections in the office of the secretary of said sanitary board, which record shall set forth the date of the inspection, the place where, and the person by whom made; the name and post-office addresses of the owner, shipper, or claimant of the cattle so inspected, and the names and post-office addresses of all persons in charge of such cattle at the time of the inspection, the destination of such cattle, as well as a list of all brands and earmarks upon the cattle so inspected, and the number and classification of such cattle.

SEC. 4. It shall be the duty of every person shipping or driving any cattle out of this Territory to hold the same at some convenient place for inspection, as provided

by this act, and it shall be unlawful for any person to ship, drive, or in any manner remove beyond the boundaries of this Territory any herd or band of cattle, until they shall have been inspected as provided by this act.

SEC. 5. It shall be unlawful for any railroad company to receive any herd or band of cattle, for transportation to a point beyond the boundaries of this Territory, until the same shall have been inspected as required by this act, and until such railroad company shall have been furnished with a certificate by a duly authorized inspector, showing that the brands and earmarks upon such cattle have been duly inspected as required by this act, and any railroad company or any officer, agent, or servant of a railroad company, who shall violate the provisions of this section, shall be deemed guilty of a misdemeanor, and on conviction thereof shall be fined not less than one hundred dollars and not more than five thousand dollars, in the discretion of the court.

SEC. 6. Every person, company, or corporation, or their, or either of their agents, servants, or employés having in charge cattle destined for transportation by rail or to be driven beyond the limits of this Territory, may make application to the proper inspector to inspect the brands and earmarks of any such cattle, stating in such application the time and place when and where said cattle will be ready for inspection, and it shall be the duty of such inspector, or of some other inspector to be designated by the said sanitary board, to attend at the time and place designated in such application, and inspect the said cattle, make the record, and give the certificate required by the provisions of this act, free of charge to the owner of said cattle; provided, however, that in the case of cattle transported out of this Territory by rail, the place of inspection shall be at some stockyard, or other convenient place near the proposed point of shipment of said cattle from the Territory; and provided further, that, if the owner or person in charge of said cattle shall cause any unreasonable delay or loss of time to such inspector, such owner or person in charge of any such cattle shall pay the expenses and salary of such inspector, during such delay or loss of time.

SEC. 7. Every inspector employed by the sanitary board under the provisions of section ten of the act entitled "An act to prevent the introduction of diseased cattle into New Mexico," shall, in addition to the duties prescribed by the said act, be an inspector of brands and earmarks, and also an inspector of hides and slaughterhouses under the provisions of this act, and it shall be the duty of some one of such inspectors to inspect the brands and earmarks of all cattle transported or driven out of this Territory, and to make a sworn report to the secretary of the said sanitary board, of the result of such inspection, at least once in every thirty days, and oftener if, in the opinion of the sanitary board, it shall be necessary to do so; every slaughterhouse in this Territory shall be carefully inspected by some one of the inspectors aforesaid, and all hides found in such slaughterhouses shall be carefully compared with the records of such slaughterhouses, and a report in writing setting forth the number of cattle killed at any such slaughterhouse since the last inspection—or since the passage of this act, as the case may be—the names of the persons from whom each of said cattle was bought, the brands and marks upon each hide, and any information that may be obtained touching the violation by the owner of any such slaughterhouse, or any other person, of the provisions of an act entitled, "An act for the protection of stock and for other purposes," approved April first, eighteen hundred and eighty-four. For the purpose of making the inspection authorized by this act, any inspector employed by the said sanitary board shall have the right to enter in the day or night time any slaughterhouse or other place where cattle are killed in this Territory, and to carefully examine the same, and all books and records required by law to be kept therein, and to compare the hides found therein with such records. Any person who hinders, or obstructs, or attempts to hinder or obstruct, any inspector employed by the said sanitary board in the performance of any of the duties required of him under the provisions of this act, shall be deemed guilty of a misdemeanor, and on conviction thereof, shall be fined in any sum not exceeding one hundred dollars, at the discretion of the court trying the case.

SEC. 8. Any person being the owner of a recorded brand in this Territory may file in the office of the secretary of the said sanitary board a copy of his or her brand, or brands, and earmarks, and after the filing of such copy with said secretary it shall be the duty of said secretary to notify any persons having a copy of his brand on file in said office, of the removal from the Territory of all cattle in such brand and earmark, giving full particulars as to time and place of inspection and shipment or removal of any such cattle, and the names and post-office addresses of all persons in charge of such cattle at the time of inspection.

SEC. 9. The records required to be kept by the secretary of the said sanitary board shall be kept in a well bound book to be provided by the board for that pur-

pose, and a certified copy of any such record under the hand and seal of the secretary of said board shall be prima facie evidence in all courts of this Territory of the truth of any fact required to be recorded therein by this act.

SEC. 10. Any inspector employed by the said sanitary board, who shall knowingly make any false certificate under the provisions of this act, or who shall knowingly swear falsely as to the truth of any report made by him to the secretary of said sanitary board, or who shall accept any bribe or compensation for the performance or failure to perform any of the duties prescribed by this act, except such compensation as may be paid him by the said sanitary board, shall, upon conviction thereof, be fined in any sum not exceeding one thousand dollars, or imprisoned in the Territorial prison not exceeding five years at the discretion of the court.

SEC. 11. The secretary of the said sanitary board shall receive such compensation as shall be fixed by the said board, not exceeding one thousand dollars per annum. He shall keep a record of all inspections of brands and earmarks in well bound books to be provided for that purpose, and shall perform such other duties as secretary of such board, and shall enter into bond in the penalty of five thousand dollars with good and sufficient sureties to be approved by the said sanitary board conditioned for the faithful performance of his duties. Any person injured by any misfeasance, malfeasance, or nonfeasance of the said secretary may institute an action on said bond in the name of the Territory of New Mexico for his use and benefit in any court of competent jurisdiction, and recover thereon such damages, not exceeding the penalty of the bond, as he shall have sustained by such misfeasance, malfeasance, or nonfeasance.

SEC. 12. The salaries of all employés and all other expenses incurred by the said sanitary board shall be paid as now provided by law, except that in addition to moneys hereafter to be raised by taxation all surplus moneys now in the treasury arising from the special tax known as the cattle indemnity fund, shall be available for that purpose.

SEC. 13. Any person, firm, or corporation, who shall violate any of the provisions of this act, or who shall remove any cattle beyond the limits of this Territory, without having the same inspected as required by this act, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not less than one hundred dollars and not more than five thousand dollars, in the discretion of the court; but nothing in this act contained shall be construed as in any manner affecting the laws now in force respecting the larceny of cattle.

SEC. 14. This act shall take effect and be in force from and after the 15th day of March, eighteen hundred and ninety-one, and all acts and parts of acts in conflict with this act are hereby repealed.

Approved February 14, 1891.

NEW YORK.

AN ACT to amend chapter one hundred and thirty-four of the laws of eighteen hundred and seventy-eight, entitled "An act in relation to infectious and contagious diseases of animals."

SECTION 1. *The people of the State of New York, represented in senate and assembly, do enact as follows*, That section two of chapter one hundred and thirty-four of the laws of eighteen hundred and seventy-eight, entitled "An act in relation to infectious and contagious diseases of animals," is hereby amended so as to read as follows:

SEC. 2. For such purpose the governor shall have power: To issue his proclamation stating that an infectious or contagious disease exists in any county or other geographical district of the State, and warning all persons to seclude in the premises where they may be at the time, all animals within the quarantined district that are of a kind susceptible to contract the disease in question, and ordering all persons to take such precautions against the spread of such disease as the nature thereof may in his judgment render necessary or expedient.

To call upon all sheriffs and deputy sheriffs to carry out and enforce the provisions of such proclamations, orders, and regulations; and it shall be the duty of all sheriffs and deputy sheriffs to obey and observe all orders and instructions which they may receive from the governor in the premises.

To employ such and so many medical and veterinary practitioners and such other persons as he may from time to time deem necessary to assist in performing his duties as set forth in the first section of this act, and to fix their compensation.

To order all or any animals coming into the State to be detained at any place or places for the purpose of inspection and examination.

To prescribe regulations for the destruction of animals affected with infectious or contagious disease, and for the proper disposition of their hides and carcasses, and

of all objects which might convey infection or contagion; provided that no animal shall be destroyed unless first examined by a medical or veterinary practitioner in the employ of the governor as aforesaid.

To prescribe regulations for the disinfection of all premises, buildings, boats, and railway cars, and of all objects from or by which infection or contagion may take place or be conveyed.

To alter and modify from time to time as he may deem expedient the terms of all such proclamations, orders, and regulations, and to cancel or withdraw the same at any time.

SEC. 3. This act shall take effect immediately.

Approved, May 11, 1888.

NORTH CAROLINA.

Acts for the protection of cattle and other live stock.

