

## **Knowledge, Epistemology, and Chemistry in the American Meat Industry**

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## Knowledge, Epistemology, and Chemistry in the American Meat Industry

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This paper argues that the "knowledge" employed by firms to successfully cure meat products in America rested on unstable definitions, or epistemologies, of evidence and proof of wholesomeness and quality. Acceptance or rejection of curing agents in the early 20th century nominally depended on scientific evidence concerning an ingredient's likely impact on consumers. Meat processors naturally minimized additives' effects and demanded conclusive proof of harmful effects prior to regulatory intervention. Critics instead viewed any sign of health risk as sufficient information that an ingredient should be banned. Since the actual effects of additives could only be determined through several decades of exposure and consumption, resolving these differences ultimately rested not on evidence but on a "political epistemology", the definitions of evidence accepted at particular times by regulatory agencies.

Regulation of American food industries has been haunted by these problems of interpreting scientific evidence. The first national conflict over additives in the early 20th centuries foreshadowed subsequent debates, and suggests how the deployment of knowledge as an abstract category served to conceal limited scientific ability to predict the cumulative effects of ingesting particular chemicals.

The focus of this paper is the controversy that erupted in the early 20th century over the use of

borax and boracic acid in cured pork products. Until the 1870s firms cured pork with methods that drew on widely disseminated rural practices, relying primarily on salt, smoke, sugar, and saltpeter. Americans did not worry about the impact of these ingredients on their health because of widespread knowledge of and experience with their use.

As meat processing and distribution became centered in a few midwestern cities after 1870, firms found traditional curing agents inadequate for their purposes. National distribution networks of refrigerated cars expanded fresh pork's potential market and the new large centralized firms developed consumer-oriented forms of cured pork. However, bacteria had a greater opportunity to contaminate meat cured through mass production methods, stored in huge quantities for months, and shipped around the country by rail, than in the days of local meat production and distribution.

Seeking to speed and improve the curing process firms drew on new chemicals, principally borax and boracic acid, making dubious and unsubstantiated assertions that these cures were superior to those practiced historically on America's farms. As their use gradually became better known (slowed by the absence of any labeling or approval procedures), public health crusaders campaigned for their prohibition as part of a larger effort to involve the federal government in regulation of food. Popular revulsion against these additives triggered in large part the meat inspection act and regulations of 1906 that, among other provisions, permanently banned these ingredients in meat products.

### Country Pork

Pork slaughtering and curing was widespread in early America because of the dispersion of livestock holdings and difficulty of transporting pigs or their meat over land in an era with limited railroad

track mileage. A meat eaten cured rather than fresh, pork was America's pre-eminent meat before urban growth and home refrigeration made beef more accessible. In 1880 almost 50 percent of all pork was consumed in the form of ham or bacon, an amount larger than the entire national consumption of beef.<sup>1</sup>

As a meat variety cured pork's origins stem from traditional preservation methods of American farmers, who in turn used well-established European methods. For home curing pigs' "Joints"--the ham (rear leg) and shoulder--were separated from the trunk, which in turn was cut into pieces small enough to place in a barrel filled with a brine solution usually composed of salt, saltpeter, and sugar or molasses. Salt carried most of the curing burden, while sugar and molasses helped with taste and saltpeter improved the meat's color. The cure was intended to keep the meat for six months to a year, and in essence substituted for refrigeration in keeping the meat from deteriorating. James Fenimore Cooper acknowledged salt pork's place in American popular cuisine in *The Chainbearer*, whose housewife considered "a family to be in a desperate way when the mother can see the bottom of the pork barrel." (The American aphorism, "scraping the bottom of the barrel" is a relic of this nineteenth century notion.)

Complementing barrel pork were cuts cured with a combination of salt and smoke. Hams and shoulders often were dry cured, sprinkled with salt, saltpeter and sugar rather than immersed in a liquid solution, then smoked to complete the curing process. Smoke added flavor and the dry cured meat could last well over a year without spoiling. Sometimes farmers separated the ribs from the pig's belly and cured the latter as bacon. In addition to their contribution to the family's food, hams were a valuable commodity for rural Americans, usable to exchange for salt, sugar, or rum at local stores.

