William Cochran

William Cochran, who died on 28th August 2003 at the age of 81, was a distinguished physicist of international renown. During the 1950's and 1960's he did pioneering work on many of the problems that underpinned Nobel prizes won by others, including the structure of DNA, so-called 'direct methods' for determining the arrangement of atoms in crystal structures, and the interpretation of the way atoms vibrate in solids from the then new technique of inelastic neutron scattering. He was also responsible for major advances in the theoretical understanding of the way crystalline solids transform from one structure to another, often accompanied by important changes in physical properties.

Bill Cochran was born on 30th July 1922 and was educated at Boroughmuir High School in Edinburgh before going to Edinburgh University to read physics. After the award of a First Class degree, he became an Assistant in the Department of Natural Philosophy in Edinburgh, but soon realised that his research would be better pursued in the Chemistry Department. Here he worked with Arnold Beevers on x-ray crystallography, and determined the crystal structure of sucrose and its derivatives, combining this with his war-time obligations as an air-raid warden. He was awarded his PhD in Chemistry in 1946 and left Edinburgh in 1948 for the Cavendish Laboratory in Cambridge where he held a succession of posts as Demonstrator, Lecturer and Reader until 1964.

In this period he performed much of the research work for which he is well known. His interest and skills in the determination of complex crystal structures of organic molecules led Francis Crick to seek his assistance with the problem of understanding the diffraction patterns of DNA, and together they worked out a solution for the scattering from a helical structure that enabled Crick and Watson to obtain their Nobel prize winning structure of DNA. Around the same time, he became interested in systematic relationships between the intensities of the x-ray reflections from crystals and made the crucial breakthrough in showing how to exploit these relationships in a general way for solving structures. These 'direct methods' of structure solving required considerable computational power to be effective, and he was one of the first to exploit computers for this purpose, working with the EDSAC I and EDSAC II computers in Cambridge. Hauptman and Karle received the chemistry Nobel prize in 1985 for the full development of direct methods which are now used routinely worldwide for crystal structure determination. Amongst other important work, he wrote key papers on x-ray scattering from defected crystals, made one of the very first really precise measurements of electron density in a crystal, and co-authored with Henry Lipson '*The Determination of Crystal Structures'* which was the definitive text for a whole generation of crystallographers.

His research took a very different turn when he spent a sabbatical year at the laboratories of Atomic Energy of Canada Ltd. in 1958-1959 to work with Bert Brockhouse. At that time Brockhouse, another subsequent Nobel prize winner, had just successfully completed his novel triple-axis spectrometer for the study of the crystal dynamics of solids using slow neutron scattering, and was obtaining the first data from a single crystal of sodium iodide. Bill's analysis revealed that the model developed by Max Born and co-workers in Edinburgh 15 years before was inadequate. The success of his new model immediately attracted considerable and wide attention, especially when it was applied to other alkali halides, like potassium bromide, and to the well-known semiconductors, germanium, silicon and gallium arsenide. Further developments of this model led to the so-called 'soft mode' picture of the onset of ferroelectricity in a crystal – a property now of high interest in a wide range of device applications – in which the ferroelectric transition occurs as an instability of the crystal structure against a particular mode of vibration of the atoms. This mode was correctly predicted to decrease to zero frequency as the temperature of the transition was approached. The theory was later generalised by Bill and has been shown to provide a broadly correct picture of most structural phase transitions.

In 1964 Bill was appointed Professor of Physics and established a new research group at The University of Edinburgh in condensed matter physics. His great success in this continues to bear fruit today in the high reputation of Edinburgh in this field. Bill played a leading role in creating the modern Department (now School) of Physics, and in 1975 he succeeded Norman Feather as Professor of Natural Philosophy and Head of Department. This led to a growing role in University administration as first Dean of the Faculty of Science from 1979 to 1982 and then Vice-Principal from 1984 to 1987.

Bill was a Fellow of the Royal Societies of London and Edinburgh, and a Fellow and then Honorary Fellow of Trinity Hall, Cambridge. He was elected as a Fellow of the Royal Society of Edinburgh in March 1965, serving on the Society's Council from 1980 – 1985, the last three years as Vice-President. He was awarded the Guthrie Medal by the Institute of Physics, The Hughes Medal of the Royal Society and the Potts Medal of the Franklin Institute among others.

He will be remembered warmly by his colleagues as a kindly and perceptive man with a dry sense of humour. As a teacher he was revered by students at both undergraduate and postgraduate level for the

clarity of his explanation of even the most difficult topics, leavened by humour and an annual limerick competition.

Bill was a keen Scotsman with interests in Scottish literature and heritage, and an enduring affection for the Scottish landscape. He wrote about the Edinburgh Natural Philosophers, David Brewster and James Clerk Maxwell, and his interest in Scots verse led him to twice address retiring Principals, to their surprise in his own verse, at Senatus. He will be sorely missed by his son and two daughters, and by his wife, Ingegerd, whom he married in 1953.

R.J. Nelmes

P.N. Pusey

William Cochran BSc, PhD (Edinburgh), MA (Cantab), HonDSc (Edinburgh, Heriot-Watt). Born 30 July 1922, Elected FRSE 1 March 1965 (Vice-President 1982-85), Died 28 August 2003.