A NATIONAL HISTORIC
CHEMICAL LANDMARK

HAVEMEYER HALL

COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK
OCTOBER 9, 1998

AMERICAN CHEMICAL SOCIETY
Division of the History of Chemistry and
The Office of Communications

Havemeyer Hall under construction, 1897.

This booklet commemorates the designation of Havemeyer Hall at Columbia University in the City of New York as a National Historic Chemical Landmark. The designation was conferred by the American Chemical Society, a not-for-profit scientific research and educational organization of more than 155,000 chemists and chemical engineers. A plaque marking the event was presented to Columbia University on October 9, 1998. The inscription reads:

> Havemeyer Hall was built between 1896 and 1898 under the leadership of Charles Frederick Chandler. It provided research and teaching facilities for faculty and students specializing in industrial, inorganic, organic, physical, and biological chemistry. Pioneering research done here led to the discovery of deuterium, for which Harold Clayton Urey received the Nobel Prize in 1934. Six others who did research here subsequently received the Nobel Prize, including Irving Langmuir, the first industrial chemist to be so honored, in 1932. The grand lecture hall in the center of Havemeyer remains the signature architectural feature of Charles Follen McKim's original design.

When the cornerstone for Havemeyer Hall was laid in 1896, Columbia University was about to celebrate its sesquicentennial as it prepared to move uptown to its third and present campus. At that time, most young American students seeking advanced training in chemistry and engineering obtained their Ph.Ds in Western Europe. But that was about to change as universities in the United States began to develop strong teaching and research programs of their own. The department that Columbia University housed in Havemeyer Hall was among the most prestigious and influential.

On the Cover: (clockwise) Frederick Christian Havemeyer; Havemeyer Hall; Charles Frederick Chandler; teaching laboratory, ca 1924.

Acknowledgments:

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HAVEMEYER HALL

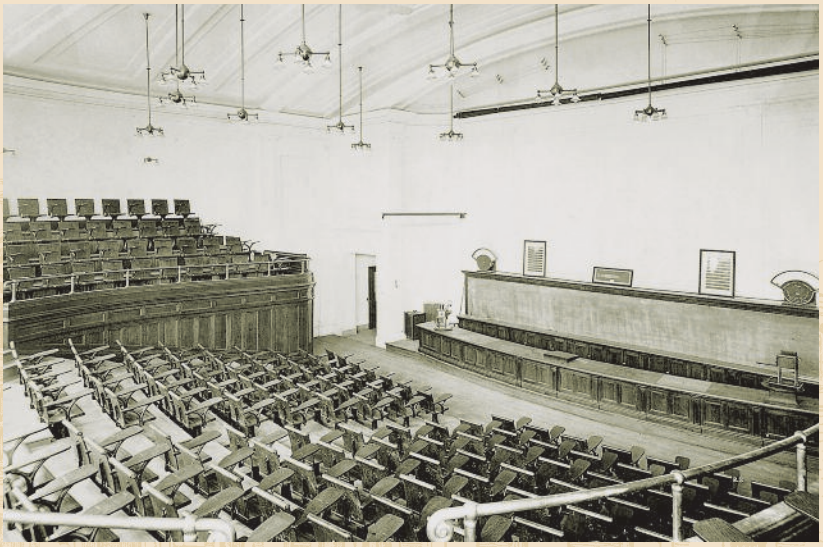
One of the six original buildings designed and built on what is now known as Morningside Heights, on the third and current campus of Columbia University, Havemeyer Hall opened its doors to classes and laboratories in the fall of 1898. Charles Frederick Chandler, former President of the Health Department of New York City, leading industrial chemist, and noted educator and professor of chemistry at Columbia, was largely responsible for the construction of the building. Funds were provided by Chandler's close friend, Theodore Havemeyer (Columbia School of Mines, class of 1868), of the family long identified with the sugar industry in America, to honor his father, Frederick Christian Havemeyer (Columbia College, class of 1825). The building still carries the Havemeyer name, though an extension, constructed in 1927, is called the Chandler Laboratories.

