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The Modernization of the Louisiana Sugar Industry, 1830-1910

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1

The French Connection

Boom times are nothing new to the inhabitants of south Louisiana. New Orleans, Baton Rouge, Lafayette, New Iberia, Morgan City, and other nearby communities experienced spectacular growth during the late 1970s and early 1980s as the state's "oil patch" was systematically explored and exploited. With this surge of prosperity came the fast-food chains, housing developments, shopping malls, heliports, and metal prefabs—all testimony to economic expansion. Rusted out cars with Ohio, Michigan, and Pennsylvania tags reflect the migration of families from the depressed northern states to this promised land.

Yet amid the bustle of this plastic world stands a legacy from the past—plantation homes and sugar factories—that serves as a reminder of a similar rush of settlers and fortune hunters to the region some 160 years ago.¹ During the 1820s word spread that great profits could be made from planting sugarcane. The dream of riches lured both footloose fortune hunters and entire families from New England, New York, Virginia, North Carolina, Ireland, and elsewhere to this lush, semitropical, and in many ways mysterious, region.

The antebellum sugar bowl consisted of three chief areas within south Louisiana. The oldest and most established area extended

1. Clarence John Laughlin, *Ghosts Along the Mississippi* (New York, 1961).

nearly 130 miles north of New Orleans along the banks of the Mississippi River (including territory in Avoyelles, West Feliciana, Pointe Coupee, East and West Baton Rouge, Iberville, Assumption, Ascension, St. James, St. John the Baptist, St. Charles, and Jefferson parishes) and approximately 60 miles downriver into St. Bernard and Plaquemines parishes. A second major area of sugar cultivation and production developed along the banks of Bayou Lafourche southwest of New Orleans in Lafourche and Assumption parishes, including the towns of Donaldsonville and Thibodaux. Finally, a third region, the destination of many settlers during the rush of the 1820s, centered around the towns of New Iberia and Franklin along the banks of Bayou Teche and environs in Lafayette, St. Martin, Iberia, and St. Mary parishes. Other secondary areas, including Rapides and Terrebonne parishes, were also important sugar-producing areas, but the large plantations of the wealthy sugar barons that dominated the industry were almost invariably located in one of the three major geographical regions. It was there that nineteenth-century risk takers, in part motivated by favorable tariffs, the introduction of new cane varieties, and falling cotton prices, were willing to invest tens of thousands of dollars to purchase land, equipment, and slaves.² More often than not the harsh realities of freezes, floods, and labor problems shattered the overly optimistic dreams of these pioneer sugar planters, a situation not unlike that of many transplanted Yankees who came to the state during the 1880s.

The origins of the sugar bonanza can be traced to experiments in the cultivation and production of cane that initially took place during the 1790s. Until that time indigo was the chief cash crop of Louisiana, but the ravages of insects and the appearance of plant diseases caused local planters to look for alternatives. As early as the 1750s and 1760s some sugarcane indigenous to Santo Domingo was planted near New Orleans, but these tentative trials ended with Spanish cession and the subsequent revolt. In the early 1790s interest in sugar was revived.

As a result of the efforts of Joseph Solis, Antonio Mendez, Antoine Morin, and Etienne Boré, the profitability of sugar making in Louisi-

2. Sitterson, *Sugar Country*, 23–25; Timothy Flint, *Recollections of the Last Ten Years* (1826; rpr. New York, 1968), 325.

ana was demonstrated.³ Solis had come to Louisiana from Cuba during the 1780s, or perhaps earlier, and along with his father established a plantation and erected a small grinding mill and rum distillery in Terre-aux-Boeufs in what is now St. Bernard Parish. In 1794 Solis sold his property and equipment for six thousand silver pesos to Antonio Mendez, a native of Havana. It was probably late in 1794 that Mendez hired Antoine Morin, a chemist and sugar maker, originally from Santo Domingo, to handle his crop. For reasons unknown, Morin was soon employed by planter Etienne Boré, who in 1795 made a crop of sugar that sold for twelve thousand dollars and who, if we are to accept the dramatic reconstruction of Boré's experiments by his grandson Charles Gayarré, convincingly demonstrated that syrup from Louisiana canes would granulate and produce raw sugar.

Boré's attempt had excited the keenest interest; many had frequently visited him during the year 1795 to witness his preparations; gloomy predictions had been set afloat, and on the day when the grinding of the cane was to begin, a large number of the most respectable inhabitants had gathered in and about the sugar-house to be present at the failure or success of the experiment. . . . Suddenly the sugarmaker cried out with exultation, "It granulates!" . . . Each one of the by-standers pressed forward to ascertain the fact on the evidence of his own senses, and when it could no longer be doubted, there came a shout of joy, and all flocked around Etienne de Boré, overwhelming him with congratulations, and almost hugging the man they had called their savior—the savior of Louisiana.

