THE CONTRIBUTIONS OF E. H. S. BAILEY TO THE DEVELOPMENT OF PURE FOOD AND WATER LAWS IN KANSAS

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During his 50-year tenure at the University of Kansas, E. H. S. Bailey trained thousands of chemists and helped establish a strong, dynamic Chemistry Department. He dedicated his life to educating Kansans about the need for clean water, proper labeling, and unadulterated foods. His many publications, analyses of industrial products, desire to educate, and leadership in the Kansas State Board of Health brought national recognition to the University of Kansas Chemistry Department (1).

Scientific developments in the nineteenth century began to revolutionize chemistry. Advances in bacteriology and the invention of the achromatic microscope in the 1830s brought about the first serious laboratory testing and analysis of water, milk, and foods. The number of laboratories in medical schools, universities, health departments, and hospitals increased. Many new scientific publications began to appear. In January 1879 in an address to the Medical Society of New York, Edward Robinson Squibb, a pharmacologist and pioneer in anesthesia, proposed a national statute to regulate food and drugs. He convinced Senator Warner Miller of New York State to introduce such a bill on December 20, 1881, to the Forty-seventh Congress of the United States, but it was defeated by a group of prosperous manufacturers of patent medicines who lobbied against the bill. Squibb died before he could see his dream come to fruition. Twenty-five years later, such a law was passed by the United States Congress as the Federal Pure Food and Drugs Act of 1906 (2).

The young Bailey

During these times of important advances in science and technology, Edgar Henry Summerfield Bailey was born on September 17, 1848, in the manufacturing village of Baileyville, near Middlefield, Connecticut. He was the only son of Russell E. and Hannah Miller Bailey. Russell owned a machine shop that made wooden coffee mill handles for a hardware factory, later turning out

clothes wringers for a washing machine company and spools and spindles for textile mills. The son grew up in this environment, building machinery, mill dams, and water wheels. After he completed education at the district school, he attended the Wesleyan Academy in Wilbraham, Massachusetts, where he became especially interested in chemistry, physics, and geology (3). After Wesleyan he attended the Sheffield Scientific School at Yale University from which he received a bachelor's degree in 1873. He spent another year at Yale doing graduate study and teaching before assuming his first full-time teaching position at Lehigh University in Bethlehem, Pennsylvania, at an annual salary of $1,000. Along with his teaching, Bailey performed commercial work, analyzing iron, zinc, and manganese ores, coal, limestone, furnace gas, and other industrial products. He remained at Lehigh for nine years, gaining experience in performing commercial chemical analyses and preparing himself to teach mineralogy, metallurgy, and assaying (4).

Following the American pattern at the time, Bailey studied in Europe at the Kaiser Wilhelm University at Straßburg under Dr. Rudolph Fittig (5). In 1883 he received the degree of Doctor of Philosophy from Illinois Wesleyan University (6) and became head of the University of Kansas Chemistry Department. He arrived in Lawrence when it was a town of board walkways, mud roads, and community drinking cups. Disease was widespread; contaminated food was common, and drinking waters often were polluted. During the next fifty years of teaching and research, he helped bring healthy food and safe drinking water to the people of Kansas.

Bailey's meager laboratory was in the basement of Fraser Hall, one of only two buildings on the campus.

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The entire chemistry library consisted of 22 of his own books. As the only teacher in his department he had no assistance other than what the more advanced students were able to give. He taught a remarkable spread of subjects, including general chemistry, qualitative chemistry, quantitative chemistry, organic chemistry, assaying, mineralogy, metallurgy, blowpipe analysis, toxicology, physiological chemistry, and *materia medica*. In 1885, perhaps out of sheer enthusiasm, he added a course in domestic and sanitary chemistry. The University of Kansas thus became one of the first universities to offer a course in the practical applications of chemical principles to everyday life. This led to the establishment of the Department of Home Economics and to Bailey's writing one of the first textbooks in the field in 1914: *The Source, Chemistry and Use of Food Products* (7).

