

# George Ellery Hale Master Builder for Astrophysics

Genevieve Gill

*This is the third in a series of articles highlighting outstanding personalities in the history of optical science. Astrophysicist George Ellery Hale (1868-1938) was one of OSA's first honorary members.*

George Ellery Hale was an insatiable student of science. Helen Wright wrote in her biography of Hale that even as a child, he kept books, tools, bugs, rocks and a microscope in his bedroom. When the room became too crowded for him to sleep in, Hale convinced his mother to let him use her hallway closet as a "laboratory." He later enlisted his siblings to help him build a small workshop in the backyard.

"These were real adventures, as exciting as those I have had so often in later years," Hale wrote of his childhood. "I had made the discovery that simple instruments suffice to reveal new and wonderful worlds, hidden from the unaided eye. Here was the origin of a life of research."

A leader among early astrophysicists, Hale focused in particular on the sun. He is largely responsible for the construction of several of the best-known observatories in the United States, and he played a central role in the founding of scientific institutions and organizations around the world.

Born in Chicago on June 29, 1868, Hale was the oldest of three children. His father, William Ellery Hale, was an entrepreneur who began producing hydraulic elevators after the great Chicago fire of 1871. The family's wealth grew as the city was rebuilt. The business expanded to London and Paris, where the company helped install elevators in the Eiffel Tower.

Hale's general love of science soon sharpened into a focused interest in astronomy. At age 14, he found a description of how to build a spectroscope in *Cassell's Book of Sports and Pastimes*. Immediately he went to work on the

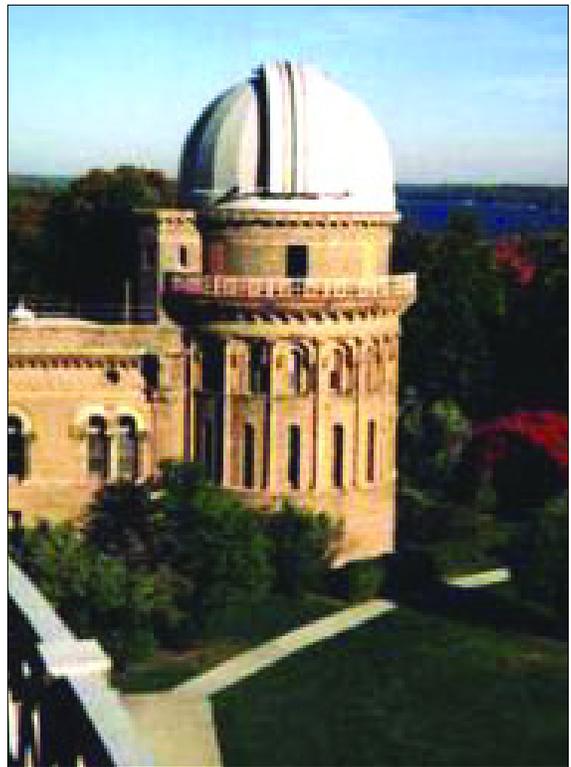
instrument. It was a success, and soon after he created a large carbon disulphide prism.

In 1886, Hale entered the Massachusetts Institute of Technology (MIT) to pursue a degree in physics. Because MIT did not offer any courses in astronomy, he searched out E. C. Pickering, director of the Harvard Observatory and a leader in spectral classification and photometry. For two and a half years, Hale volunteered at the observatory every Saturday, working at times until dawn.

In 1889, Hale published an article—his first—in *The Beacon*, a small Chicago journal. He wrote about the history of the spectroscope and its applications to astronomy, and described a "new astronomy" in which physicists, chemists and astronomers collaborate in the investigation of the universe. This philosophy of collaboration between scientific disciplines would come to define his career.

Also in 1889, Hale invented the spectroheliograph, an instrument that made it possible to take photographs of the sun showing its faculae and prominences. Harry Goodwin, a lifelong friend of Hale's, said the invention "unquestionably contributed more to advance our knowledge of solar phenomena than any other invention since the time of Galileo."

After graduating from MIT in 1890, Hale married his childhood sweetheart, Evelina Conklin. While honeymooning in California, he met another early astrophysicist, James E. Keeler, at the Lick Observatory in Mount Hamilton. In 1895, Hale and Keeler founded *The Astrophysical Journal*, a publication that is still considered one of the world's leading research journals in the field of astronomy and astrophysics.



The Yerkes Observatory in Williams Bay, Wisconsin, the largest astrophysical laboratory of its time, was the brainchild of George Ellery Hale.

## Building observatories

After returning to Chicago, Hale created what became known as the Kenwood Physical Observatory on the grounds of his family's mansion. Hale's father purchased a 12-in. telescope for the facility. In 1892, the head of the physics department at the University of Chicago, A. A. Michelson, offered Hale a position there in the new field of astrophysics. Hale's father gave the Kenwood observatory to the university with the understanding that the school would work toward building another, more powerful one. After being named director of the observatory and associate professor of astrophysics (becoming the first in the world to hold such a title), Hale began plans to add a 40-in. lens.