Production of sugar steadily increased during the first quarter of the nineteenth century, and by 1830 over 33,000 tons of sugar were made in the state.⁴

The manufacture of sugar in Louisiana in the 1830s generally differed only slightly in method from the manufacture of sugar in the French, Spanish, and English Caribbean colonies of the eighteenth century. The process of converting sugarcane to raw sugar can be divided into five steps: grinding the cane; defecating and purifying the

3. Rene J. Le Gardeur, Jr., "The Origins of the Sugar Industry in Louisiana," in Center for Louisiana Studies, *Green Fields: Two Hundred Years of Louisiana Sugar* (Lafayette, La., 1980), 1–28.

4. Charles Gayarré, "A Louisiana Sugar Plantation of the Old Regime," *Harper's New Monthly Magazine*, LXXIV (1887), 607; A. Bouchereau, *Bouchereau's Revised Directory for 1917* (New Orleans, 1917), 38.

extracted juice; evaporating the juice to a viscous syrup; granulating the syrup, with the formation of sugar crystals; and potting, the separation of crystals and molasses by slow drainage.⁵

The sugarcane, normally harvested between late October and December, was taken in carts from the field to the sugarhouse. During the 1830s two methods of grinding the cane were practiced, one using animal power and the other employing the steam engine as the prime mover. In either case, the mill was elevated, not only to allow the juice to run into vats, but also to leave room to receive the exhausted cane, or bagasse. The animal-powered mill was usually of a vertical design, consisting of three fluted, interlocking cylinders, each 30 to 40 inches long and 20 to 25 inches in diameter. The oxen, horses, or mules applied power to the central cylinder of the mill by means of a lever or beam arrangement. Adjustments made to the distance between cylinders, in response to changes in the nature of the cane, were achieved by a system of cross keys and wedges.

By the 1830s steam engines began to supplant animal power. In 1828 only 120 of the 691 sugarhouses in Louisiana employed steam-powered mills; sixteen years later, 408 of the 762 mills employed the steam engine to crush the cane.⁶ The steam-powered mill usually had its cylinders arranged in a horizontal configuration; these cylinders, 4 to 5½ feet long and 25 to 27 inches in diameter, were arranged triangularly, with one cylinder above and two beneath. The cane, in 3- to 4½-foot lengths, was brought to the mill by a cane carrier, a continuous chain that was powered by the steam engine. The carrier dropped the cane into a wooden hopper, and gravity carried it to the mill rollers. After passing through the mill, the cane was conveyed outside the sugarhouse by means of an inclined plane.

The mill was a constant source of anxiety for the planter. In his business, time was crucial; an early frost could lead to financial ruin. The mill's operation was uncertain; for example, if the cane piled up

5. Benjamin Silliman, *Manual on the Cultivation of the Sugar Cane and the Fabrication and Refinement of Sugar* (Washington, D.C., 1833), 30–41; H. O. Ames, *H. O. Ames' Improved Method of Evaporating Saccharine Juices by Steam* (New Orleans, 1859), 2–4; V. Alton Moody, *Slavery on Louisiana Sugar Plantations* [N.p. [1924?]], 48–52; Sitterson, *Sugar Country*, 137–44.

6. Silliman, *Manual on the Cultivation of the Sugar Cane*, 31; J. A. Leon, *On Sugar Cultivation* (London, 1848), 4.

at the entrance between the first two rollers, the roller shafts often broke suddenly. And the necessary parts and repair service were to be found only in New Orleans. Also, the ridges on the cane shafts—the nodes or joints—determined the distance set between the mill cylinders. Because of the varying distances, pressure was often inadequate to squeeze all the juice from the cane. Thus, a great deal of juice was often left in the cane after its passage through the mill.

The freshly extracted cane juice flowed through a spout into two large vats, or juice boxes, made of cypress planks. These vats, which had a capacity of several hundred gallons, were located in the mill room (sometimes called the laboratory), in an area separated from the boilers. Prior to boiling, a strainer was used to skim the juice contained in these boxes, thus removing scum, trash, and cane pieces. The juice was boiled in large open kettles that were set in brickwork and arranged over a furnace. This set of kettles was called a “battery,” “equipage,” or “kettle train.” Each kettle was of a different capacity—the largest held from three hundred to five hundred gallons, and the smallest held seventy to one hundred gallons. The first and largest kettle was called the *grande*. The second was the *flambeau*, so called because the point of the flame touched the kettle. In the third kettle, or *sirop*, the juice was boiled down to the density of syrup. Finally, in the *batterie*, or last kettle, the concentrated syrup was “struck”; small, almost invisible crystals of sugar formed. At a number of plantations, a fifth kettle was placed between the *sirop* and *flambeau*. This fifth kettle was called the *proper clear* because it was in it that the juice began to become transparent.