After the Federal Pure Food and Drug Act was passed in 1906, Bailey began to press for such an act in the state of Kansas. He sent the first food analysis to the State Board of Health in January 1906 (8), in which he reported that two-thirds of the food analyzed contained preservatives and adulterants. The report was copied

widely by the press and caused a sensation throughout the state. It was also met with opposition, especially from the owners of the packinghouses. For example, when sausages were examined and reported to be artificially colored and to contain a preservative, the attorney for the packinghouse complained to Governor Edward W. Hoch that the packing house was being ruined since people quit buying its sausages. Politicians and lawyers tried to bribe the Board of Health staff to look the other way when inspecting their meat products. In spite of the pressures, the governor supported the State Board of Health and, on the basis of previous work at the Chemistry Department, the Kansas Pure Food and Drug Act was passed on February l4, l907 (9).

Enforcement of this law was placed in the hands of the State Board of Health which delegated the examination of foods and drugs to Julius T. Willard at the Kansas State Agricultural College in Manhattan and to Bailey at the University of Kansas Chemical Laboratory. The latter facility became known as the State Food Laboratory (10). Under the auspices of the state board, sectional meetings were held throughout the state for the purpose of educating everyone whose business related to the Kansas Pure Food and Drug Act. The committee chairing these meetings consisted of Bailey, Lucius E. Sayre of the Pharmacy Department at the University of Kansas, Willard, and Samuel J.Crumbine, the state health officer. During one of these meetings, Bailey listed the following examples of the most commonly adulterated foods in Kansas (11):

> Flour bleached by an electrical process; sugar whitened with bluing; butter mixed with too much water; pickles hardened with alum; pure cider vinegar made of a malt substance and colored with burnt sugar; lemon extract made of diluted alcohol passed through the shadow of a lemon and colored with coal tar yellow; vanilla extract made of artificial substances, colored with burnt sugar and flavored with prune juice; spices from which the essential oils have been removed; meat that has been artificially preserved with sulphites and brightened in appearance; and tomato catsup artificially colored and preserved.

Keeping food safe was not an easy task, since manufacturers were trying to cut costs, often by slipping cheap substitutions into foods. To do its work, the State Food Laboratory purchased products to analyze. These products, their manufacturers, and the chemist's findings were listed in the newspapers. A report on the Primrose Extract of banana was typical (12):

> Primrose Flavoring Extract of Banana, Manufacturing Department of Parkhurst-Davis Mercantile Company, Topeka, Kan. Amount contained in bottle, 50 grams, or 1.8 fluid ounces. This contained 28.6 per cent of alcohol, by weight; artificial flavoring, 16.5 per cent, by volume; coloring material, a coal-tar dye. As it is not practical to make a concentrated extract of banana, there seems to be no objection to the sale of an artificial preparation like this. It should not be labeled Extract of Banana, however, but Artificial Banana Flavoring. Compound ethers are very often used in making these so-called "pure-fruit flavors." The materials should be sold upon their merits and not under an assumed name, for there is usually no fruit used in their preparation.

Bailey's findings revealed many forms of adulteration. He found that copper had been added to canned vegetables to produce a natural-looking green color. A commercial sausage had a large amount of starch added to allow the use of more fat or water. Jams and jellies, made from treated cider mill refuse, proclaimed Bailey (13):

> ..had their compositions so exposed that if they had not been already as red as aniline colors could make them, they would have blushed to acknowledge that no fruit whatever had been used in their manufacture.

Lead chromate was put into lemon drops; burnt sienna, a mineral substance, was used to imitate chocolate; butter and cheese were colored to appear golden. Bailey hoped this practice of coloring food to make it attractive would be eliminated, saying, "A dyed food like a made-up complexion will cease to be admired (14)."