SECTION 2319. If any person who shall be a resident citizen of another State or of one of the Territories, shall drive or cause to be driven into any county in this State, any horses, mules, hogs, cattle, or sheep, between the first day of April and the last day of November, and suffer them to run at large in any marsh or forest range in this State, he shall forfeit five dollars for each head so permitted to run at large to any one who may sue for the same, or proceed by attachment, in case the offender is not to be found, one-half to the party suing for the same, the other half to the school fund of the county: *Provided*, This section shall not apply to any nonresident, who for the time being may own in said county any estate in land for one year, or other higher estate, unless such nonresident shall bring into the range more than twenty head of any of said beasts, for every two hundred acres of land owned by him in manner aforesaid in said county: *Provided further*, This section shall not apply to any person or persons driving oxen to and from market from the fifteenth of October to the first of March, or to imported cattle shipped for breeding purposes at any time: *Provided further*, This section shall not apply to any person or persons in the counties of Caldwell, Wilkes, Surry, Yadkin and Alexander, owning lands west of the Blue Ridge: *Provided also*, This section shall not apply to persons driving cattle to Watauga County to pasture for hire. (R. C., c. 17, s. 3; 1879, c. 95; 1881, c. 333; 1883, c. 355, ss. 1, 2.)

SEC. 2320. No person shall drive any cattle from those parts of this or any other State, where the soil is sandy and the natural production or growth of timber is the long-leaved pine, into or through any of the highland parts of the State where the soil or growth of timber is of a different kind, between the first day of April and the first day of November, under the penalty of four dollars for each head of cattle so driven, to be recovered as provided in the preceding section. (R. C., c. 17, s. 4.)

SEC. 2321. No person shall drive any cattle from any part of the State through any other part thereof, without first obtaining and carrying with him a certificate under the hands and seals of two justices of the peace of the county where such cattle were severally purchased or selected from the range, accompanied with an affidavit of the owner setting forth the place where said cattle were purchased, or had ranged as aforesaid, and describing therein the nature of the soil and growth of timber on such place; and also that said cattle were, at the time of purchase or removal, sound and free from any infectious distemper. And if any justice shall grant such certificate without such affidavit of the owner, it shall be a misdemeanor in office. (R. C. c. 17, s. 5.)

SEC. 2322. If any person shall drive or cause to be driven any cattle from any county in this State, or from any county or district in any other State into any county in this State, at any time between the first day of April and the first day of November, knowing such cattle to be distempered or otherwise infected, or shall permit any distempered cattle to roam at large and enter any uninfected district, he shall be guilty of a misdemeanor, and be liable to an action for all damages which may arise from a violation of this section. (1868–'9, c. 50, s. 1.)

SEC. 2323. If any person shall drive or cause to be driven any cattle as aforesaid, not knowing them to be infected, and losses should be sustained by the spreading of distempers or infection from said cattle, he shall be subject to damages only. (1868–'9, c. 50, s. 2.)

SEC. 2324. If any person complies with the requirements of section twenty-three hundred and twenty-one, without regard to growth or locality, said person shall not be subject to the above penalties. (1868–'9, c. 50, s. 3.)

NORTH DAKOTA.

AN ACT to prohibit the importation, sale, or exposure of infected animals and to prescribe punishments therefor.

SECTION 1. If any person knowingly import or bring into this Territory any horse, mule, or ass affected by the disease known as glanders or button farcy, or suffer the same to run at large upon any common, highway, or uninclosed land, or use, tie, or keep the same in any public place, stable, or barn, or sell, trade, or offer to sell or trade any such horse, mule, or ass, knowing or having good reason to believe the same to be so diseased, he shall be deemed guilty of a misdemeanor and shall on conviction be punished by a fine of not less than fifty nor more than five hundred dollars, and in default of payment shall be imprisoned for any period not exceeding twelve months or by both such fine and imprisonment, in the discretion of the court.

SEC. 2. This act shall take effect and be in force from and after its approval.

Approved, March 7, 1889.

AN ACT to prevent the spread of contagious and infectious diseases among domestic animals.

SECTION 1. *Be it enacted by the legislative assembly of the State of North Dakota,* That the governor of the State is hereby authorized to nominate, and with the consent of the senate to appoint a competent veterinary surgeon, who shall be known as the "State veterinary surgeon," and on entering on his duties shall take an oath to well and truly perform his duties as provided by law.

SEC. 2. The duties of said veterinary surgeon shall be as follows:

First. To investigate any and all cases of contagious or infectious diseases among cattle, horses, mules, asses, and other domestic animals in this State of which he may have knowledge, or which may be brought to his notice by any resident in the locality where such disease exists, and it shall be his duty, in the absence of specific information, to make visits of inspection to any locality where he may have reason to suspect that there are contagions or infections.

SEC. 3. In all cases of contagious or infectious disease among domestic animals or Texas cattle in this State, the State veterinary surgeon shall have authority to order the quarantine of the infected premises, and in case such disease shall become epidemic in any locality in this State, the State veterinary surgeon shall immediately notify the governor of the State, who shall thereupon issue his proclamation, forbidding any animal of the kind among which said epidemic exists to be transferred from said locality without a certificate from the State veterinary surgeon showing such animal to be healthy. The expenses of holding, feeding, and taking care of all animals quarantined under the provisions of this act shall be paid by the owner, agent, or person in charge of said stock.

SEC. 4. In case of any epidemic diseases, where premises have been previously quarantined by the State veterinary surgeon, as before provided, he is further authorized and empowered, when in his judgment it is necessary, to order the slaughter of any and all diseased animals upon said premises. Said order shall be a written one, and shall be made in duplicate, and there shall be a distinct order in duplicate for each owner of the animals condemned, the original of each order to be filed by the State veterinary surgeon with the governor of the State, and the duplicate given to said owner.

SEC. 5. The State veterinary surgeon shall make a report at the end of every year to the governor of all matters connected with his work, and the governor shall transmit to the several boards of county commissioners such parts of said report as may be of general interest to the breeders of live stock. The governor shall also give information in writing, as soon as he obtains it, to the various boards of county commissioners, of each case of suspicion or fresh eruption of disease in each locality, its cause, and the measures adopted to check it.

SEC. 6. It shall be the duty of any person or persons who shall have or suspect that there is upon his or their premises or upon the public domain any case of contagious or infectious disease among domestic animals or Texas cattle to immediately report the same to the State veterinary surgeon, and a failure so to do, or any attempt to conceal the existence of such diseases, or to wilfully or maliciously obstruct or resist the State veterinary surgeon in the discharge of his duty as hereinbefore set forth, shall be deemed a misdemeanor, and any person or persons who shall be convicted of any one of the above acts or omissions shall be fined not less than fifty (50) dollars nor more than five hundred (500) dollars for each and every such offense; and upon conviction a second time shall, in addition to the above-named fine, be imprisoned in the county jail for a term not less than thirty days nor more than six months.

SEC. 7. The following regulations shall be observed in all cases of disease covered by this act:

(1) It shall be unlawful to sell, give away, or in any manner part with any animal affected with, or suspected of being affected with, contagious or infectious disease, and in case of any animal that may be known to have been affected with or exposed to any such disease within one year prior to such disposal, due notice of the fact shall be given in writing to the party receiving the animal.

(2) It shall be unlawful to kill for butcher purposes any such animal; to sell, give away, or use any part of it, or its milk, or to remove any part of its skin. A failure to observe these provisions shall be deemed a misdemeanor, and on conviction shall be punished by a fine not less than one hundred (100) dollars, nor exceeding five hundred (500) dollars. It shall be the duty of the owner or person having in charge any animal affected with or suspected of being affected with any contagious or infectious disease to immediately confine the same in a safe place isolated from other animals, and with all necessary restrictions to prevent the dissemination of the disease until the arrival of the State veterinary surgeon. The above regulations shall apply as well to animals in transit through the State as to those resident therein, and the State veterinary surgeon or his duly authorized agent shall have full authority to examine, whether in car, or yards, or pastures, or stables, or upon the public domain, all animals passing through the State or any part of it, and on detection or suspicion of disease, take possession of and treat and dispose of animals in the said manner as is prescribed for animals resident in the State.

SEC. 8. The State veterinary surgeon shall receive for his services the sum of $1,000 per annum, together with his necessary traveling expenses, not exceeding five hundred (500) dollars, in any one year, actually paid out when in performance of his duty. These payments shall be made from any funds in the State treasury, not otherwise appropriated, upon itemized vouchers signed and sworn to by him, and submitted to the State auditor, who shall draw warrants upon the State treasurer for the amounts if found correct, separate vouchers being made for salary and expenses. No person shall be competent under this act to receive the appointment of State veterinary surgeon who is not at the date of his appointment either a graduate in good standing of a recognized college of veterinary surgeons, or of not less than five years actual practice as a veterinary surgeon. He shall hold his office for two years. He may be removed for cause by the governor, who shall also have power to fill the vacancy as hereinbefore provided. Before entering upon the discharge of his duties he shall give a bond to the State of North Dakota, with good and sufficient security in the sum of $5,000 conditioned for the proper discharge of the same. No constructive mileage shall be paid under this act, nor shall the State veterinary surgeon receive any mileage.

SEC. 9. The State veterinary surgeon shall select the place or places where stock shall be quarantined.

SEC. 10. All fines collected under the provisions of this act shall be paid into the public common school fund.

SEC. 11. It is hereby made the duty of the attorney-general or State's attorney of the respective counties to prosecute any case complained of for prosecution in any justice or district court within the jurisdiction of which any violation of this act may have been had, and on conviction of violating any of the provisions of this act, the court may award, in addition to the penalties prescribed by law, and add to the judgment such attorneys' fees and costs of prosecution as the court may determine just in the premises.