At the beginning of the clarification and evaporation step, the contents of the nearly full *grande* were brought close to the boiling point, and the proper defecating agent, usually lime, was carefully added. Rising to the surface, the resultant scum was ladled off and discarded. The water in the juice evaporated, and the resulting sugar syrup was concentrated during this step. As the water evaporated, the juice was gradually ladled by hand into the *flambeau*. The juice, tempered again with lime in the *flambeau*, was eventually transferred to the *sirop*, and as it approached the proper density and quality, was placed in the *batterie*. The syrup, having reached its striking point in the *batterie*, was promptly turned out into the cooler. The last kettle was then recharged with a fresh supply from

the sirop, and the sirop replenished by the contents of the flambeau, which in turn was recharged with the material from the grande. The transfer of juice from one kettle to another involved the danger of exposing a nearly empty kettle to the direct heat of the flame. The remaining liquor would then be carbonized, producing a lower quality sugar.

In the last kettle, or batterie, the sugar was granulated or "struck." The sugar maker used a number of criteria to determine the proper moment for crystallization. A common practice was to thrust a wooden-handled copper spoon into the batterie. If the syrup had a grained appearance and formed a slowly draining film over the entire spoon, it was ready for removal to the cooler. Another method of testing the syrup was to place a small amount of the boiled juices between the thumb and forefinger; when drawn out into a thread, properly boiled syrup would break dry and rise in a spiral.

The resulting concentrated syrup was placed in coolers, where it remained for about twenty-four hours. The crystallized mass was then dug out and placed in hogsheads (large casks) located in the draining room. The modern sugarhouses of the 1830s normally had two draining houses, located at right angles to the sugarhouse with connecting doors to the area occupied by the coolers. The floor consisted of small beams running crosswise and placed about eighteen inches apart. The hogsheads were placed on these beams, and underneath were placed the molasses cisterns, each covering an area of about twenty square feet and approximately sixteen to twenty inches deep. The molasses drained from three or four holes located in the bottom of the hogshead. To facilitate drainage, canes were often loosely stuck into these holes, and as the separation of crystallized sugar from molasses took place, the liquor drained down the sides of the canes into the cisterns. The by-product molasses was then set aside, later to be packed in barrels and sent to market.

The New Orleans levee was the hub of commercial activity, a place where hundreds of hogsheads containing raw sugar were loaded on steamboats and ocean vessels. Approximately one-half of the sugar and molasses made in Louisiana was sold to western customers.⁷

7. J. Carlyle Sitterson, "Financing and Marketing the Sugar Crop of the Old South," *Journal of Southern History*, X (1944), 188-90; Merl E. Reed, "Footnote to the Coast-

With the exception of a small quantity consumed in the local region, the remainder of the product was shipped to the east coast cities of Boston, New York, Baltimore, Savannah, or Charleston. Planters along Bayou Teche, having no convenient transport connection with New Orleans, frequently transported their sugar and molasses directly to eastern ports, even after the completion in 1855 of the New Orleans, Opelousas and Great Western Railroad between the Mississippi River and Berwick Bay.

During the 1830s an increasing number of Louisiana planters recognized the inefficiencies of the traditional open kettle method, both in terms of labor and fuel costs. It was necessary to station a worker at every kettle, not only for the "skipping out" of the juice by the attendants using long-handled scoops, but also for "brushing off" the impurities that rose to the surface. With the exception of the cost of the cane itself, cordwood to fuel the furnaces was the most expensive cost element of the sugar-making process. In addition, sugar making was an empirical art, and sometimes even the most experienced sugar boiler could not control the process enough to produce good quality, crystallized sugar. Planters gradually became aware of enormous losses of sugar during the process. Also, concern was growing among Louisiana planters over the quality of the product—particularly because Louisiana's raw sugar had a dark brown color and brought lower market prices than the lighter-colored raw sugar made in the Caribbean.

