Donald Arthur Glaser


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Donald Arthur Glaser

Donald Arthur Glaser, a professor of physics and of molecular and cell biology at the University of California, Berkeley, and the inventor of the bubble chamber, for which he received the Nobel Prize, died at his home in Berkeley on 28 February 2013.

Glaser was born on 21 September 1926 in Cleveland, Ohio, and grew up there. After high school he attended the Case Institute of Technology (now Case Western Reserve University) in Cleveland; he earned his BS degree in physics and mathematics in 1946. While he was a college student there, he also played the viola in the Cleveland Philharmonic Orchestra. He then went to Caltech, where he earned his PhD in 1950 as a student of Carl Anderson. His thesis research was a cloud-chamber study of the momentum spectrum of high-energy cosmic rays at sea level. He joined the University of Michigan physics department faculty in 1949 to work with Wayne Hazen on cosmic rays.

In those days, the only detectors for particle-physics studies that provided a visual image of the events were nuclear emulsions and cloud chambers. At Michigan, Glaser conceived the idea of the bubble chamber as a device that could be used at particle accelerators and, compared with the cloud chamber, could provide better images of particle interactions and trajectories.

The basic idea was to have a liquid under pressure, then to suddenly drop the pressure so that it was above the boiling point (superheated); the ionization of the fluid molecules by a charged particle passing through would then trigger bubble formation, and the bubbles would record the particle's track. It was, of course, necessary to properly time the pressure drop, the passage of the charged particles, and a photographic flash within milliseconds to obtain the photograph of the particle tracks. Glaser's original chambers, created in 1952, were thumb-sized Pyrex glass cylinders filled with diethyl ether. A popular myth is that he got the idea for the bubble chamber by observing the bubbles form and rise in a glass of beer, but Glaser denied that. He also later learned that Enrico Fermi had "proven" that the bubble chamber would not work.

Glaser soon built a 15-cm propane bubble chamber that he took to the Brookhaven National Laboratory with graduate student David Rahm in 1954. Donald Meyer and Martin Perl joined them there, and they used Glaser's chamber to study pion physics at the 3-GeV Cosmotron. Perl went on to receive the Nobel Prize in Physics in 1995 for the discovery of the tau lepton.

The 6-GeV Bevatron at the Berkeley Radiation Laboratory was completed and began operating in 1954; Glaser and his Michigan group built a 30-cm xenon bubble chamber with which they studied the production and decay modes of kaons at the Bevatron in 1959. Among his group were Byron Roe, Jack van der Velde, George Trilling, and Dan Sinclair. Also in 1959 Glaser, followed by Trilling, joined the physics department faculty at the University of California, Berkeley. A year later he was awarded the Nobel Prize in Physics; at age 34 he was among the youngest Nobel laureates.

The bubble chamber became a dominant tool for elementary-particle physics research during the 1960s and 1970s. Luis Alvarez at Berkeley built on Glaser's bubble-chamber concept; he constructed large liquid hydrogen bubble chambers, which were ideal for studying fundamental particle interactions because the target particles in the chambers were only protons. Hydrogen bubble chambers were employed at the next generation of accelerators, including the Brookhaven and CERN proton synchrotrons of about 30 GeV. For his development of the hydrogen bubble chamber, Alvarez was awarded the Nobel Prize in Physics in 1968.

Bubble chambers contributed greatly to the understanding of elementary-particle interactions and to the discovery of a plethora of particles and resonant states. Of course, the physics results required the analysis of the bubble-chamber photographs, which was done by teams of manual scanners. Within the past 30 to 40 years, though, totally electronic detector matrices have evolved; high-density multiwire arrays and other devices have replaced the bubble chamber, although some groups searching for dark matter have recently adopted the bubble chamber as their search detector.

In 1961 Glaser turned his attention from elementary-particle physics to molecular biology. He had always had an interest in the biological sciences, and he preferred to work by himself or in small groups rather than on the large teams that bubble-chamber programs had become. As a molecular biologist, he worked in Berkeley's virus laboratory, where he studied bacteria, bacterial viruses (phages), bacterial evolution, and regulation of cell growth. He also studied how skin cancer develops in mammals. In 1971 he joined with two colleagues, Ronald Cape and Peter Farley, to found Cetus Corp, the first biotechnology company to apply the new discoveries in molecular biology research to medicine and agriculture. In 1983 Kary Mullis, a researcher at Cetus, pioneered the polymerase chain reaction, for which he received the Nobel Prize in Chemistry in 1993.

In the 1980s Glaser turned his attention to neurobiology, another of his long-term interests. He spent a semester at Edwin Land's Rowland Institute for Science in Cambridge, Massachusetts, where he undertook psychophysics experiments in human vision to understand how the brain processes visual indicators of motion. At Berkeley he continued his study of the human visual system, including developing computational models that have yielded descriptions of the perception of motion and depth.

