intercrystalline free space in a complex way. Much stimulating discussion was held about the physical chemistry of the reaction zone in detonations. The importance of the intercrystalline free space is further emphasized by a contribution which described the behaviour of single crystals studied individually. High initial pressures are found to have only a slight effect on the 'runaway temperature' in the self-heating of single crystals of explosives.

Experiments on the homogeneous detonation of acetylene should in principle be simpler to interpret than the behaviour of heterogeneous systems. However, the formation of solid products of detonation leads to complications when attempting theoretical interpretations. It is not clear at what stage the 'carbon' ultimately obtained from the detonation of acetylene is actually formed; it seems unlikely, furthermore, that the crystal structure and heat content of such 'carbon' can be taken as the same as in ideal graphite. The kinetics of pyrolysis of acetylene in shock waves to give carbon offers further information about reactions at transient high pressures, which present complications due to the formation of solid products of variable physical structure and chemical composition. Extensions of such kinetic studies promise to cover ranges of high

pressure and high temperature not conveniently obtainable in other ways. The possibility of obtaining conveniently kinetic results at several hundred thousand atmospheres obviously attracts a number of research groups. However, as in other studies of transient phenomena, relaxation effects may complicate any interpretation of the results on the basis of the thermodynamics of high pressures. Detonation and shock velocities can now be measured with very considerable precision. The measurement of detonation and shock pressures still present technical difficulties, though they may become accessible from techniques such as X-ray shadowgraphy and measurements of mass flow. But in the case of detonations and shock waves there are very serious doubts about the applicability of 'temperature' at all as a significant modulus in describing the statistical distribution of various kinds of internal energy among the molecular and atomic species present. Active research in the physical chemistry of matter at high pressures receives still further stimulus from the possibility of observing transitions from insulator to conductor behaviour of various crystals when sufficiently compressed. Preliminary studies of this kind were described at the meeting and added further zest to a very lively two-day discussion.

A. R. UBELLOHDE

OBITUARIES

Prof. J. C. Cruickshank

JOHN CECIL CRUICKSHANK, professor of bacteriology as applied to hygiene in the University of London at the London School of Hygiene and Tropical Medicine, died on October 30 at the age of fifty-seven. Educated at George Watson's College in Edinburgh, he served in the Gordon Highlanders at the end of the First World War, and then proceeded to the University of Edinburgh, whence he graduated M.B., Ch.B. in 1921. He took the D.T.M. at Liverpool in 1923, winning the Alan H. Milne Memorial Medal, and then served in the West African Medical Service in the Gambia for seven years, gaining tropical experience which was of great value to him and to his students later in London.

Cruickshank came to the London School of Hygiene and Tropical Medicine to take the diploma in bacteriology in 1933, and remained there first as demonstrator, then as lecturer in bacteriology. During the Second World War he directed Emergency Public Health Laboratory Services laboratories, first at Horsham, later at Exeter, returning to the School in 1945 as reader in bacteriology as applied to hygiene, to re-open the Department under the part-time direction of Prof. G. S. Wilson, and to start teaching courses again. Cruickshank was a great teacher, whose wide experience of tropical and public health bacteriology fitted him uniquely well to teach in courses for the diploma in bacteriology, the diploma in public health and the diploma in tropical medicine and hygiene. Many hundreds of students will remember his excellent teaching with gratitude. In 1947 he became professor in bacteriology as applied to hygiene.

Throughout the past twenty-five years, Cruickshank had maintained a steady output of research on bacteriological topics, chiefly on brucella infections and on immunity. He acted for some years as expert

adviser to the Public Health Laboratory Service on clostridia and on brucella. He served on the Water Pollution Research Board of the Department of Scientific and Industrial Research and its Detergents Committee, and on various other public committees and bodies. He was a member of the Pathological Society, the Society of General Microbiology, and the Medical Research Club. In 1952 he gained his M.D. (Edinburgh) with a gold medal. He was loved and respected by all his colleagues and students and all others who knew him; his early death is a great blow to the School. He leaves a widow, two sons and a daughter.

E. T. C. SPOONER

Dr. John McLuckie

DR. JOHN MCLUCKIE, until recently reader in botany in the University of Sydney, died on September 27 at the age of sixty-six. He was still in harness, for he was asked to come back after his official retirement to take the advanced mycology course. He had given a lecture and a practical class on the day of his death.

McLuckie was born in Killermont, in Dunbartonshire, on August 12, 1890. He was the eldest of a family of seven. His father was a gamekeeper, and as a boy John McLuckie learnt to handle a fishing rod and a gun—skills which he practised with great distinction during his forty years in Australia. From these early days he acquired, too, an intimate knowledge of natural history and a love for the countryside.

He won a bursary to the school which is now Bearsden Academy and proceeded in 1909 to the University of Glasgow, where he was a pupil of F. O. Bower. After graduation in 1914, McLuckie sailed for Australia to serve under Prof. A. A. Lawson (also one of Bower's pupils) in the newly established Botany Department in the University of Sydney.

