would produce tumour-like growth after heterotransplantation into experimental animals.

The usefulness of organ culture was further illustrated by Dr. Lasnitski's research on another form of cancer. Malignancy of the prostate gland in men is one of the hazards of old age and it is of particular interest to the investigator that this type of cancer can temporarily be controlled by treatment with female sex hormones. Cultures of mouse prostate gland were exposed to a chemical carcinogen, this time 20-methylcholanthrene, and again the epithelium of the alveoli became hyperplastic and produced a histology similar to that of skin. Dividing cells with polyploid chromosomes were frequently seen in the cultures. As in cases of human tumours, the cell proliferation was dependent upon the hormone, since the hyperplastic action of the carcinogen was abolished by the presence of œstrone in the medium and preserved by the male hormone, testosterone. Dr. Lasnitski concluded by describing briefly investigations on the metabolism of these cultures. Autoradiographic studies, undertaken with Dr. S. R. Pelc, showed that the carcinogen stimulated deoxyribonucleic acid synthesis in the epithelial cells, but inhibited deoxyribonucleic acid synthesis by fibroblasts after 2–8 days treatment. Amino-acid uptake from the medium was investigated in collaboration with Dr. J. A. Lucy and it was found that leucine and *iso*-leucine were well utilized by normal and treated cultures. However, the uptake of arginine associated with normal cultures was decreased after a period of exposure to methylcholanthrene.

In the fourth paper, Dr. I. Leslie (Department of Biochemistry, Queen's University, Belfast) described the search for metabolic features which distinguish normal and cancer cells, and the opportunities provided by cell culture for tackling this problem. Three cell types are being studied in Belfast. Normal cells are represented by short-term cultures of human fœtal tissues, and malignant cells by the *HEP* 1 strain, derived from a human carcinoma at the Sloan-Kettering Institute for Cancer Research, New York. The *HLM* strain came from liver cell cultures prepared from a human fœtus in 1956. Unlike the other cells grown from this fœtus, the *HLM* cells grow indefinitely in culture and, in this respect, they resemble the *HEP* 1 carcinoma cells. This 'transformation' of normal cells to an apparently 'immortal' form is not uncommon in cell culture and the process is open to investigation. It is important to find how far transformed cells resemble cancer cells and how far they retain the properties of the parent cells. The way in which these cells derive their energy from glucose was investigated in 1956 in collaboration with Drs. W. C. Fulton and R. Sinclair. According to Warburg's original concept, the unique property of malignant cells is their ability to grow by means of the energy of fermentation, that is to say, the enzymic conversion of glucose to lactic acid. During proliferation in cell cultures, however, the normal (fœtal) cells showed more intensive fermentation than the carcinoma or the transformed *HLM* cells. Other investigators have reported similar results, and Warburg's recent studies on monolayer cultures of monkey kidney cells have caused him to change fundamentally his emphasis on fermentation as the essential feature of malignancy.

The explanation of cancer has, therefore, to be sought elsewhere in the metabolism of the cell. Since 1953, when Watson and Crick first described the deoxyribonucleic acid molecule and its process of replication, knowledge of cellular physiology has been progressing rapidly. As a working basis, Dr. Leslie suggested that cancer metabolism can be defined in terms of the biochemical events which lead to the continued replication of deoxyribonucleic acid and which are out of control of the normal restraints imposed by the adult organism. It is necessary to study the metabolic events leading to deoxyribonucleic acid synthesis, and to find which are essentially different in normal and cancer cells.

Four possible defects in cancer cells were discussed and illustrated by observations on cell cultures. The defects were: abnormal chromosomes producing modified cell proteins; the channelling of compounds into the synthesis of nucleic acids; the deletion of enzymes controlling the degradation of nucleic acids and proteins; and the loss of control over growth because of the altered response of cancer cells to hormones. Evidence for enzyme deletion as a vital defect has come principally from biochemical investigations on liver tumours at the McArdle Memorial Laboratory, Madison, and the Montreal Cancer Institute. Now, the absence of xanthine oxidase and arginase in both transformed and carcinoma cells is an example of this type of defect in permanent cell strains. The failure of the *HEP* 1 cells of cervical origin to respond to œstradiol (although they respond to insulin) is possibly linked to the recent discoveries by American groups that œstradiol is the co-factor for a transhydrogenase system, and that this enzyme is much reduced in certain tumours. It would, however, be wrong to suppose that there is one vital defect common to all tumours. The encouraging features of current research are that the key problems in tumour metabolism can be clearly specified and that the techniques for solving them are available.

I. LESLIE

OBITUARY

Prof. F. S. Bodenheimer

FREDERICK SIMON BODENHEIMER, who died in a London hospital on October 4 from internal complications after a successful eye operation, was born in Cologne on June 6, 1897, son of Max Bodenheimer, one of the founders of the Zionist movement. As a schoolboy, he was attracted to biology, but was persuaded to study medicine, which offered a more certain future, at Frankfurt and Bonn. His main interest was, however, still in zoology, and he obtained his Ph.D. at Bonn in 1921 with the intention of specializing in entomology and going to Palestine to work there. He studied at the School of Agriculture in Geisenheim, and after spending half a year at Portici with Silvestri and Grandi, accepted an appointment as entomologist in the new agricultural research station of the Jewish Agency at Tel Aviv, where he worked during 1922–28.