The State Food Laboratory also examined the purity of grains. Because the bleaching of flour could cover up many imperfections, Bailey suggested the public could avoid eating unwholesome or musty flour by us-

ing unbleached flour. The public's preference for white bread over dark bread dated back to the time when a cheaper bread was made from rye flour or badly milled wheat flour that was only bought by the poor. Because the bleached flour was white, it was thought to be pure. Instead of purifying the flour by bleaching with nitrogen dioxide, however, this process rendered the flour so antiseptic that it resisted the digestive juices and thus was unhealthy. The consumer now wants (15):

> ..nice, white bread to set before her guests. It doesn't matter that this flour is usually bleached by chemicals, just as much as your straw hat is bleached by sulfur fumes, and your sheeting is bleached by chloride of lime in the bleachery.

To make the public aware of these adulterations Bailey began publishing pamphlets and writing articles for the newspapers. One such pamphlet, "Some Simple Kitchen Tests to Detect the Adulteration of Foods," was distributed throughout the state. Anyone could perform these simple tests, and the pamphlet was popular with housewives who kept it handy in the kitchen drawer. He wrote articles in the *Topeka Daily Capital* under a column called "Sanitary Suggestions" with such titles as "What Water Shall We Drink?" and "The Art of Coloring Food (16)."

The size of cans and containers for foods was a concern handled by the State Food Laboratory. When a weights and measures law was passed in 1911, its enforcement was delegated to the State Board of Health. Bailey tried to teach people to be aware of both the content and weight of the food they bought (17):

> Pound packages originally contained sixteen ounces, and quart cans held two pints; but the commercial conscience slept, and while it slept the thrifty manufacturer, in order to further increase his profits, trimmed off an ounce here, and half a gill there.

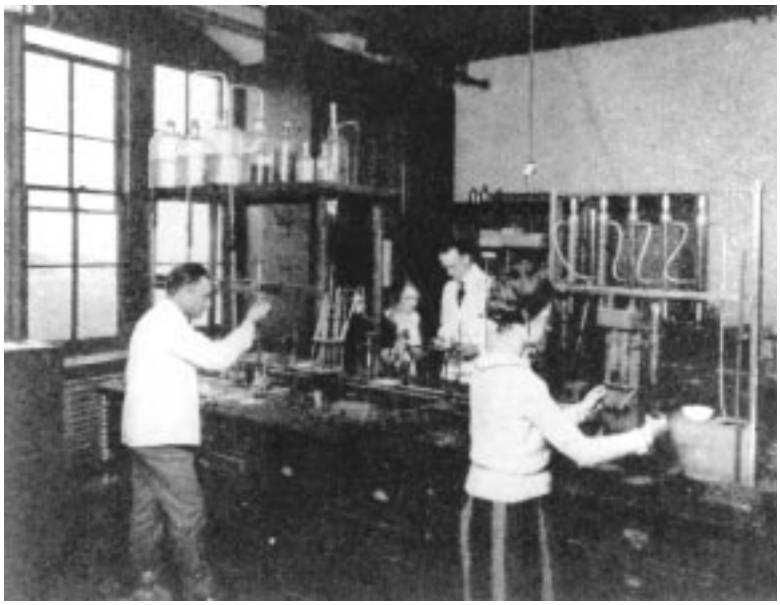
Food in state institutions was also under the jurisdiction of the State Board of Health, and often it was found to be of poor quality and lacking nutritional value. Since Bailey was chemist for the State Board of Health he tried to improve the situation by making dietary studies of such institutions as the Kansas State Penitentiary in Lansing, the State Industrial Reformatory in Hutchinson, the Osawatomie State Hospital, and the Girls' Industrial School in Beloit. He was also called upon from time to time to testify in court trials concerning poisons and drugs. At one such trial the defendant had supposedly disposed of his wife with poisoned chocolates. When Bailey declared the chocolates untainted, the judge asked where they were. Bailey replied that he had eaten them (18).