While dinner tables of families from all classes and regions offered pork for dinner, consumption of particular products were markers of America's social hierarchy. Barrel salt pork was a poor family's

meat, whether they were slaves, farmers, or wage earners, along with bacon that was especially popular among rural southern whites. Elites favored hams and other choice dry cured products in warm weather and fresh roasts during the colder months. They especially disdained barrel pork as "sea-junk," cured by "sopping in brine" that imparted a "villainous" and "nauseous" taste entirely different from the "savoury" dry salted pork varieties. <sup>2</sup>

Elite prejudices aside, wet cured pork was widely consumed and highly valued among 18th and 19th century Americans. Sarah F. McMahon's careful studies of probate inventories in Middlesex County, Massachusetts indicates the popularity of this form of meat. By the time of the American Revolution, 69 percent of her sample had barrel pork on hand in the summer, six to nine months after it had been prepared, and that proportion remained virtually constant through 1835. While poorer families were less likely to have salt pork stores than more prosperous ones, nonetheless 50 percent of the estates valuing between \$100 and \$200 in 1835 contained salt pork, compared to 75 percent of the estates between \$400 and \$800. And its noteworthy that this barreled meat was a significant enough asset to appear in probates at all. <sup>3</sup>

### Industrial Pork

Beginning with the rise of Cincinnati in the 1820s, entrepreneurs discovered that, whenever possible, it was cheaper to move the slaughterhouses and meat processing facilities to the animal than to ship live animals to major population centers. So long as the meat could be kept from spoiling and transported economically, large-scale production facilities near livestock sources permitted economies of scale in meat production. Fragmenting the labor process to increase productivity and centralize

distribution reduced costs significantly--and eventually changed the types of pork consumed in America.

Climate and geography were the principal determinants of meatpacking's initial concentrations. Growth of internal transportation after 1815, principally roads, canals, and steam boat shipping on inland and coastal waterways, allowed nodal points to emerge for packing cured meat, pre-eminently pork. Seizure of the Ohio valley in the early 1800s from the native inhabitants opened up large areas for corn cultivation, and as farming advanced so too did pig raising as farmers essentially converted part of their corn crop to pork. They either slaughtered the pigs on the farm or drove larger herds to convenient riverfront market centers for slaughter and processing. Initially general merchants along waterways entered pork packing as a minor adjunct of their business, but soon the steadily growing flow of pigs off local farms induced the first true meatpacking companies to emerge.<sup>4</sup>

Its advantageous geographic location helped Cincinnati become America's leading antebellum pork processing center. Perched on the Ohio River's banks in rich farming country, Cincinnati was a favorite destination for farmers eager to take advantage of its superior outlets to southern and eastern markets. The network of rivers, canals, and lakes available to Cincinnati shippers led an observer to comment that the city was located in "the centre of a circle which bears on the Atlantic in the east, the vast prairies on the west, the lake-counties on the north, and the Gulf of Mexico on the south."<sup>5</sup> Annual production levels exceeded 100,000 hogs in the 1830s, then doubled to 250,000 in the 1840s and reached 400,000 on the eve of the Civil War.<sup>6</sup> In the 1860-61 packing season, Cincinnati exported 70 million pounds of cured pork and bacon.<sup>7</sup> By mid-century Cincinnati's pork could be found on the tables of planters and slaves in the south as well as artisans and the upper class in east coast cities. The town which grandly proclaimed itself the "Queen City" of the West achieved true fame with its more quotidian persona as the nation's "porkopolis."

In the absence of reliable refrigeration, climate governed the cycle of meat operations in Cincinnati. Beginning in November, as the weather turned cold enough for animals to be slaughtered and chilled for curing, pigs clogged roads leading into town. When Frederick Law Olmstead departed from Cincinnati in November 1853, droves of hogs "filling the road from side to side for a long distance" impeded his progress.<sup>8</sup> Roadside killing sheds located alongside or over streams on the city's outer fringes furiously slaughtered these animals during the cold months. These crude wood structures used the simple expedient of "movable lattice-work at the sides" to admit sufficient cold air to chill the carcasses.<sup>9</sup> Some pork quickly left the city as "green" or lightly cured meat, sent south on flatboats before the river froze.

