National Institute of Standards and Technology
Gaithersburg, Maryland
December 5, 2001

A National Historic Chemical Landmark

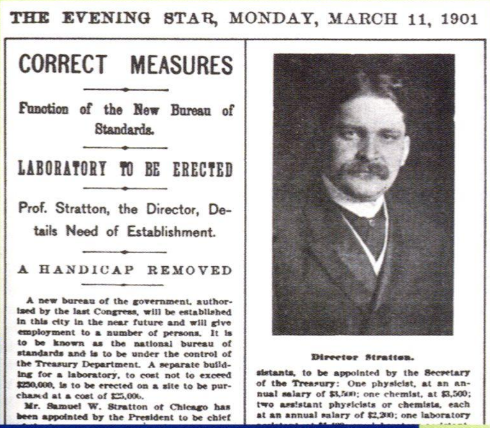
standards

AMERICAN CHEMICAL SOCIETY
SCIENCE THAT MATTERS

Setting the standards of excellence

Celebrating chemistry

The American Chemical Society designated the National Institute of Standards and Technology a National Historic Chemical Landmark on December 5, 2001. For additional information see our Web site: chemistry.org/landmarks.



THE EVENING STAR, MONDAY, MARCH 11, 1901

CORRECT MEASURES

Function of the New Bureau of Standards.

LABORATORY TO BE ERECTED

Prof. Stratton, the Director, Details Need of Establishment.

A HANDICAP REMOVED

A new bureau of the government, authorized by the last Congress, will be established in this city in the near future and will give employment to a number of persons. It is to be known as the national bureau of standards and is to be under the control of the Treasury Department. A separate building for a laboratory, to cost not to exceed $250,000, is to be erected on a site to be purchased at a cost of $25,000.

Mr. Samuel W. Stratton of Chicago has been appointed by the President to be chief

Director Stratton.

sistants, to be appointed by the Secretary of the Treasury: One physicist, at an annual salary of $3,[illegible]; one chemist, at $3,500; two assistant physicists or chemists, each at an annual salary of $2,200; one laboratory

"It is therefore the unanimous opinion of your committee that no more essential aid could be given to manufacturing, commerce, the makers of scientific apparatus, the scientific work of the government, of schools, colleges and universities, than by the establishment of the institution proposed in this bill."

Report on bill to establish the National Bureau of Standards, House of Representatives, May 14, 1900

The federal government's first physical science research laboratory was chartered by Congress on March 3, 1901, as the National Bureau of Standards. NBS became the National Institute of Standards and Technology (NIST) in 1988. Then and now, NIST's mission is to develop measurements and standards that strengthen the U.S. economy and improve our quality of life.

The Chemistry Division was among the first programs. Today, the Chemical Science and Technology Laboratory, one of the Institute's seven measurement and standards laboratories, offers the most comprehensive range of chemical, physical and engineering measurement capabilities in its field.

A century of progress

The year was 1901. The Victorian era had ended and the age of technology had dawned. Jacobus Henricus Van't Hoff of the Prussian Academy of Sciences in Berlin became the first Nobel Laureate in Chemistry for his discovery of the laws of chemical dynamics and osmotic pressure in solutions.

America was poised for progress and competition but there were few national standards for measuring, comparing and evaluating its products. A foot in Illinois was longer than a foot in Virginia. Eight different values defined a gallon. Time-keeping was local. Electric power lacked defined electrical units.

The beginning

In March 1901, Samuel W. Stratton, a well-regarded physicist, became the new national laboratory's first director. The initial challenge for the staff of 12 was to establish standards for electricity, length, temperature and time. This nucleus grew steadily to today's 3,300 scientists, engineers, technicians and support personnel.

NIST: contributions to chemistry

The earliest standards

Heat and thermometry were early concerns of the newly formed laboratory. In 1901, the lab acquired specially constructed thermometers from Europe and was prepared to perform certification but lacked a unified standard. In 1927, after years of research, laboratories here and abroad adopted an international scale.