To improve their processes and thus their products, Louisiana planters looked to France for scientific and technical knowledge and expertise. Indeed, it seems that by the early 1830s the entire cane-sugar industry began to recognize the potentialities of scientific technology. The progressive spirit embraced by the typically tradition-bound planters resulted in part from the abolition of slavery in certain sugar-producing areas and in part from a phenomenal upsurge in sugar consumption by European working classes and the English in particular during the 1830s. As Sidney Mintz ably demonstrated in *Sweetness and Power*, increased demand during this period came

wise Trade—Some Teche Planters and Their Atlantic Factors," *Louisiana History*, VIII (1967), 191-97.

from the lower classes of society who were experiencing a transformation in diet as well as in economic environment.⁸

Beginning with the 1830s, new scientific techniques, manufacturing processes, and large-scale apparatuses transformed the manufacture of sugar on numerous plantations. These innovations, brought about in part through efforts of American inventors and chemists, were largely due to the diffusion of French chemical methods and beet-sugar technology into Louisiana. The reception and subsequent selective adoption of French scientific ideas by Louisiana planters was facilitated by the presence of a large population of French descendants and French-speaking American citizens residing on plantations located along the Mississippi River and Bayou Lafourche.

Frederick Law Olmsted, a frequent traveler to the southern states during the 1850s, noticed the influence of French scientific ideas on the progressive Louisiana planter community. He wrote in *A Journey in the Seaboard Slave States, With Remarks on their Economy* (1856):

The whole process of sugar manufacturing, although chemical analysis proves that a large amount of saccharine is still wasted, has been within a few years greatly improved, principally by reason of the experiments and discoveries of the French chemists, whose labors have been directed by the purpose to lessen the cost of beet sugar. Apparatus for various processes in the manufacture, which they have invented or recommended, has been improved, and brought into a practical operation on a large scale on some of the Louisiana plantations, the owners of which are among the most intelligent, enterprising, and wealthy men of business in the United States.⁹

At least four pathways can be reconstructed for the diffusion of French science and technology into Louisiana. First, recent immigrants or Americans educated at French universities played a significant role in the injection of scientific knowledge into the Louisiana sugar industry. Second, the continental travels of planters and their employees often led to the acquisition of valuable practical knowl-

8. Mintz, *Sweetness and Power*, 160–202.

9. Frederick Law Olmsted, *A Journey in the Seaboard Slave States, With Remarks on Their Economy* (1856; rpr. New York, 1968), 670.

edge and theoretical principles. Third, in 1847 a study of sugar chemistry and manufacturing methods, sponsored by the United States Treasury, was made available to planters. This treatise described the numerous French contributions in both sugar chemistry and technology. Finally, the appearance of *DeBow's Review* in 1846 provided Louisiana planters with numerous essays on the cultivation and manufacture of sugar in Louisiana, as well as reprinted English and French articles and treatises on the scientific and engineering aspects of sugar manufacture.

French-educated scientists played a central role in improving the Louisiana sugar industry prior to the Civil War. J. B. Avequin, a New Orleans apothecary and pupil of Nicolas Louis Vauquelin, studied the chemistry of sugarcane and employed chemical analysis in determining the efficiency of milling during the 1830s and 1840s. Avequin apparently first became interested in sugar chemistry while in Santo Domingo during the early 1830s. He arrived in St. James Parish in 1832 where he analyzed the composition of sugarcane using extraction and distillation techniques. He remained active in this field until his death in 1861.¹⁰ Norbert Rillieux, born a free quadroon (one-fourth Negro) in Louisiana in 1806, was a graduate of the Ecole Polytechnique.¹¹ As a student in Paris, Rillieux was interested in steam

10. J. B. Avequin, "Notice historique sur l'introduction des variétés de la canne à sucre à Louisiana, et analyse comparée," *Journal de Chimie Medicale*, II (1836), 26–34, 132–35; "Sur la matière circuse de la canne à sucre," *Annales de Chimie et de Physique*, LXXV (1840), 218–22; "De la formation du cal dans les chaudières pendant la fabrication du sucre brut (sucre de canne)," *Journal de Pharmacie et de Chimie*, XXVII (1840), 15–20; "Du sucre d'érable aux Etats-Unis," *Journal de Pharmacie et de Chimie*, XXXII (1857), 280–85; "Des ennemies de la canne à sucre ou les insectes qui attaquent la canne à sucre dans les Antilles et en Louisiana," *Journal de Pharmacie et de Chimie*, XXXII (1857), 335–37; "La canne à sucre à la Louisiana," *Journal de Pharmacie et de Chimie*, XXXII (1857), 337–45. For Avequin's obituary, see *New Orleans Daily Picayune*, February 26, 1861, p. 6.

