

George P. Smith

Chemist

Date of birth: March 10, 1941

Place of birth: Norwalk, Connecticut

Education: Haverford University; Harvard University

Significance: Noted biochemist George P. Smith received the 2018 Nobel Prize in Chemistry along with Sir Gregory P. Winter and Frances Arnold. A longtime faculty member of the University of Missouri, Smith developed the phage display technique, in which viruses are used to develop new proteins through evolution. The groundbreaking technique has wide applications across many fields and has led to significant discoveries in biology, chemistry, and medicine.

Background

George P. Smith was born on March 10, 1941, in Norwalk, Connecticut. One of three children of A. Mark Smith, a career army officer, and Jessie Smith, he moved often as a child and lived on an army base in Japan for two years. He attended numerous elementary and high schools before graduating from Phillips Academy in Andover, Massachusetts, in 1958. He then spent a year as an exchange student in England.

George P. Smith, Stockholm, Sweden, December 2018.



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Interested in animals, particularly reptiles, from childhood, Smith enrolled in Haverford University in Pennsylvania with the idea of becoming a herpetologist or naturalist. Instead, he became interested in molecular biology and went on to complete a senior thesis on molecular immunology. He graduated with a bachelor of arts in biology in 1963. Smith then taught in a North Philadelphia high school for one semester before returning to school for graduate work. He graduated from Harvard University in 1970 with a PhD in bacteriology and immunology and then completed five years of postdoctoral training under Dr. Oliver Smithies (a future Nobel laureate) at the University of Wisconsin—Madison. For three of those years he was a Helen Hay Whitney Postdoctoral Fellow in the Department of Medical Genetics.

Research and Teaching

Smith joined the University of Missouri—often called Mizzou—in 1975 as an assistant professor of biological sciences. He became an associate professor in 1981 and a professor in 1990. He was named a Curators' Distinguished Professor in 2000. In addition to teaching classes on genetics, molecular genetics, molecular biology, and cell biology, he received several grants

throughout his long career at the University of Missouri. His early research focused on the molecular genetics of antibodies and nematode development.

Smith authored or coauthored numerous scientific articles as well as the book *The Variation and Adaptive Expression of Antibodies* (1973), a critical examination of theories on the origin of the diversity of antibodies. He lectured or presented at numerous universities, research institutes, corporations, and national and international conferences and symposiums on subjects such as molecular genetics, synthetic peptides, genome mapping, and gene regulation.

In 1983, Smith took a one-year sabbatical and went to Duke University. While there, he began researching bacteriophages, viruses that infect bacteria. A bacteriophage, or phage, is a small piece of RNA or DNA covered with a coat of protective proteins. When it reproduces, it inserts its genetic material into bacteria, which causes the bacteria to replicate the phage's genetic material and produce a virus. Genetic research was in its early years, and there were large libraries of unknown genes. Smith theorized he could identify some of these unknown genes by inserting genetic material into them and then seeing what proteins appeared in their protective coatings. He continued his research when he returned to the University of Missouri, and in 1985 he successfully demonstrated a technique, known as phage display, that allowed for the identification and selection of genes for useful proteins.

Other scientists soon began using phase display for their own research and developing applications for it. It proved especially useful in the development of new biomolecules. Gregory Winter used phage display to develop humanized antibodies, which led to the development of the groundbreaking drug adalimumab, approved in 2002 to treat rheumatoid arthritis. Additional drugs were later developed to treat psoriasis, cancer, and autoimmune diseases.

Smith continued to develop phage display technology and used it in several studies to advance knowledge about vaccines and to search for peptides that could be used to diagnose conditions such as chronic fatigue syndrome and Lyme disease. He also used it to develop agents used in the molecular imaging of cancers. These agents were made up of radioactive molecules that bind to cancer cells, allowing for clearer images of a tumor than through nonradioactive imaging.

Smith was highly regarded for his work with students and his collaborative methods. He advised several doctoral and master's students and trained several postdoctoral fellows. In 2009, he implemented the University of Missouri's Mathematics in Life Sciences program, funded by the National Science Foundation, to recruit more students into STEM majors and to better integrate mathematics throughout the natural sciences curriculum. He retired in 2015 as a professor emeritus but kept a lab at the university and continued to teach one class, on world issues.

Impact

The phage display technology that Smith developed has become a vital tool used in laboratories around the world. It has led to the development of fully human monoclonal antibodies, new therapeutic agents to treat disease, and the creation of engineered phages to research protein interactions with specific targets. In 2018, the Royal Swedish Academy of Sciences awarded Smith a share of the Nobel Prize in Chemistry for his influential achievement. He shared the prize with fellow chemists Gregory Winter and Frances Arnold.

In early 2019, Smith donated the monetary award he received for the Nobel Prize to the University of Missouri's College of Arts and Science to support students in the college.

Personal Life

Smith and Marjorie Sable, a colleague at the University of Missouri, married in 1981. They had two children, Bram and Alex. Smith was known as an avid bicyclist and sang with the Columbia Chorale, which he helped found as the Ad Hoc Singers in 1978.

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