Pioneer Science and the Great Plagues

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in Pittsburgh—but there was no information on facilities or faculty. Equally dubious was the California Veterinary College in downtown San Francisco; it had affiliated with the University of California San Francisco but was unable to attract students, dedicated academic faculty, or funds to continue operating.

18. THE BUREAU OF ANIMAL INDUSTRY AND HOG CHOLERA

As the new century began, the Bureau of Animal Industry under director Daniel Salmon was proving its worth many times over in protecting the livestock industry. An unexpected calamity had begun in November 1902 when the local chief of the Massachusetts BAI telegraphed headquarters that a disease he had examined in Rhode Island dairy cows appeared to be foot-and-mouth disease. Cows were standing in their stanchions without eating, drooling saliva into the feed bunk. They had painful ulcers of the mouth and feet and swollen udders with ulcers and abscesses. The weight loss of affected cows was striking. Calves failed to nurse, and the loss of milk production was catastrophic. The diagnosis of foot-and-mouth disease was confirmed and the work of eradicating the disease began, including the hurried summons of BAI veterinarians from throughout the country to New England. The disease had existed since August and had spread rapidly into neighboring states. The massive effort to find, test, and slaughter infected animals was effective, and the disease was eliminated from New England by the end of 1903.

Foot-and-mouth disease continued to require constant vigilance; it again appeared on a hog farm outside of Niles, Michigan, in August of 1914, and by the next February, twenty states were affected. The BAI went into action, imposing quarantines throughout the Midwest. This time, the national publicity began to have an impact and there was renewed interest in the veterinary profession, with effects as diverse as education and sanitary laws. One of the benefits that resulted from this plague was the introduction of short courses to educate veterinary practitioners by veterinary colleges.

BAI Director Salmon assigned hog cholera work to his best scientist, the chemist Emil A. De Schweinitz. In the 1890s, De Schweinitz did a variety of animal injection studies using Salmon’s hog cholera bacillus and produced an
antiserum that would protect guinea pigs infected with the bacillus. The antiserum needed to be tested under field conditions. In Iowa, the field studies of the BAI’s William Niles were underway. Then in 1897, when hog cholera outbreaks were massive, the secretary of the USDA organized field tests to be done in Iowa and the governor of Iowa selected Page County for the BAI’s experimental work on Salmon’s hog cholera bacillus.

Injecting several Page County swine herds with the “immune serum” developed by De Schweinitz, Niles found little reduction in mortality from hog cholera at the end of the season. What was worse, Niles wrote De Schweinitz that the hog cholera specimens he was receiving from outbreaks in the field did not contain any agent that would sicken guinea pigs or any other laboratory animal as did Salmon’s hog cholera bacillus.

Foot-and-mouth disease in New England counties. Mapping outbreaks of the disease by the Bureau of Animal Industry was critical in its control. Disease first appeared in 1902 and rapidly spread to adjacent states. (Reprinted from the Bureau of Animal Industry Report for 1903.)
Salmon dispatched the young biochemist Marion Dorset to Iowa to coordinate the Page County work and to repeat the tests with the antiserum of De Schweinitz that had been prepared by immunizing pigs with his *Bacterium cholera-suis*. On arriving by train in Sydney, Iowa, at night, Dorset inquired about the fires glowing in the hills around town and was told by the hotel clerk: “Them’s the fires of dead hogs that farmers can’t do nothin but burn.” Dorset, short and slight with a limp and no experience with hogs, only observed as Niles injected antiserum into pigs in several test herds. Several days later, Niles and Dorset returned to observe the pigs. They had all died on every farm that was treated. It was clear: the De Schweinitz antiserum against Salmon’s hog cholera bacillus had nothing to do with hog cholera.

Emil De Schweinitz and Marion Dorset began to wonder about one of these new “filterable viruses” being the cause of hog cholera. What had caught their attention was the report from Friedrich Loeffler that foot-and-mouth disease of cattle was caused by a filterable virus. Perhaps some unidentified tiny agent like the one causing foot-and-mouth disease might be causing hog cholera in Fremont County. They placed an order for a Chamberlain filter with Pasteur Laboratories.

