that gets the blame. Applying this dictum to the bladder tumours, the committees found that since saccharin has been used for longer than cyclamates without apparently harmful effects, it must have been the cyclamate which caused the tumours. They therefore recommended to the minister that it would be prudent to stop further addition of cyclamates to food until the research programme half completed by the British Industrial Biological Research Association (BIBRA) has been brought to a conclusion. Scarcely twenty-four hours later, on October 24, a happy Mr Cledwyn Hughes was able to announce that the vicious sweetener was to be phased out.

The postscript to this seven day wonder has been afforded by a spokesman at the Ministry of Agriculture. Asked why such terrible speed was necessary, he admitted that "Public opinion wanted an answer straight away. We'd have been caught very much with our head in the sand if we didn't do anything about the cyclamates. We had either to ban them or prove them harmless". Ostrich-like or not, even the fleet footed Ministry of Agriculture could not prove cyclamates harmless at seven days' notice and, discretion being the better part of valour, it only remained for housewives to be soothed with advice as to what foods and beverages were likely to contain the deadly substance before a grateful public could sink back, probably to soothe itself with a well earned cigarette, confident in the knowledge that its political and scientific guardians would leave no stone unturned to protect the nation's health, save any such as might be inconveniently heavy to uproot.

Herod in Camberley

If the Ministry of Agriculture finds itself finally committed to a programme for the extermination of all wildlife in the part of England around Camberley, where a dog died of rabies ten days ago, its most serious problem will be to know just what has got away. There is historical evidence to show how difficult is a programme of complete eradication. Wildlife on an open common is particularly hard to control and exterminate. It may be possible to get rid of the foxes but nobody will be sure, perhaps for a year or so, that other forms of wildlife are not affected.

The problem of rabies in developed countries is peculiar. For one thing, the disease itself has a mediaeval quality. The horrific tales of how people used to die from it in the Middle Ages are too vivid to be forgotten. But rabies is also almost mediaeval in the way in which it persists in wildlife and in the way in which it can so easily be transferred from an animal population to human beings. In Britain, rabies was common in the nineteenth century but for practical purposes was eradicated by the beginning of this century. Since then there has been an apparently successful programme of quarantine—domestic animals must spend six months in quarantine before being allowed to mix with their fellows already well established. The dog that died in Camberley seems to have been infected with rabies at a quarantine kennel at which another animal had died of the disease.

Several questions must be asked about the management of the disease. To begin with, there seems no prospect that it would be possible to substitute immunization for quarantine. In the past few months, there has been a tendency to suggest that preferential treatment might be given to imported animals which had been vaccinated or that the quarantine regulations must be relaxed now that the rabies virus has been identified and purified and human vaccines made more effective as a result. Unfortunately, however, as two recent articles in *Nature* demonstrate (**224**, 244 and 246; 1969), the use of a human vaccine, like the immunization of domestic animals, is an uncertain safeguard. It seems now to be well established that a dog that died in quarantine in 1968 had been vaccinated on several occasions. The use of the human vaccine is hazardous. In brief, the World Health Organization is right to insist that the countries which are now free from rabies should persist with their quarantine regulations. If anything, there is a case for asking that the length of the period of quarantine should be increased. If the regulations are given their full meaning, there is also a case for thinking they should apply to imported monkeys as well as dogs, which in turn implies that animals for medical research would have to be obtained by breeding artificially within a quarantine fence. This would add substantially to the cost. There is also a strong case for asking that quarantine kennels such as that in which the Camberley dog picked up its infection should be more strictly managed.

Dogs are the chief hazard to be sure, and for this reason there is even a case for asking whether it would be wise to ban the import of dogs. After all, it is not as if there were a shortage of these animals, and a ban on imports might do no damage to the commercial interests of the British dog breeding industry.

NOBEL PRIZES

Honouring Founding Fathers

The sociology of the Nobel Prize is a fascinating subject and a source of endless gossip. What significance, for example, can be attached to the delay between the time when an eventual Nobel laureate is at the peak of his experimental career and when he reaps his reward in Stockholm? Lately the prize committee has to its credit given the prize to comparatively young molecular biologists who were clearly destined to be honoured eventually. But this year, at least as far as the molecular biologists are concerned, the committee seems to have gone back over its lists and corrected an oversight. Max Delbrück, Salvador Luria and Al Hershey who have won this year's Nobel Prize for Medicine are

in their fifties and sixties; it is inconceivable that their names have not cropped up in the prize committee's discussions on many occasions in the past ten years or so. It is now some thirty years since they recognized that bacteriophage held the answer to the key question of biology, the mechanism of inheritance. The bacteriophages are the experimental material for running the genetic code to earth, and Delbrück, Luria and Hershey are the three men who, more than others, realized this and laid the foundations of molecular genetics.