SEC. 12. Whereas an emergency exists in that, in order to carry out the provisions of this act, it is necessary that the State veterinary surgeon should be appointed prior to July 1, 1890; therefore, this act shall take effect and be in force from and after its passage and approval.

Approved, March 29, 1890.

AN ACT to amend sections 1, 2, 3, and 4 of chapter 135 of the general laws of 1885, entitled "An act to provide for the appointment of sheep inspectors and to provide for the supervision of sheep in case of infection."

SECTION 1. *Be it enacted by the legislative assembly of the State of North Dakota*, That section 1 of chapter 135 of the general laws of 1885 be amended to read as follows:

"SECTION 1. The county commissioners of any organized county shall, upon the presentation of a petition signed by ten wool growers of said county, appoint a sheep inspector who is acquainted with the diseases to which sheep are subject and who shall be a citizen of the county for which he is appointed, who shall hold his office for two years, unless sooner removed, and any inspector may act in an adjoining

county having no inspector, or any unorganized counties attached thereto for judicial purposes, upon the request of the commissioners of said organized county. Such inspector may appoint as many deputies as he may deem necessary."

SEC. 2. That section 2 of chapter 135 of the general laws of 1885 be amended to read as follows:

"SECTION 2. It shall be the duty of the sheep inspector, whenever he has knowledge or information that any sheep within his jurisdiction have the scab or any other malignant contagious diseases, to inspect said flock, and report in writing the result of his inspection to the county clerk in which such inspection was made, to be filed by him for reference for the county commissioners or any party concerned, and if so diseased, once every four weeks thereafter to reinspect said flock, and report in writing the result and treatment, if any, in the same manner until said disease is reported cured: *Provided*, That in case of the removal of the flock ten miles from the range of any other sheep, as hereinafter provided, he shall only make one inspection every three months."

SEC. 3. That section 3 of chapter 135 of general laws of 1885 be amended to read as follows:

"SECTION 3. And upon the arrival of any flock of sheep into the State the owner or agent thereof shall immediately report them to the inspector of the county in which such sheep are located for inspection, and the inspector shall inspect and report as provided in section 2 of this act, and in case of failure from any cause of the owner or agent of such flock of sheep to report them for inspection, a penalty of one hundred (100) dollars shall be imposed on said owner or agent for each offence, by any court of competent jurisdiction, which penalty when collected shall be paid into the county treasury for the use of the sheep inspector's fund, and any judgment for such penalty shall be a lien upon such flock."

SEC. 4. That section 4 of chapter 135 of the general laws of 1885 be amended to read as follows:

"SECTION 4. The owner or his agent of any flock reported by the inspector to be so diseased, shall immediately herd them so that they can not range upon or within one mile of any grounds accustomed to be ranged upon by any other sheep, or shall restrain them from passing over or traveling upon or within one mile of any public highway or road, and in case this can not be done, he shall immediately remove said sheep to a locality where they shall not be permitted to range within less than ten miles of any other flock of sheep, and said sheep shall continue to be herded under the above restrictions until upon inspection they shall be reported free from such diseases."

SEC. 5. In no case shall any scabby sheep be allowed to be removed from any one point to another within any of said counties, or from one county to another, or any sheep that have within one year been scabby, without a written certificate from the said sheep inspector: *Provided*, Such sheep may be transferred and removed with the written consent of all sheep owners or managers along the route, and in the vicinity of the proposed location except those mentioned in the preceding section: *Provided*, That in no case shall any sheep infected with scab or any infectious disease be allowed to enter the State, and any person violating the provisions of this section shall be deemed guilty of a misdemeanor, and upon conviction shall be fined not less than fifty (50) dollars nor more than two hundred (200) dollars for each and every offence.

Approved, March 31, 1890.

AN ACT to prevent the spread of contagious and infectious diseases among domestic animals.

SECTION 1. *Be it enacted by the legislative assembly of the State of North Dakota*, That the governor of the State is hereby authorized to nominate, and with the consent of the senate to appoint, a competent veterinarian, who shall be known as the "State veterinarian," who, upon entering upon his duties, shall take an oath to well and truly perform his duties as provided by law, which said oath shall be taken before any district judge within the State, and shall be filed with the secretary of state.

SEC. 2. The duties of said "State veterinarian" shall be as follows:

First. To investigate, in person or by deputy, any and all cases of contagious or infectious diseases among cattle, horses, mules, asses, sheep, and other domestic animals in this State, of which he may have knowledge or which may be brought to his notice by any resident in any locality where such disease may exist; and it shall be his duty, in person or by deputy, in the absence of specific information, to make visits of inspection to any locality within the State, where he may have reason to believe that there are contagious or infectious diseases existing among such domestic animals,

Second. To seize and inspect, either in person or by deputy, at the State line, or as near thereto as may be possible, any horses, mules, cattle, asses, sheep, or other domestic animals, which may be unloaded temporarily or consigned to any point within this State, when the owner, agent, or person in charge thereof shall not, upon demand, produce certificates of the health of such animals satisfactory to the State veterinarian or his deputy, from a duly authorized State veterinarian or examiner of the State from which said animals have been shipped.

Third. To examine, either in person or by deputy, so often as he may deem reasonable, all pens, enclosures, and cars within the State, within which such domestic animals may be confined or transported, and to require the owner, agent, or person in charge of all such pens, enclosures, and cars to keep the same in proper sanitary condition.

Fourth. To require, either in person or by deputy, the owner, agent, or person in charge of all pens, enclosures, or cars, within which domestic animals may be confined or transported, to cleanse, fumigate, and disinfect all pens, enclosures, or cars within which such domestic animals may be confined or transported, within two days after written notice, when, in his opinion, such cleansing, fumigating, and disinfecting shall be necessary for the prevention of the spread or outbreak of any contagious or infectious disease among such animals.

Fifth. It shall also be the duty of the State veterinarian, in person or by deputy, to seize and inspect all domestic animals coming into and to remain within the State without a certificate of the health of such animals, from a duly authorized State veterinarian or examiner from the State from which said animals have been shipped, and before such animals shall be allowed by the State veterinarian to be transported into and to remain within the State. In addition to such inspection, he shall, either in person or by deputy, require from the owner of such animals, or from the agent or person in charge of such animals, an affidavit to the effect that such animals have not been exposed to any infectious or contagious disease for a period of at least ninety days prior to the making of such affidavit, and, in case the State veterinarian shall have reason to believe that any domestic animals have been exposed to, or have contracted any contagious or infectious disease, it shall be his duty to seize and inspect such animals, notwithstanding any certificate of their health by any veterinarian or examiner of any other State.

SEC. 3. The State veterinarian is hereby authorized to appoint deputy State veterinarians, in case they shall be necessary to the proper discharge of the duties of his office, who shall act under the direction and by the instruction of the State veterinarian, which said deputy State veterinarians shall each furnish a satisfactory bond, in the penal sum of one thousand dollars, to the State veterinarian for the faithful performance of their duties, and said deputy State veterinarians may be dismissed from office at the pleasure of the State veterinarian and their places may be filled by his appointment.

SEC. 4. Whenever any deputy State veterinarian shall be appointed, as provided in section 3 of this act, he shall receive for his services the sum of five (5) dollars for each day actually and necessarily employed by the direction of the State veterinarian, together with his necessary traveling expenses, actually paid out while in the performance of his duties. These payments shall be made from any funds in the State treasury, not otherwise appropriated, upon itemized vouchers signed and sworn to by him, and submitted to the State veterinarian and the State auditor. No constructive mileage shall be paid under this act to any deputy State veterinarian, nor shall any deputy State veterinarian receive any mileage.

SEC. 5. Whenever any domestic animals are seized and inspected under the provisions of this act, by the State veterinarian, or by any deputy State veterinarian, while such animals are being transported in cars, on shipboard, or brought into the State in any other manner, the State veterinarian, or any deputy State veterinarian, making such seizure and inspection, shall require the owner, agent, or person in charge of such animals to pay one-half cent each for the inspection of sheep and twenty-five cents each for all other animals named therein. All money so collected by any deputy State veterinarian shall be immediately transmitted to the State veterinarian, together with a detailed report of the seizure and inspection, and it shall be the duty of the State veterinarian to transmit, monthly, all money collected as inspection fees under the provisions of this act, to the State treasurer, who shall receipt to the State veterinarian therefor. All such fees shall be paid by the State treasurer into the State treasury general fund: *Provided*, That no inspection shall be made by any deputy State veterinarian of any domestic animals in transit through the State, without special instructions from the State veterinarian, when the owner, agent, or person in charge thereof shall produce certificates of the health of such animals from a duly authorized veterinarian or examiner from the State from which said animals have been shipped.

SEC. 6. In all cases of contagious and infectious disease among domestic animals, or Texas cattle in this State, the State veterinarian shall have authority to order the quarantine of the infected premises and animals, and in case such disease shall become epidemic in any locality in this State, the State veterinarian shall immediately notify the governor of the State, who shall thereupon issue his proclamation, forbidding any animals, of the kind among which said epidemic exists, to be transferred from said locality without a certificate from the State veterinarian showing such animals to be healthy. The expense of holding, feeding, and taking care of all animals quarantined under the provisions of this act shall be paid by the owner, agent, or person in charge of said animals.

