

RADIOISOTOPE CONFERENCE AT OXFORD

THE Second Radioisotope Conference organized by the Atomic Energy Research Establishment, Harwell, was held at Oxford during July 19-23, with the object of discussing the experimental uses of radioisotopes and new techniques in their various applications in medicine, biology, agriculture, chemistry, physics, engineering and industry. The organizers of the Conference took the bold step of accepting only seventy-one out of more than two hundred papers which were proffered; this removed the usual scourge of conferences—an overcrowded programme and multiple sessions in parallel. Another notable achievement was the issue of preprints of all the papers well in advance of the Conference, and the limitation of the time of reading each paper to ten minutes; this allowed a considerable amount of time for discussion, which was very lively and stimulating.

The Conference started off with several papers dealing with the therapeutic applications of radioactive isotopes. Some of these are used as external applicators much in the same way as radium, but utilizing the special advantages offered by the new radioactive substances. R. C. Tudway, H. F. Freundlich and T. S. M. Marshall (Bristol) used iridium-192 as a cervix applicator; the soft γ -rays from iridium make shielding of neighbouring organs much easier. Similarly, yttrium-90, which was used by F. Crainz (Catania), lends itself to intra-uterine application, as it is a pure β -ray emitter. F. Ellis and R. Oliver (Oxford) demonstrated the use of tantalum wire containing tantalum-182 as an applicator; the great flexibility of these wires makes them less likely to obstruct blood vessels than the rigid radium needles.

The internal use of radioisotopes in therapy depends on the ability to concentrate the radioactivity in the organ to be irradiated. One such method, which may be used for the treatment of cancer of the lung, was developed by E. E. Pochin, G. B. Cook, R. M. Cunningham, A. Hollman, F. Hudswell and B. R. Payne (University College Hospital, London, and A.E.R.E., Harwell). Colloidal gold, containing gold-198, is precipitated on sugar charcoal particles which are too large (30-43 μ in diameter) to pass through the lung capillaries. If injected intravenously they will therefore be concentrated in the lungs, with only a very small fraction reaching the liver. This preparation can also be localized in any specified area of the lung by means of cardiac catheterization. J. Van der Werff (Nijmegen) described a somewhat similar use of bismuth-206 for deposition in the reticulo-endothelial system.

In the field of diagnosis, radioiodine is still the chief isotope employed in a variety of new problems. Very interesting results were obtained by H. G. Thode, C. H. Jaimet and S. Kirkwood (Hamilton, Ontario) on the uptake of iodine-131 by the salivary glands. It appears that a simple procedure, the comparison of the activity in a sample of saliva with that in the blood, provides a very sensitive method of discriminating between various types of thyroid disorders; the mechanism of the uptake in the salivary glands is not quite clear. The possibility of

diagnosing carcinoma of the thyroid by means of a simple iodine-131 test was described by J. Rotblat and G. Owen (St. Bartholomew's Hospital, London), and the technique of outlining the thyroid and the location of tumours was improved by H. C. Allen, jun., J. R. Risser and J. A. Greene (Houston, Texas), who employed for this purpose a crystal spectrometer with a double discriminator coupled to a scanning and recording device. A comparison of the behaviour in the body of iodine-131 and its analogue astatine-211 has been carried out by J. G. Hamilton, P. Wallace-Durbin and M. W. Parrott (Berkeley, California); astatine, being an α -emitter, offers many advantages over the β -emitting iodine isotopes, but Dr. Hamilton emphasized the dangers involved in handling this element. Most of the experiments were carried out on rats; but the few studies on humans indicated some promising applications. The use of serum albumin labelled with iodine-131 for the determination of cardiac output was described by N. Veall, J. D. Pearson, T. Hanley and A. E. Lowe (Guy's Hospital and Hammersmith, London), who used a scintillation counter placed over the region of the heart and connected to a ratemeter and chart recorder; the method has still to prove its value, but the advantages it offers as compared with older methods of cardiac output measurements merits further study.

