A NATIONAL HISTORIC CHEMICAL LANDMARK

THE JOSEPH PRIESTLEY HOUSE

NORTHUMBERLAND, PENNSYLVANIA
AUGUST 1, 1994

AMERICAN CHEMICAL SOCIETY
Division of the History of Chemistry and
The Office of Public Outreach

The Priestley House and Laboratory.

This booklet commemorates the designation of the Joseph Priestley House as a National Historic Chemical Landmark. The designation was conferred by the American Chemical Society, a non-profit scientific and educational organization of nearly 150,000 chemists and chemical engineers.

The Joseph Priestley House is located on Priestley Avenue, overlooking the Susquehanna River, in Northumberland, Pennsylvania. It was built on a 2.2 acre lot in the Haines Tract and included the house and an English barn complex. The current size of the site is 1.87 acres. The two and one-half story building has 17 rooms. The first floor covers 1000 square feet in the main house and 445 square feet in the adjacent laboratory.

A plaque marking the ACS designation was presented to the Pennsylvania Historical and Museum Commission on August 1, 1994. The inscription reads: "Joseph Priestley (1733-1804) – Unitarian minister, teacher, author, natural philosopher, discoverer of oxygen, and friend of Benjamin Franklin and Thomas Jefferson – supervised the construction of this house and laboratory from 1794 to 1798, then lived and worked here until his death in 1804. His library of some 1,600 volumes and his chemical laboratory, where he first isolated carbon monoxide, were probably the best in the country at that time. As suggested by Edgar Fahs Smith in 1920, the Joseph Priestley House has become 'a Mecca for all who would look back to the beginnings of chemical research' in America."

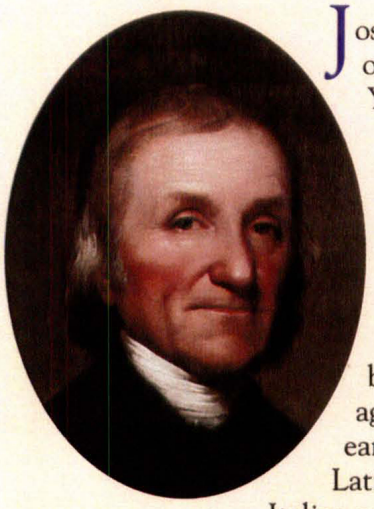
ACKNOWLEDGMENTS

The American Chemical Society gratefully acknowledges the assistance of the scientists and historians who helped to prepare this booklet, including: Margaret E. Kastner, Department of Chemistry, Bucknell University; Ron Blatchley, Mifflinburg Area High School; William Richardson, Site Administrator for the Joseph Priestley House; Bennett Willeford, emeritus, Department of Chemistry, Bucknell University; James J. Bohning, The Chemical Heritage Foundation; Jeffrey L. Sturchio, Merck & Co., Inc.; David J. Rhees, Bakken Library and Museum and the Friends of the Joseph Priestley House.

This booklet was produced by the ACS Office of Public Outreach. Production Supervisor: Vivian Powers. Layout: Dahlman Middour Design. Photographs courtesy of the Pennsylvania Historical and Museum Commission, James J. Bohning, and Dickinson College, Special Collections.

Background: Detail from drawing of Priestley's Laboratory.

JOSEPH PRIESTLEY (1733-1804)



Joseph Priestley was born on March 13, 1733, in Yorkshire, England, the eldest of nine children. His mother died when he was six and his father, who made wool cloth, remarried when Joseph was twelve. He was raised by an aunt who encouraged his education. His early studies included Latin, Greek, French, Italian and High Dutch.

His aunt was a pious woman of Calvinistic principles. She was tolerant, however, of the beliefs of others and it was in her home that Joseph Priestley met and studied with Dissenting ministers, whose convictions differed from those of the established Church of England. At the Academy at Daventry from 1752 to 1755, his studies included a focus on his future duties as a Christian minister.

In 1762 Joseph Priestley married Mary Wilkinson, the sister of one of his students at Nantwich, and the daughter of the ironmaster Isaac Wilkinson. He wrote that she was a woman "...of great fortitude and strength of mind, and of a temper in the highest degree affectionate and generous, feeling strongly for others, and little for herself... . Also excelling in everything relating to household affairs, she entirely relieved me of all concern of that kind, which allowed me to give all my time to the prosecution of my studies." A Madam Belloc is quoted as saying: "It is a tradition in the family that Mrs. Priestley once sent her famous husband to market with a large basket and that he so acquitted himself that she never sent him again!"

Joseph Priestley supported himself, and then his family, by a succession of positions as pastor or school teacher. In 1773 he became librarian to the Earl of Shelburne, and tutor for the Earl's children. This position allowed him to travel, and gave him leisure to pursue his investigations in "pneumatic" chemistry, as the study of gases was then known, and to write prolifically on science and philosophy. In 1780 he moved to Birmingham. There he continued both his theological investigations and his scientific experiments, receiving financial support from a number of benefactors.

