common purines and pyrimidines have any real biological significance.

The second paper of the morning session was given by Dr. M. H. F. Wilkins (Medical Research Council Biophysics Unit, King's College, London), who described some of the elegant X-ray crystallographic work which has come from King's College, London, and which has been responsible for our present conception of deoxyribonucleic acids as double helices. He pointed out that the X-ray data indicate that the molecule has two grooves of unequal depths, and that in the nucleoprotamines the polypeptide chains lie inside these grooves, the non-basic amino-acid residues occurring in pairs so as to be able to loop away from the main helix. The data obtained with nucleohistones are not so easily interpreted, but they suggest a substantial amount of orientation of the protein on the nucleic acid molecules.

Dr. Wilkins deplored the current tendency of physicists to explain the relationship between nucleic acids and protein synthesis by numerological arguments, and suggested that, among other things, certain of their premises are faulty. This evoked a reply by Dr. Crick, who pointed out that the number of amino-acids in each protein has been found to be essentially the same, namely twenty, if a few minor suppositions are made.

The afternoon session, with Prof. J. N. Davidson (Biochemistry Department, University of Glasgow) in the chair, was concerned with the relationship of the nucleic acids with protein synthesis; he introduced the session with a general survey of the present knowledge of the various sub-cellular elements and the problem of their isolation.

The study of protein synthesis in higher organisms was discussed by Dr. B. A. Askonas (National Institute for Medical Research, London), who described the use of radioactive tracers to follow amino-acid incorporation into proteins in various cell fractions. A particularly suitable system for this kind of experiment is to be found in cells synthesizing protein in response to a specific stimulus such as occurs in immunological reactions. It is, however, difficult to obtain results of this type with sub-cellular preparations, and it is necessary in such cases to follow the labelling of various fractions isolated by physical methods. Fractions rich in nucleic acid are found to have most activity.

Dr. E. F. Gale (Medical Research Council Unit for Chemical Microbiology, Cambridge) described some of the recent work which he has carried out on disrupted *Staphylococcus aureus* suspensions, following the incorporation of labelled amino-acids. Deoxyribonucleic acid is a powerful stimulatory substance and loses its activity on hydrolysis. Ribonucleic acid is not so active, but on enzymic degradation becomes very active indeed. The identification of the various factors influencing the incorporation of specific amino-acids with specific polynucleotides has, however, been found to be incorrect, and it appears that specific substances of unknown nature are liberated when the nucleic acid is broken down.

In comment, Dr. W. E. Cohn remarked that nucleic acid preparations may yet prove to contain substances of which we have no knowledge at present.

The bacteriophage–bacterium system was the subject of the last paper in the session, which was given by Dr. K. Burton (Medical Research Council Cell Metabolism Research Unit, Oxford). This system is of particular interest in view of the injection of virus nucleic acid which is known to take place on infection; but it was pointed out that a not inconsiderable amount of protein is also introduced at the same time into the bacterium. In the case of the *T* even bacteriophages which parasitize *Escherichia coli*, it is actually possible to follow the synthesis of bacteriophage nucleic acid because of the presence of a specific pyrimidine, 5-hydroxymethyl cytosine, in the latter, and it is certain that study of this system will be of great importance in the future. Results obtained so far, however, do not seem to fit with any simple replication mechanism of the types which have been proposed.

The meeting ended with a general impromptu discussion of template mechanisms involving nucleic acids. Although the general tenor of the symposium was somewhat speculative, the interest of the audience and the many questions raised in discussion showed that the choice of subject was a good one, and the Biochemical Society and its symposium organizer, Dr. E. M. Crook, are to be congratulated on the success of the meeting.

OBITUARIES

Prof. W. C. McC. Lewis, F.R.S.

WITH the death of William Cudmore McCullagh Lewis on February 11, Britain lost one of its finest physical chemists. After graduating with distinction at the Royal University of Ireland in 1905, he carried out research work at the Universities of Liverpool, Heidelberg and London and was appointed lecturer of University College, London, in 1910. The best-known of his many early researches were his experimental verification, with F. G. Donnan, of the Gibbs adsorption isotherm and his theoretical treatment of the Joule–Kelvin effect. These two substantial advances have long since found their way into standard text-books. In 1913 Lewis was appointed to the Brunner professorship of physical chemistry at the University of Liverpool, a chair which he held until his retirement in 1947. He was elected a Fellow of the Royal Society in 1926.

During his first decade at Liverpool, Lewis led an active school in experimental studies of chemical kinetics. The most notable single publication in a long series of papers on catalysis is his "Calculation in Absolute Measure of Velocity Constants and Equilibrium Constants in Gaseous Systems" (1918). Not all the conclusions of this paper have proved to be correct. It is now known, for example, that diatomic molecules do not dissociate by a first-order mechanism, and that activation generally is not by direct interaction with the radiation field. These, however, are points of detail in comparison with his main conclusions, which are that velocity coefficients in gaseous systems can be treated by the methods of statistical mechanics and that in certain examples the rate of chemical change is simply the rate of molecular collisions multiplied by the fraction of the total number of molecules which have sufficient

energy. Trautz had independently come to the same conclusion in 1916 but, on account of the First World War, the *Zeitschrift für anorganische und allgemeine Chemie* was not available to Lewis, and both can claim equal credit for their outstanding contribution. The Trautz–Lewis collision theory gave a very considerable impetus to the study of chemical change.