SEC. 7. In case of any epidemic diseases, where premises and animals have been previously quarantined by the State veterinarian, as before provided, he is further authorized and empowered, when in his judgment it is necessary, to order the slaughter of any and all diseased animals upon said premises. Said order shall be a written one, and shall be made in duplicate, and there shall be a distinct order in duplicate for each owner of the animals condemned, the original of each order to be filed by the State veterinarian with the governor of the State, and the duplicate given to the said owner, agent, or person in charge of said condemned animals. It shall be the duty of the owner, agent, or person in charge of any and all animals slaughtered under the provisions of this act, to immediately bury the carcasses of such slaughtered animals in a trench at least six feet in depth and at least four feet beneath the surface of the ground, or burn or consume such carcasses, under the direction of the State veterinarian or his deputy; and it is hereby made the duty of the State veterinarian, in person or by deputy, to require the owner, agent, or person in charge of such slaughtered animals to immediately bury or burn the carcasses of such slaughtered animals as herein provided.

SEC. 8. The State veterinarian shall make a report at the end of every year to the governor of all matters connected with his work, and the governor shall transmit to the several boards of county commissioners such parts of said report as may be of general interest to the breeders of live stock. The governor shall also give information in writing, as soon as he obtains it, to the various boards of county commissioners, of each case of suspicion or fresh outbreak of disease in each locality, its cause, and the measures adopted to check it.

SEC. 9. It shall be the duty of any owner, person, or agent in charge of any cattle, horses, mules, asses, sheep, or other domestic animals, when such owner, agent, or person in charge intends to bring any such animals into this State for distribution, sale, residence, or transportation, without a certificate of their health from a duly authorized veterinarian or examiner of the State from which such animals are shipped, to give notice, in writing, to the State veterinarian at least three days before such animals are brought into this State beyond the quarantine station at the State line; and it shall be the duty of any person or persons who shall have knowledge or suspect that there is upon his or their premises, or upon the public domain, any case of contagious or infectious disease among domestic animals or Texas cattle, to immediately report the same to the State veterinarian, and a failure so to do, or any attempt to conceal the existence of such diseases, or a failure to give notice before passing the quarantine station at the State line, as in this section required, or to willfully or maliciously obstruct or resist the State veterinarian or his deputies in the discharge of his duty, as set forth in this act, shall be deemed a misdemeanor, and any person or persons who shall be convicted of any one of the above acts or omissions, shall be fined not less than fifty (50) dollars nor more than $2,000 for each and every such offense; and upon conviction a second time shall, in addition to the above-named fine, be imprisoned in the county jail for a term of not less than ninety days nor more than one year.

SEC. 10. The following regulations shall be observed in all cases of disease covered by this act:

First. It shall be unlawful to sell, give away, or in any manner part with any animal affected with, or suspected with being affected with, any contagious or infectious disease, and in case of any animal that may be known to have been affected with or exposed to any such disease within one year prior to such disposal, due notice of the fact shall be given in writing to the party receiving the animal.

Second. It shall be unlawful to kill for butcher purposes any such animal; to sell, give away, or use any part of it or its milk, or to remove any part of the skin. A failure to observe these provisions shall be deemed a misdemeanor, and, on conviction, shall be punished by a fine not less than one hundred (100) dollars nor exceeding two thousand dollars; and, in addition to the above-named fine, be imprisoned in the county jail for a term of not less than ninety days nor more than one year. It shall be the duty of the owner, or person having in charge any animal infected with or suspected of being infected with any contagious or infectious disease,

to immediately confine the same in a safe place, isolated from all other animals, and with all necessary restrictions to prevent the dissemination of the disease until the arrival of the State veterinarian. The above regulations shall apply as well to animals in transit through the State as to those resident therein; and the State veterinarian, or his duly authorized deputy, shall have full authority to examine, whether in car or yard, or pasture or stables, or upon the public domain, all animals passing through the State, or any part of it, and on detection or suspicion of disease, take possession of and treat and dispose of such animals in the said manner as is prescribed for animals resident in the State.

SEC. 11. The State veterinarian shall receive for his services the sum of $2,000 per annum, together with his necessary traveling expenses actually paid out when in the performance of his duty: *Provided*, Such expenses shall not exceed $2,000 in any one year. These payments shall be made from any funds in the State treasury not otherwise appropriated, monthly, upon itemized vouchers, signed and sworn to by him, and submitted to the State auditor, who shall draw warrants upon the State treasurer for the amounts, if found correct, separate vouchers being made for salary and expenses. No person shall be competent under this act to receive the appointment of State veterinarian who is not, at the date of his appointment, either a graduate in good standing of a recognized college of veterinary surgeons or of not less than ten years' actual practice as a veterinary surgeon in this State. He shall hold his office for two years. He may be removed for cause by the governor, who shall also have power to fill the vacancy as hereinbefore provided. Before entering upon the discharge of his duties he shall give bond to the State of North Dakota, with good and sufficient security, in the sum of $5,000, conditioned for the proper discharge of the same. No constructive mileage shall be paid under this act, nor shall the State veterinarian receive any mileage.

SEC. 12. The State veterinarian or his deputy shall select the place or places at which all animals referred to herein shall be quarantined.

SEC. 13. All fines collected under the provisions of this act shall be paid into the public common school fund.

SEC. 14. It is hereby made the duty of the attorney-general or State's attorney of the respective counties to prosecute any case complained of by the State veterinarian for prosecution, in any justice or district court within the jurisdiction of which any violation of this act may have been had, and on conviction of violating any of the provisions of this act the court may award, in addition to the penalties prescribed by law, and add to the judgment such attorney's fees and costs of prosecution as the court may determine just in the premises.

SEC. 15. It shall, in addition to their duties already defined by law, be the duty of all sheep inspectors, and the State veterinarian shall require all sheep inspectors, to report in writing, at the end of each calendar month, to the State veterinarian, any knowledge or information such sheep inspectors may possess relative to any diseased sheep which may be within his own or adjacent counties; and whenever, in the opinion of the State veterinarian, any sheep inspector is incompetent to or neglects or refuses to attend in a proper manner to his duties, the State veterinarian, in person or by deputy, may take charge of any diseased sheep in such county, and dip and treat them in the manner provided for in the law relating to sheep inspectors, chapter 135, general laws of 1885; and the owner, agent, or person in charge of such sheep shall be required by the State veterinarian, in person or by deputy, to pay a fee of five (5) dollars per day, together with the necessary expenses of the State veterinarian or his deputy, while in the performance of his duty, as set forth in this section 15, and said fees shall be a lien on the sheep inspected, subject to foreclosure, same as chattel mortgages. All fees and other money collected by the State veterinarian or his deputy, under the provisions of this section 15, shall be remitted, turned over, receipted for, and placed in the State treasury general fund in the same manner as is provided for inspection fees in section 5 of this act.

SEC. 16. In all counties of this State where a sheep inspector has been or may be appointed, as provided for by law, the resident sheep therein shall be under the supervision and inspection of such sheep inspector: *Provided, however*, Upon a written application, signed by not less than three sheep owners, the State veterinarian or his deputy shall visit such county and take such authority or give such directions as in his judgment is necessary.

SEC. 17. No railroad company shall transport any cattle, horses, mules, asses, sheep, or other domestic animals into this State, to be unloaded, temporarily, or consigned to any point within this State, without a certificate of health of such animals from a duly authorized State veterinarian or examiner from the State from which said animals have been shipped, nor shall any such animals be shipped out of the State without such certificate of health; *Provided, however*, That said veterinarian, surgeon or his deputy shall issue such certificate of health without charge

when such animals are shipped out of this State. Any violation of this section shall be deemed a misdemeanor and punished by a fine of not less than fifty (50) dollars nor more than $5,000.

SEC. 18. All acts and parts of acts conflicting with the provisions of this act are hereby repealed.

SEC. 19. Whereas, an emergency exists in that the existing law is defective and inadequate to enable the State veterinarian to properly discharge the duties of his office, prior to July 1, 1891; therefore, this act shall take effect and be in force from and after its passage and approval.

Approved, March 6, 1891.

AN ACT to provide for the appointment of sheep inspectors and to provide for the supervision of sheep in case of infection.

SECTION 1. *Be it enacted by the legislative assembly of the State of North Dakota*, That the county commissioners of any organized county shall, upon the presentation of a petition signed by ten wool growers of said county, appoint a sheep inspector who is acquainted with the diseases to which sheep are subject, and who shall be a citizen of the county for which he is appointed, who shall hold his office for two years, unless sooner removed. Such inspector may appoint as many deputies as he may deem necessary.

SEC. 2. It shall be the duty of the sheep inspector, whenever he has knowledge or information that any sheep within his jurisdiction have the scab or any other malignant contagious disease, to inspect said flock and report in writing the result of his inspection to the State veterinarian, to be filed by him for reference for the county commissioners or any party concerned; and if so diseased, once every four weeks thereafter to reinspect said flock and report in writing the result and treatment, if any, in the same manner until said disease is reported cured.