Phlogiston and Oxygen

The prevailing view of combustion in Priestley's day was formulated by J. J. Becher (1635 - 1682) and Georg Stahl (1660 - 1734) between 1669 and 1723. According to this view, combustion of an object was accompanied by the release of a substance known as phlogiston, thought to impart flammability to materials containing it. Where today's chemist sees the *gain* of oxygen, phlogiston theorists saw the *loss* of phlogiston. This theory satisfactorily accounted for many of the experimental observations of that time.

On August 1, 1774, Priestley prepared a sample of a new gas by using a lens to focus sunlight on mercury(II) oxide ("red calx" of mercury) floating on mercury in a glass tube. Over the next several months he found that the gas evolved was insoluble in water, that a candle burned more brightly in this gas than in the atmosphere, and that a mouse would live in it four times longer than in the atmosphere. Because it supported combustion so well, or absorbed so much phlogiston, he called it "dephlogisticated air." He wrote, "The feeling of it in my lungs was not sensibly different from that of common air, but I fancied that my breast felt peculiarly light and easy for some time afterwards. Who can tell but that in time, this pure air may become a fashionable article in luxury. Hitherto only two mice and myself have had the privilege of breathing it."

Priestley and Lavoisier (1743 - 1794)

The French aristocrat and scientist Antoine Lavoisier was also investigating the chemistry of gases and metallic calxes (the powdery residues, almost always oxides, left after heating substances strongly in air). The two met just once, in the fall of 1774, during Priestley's only trip to Paris. Priestley spoke of his early experiments on "dephlogisticated air" at that meeting, but it is unclear how useful this information was to Lavoisier. Lavoisier's work was quantitative in nature; his careful measurements led him to the conclusion that since the calxes weighed more than the original metals, combustion must involve a *combination* with a substance from the air, rather than a loss of phlogiston. That substance, Priestley's dephlogisticated air, he named *oxygene*, and he recognized it as one of the chief components of the atmosphere, along with *azote*, or nitrogen.

PRIESTLEY'S OTHER AIRS

Joseph Priestley investigated many gases in addition to oxygen and is credited with the discovery of sulfur dioxide, sulfur trioxide, hydrogen sulfide, silicon tetrafluoride, nitric oxide, nitrous oxide, nitrogen dioxide, ammonia, hydrogen chloride, and carbon monoxide. His remarkable record of isolating new gases was instrumental in demonstrating that the traditional notion of an undifferentiated "air" was inadequate. He was also the first to discover how to make carbonated water, for which he received the Copley Medal from the Royal Society of London in 1773.

Scientific apparatus, including Dr. Priestley's microscope, and reproductions of glassware used in Laboratory.

The Priestleys Emigrate

Joseph Priestley's religious views, and his sympathy for both the French and American Revolutions, had made him an unpopular figure in England. On July 14, 1791, the second anniversary of the French Revolution, a mob began burning the homes and meeting places of suspected anti-royalists in Birmingham. Warned of impending danger, Priestley and his family barely escaped before the mob attacked, destroying the house and its contents. The family found temporary refuge in London, a city more tolerant of divergent views. But the Priestleys could not maintain their lifestyle in that expensive city, nor could Priestley expect to find religious and political freedom there. On April 8, 1794, Joseph and Mary set sail for America in search of a peaceful haven.

They stayed for a time in Philadelphia, but Mary's aversion to city life prompted them to move to Northumberland, Pennsylvania, then a village of 100 homes at the junction of the branches of the Susquehanna River, a five-day trip from Philadelphia. Two of Priestley's sons had already settled there, planning to establish a community for dissident Englishmen. When the scheme fell through, the Priestleys decided to stay. Of the area, Joseph Priestley wrote: "I do not think there can be, in any part of the world, a more delightful situation than this, and the neighborhood and the conveniences of the place are improving daily." Mary Priestley observed: "I am happy and thankful to meet with so sweet a situation and so peaceful a retreat as the place I now write from. Dr. Priestley also likes it and of his own choice intends to settle here, which is more than I hoped for at the time we came up.... This country is very delightful, the prospects of wood and water more beautiful than I have ever seen before, the people plain and decent in their manners."

In England, Benjamin Franklin had been Joseph Priestley's friend and mentor. Priestley's first scientific work was a book on the history of electricity. After coming to America, Priestley also met with George Washington, with whom he had a meal and was invited to return. Thomas Jefferson was a close friend, and invited Priestley to join him at the new university in Virginia. Priestley declined, as he had declined a similar call to teach at the University of Pennsylvania. But Priestley's writings did influence the design of the liberal arts curriculum of the University of Virginia.