In addition to Bailey's work to protect the public from fraud and impure food, he was concerned about the state's water. When in 1889 the Kansas Legislature authorized The University of Kansas to undertake "a complete geological survey of such portions of the state of Kansas as have any natural products of economic importance," Bailey was an obvious leader for the resulting Kansas Geological Survey, in partnership with Erasmus Haworth (physical geology and mineralogy) and Samuel Williston (paleontology) (19). Between 1898 and 1908 this trio of scientists wrote *The University Geological Survey of Kansas*. This nine-volume work included their explorations on Kansas' paleontological sites, coal, gypsum, mineral waters, oil, gas, lead, and zinc. Bailey's primary contribution to this survey was an analysis of the state's mineral waters, which includes descriptions of and notes about the resorts, bath houses, and hotels built around the mineral springs. He described the Great Spirit Spring in Mitchell County that the Indians had always regarded as sacred. It was unusual in that it did not flow like a spring but rose from a mound of stone, seldom overflowing, and seeped back into the surrounding porous rock. He commented on the large bathhouse and hotel built in Geuda Springs where the Geuda Springs Town and Water Company bottled water for sale, along with lemon sour, ginger ale, and other carbonated beverages. He noted that the flow from one of the largest springs in the state at Sun Springs in Brown County was estimated to be 5,000 gallons an hour. He also mentioned the sanitarium at Bonner Springs, Wyandotte County built around the springs for the treatment of mental and nervous disorders (20). As the cities became more populated, the danger of infection from the wells by surface drainage increased. In a town on the Smoky Hill River it was suspected that a cesspool was polluting a well about 150 feet away. To determine whether this was correct, a solution of iron sulfate was put into the cesspool, and in about 48 hours the residents tasted the bitter iron. Chemical analysis of the well water proved that the users were drinking their neighbor's diluted sewage. Another example of this type of pollution occurred at the beet sugar plant in Garden City where the used pulp was thrown out on the ground and allowed to ferment and decompose. These instances prompted a warning from Bailey and Bartow (21):

> Shallow wells or springs in densely populated areas or in loose, porous soil, or near a known source of pollution, should always be tested. To conclude that just because water is bright, clear and sparkling makes it safe to drink is dangerous because the very gases of decomposition may make the water look sparkly.

The mining industry was another cause of river pollution. An analysis of the run off waters showed large quantities of iron sulfate and sulfuric acid, which prevented the survival of fish (22).

The best source of drinking water, said Bailey, was a city water and sewage plant, where the whole quantity could be supervised carefully and analyzed frequently. The first such plant was built in Lawrence in 1886, with the Kansas (Kaw) River as its supply. Rainwaters falling off the roofs into cisterns or reservoirs were



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recommended in the rural areas as safe if they were obtained from a well-painted shingle roof where the first run-off had been discarded so as to wash the roof thoroughly. But boiling water was the safest way to free it of contamination (23).

Southeastern Kansas and southwestern Missouri were of great economic importance because of their lead and zinc mines, which yielded in 1909 about 9% of the total lead output and almost 50% of the total zinc output of the United States. Bailey's chemistry department was an important location for the training of analysts and mineralogists for the coal and metal ore mining industries, as well as for the oil and gas industries. He carried out the first analysis of Kansas oil and natural gas, the forerunner of the helium industry (24). Hamilton Cady, who succeeded Bailey as head of the Chemistry Department, cited an example of his wide influence as a technologist in an address (25):

> A shipment came [to the laboratories] from Utah of a peculiar mineral, alunite. This mineral, after being heated, would partly dissolve in water, and from the solution alum could be crystallized. Some years later, I saw an unusual mine operation in south-eastern Utah, and upon inquiring I found they were alunite mines, being worked by the same process Bailey had suggested. A Bailey industry way out there in Utah.

During the fifty years of Bailey's tenure at the University of Kansas (1883-1933), his students made important contributions to the development of the industrial resources of the state. Some went into the zinc and lead mining industries in the southeastern part of the state. Others were employed by the gas, oil, and glass industries, as well as in the short-lived sorghum industry at Medicine Lodge, Topeka, Ottawa, and Fort Scott. The smelters, oil refineries, soap factories, and packing plants at Kansas City, St. Joseph, and Omaha hired many Kansas chemists. In this manner, chemists played an important role in improving the lives of Kansans. Bailey never wavered in his crusade to safeguard the public against impure and injurious foods and to protect them from the frauds of mislabeling and misbranding. He believed that the public's good health could be maintained through knowledge gained from the chemist's experiments, and he devoted his life to sharing this knowledge with the people of Kansas (26).