Recently posted notices at http://www.physicstoday.org/obituaries:

Kenneth Stevens
23 March 1924 – 19 August 2013
John R. Clem
24 April 1938 – 2 August 2013
John Ural Guillory
15 July 1940 – 28 July 2013
Beatrice Anne Sudler
1 January 1949 – 23 July 2013
Donald C. Hagerman
2 May 1929 – 30 June 2013
John Roberts Murray
8 August 1943 – 2 June 2013

Glaser was a remarkably creative, productive scientist who was always interested in the problems and puzzles of nature. His move from particle-physics detector technology to neurobiology illustrated his broad range of talents and interests.

Lawrence W. Jones
University of Michigan
Ann Arbor

George William Gray

Few research scientists could claim to be able to design and generate new materials with targeted condensed-phase structures and novel functionalities at will; George William Gray was unique in that respect. His research on liquid crystals and self-organizing systems provided the seminal inspiration in the creation of the electro-optic materials that underpin today's flat-panel display industry. George died in Poole, England, on 12 May 2013.

George William Gray

Although the LCD abbreviation has become a common descriptor of material goods such as digital watches, calculators, laptop computers, monitors, and TVs, there are other sides to those inventions that are usually unappreciated. They include the myriad of opportunities to communicate through the portal of an LCD screen: We can talk to and see our friends and families by Skype, enter into debate on Twitter or Facebook, shop for deals online, and educate ourselves on a plethora of topics. Because of LCDs, our world is smaller and politically freer. George's work thus has been life-changing, not only for us in the scientific and commercial businesses but also for millions who never came across the name George Gray.

George was born in Denny, Scotland, on 4 September 1926. His methodical research into the synthesis and characterization of liquid crystals began, with the encouragement of Brynmor Jones, in 1946 when George was a laboratory demonstrator at the University College of Hull (now the University of Hull). He had just received his undergraduate degree in chemistry from the University of Glasgow, and in 1953 he would earn his PhD from the University of London.

His early work from the start of his PhD up to the invention of displays in the late 1960s determined the mesomorphic properties of alkoxybenzoic and naphthoic acids and was followed by his synthesis of substituted fluorines and fluorenones, materials that are often incorporated in today's organic LED systems. During that period George started to investigate chemical derivatization in biphenyl and terphenyl systems. With the support of the Royal Signals and Radar Establishment at Malvern, that research led to the preparation in 1972 of the alkyl-substituted cyanobiphenyls and terphenyls, which were the first chemically and photochemically stable, colorless, room-temperature nematogenic materials with positive dielectric anisotropy, suitable for use in twisted nematic LCD devices.

Ultimately, the cyanobiphenyl and terphenyl liquid crystals found their way into the many different forms of display and became templates for the development of materials for super-twisted nematic LCDs. Those materials were used in the first mobile telephones and Apple computer laptops and in thin-film-transistor LCDs for monitors and televisions. Their derivatives were also used as nonsteroidal cholestrogens for surface thermographic applications and strip thermometers.

Although George's research focused on applications, he used it as a springboard for studies into novel materials and condensed phases, particularly in the areas of smectic and ferroelectric liquid crystals and side-chain liquid-crystal polymers. His work formed the basis of much of the fundamental research that ensued in the fledgling subject of liquid crystals and became a superb example of multidisciplinary nanoengineering of novel states of matter; his materials became the subjects of thousands of articles by other scientists.

George worked at Hull until 1990, and his research team's production of several thousand novel liquid crystals made him the world's premier synthesizer of new mesomorphic materials; virtually every home, workplace, and entertainment center in the developed world uses his compounds. He published more than 350 research papers and patents and wrote several textbooks, including the first English-language textbook on liquid crystals, *Molecular Structure and the Properties of Liquid Crystals* (Academic Press, 1962).

George's research at Hull earned the university the Queen's Award for Technological Achievement, and in November 2005 the Royal Society of Chemistry named Hull a Historical Chemical Landmark for his more than 40 years of liquid-crystal research. George himself received the Rank Prize for Optoelectronics in 1980 from the Rank Prize Trust, the 1987 Leverhulme Medal from the Royal Society, and the Kyoto Prize in 1995 from the Inamori Foundation. He was made a Commander of the British Empire in 1991. Of George's many recognitions, I think he took the most pride in being elected by his peers as a fellow of the Royal Society, and I think he got a real kick out of having a high-speed train running between Hull and London named after him. Scientists love toys, and in our early days most of us liked train sets, but here was George with his very own train!

When asked what advice he would give to promising young scientists, George responded, "Science is a difficult field that demands great effort and dedication, but if you are willing to make the effort, there is much to gain." His legacy is not just in the amazing materials he invented that allowed a technological revolution but in the physicists, engineers, and chemists he inspired.

John W. Goodby
University of York
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