SEC. 3. The owner, or his agent, of any flock reported by the inspector to be so diseased shall immediately herd them so that they can not range upon or within one mile of any grounds accustomed to be ranged upon by any other sheep, or shall restrain them from passing over or traveling upon or within one mile of any public highway or road, and in case this can not be done he shall immediately remove said sheep to a locality where they shall not be permitted to range within less than five miles of any other flock of sheep, and said sheep shall continue to be herded under the restrictions until, upon inspection, they shall be reported free from such disease.

SEC. 4. The owner or the person in charge of any sheep which are now or shall hereafter be affected with the scab or any infectious or contagious disease shall keep the said sheep securely within some enclosure, or shall herd them at a distance or [of] not less than five miles from all farms, corrals, sheds. or other established headquarters where sheep are kept or are being herded: *Provided*, That any persons owning sheep affected with the scab or any infectious or contagious disease, who prior to the passage of this act established headquarters, shall be allowed to range such sheep upon the public domain within five miles in any direction of such established headquarters: *Provided further*, That such sheep shall not be allowed to range within three miles of any other headquarters, unless the other headquarters be less than five miles distant, in which case such sheep shall not be herded nearer to the other headquarters than a distance equal to one-half of the distance between the two headquarters.

SEC. 5. Any person owning sheep or any one in his employ shall have the right to examine any band of sheep that shall be driven within five miles of his headquarters, and any person or persons in charge of such sheep shall stop them and allow them to be examined and shall render the necessary assistance in catching and examining them. If the person so in charge of sheep refuse to render the assistance as above required he shall be punished as hereinafter provided.

SEC. 6. Any person who shall knowingly carry or drive or cause to be carried or driven one or more sheep affected with the scab, or any infectious or contagious disease, into a herd of sheep belonging to another person, or shall knowingly carry or cause to be carried the parasite which causes such scab or disease and place it where another person is corralling or herding sheep so that such person may become affected thereby, shall be adjudged guilty of a misdemeanor, and upon conviction thereof shall be confined in the State prison not more than five years or in the county jail not exceeding one year, and shall pay a fine of not less than one hundred (100) dollars nor more than $1,000, or by both such fine and imprisonment, in the discretion of the court.

SEC, 7. Any person violating any of the provisions of this act shall be liable in damages to any person or persons injured thereby directly or indirectly, to be recovered in a civil action in any court of competent jurisdiction.

SEC. 8. Every inspector, before entering upon the duties of his office, shall take oath of office prescribed by law and shall give bond to the State of North Dakota in the sum of $1,000 with good sureties, conditioned that he will faithfully perform the duties of his office; such bond shall be approved by the board of county commissioners.

SEC. 9. Such bond, with the oath indorsed thereon, shall be recorded in the office of the clerk of the district court for the county in which the inspector shall reside, and may be sued on by any person injured on account of the unfaithful performance of said inspector's duty: *Provided*, That no suit shall be so instituted after more than twelve months have elapsed from the time the cause of action occurred.

SEC. 10. Every owner of sheep having scab or other malignant contagious disease shall dip or otherwise treat the same upon his own premises: *Provided*, That when he has more than one ranch or set of ranches and the diseased sheep are not upon the ranch where the dipping works or other facilities for treating the diseased are situated, he shall have the right to drive through intermediate ranges, but in so doing shall consult the owners or occupants of said ranges as to where he shall cross the same, and in no case shall he enter another's corral or water at his troughs or accustomed watering places with his diseased sheep without the written or otherwise expressed consent of the owner, and for every violation of the provisions herein he shall be subject to a penalty of not exceeding one hundred (100) dollars.

SEC. 11. The inspector shall receive for his services five (5) dollars per day while necessarily employed in inspecting, which shall be paid out of the county general fund in the same manner and form as claims against the county are paid: *Provided, however*, The board of county commissioners shall require said sheep inspector to present an itemized statement of the number of sheep inspected and the number of days actually employed in the performance of his official duties.

SEC. 12. In all cases where scab or other contagious diseases are found in any flock of sheep, the sheep inspector is hereby empowered to prescribe what dip or other remedies shall be applied and specify the manner of treatment.

SEC. 13. In all cases where sheep are brought into any county of this State the owner or person in charge of said sheep shall notify the inspector of the date of the arrival in said county, and before being allowed to mingle with other sheep shall be quarantined for a period of not less than forty days, in a location approved of by the sheep inspector of said county: *Provided, however*, Where sheep have been ranged for not less than forty days near the county line of the county to which said sheep are to be removed and are known to be free from disease, the provisions of this section shall not apply.

SEC. 14. In all cases where sheep are diseased and the owner or person in charge shall permit any of said sheep to stray away from their land [band] he or they shall be guilty of a misdemeanor and shall be subject to a fine of not less than one hundred (100) nor more than five hundred (500) dollars.

SEC. 15. All fines and penalties for violation of any of the provisions of this act shall constitute a lien upon the flock, subject to foreclosure the same as chattel mortgages are foreclosed.

SEC. 16. All acts and parts of acts in conflict with any of the provisions of this act are hereby repealed.

SEC. 17. An emergency exists in this that contagious diseases are known to exist among flocks of sheep within this State and the sheep inspectors are powerless to enforce proper restrictions, therefore this act shall become a law from and after its passage and approval.

Approved, March 9, 1891.

OHIO.

AN ACT to prevent the introduction of Texas fever among cattle.

WHEREAS all cattle wintered in the States of Florida, South Carolina, North Carolina, Georgia, Alabama, Mississippi, Louisiana, Tennessee, Arkansas, Texas, and the Indian Territory are infected with a germ which renders them capable, except during the frost of winter, of infecting Northern cattle with a malady commonly known as "Texas fever," while they show no manifestation of disease: Therefore,

SECTION 1. *Be it enacted by the general assembly of the State of Ohio*, That during the months of March, April, May, June, July, August, September, and October, no cattle shall be permitted to be driven into this State from any of the above mentioned States or Indian Territory, or that shall have been wintered therein, nor shall any person or company bring, or cause to be conveyed into this State by railway or otherwise, any such cattle under such conditions, except as specified in the next section of this act.

SEC. 2. Any railroad or other transportation company conveying any such cattle through this State during the months aforesaid, will not be permitted to unload the same in this State for any other purpose than to be fed and watered, and in yards and premises especially provided for that purpose, and into which Northern cattle shall not be permitted to enter.

SEC. 3. Any person or corporation that shall bring or cause to be brought or driven into this State any cattle wintered in the States or Territory above mentioned, or to be driven or conveyed otherwise than as herein specified, shall, upon conviction thereof, be fined in any sum not less than one hundred dollars nor more than one thousand dollars, and shall, moreover, be liable for all damages that may be occasioned on account of other cattle being infected with said disease.

SEC. 4. It shall be the duty of all railway and other transportation companies bringing into and unloading in this State cattle, otherwise than as specified in section 2 of this act, during the months above specified, to require a statement to be made in their shipping bills, showing in what State or Territory the cattle shipped were wintered; and it shall be the duty of every railroad company bringing into this State cattle, which may unload such cattle for any other purpose than to be fed and watered as specified in section 2 of this act, to leave at the office of such company nearest the point where such cattle may be unloaded a copy for public inspection of the statement above required, showing where the same were wintered, and any company or corporation neglecting to comply with the provisions of this section shall, upon conviction thereof, be fined in any sum not exceeding five hundred dollars.

SEC. 5. Proceedings against any railway company under this act may be had in any county in this State through which any portion of such company's road may pass, or in which its principal office may be situated, and process may be served by leaving a copy at the office of such company within such county.

SEC. 6. This act shall take effect and be in force from and after its passage.

Passed March 14, 1888.

OREGON.

AN ACT to prevent the spread of contagious animal diseases.

SECTION 1. *Be it enacted by the legislative assembly of the State of Oregon.* That the governor, secretary of State, and the president of the State board of agriculture are hereby created a board, under the name and style of the "Oregon domestic animal commission." Said commission shall appoint a competent and skilled veterinary surgeon for the State, who shall hold the office for two years, or until his successor is appointed.

SEC. 2. Said veterinary surgeon, before he enters upon the duties of his office, shall take and subscribe to the constitutional oath of office, and file the same with the secretary of State.

SEC. 3. The salary of the State veterinarian shall be fixed by the commissioner [commission], and shall not exceed one thousand dollars a year and his necessary traveling expenses, and the salary of the commissioners, except the secretary of state, shall be $250 each per annum.

SEC. 4. It shall be the duty of the commission to protect the health of the domestic animals of the State from all contagious or infectious diseases of a malignant character, and for this purpose it is hereby authorized and empowered to establish, maintain, and enforce such quarantine, sanitary, and other regulations as it may deem necessary.

SEC. 5. It shall be the duty of the stock inspector of each county who discovers, suspects, or has reason to believe that any domestic animal or animals in his county is affected with any dangerous contagious disease to immediately report such fact to the State veterinarian.