11. David Harbison, *Reaching for Freedom: Paul Cuffe, Norbert Rillieux, Ira Aldridge, James McCune Smith* (N.p., 1972); Harry A. Ploski and Warren Marr (eds.), *The Negro Almanac* (New York, 1976), 794–95; "Norbert Rillieux," *The Louisiana Planter and Sugar Manufacturer* (hereinafter cited as *LP*), XIII (1894), 285; P. Horsin-Deon, "Norbert Rillieux," *LP*, XIII (1894), 331; Marcus Christian, *Negro Ironworkers in Louisiana 1718–1900* (Gretna, La., 1972), 23–24; R. L. Desdunes, *Nos Hommes et Notre Histoire* (Montreal, 1911), 101–103; H. E. Sterkx, *The Free Negro in Antebellum Louisiana* (Rutherford, N.J., 1972), 227–28.

engines, and he later published a series of papers on their use. During his residence in France, he became interested in the application of the steam engine to sugar manufacturing, but after having little success in selling his ideas to French refiners, Rillieux returned to Louisiana. There he began to experiment with vacuum evaporation and for over a decade conducted a series of trials that initially ended in failure. Finally succeeding, he patented his multiple-effect evaporation system in 1843 and further improved his invention with an 1845 patent. Rillieux's design was the premier engineering achievement in nineteenth-century sugar technology.

Antoine M. F. Chevet immigrated from France to Louisiana in 1839. Although Chevet was president of Jefferson College, located in St. James Parish, he was also an inventor. In 1847 he was awarded two patents for improvements in the manufacture of sugar.¹² Both innovations focused on improving the defecation step of the process. One method used high pressure to destroy impurities; the other employed a lime-sugar compound, rather than lime alone, as the defecating agent.

Pierre Adolph Rost was born in 1797 in France and was educated at the Ecole Polytechnique.¹³ Having immigrated to New Orleans in 1816, he became a judge of the Supreme Court of Louisiana in 1838. A key figure in the Louisiana Agriculturists' and Mechanics' Association, he was described by one traveler in 1849 as "one of the few planters who study science to apply it to practical operations of planting sugar cane."¹⁴ Thus, immigrants helped inject French science into Louisiana. In particular, the works of Avequin and Rillieux, the former in sugar chemistry, the latter in engineering, were central to the emergence of an improved sugar industry in the 1840s.

A number of planters learned of French innovations in their travels.

12. A. M. F. Chevet, "Improvement in the Manufacture of Sugar," U.S. Patent 4,985, February 27, 1847. See also Chevet, "Improvement in Sugar Making," U.S. Patent 5,276, September 4, 1847. For information on Chevet, See Chevet to Bannon G. Thibodeaux, July 12, 1846, U.S. Patent 4,985. These documents are all in Record Group 241, Records of the Patent Office, National Archives, Washington, D.C. (hereinafter cited as NA).

13. *National Cyclopedia of American Biography*, XI, 468.

14. Herbert Anthony Kellar (ed.), *Solon Robinson: Pioneer and Agriculturist, Selected Writings* (1936; rpr. New York, 1968), II, 168.

Valcour Aime, a St. James planter, and his neighbor, Pierre Michel La Pice, observed an improved method of manufacture (the Derosne and Cail apparatus) in their 1845 travels to Cuba and actively promoted it upon returning home.¹⁵ La Pice was born on the island of Santo Domingo in 1797. After the massacre of whites on that island, the family settled in New Orleans in 1804. As a young man he entered into a mercantile partnership with a Mr. Millandon and represented the firm's interests in Natchez. In 1834 La Pice settled in St. James Parish and became a neighbor of Aime. There on his plantation he made white sugar using charcoal filters and was the first to install a five-roller mill and bagasse burner in Louisiana.

Aime, born into an old Louisiana family in St. Charles Parish in 1798, acquired a sugar plantation as a young man in St. James Parish and developed the first sugar refinery in the state. As early as 1829 he employed steam machinery and adopted new boiling equipment, including Rillieux's multiple-effect evaporation system, as soon as it became available. Aime learned of developments in France by sending "a young man who had, under my tuition, become a pretty good sugar boiler, to take further lessons from a refiner living near St. Quentin. He has orders also to go to England, and to visit, before he returns, the refineries of our northern cities."¹⁶

Of all the information acquired by travelers to France during the 1840s, Judah P. Benjamin's observations and experiences were most widely disseminated to Louisiana planters. While his contemporaries recognized Benjamin as a knowledgeable and successful sugar planter in Louisiana, historians have focused on his career as secretary of state during the Civil War. Born in 1811 on the island of St. Thomas, Benjamin was educated at Yale and practiced law in New Orleans during the 1830s.¹⁷ He subsequently purchased a sugar plan-

15. *Dictionary of American Biography*, I, 130; Valcour Aime, *Plantation Diary of the Late Mr. Valcour Aime* (New Orleans, 1878); *Biographical and Historical Memoirs of Louisiana* (Chicago, 1892), II, 533–34; Roulhac B. Toledano, "Louisiana's Golden Age: Valcour Aime in St. James Parish," *Louisiana History*, X (1969), 211–24.