Joseph Priestley had great hope for his adopted nation. In 1803 he was invited to a testimonial dinner in his honor by the American Philosophical Society. In accepting the invitation he wrote: "Having been obliged to leave a country which has been long distinguished by discoveries in science, I think myself happy by my reception in another which is following its example, and which already affords a prospect of its arriving at equal eminence...."

On February 3, 1804, Priestley began an experiment in his laboratory, but became too weak to continue it. On February 6, Thomas Cooper wrote to Benjamin Rush that "Dr. Priestley died at about 11 o'clock without the slightest degree of pain."

THE JOSEPH PRIESTLEY HOUSE

Design and Construction

Joseph and Mary Priestley designed the house and he supervised its construction. Although the lower cost of living in Northumberland was a factor in their decision to build there, in April 1795 he wrote: "Nothing is yet done towards building my house. It is next to impossible to get workmen and the price of everything is advanced one-third since we have come hither."

Overcoming those obstacles, he changed his original plan to build with brick in favor of board construction. He wrote:

> "To kiln-dry boards we dig a trench about two feet deep, the length of the boards and what breadth you please. We then support the boards with the edges downwards and so that when the fire is made under them, the smoke and heat may have access to every part of them. Two or three stages are placed one over another and on the outside, boards to keep off the rain. In ten days they will be as much dried as by exposure to air in two years. We commonly kiln-dry ten thousand feet at a time. The firewood must be such as is not apt to flame, least the boards should take fire, which sometimes happens. The expense cannot be much. A house constructed with such boards I prefer to one of brick and stone."

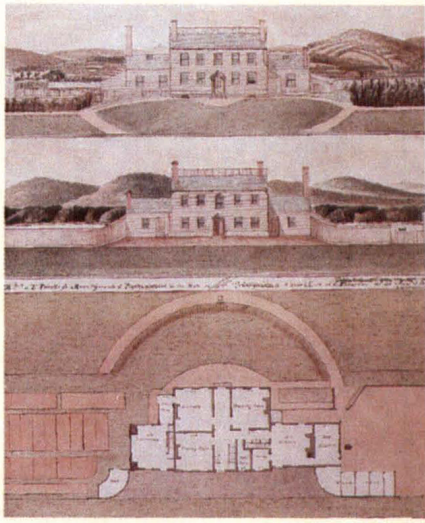
Mary Priestley died in September 1796. After Mary's death, Priestley wrote of her: "She had taken much pleasure in planning our new house, and now that it is advancing apace and promises to be everything that she wished it to be, she goes to occupy another. I shall however finish the house, as it is fitted to my use as well as that of a family, and Joseph will live with me in it, for I am not able to manage a house for myself."

In the posthumous continuation of his father's *Memoirs*, Joseph Priestley II wrote:

> "It was not until towards the end of 1797 that his library and laboratory were finished. None but men devoted to literature can imagine the pleasure he derived from being able to renew his experiments with every possible convenience, and from having his books once more arranged. His house was situated in a garden, commanding a prospect equal, if not superior, to any on the river Susquehanna, so justly celebrated for the picturesque views its banks afford.
>
> "It was a singularly fortunate circumstance that he found at Northumberland several excellent workmen in metals, who could repair his instruments, make all the new articles he wanted in the course of his experimenting...."

Care and Restoration

Prior to World War I, Dr. George Pond of Pennsylvania State College, a profound admirer of Priestley, spoke frequently of the deplorable condition of the house and grounds. Following the war, he began to raise funds to purchase the house, primarily from his own former students. In 1919 a generous gift from Mr. William Teas of Marion, Virginia, enabled Dr. Pond to purchase the house at auction for $6,000.



Watercolor architectural drawing by T. Lambourne, "Plan of Dr. Priestley's House and Grounds at Northumberland," 1800.

In 1968, the Pennsylvania Historical and Museum Commission began an $80,000 restoration project to correct over 150 years of decay and alteration, returning the house to its original condition. Victorian ornamentation was removed, the shutters returned to their original location inside the windows, doorways returned to their original locations, windows replaced, and the building generally refurbished. Formal dedication by the Commission was held on October 18, 1970, at which time the National Park Service designated the Priestley Home as a National Historic Landmark.

Evidence from Archaeology

Two archaeological excavations have been made at the Priestley House. The artifacts provide evidence of inhabitation by prehistoric Native Americans, the Priestley family (1798-1811), and those who lived in the house after the Priestleys. Pieces of glass test tubes were found, some with chemical residues. Some were marked as having been made by Josiah Wedgwood, a famous English maker of glass and ceramics and a personal friend of Joseph Priestley's.