Once cold weather paralyzed shipping, attention turned to curing pork in the separate packing operations, clustered in brick buildings located along the Miami canal in Cincinnati's central industrial district. While hogs made their own way to the slaughterhouses on foot, they were trucked by the tens of thousands on wagons "piled up in rows as high as possible" through city streets to the packing plants.<sup>10</sup> Pork packing was so ubiquitous during the winter that a visitor complained, "we could not look into a warehouse in the street without being agonized by the sight of thousands of dead corpses, heaped and piled upon one another."<sup>11</sup> Once spring thawed the Ohio River, killing operations halted and shipments reached their peak as the meat companies desperately sought to sell their stock, acquired from farmers on bills of credit. Cured meat awaiting loading onto riverboats would "spread over the public landing, and block up every vacant space on the sidewalks, the public streets, and even adjacent lots otherwise vacant."<sup>12</sup> By May the industry was in its slow season, only to surge once again in the fall with the harvest and return of cold weather.

By the late 1850s Chicago was challenging Cincinnati as the nation's leading pork packing

center. The expansion of the nation's rail network explains much of this change, along with the continued westward movement of agriculture. As railroad track mileage grew to 9,000 in 1850 and 31,000 by 1860, canals and rivers became less desirable means for transporting meat. Railroads had at two principal virtues in comparison to water transport: trunk routes could convey food to eastern markets on a year-round basis, and feeder lines could enter the countryside and bring livestock from landlocked farms directly to central markets. Located astride this rail network, Chicago took full advantage of its transportation advantage and passed Cincinnati as the nation's leading meatpacking center during the American Civil War of 1861-1865.

Meat's perishable nature still restricted the industry in the decade after the Civil War; it was Chicago that turned meatpacking into a year-round business. Until freshly slaughtered meat could be kept from spoiling during warm weather, the enterprise remained imprisoned by the seasons. In 1870 over 90 percent of Chicago's pork products were processed during the late fall and winter months.<sup>13</sup> With the expansion of production and improved rail lines, however, both the interest and feasibility of using bulk ice refrigeration increased. By the mid-1870s Armour and other large Chicago packers had invested in cold storage facilities kept cool through the summer with ice from the Great Lakes. Now able to use artificial means to chill the animal after slaughter, summer hog processing increased steadily throughout the 1870s from a half million animals in 1873 to over four million in 1880.<sup>14</sup> With its productivity augmented by year-round operations, Chicago accounted for over one-third of all meat produced in the USA in 1890.

Industrialization of pork systematized the categories of pork consumed by Americans. Vernacular styles became regulated varieties, as Boards of Trade in meatpacking centers sought consistency in the terms applied to meat sold to the public. In the 19th century particular care was

devoted to the categories of barreled pork, the chief product of these packing centers and the variety most vulnerable to bastardization and deception.

Cincinnati packers agreed to inspection regulations carefully delineating among barrel pork products, and in so doing facilitated selling their goods to distinct market segments. Among barreled meat (defined as at least 196 pounds in each container), clear pork was the best class, comprised of the sides of large hogs, with the ribs cut out. It was destined for New England residents who "in the line of pickled pork, buy nothing short of the best."<sup>15</sup> Mess pork came next in quality (and price), as it included two rumps as well as the sides. The navy and commercial marine took a great deal of these. A barrel of prime pork was one step down, typically contained sides from lighter hogs along with two shoulders and two jowls. It was marketed for maritime "ship use" as well as "the southern market" where it generally ended up on plantations. The lowest grade was bulk pork, the barrels of which could contain any part of the hog (including the head and feet) and usually were "sent off in flat boats to the lower Mississippi" where they probably ended up distributed out of New Orleans to slaves in the deep South.<sup>16</sup>

Distinction among barrel pork varieties grew along with the centralization of the industry in Chicago. By the 1880s the Chicago Board of Trade had doubled barrel pork varieties to eight. The elite clear pork, for example, now had a regular variety with the backbone and half of the ribs removed from the sides of "extra-heavy, well-fatted hogs," and an "Extra Clear Pork" version which was completely boned and limited to fourteen pieces to the barrel. Prime pork metamorphosed into regular prime, extra prime, and prime mess. Only regular prime could contain heads, and prime mess meat had to be in four pound square chunks and packed so that for every 20 shoulder pieces there were 30 from the side. Cures also were clearly specified, with mess pork defined as containing "not less than forty pounds of Turk's Island, St. Ustes, or Trepanne', or 45 pounds of foreign and domestic course salt."<sup>17</sup>