16. "Sugar Culture and Manufacture of Louisiana and West Indies," *DeBow's Review*, IV (1847), 383.

17. Pierce Butler, *Judah P. Benjamin* (Philadelphia, 1906); Simon I. Neiman, *Judah P. Benjamin* (Indianapolis, 1963), 44–47; Robert Donthat Meade, *Judah P. Benjamin* (New York, 1943), 57–61; *National Cyclopedia of American Biography*, IV, 285.

tation. Before Benjamin lost the property through an unfavorable financial settlement during the late 1840s, he wrote the most perceptive essays of any Louisiana planter about sugar chemistry and new process machinery. His visits to Paris had resulted in "notes . . . of value, comprising references to what I have read, and statements of what I have seen and heard and subject so interesting to me as the sugar culture and manufacture, and have collected every thing of any value that has ever been published on the subject."¹⁸ Benjamin contributed a number of articles to *DeBow's Review* about new apparatuses, the chemistry of sugar manufacturing, and advanced methods of chemical analysis.

A third way in which French ideas were introduced into Louisiana was in the widespread distribution of an 1847 treatise by R. S. McCulloch entitled *Report of Scientific Investigations Relative to the Chemical Nature of Saccharine Substances, and the Art of Manufacturing Sugar*. Richard Sears McCulloch was born in Baltimore in 1818.¹⁹ While working as a laboratory assistant to Joseph Henry, McCulloch graduated with a bachelor of arts degree from the College of New Jersey in 1836. Acting on Henry's suggestion, he spent the winter of 1838–1839 in the study of practical chemistry at the laboratory of James Curtis Booth in Philadelphia. During the late 1830s, McCulloch was first employed by the Chesapeake and Ohio Canal Company, and later he was an observer in Girard College's Magnetic Observatory in Philadelphia. In 1840 he became a professor of natural philosophy, mechanics, and chemistry at Jefferson College in Canonsburg, Pennsylvania. McCulloch was appointed melter and refiner at the United States Mint in Philadelphia in 1846, and while he was in this position, he assisted the secretary of the treasury in studying chemical and manufacturing problems related to the sugar industry. In addition to his work on the chemistry and manufacture of sugar, McCulloch published a number of reports

18. "Sugar—Its Cultivation, Manufacture and Commerce, No. II," *DeBow's Review*, IV (1847), 297.

19. McCulloch's treatise is contained in A. D. Bache and R. S. McCulloch, *Reports for the Secretary of Treasury of Scientific Investigations in Relation to Sugar and Hydrometers* (Washington, D.C., 1848). Biographical information on McCulloch is from Milton Halsey Thomas, "Professor McCulloch of Princeton, Columbia and Points South," *Princeton University Library Chronicle*, IV (1947), 17–29.

on related subjects during the mid-1840s, including *A Report of Chemical Analyses of Sugars, Molasses, Etc., and of Researches on Hydrometers* (February 21, 1845), and *A Report of Researches on Hydrometers and Spirituous Liquors* (June 2, 1848).

McCulloch's work had two purposes: first, to prevent revenue frauds by determining which analytical chemical procedures were the most specific and accurate for the analysis of sugar in molasses; second, to characterize the current status of scientific sugar manufacturing so that an assessment could be made of the relative merits of the methods practiced in Louisiana and the Caribbean. McCulloch's treatise on sugar manufacturing included a report of his own studies and presented a collection of chemical and technical treatises and articles translated from French. Indeed, this study was grounded on theoretical and applied studies conducted by a host of French or French-related investigators, including J. B. Avequin, Norbert Rillieux, Anselme Payen, Jacques François Dutrône la Couture, E. Degrand, Jean Baptiste Boussingault, Eugène Pécelet, Jean Baptiste Dumas, Nicolas Vauquelin, T. Clerget, Henry Braconnot, Augustin Pierre Dubrunfaut, and Eugène Peligot.²⁰ For McCulloch, the modernization of the cane-sugar industry in Louisiana meant the injection of French ideas concerning the manufacture of beet sugar into an industry that was dominated by rule-of-thumb methods. McCulloch acknowledged that the European beet-sugar industry had benefited from the application of scientific innovations. In contrast, he felt that cane-sugar manufacturing had remained technically backward because the process was controlled by Negro slaves instead of scientifically trained experts. He wrote:

