rather more at the present day. Similar increments in the acreage yield have been obtained both in wheat and other crops in Britain, the Continent, and the great grain-producing countries of America and Australasia.

It cannot, of course, be claimed that all this increase has been due to the effect of the use of chemical manures only. Science has performed other functions in breeding new and more productive varieties, and has made great advances in the control of plant pests and diseases, all of which have helped the farmers of the world to produce more and more adequate supplies of food for society, though the whole world is not yet free from hunger. Some of the credit for this great advance, too, must be given to the engineers who have provided the modern power units and the machinery used with them as well as means of moisture conservation and disposal. So many factors are involved that it is difficult to make a real assessment of the effect of each; but the chemical fertilizers the use of which was directed by science, which is also guiding their production, certainly played a major part in the early days of the nineteenth century, and have continued to be most important, indeed increasingly important, to the present day.

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¹⁹ Marshall, John, *J. Roy. Agric. Soc. Eng.*, 164 (1842).

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OBITUARY

Dr. H. Hamshaw Thomas, M.B.E., F.R.S.

HUGH HAMSHAW THOMAS, who died on June 30 at the age of seventy-seven, was the senior British palaeobotanist. He spent his whole working life in Cambridge apart from the two World Wars. In the First he served with the Royal Air Force in the Near East, and in the Second was in charge of a team of Air Force Intelligence men near Henley-on-Thames.

His first important palaeobotanical papers published in 1909 and 1911 were careful studies of petrified Calamite leaves and in the well-established tradition of Scott, and gave no sign of what was to come. However, Seward suggested that he should re-investigate the British Jurassic plants—and it must then have seemed a simple and short task. At that time an ordinary fossil plant, 'impression with carbon', as it was called, was just a black mark on a rock and observation with a hand lens was the limit. However, Nathorst in Stockholm was developing the intelligent study of fossil cuticles, and Thomas went there to fit himself for advanced work. He came away with a robust view at the opposite extreme: such a fossil was no more black mark but a whole organ, albeit compressed, and failure to see every cell of its structure is failure of technique or observation.

Thomas was also inspired by Robert Kidston with whom he collected in the Scottish coalfields. From him he learnt that the tradition that the proper subject for a palaeobotanist's studies is the specimens provided by a geologist or by an early amateur collector is no good. He must collect for himself, study his material and then go back and get more;

he ought not to publish until he has a great collection confirming every point repeatedly.

These perfectionist ideas dominated Thomas's work; but they had their perils, for like Kidston, Thomas only described a fraction of the good things he discovered. However, they combined happily in his famous paper published in 1925 on the Caytoniales, those tantalizingly Angiosperm-like plants. This family is Thomas's creation, for although small pieces were known as isolated and uncommon fossils they were hopelessly misunderstood. Thomas gathered together hundreds of specimens over the years and patiently attempted to section them. His success was only moderate, for he could see the more robust cells in about a tenth of the specimens he treated; but it was much the best work of its kind that had been done. A good many shook their heads over Thomas's synthesis of *Caytonia* but later work has confirmed it.

The first important fruit of his work with Nathorst was a paper (in 1913 with Dr. N. Baneroff) on the cuticles of "Fossil Cycad" leaves, that welter of confused genera and species. They showed that the cuticles divided them sharply into two groups, the Bennettitales and the Nilssoniales or true cycads. Others working over the same material have merely sharpened the distinction which remains the beginning of orderly treatment.

Thomas's last major paper in palaeobotany was on the Crystospermaceae (1933), another entirely new family of Mesozoic Gymnosperms, this time from South Africa, where he spent a good deal of time with his wife. Those are perhaps more important than the Caytoniales, for they are by no means

rare, but apparently dominant over the southern hemisphere throughout the earlier Mesozoic. His election to the Royal Society happened in the next year. Apart from these contributions, which opened entirely new fields, he wrote a good many other papers which made valuable contributions to knowledge. In his later years, indeed since *Caytonia*, he became increasingly pre-occupied with general prob-

lems, the origin of the Angiosperms, the nature of morphology, and indeed the philosophy of natural science, for his outlook was anything but restricted.

Although an obituary in *Nature* of a distinguished scientist should deal mainly with scientific work we must also recall his deep appreciation of beauty, his gentle manner and his kind thoughtfulness.