SEC. 6. It shall be the duty of said State veterinarian, upon receipt of such information from a stock inspector of any county that any contagious or infectious disease does exist, to immediately examine, or deputize a competent person to examine, all animals reported to be diseased, and if he finds that such animals are infected with a contagious or infectious disease, he shall promptly take such measures as he may deem expedient and necessary to prevent the spread of the disease; he shall also immediately notify the commission of his actions, which shall be subject to the approval of the commission, who shall subsequently instruct him how to proceed, and prescribe such rules and regulations as in their judgment the exigencies of the case may require for the effectual suppression and eradication of the disease, and for that purpose the State veterinarian may list and describe the domestic animals affected with such disease, and those which have been exposed thereto, and

included within the infected district or premises so defined, and quarantine with such reasonable certainty as would lead to their identification; and no domestic animal liable to become infected with the disease, or capable of communicating the same, shall be permitted to enter or leave the district, premises, or grounds quarantined except by the authority of the commission, When, in the opinion of the commission, it shall be necessary, to prevent the spread of contagious or infectious disease among the live stock of the State, to destroy animals affected with or which have been exposed to any such diseases, it shall be determined what animals shall be killed, and appraise the same, as hereinafter provided, and cause the same to be killed and the carcasses disposed of as in their judgment will best protect the health of domestic animals of the localities.

SEC. 7. When, in the opinion of the commission, it becomes necessary to restrict or regulate the traffic of domestic animals coming from other States, Territories, and counties [countries] to this State, they shall establish quarantine stations and prescribe such other rules and regulations as they may deem essential; also, may compel railroad companies that are operating railroads within the State to disinfect cars, yards, or premises, and keep all stock cars in a cleanly and healthy condition that are under their control where animals affected with contagious or infectious diseases have been; and by the consent of the governor can prohibit said companies or individual owners of railroads, steamboats, ships and all other conveyances from bringing domestic animals into the State contrary to the regulations of the commission.

SEC. 8. When the commission shall have determined the quarantine and other regulations necessary to prevent the spread among domestic animals of any malignant, contagious, or infectious disease found to exist among the live stock of this State, or liable to be brought from other States, Territories, or countries, and given their orders, as hereinbefore provided, prescribing quarantine and other regulations, the governor shall issue his proclamation, proclaiming the boundary of such quarantine and the orders, rules, and regulations prescribed by the commission, which proclamation may be published by written or printed handbills posted within the boundaries or on the lines of the district, premises, places, or grounds quarantined: *Provided*, That if the commission decide that it is not necessary by reason of the limited extend [extent] of the district in which such disease exists that a proclamation should be issued, then none shall be issued; but such commission shall give such notice as may to it seem best to make the quarantine established by it effective.

SEC. 9. Whenever the commission shall direct the killing of any domestic animal or animals it shall be the duty of the commission to appraise the animal or animals condemned, and in fixing the value thereof the commission shall be governed by the value of said animal or animals at the date of appraisement, taking into consideration its diseased condition.

SEC. 10. Whenever any live stock have been appraised and killed by order of the commission it shall issue to the owner of the stock so killed a certificate showing the number and kind of animals killed and the amount to which the owner is entitled, and the secretary of state shall draw his warrant on the State treasurer for the amount therein stated, payable out of any money in the treasury not otherwise appropriated.

SEC. 11. When any animal or animals are killed under the provisions of this act by order of the commission, the owner thereof shall be paid therefor the appraised value as fixed by the appraisement hereinbefore provided for: *Provided*, The right of indemnity on account of animals killed by order of the commission under the provisions of this act shall not extend to the owners of animals which have been brought into the State in a disease [diseased] condition, or from a State, country, Territory, or district in which the disease with which the animal is affected or to which it has been exposed exists, nor shall any animal be paid for by the State which may be brought into the State in violation of any law or quarantine regulations thereof, or the owner of which shall have violated any of the provisions of this act or disregarded any rule, regulation, or order of the commission. Nor shall any animal be paid for by the State which came into the possession of the owner with claimant's knowledge that such animal was diseased or was suspected of being diseased or of having been exposed to any contagious or infectious disease.

SEC. 12. Any person who shall have in his possession any domestic animal affected with any contagious or infectious disease, knowing such animal to be so affected, or after having received notice that such animal is so affected, who shall permit such animal to run at large, or who shall keep such animal where other domestic animals not affected by or previously exposed to such disease may be exposed to such contagion or infection, or who shall sell, ship, drive, trade, or give away such diseased animal or animals which have been exposed to such contagion or infection, or who shall move or drive any domestic animal in violation of any direction, rule,

or regulation or order establishing and regulating quarantine, shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be fined in any sum not less than $10 nor more [than] $250 for each of such diseased or exposed domestic animals which he or they shall permit to run at large or keep, sell, ship, drive, trade, or give away in violation of the provisions of this act: *Provided*, That any owner of any domestic animal which has been affected with or exposed to any contagious or infectious disease may dispose of the same after having obtained from the State veterinarian a certificate of health for such animal: *Provided, also*, That horses running on the range within this State infected with distemper, lung, or mountain fever shall be exempt from the operation of this act.

SEC. 13. Any person who shall knowingly bring into the State any domestic animal which is affected with any contagious or infectious disease, or any animal which has been exposed to any contagious or infectious disease, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined not less then [than] $10 or more than $250.

SEC. 14. Any person who owns or is in possession of live stock which is affected, or which is suspected or reported to be affected, with any contagious or infectious disease, who shall willfully prevent or refuse to allow the State veterinarian, or commissioners, or other authorized officer or officers, to examine such stock, or shall hinder or obstruct the State veterinarian or other authorized officer or officers in any examination of, or in any attempt to examine such stock, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not less than $10 nor more than $250.

SEC. 15. Any person or persons who shall willfully violate or evade, or attempt to violate, disregard, or evade any of the provisions of this act, or who shall willfully violate, disregard, or evade any of the rules, regulations, orders, or directions of the commission establishing and governing quarantine, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in any sum not less than $10 nor more than $250.

SEC. 16. The commission provided for in this act shall have power to employ, at the expense of the State, such persons and purchase such supplies and material as may be necessary to carry into full effect all orders by it given, and to pay a reasonable compensation therefor.

SEC. 17. The commission shall have power to call upon any sheriff, undersheriff, deputy sheriff, or constable to execute their orders, and such officers shall obey the orders of said commission, and the officers performing such duties shall receive compensation therefor as is prescribed by law for like services, and shall be paid therefor in like manner, and any officer may arrest and take before any justice of the peace of the county [any person found violating] any of the provisions of this act, and such officer shall immediately notify the prosecuting attorney of such arrest, and he shall prosecute the person so offending according to law.

SEC. 18. Whenever the governor of the State shall have good reason to believe that any dangerous, contagious, or infectious disease has become epizoötic in certain localities in other States, Territories, or countries, or that there are conditions which render such domestic animals from such infected districts liable to convey such disease, he shall by proclamation prohibit the importation of any live stock of the kind disease [diseased] into the State, unless accompanied by a certificate of health, given by a duly authorized veterinary surgeon; and all such animals arriving in this State shall be examined immediately upon their arrival by the State veterinarian, and if in his opinion there is any danger of contagion or infection they shall be placed in close quarantine until such danger of contagion and infection is passed, when they shall be released by order of the commissioners; provided, that sheep shall be exempt from the operation from this act.

SEC. 19. For the purpose of this act, each member of the commission is hereby authorized and empowered to administer oaths and affirmations.

SEC. 20. This commission is hereby anthorized and required to coöperate with any board or commission acting under any present or future act of Congress for the suppression and prevention of contagious or infectious diseases among domestic animals, and the same right of entry, inspection, and condemnation of diseased animals upon private premises is granted to the United States Board of Commissioners as is granted to the commission under this act.

SEC. 21. The commission shall make biennially a detailed report of its doings to the legislature at its regular business session.

SEC. 22. This act shall take effect immediately upon its passage by the senate and house and has been approved by the governor.

Approved, February 25, 1889.

AN ACT to amend section 3 of an act approved February 25, 1889, entitled "An act to amend section 3350, section 3351, section 3353, section 3354, and section 3362, and to repeal section 3359 and section 3360 of title I, of chapter xxxviii of the miscellaneous laws of Oregon, as compiled and annotated by William Lair Hill."