Charles Frederick Chandler, 1905.

Havemeyer Hall reflects the brilliance and style of Charles Follen McKim, founding partner of McKim, Mead, and White, then one of New York's most important architectural firms. His designs transformed the Columbia campus into one of the city's great monuments of the American Renaissance. The interior of this imposing red brick and limestone-trimmed structure is distinguished by a grand lecture hall, Room 309. The windows were originally of French plate glass. All the corridors in the building are still tiled in the original mosaic. The main entrance to Havemeyer is found on the third floor, at the campus level. Two lower floors, originally housing the operations laboratory and engineering chemistry, are now occupied by research and teaching space for physical chemistry.

Chemistry in the United States at the Turn of the Century

By the mid-19th century, science was established in the college curriculum in the United States through the founding of schools such as the Sheffield Scientific School of Yale College, and the Lawrence Scientific School of Harvard. Columbia University's School of Mines, the first in the country, was established in 1864. (It is now a department in the Fu Foundation School of Engineering and Applied Science.) Graduate schools began to appear in the United States that imitated the German university. By the end of the century, respectable programs for graduate study in chemistry were developing at The Johns Hopkins University, The University of Pennsylvania, Harvard University, University of Chicago, Columbia University, and other schools. At Columbia, between 1898 and 1938, the chemistry department granted more Ph.D.'s than any other in the country. Today, the department continues to graduate about 20 Ph.D.'s a year.



Havemeyer Hall, Room 309. The grand lecture hall has a 40-foot domed ceiling and skylight, 330 tiered seats, a brass railed gallery and a 40-foot oak demonstration table. It is much the same today as it was in 1898, when Havemeyer opened for its first classes.

PIONEERS IN CHEMISTRY AT COLUMBIA

Louis P. Hammett, professor of chemistry at Columbia, once said: "To the scientist, it is self-evident that major scientific advance depends upon the pioneering genius, that is, that it depends upon exploratory research in areas which have no immediately obvious practical value, carried out by people of outstanding and exceptional ability." Four chemists of such outstanding and exceptional ability exemplify the pioneering work in chemistry done within Havemeyer Hall in the early years of the twentieth century: Charles Frederick Chandler, Marston Taylor Bogert, Henry Clapp Sherman, and John Maurice Nelson.

Charles Frederick Chandler, 1836–1925

Although chemistry at Columbia University traces its roots back to 1754, it is only with the arrival of Charles Frederick Chandler in 1864, coinciding with the opening of the School of Mines, that one first recognizes the beginnings of a modern chemistry department at Columbia. Chandler received his Ph.D. with Friedrich Wöhler at the University of Göttingen. On his return to the United States in 1856, he received an invitation from Professor Charles Joy to help develop a chemical laboratory at Union College in Schenectady, NY. When Chandler arrived he found that no provision had been made for his salary, so he accepted the $400 budgeted for janitorial services and became "janitor assistant". When Joy was called to Columbia in 1857, the young janitor became the professor of chemistry. Following Joy in 1864, Chandler left Union College for New York City to help organize the School of Mines at

Charles Frederick Chandler in his office in Havemeyer Hall.

The Chandler Chemical Museum

The Chandler Museum, 1905. Chandler began to collect materials for the museum around 1865. For 50 years, he added chemical exhibits and artifacts including original mauve dye as first synthesized by W. H. Perkin, lab equipment that once belonged to Joseph Priestley, Friedrich Wöhler, and Louis Pasteur, and a collection of electric light bulbs dating back to Thomas Edison.