TOM M. HARRIS

NEWS and VIEWS

The Russian Satellites Vostoks 3 and 4

THE third Russian manned Earth satellite, *Vostok 3*, carrying Major Andrian Nikolayev, was launched at 08.30 h U.T. on August 11. The satellite, designated 1962 α u.1, entered an orbit inclined at $64^{\circ} 59'$ to the equator: at 16.00 h U.T. on August 11 its orbital period was 88.32 min, the perigee and apogee heights being 180 and 234 km respectively. At 08.02 h U.T. on August 12, *Vostok 4* (1962 α v.1), carrying Lieut.-Colonel Pavel Popovich, was launched into an almost identical orbit. Initially, the two satellites were very close together, and Major Nikolayev saw *Vostok 4* through his porthole; but since the orbital period of *Vostok 3* was slightly lower, it slowly drew ahead of *Vostok 4*, at a rate of about 2 min a day. At 18.00 h U.T. on August 12 the periods of *Vostoks 3* and *4* were 88.2 and 88.3 min respectively, their perigee heights 177 and 178 km, their apogee heights 228 and 235 km, and their orbital inclinations $64^{\circ} 59'$ and $64^{\circ} 57'$. On August 15 the two astronauts successfully returned to Earth, close to the intended point, south of Karaganda in Kazakhstan, within a few minutes of each other, at 06.55 and 07.01 h U.T. respectively.

The flights of *Vostoks 3* and *4* mark several impressive new achievements in the development of space exploration. Both Major Nikolayev and Lieut.-Colonel Popovich lived, slept and worked in conditions of weightlessness, apparently with efficiency and without ill-effect, for 4 and 3 days respectively, much longer than the 25 h of their predecessor Major Titov. For the first time live television pictures of a man in orbit were publicly shown on Earth, and there was the first radio communication between men in space, as well as the first double descent from orbit. The placing of *Vostok 4* into such close proximity with *Vostok 3* shows that a satellite can be launched into a specified orbit at a specified time, and the experiment goes a long way towards demonstrating the feasibility of a rendezvous between two spacecraft.

Eightieth Birthday of Prof. James Franck

PROF. JAMES FRANCK, who celebrates his eightieth birthday on August 26, had his first great achievement fifty years ago, when he showed (with G. Hertz, with whom he shared the Nobel Prize in 1926) that the energy loss of electrons in mercury vapour changed sharply at particular electron energies. Here was direct evidence for the existence of quantum states in atoms, preceding Bohr's model of the hydrogen atom. Atomic and molecular energy-levels remained Franck's field of study for another twenty

fruitful years at the University of Göttingen, where he was professor and head of a flourishing school; many of his students from abroad became distinguished physicists (such as Blackett, Condon, Oppenheimer, to mention a few). After 1933, though being a Jew, he could have stayed on because he had done distinguished service as an officer during the First World War. But Franck preferred exile, first for a short time in Copenhagen, then in the United States. There he devoted much of his effort—and still does—to the study of what is perhaps the most complicated and most important molecular process: the photosynthesis of living material in plants. For this work he was quite recently awarded a prize from the Academy of Göttingen.

What distinguishes his work is his amazing physical intuition—rivalled only by people like Faraday and Rutherford—which has repeatedly enabled him to achieve penetrating insights with scarcely any use of mathematics or complex theories. The 'Franck-Condon' principle, which explained many fine details in molecular spectra and which appeals directly to the imagination of the physicist, is a good example. During the Second World War, Franck helped with the development of the atom bomb. But when it was achieved he did his best—as chairman of a committee of scientists brought together for that purpose—to prevent its use and to forestall the arms race which he could foresee. This is but one example of the deep humanity and unfailing kindness that have made him loved by everybody who knows him.

Aviation at the Imperial College of Science and Technology : Prof. P. R. Owen

PROF. P. R. OWEN, who has recently been appointed to the Zaharoff chair of aviation in the Department of Aeronautics of the Imperial College of Science and Technology, is an eminent successor to the previous holders of this chair: L. Bairstow, A. A. Hall and H. B. Squire (see *Nature* obituary, 193, 421; 1962), who graced this important appointment. Prof. Owen graduated with an honours B.Sc. degree in aeronautics at the Queen Mary College in 1940 and worked afterwards in industry and the Royal Aircraft Establishment for a number of years. While in the Royal Aircraft Establishment he became, in 1948, a principal scientific officer and head of the Fluid Motion Section, at which position he remained until 1953. After this period he joined the University of Manchester as a reader and director of the Fluid Motion Laboratory and was ultimately appointed professor of mechanics of fluid motion. Prof. Owen