SECTION 1. *Be it enacted by the legislative assembly of the State of Oregon*, That section 3 of the act of the legislative assembly of the State of Oregon, approved February 25, 1889, entitled "An act to amend section 3350, section 3351, section 3353, section 3354, and section 3362, and to repeal section 3359 and section 3360 of title I, of chapter xxxviii, of the miscellaneous laws of Oregon, as compiled and annotated by William Lair Hill," be amended to read as follows:

SEC. 3. That section 3353 of title I, of chapter xxxviii, of the miscellaneous laws of Oregon, as compiled and annotated by William Lair Hill, be amended so as to read as to follows:

"SEC. 3353. Whenever, on examination of any bands or herds of sheep, kept or herded in any county in the State of Oregon, the stock inspector shall find such sheep, or any portion of them, affected with scabs or scabies, or any infectious or contagious disease, he shall forthwith notify the owner or person in charge of such sheep, in writing, to dip said sheep for said disease within a period of fifteen days from such notice, and also during such period to keep said sheep from contact with other sheep by such means as he may specify; and if the owner or owners, or person or persons in charge of said sheep, shall not dip said sheep for said disease, as required by said notice within said fifteen days, or if said diseased sheep shall not be kept from contact with other sheep that are free from said disease or diseases by such means as the said inspector may specify, the owner or owners, or person or persons controlling said sheep shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than one hundred nor more than two hundred and fifty dollars; and in case said sheep have not been dipped for said disease, the inspector shall immediately take possession of said sheep and dip them for said disease, and all expenses incurred in so doing, including a compensation of three dollars per day for every day or part of a day in which the inspector may be engaged in dipping said sheep, shall become a lien upon said sheep, and the inspector shall hold the sheep until the same is paid; or if it be not paid within ten days after such dipping is completed, he shall collect the same, together with the costs and expenses of collection, by advertising and selling said sheep, or so many thereof as may be necessary, in the manner provided by law for the sale of personal property upon execution. If, however, upon examination at the end of thirty days from such notice, as before mentioned, the inspector finds that said sheep have been dipped for such disease, but are still infected with the same, then he shall instruct the owner or controller of said sheep to dip said sheep once or more, as soon as possible, but with an interval between the dippings of not less than nine nor more than seventeen days; and if, upon examination at the end of thirty days further, the inspector finds that said sheep have been dipped for said disease, but are still infected, then he shall at once take possession of said sheep and dip them for said disease as above specified. If, however, upon examination he finds said sheep have not been dipped for said disease, he shall seize said sheep and dip them for said disease as above specified, and the owner or owners shall be guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than one hundred nor more than two hundred and fifty dollars: *Provided*, No person, company, or corporation shall be required to dip a band of ewes, or any part of them, in which there are ewes with lambs, at any time from the first of March to the first of May of any year: *Provided further*, That in Lake County no person, company, or corporation shall be required to dip or treat any ewes at any time from the first day of April to the first day of July: *And provided further*, That no owner of a flock of ewes and lambs keeping his flock west of the Cascade range shall be required to dip such sheep between the first day of January and the first day of May of each year."

Approved, February 18, 1891.

AN ACT to amend sections 3, 4, 5, 6, and 17 of an act entitled "An act to prevent the spread of contagious animal diseases," passed at the session of 1889, and approved February 25, 1889.

SECTION 1. *Be it enacted by the legislative assembly of the State of Oregon*, That section 3 of an act entitled "An act to prevent the spread of contagious animal diseases," approved February 25, 1889, be amended so as to read as follows:

"SEC. 3. The salary of the State veterinarian shall be fixed by the commission and shall not exceed fifteen hundred dollars a year and his necessary traveling expenses, and the salaries of the commissioners shall be two hundred and fifty dollars each per annum."

SEC. 2. That section 4 of an act entitled "An act to prevent the spread of contagious animal diseases," passed at the session of 1889, and approved February 25, 1889, be amended so as to read as follows:

"SEC. 4. It shall be the duty of the commission to protect the health of the domestic animals of the State from all contagious or infectious diseases of a malignant character, and for this purpose it is hereby authorized and empowered to employ local inspectors in localities where the commission deem it essential for the protection of domestic animals from contagious diseases, and to establish, maintain, and enforce such quarantine, sanitary, and other regulations as it may deem necessary."

SEC. 3. That section 5 of an act entitled "An act to prevent the spread of contagious animal diseases," passed at the session of 1889, and approved February 25, 1889, be amended so as to read as follows:

"SEC. 5. It shall be the duty of the stock inspector of each county, and of each local inspector, who discovers, suspects, or has reason to believe that any domestic animal or animals in his county or locality is affected with any dangerous contagious disease to immediately report such fact to the State veterinarian."

SEC. 4. That section 6 of an act entitled "An act to prevent the spread of contagious animal diseases," approved February 25, 1889, be amended so as to read as follows:

"SEC. 6. It shall be the duty of said State veterinarian, upon the receipt of such information from a stock inspector of any county that any contagious or infectious disease does exist, to immediately examine or deputize a competent person to examine all animals reported to be diseased, and if he finds that such animals are infected with a contagious or infectious disease, he shall promptly take such measures as he may deem expedient and necessary to prevent the spread of the disease; he shall also immediately notify the commission of his actions, which shall be subject to the approval of the commission, who shall subsequently instruct him how to proceed, and prescribe such rules and regulations as in their judgment the exigencies of the case may require for the effectual suppression and eradication of the disease, and for that purpose the State veterinarian may list and describe the domestic animals affected with such disease, and those which have been exposed thereto and included within the infected district or premises so defined and quarantined, with such reasonable certainty as would lead to their identification; and no domestic animal liable to become infected with the disease or capable of communicating the same, shall be permitted to enter or leave the district, premises, or ground quarantined, except by authority of the commission. When, in the opinion of the commission, it shall be necessary to prevent the spread of contagious or infectious disease among the live stock of the State, to destroy animals affected with or which have been exposed to any such disease, it shall determine what animals shall be killed, and appraise the same, as hereinafter provided, and cause the same to be killed and the carcasses disposed of, as in their judgment will best protect the health of domestic animals of the localities."

SEC. 5. That section 17 of "An act entitled an act to prevent the spread of contagious animal diseases," approved February 25, 1889, be amended so as to read as follows:

"SEC. 17. The commission shall have power to call upon any sheriff, undersheriff, deputy sheriff, constable, or stock inspector of any county to execute their orders, and such officers shall obey the orders of said commission, and the officers performing such duties shall receive compensation therefor as is prescribed by law for like services, and shall be paid therefor in like manner, and any officer may arrest and take before any justice of the peace of the county any person found violating any of the provisions of this act, and such officer shall immediately notify the prosecuting attorney of such arrest, and he shall prosecute the person so offending, according to law."

SEC. 6. Inasmuch as the labor required of the commissioners and the State veterinarian is in excess of the compensation now allowed, this act shall take effect and be in force from and after its passage.

Filed in the office of the secretary of state, February 21, 1891.

PENNSYLVANIA.

AN ACT to prevent the extension of disease among cattle

SECTION 1. *Be it enacted, etc.*, That it shall not be lawful for any person who may own any cattle or sheep affected by the disease known as pleuro-pneumonia, or other contagious or infectious disease, to sell or otherwise dispose of any cattle, either alive or slaughtered, from the premises where such disease is known to exist,

nor for a period of two months after such disease shall have disappeared from said premises.

SEC. 2. That no cattle or sheep shall be allowed to run at large in any township or borough where any contagious disease prevails; and the constables of such townships are hereby authorized and required to take up and confine any cattle so found running at large, until called for and until all costs are paid; and in townships where there are no constables, it shall be the duty of the township clerk to perform this service; and the said officers shall be entitled to receive one dollar for each head of cattle so taken up; and any officer who shall refuse to perform the duties of this act shall be liable to a fine of ten dollars.

SEC. 3. Any person offending against the provisions of the first section of this act shall be guilty of a misdemeanor, and upon conviction be sentenced to pay a fine not exceeding five hundred dollars or undergo an imprisonment not exceeding six months.

Approved, April 12, A. D. 1866.

AN ACT to prevent the spread of contagious diseases among domestic animals.

SECTION 1. *Be it enacted, etc.*, That when it shall be brought to the notice of the secretary of the State board of agriculture that any contagious disease, not otherwise provided for by law, prevails among domestic animals, he may take such measures to prevent its spread as may be deemed expedient, and for this purpose shall have power to place infected animals, herds, buildings, and farms in quarantine, and to prevent the movement of animals or objects likely to convey the contagion, except upon proper permits, and, with the consent and approval of the governor, to make such rules and regulations for the government of such quarantine as may be deemed necessary to effectively carry out the purpose of this act.

SEC. 2. That any person or persons who shall willfully or intentionally interfere with any officer or officers, duly authorized to carry out the provisions of this act, or who shall willfully or intentionally violate the provisions of the quarantine authorized by section one of this act, shall be deemed guilty of a misdemeanor, and upon conviction shall be liable to an imprisonment not exceeding three months, or a fine not exceeding one hundred dollars, or both, at the discretion of the court.

SEC. 3. That when it shall be necessary or expedient to kill any animal or animals to prevent the spread of contagious diseases, it or they shall first be appraised by sworn appraisers, who shall have due consideration for the actual condition of the animal or animals at the time of appraisement, and the owner or owners shall be entitled to receive from the secretary of the State board of agriculture a certificate of value, which may be paid from current appropriations or by a subsequent appropriation by the legislature: *Provided*, That the amount of such certificates issued in any one year shall not exceed the sum of twenty-five hundred dollars.

SEC. 4. That for the economical eradication of contagious diseases of domestic animals, the secretary of the State board of agriculture shall have power, with the consent and approval of the governor, to arrange for and carry into effect terms of coöperation with the proper officers of the National Government.

SEC. 5. That all acts or parts of acts inconsistent herewith are hereby repealed.

Approved the 9th day of May, A. D. 1889.

RHODE ISLAND.

AN ACT for the suppression of tuberculosis among cattle.

SECTION 1. *It is enacted by the general assembly as follows:* The State board of agriculture shall cause an examination to be made of any herd of cattle, or of any single animal in the State, whenever it shall appear that there is reason to suspect that such herd or animal is affected with tuberculosis; and upon confirmation of such suspicion, shall direct the disposal of the affected animal or animals according to their best discretion.

SEC. 2. Whenever the examination directed by the State board of agriculture shall fail to discover conclusive evidence of the existence of tuberculosis in the suspected animal or animals, the professor of veterinary science at the Rhode Island State agricultural school and experiment station at Kingston shall examine such animal or animals, and his examination and opinion shall be final thereon.