PRIESTLEY'S AMERICAN LEGACY

Carbon Monoxide

One of the gases Joseph Priestley was the first to isolate and characterize was carbon monoxide. This work he did in Northumberland in 1799. He packed "finery cinder" (an iron oxide) and charcoal into a gun barrel and then filled the remaining space with dry sand. The gun barrel was then heated in a furnace to reduce the finery cinder to ferrous oxide, while the charcoal was converted to carbon monoxide. Observing that the gas burned with a blue flame and had a density near that of ordinary air, Priestley named it "heavy inflammable air" to avoid confusion with a "light inflammable air," or hydrogen.

Gun barrel used by Priestley in his discovery of carbon monoxide.

1874 Centennial Celebration

In April 1874, Dr. Henry Carrington Bolton of the Columbia School of Mines proposed that a centennial commemoration of the discovery of oxygen should be held. Professor Rachel Bodley of the Women's Medical College of Pennsylvania (who later became one of the charter members of the American Chemical Society) suggested that it be held at the Priestley home in Northumberland.

Seventy-seven chemists met there on July 31 and August 1, 1874. Benjamin Silliman read a lengthy review on "American Contributions to Chemistry." On the second day, Professor Persifor Frazer of the University of Pennsylvania proposed "the formation of a chemical society which should date its origin from this centennial celebration." The idea was opposed by several on the grounds that there were not enough chemists in the country, and probably never would be, to support such a society. But within two years the skeptics were proved wrong, and the American Chemical Society was founded in New York City in April 1876.

Ever since, American chemists have felt a special affinity with Priestley and Northumberland. Many pilgrimages have honored Priestley's legacy: in 1926, on the 50th anniversary of the ACS; in 1974, when the Mid-Atlantic Regional Meeting of the ACS celebrated the 200th anniversary of Priestley's discovery of oxygen; in June 1994, when the Royal Society of London joined the ACS in the 7th BOC conference, and in August 1994, when the ACS 13th Biennial Conference on Chemical Education commemorated the bicentenary of his arrival in the United States and Northumberland.

Preserving Priestley's American Past

The 1968 restoration did much to preserve the house. However, the winter of 1993-4 was particularly hard on the structure, necessitating repair of the plaster walls, repainting, and a new roof, scheduled for the fall of 1994. Additionally, the interpretation of the interior of the home is inconsistent with the use Joseph Priestley made of it. For the last twenty-five years, the room Joseph Priestley used as his library and apartment — and in which he died — has been presented as a drawing room. Historic paint analysis suggests the walls were not papered, but rather painted light gray with yellow-gray trim. The room Priestley used as a drawing room and a place for Unitarian services has been interpreted as a Georgian dining room.

With new information on the use of the interior rooms, and with plans of the landscape now available, there is hope that the Joseph Priestley House can be restored to its original design. As with many historical landmarks, it is only with the generosity of citizens and government alike that our history can be kept alive. Chemists, in particular, are encouraged to join in efforts to maintain and preserve this National Historic Chemical Landmark.

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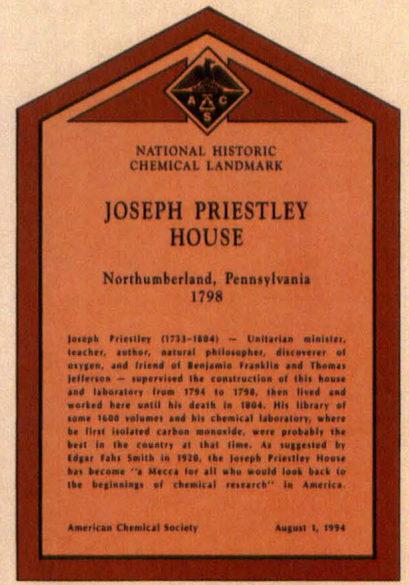
THE NATIONAL HISTORIC CHEMICAL LANDMARKS PROGRAM OF THE AMERICAN CHEMICAL SOCIETY



The National Historic Chemical Landmarks Program (NHCLP) illuminates our scientific and technical heritage and serves to encourage the preservation of the physical remains of historically important works. It provides an annotated roster for chemists and chemical engineers, students, educators, historians, and travelers, and helps to establish persistent reminders of where we have been and where we are going along the divergent paths of discovery. The Joseph Priestley House is the third National Historic Chemical Landmark to be designated under this program.

An ACS Historic Chemical Milestone 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 development of chemistry and chemical engineering.

The NHCLP began in 1992, when the Division of the History of Chemistry of the ACS formed an international Advisory Committee, composed of chemists, chemical engineers, and historians of science and technology. The Advisory Committee, working with the ACS Office of Public Outreach and assisted by the Chemical Heritage Foundation, provides a public service by examining, noting, recording, and acknowledging achievements in chemistry and chemical engineering of particular significance. For further information, please contact the ACS Public Outreach Office, 1155 16th Street, NW, Washington, DC 20036, 1-800-ACS-5558, press 54; fax 202-872-4377.

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