REFERENCES AND NOTES

l. From classes conducted by Bailey went young people who became leaders in scientific research in this country: H. P. Cady and D. F. McFarland, , first to demonstrate that helium occurred in natural gas; E. V. McCollum, discoverer of vitamins A & C; Vernon Kellogg, secretary of the National Research Council; Edwin E. Slosson, founder of Science Service Center in Washington, DC; Robert Duncan, founder of the Mellon Institute of Industrial Research; E. C. McClung, who discovered the significance of sex chromosomes; and George E. Coghill, a pioneer in neurology.

2. J. Duffy, *The Sanitarians: a History of American Public Health*, University of Illinois Press, Chicago, 1990, 193; L. G. Blockman, *Doctor Squibb; The Life and Times of a Rugged Idealist*, Simon and Schuster, New York, l958, 273.

3. "Celebrating 40 Years of K.U. Service," Graduate Magazine, Univ. of Kansas, October, 1923, 7; "History of the Chemistry Department of the University of Kansas," *University of Kansas Bulletin*, February l5, 1925, *26*, 13.
4. "History of the Chemistry Department of the University of Kansas," *University of Kansas Bulletin*, February l5, 1925, *26*, 15; K.U. News Bureau Release, June 1, 1933, E. H. S. Bailey Collection, University Archives, University of Kansas, Lawrence, KS, 2.
5. At the time Bailey studied in Straßburg, Fittig's research in preparative organic chemistry was contributing significantly to the development of structural organic chemistry.
6. Bailey's thesis was entitled "On Manganese, Including a Discussion of the Methods for its Graviometric and Volumetric Estimation." [Copies of the thesis are available from the author.] In 1874 Illinois Wesleyan University, Bloomington, IL, was the first school in the US to offer degrees of Bachelor of Arts, Bachelor of Philosophy, Master of Arts, and Doctor of Philosophy, in absentia. The program was patterned after the ones already in effect in several British Universities, Oxford, Cambridge, and University of London. The purpose was to fill an urgent and legitimate need on the part of many mature individuals throughout the United States who desired to further their education but were unable to leave their current employment. In 1882 when Professor Bailey received his doctoral degree, Prof. C. M. Moss was Dean of the College of Liberal Arts and also director of the nonresident work. Branches of this department were established in both Canada and England. A total of 750 students finished their degrees in this program between 1881 and 1890, reaching a high point in 1900/1901 when 478 were enrolled. Nonresident work was discontinued with the end of the school year in June 1910. E. H. Cates, "The History of Non-resident Courses at Illinois Wesleyan," *The Home Study Review*, Winter 1965, 16-20.
7. "History of the Chemistry Department of the University of Kansas," *University of Kansas Bulletin*, February l5, 1925, *26*, 18; V. J. Anderson, *The Department of Home Economics, the First 50 Years, 1910-1960*, University of Kansas Press, Lawrence, KS, 1964, 3. Besides *The Source, Chemistry and Use of Food Products*, Bailey published the following books*: Kansas Geological Survey, V,* joint author of "Special Report on Gypsum and Gypsum Cement Plasters;" *Kansas Geological Survey, VII*, "Special Report on Mineral Waters;" *A Laboratory Guide to the Study of Qualitative Analysis*, Blakiston's Sons, Philadelphia, PA, 1937; *Textbook of Sanitary and Applied Chemistry*, Macmillan Co., New York, 1917; *Laboratory Experiments on Food Products*, Blakiston's Sons, Philadelphia, PA, 1915; *Food Products: Their Source, Chemistry and Use*, Blakiston's Sons, Philadelphia, PA, 1928; with Herbert Bailey, *Food Products From Afar*, Century Co., New York, 1922.