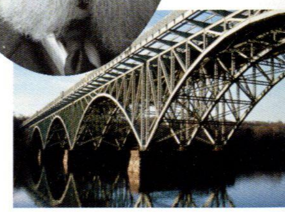
In 1905, the railroad industry, trying to solve the problem of rail car derailments caused by the fracturing of cast iron wheels, asked for "standardizing" materials to calibrate measuring systems. The first Standard Samples defined composition of various types of iron.

In 1906, the laboratory initiated the program of Standard Reference Materials (SRMs) — well-characterized homogenous materials or simple artifacts certified by NIST as possessing specific physical and chemical properties. That year, NIST provided physical data for more efficient refrigeration by determining specific heats of several calcium chloride brines. This early work has grown into 50 electronic databases.

In 1908, William F. Hillebrand became Chief Chemist of the laboratory.

Industry standards

The laboratory addressed construction industry standards in 1911, and by 1912, a single standard governed all federal construction purchases.



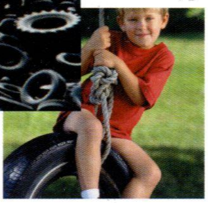
During World War I, NIST performed composition analysis and properties determinations for chemicals and steels used in weapon production.

Automotive industry standards, pursued in 1922, included research to increase operating efficiency. Also in 1922, chemists began using the polariscope, an instrument that measures the rotation of polarized light to analyze solutions, in order to determine the duty to be levied on imported sugar.

The Chemistry Division made the first "heavy water" produced by electrolysis in 1931 and, together with the Cryogenic Laboratory, supported theoretical work that subsequently won the Nobel Prize for Harold Urey.

In early 1940, NIST participated in the Manhattan Project, developing a new method of ether extraction that became the standard technique for purifying uranium. Also during the 1940s, NIST developed tests to measure freezing points to determine material purity.

Rubber and polymers



When the war cut off imports of natural rubber in 1943, NIST helped determine which types of synthetics to use. NIST's application of viscometry for characterization and testing became an indispensable tool.

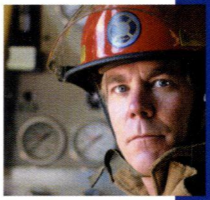
During the 1940s and 1950s, NIST's thermochemical determinations of the heat of combustion and the heat of formation of compounds gave an important boost to the nascent synthetic polymer industry. Today, most manufacturers of polymer resins rely on NIST's SRMs.

The chemist's right hand

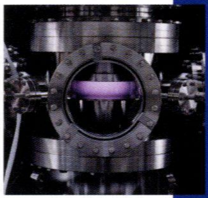
In 1952, NIST's 1,200-page circular, *Selected Values of Chemical Thermodynamic Properties*, evaluated and systematized data that appeared in chemistry literature. The book became the bible of thermochemists.

The Electrochemistry Division's testing of a commercial battery additive called AD-X2 led to Congressional hearings in 1953. By helping to expose fraudulent claims, NIST garnered praise for its testing procedures and integrity.

During the 1950s, NIST developed a new method to accurately measure isotopic abundance in SRMs used in nuclear chemistry and geochemistry. In the early 1960s, this process supported determination of the Faraday constant and improved the accuracy of the key element of weight determination for the unified atomic weight scale.

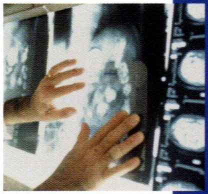


NIST continues to develop SRMs and NIST-traceable reference materials as solutions for specific needs. In recent work with industry, NIST has helped ensure that air pollution reduction goals are met.



From nanotechnology to biotechnology

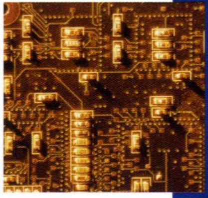
Assisting industry in attaining ultra-high resolution depth profiles, NIST develops measurement tools that enable chemical characterization at the millimeter to nanometer spatial scales.



In 1967, a measurement for serum cholesterol was the first of 12 health care markers. The first standard for DNA profiling, released in 1992, paved the way for DNA acceptance as evidence in court.