The east end of Havemeyer's main corridor was originally devoted to the Chandler Museum. Begun by Charles Frederick Chandler as a means of illustrating his chemical lectures, the collection soon included rare and valuable objects as well as the finest classroom exhibits, including nearly every inorganic salt known at the time and a collection of more than 4000 organic compounds, 1000 of them first developed in the laboratories of Columbia University; vegetable, petroleum and essential oils; explosives dating back to the Civil War; tanning and fertilizer exhibits; resins, varnishes, and pigments; a comprehensive electrochemical exhibit; colloids; an excellent collection showing the history of ceramic arts; a nearly perfect set of early 19th century apothecary jars; a collection of the earliest photographs; and an exhibit of rare earths.

Of particular importance was a complete set of pre-World War I German dyes and a large collection of synthetic dyes. The Chandler Museum collection was the only one available for use by the U.S. government for standards after German dye patents were confiscated during the war.

Much of the museum's content survives to this day, though only a small percentage of the artifacts are displayed in Havemeyer Hall.

Columbia. At the age of 27, he began a 54-year tenure with Columbia that included positions as professor of chemistry and dean of the School of Mines, the School of Pharmacy, and the Medical School.

As an exceptional teacher, Chandler attracted numerous students to the various schools of Columbia University. His influence on chemical research and the chemical industry, as passed on through his students, is incalculable. For many years, he and his brother, William H. Chandler of Lehigh University, edited *The American Chemist*, a journal devoted to applied chemistry. Chandler was one of the founders of the American Chemical Society and twice served as its president.

Marston Taylor Bogert, 1926.

As president of the Health Department of New York City, Chandler regulated supplies of natural gas, kerosene, city water and milk, and the slaughter houses of the city. Chandler's tenure was marked by unprecedented action against threats to public health. As a health officer, he established a proper system of plumbing in houses and introduced the system of visiting physicians, free vaccination, and the care of contagious diseases in special hospitals.

As an industrial chemist, Chandler was a pioneer in the field of sugar refining, gas manufacture, petroleum refining, photography, and dyeing and was an advisor and consultant to industry and local government. He was one of the earliest advocates of the cooperation between science and industry and was recognized for his valuable contributions to applied chemistry by the award of The Perkin Medal in 1920.

As a university administrator, Chandler's efforts to attract excellent young faculty to Columbia were so successful that its chemistry department was in the forefront of American universities.

Marston Taylor Bogert, 1868–1954

Substantive research in modern organic chemistry began at Columbia with Marston T. Bogert. With only a bachelor's degree from Columbia College in 1890 and no formal training in organic chemistry, Bogert became the first professor of organic chemistry at Columbia and an internationally known chemist. He published more than 500 scientific papers during a career that spanned half a century. His interest in synthetic organic chemistry included the study of quinazolines and thiazoles, essential oils, terpenes, alkaloids, vitamins, arsenicals, and drugs. Bogert was one of a small group of pioneering organic chemists who greatly influenced the growth of the chemical industry in the United States.

Henry Clapp Sherman, 1875–1955

After receiving an M.S. degree in 1896 and a Ph.D. in 1897 from Columbia University, Henry C. Sherman joined his alma mater as a lecturer and was given charge of a new course on quantitative organic analysis. This led to the publication of his first book *Methods of Organic Analysis*, which he published at age 28. One of Sherman's first areas of research was the investigation of the requirements in humans for calcium, phosphorus, iron, and protein. By 1907, when he became professor of chemistry, he proved that digestive enzymes were proteins. In 1920, Sherman began to study vitamins and developed biological assay methods for vitamin A, thiamine, ascorbic acid, and riboflavin.

Chandler's (center front) last visit to Havemeyer, 1925. Henry C. Sherman is on Chandler's left.

During World War II, Sherman left Columbia to serve as the chief of the Bureau of Human Nutrition at the Department of Agriculture. Several years later, he became the chairman of the Commission of Dietary Allowances of the National Research Council. In his work with animals, he established that old age could be postponed by a diet rich in "protective foods" such as fruits, vegetables, and milk. Sherman published more than 200 original research papers, as well as several monographs and textbooks.