## Remaking Modern Pork

Industrializing pork, however, in time changed the character of the meat as well as the types of pork favored by Americans. At the same time as they were improving production technologies and systematizing barrel pork varieties, the national packing companies were seeking to expand consumption of branded pork meats, principally ham and bacon. While the salt pork purchased from local merchants had no name on them, bacon and ham did. As the leading items in a packer's portfolio, "the quality and reputation" of branded pork products established the firm's "prestige" in the consumer marketplace and stimulated sales of its more prosaic products such as lard. Through their branding strategy meatpacking companies transformed American pork.<sup>18</sup>

Increasing demand for bacon and ham relative to other cured meats was apparent by the end of the 19th century. Pork consumption grew from 2.84 billion pounds in 1880 to 4.3 billion in 1900, while cured meat remained stable at 70 percent of the total. Within the cured pork category, however, bacon and ham were growing far more rapidly. Between 1890 and 1900, production of these items increased 48 percent while barrel pork grew just 9 percent.<sup>19</sup> Astute packing executives could see that anonymous barrel pork was "a part of the packing house business which is becoming of less importance year by year" and that the future, for pork packers, was branded bacon and ham.<sup>20</sup>

Pursuing a branding strategy, however, was hindered by turn of the century production and curing methods. The packers could take the pig from the sticker to the coolers in 15 minutes; but trimming these products remained hand labor, and worse yet, curing times were unchanged from what they had been 100 years before. A 1905 manual for prospective meatpacking entrepreneurs warned that going into commercial pork packing was far more expensive than entering the beef trade, as "in

slaughtering hogs fully 70 percent of the carcass goes into curing departments, to stay there anywhere from thirty to ninety days.<sup>21</sup> Hence, beginning in the 1880s and continuing almost without rest subsequently, packing firms changed the physical chemistry of curing materials employed to make these products.

While salt, saltpeter, spices and smoke were used universally to cure ham and bacon, altering the proportion of ingredients could produce significant variations in taste. Firms capitalized on the specificity of curing techniques by branding their hams and bacon at the same time as they sought to standardize their recipes. As late as the 1890s the cures used at Swift plants varied from place to place. "The cures for pork were all secret," recalled Louis Swift, son of the firm's founder. "The head man at each plant had his secret formula. By paying him a large salary, we obtained his services." Spoilage of meat at the Kansas City plant prompted the company's founder to terminate this practice. In a story that may be apocryphal, Gustavus Swift called together his plant managers and ordered them to turn over their recipes to him. He chose the best and decreed that all plants would use the particular combination of ingredients.<sup>22</sup>

The focal points for innovation, bacon and ham, occupied different places in the pork hierarchy. Hams were unquestionably "the finest parts of the animal" because of the meat's quality and the careful curing process. Fine differences among hams could be established by the foods fed to the pigs, the cut and trim of the raw meat, and the ingredients in the curing solution. Smithfield ham, for example, came from hogs that pastured in the peanut fields of Virginia and the Carolinas after the crop was harvested. These hams were dry cured, smoked over a hickory fire, then rubbed with black molasses and black peppers and hung to dry for at least one year. A guidebook for hotels advised, "they improve with age up to three years, which is considered a prime age." To legally "brand" this ham against imitation,

Virginia producers secured legislative passage of a statute specifying that Smithfield hams came from "the carcasses of peanut-fed hogs...and which are cured, treated, smoked and processed in the town of Smithfield, in the state of Virginia."<sup>23</sup>

Most other 19th century ham varieties were fully cured in a liquid brine solution after an initial dry curing period. Consistently, though, hams were subsequently dried and smoked similar to bacon. Such heavy curing led to claims that hams "may be kept any length of time." Apocryphal stories abound in 19th century sources of hams upwards of fifty years old remaining wholesome and tasty.<sup>24</sup>

Bacon, on the other hand, was a common meat, perhaps slightly better than bulk pork, but still a rough, non-elite provision. "You'r greasy and salty and smokey as sin/But of all grub we love you the best," a poem simply titled "Bacon" opened. The tension between bacon's nutritional features and status as a food item persisted throughout the poem. "You'r as good in December as May/You have always come in when the fresh meat has ceased" the poem gushed; as a result, "the rough 'course of empire' was greased/By the bacon we fried on the way." But while rhapsodizing bacon's role as provision the poem also expressed a troubled undercurrent about its symbolic associations. "We've sworn you were not fit for white men to eat," the poem admitted, and "called you by names that I dare not repeat."<sup>25</sup>