20. Among the treatises employed in McCulloch's report were: Jean Baptiste Dumas, *Traité de Chimie Appliquée Aux Arts* (Paris, 1828-46); Eugène Pécelet, *Traité de la chaleur considérée dans ses applications* (Paris, 1843); Jean Baptiste Boussingault, *Rural economy, in its relations with chemistry, physics and meteorology*, trans. George Law (New York, 1845); E. Degrand, *Fabrication et Raffinage du sucre: Notice sur la concentration des jus sucres et la cuisson des sirops* (Paris, 1835); Jacques François Dutrône la Couture, *Precis sur la canne et sur les moyens d'en extraire le sel essentiel* (Paris, 1790); Anselme Payen, *Cours de chimie elementaire et industrielle* (2 vols.; Paris, 1832-33); Eugène Peligot, *Recherches sur la nature et les proprietes chimiques des sucres* (Paris, 1838).

While the beet sugar industry has had great difficulties to contend with in the very impure nature of the juice employed, it yet has received in France every facility and advantage which the science, intelligence, and fostering care of a powerful and enterprising nation could afford. On the other hand, the cultivation of the cane, and the art of extracting sugar from it, seem almost to have been left for centuries to the management of the ignorant and stupid negro. . . . Thus, in these two similar and rival industries, we behold science overcoming obstacles imposed by nature, and contending with indolence favored in every respect.²¹

Although the role of immigrants, the observations from travelers, and government reports stimulated the diffusion of French science into Louisiana, the numerous articles, reprints, and opinions published in *DeBow's Review* provided the Louisiana planter with a steady supply of valuable scientific and technical information.²² This magazine, founded by J. D. B. DeBow in 1846, contained numerous articles describing scientific sugar culture and manufacture; reprints of valuable treatises, including Evans' *A Handbook for Sugar Planters*; translations of French articles, including those by E. Degrand and Anselme Payen; reports and financial statements from Valcour Aime, Norbert Rillieux, and others; and discussions of new processes patented in the United States and Europe. DeBow himself commented from time to time on the development of the sugar in-

21. Bache and McCulloch, *Reports for the Secretary of Treasury*, 221.

22. Ottis Clark Skipper, *J. D. B. DeBow, Magazinish of the Old South* (Athens, Ga., 1958). There are numerous articles in *DeBow's Review* that attempted to join together theory and practice in the manufacture of sugar. They included: J. D. B. DeBow, "Agricultural Associations," I (1846), 161-68; J. P. Benjamin, "Louisiana Sugar," II (1846), 322-45; E. J. Forstall, "Louisiana Sugar," I (1846), 53-55; L. B. Stone, "On the Crystallization of Sugar," III (1847), 230-34; Maunsel White, "The University of Louisiana," III (1847), 260-65; L. B. Stone, "A Few Notes for Sugar Planters," III (1847), 297-305, 376-96; "Southern and Western Agricultural and Mechanics' Associations," IV (1847), 415-50; "McCulloch's Report on Sugar—Reviewed," V (1848), 244-57; "Avequin's Review of McCulloch, Reviewed," V (1848), 334-63; "Sugar Making in Louisiana," V (1848), 285-93; J. P. Benjamin, "Soleil's Saccharometer," V (1848), 357-64. DeBow also condensed important treatises including William J. Evans, *A Handbook for Planters* (London, 1847) in "Sugar—Its Cultivation, Manufacture and Commerce," IV (1847), 152-59, 296-310. See also J. D. B. DeBow, *The Industrial Resources of the Southern and Western States* (New Orleans, 1853).

dustry in Louisiana, usually within the context of related institutions—the University of Louisiana and the Louisiana Agriculturists' and Mechanics' Association. Judah P. Benjamin wrote a number of the longer articles on sugar. DeBow also acquired information from J. B. Avequin, Valcour Aime, Maunsel White, P. M. La Pice, Thomas Packwood, and other Louisiana planters. He obtained foreign reports from a number of sources, including R. S. McCulloch in Philadelphia, and Thomas G. Clemson, located at the United States consulate in Brussels.²³

