1979 Nobel Prizes for Medicine, Physics, and Chemistry

35th prize for inventor of EMI X-ray scanner

"I'm not the sort of person to build model planes" said Godfrey Hounsfield, co-winner of this year's Nobel prize for medicine, last week. "Ive always searched for original ideas; I am absolutely opposed to doing something someone else has done."

Dr Hounsfield invented the EMI 'brain scanner' for computerised tomography — using X-rays to make two-dimensional images of slices of a patient's brain. "It came to me on a ramble" he said. The device, and its successor, the whole body scanner, brought EMI medical division a ten-fold increase in profits from 1973 to 1977, when the US market collapsed from 40 scanners a month (at £250,000 each) to just eight (see following story).

To date, Dr Hounsfield has received 35 academic awards for his work on the scanner, beginning with the MacRobert Award (the UK's major prize for engineering) in 1972, a Fellowship of the Royal Society, a CBE and many foreign degrees, and ending with the Nobel. He hopes to use his £44,000 prize to buy scientific equipment for his home "so I have something to do when I retire".

Sixty years old and a bachelor, Dr Hounsfield hasn't much time for the arts. "Science has very much a 3rd place in this country; I'd like to do something about that. The sciences are far more exciting than the arts, than fantasy".

Farming educated Hounsfield. "I was brought up in the country; I played around with farm machinery, and to prevent myself being bored I started to reason why things work".

EMI's central research laboratories have provided Hounsfield with "a very relaxed place to do original thinking; and there's just enough pressure to produce a product. It enables one to come to a logical conclusion rather quicker than one would in academic life".

Dr Hounsfield does not know his co-winner, Allan Cormack, and says he first heard of him when he was recommended as a referee for a paper in 1972-3. Cormack had taken a mathematical approach to computerised tomography, whereas, says Hounsfield "I find I've got other tools of thinking than maths — the most important thing is a very broad understanding of the problem, not to be fogged by detail".

"In the last few years I've spent half my time on developments of the scanner, half on other things" says Hounsfield. A new version, the '7000', will cut scan time from 18 to 3s, so reducing the effects of organ movement in the body. "I've always been interested in the heart; we are working on pictures synchronised to the heart to 'arrest' the heartbeat."

Dr Hounsfield has also been working on newer, non-invasive techniques, such as nuclear magnetic resonance. This "looks promising, but isn't diagnostically useful yet. But we've a long way to go before we reach a brick wall." Further developments of the scanner involve a system directly linked to a machine for delivering therapeutic X-rays, so the surgeon can see precisely where he is working. "We're well ahead on that".

Godfrey Hounsfield: started with farm machinery

"The scanner can save money if it's used properly" says Hounsfield. "It's said the head machines can pay for themselves in 2 years" by avoiding the need for exploratory surgery or dangerous techniques like pumping air into the ventricles or heavy metals into the veins of the brain, which are the more traditonal techniques for revealing defects.

Nevertheless the profits of EMI medical electronics have fallen from £14.7m in 1977 to a loss of £12.8m this year, in part because of the spectacular collapse of the US market for the scanner. And meanwhile EMI has been fighting patent rights battles with three US manufacturers of scanners: Ohio Nuclear, which is now to work under an EMI licence, and Pfizer Inc., and GEC.

Robert Walgate

● A six-month tenure at the Groote Schuur hospital in Capetown gave Allan Cormack, a native South African, first-hand knowledge of the limitations of the X-ray techniques being used. "I saw these girls

Dithering on the deadline

PROFESSOR Cormack and Dr Hounsfield became Nobel laureates after a controversy that prolonged the announcement of the prize by more than an hour. Until the last minute, it was unclear whether they or another group would share the award.

The rival nomination was reportedly for a group of three American and French scientists who have made crucial discoveries in immunogenetics. As a result of these discoveries, organ transplant have been made easier.

Exactly who these scientists are is not being revealed. But the Nobel committee, a group of 15 professors from the Karolinska Institute which goes through all the nominations and prepares a short-list, was so sure that the group would be approved that it had prepared its publicity material only on the immunogeneticists, in the usual languages: Swedish, German, French and English.

When the committee presented its proposals to the Nobel Assembly for final decision, however, the Assembly — composed of the 64 full professors at the Karolinska Institute — argued in favour of Cormack and Hounsfield instead. After a prolonged discussion, the committee's secretary, Professor Jan Lindsten, left the deliberations to face the waiting journalists. He made the official announcement in Swedish only: the translations came later. "There was no time to check with the translators" he told *Nature* — and the foreign correspondents had to manage as best they could.

In voting for Cormack and Hounsfield, the Assembly decided to give the prize to applied instead of basic research. The relative merits of these was reportedly one of the subjects of the Assembly's discussion. The information secretary of the Royal Academy of Sciences, Lennart Daleus, wondered afterwards how such a controversy could have arisen at the last minute. By the time the Academy's classes of physicists, chemists and economists present the full Academy with their proposals for the respective prizes, he mused, all the substantive disagreements have usually been ironed out.

Nominations for the medicine prize are invited from many sources. According to Professor Lindsten, invitations to nominate are sent to previous laureates, professors of Scandinavian faculties of medicine, and about 40 faculties of medicine in different parts of the world.