In 1905, to deal with the growing disasters of hog cholera, the BAI moved its fieldwork from Sidney, Iowa, near the Nebraska border where Niles was working, to a new hog cholera field station near Ames. A small building was constructed on a hill east of town across the Skunk River. Niles was placed in charge, with the specific assignment to produce an antiserum and a protocol for its use to prevent hog cholera.

Dorset was again assigned to Iowa, this time at the Ames station with Niles to investigate the cause of hog cholera in view of producing a vaccine. Using the Chamberlain filters, he established that the hog cholera agent was much smaller than bacteria. It was not retained by the filter as bacteria should have been but passed into the filtered fluid. The results made it clear—the cause of hog cholera was not the hog cholera bacillus as proposed by Salmon, Smith, Pasteur, Billings, and a host of others but one of these new filterable viruses. Dorset and the team published their results in the *Twenty-First Annual Report of the Bureau of Animal Industry* in 1904.

The discovery of hog cholera virus focused Niles’s research on producing antiserum and developing a protocol for use that would provide immunity in
the pig against hog cholera. In 1905, using a plan devised by Dorset, Niles began antiserum production at the Ames laboratory and in the next season used it in a limited number of pigs. The results were “most favorable.”

Niles enticed his friend, South Carolina physician Charles McBryde, to join him in the BAI work in Ames to expand the investigations. In the spring of 1907, over two thousand pigs in forty-seven herds in Story and Boone Counties in Iowa were vaccinated by Niles and McBryde under normal farm conditions; pigs were injected with a small amount of infectious blood from an animal with active hog cholera simultaneously with varying amounts antiserum—blood serum from recovered pigs that were immune to hog cholera. When a hog cholera epidemic came in the fall, all of the vaccinated pigs remained healthy while 89 percent of the unvaccinated pigs died.

By the next year, Niles, McBryde, and Dorset had perfected hog cholera antiserum production and the dosages that would protect pigs. Their process was patented by the USDA to ensure the right to its free use. Using the antiserum simultaneously with a small amount of dangerous virulent virus, immunity resulted without any signs of disease; the process soon became known among veterinarians and farmers as the serum and virus method of vaccination.

To prove that his vaccine protocol was effective, Niles took the Great Western overnight passenger train from Des Moines to Kansas City and arranged to test the serum and virus technique in the Kansas City Stockyards. Spending a month selecting appropriate shoats (young pigs after weaning) from the surrounding countryside, he arranged pens and designed a large-scale experiment that had groups of pigs receiving virus only (no serum), serum only (no virus), and both virus and serum in 15, 20, and 25 cc amounts. The pigs receiving virus alone should die and all others should be protected.

News of the experiment got around, and every morning there would be groups of salesmen, shippers, farmers, and journalists visiting the Stockyards to check on the outcome. The results were spectacular. By the fifteenth day, all of the virus-only pigs had died; none of those receiving serum sickened. Publication by the journalists in the group made the spectacle widely known and established public acceptance of the new technique.

Within a month, a dozen new companies started up around the Kansas City Stockyards to harvest and process hog cholera antiserum. Failures of supply to the Army veterinary hospitals in World War I had shown the lack of any
capacity for American production of veterinary drugs. Before the war, veterinarians had procured crude drugs or were their own pharmacists. Mortar and pestle, scales, and ointment slabs were standard equipment of the practitioner. The enormous demand for hog cholera antiserum and the high prices of pork inspired new industries in the Corn Belt. In the next half-century new companies in Kansas City would grow, from the commercial hog cholera antiserum production center to the premier site of the veterinary pharmaceutical industry.26

Despite the rapid commercial buildup to develop and market hog cholera antiserum and virus, the products produced covered only a fraction of the needs in the pig-producing states of the Midwest and South. Rushing to save their swine industry, veterinary colleges and state experiment stations moved to make up the deficit. Kansas State College built a small antiserum plant on the old college farm in 1908 and began sales to the public in early 1910. Unable to meet
demands, in 1913 the Kansas Board of Regents ordered a new two-story brick building be constructed. Completed in 1914 on a hill north of campus, Research Hall and its swine pens produced and sold hog cholera antiserum until 1920.