John Maurice Nelson, 1935.

John Maurice Nelson, 1876–1965

After returning from studying with Wilhelm Ostwald in Germany, John M. Nelson received his Ph.D. under Marston T. Bogert. He, along with a Columbia University colleague K. George Falk, applied the electronic theory of valence to covalent bonds. They suggested that the direction the electron moves would depend on the relative position of the elements in the periodic table. This pioneering work offered an explanation for properties of organic compounds that had previously been a mystery.

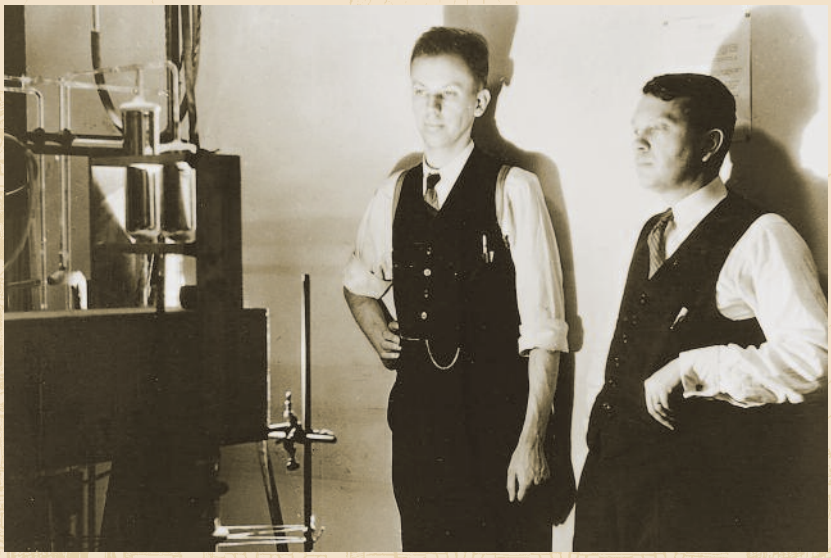
Nelson, with Harold Fales, uncovered the effect of neutral salts on hydrogen ion activity, which they found by direct electrometric measurement and by their effect on the rate of hydrolysis of sucrose. Much of Nelson's research involved the study of the nature of invertase, which catalyzes the hydrolysis of sucrose. His discovery that the addition of sodium chloride increases the hydrogen ion activity was the first documented case of the salt effect. He was also the first to study the kinetics of enzyme inhibition before it was ever identified as such.

Nelson is said to have been an excellent lecturer for the undergraduate organic course for premedical students given in the grand lecture hall. But it was his course for the first-year graduate students on the theories of organic chemistry that was unique and profoundly important in influencing students. After retirement and until his death at the age of 89, "Pop" Nelson was active in reorganizing the Chandler Chemistry Museum.

Havemeyer Hall was home to many notable scientists and scientific discoveries in the 20th century. Irving Langmuir, one of Charles Frederick Chandler's students at the School of Mines, who received a degree in metallurgical engineering in 1903, received the 1932 Nobel Prize in chemistry for his outstanding discoveries and inventions within the field of surface chemistry. He was the first American employed by an industrial laboratory to receive the prize. Harold Clayton Urey won the 1934 Nobel Prize in chemistry for his discovery of deuterium (heavy hydrogen). Louis P. Hammett was a founder of the field of physical organic chemistry. As chairman, he led the chemistry department into the modern era. Other chemists who were trained at Columbia would themselves become pioneers of chemistry. These include Nobel laureates John H. Northrup, a 1946 recipient for his investigations of protein molecules; Edward C. Kendall, 1950 recipient for his work in cortical hormones; and Roald Hoffmann, who shared the 1981 Nobel Prize for his work in applied theoretical chemistry.

Irving Langmuir, 1909.