After the drama of the announcement, none of the Assembly's members was willing to talk about the controversy. The remark made by the Assembly's chairman, Professor Georg Klein, was typical of the others' tantalising restraint. "I have a lot of comments", he told *Nature*, "but I can't make them."

Wendy Barnaby

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preparing all these X-ray treatments, and as a physicist, it struck me as a very rough process," Dr Cormack said. "How can you know how to treat something in the middle of the head if you do not have proper information of the effect on the radiation of the material through which it has to pass?"

The question appealed to him as a scientist. But the task of working out the answer was "mostly a mathematical one", extrapolating what physicists already knew about the attenuation of radiation passing through a homogenous material to similar calculations for inhomogenous materials.

"After publication in 1963 there was virtually no response at all, except for a few physicians, until someone came along in about 1970 to say that similar ideas had been developed by engineers at EMI," says Mr Cormack. He says that he has never met Godfrey Hounsfield, with whom he now shares the Nobel Prize, but adds that "I have heard that the is an inventive person."

Cormack's lack of involvement with the commercial development of computerised comography (CT) scanners means that he has been able to watch from the sidelines the intense debate which has taken place in the US — and which promises to be revived by the Nobel Prize award — over the use of the technology. In particular, this debate has focussed on the extent to which the federal government should support the growth of a technology whose extremely high capital costs have contributed to the rapid increase in hospital care costs in recent years.

Mr Cormack is critical of the US government's decision to place stringent restrictions on the use of CT. This move followed a report from the National Academy of Science's Institute of Medicine pointing out that in many cases, conventional X-ray techniques were much cheaper and might be just as effective (*Nature*, 12 May 1977).

"The arguments against the CT-scanner leave out a lot of things. In doing a cost-benefit analysis, for example, how much to you put in for the pain and suffering of patients for whom exploratory surgery might be avoided by using the scanner? ' Mr Cormack says.

"I think the scanner has become a symbol, it is used as a whipping boy as a way of pointing out the expense of medical care; intensive care units probably cost a lot more money, but you do not usually hear about them."

At the same time, however, he admits that the cost of the basic equipment might be brought down if manufacturers were not under great pressure from physicians to improve its performance, for example through faster scans or higher resolution. "A substantial part of the costs must still be in development. If they could standardise the model, the costs would probably go down a lot," Mr Cormack says.

David Dickson

Neutral currents bring rewards

THIS is the prize that many physicists have been waiting for — not least Abdus Salam, of Imperial College, London, and the International Centre for Theoretical Physics, Trieste, and Steven Weinberg of Harvard, whose unified model of the action of the weak and electromagnetic forces has been finding corroboration in an increasing number of experiments.

But one of the severest tests of the theory — the discovery of heavy counterparts to the photon, the 'intermediate vector bosons', is yet to come, and a few will no doubt consider the prize to be premature. Experiments planned at CERN, the European centre for subnuclear physics, for 1982 are expected to provide the first direct evidence of the particles.

However the citation refers to the prediction "*inter alia*" of neutral currents, and here the theory is on firm ground. Sheldon Glashow, of MIT, played a key role in their prediction independently of the machinery of the Salam-Weinberg model, and hence his well deserved share in the prize.

The term 'neutral current' is a somewhat confusing epithet for weak interactions not involving the exchange of electric charge. For example, the familiar weak decay of atomic nuclei involves neutrons changing into protons (or *vice versa*), the excess charge being taken up by the creation of an electron and an antineutrino (or their antiparticles). This is supposed to take place by the emission and reabsorption (exchange) of a *charged* intermediate vector boson between the nucleon and electron systems. Neutral current interactions, on the other hand, involve the exchange of a neutral IVB, and so change protons into protons, electrons into electrons, and so on.

The weak force being extremely weak, the effects of these 'neutral' exchanges are completely masked by the analagous exchange of photons which creates the electromagnetic force between, say, protons and electrons. (It is this analogy, indeed, which allows the two forces to be unified in an all embracing theory.)

The detection of neutral currents has thus proved extremely difficult, and its history has not been without its conflicts of evidence. The first observation was made with neutrinos (where electromagnetic effects are absent) at CERN; others followed, and gradually the neutrino evidence has built up into an impressive body of evidence not only for the existence of the neutral current, but for the exact form of it predicted by Glashow and incorporated by Salam and Weinberg in their (independently generated) 1967 and 1968 unified theory. More recently, a brilliant experiment with polarised electrons at the Stanford Linear Accelerator Center in California measured the interference between the electromagnetic and neutral weak interactions between electrons and protons, and also confirmed predictions.

Robert Walgate

Boron and phosphorus

Herbert C Brown of Purdue University, Indiana, and Georg Wittig of Heidelberg University share the Nobel Prize for chemistry. The citation describes their work on the application of boron and phosphorus compounds respectively to synthetic organic chemistry.

Professor Wittig, who is now over 80 but still academically active, is best known for the development of Wittig reagents, a class of phosphorus-based compounds used to form carbon-carbon double bonds at precisely predetermined places in organic molecules. They have applications in the synthesis of many compounds, including prostaglandins.

Professor Brown, on the other hand, has developed a series of very versatile organo-boron compounds which can selectively modify functional groups in organic molecules, and is also renowned for his theoretical contributions to carbo-cation chemistry. His birthplace was in the UK, but he has pursued his career in the US. □

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