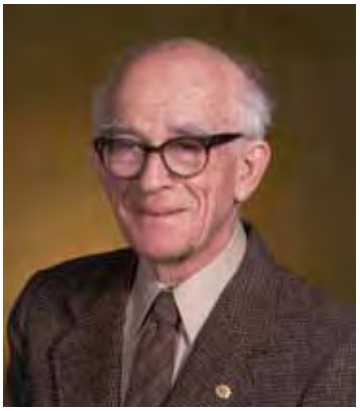
Sidney Cyril Abrahams was a crystallographer at Bell Labs for 31 years, a charter member of the ACA and its president in 1968. As part of the ACA History Project, he describes here his career as a crystallographer, also as editor of Acta Crystallographica. Sidney's full narrative will be deposited at the Center for the History of Physics (AIP). This article is part of an ongoing series by individual crystallographers. If you would like to contribute your story, contact Virginia Pett, pett@wooster.edu.



Born May 28, 1924 in London, England and educated at Ilford County High School 1935-1938 and Greenock Academy 1938-1942, the present writer graduated BSc with first class honors in chemistry from the University of Glasgow in 1946, where J. Monteath Robertson was Gardiner Professor of Chemistry. Entering graduate school under the supervision of JM, a pioneer of x-ray crystallography, was a "no brainer". Working at the Royal Institution with such major figures as W. H. Bragg, W. T. Astbury, J. D. Bernal and K. Lonsdale, JM had become a founder of organic crystallography, an area in which he played a major role by his development of heavy-atom and isomorphous-replacement methods for solving the phase problem.

JM's research group in 1946 included Jack D. Dunitz, A. (Sandy) McL. Mathieson and John G. White, each of whom subsequently made valuable contributions to structural crystallography. In 1948, the summer before completing his PhD thesis, the writer received an invitation to participate in Massachusetts Institute of Technology's coming summer term as one of 62 graduate students from 18 different European countries, four of whom were from the United Kingdom. Entirely fortuitously, the first Congress of the International Union of Crystallography with its 310 participants was due to convene that summer at nearby Harvard University, presenting the opportunity for meeting such major figures as Lawrence Bragg, Desmond Bernal, Dorothy Hodgkin and Kathleen Lonsdale.

The writer received his PhD in early 1949 and, soon after, an invitation from Bill Lipscomb to join him in Minnesota as a post-doc, with a view to setting up a low temperature crystallographic laboratory. A day or so after disembarking in New York, it proved possible to visit I. Fankuchen's low temperature laboratory in Brooklyn Polytechnic. In Minnesota, we built on and extended Fan's excellent techniques that allowed a liquid at ambience within a capillary mounted on a precession camera to be cooled below its melting point and grown into a single crystal, the diffraction pattern of which could then be visually estimated. A single crystal of H_2O_2 and, later, one of thiophene could thus be grown and each structure determined relatively efficiently; these techniques were later extended by Bill and his students in their exploration of the boron hydride (borane) structures, leading to his Nobel Prize award in 1976.

Bill and the writer proved part of the large majority, at the 1949 summer business meeting of the Crystallographic Society of America in Ann Arbor MI, that voted enthusiastically in favor of merging the CSA and the American Society for X-ray and Electron Diffraction, ASXRED, a result leading directly to formation of the ACA. Both also participated in the first ACA meeting the following year, held in State College, PA where members' enthusiasm for the new society was palpable. This enthusiasm was likely enhanced by the new and exciting computational possibilities offered by Ray Pepinsky, the meeting's chairman, from use of his x-ray analog computer (XRAC). Many members present brought enough structural data to let them experiment with XRAC and achieve useful results. During that meeting, Emmanuel Grison unexpectedly invited the writer to visit MIT's Laboratory for Insulation Research (LIR) as a candidate for the position he was leaving in order to return to France.