8. E. H. S. Bailey, "Analysis of Food Products," *Kansas State Board of Health Bulletin*, January 1906, *2*, 5-13.
9. Kansas General Statutes, Supplement, 1907, 157; "Kansas Pure-Food Laws," *Kansas State Board of Health Bulletin*, January 1906, *2*, 5, 16.
10. R. Taft, *Fifty Years in Bailey Chemical Laboratory at the University of Kansas*, University of Kansas, Department of Chemistry, 1950, 3.
11. S. J. Crumbine, "Pioneering in Food and Drug Law Enforcement, June 5, 1942," 5; manuscript, Clendening Medical Library, University of Kansas Medical School, Kansas City, MO.
12. Ref. 8, p 6.
13. E. H. S. Bailey, "The Practical Side of Some Scientific Work in the University," *Graduate Magazine of the University of Kansas*, November 1906, Vol. 2, 44, 45.
14. E. H. S. Bailey, "Sanitary Suggestions: The Art of Coloring Food," *Topeka Sunday Capital*, December 12, 1909, 4.
15. E. H. S. Bailey, "The Art of Bleaching and Dyeing as Applied to Food," *Popular Science Monthly*, January 1909, 59; "Blondined Flour," *Merchants Journal*, August 22, 1908, 2.
16. E. H. S. Bailey, "Some Simple Kitchen Tests to Detect the Adulteration of Foods," 1908, Bailey Collection, University of Kansas Archives.
17. Ref. 13, p 48.
18. Earl Huyser, interview by author, June 28, 1994; E. H. S. Bailey, "A Dietary Study of Some Kansas Institutions under the Control of the State Board of Administration," Bailey Collection; "Obituary," in *Trans. Kans. Acad. Sci.*, April 1934, *37*, 27; Bailey was the chemist on the State Board of Health from 1883 to 1933.
19. Board of Regents and Officers of the University of Kansas, *Ninth Biennial Report*, 1894, 22-23, Bailey Collection; C. S. Griffin, *The University of Kansas: A History*, University of Kansas Press, Lawrence, KS, 1974, 254, 255.
20. E. H. S. Bailey, *The University Geological Survey of Kansas*, Vol. VII, (Special Report on Mineral Waters), State Printer, Topeka, KS, 1902, 143, 182, 197, 226. Some other publications by Bailey on water were: "Methods of Classification of Mineral Waters," *Proc. Am. Chem, Soc*., **1902**, *24*, 4l; "Occurrence of Manganese in a Deposit Found in City Water Pipes," *J. Am. Chem. Soc.*, **1904**, *26*, 7l3; "State Water Survey No.9," *Bull. Kan. State Board of Health*, **1911, *7,*** 17; "On the Occurrence of Nitrates in Well Waters," *Trans. Kans. Acad. Sci*., *16*, 40-42; "Some Sandstone Waters of Great Purity," *Trans. Kans. Acad. Sci*., *18*, 68-69.
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ABOUT THE AUTHOR

Carolyn Bailey Berneking, a native of Kansas City, MO, earned her master's degree in library science at Emporia State University, Emporia, KS. She researches topics in local history and is involved in local preservation activities. Since her retirement she has served as a volunteer in the University Archives, Kenneth Spencer Research Library, University of Kansas, Lawrence, KS. She is the granddaughter of E. H. S. Bailey.

1999 DEXTER AWARD

The Dexter Prize Committee of HIST has selected **Dr. Mary Jo Nye**, the Thomas Hart and Mary Jones Horning Professor of the Humanities and Professor of History at Oregon State University, as recipient of the **1999 Dexter Award for Outstanding Achievement in the History of Chemistry**. Professor Nye is the author of four books and more than three dozen articles on the history of chemistry and its interactions with physics. For 25 years she participated actively in the formation of leading undergraduate and graduate programs in history of science at the University of Oklahoma, and she served for three years as President of the History of Science Society. The award will be presented at a luncheon at the conclusion of the Dexter Award Symposium at the 219th National American Chemical Society meeting in the spring, 2000, in San Francisco.