He devoted his whole career to this Department. His early work was a series of studies in mycorrhiza and parasitism, published in the *Proceedings of the Linnean Society of New South Wales*. Then he turned to ecology; his primary surveys of the Kosciusko and Mount Wilson districts are still standard works, and show how well McLuckie had mastered (with the aid only of an out-of-date handbook of the flora) the perplexities of Australian vegetation. But it is as a teacher that he will be remembered. For forty years medical students, pharmacists, scientists and agriculturists passed through his classes. Some of them arrived under the impression that botany was a 'soft option', but none who survived McLuckie's practical classes preserved that illusion. He took immense pains to ensure that students were given good plant material for their practical work (it was not unusual for first-year students to see fertilization in living *Hormosira*); and having provided good material, he took immense pains to ensure that students observed thoroughly and drew accurately.

He was exacting in his demands and he had no patience with a student who did not take botany seriously; but the student who did take botany seriously found in McLuckie an enthusiast who delighted in plants and for whom no trouble was too much. He conveyed to his colleagues an impression of deep loyalty to his subject. On field trips he was at his best, and his students will long remember him striding ahead, under the scorching Australian sun, to show them some rare plant or some characteristic patch of vegetation; and then standing by, lighting his pipe and smilingly awaiting their comment.

Through many changes of staff, and during dislocations caused by the War, the Botany Department depended for its stability and cohesion on McLuckie. On at least five occasions he modestly undertook the duties of acting professor. He was a dedicated teacher, and his massive "Australian and New Zealand Botany", published jointly with H. S. McKee in 1954, is a fitting memorial to his career.

ERIC ASHBY

NEWS and VIEWS

Nobel Prize in Physics for 1956: Dr. W. Shockley, Prof. J. Bardeen and Dr. W. H. Brattain

THE Nobel Prize in Physics for 1956 has been awarded, jointly, to Dr. W. Shockley, Prof. J. Bardeen and Dr. W. H. Brattain for their work on semiconductors. During the years they worked together at the Bell Telephone Laboratories they removed many of the obscurities and much of the empiricism from semiconductors and founded the subject of transistors.

Bardeen and Brattain discovered transistor action when they placed two metallic whisker tips on the surface of one small piece of germanium and found that the current passed by one metal-semiconductor contact greatly influenced the properties of the other, if the separation was less than about 0.02 cm. Both current and power gains were demonstrated in this, the first solid-state amplifier (now called a point-contact transistor). The existing, one-carrier, theories of conduction postulated that the majority of mobile charge-carriers in extrinsic semiconductors were either negative electrons in the conduction band (*n*-type conductivity) or vacancies (holes) in the valence band behaving as positive charges (*p*-type conductivity). Because transistor action could not be explained in terms of majority carriers only, Bardeen and Brattain proposed that minority carriers—injected at the first contact, transmitted through the semiconductor in the presence of the majority carriers without much probability of mutual (hole-electron) annihilation and collected at the second contact—were responsible.

Shockley saw that metal contacts were not essential to the action, and in 1949 he analysed the properties of *p-n* junctions within one piece of a semiconductor and predicted the behaviour of transistors having *n-p-n* and *p-n-p* structures. He very quickly obtained full experimental confirmation. A theory of the recombination of electrons and holes was proposed and direct measurements made of many properties of minority carriers. Later he proposed and analysed another structure—the unipolar transistor—which, though using *p-n* junctions, is dependent for power gain on majority carriers only;

again, experiments quantitatively confirmed his predictions. Bardeen and Brattain had meanwhile returned to studies of surfaces of semiconductors; by careful measurements they added to the understanding of the properties of very thin adsorbed layers in the presence of electric fields. Dr. Shockley is now with Beckman Instruments and Prof. Bardeen is at the University of Illinois.

Control Mechanisms and Electronics at the National Physical Laboratory: Dr. A. M. Uttley

THE appointment is announced of Dr. A. M. Uttley as superintendent of the Control Mechanisms and Electronics Division of the National Physical Laboratory, Teddington, in succession to Mr. R. H. Tizard, who has taken up a post at the London School of Economics. The Control Mechanisms and Electronics Division was formed in 1954 to study the automatic control of experimental, industrial and administrative operations and the development of techniques and equipment for data processing and computation. Dr. Uttley graduated at King's College, London, in mathematics and psychology. After some teaching experience he joined, in 1940, the Telecommunications Research Establishment (now known as the Radar Research Establishment), Malvern, Ministry of Supply, where he remained until his present appointment. During the War he was responsible for the design of many of the synthetic trainers used to great effect in the training of operational crews. While thus engaged, Dr. Uttley developed a keen interest in electronic and in electro-mechanical control systems, developing the split-field type of motor for use in such applications. One of the developments was the now well-known servo-motor known as the 'Velodyne'. Dr. Uttley's immediate interest after the War was in the automatic guiding of astronomical telescopes, and he acted as adviser on electronics for the Sir Isaac Newton telescope. Later, he turned his attention to problems of digital computation and was largely responsible for the functional design of TREAC, an electronic digital computer in use in the Physics Department at the Radar Research