Arthur von Hippel, director of the LIR, offered the open position as member of MIT staff to the writer during his visit some weeks later. Among the primary interests of the LIR were the physical, particularly the dielectric, properties of condensed matter; as such properties relate to structure, they also became major interests of the writer. He investigated the structure of such materials as the polysulfides, magnetite, the alkali borohydrides, several peroxides and elemental sulfur at MIT, some jointly with Emmanuel Grison before the latter returned to the Service de Radiométallurgie du Commissariat à l'Énergie Atomique, France. His interest in instrumental improvements, such as adapting commercial powder diffractometers for use below liquid nitrogen temperatures, thereby allowing relatively high-accuracy lattice constants to be measured over wider thermal ranges, increased further over that period. He also adapted such devices for comparable use in single crystal diffraction measurement. Soon after Emmanuel left, Judith Grenville-Wells, who had just received her PhD under Kathleen Lonsdale, joined the writer as his first post-doc.

Accepting the offer of a Research Fellowship in Glasgow funded by Imperial Chemical Industries, he returned to the UK in 1954 with every intention of remaining in his native country. However, although he completed a series of successful structural investigations, capped by the award of a DSc in 1957, the economically stringent conditions in the UK during the mid-50's made the offer of an appointment at Bell Telephone Laboratories too good to pass.

Bell Labs in Murray Hill, N.J. was home to many distinguished scientists with interests close to crystallography including Clinton (Clint) Davisson, co-winner with George Thomson of the 1937 Nobel Prize for the discovery of electron diffraction who, although retired some years earlier, still visited Bell Labs and Lester Germer, president of ASXRED in 1944; the Davisson-Germer experiment of 1927 unambiguously demonstrated the wave nature of the electron. Also still at Bell Labs were Richard Bozorth, likely in 1923 to have been the first Bell Labs member to solve a crystal structure; Walter Bond, who designed and built an automatic recording x-ray diffractometer and a high temperature powder diffraction camera; and Betty Wood, president of ACA in 1957, whose interests ranged from the growth of single crystals having useful and unusual properties to their crystallographic investigation.

Soon after the writer's arrival at Bell Labs, and spurred by the discovery of ferrimagnetism in rare earth-iron garnets, Seymour Geller and he determined and refined the structure of a grossularite garnet. A few months later, the writer moved to Brookhaven National Laboratory where Bell Labs maintained a neutron diffraction facility run by Edward (Ted) Prince. The measurement of neutrons diffracted by a single crystal was, at that time, largely a manual operation, hence rather slow. In jointly revising the paper tape system that Ted had initiated for controlling the system, the Bell Labs diffractometer became one of the first such systems to be automated. We subsequently incorporated a goniometer-mounted liquid-helium cryostat into our system, thereby significantly extending the available thermal range of measurement. The writer returned permanently to Murray Hill in 1960 where he set up a new automated x-ray diffraction laboratory while remaining responsible for the neutron facility.

He participated in the 4th IUCr Congress held in Montreal on his return to the US in 1957 and, thereafter, in each succeeding Congress until the 18th in Glasgow, except for the 16th in Beijing. Similar participatory patterns were not uncommon among his contemporaries. His crystallographic and related investigations over the following decades continued vigorously, ably assisted by his long term assistant Joel Bernstein and, later, Phil Marsh together with a sequence of post docs and visiting scientists including Peter Jamieson, Tom Keve, Rune Liminga, Jörgen Albertsson, François Lissalde, Christer Svensson, Jean Ravez, Åke Kvick and Jörg Ihringer. The results that followed included a further increase in the accessible thermal range for structure determination, contributions to automated instrumental measurement, estimation and reduction of both systematic and random measurement error, and relationships between physical properties and structure, including the prediction of some properties.

