In Memoriam

Sir Godfrey Newbold Hounsfield, who died on August 12th at the age of 84 invented X-ray Computed Tomography (CT). Its introduction was a fundamental advance of the greatest importance to diagnostic medicine. Many would say that CT had as great an impact on clinical medicine and surgery as Rontgen's earlier discovery of X-rays. It had a profound effect on radiology, liberating with the first step, the brain of both patient and doctor from the constraints of traditional imagery. It introduced the concepts of digital data acquisition, sophisticated interactive display systems and powerful image processing to *in vivo* biological studies, at the same time providing a stimulus and scientific environment for other major developments to follow, including Magnetic Resonance Imaging. CT provided, for the first time, quantitative information about tissue density differences in uniformly thin slices of tissue by employing collimated X-rays directed only at the layer under investigation. A density discrimination of 1:1000 could be achieved together with an increase of two orders of magnitude in data retrieval per unit of radiation dose. The distribution of this numerical information, now expressed as Hounsfield numbers, could be related to the ability of tissue to attenuate X-rays and by digital to analog conversion displayed as a grey level picture on a television monitor. Most importantly the picture so produced could be interrogated by the observer enabling the whole dynamic range of tissue to be explored.

Sir Godfrey Hounsfield
1919–2004
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Godfrey Newbold Hounsfield was born near Newark in Nottinghamshire, England on August 28th in 1919, the youngest of 5 children. He grew up on a farm in Sutton on Trent, a nearby village. He delighted in experimenting with electronics, the farm's mechanical and electrical machinery and the elements of flight from haystacks using a home made hang glider. He had always had an aptitude for physics and mathematics but never entered a University. After leaving school he worked in a builder's drawing office and then, in September 1939, joined the RAF as a volunteer reservist where he simply read some RAF books on radio mechanics and took a test. To his surprise he was posted as a radar-mechanic instructor to RAF Cranwell where he was promoted to Corporal. After the war he obtained a grant to study electrical and mechanical engineering at Faraday House in London and then joined the research staff of Electric and Musical Instruments (EMI) in 1951. After working on radar he went on to make notable advances in computer memory design, increasing the speed of the machine by redesigning the then very slow transistor to compete with the valve. In 1967 he moved to the Central Research Laboratories (CRL) of EMI and into the field of automatic pattern recognition where he realised that much information was being lost by inefficient data retrieval methods. Hounsfield conceived the idea of CT in that year during a ramble in the countryside—one of his greatest pleasures—when he wondered if it might be possible "to determine what was in a box by taking readings at all angles through it." He then realised that this would be achievable in biological terms, using finely collimated X-ray beams. The contemporaneous development of computer technology and the notion of the skull as a box provided the ideal circumstances. Without any knowledge of earlier observations by Radon and Cormack, Hounsfield went on to develop the principles of CT and three dimensional reconstruction. In his initial experiments using a gamma source it took 9 days to acquire the data and 2.5 hours to reconstruct the image on a large main frame computer. Replacing the gamma ray source with an X-ray tube reduced the scanning time to 9 hours. The basic principle was that of a rotate-translate system and with this apparatus Hounsfield was able to differentiate white and grey matter in a preserved brain specimen.

EMI, at that time, were concerned principally with the manufacture of records and electronic components and had no experience of radiological equipment. The Beatles, who recorded under the EMI label provided the most significant financial input to the company. The Department of Health and Social Security (DHHS)—as it was then—was approached by Hounsfield and radiologists James Ambrose and Louis Kreel and with commendable foresight agreed to support, with EMI, the development of a head scanner. Hounsfield and a small team were installed in the radiological department of the Atkinson Morley's Hospital in Wimbledon—a location chosen to avoid wide spread publicity in the development phase. The Consultant Radiologist, James Ambrose, provided clinical advice and conducted the first clinical trials on a prototype EMI head scanner (Mark I) in 1972. The first clinical image of a patient with a suspected brain lesion revealed the presence and location of a cystic tumour. James Ambrose later recalled that both he and Hounsfield felt like footballers who had just scored the winning goal! The skull was no longer a barrier to the radiological investigation of brain disorders including tumors, head injuries and strokes. The DHSS ordered 3 scanners and placed them in Manchester, Queen Square and Glasgow for evaluation. The discomfort of the pneumoencephalogram became a thing of the past. All the early scanners did, however, require a water bath to surround the patient's head and the results, in the early stages, necessitated evaluation of the computer print out of numerical data alongside polaroid prints of the grey scale image. The audible noise of the printer in the confined space of the control room very often exceeded health and safety regulations! In 1975, at an international conference in Bermuda, Hounsfield announced a general purpose scanner which did not require a water bath and therefore enabled access to other parts of the body providing not only enhanced diagnostic possibilities but also more effective appli-

cation of treatment programmes. His announcement was greeted with a standing ovation.

In 1972 Hounsfield had won the MacRobert Award, the UK's highest award for innovation. Numerous awards and Honorary Degrees followed with recognition from around the world. On the presentation of his Honorary Doctorate in Manchester and his appointment as Honorary Research Professor in the Manchester Departments of Diagnostic Radiology and Medical Biophysics, the list of awards and honorary degrees was longer than his conventional CV including the publications! In 1975 he was elected a Fellow of the Royal Society and received the Lasker Award in the United States. In 1967 he was appointed CBE and in 1979 was awarded, together with Cormack, the Nobel Prize for Medicine. In 1981 he was knighted by HM the Queen. In 1994 he was elected an Honorary Fellow of the Royal Academy of Engineering. After his official retirement in 1986 he continued as a consultant for EMI and various departments and hospitals.

Sir Godfrey Hounsfield was a shy retiring bachelor, embarrassed by awards and honours, who lived in modest surroundings, loved walking in the mountains, enjoyed music, played the piano by ear and retained his own time-clock wherever he was in the world. This last trait could be disconcerting to those who were unfamiliar with his habits and encountered him wide awake on a hotel corridor in the early hours of the morning. His words of advice to young relatives and Nobel Laureates alike were "not to worry about passing exams so long as you have understood the subject" and, to the joy of young relatives, "not to worry about not getting up before 9 am!" He was a man without interest in power, position or possessions yet a man whose work contributed massively to the advance of human welfare across the globe.

—Ian Isherwood, CBE

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