British agricultural research

The worst is still to come

THE agony of the British research establishment remains where it has mostly been for several years, in agriculture. During the past few weeks, institutes of the Agricultural and Food Research Council (AFRC), such as the animal diseases institute in Berkshire and the poultry research station in Cambridgeshire, have been putting out forecasts of the numbers of people they will have to shed from the beginning of next year (35 and 26½ respectively), the Ministry of Agriculture, Fisheries and Food (MAFF) has explained how it will close four of the laboratories run by the Agriculture Development and Advisory Service (ADAS) to save £4 million a year, and the cry has gone out that the cost of applied research in agriculture must in future be borne by its beneficiaries.

The newest round of cuts is the consequence of the British government's decision, announced at the beginning of this year, that research supported by MAFF and the other agriculture ministries (in Scotland and Northern Ireland) would be reduced by £10 million in each of the years 1986–87 and 1987–88. This decision followed several years of steady decline in direct support from the government's science budget for AFRC.

The effect of the latest cuts will be to have reduced AFRC's staff by close on 2,000 in three years, or by nearly a third. During the current financial year, some 600 posts will have been lost. Some 570 posts will go next year with perhaps as many in the succeeding year.

One of the curious effects of these decisions is that the total cost of getting rid of the posts concerned is likely to exceed the money savings, at least in the short term. Paying people to retire early, paying others to move from one institute to another and the costs of reorganizing research programmes are likely to amount to £20 million in the next two years. On this occasion, however, there seems to be an understanding by the government that the burden of this "restructuring" will not fall on the science budget, but will be borne directly by central government.

Final details of the government's plans for the years ahead are likely to become known during the next few weeks. The Priorities Board, which gives advice on agricultural strategy, is soon to produce a report suggesting where cuts should fall; its guiding principle seems to be that the government should pay for research that nobody else can be expected to support. This doctrine seems to have inspired the government's present line that the beneficiaries of research should pay for it.

Later, perhaps in December, the Advisory Board for the Research Councils may have something to say in defence of AFRC in its annual advice to the Secretary of State for Education and Science. On present form, the council may argue the need for more time if AFRC's research effort is not to be unreasonably and uneconomically reduced.

There may also be before the end of the year, a decision on the future of plant breeding research in the United Kingdom, especially that at the Plant Breeding Institute at Cambridge. For several years, the commercial value to the Treasury of the exploitation of novel strains by the Seed Development Organisation has far exceeded the cost of keeping the Plant Breeding Institute at work. Several options veering towards privatization have been put to the government.

Further ahead, the level of agricultural spending on research beyond 1987–88 should become apparent next February, in the annual forecast of public spending for the succeeding three years. The possibility that some parts of the total cost might be shouldered by the ultimate users of research seems to vary from one field to another. On the strength of a meeting held by the Institute of Horticulture at the end of September, there seems some hope of subventions in that area, while the Milk Marketing Board and other such public organizations are potential contributors to some dairy research. But making farmers pay for research is reckoned to be possible only through legislation, for which there appears to be no preparation. □

Chemistry Nobel

New routes to X-ray phases

Washington

JEROME Karle and Herbert Hauptmann, winners of the 1985 Nobel Prize for Chemistry, developed "direct" methods of crystal structure determination while collaborating at the Naval Research Laboratory in Washington DC between the 1940s and 1960s. The award is considered by many crystallographers to be long overdue; almost all three-dimensional crystal structures are now determined using methods based on the equations derived by Karle and Hauptmann. The importance of their work, a mathematical method to measure the phases of X rays diffracted by crystals, was only generally appreciated 15 years after the first paper in a series was published in 1950.

The Hauptmann–Karle method enables phases to be calculated from structure factors, those parts of the diffracted wave that depend on the structure under investigation. To calculate the positions of atoms in a crystal, the intensities and phases of the reflections must be known. Intensities can be calculated empirically by recording the reflections on a photographic plate, where they are seen as a series of dots of different brightness. Until the Hauptmann–Karle method, the phase information was thought to be lost, and only "special molecules" (for example, those containing bromine or other large atoms) could be unambiguously resolved. Isomorphous replacement, in which heavy metal ions are bound to large molecules, gave Max Perutz and John Kendrew the Nobel prize in 1962 for determining the first three-dimensional structures of proteins, but this method is not suitable for smaller molecules.

Hauptmann and Karle, using the fact that the electron densities of atoms in a crystal can never be less than zero, developed a series of equations to describe the limitations of the possibilities of phase displacements of diffracted waves. The practical applications of these equations became apparent when David Sayre used a more intuitive approach to derive the same relationships, and Isabel Karle developed a symbolic addition procedure. The first application allowed the structure of a 15-atom antibiotic molecule to be calculated in two years. Computer programs based on the equations, originally developed by M. Woolfson and colleagues at the University of York, now allow the structure of a 50-atom molecule to be determined in two days.

The next challenge will be to apply the method to larger molecules such as proteins; Karle and Hauptmann are now trying to do exactly that. **Maxine Clarke**

Astronomer's prize

THE US astrophysicist Lyman Spitzer Jr has received the Royal Swedish Academy of Sciences' first Crafoord prize for astronomy. The prize, worth US$135,000, was awarded for "fundamental pioneering studies of practically every aspect of the interstellar medium, culminating in the results obtained using the Copernicus satellite".

Since the 1940s, Lyman Spitzer has explored all aspects of the physics of the interstellar medium, especially in the ultraviolet. Following pioneering work with balloon-borne telescopes, he led the work on the third of the National Aeronautics and Space Administration (NASA)'s Orbiting Astronomical Observatories, which became known as the Copernicus satellite. One of the discoveries made with this satellite was that our Galaxy is surrounded by a corona of very hot million-degree gas, the existence of which Spitzer had predicted on theoretical grounds. He also had a major hand in the acceptance of the Hubble Space Telescope by NASA.

The Crafoord prize is awarded alternately for mathematics, geoscience, bioscience and astronomy and was first awarded in 1982. M. Rowan-Robinson