Their influence on many of the younger men who have already won Nobel prizes for work in molecular biology has been subtle but none the less profound. The collected papers of Delbrück, Luria and Hershey would form only slim volumes compared with those of many of their peers; it has been not so much what they have published but what they have said in private and at meetings, especially those at Cold Spring Harbor, which has changed the face of genetics. The mythology of molecular biology and the festschrift *Phage and the Origins of Molecular Biology*, celebrating Delbrück's sixtieth birthday in 1966, abound with stories of Delbrück's insistence on rigorous evidence for any claim. When Marmur and Doty published their first paper on nucleic acid hybridization, for example, Delbrück wrote a ten page critique. And on receiving the umpteenth paper from Seymour Benzer on T-phage genetics for communication to the *Proceedings of the US National Academy of Sciences*, his comment was "Not another"; soon afterwards, Benzer took the hint and began working on the nervous system.

Max Delbrück, a postdoctoral student of Niels Bohr, left Germany in 1935 and at Caltech started work in genetics, not with *Drosophila* as a less perspicacious man would have done, but with bacteriophage. Steeped in quantum theory, a bacteriophage was as close to a quantum of genetic information as anyone could get. A bacterium infected with a bacteriophage contained all the key elements of biological self-replication but lacked all the trimmings which then and now bedevil experiments with nucleated cells.

Luria, another refugee from Europe, met Delbrück in Philadelphia in 1940 and from the meeting they emerged as a team devoted to phage genetics. In 1943 they published an epoch-making paper proving that in populations of bacteria sensitive to bacteriophage, bacterial cells resistant to the phage appear as a result of natural selection of spontaneous mutations conferring phage resistance. It was the manuscript of this paper that brought Luria and Delbrück in touch with Hershey. The three men were instrumental in establishing the American Phage Group and establishing the Cold Spring Harbor Laboratory and the symposia held there as the Mecca of molecular biology. Hershey, a retiring man poles apart from the ebullient Luria, has remained at Cold Spring Harbor ever since, sailing or gardening when the summer migrants are at their peak and returning each autumn with a new idea.

In 1945 both Hershey and Luria demonstrated spontaneous phage mutation and in 1946 Delbrück and Hershey independently showed genetic recombination in phage. Hershey's most famous experiment, however, was yet to come. In 1952, with Martha Chase, he proved that phage DNA is the only component of a phage particle injected into a bacterium on infection. Readers of *The Double Helix*—J. D. Watson was one of Luria's postgraduate students—need no reminding of the impact of the Hershey–Chase experiment on Watson and Crick in their search for the structure of DNA.

Since those pioneer days Hershey has done a series of experiments, with the analytical centrifuge as his chief tool, which have not only led to the realization that many phage and bacterial genomes are circular DNA molecules but have also set the universal standard for accuracy of measurement. When Hershey cites a fact or figure in his papers it is never challenged. As one of his closest colleagues at Cold Spring Harbor is wont to say, "Al is always right". Unlike Hershey, Delbrück and Luria have not hidden themselves away but have become heavily involved in teaching. Delbrück, for example, whenever he changes his field of research, subjects himself to the mental discipline of teaching a course on his new interest. He also spent two years in Germany trying to alter the hierarchical structure of the German university. Luria, now at MIT, finds time not only to teach large undergraduate classes but also to sculpt, collect art and play a leading part in the anti-Vietnam War movement, which has not won him friends in Washington.

All three men, however different in character, have repeatedly put modern biology on the right tracks in the past thirty years, and the Nobel Prize committee deserves credit for recognizing that.

SOCIETIES

Another Anniversary

On November 2, 1819, a Philosophical Society was founded in Cambridge "for the purpose of promoting scientific enquiries and of facilitating the communication of facts connected with the advancement of Philosophy and Natural History". This was the third attempt at organizing a scientific group among the members of the university at a time when it was far from being a centre of British intellectual progress. It was also a successful attempt, largely because enough people were convinced that something had to be done at last: it united and revived the efforts of the individual scientists, published their work and transformed the attitude of the university to advances in what was then known as the Natural Philosophy. And it is still flourishing.

From the start the Cambridge Philosophical Society concerned itself with all aspects of science—its creators were Adam Sedgwick, the geologist, and John Henslow, who became well known for his influence on Darwin. Perhaps it won greater renown on the physical side during the nineteenth century, with the mathematician Charles Babbage and the astronomer George Airy making important contributions to meetings, but it was certainly well involved with the rantings that followed the publication of Darwin's theory of evolution in 1859. Sedgwick, who was president in 1860, launched an attack on this theory which prompted the author to label him as one of "the old fogies at Cambridge".

This was fortunately not a symptom of the society's general outlook. After the establishment of the Cavendish Laboratory, it published much of the new physics that was being developed there, and this close association continued into the era of the quantum; a crucial paper by Dirac on "The Quantum Theory of