In collaboration with Blair Bell, Lewis led, in the early 1920's, another active team of physical chemists in cancer research. This circumstance probably explains why, like Arrhenius before him, he later transferred his research interest to biochemical and physiological problems.

Lewis is most widely known as the author of "A System of Physical Chemistry", a graduate text-book in three volumes which went into four English editions in nine years. To the task of preparing it he brought the experience of a skilled experimentalist, the wide learning of one conversant with many foreign tongues and the sympathy of one accustomed to teach. His book reveals a breadth of outlook which is not entirely unexpected from one familiar with the methods of research of so many different universities; there is in it no vestige of the narrowness so often found in books written by those who teach only where (and often only what) they were taught. His book is by no means perfect. At the time of its appearance the character of physical chemistry was rapidly changing, and the author must have worked exceptionally hard to keep abreast with the many developments of that period. As things turned out, material which Lewis had to put in an appendix to his third volume appears in the introductory passages of modern text-books. Despite its shortcomings, however, his text-book exerted a wide influence and can truly be described as the first original treatise of advanced physical chemistry in the English language.

Nature had endowed W. C. McC. Lewis not only with a brilliant intellect but also with magnificent physique, so that the reflexion of most men on meeting him was that here was a grand type of man. The dignity of his appearance was heightened by his impeccably correct bearing and mellifluous voice. The frequent gleams of humour in his eye and flashes of Irish wit in his utterances saved him from being ponderous or pompous. He was an extremely retiring man and abhorred publicity. His attendance at public scientific gatherings averaged one in twenty years. He made lasting friends of those whom he taught, and proved himself to be throughout his career a great scientist and a kind man.

E. A. Moelwyn-Hughes

Dr. Harold King, C.B.E., F.R.S.

Dr. Harold King, a former member of the scientific staff of the Medical Research Council, died suddenly at his home in Dorset on February 20 at the age of sixty-eight.

The son of a schoolmaster, King studied chemistry at Bangor under K. J. P. Orton and in 1911 published, with Orton, his first group of papers, on the chlorination of aromatic compounds. From Bangor he moved for a few months to a company of tar distillers at Beckton, but, finding the atmosphere uncongenial, he accepted in 1912 an appointment with Burroughs Wellcome. Here he came into contact with F. L. Pyman, G. Barger and H. H. Dale, and acquired his abiding research interest in the chemistry of pharmacologically active compounds. In 1919, King was asked to join a small group of workers who were to establish the reputation of the new National Institute for Medical Research at Hampstead; here he remained for the rest of his working life.

A man of quiet and retiring disposition, King preferred his laboratory bench to all other attractions, and his gradual emergence as a scientific figure of international repute seemed almost to surprise him. Early contributions on hyoscine, muscarine and the cinchona alkaloids were followed, in 1924, by the first paper of a long series on trypanocidal arsenicals. While no outstanding new drug was synthesized during these investigations, there emerged a much fuller understanding of the relationship between constitution and trypanocidal action, and eventually, in collaboration with the late Warrington Yorke and E. M. Lourie, King developed an entirely new group of chemotherapeutic drugs, the diamidines.

Although probably the most active British chemist of his generation in chemotherapy, with many contributions on trypanocides, antimalarials, amœbicides and on the chemotherapy of virus infections, King's interests ranged over a much wider field, and his most outstanding contributions were in the field of the chemistry of natural products. In 1935, he published in *Nature* a brief note on curare, followed by a masterly series of papers extending over fourteen years in the *Journal of the Chemical Society*; in these he reported methods for the isolation of pure curare alkaloids; he also provided complete proof of the structure of *d*-tubocurarine and related alkaloids and clarified the botanical problem of the origin of the different curares. Moreover, he stimulated work at the National Institute on the polymethylene di-quaternary ammonium salts, simple analogues of tubocurarine, now in general therapeutic use as the well-known methonium compounds.

In 1932 also, King, together with the late Dr. O. Rosenheim, suggested a new structural formula for the steroids, which was quickly accepted as an outstanding clarification of the field, and made possible the rapid progress which followed in elucidation of the structural relationships of the sex hormones and the cardiac aglycones.

Although he did not welcome administrative responsibility, Dr. King was for many years an efficient secretary to the Chemotherapy Committee of the Medical Research Council, and during the War, secretary also to the Committee for Penicillin Synthesis. In 1933, he was elected to the Royal Society, and in 1941 was awarded the Hanbury Medal of the Pharmaceutical Society.

One additional publication deserves special attention, since it relates to King's activity outside the laboratory; in 1946 he read a paper to the South London Entomological and Natural History Society on the "Sex-attractant Principles of Moths". Few men can have derived such constant pleasure from their hobby as did King from his collection and study of British moths. No colleague could regard himself as a friend until he had been privileged to examine that collection, and no other subject could thaw King's natural reserve in the same way. Perhaps this collection showed his true character more clearly than any scientific paper; a lover of order, peace and beauty, King was a true naturalist. Those of us who passed through his laboratory as junior colleagues will always remember him with affection, not only because he was helpful, but also because of his