

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.

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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 nematic 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 cholesterogens 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.

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