DeBow's Review played an important role in the planters' early attempts to modernize the Louisiana sugar industry. It not only contained articles describing French processes for manufacturing sugar, but also propounded a progressive view concerning the role of science and its relationship to the manufacturing arts, usually with reference to French science. It appears that several planters viewed science as both a guide and an active force for industrial improvement. One *DeBow's* article stated, "It is plainly important then, to gather from science the light necessary to protect us from the delusions of an excited imagination, and to guide us to the way of safe and profitable enterprise." In an article entitled "The Mission of Science," DeBow maintained that science had a divine purpose, and that scientific progress was the will of God. He felt that God fostered and perfected science, and that God "will sweep away the ignorance and prejudice that oppose barriers to its advance—that he will permit no more the great book of nature to be closed, . . . that a lustre, brighter each day, may beam from its pages, diffusing and reflecting . . . chasing away the clouds of error and idolatry, . . . and ushering in the great and desired year—the Millenium of Science." Others, like L. B. Stone of New Orleans, felt that the advancement of science would be due more to the efforts of man than those of God. He asserted that "we should despise the feeling that there is anything either in the simple or refined operations of nature too large for our comprehension, or too minute to be worthy [of] our devoted attention."²⁴

This new ideology of science proclaimed that man had control

23. "Melsen's Sugar Manufacture," *DeBow's Review*, VIII (1850), 111–22.

24. L. B. Stone, "A Few Notes for Sugar Planters," *ibid.*, III (1847), 298; J. D. B. DeBow, "The Mission of Science," *ibid.*, XXIII (1857), 662–63; L. B. Stone, "On Crystallization of Sugar," *ibid.*, III (1847), 396.

over his circumstances and that, as a consequence of intelligent activity, improvements would eventually follow. Pierre Rost, in his 1845 address to the Agriculturists' and Mechanics' Association of Louisiana, stated: "The innate faculty of our people is to subdue the physical world. . . . With heroic determination, then, speed the plow; bear in mind that to go ahead without ever taking difficulties into account, and by that means to succeed when others dare not undertake, is emphatically the AMERICAN SYSTEM."²⁵

Judah P. Benjamin, the New Orleans lawyer and Plaquemines Parish planter, wrote the most detailed essays in *DeBow's Review* concerning the relationship between science and sugar manufacture. It appears that his ideas about science were significantly influenced by his observations of French science and French beet-sugar manufacture. Benjamin felt that only in France "have the researches of men of science been so ardently and extensively directed to the practical application of the discoveries of the laboratory to the improvement of the manufacturing industry." He recalled that if an industry were to be transformed by the injection of science, the presence of experts familiar with fundamental physical laws would be necessary. He noted that in France

the men who conduct their manufactories and refineries are in very many instances carefully educated with a view to this pursuit, and only enter into the practice of their art after being intimately acquainted with its theory in all its branches. With those principles of physics and mechanics which will enable them thoroughly to understand the working of the machinery employed, and with those discoveries of modern chemistry which can best enlighten them as to the real nature of the delicate and beautiful process. . . . The advantages possessed by such men, surrounded by all the means and appliances of advanced civilization, with ready reference on all subjects of doubt or difficulty to men of eminent scientific attainments, and with every facility for obtaining at the cheapest rate, the supply or repair of machinery and material of every kind, over the indolent or ignorant colonial Planter, or even over our own more intelligent agriculturists are inappreciable.²⁶

25. "Southern and Western Agricultural and Mechanics' Associations," *ibid.*, IV (1847), 435-36.

26. "J. P. Benjamin's Address on Agriculture," *ibid.*, V (1848), 47.

Benjamin felt that the Louisiana industry was backward and would remain that way until planters became acquainted with the basic principles of chemistry. He considered Louisiana planters to be quite familiar with the mechanical principles associated with the steam engine, but felt that their knowledge of acids and bases was lacking. Benjamin also saw the value of cooperative investigation and problem solving. The Agriculturists' and Mechanics' Association of Louisiana was one institution that could bring planters, their problems, and their ideas together. The activities on Benjamin's Belle Chasse plantation, as recounted by one biographer, seemed to reflect his ideas concerning mutual cooperation. "And frequently, for quite long visits, came the dried up little chemist, Rillieux, always the centre of an admiring and interested group of planters as he explained this or that point in the chemistry of sugar or the working of his apparatus. . . . 'Bellechasse' became not only a sort of social focus for the planters of the neighborhood, but the scene of a symposium, as it were, on sugar."²⁷

Planters like Benjamin, Aime, La Pice, and others recognized that science was the key to the improvement of traditional processes and to increased profits. It was natural that south Louisiana planters would be receptive to European ideas, since the region itself was a melting pot of capitalists having diverse origins and a land in which French and English were often interchangeably spoken. Yet this flow of ideas and methods had to be facilitated by institutions as well as individuals, and it was the weakness of local organizations that proved to be the greatest stumbling block to modernization in the years before the Civil War.

27. Butler, *Judah P. Benjamin*, 59.