Consumed throughout the country, bacon was especially popular in the south where local production was widespread. One British traveler to Kentucky was disgusted at the penchant for southerners to "eat salt meat three times a day" and disparagingly termed bacon "the favourite diet of all the inhabitants of the State." Clearly a low-status meat, bacon remained widely popular in the 19<sup>th</sup> century because preserved through dry cure methods it lasted longer than salt pork soaked in brine and could be purchased in smaller quantities. And while travelers might have tired of its "greasy and salty and smokey" taste, it certainly was better than low-grade barrel pork.<sup>26</sup>

Contradictory definitions of what constituted bacon reflected the incomplete confluence of vernacular tastes with the commercializing meat economy. While Cincinnati and Chicago packers defined bacon as cured pigs' bellies, in traditional country parlance bacon referred to the dry curing method of impregnating the meat with salt followed by smoking and drying. Virtually any part of the pig could become bacon if cured in this manner. "The bacon cured here is not to be equalled in any part of the world, their hams in particular," expounded a proud Virginian on the state's curing methods around the time of the American Revolution. After first applying sugar to the meat, the bacon/ham would "lie in salt for 10 days or a fortnight." Rubbed by saltpeter or hickory ashes to impart a red color, the meat dried in for three to four weeks over a slow smoky fire using "nothing but hickory wood." Prepared in this manner preserved the meat "for several years." Whether this process referred to the joints, belly, or sides was unimportant relative to the use of a dry cure technique.<sup>27</sup>

This prosaic country method, developed from rural experience and not scientific knowledge, nonetheless was highly effective and subsequently endorsed by 20th century physical chemistry. Imparting sugar to the meat drew out the water, magnify salt's dehydrating effects. This initial treatment ensured that harmful bacteria did not gain a foothold in the critical period immediately after slaughtering, as bacteria needs water and oxygen within which to grow. Such success carried a price, unfortunately. Deprivation of oxygen turned meat an unappetizing grayish color as it prevented myoglobin proteins from "blooming" and turning red. Saltpeter counteracted this effect by giving meat (albeit artificially) "the ruddy appearance always desired."<sup>28</sup> Smoking not only dried the meat, but also (and especially in the case of hickory wood) produced pyroligneous acid (containing methanol, acetic acid, acetone, and acetate) with its own preservative effects.

Industrial pork refined, but did not transform, dry curing methods. Large-scale production for

national commerce encouraged defining bacon more precisely as cured pig's bellies, but the only real changes were the scale of curing operations. Bacon went into huge wooden (later metal) containers (holding 800-900 pounds) to cure, with layers of salt, sugar, and saltpeter sprinkled between them. Smokehouses grew larger and relied on steam heat and hickory sawdust rather than a slowly burning fire to impart flavor and preservations, but the long curing times did not change appreciatively. One meatpacking handbook recommended holding bacon in dry salt for 35 days and then smoking it for an additional 20, a week longer than the traditional methods of colonial Virginia.<sup>29</sup>

Dry curing techniques were not convenient for high volume bacon production. Adding too much sugar to the cure negatively affected the meat's color, as it darkened during cooking. Yet failing to add enough sugar left the bacon tasting extremely salty, and lacking "from an American standpoint, at least, the flavor which is obtained in sweet pickle bacon."<sup>30</sup> A liquid "sweet pickle" solution, in addition to more reliably imparting the right flavor, also reduced handling and material costs. Thousands of pounds could be wet cured in the 1500 gallon vats that were standard packinghouse equipment in the early 20th century. Once the meat went to the smokehouse the remaining liquid could be reused for the next batch.

With all these advantages little wonder that packing firms began to cure bacon with wet methods similar to hams. By the early 20th century only "fancy" bacon was made through dry cure methods. In so doing the firms turned the definition of this form of pork upside down; rather than it referring to meat cured a particular way, bacon now referred to a part of the pig, regardless of how it was cured.