Future advances

In May 1999, the Advanced Chemical Sciences Laboratory began addressing 21st-century needs from pharmaceutical manufacturing to pollution monitoring and nutritional analysis to tissue engineering. By 2004, a new Advanced Measurement Laboratory will help NIST chemists keep pace with emerging technologies.



NIST: service to society

- **Measuring meters**

A platinum alloy bar was the measure of the meter in 1901 and scientists attempted for years to provide a redefinition. In 1972, a NIST physicist made a measure of the frequency of laser light, which led to an international redefinition in 1983.

- **Hoses and hydrants**

A raging fire in Baltimore in 1904 drew firefighters from as far away as New York, only to stand by helplessly. The couplings of their hoses would not fit the hydrants, leading NIST to help develop national standards for hose couplings.

- **Early aviation**

During the years following the Wright brothers' flight in 1903 through the United States' involvement in World War I, America's military forces sent their instruments to NIST for testing. NIST also produced the first U. S. study of the aerodynamics of flight.

- **The front lines**

In 1917, the military requested the manufacture of optical glass — America's only supply, from Germany, had been cut off. NIST was the country's only producer of optical glass during WWI and produced about half of the supply during WWII.

- **Radiation standards**

NIST provided physical measurement standards to assure the safety of radium and X-rays, which helped bring about the 1931 X-ray safety code.

- **"Smart" weapons**

In 1941, NIST tested the radio proximity fuse for non-rotating projectiles — critical to allied victory in WWII.

- **The nation's clock**

NIST has maintained the nation's primary time standards from the pendulum to the quartz clock to the first atomic clock, developed in 1949.

- **The dawn of computers**

In 1947, NIST began building the first operational internally programmed digital computer in the United States.

- **Outer space**

The space program required new measurements. By 1964, NIST was routinely measuring temperatures in the 20,000° C range as well as calibrating devices to measure the forces of large rockets.

- **Smoke detectors**

In 1974, NIST helped develop the first standards for smoke detectors. Extensive work in fire research also includes standards on children's sleep wear and mattresses. In 1997, NIST produced the only validated method for quantifying lethality of smoke, now routinely used in fire hazard analysis.

Noble pursuits, Nobel Prizes

William D. Phillips, NIST physicist, shared the 1997 Nobel Prize in Physics for his work on the development of methods to cool and trap atoms with laser light.

Eric A. Cornell, NIST senior scientist, shared the 2001 Nobel Prize in Physics. He had observed a new state of matter called the Bose-Einstein condensate in 1995.

National Historic Chemical Landmark

The American Chemical Society designated the National Institute of Standards and Technology a National Historic Chemical Landmark on December 5, 2001. The plaque commemorating the event reads:

For one hundred years, scientists and engineers at the National Institute of Standards and Technology, formerly the National Bureau of Standards, have made broad-based and comprehensive contributions to chemical science and technology and to the economic strength and competitiveness of the United States. Through internationally recognized programs in materials characterization and standards, measurement, calibration, and synthesis — and in areas as diverse as cryogenics, weather prediction, solid state devices, and synthetic rubber — the National Institute of Standards and Technology continues to demonstrate that the intelligent application of research in physical sciences to a wide range of societal challenges contributes to a higher quality of life for everyone.

About the National Historic Chemical Landmarks Program

The American Chemical Society, the world's largest scientific society with more than 163,000 members, has designated landmarks in the history of chemistry for more than a decade. The process begins at the local level. Members identify milestones in their cities or regions, document their importance, and nominate them for landmark designation. An international committee of chemists, chemical engineers, museum curators, and historians evaluates each nomination. For more information, please call the Office of Communications at 202-872-6274 or 800-227-5558, e-mail us at nhclp@acs.org, or visit our Web site: chemistry.org/landmarks.

A non-profit organization, the American Chemical Society publishes scientific journals and databases, convenes major research conferences, and provides educational, science policy and career programs in chemistry. Its main offices are in Washington, DC, and Columbus, Ohio.

Acknowledgments
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