resistive medium. Fred's two papers have been the most-cited works in the *Astrophysical Journal* during the past half century.

Fred became the director of the Smithsonian Astrophysical Observatory when it moved in 1955 to begin an association with the Harvard College Observatory. As director for the next 18 years, he helped to form the Harvard–Smithsonian Center for Astrophysics (CfA). He was a superbly innovative and imaginative scientist, an instigator, and a skilled administrator who also was involved with remarkable engineering feats. In addition to the invention of the meteor bumper, he is internationally famous for his work in World War II on aluminum foil chaff (code-named "window" by the British), shreds of aluminum foil that were dropped from aircraft as a countermeasure to Germany's radar. That work earned him the nickname "Chief of Chaff." Early in the war, he coinvented a cutter that would turn 3 ounces of aluminum foil into 3000 half-wave dipoles, and he also found optimum aspect ratios for the foil strips that would work over a range of radar frequencies. President Harry S Truman awarded Fred a Certificate of Merit in 1948 for that work.

Fred's earlier work on meteors and other natural space objects led him to artificial satellites and the birth of the US space program. That program officially began in 1954 when the Office of Naval Research asked Fred, Fred Singer, and Wernher von Braun to make specific proposals for the American satellite program, an effort that was part of the International Geophysical Year (1957–58).

Fred built a worldwide network of cameras to precisely track satellites with the intention of improving the global geodetic uncertainty from hundreds of meters to 10 meters. When the Soviet Union launched *Sputnik* in October 1957, one of the cameras was already set up and took precise data. Fred also set up Moonwatch, a global network of amateur astronomers using special Moonwatch telescopes, small refractors that looked downward at the image of the sky that was bounced off an upward-facing flat mirror. The Moonwatch program provided the first publicly available US information on Earth's first artificial satellite. The satellite effort evolved into a tracking network of elegant Baker–Nunn cameras that were optical marvels of the space age. In 1963, President John F. Kennedy gave Fred the Distinguished Federal Civilian Service award for his work contributing to the birth of the space age.

Fred remained quite active and influential until his death at age 97. He lectured to teachers and other attendees at the 1999 launch of the Stardust comet mission, and he was an official co-investigator of the Contour comet mission launched in 2002. He participated in the development of large multimirror telescopes; the Fred Lawrence Whipple Observatory on the summit of Arizona's Mt. Hopkins includes the 6.5-m Multiple Mirror Telescope, the Whipple 10-m Gamma Ray Telescope, and others.

In addition to his remarkable scientific, technical, and organizational contributions, Fred was also revered by colleagues for his ever-handy telescoping pointer, his car's "COMETS" license plate, and his outstanding collection of astronomical neckties. A small but spectacular collection of those ties is on permanent display at the visitor center at the base of the impressively winding road that leads to Whipple Observatory. For those who love comets, meteors, or any of the other many things on which Fred Whipple worked his magic, a pilgrimage to see his ties is highly recommended.

Don Brownlee
Paul Hodge
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David Mervyn Blow

Biophysicist David Mervyn Blow played a pivotal role in the development of x-ray macromolecule crystallography. This discipline provides critical structural information for understanding the function of biological molecules and is particularly applicable in the field of drug design. David's contributions to this outstandingly successful field have led to the detailed structure determinations of thousands of proteins. He died of lung cancer on 8 June 2004 in Devon, England.

David was born in Birmingham, England, on 7 June 1931. After completing his education at Kingswood School in Bath, he interrupted his studies to serve in the Royal Air Force as a glider pilot. He then pursued an undergraduate physics degree at Corpus Christi College of Cambridge University.

From there he continued research in 1954 under the direction of Max Perutz at the renowned Cavendish Laboratory, where he worked on the structural elucidation of the protein hemoglobin. Having a strong mathematical background, David was able to develop methods for analyzing the diffraction data collected from horse hemoglobin.


NICK JACKSON

David Mervyn Blow

That effort led to the successful elucidation of one of the first protein structures. (The structure of myoglobin was determined by John Kendrew at approximately the same time.)