The wider application of wet curing techniques facilitated introduction of new ingredients into the curing solution, principally boracic acid and borax. Both were antiseptic compounds that inhibited bacterial growth, but did not actually cure meat. Employed to address a range of ailments in the 19th

century, they were especially useful in wartime to block infections in soldiers' wounds. Their attraction to meatpacking firms is obvious; they promised to prevent food decay and thereby facilitate conveying "meat, hams, bacon, etc., from very distant places to market in a perfectly sweet and fresh state."<sup>31</sup> A curing agent marketed by B. Heller that doubtless contained these materials (but did not indicate so) promised that chopped meat treated with the compound would "retain its fresh, appetizing appearance from one to three weeks if necessary, without the use of ice or cold storage." The Preservaline Company sold a similar compound that they promised "WILL KEEP FRESH pork and liver sausage when exposed on your counter, and in the hottest weather, for at least one week..."<sup>32</sup> Neither of these manufacturers admitted that boracic acid and borax allowed them to make these disturbing claims, although Preservaline had by that time acquired "extensive borax mines" in California whose product doubtless went into its curing products.<sup>33</sup>

Although the first use of these chemicals in curing solutions is murky, turn of the century industrial cures routinely contained substantial quantities. A 1905 sweet pickle solution for ham called for 3,750 pounds salt, 700 pounds sugar, 160 pounds saltpeter and 50 pounds of borax to be dissolved in a 1500 gallon vat. In dry cures, borax was routinely part of the curing agent and also sprinkled on prior to shipping, "to prevent them [the meat] turning slippery or mouldy." As there were neither product labeling requirements nor federal regulation of domestic meat products, inclusion of these ingredients was not widely known.<sup>34</sup>

These two ingredients were at the center of the public health controversy that finally resulted in federal regulation of meat industry. Defenders of boracic acid and borax attributed criticism of these ingredients to the way "Every innovation and improvement of this kind has always first to contend with a considerable amount of unreasoning prejudice." Rather than being "injurious" to consumers, these

materials were an improvement over older curing methods and were of "inestimable value" in safeguarding the public's health.<sup>35</sup> Supporters were able to marshal considerable medical opinion in support of these claims, as well as tests showing that the human body passed boracic acid and borax quite rapidly.

Critics, led by Harvey Wiley, a chemist and leading exponent of government regulation of the meat industry, countered by stressing the incremental impact of these products. Employing human subjects, Wiley conducted careful chemical tests for the Department of Agriculture showing, he alleged, that over time these agents interfered with "the processes of digestion and absorption" and could damage the kidneys. Wiley's tests would not have convinced medical experts today; he only used twelve volunteers, all white men in their 20s, and even those results were not consistent. He won, however, the political point that the danger posed by cumulative ingestion of these ingredients, especially among children and the elderly, was a sufficient basis to prohibit them.

Wiley's tests serendipitously intersected with widespread public suspicions about the meat industry. His studies took place at the same time as a national strike against the meatpacking companies brought widespread criticism of the industry's labor practices. One journalist outraged by the 1904 strike, Upton Sinclair, commenced a syndicated series of articles in a muckraking publication that focused on the firms' handling of meat products as much as their labor practice. His sensational if unsubstantiated accusations of unwholesome practices had a great impact, for the public was already uneasy about meat curing and handling practices that deviated from the traditional and respected vernacular practices of the farm.

Wiley, quite strategically, tapped into the widespread concern over industrial meat production by arguing that borax and boracic acid were dangerous in their own right and because they permitted

preserving meat "with very much less care, in a very much shorter time, and at a very greatly reduced expense." Rather than a modern improvement in curing methods, they permitted shoddy meat processing practices, exactly what the public feared most. In 1906, as part of the regulations governing the meatpacking industry, the Department of Agriculture banned all meat additives others than those specifically authorized, which was limited to "common salt, sugar, wood smoke, vinegar, pure spices, and pending further inquiry, saltpeter."<sup>36</sup>

### Conclusion

Banning unproven additives such as boracic acid did not spread to saltpeter, an ingredient used for so long without harm that even Wiley's ministrations failed to stir government action. But meat industry firms continued to search for ways to shorten the two to three month curing period for ham and bacon that saddled them with large meat inventories. Preservaline (which sold its borax mines soon after the 1906 Act) and a new firm, Griffith Laboratories, began investigating the use of sodium nitrite and nitrate to speed curing times. Griffith began importing nitrite under the brand name "Prague Salt" in 1925 and secured USDA permission to include it in curing solutions the same year.<sup>37</sup>

Rapid approval of these new additives took place in a vastly different political climate. Unionism had been crushed several years before, and there was no visible consumer movement to raise questions about these new ingredients. It would take almost a half-century for concerns to be raised about the carcinogenic dangers posed by nitrites in cured meat products.

At heart these controversies over meat additives were about how to apply knowledge to industrial practice, not scientific knowledge per se. Borax and boracic acid remain banned while nitrites are still in our meat; the difference is due to the epistemologies and political contexts of those moments

when their presence became public knowledge. We would have borax and boracic acid in American meat today if Wiley's texts had been replicated in a more benign (for business) political environment.