He couldn't wait for the university to raise the money for the new observatory, and decided to fundraise himself. He approached Charles Tyson Yerkes, who had accumulated a vast fortune by financing Chicago's elevated tracks, the underground cable system and the

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— Donald Nicholson, Mount Wilson Observatory Association

Peoples Gas Company. Yerkes agreed to pay for the 40-in. lens for the new observatory that would carry his name.

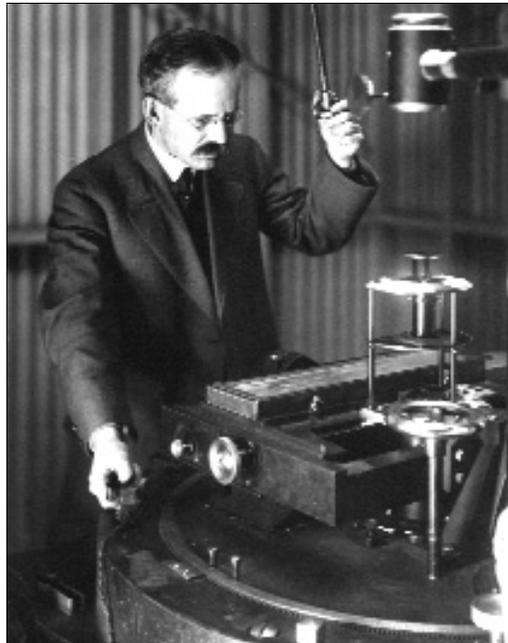
The Yerkes Observatory, in Williams Bay, Wisconsin, became the largest astrophysical laboratory that had ever been constructed. Williams Bay was an ideal site because of its distance from city lights, smoke, fog, vibrations in the ground, air turbulence, and because of its proximity to Chicago.

Hale traveled to Berlin to begin graduate school during construction of the observatory, but with so many unresolved details surrounding the project, he left his studies after one year. Although he received many honorary degrees, Hale earned just one—a bachelor’s from MIT. For this reason, he chose to be addressed throughout his career as “Mr. Hale.”

By the end of 1897, both the 12-in. lens from Kenwood and the 40-in. lens had been installed at the Williams Bay site. That year, Hale invited the world’s leading astronomers to Yerkes for a conference and for the dedication of the observatory. Seven hundred guests attended. Williams Bay, Wisconsin, with the most advanced instruments available at that time, was at the center of the astronomical community.

### Moving south

In 1905, Hale resigned from Yerkes and from the University of Chicago to take the director’s position at the new Mount Wilson Observatory in southern California. He had been the leader of a group of astrophysicists who organized and designed the new observatory’s construction in this part of the country.



Hale Observatory, courtesy AIP Emilio Segrè Visual Archives

George Ellery Hale helped found OSA and the American Astronomical Society.

Thanks in part to Hale's leadership, the Mount Wilson Observatory dominated the world of astronomy throughout the first half of the 20th century. Major astronomical achievements made there included Hale’s discovery that sunspots were regions of relatively low temperatures and high magnetic fields. He pressed for research in galactic and extragalactic astronomy, as well as in solar and stellar astrophysics.

“Hale was not the first astrophysicist by any means. But he was one of the pioneers of astrophysics... and with every institution he helped create he established a tradition of having a laboratory as part of the observatory,” said Donald Nicholson, president of the Mount Wilson Observatory Association.

“His spirit, his vision and his ability to convince others, especially others of great wealth, that such an institution was essential to astronomy” helped in the founding of Mount Wilson, Nicholson said. “This momentum he established was kept up for years after he retired. He never stopped working.”

Hale played a major role in turning the Throop Polytechnic Institute into the California Institute of Technology (Caltech). He worked for the rest of his life to secure funding and construction of the 200-in. telescope at Caltech’s Palomar Observatory. In appreciation, the telescope was named for him.

### A lifetime of honors

Hale helped found the American Astronomical and Astrophysical Society (now the American Astronomical Society); the International Astronomical Union; the National Academy of Sciences; the National Research Council; and the Huntington Library in San Marino, California.

He also played an important role in the founding of OSA. He was one of its 30 charter members, as well as its first vice president. He was one of the first three honorary members elected at the Society’s first annual meeting in New York at Columbia University in December 1916. In 1935, he was given the Society’s highest award, the Frederic Ives Medal, for overall distinction in optics. Hale received the Janssen Medal, the highest astronomical award of the Paris Academy of Sciences, in 1894; the Rumford Medal, of the American Academy of Arts and Sciences, in 1902; the Gold Medal, of the Royal Astronomical Society, and the Draper Medal, of the National Academy of Sciences, in 1904. In 1916, the Astronomical Society of the Pacific named him a Bruce Medalist.

Ira S. Bowen, a former director of the Mount Wilson and Palomar Observatories, wrote in Hale’s biography: “George Ellery Hale probably did more than any other one man to awaken interest and find support for a sound and effective development of science in this country.”

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