SEC. 3. Whenever it may be deemed expedient to slaughter any animal or animals having tuberculosis, the value of such animal or animals, if killed on the written order of the said board, shall be appraised by three disinterested persons appointed by the said board, immediately before such animal or animals are

slaughtered, and such appraised value shall be paid to the owner upon a bill approved by the governor, and the State auditor is hereby authorized to draw his order on the general treasurer for the amount approved, the same to be paid to the owner out of any money in the treasury not otherwise appropriated: *Provided*, That not more than $40 shall be paid for any single native animal, nor more than $75 for any single grade animal, nor more than $100 for any single registered animal; and further, that when any owner shall be shown to have knowingly brought any animal suffering or suspected to be suffering from tuberculosis into his herd, or has concealed the existence of that disease in his herd, nothing shall be paid to such owner for animals slaughtered under this act.

SEC. 4. Whenever the board, or the veterinarian employed under this act, shall deem it expedient to quarantine any animal or animals, one-third of the expense of such quarantine shall be paid by the State, as provided in section 3.

SEC. 5. The veterinarian named in this act shall be paid a sum equal to that expended for his actual traveling expenses and no more; such sum to be paid on affidavit of such veterinarian, and in the manner provided in section 3.

Approved, July 31, 1891.

SOUTH DAKOTA.

AN ACT to prohibit the importation, sale, or exposure of infected animals and to prescribe punishments therefor.

SECTION 1. *Be it enacted by the legislative assembly of the Territory of Dakota*, If any person knowingly import or bring into this Territory any horse, mule, or ass affected by the disease known as glanders or button-farcy, or suffer the same to run at large upon any common, highway, or uninclosed land, or use, tie, or keep the same in any public place, stable, or barn, or sell, trade, or offer to sell or trade any such horse, mule, or ass, knowing or having good reason to believe the same to be so diseased, he shall be deemed guilty of a misdemeanor and shall on conviction be punished by a fine of not less than fifty nor more than five hundred dollars, and in default of payment shall be imprisoned for any period not exceeding twelve months, or by both such fine and imprisonment, in the discretion of the court.

SEC. 2. This act shall take effect and be in force from and after its approval.

Approved, March 7, 1889.

AN ACT to amend chapter 135 of the laws of 1885, in relation to the inspection of sheep.

SECTION 1. *Be it enacted by the legislature of the State of South Dakota*, That section 1, chapter 135 of the laws of 1885 be amended to read as follows:

"SEC. 1. In every county in this State containing 2,000 sheep or more, the county commissioners shall appoint a sheep inspector, who shall be selected by the sheep owners of the county at a meeting for that purpose; such inspector shall hold his office for a period of two years, unless removed for cause. Any inspector may act in an adjoining county having no inspector on the request of the commissioners thereof. The meeting mentioned in this section shall be called by the county commissioners, and they shall give notice of such meeting by notice published in a newspaper of the county for two successive weeks prior to the date of the meeting, and the first publication shall be at least twenty days before the day fixed for the meeting, and said notice shall give time and place of holding the same."

SEC. 2. That section 2 of chapter 135 of the laws of 1885 be amended to read as follows:

"SEC. 2. It shall be the duty of the sheep inspector, whenever he shall have knowledge or information that any sheep within his jurisdiction have the scab or any other malignant contagious disease, to inspect said flock and report in writing the result of his inspection to the county auditor of his county, to be filed by him for reference for the county commissioners or any party concerned; and said inspector shall give to owner or agent direction for treatment, and require from same a report every month thereafter until the inspector is satisfied that the disease is cured, when he shall again inspect the flock and give his certificate of freedom from disease and make report. The certificate of freedom mentioned in this section shall be a passport for all other counties in the State into which said sheep may be moved."

SEC. 3. That section 4, chapter 135, of the laws of 1885 be amended to read as follows:

"SEC. 4. The owner of any flock, or his agent in charge thereof, when the same is reported by the inspector to be so diseased shall immediately herd or house the same, or keep in some inclosure, so that they can not range upon any ground accustomed to be ranged upon by any other sheep, and shall restrain them from passing over or

traveling upon any public highway or road. The owner of such sheep, or his agent in charge thereof, shall at once follow any directions for treatment prescribed by the inspector, and promptly and faithfully carry out the same until a cure is effected, and shall report to the inspector as provided in section 2, chapter 135, of the laws of 1885, being section 2352 compiled laws. In all cases where the owner of sheep, or his agent in charge thereof, believe themselves wronged by the report or action of the inspector, they may appeal to the veterinarian of the State Agricultural College; such appeal to be made by notice in writing served upon the inspector and upon the county clerk. Within five days after the service of notice on the county clerk he shall forward all papers filed with him, and referring to such matter, to the said veterinarian aforesaid."

SEC. 4. That section 8, chapter 135, of the laws of 1885, be amended by striking out the words "register of deeds" where they occur in said section, placing the words "county auditor" in place thereof.

SEC. 5. That section 9, chapter 135, of the laws of 1885, be amended to read as follows:

"SEC. 9. The inspector shall receive three dollars per day while necessarily employed in inspecting sheep, and all fines and penalties shall be paid to the county treasurer, to be set aside as an inspection fund."

SEC. 6. That section 11, chapter 135, of the laws of 1885, be amended to read as follows:

"SEC. 11. Whenever any sheep inspector shall willfully and falsely report any sheep to be affected with disease, or willfully or falsely report any sheep inspected by him free from disease, he shall forfeit his office as inspector, and shall be subject to a penalty of not less than twenty-five dollars nor more than one hundred dollars."

SEC. 7. That section 14, chapter 135, of the laws of 1885, be amended by striking out the word "fees" wherever the same occurs in said section, and insert in place thereof the word "service."

SEC. 8. All acts and parts of acts inconsistent with this act are hereby repealed.

Approved, March 7, 1891.

SOUTH CAROLINA.

AN ACT to prohibit any person from transporting horses, mules, or asses into this State infected with glanders.

SECTION 1. *Be it enacted by the senate and house of representatives of the State of South Carolina, now met and sitting in general assembly and by the authority of the same,* That from and after the passage of this act, it shall be unlawful for any person or persons to transport, within the borders of this State, any horse, mule, or ass infected with glanders.

SEC. 2. That any person or persons violating the provisions of section 1 of this act, unless he can produce a clean bill of health from some veterinary surgeon that said stock was not infected with said disease when transported within the borders of this State, shall be liable for all damages attending the introduction of said disease, to be recovered by any person so damaged, and shall also be deemed guilty of a misdemeanor, and, on conviction, shall be fined in a sum not exceeding five hundred dollars, or be imprisoned not exceeding twelve months.

In the senate house, the twenty-fourth day of December, in the year of our Lord one thousand eight hundred and ninety.

VIRGINIA.

AN ACT to amend and re-enact section 2197 of the code of Virginia, in reference to burial of hogs that die from disease and accidental injury.

SECTION 1. *Be it enacted by the general assembly of Virginia,* That section 2197 of the code of Virginia, edition of 1887, be amended and reënacted so as to read as follows:

"SECTION 2197. The owner of hogs that die from disease or accidental injury, knowing of such death, shall bury them not less than two feet below the surface of the ground as soon as practicable after their death, and if he fails to do so, any justice, after notice to the owner, if he can be ascertained, shall cause any such dead animal to be buried by a constable or other person to be designated for the purpose, and the constable or other person shall be entitled to recover of the owner of every hog so buried a fee of one dollar, to be recovered in the same manner as officers' fees are recovered, free from all exemptions in favor of the owner."

SEC. 2. This act shall be in force from its passage.

Approved, March 3, 1890.

WEST VIRGINIA.

AN ACT to coöperate with the United States in the suppression and extirpation of pleuro-pneumonia.

SECTION 1. *Be it enacted by the legislature of West Virginia*, That the governor is hereby authorized to accept, on behalf of the State, the rules and regulations prepared by the Commissioner of Agriculture, under and in pursuance of section 3 of an act of Congress approved May 29, 1884, entitled "An act for the establishment of a bureau of animal industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," and to coöperate with the authorities in the enforcement of the provisions of said act.

SEC. 2. The inspectors of the Bureau of Animal Industry of the United States shall have the right of inspection, quarantine, and condemnation of animals affected with any contagious disease, or suspected to be so affected, or that have been exposed to any such disease, and for these purposes are hereby authorized and empowered to enter upon any ground or premises. Said inspectors shall have the power to call on sheriffs, constables, or peace officers to assist them in the discharge of their duties in carrying out the provisions of this act of Congress, approved May 29, 1884, establishing the Bureau of Animal Industry, and it is hereby made the duty of sheriffs, constables, and peace officers to assist said inspectors when so requested, and said inspectors shall have the same powers and protection as peace officers while engaged in the discharge of their duties.

SEC. 3. All expenses of quarantine, condemnation of animals exposed to disease, and the expenses of any and all measures that may be used to suppress and extirpate pleuro-pneumonia, shall be paid by the United States, and in no case shall this State be liable for any damages or expenses of any kind under the provisions of this act.

Passed February 21, 1891.

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