## Notes

- 1 U.S. Bureau of the Census, *Report on the Manufactures of the United States at the Tenth Census* (Washington: Government Printing Office, 1883), 474.
- 2 Chamber's *Information for the People* (Philadelphia: Jas. B. Smith & Co., 1859), 630.
- 3 Sarah F. McMahon, "'All Things in Their Proper Season': Seasonal Rhythms of Diet in Nineteenth Century New England," *Agricultural History* 63, 2 (Spring 1989), 135-37, and "A Comfortable Subsistence: The Changing Composition of Diet in Rural New England, 1620-1840," *William and Mary Quarterly*, 3rd series, 42 (January 1985), 65.
- 4 On this point see generally Margaret Walsh, *The Rise of the Midwestern Meat Packing Industry* (Lexington: University of Kentucky Press).
- 5 Chamber's 15.
- 6 Charles Flint, *Eighty Years of Progress of the United States* (Chicago: O.F. Gibbs, 1864), 67.
- 7 Walsh<sup>34</sup>.
- 8 Frederick Law Olmstead, *A Journey Through Texas* (New York: Dix, Edwards, & Co., 1857), 12.
- 9 Charles Cist, *Cincinnati in 1851* (Cincinnati: Wm. H. Moore & Co., 1851), 278.
- 10 Cist 281.
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- 12 Cist 286.
- 13 Louise Carroll Wade, *Chicago's Pride: The Stockyards, Packingtown, and Environs in the Nineteenth Century* (Urbana, IL: University of Illinois Press, 1987), 105.
- 14 U.S. Department of Commerce, *Twelfth Census of the United States, Manufactures*, Part III (Washington: 1902), 388.
- 15 Cist 282.
- 16 Flint, 66.
- 17 Artemas Ward, *The Grocers' Hand-Book and Directory for 1883* (Philadelphia: Philadelphia Grocer Publishing Co., 1883), 166-8. Use illustration of how to cut up pig for these cuts.
- 18 Rudolf Clemen, *By-Products in the Packing Industry* (Chicago: University of Chicago Press, 1927), 254.
- 19 U.S. Bureau of the Census, *Report on the Manufactures of the United States at the Tenth Census* (Washington: Government Printing Office, 1883), 474. U.S. Bureau of the Census, *Twelfth Census of the United States, Manufactures*, Part III (Washington: 1902), 394.
- 20 Quote from F. W. Wilder, *The Modern Packing House* (Chicago: Nickerson & Collins, 1905), 296.
- 21 Wilder 249.
- 22 Louis F. Swift, *The Yankee of the Yards* (Chicago: A.W. Shaw, 1927), 104.
23. First quote Frank Rivers, *The Hotel Butcher, Garde Manger and Carver* (Chicago: Hotel Monthly Press, 1935), 47; second quote, *American Heritage Cookbook and Illustrated History of American Eating and Dining* (NY: Simon and Schuster, 1964), 504.
- 24 Chamber's 630.

25. Poem "Bacon" from the Yakima Museum archives, Yakima Washington. My thanks to Daniel Levinson Wilk for sharing this with me.
26. Thomas Ashe, *Travels in America* (London: 1803), 241.
27. Quote from Frances Phipps, *Colonial Kitchens, Their Furnishings and Their Gardens* (New York: Hawthorn Books, 1972), 38-9.
28. I.C.S. Reference Library, *Packing-House Industries* (Scranton: International Textbook Co., 1902), section 38 page 1.
- 29 Wilder 320-1.
- 30 Wilder 320.
31. *Douglas's Encyclopedia* (London: William Douglas & Sons Ltd., 1901), 93
- 32 McArthur, Wirth & Co. Butchers, Packers, and Sausage Makers (Syracuse, NY: 1900), Hagley Museum and Library imprints collection.
- 33 "'The Significant Sixty': An Historical Report on the Progress and Development of the Meat Packing Industry, 1890-1951," Section Two, *National Provisioner* January 24, 1952, 242.
- 34 Wilder 322.
- 35 Douglas 93.
36. Harvey W. Wiley, *Foods and Their Adulteration* (Philadelphia: P. Blakiston's Son & Co., 1907), 37, 553.
- 37 The Significant Sixty 120.