In 1913, a year when Iowa was producing over one-sixth of the hogs in the nation, a wave of hog cholera again swept across the Midwest; the number of deaths in Iowa was just under three million. Although hog cholera vaccination was underway, there was not enough antiserum. Because commercial companies
were not able to meet the increasing demand for antiserum, the Iowa legislature solved the problem by establishing the Iowa State Biological Laboratory at the college. A law that provided for a laboratory for the manufacture and distribution of hog cholera antiserum, toxins, virus, and biological products was approved on April 23, 1913, and became effective when published in the newspapers the Register, the Leader, and the Des Moines Capital. No one was distrusting the government.

Southern states too were making progress. The state legislature in Alabama appropriated $25,000 for its hog cholera antiserum plant, which opened in 1915 in Auburn. A report from Georgia was that “within the past two years, a State Veterinary has been appointed; a Department of Animal Pathology has been installed at the Georgia Experiment Station, and a Department of Veterinary Science has been installed at the State College of Agriculture and Mechanic Arts of the University of Georgia. The State has a good Veterinary Practice Law, a State Board of Veterinary Examiners, and a lively State Veterinary Association. The hog industry is growing by leaps and bounds and it is expected that the State Legislature at the next session will make appropriation on the manufacture and distribution of hog cholera serum.”

The Iowa State Biological Laboratory report for 1915 describes a conference held in Agricultural Hall on the campus of the Iowa State College for the purpose of implementing the new serum and virus method. It was attended by concerned veterinarians throughout the country. The previous year a foot-and-mouth disease outbreak in Illinois had been spread by contaminated hog cholera antiserum produced by a serum company at Chicago’s Union Stockyards.

By 1918, approximately 96 percent of the hogs in Iowa had been vaccinated and there had been constant decline in hog cholera in the state. The original cost of purchasing antiserum from Iowa State was two cents per cc, and this had been reduced to one-and-a-half cents. With increasing use, commercial companies began production so that the college received permission to close the State Biological Laboratory and convert the buildings to laboratories for veterinary research.

In 1915 Marion Dorset was the first person to be granted an honorary degree by Iowa State College—a doctor of veterinary medicine degree presented on recommendation of the veterinary school faculty. By then both Niles and Dorset had become legendary scientists in the swine industry. Hog cholera would persist
for another fifty years because of the nature of the disease to remain hidden in between waves of disease. Its reappearance was often tied to foibles of those involved: failures to vaccinate, fly-by-night serum producers selling unstable or diluted antiserum, and delays in the laboratory diagnosis to confirm the disease—an event that made it too late to prevent spread of hog cholera.

19. VETERINARY EDUCATION, CHARLES STANGE, AND THE FLEXNER REPORT

The Committee on Intelligence and Education of the American Veterinary Medical Association issued its annual report in 1904. Ignoring Kansas City Veterinary College dean Sesco Stewart’s critique of the previous year, it included a list of colleges to be accredited by the AVMA but had used only information supplied by the school. The report was favorable to a number of “colleges” of dubious credentials. A favorable report was made for the Collins Veterinary College in Nashville, Tennessee, but an investigation the next year revealed that the college had been “chartered by the State of Tennessee but owned and run by a non-graduate. There was not a qualified veterinarian connected with the faculty. Diplomas were issued at random—no faculty, no course, no college.”

After three years of ignoring the problem, a committee was appointed by the U.S. secretary of agriculture to investigate veterinary schools. The committee’s report released in 1908 was a “bombshell.” It placed the veterinary colleges into three classes: A (those colleges whose graduates would qualify to sit for the U.S. Department of Agriculture civil service examination for employment in the USDA); B and C (those whose graduates who would not). The report was not accepted by the Education Committee of the AVMA.

IN 1908 THE AMERICAN MEDICAL ASSOCIATION directed its new Council on Medical Education to investigate medical schools in North America. The intent was simple. Medical school curricula should be standardized, with a minimum of two years of basic sciences and two years of clinical training in a teaching hospital. To provide data on the state of medical education, the AMA’s new Council asked the Carnegie Foundation for the Advancement of Teaching to survey medical education in the U.S. and Canada and propose changes. The Carnegie Foundation appointed Abraham Flexner, neither scientist nor physician, to