During the 11th IUCr Congress in Warsaw, the IUCr Executive Committee invited him to succeed Arthur Wilson as Editor of *Acta Crystallographica*. Willingly accepting this responsibility, one of his most satisfying early editorial actions led to the decision that journal production would henceforth be undertaken within the IUCr offices in Chester, thereby achieving a major increase in efficiency at about the same time it was announced that *Acta Cryst*. B would be split into two Sections. *Crystal Structure Communications*, independently founded in 1972 by Mario Nardelli and edited by him since that date would be absorbed, with Mario's enthusiastic agreement, into a new and identically named Section C of *Acta Cryst*. The boundaries between Sections would be drawn more clearly in the future. *Acta Cryst*. A, *Foundations of Crystallography*, would continue to be devoted to crystal physics, diffraction, theoretical and general crystallography; submissions to the new *Acta Cryst*. B, *Structural Science*, would be expected to advance our level of scientific understanding not only structurally but *also* in related areas of science; as noted "The purpose of this new section is to provide a showcase for exciting papers on all aspects of structural science, in which they can be published only in the company of similar papers." Offerings to *Acta Cryst*. C, *Crystal Structure Communications*, were expected to be concise, resembling the "Short Structural Papers" formerly submitted to *Acta Cryst*. *B*.

A charter member of the ACA, he was elected President in 1968. He was Founding Editor of the *Transactions of the American Crystallographic Association* with the publication of volume 1 in 1965. He was a member of the USA National Committee for Crystallography from 1966-1980 and its chairman 1970-1972. He served as IUCr representative on the International Union of Pure & Applied Chemistry's Interdivisional Committee on Terminology, Nomenclature and Symbols from 1984-2004.

Sidney Abrahams in 1969 flanked by then ACA President Walter Hamilton and the 1967 President John Kasper, both good personal friends of his but alas now both departed.

He was named "distinguished member of technical staff" at Bell Labs in 1982. After he retired in 1988, he was appointed Adjunct Professor of Physics at Southern Oregon University in 1991. He was elected Fellow of the American Association for the Advancement of Science in 1980, the American Physical Society in 1981 and IUPAC in 2004.

Sidney Abrahams and Robert E. Newnham, ACA President in 1985. (1982 ACA meeting in San Diego)

Crystallographic methods have been applied, intermittently, to newer fields of science as the full value of understanding the detailed atomic distribution of materials with increasing complexity and importance became increasingly recognized. With the growing accessibility of high flux sources for investigating the structural dynamics of phase transitions and chemical reactions,

crystallographic applications are expected to lead to a rapid increase in time-resolved experimental evidence that is likely to enhance and enlighten current theory. The resulting specialized information and terminology expected to develop in these fields, as in other crystallographic areas of rapid growth, is generally best tested initially by collegial discussion at ACA or IUCr meetings followed by submittal of resulting manuscripts to *Acta Cryst*. and the consequent acceptance of new models and terminology.

ACA Past-Presidents at the 50th Anniversary meeting in St. Paul (2000): Elizabeth Wood, David Templeton, Robinson Burbank and Sidney Abrahams. Bill Busing and Carroll Johnson in the background.

The crystallographic community has always warmly encouraged its younger members, as the writer found during the first meeting of both the ACA and the IUCr Congress, with similar encouragement clearly evident at subsequent meetings. The continuing rise in attendance, however, with 963 registrants at the recent Chicago meeting of the ACA and 2,477 at the 21st Congress, makes such interactions increasingly difficult although, potentially, of even greater value. Such encouragement can be most valuable for personal development and, although many years have now passed since his last ACA meeting and IUCr Congress so personal observation is lacking, he has confidence that neophytes will continue to receive such encouragement.

It is a pleasure to thank Peter Strickland, IUCr Managing Editor, Mike Dacombe, IUCr Executive Secretary, Chip Calhoun, AIP Niels Bohr Library, Cora Lind, Secretary-Treasurer USNCCr, Terry A. Renner, Executive Director IUPAC and Crystal Towns, ACA Membership Secretary for providing or confirming institutional assignment information

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