Nobel physics

Electron microscopy acclaimed

ERNST Ruska, who receives half of this year's Nobel prize in physics, was the first to build an electron microscope, the design of which was essentially that of current machines. He has worked on electron microscopes ever since. His most important work began when he was a graduate student and was completed by 1938, by which time he was working for Siemens and Halske.

As a graduate student, Ruska worked at the Technical University of Berlin, where with Knoll in 1931 he showed that it was possible not only to form but also to magnify an electron image. The relative contributions of Ruska and Knoll to this work have never been clear, but Ruska pursued the development of the electron microscope while Knoll instead became interested in television.

Ruska, for a time, was alone in his belief that a useful electron microscope could be built, but he teamed up with Bodo Von Borries and began to construct a prototype machine. Von Borries was more of a businessman and seems to have been responsible both for the key patent relating to the iron pole piece lens in 1933 and for attempts to win commercial backing.

In the end, the development was financed by Siemens and Halske, which gained the right to manufacture the machine, the first of which was made in 1938. Ruska and Von Borries worked in a converted bakery throughout the Second World War. Their laboratory escaped bomb damage but was looted by the Soviet army. Ruska continued working at Siemens until the 1950s, when he joined the Fritz Haber Institute, part of the Max Planck Institute in Berlin, at which he has remained.

It is unclear why it has taken so long for Ruska, who will be 81 on Christmas Day, to be awarded a Nobel prize. Although there seems no doubt that he was the brains behind the first electron microscope, the claims of other participants, including Knoll and Von Borries, must at first have complicated matters, as would have the circumstance that the first patent belonged to Rheinhold Rüdenberg, apparently with little justification.

For many years, the Nobel committee may have balked either at awarding a prize to Ruska alone or at deciding who else should share it. Could it really be that the committee has only now found a solution to its problem in the form of an invention that allowed two quite unrelated people to take the other half of the prize?

If the award to Ruska is overdue, this cannot be said of the other half of this year's prize, which goes to Gerd Binnig and Heinrich Rohrer of the IBM Research Laboratory in Zurich, Switzerland, for the invention of the scanning tunnelling microscope. The first instrument was built in Zurich between 1979 and 1981, and the paper which, according to one colleague, "won them the prize", was published in *Physics Review Letters* only in 1983.

The scanning tunnelling microscope, the first scanning instrument to resolve single atoms, uses the phenomenon of vacuum tunnelling. A voltage applied between a very sharp needle (the tip) and the surface under study allows electrons to tunnel from sample to tip; because the tunnelling effect requires the electron wavefunctions in tip and sample to overlap, the tunnelling current is a very sensitive function of the tip–sample separation. This allows variations of surface structure to be mapped within a vertical resolution of 0.07 Å and a lateral resolution of 1–3 Å. The microscope can also act as a probe of the electronic structure of a surface.

Nobel laureates Ruska (left), Binnig and Rohrer.

Although scanning tunnelling microscopy is still in its infancy, the technique is being used by more than 50 university and industrial research groups. So far, it has been applied most widely in the field for which it was invented, the study of semiconductor surfaces, but new applications are rapidly emerging. The microscopes have now been used in air at atmospheric pressure, and have even been shown to work under water.

The only severe limitation to the technique is that it cannot be used to study insulating materials. Binnig, who is setting up a new laboratory at IBM Munich, has started to tackle this problem with an instrument he calls the atomic force microscope. Here the tip is positioned so as to maintain a constant force (instead of tunnelling current) between tip and sample; the rapid decrease of interatomic force with distance gives this instrument a vertical resolution of less than 1Å and a lateral resolution of 30 Å. The atomic force microscope can be used to study conductors or insulators.

Rohmer, aged 53, and Binnig, 39, have each been awarded an IBM fellowship, a renewable appointment, given to honour "sustained technical achievement", which allows the recipient to pursue his own proect for up to five years.

Peter Newmark & Laura Garwin

European research

Tangled framework programme

FRANCE is having trouble in keeping up even present levels of support for research organized by the European Commission in Brussels; Britain and West Germany would support "modest" increases; and other countries would support the doubling requested by the Commission. This was the spectrum of national positions shortly before the meeting of the European Council of Research Ministers on Tuesday. The meeting was the last before the self-imposed 9 December deadline by which Britain, President of Council, plans a decision on the Commission's £6,200-million, five-year proposal for a 'framework programme' for research, and while the gap might appear unbridgeable, the solution is in the Commission's hands, according to British officials.

The real block, in the British view, is that the Commission refuses to disentangle its 'framework' for research into individual packages that could be identified as particular programmes (such as ESPRIT, the European stimulation programme for research on information technology). The Commission, led by its president Jacques Delors, insists on a unanimous decision on the aggregated 'framework' package, where individual nations cannot easily identify and support specific programmes. Only when the framework is agreed, he argues, will the Commission show its hand, by which time the European Single Act, the replacement for the Treaty of Rome which was the foundation of the European Economic Community, should be in place, allowing decisions on individual programmes by majority voting in the council of ministers. Britain is arguing, with the support of most other countries, that this is unrealistic. The Commission should disaggregate the framework programme, allowing real bargaining to begin among the various programmes and national interests. After that, a decision on financing could be reached relatively quickly, British officials believe.

Early this week, however, it seemed likely that the Commission would stick to its guns, with an impasse in December increasingly probable. **Robert Walgate**