His studies during that period were concentrated on economic entomology, culminating in a book, "Die Schädlingsfauna Palästinas" (1930), but his interests were wider and his energy so inexhaustible

that he succeeded, at the same time, in producing two volumes of the "Materialien zur Geschichte der Entomologie" (1928–29) and in carrying out an expedition to the Sinai with Dr. O. Theodor to settle the problem of the origin of manna, which proved to be the excretion of a coccid (*Najacoccus serpentinus*) on tamarisk. In 1928, he was appointed a Research Fellow, and in 1931 professor of zoology at the newly founded Hebrew University at Jerusalem. This opened a period of most fruitful research on a variety of biological problems, resulting in a long series of publications, the total of which during his life exceeded four hundred, including a number of books; apart from those already mentioned, he published "Animal Life in Palestine" (1935), "Prodromus Faunae Palaestinae" (1937), "Problems of Animal Ecology" (1938), "Animals in the Bible Lands" (1949, 1956), "Citrus Entomology in the Middle East" (1951), "Insects as Human Food" (1951), "The History of Biology" (1958), and "Animal Ecology To-day" (1958). His last book, just published, "A Biologist in Israel", is an extensive autobiography, and, at the same time, as he described it to me, "a history of a generation of ecologists".

Bodenheimer travelled extensively; in 1931, after a term as a visiting professor at Minneapolis, he went around the world, stopping where he would; during 1938–41 he was a visiting professor at Ankara and played a prominent part in developing entomological work in Turkey; in 1943 he was invited to Iraq to study the locust problem there; in 1955 he lectured in the University of Durham on Canon H. B. Tristram and visited Finland; in 1956 he went to Australia for a Unesco meeting on the Climatology of Arid Zones and took in South Africa *en route*. Wherever he went, he lost no opportunities of learning at first hand all that could be learned of local biological problems and institutions and workers.

His main life-interest was animal ecology in the broadest sense. His earlier published books on the subject did not receive sufficient recognition, since he had to write in English, which was not his own language, and many of his original ideas have been offered in a not easily digestible form. Moreover, he was never easily satisfied with formal definitions of concepts and always searched for other than the accepted solutions of such basic problems as the equilibrium in animal populations, animal communities, the interaction of environment and heredity, etc. On many of these points he was outspokenly critical of views of others, but his criticisms were always such as not to annoy, but to stimulate.

As an entomologist, Bodenheimer left a great heritage, but he was also well known to mammalogists for his studies on the vole (*Microtus*) populations in Palestine, and before his death he prepared a revision of Canon Tristram's work on the mammals of Palestine.

His many travels and his deep interest in the work of others have made Bodenheimer well known to a large number of biologists all over the world and his early death will be deeply regretted by many. His wife, Mrs. Rachel Bodenheimer, who accompanied him on many of his travels, made friends wherever she went. Their many friends will share her feeling of loss.

B. P. UVAROV

NEWS and VIEWS

Chief Scientist of the Ministry of Supply: Dr. R. Cockburn, C.B., O.B.E.

ON October 1, Dr. Robert Cockburn took up the post of chief scientist of the Ministry of Supply. Cockburn gained his first degree at the University of London when he was only nineteen, adding to it later both the M.Sc. and the Ph.D. From 1930 he taught science at the West Ham Municipal College, and at the same time conducted research on the effects of electron transit time in very high-frequency oscillators, until, in 1937, he joined the Radio Department of the Royal Aircraft Establishment, Farnborough, where he was engaged in the development of a new very high-frequency communication system for the Royal Air Force. From 1939 until 1945 Cockburn was at the Telecommunications Research Establishment, Malvern, where he and his team developed and used radio counter-measures of all kinds in the protection both of targets in Britain and British bombers operating over enemy territory. For his outstanding work he was appointed O.B.E. in 1946. He spent a short period at Chalk River and at Harwell, until in 1948 he became scientific adviser to the Air Ministry. He stayed there for five years, joining the Ministry of Supply in 1953, where he has been successively responsible for research and forward thinking in all applications of electronics, for the organization of all the research and development programmes in this field, and since 1956, as controller of guided weapons and electronics, for the whole field of research, development and production of these equipments.

Cockburn brings to his new post exceptional practical knowledge of the operational use and technical requirements of systems that he gained in the Second World War, the intimate knowledge of the Services that he acquired when at the Air Ministry, and the inside knowledge of the Ministry of Supply gathered in the three senior appointments that he has already held there. He adds these to his wide basic scientific knowledge and his international standing and prestige as a scientist who has concentrated on the special problems of defence. His appointment is warmly welcomed by his professional colleagues, Service and scientific, throughout the many circles in which he is well known.

Engineering at Leicester: Prof. E. W. Parkes

DR. E. W. PARKES has been appointed to the new chair of engineering in the University of Leicester. Dr. Parkes was born at Sutton Coldfield in 1926, and was educated at King Edward's School and St. John's College, Cambridge, where he gained first-class honours in the mechanical sciences tripos in 1945. After leaving Cambridge, he worked for a year at the Royal Aircraft Establishment and for two years with the Hawker Siddeley group on the design and testing of aircraft structures. He returned to