David was fortunate to be part of the Perutz laboratory during a dynamic and exciting period in the field of structural and molecular biology. Also present in the lab at the time were James Watson and Francis Crick, who shared the Nobel Prize in Physiology or Medicine in 1962 with Maurice Wilkins. Another lab member was Kendrew; he and Perutz won the 1962 Nobel Prize for Chemistry. Being in the company of such great minds influenced David considerably; he pursued further exciting work toward protein structure determination. One of his most important contributions, and indeed a seminal paper in the field, was a joint work with Crick on the development of methods for minimizing errors that arise in the so-called isomorphous replacement technique.

David next came to the US, where he spent two years as a Fulbright scholar at the National Institutes of Health and MIT. During that period, he and Michael Rossmann worked closely to develop a method of molecular replacement, a technique for determining the three-dimensional structures of proteins based on expected structural similarities to other proteins for which structures are already known. They published a series of classic papers describing the theory and mathematics of the technique, which remains one of the most powerful methods for structure determination today. David returned to the Cavendish Laboratory in 1959. In 1962, the Cavendish Medical Re-

search Council Unit for Work on Molecular Structure of Biological Systems, under the direction of Perutz, and another MRC-funded group led by Fred Sanger took residence in the newly established MRC Laboratory for Molecular Biology.

In close collaboration with Brian Hartley, also at the MRC Lab for Molecular Biology, David commenced structural studies of the digestive enzyme chymotrypsin. He recruited Brian Matthews and Paul Sigler to join him on that project. By 1967, they had successfully determined the structure of chymotrypsin, only the third protein to be structurally characterized. That work ultimately led to the elucidation of the catalytic mechanism (the specific atomic details of how catalysis occurs) for the large class of serine protease enzymes.

In 1977, David left Cambridge to take up a professorship in the biophysics section of the physics department at Imperial College London. He continued to work on structures of important proteins. It was during that time that I had the great fortune to pursue my doctoral work under David's direction. He inspired his colleagues with the enormous passion he showed for his work. He was deeply committed to his students and strove not only to provide them with excellent training opportunities, but also to create an environment rich in learning and scientific interaction. Morning coffee and afternoon tea times with David in the "interaction room" provided opportunities for stimulating conversations on the nuances of data processing, data refinement and model building, and critical discussions on new structures from recent journal articles that littered the coffee table.

David played a key role in the formation of the British Crystallographic Association, of which he was president from 1984 to 1987. In 1991, he was persuaded to become the head of the physics department at Imperial College. However, due to ill health, he retired in 1994 and moved with his wife to North Devon, where he continued his scientific activities by giving lectures and writing papers. In 2002, his textbook entitled *An Outline of Crystallography for Biologists* (Oxford U. Press) was published and is an excellent work that is widely read by students.

Throughout his career, David received many honors, though he remained the extremely quiet and modest person known to so many of his friends and colleagues. He was elected fellow of the Royal Society in 1972, and received the British Biochemical Society's CIBA Medal in 1967, the Charles Leopold Meyer Prize of the French National Academy of Sciences in 1979 (which he shared with David Phillips), and the Wolf Foundation's Wolf Prize for Chemistry in 1987.

David's spirit of scientific endeavor, inquiry, and enthusiasm and his warm and generous demeanor are missed by many.

Alice Vrielink
University of California, Santa Cruz

Jack Emerson Crow

Jack Emerson Crow, condensed matter physicist and founding director of the National High Magnetic Field Laboratory (NHMFL) in Tallahassee, Florida, died on 3 September 2004 in Tampa, Florida. Diagnosed with cancer one year before his death, Jack inspired others with his determination to defeat his illness and with the courage he demonstrated during the last months of his life.

Born on 17 August 1939 in Angola, New York, Jack received his BS in engineering science from Cleveland State University in 1962 and his doctorate in physics in 1967 from the University of Rochester, where he worked in the laboratory of Ronald