Today, Havemeyer Hall is the centerpiece of a three-building complex that includes Chandler, the nine-story research building that is historic in its own right for the work that has gone on within its laboratories, and a new six-story annex that houses research and teaching laboratories. Havemeyer's grand lecture hall, Room 309, has been maintained in its original elegant design.



Harold Clayton Urey (right), with research student, Donald MacGillaury, at the time of the critical experiments that led to the discovery of deuterium and its positive identification spectroscopically, November 1931.

FOR FURTHER READING

B. Bergdoll. *"Mastering McKim's Plan. Columbia's First Century on Morningside Heights"*, Miriam and Ira D. Wallach Art Gallery, Columbia University in the City of New York, 1997.

R. D. Billinger. "The Chandler Influence in American Chemistry", *Journal of Chemical Education*, 1939, 16, 253–257.

R. P. Crease. *The House That Chandler Built*. 37–41, Columbia University: New York, 1987.

L. P. Hammett. *Physical Organic Chemistry: Reaction Rates, Equilibria, and Mechanisms*, McGraw-Hill: New York, 1940.

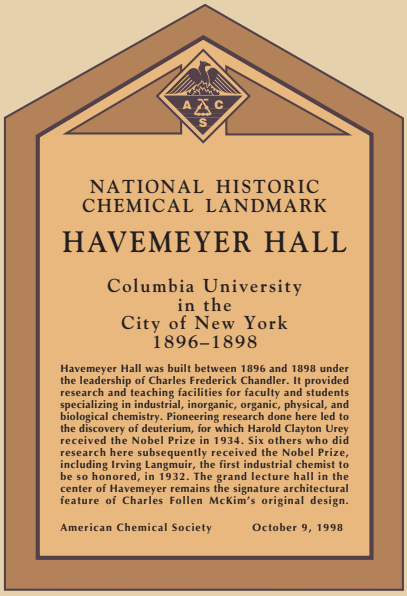
R. H. McKee, C. E. Scott, and C.B.F. Young. "The Chandler Chemical Museum at Columbia University", *Journal of Chemical Education*, 1934, 11, 275–278.

J. M. Nelson and M. T. Bogert. *Journal of the American Chemical Society*, 1954, 76, 5009.

M. I. Pupin. "Chandler: The Teacher and the Chemist", *Columbia Alumni News* 1926, 311–312.

L. P. Hammett, A. W. Hixson, D. Price, E. C. Kendall, R. M. Herriott. "Symposium on Pioneers in Chemistry at Columbia (New York, NY, September 1954)"; *Journal of Chemical Education*, 32, 1955, 498–517.

THE NATIONAL HISTORIC CHEMICAL LANDMARKS PROGRAM OF THE AMERICAN CHEMICAL SOCIETY



The ACS National Historic Chemical Landmarks Program recognizes our scientific and technical heritage and encourages the preservation of historically important achievements and artifacts in chemistry, chemical engineering, and the chemical process industries. It provides an annotated roster to remind chemists, chemical engineers, students, educators, historians, and travelers of an inspiring heritage that illuminates where we have been and where we might go when traveling the diverse paths to discovery.

An ACS historic chemical landmark represents a distinctive step in the evolution of the chemical sciences and technologies. Designations of sites and artifacts note events or developments of clear historical importance to chemists and chemical engineers. Collections mark the contributions of a number of objects with special significance to the historical development of chemistry and chemical engineering.

This program began in 1992, when the Division of the History of Chemistry of the ACS formed an international Advisory Committee. The committee, composed of chemists, chemical engineers, and historians of science and technology, works with the ACS Office of Communications and is assisted by the Chemical Heritage Foundation. Together, these organizations provide a public service by examining, noting, recording, and acknowledging particularly significant achievements in chemistry and chemical engineering. For further information, please contact the ACS Office of Communications, 1155 Sixteenth Street, N.W., Washington, DC 20036; 800-ACS-5558, ext. 6274.

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