Iron-59 has been used in several investigations carried out in the Royal Cancer Hospital, London. E. M. Ledlie and C. Baxter described some clinical applications of this isotope in hæmatological investigations, particularly in the study of erythropoiesis bone marrow diseases. L. F. Lamerton, E. B. Harriss and E. H. Belcher carried out animal experiments on erythropoiesis and the effects of X-ray irradiation; they obtained very interesting results on protection achieved by shielding of the spleen. S. Rowlands, T. Freeman and P. C. Fleming (St. Mary's Hospital, London) developed a technique for making blood volume determinations in animals by the simultaneous use of two isotopes, phosphorus-32 and chromium-51. The latter isotope was also used by J. S. Robertson, R. Milne and S. H. Cohn (San Francisco) for observing the distribution of blood platelets in rats.

A somewhat unique use of radioisotopes was presented in a paper by F. P. Bowden, J. B. P. Williamson and P. Laing (Cambridge) on the metallic transfer in screwing and bolting which they studied by the autoradiograph technique using radiochromium. The connexion of this work with medicine arises from the fact that in operations on fractured bones a certain amount of metallic transfer may occur, sufficient to form an electrolytic couple which has a harmful effect on the healing of tissue.

J. ROTBLAT

St. Bartholomew's Hospital.

One session was devoted to methods of labelling compounds with carbon-14, tritium and iodine-131, three of the nuclides most used in medical and biochemical studies. In addition, the method of preparation of tritium used at the Atomic Energy Research Establishment was outlined by W. J. Arrol,

J. Chadwick, J. Eakins, C. Evans and E. J. Wilson. R. F. Glascock (National Institute for Research in Dairying) reported on the use of tritiated compounds for studying the metabolism of dietary stearic acid by the lactating goat. Acetic anhydride labelled with tritium and carbon-14 had been employed by P. Avivi, Sylvia A. Simpson, J. F. Tait and J. K. Whitehead (Middlesex Hospital) to elucidate the structure of electrocortin and to estimate it and hydrocortisone in human peripheral blood. A paper from the National Institute for Medical Research described how high specific activity rabbit fibrinogen, albumin, normal and antibody globulins had been formed by biosynthesis using whole dried algae, labelled with carbon-14. The preparation of the algae had already been reported to the conference by J. Catch (Radiochemical Centre, Amersham). G. Wolf, B. Connor Johnson and S. G. Kahn (University of Illinois), who have synthesized vitamin A-2-¹⁴C, gave preliminary experimental results on its metabolism after injection into rats. An invigorating discussion followed the note by E. Kallee (Tübingen) on the detection of as little as 0.001 µgm. of proteo-hormone insulin by paper electrophoresis after intravenous injection of rats with radioactive iodide, iodine-131 labelled serum and insulin. The use of cobalt-60 labelled vitamin B₁₂ (C. Rosenblum, U.S.A.), the biosynthesis of penicillin (H. R. V. Arnstein) and the use of carbon-14 labelled sugars in the study of carbohydrate metabolism of the leaf (Helen K. Porter and L. H. May) were among some of the other contributions of interest to biochemists.

Among the papers dealing with plant nutrition and allied subjects, L. Ehrenberg, I. Granhall, A. Gustafsson and N. Nybom (Sweden) gave an interesting description of their first season's work on the irradiation of growing plants (barley, fruit trees, etc.) with a cobalt-60 gamma-ray source. The fruit trees showed a series of morphological aberrations such as clustering of leaves and shoots, formation of bifurcated shoots and irregular leaves. The topical subject of foliar fertilization has been studied by K. Kaindl (Austria) with phosphorus-32 labelled phosphatic nutrient. In the discussion, R. Scott Russell (Oxford) pointed out the large amount of fundamental work still to be done before the practical usefulness of foliar nutrition could be assessed. Another approach to the problem of making phosphorus available to plants was that of O. Talibudeen (Rothamsted), who had carried out experiments using phosphorus-32 to determine the readily exchangeable phosphates in soils.

Papers of interest to chemists included a description of the meticulous work by C. J. Collins and W. A. Bonner (Oak Ridge, Tennessee) on the use of carbon-14 to investigate the Wagner-Meerwein rearrangement in the study of 1:2:2-triphenylethanol and its derivatives. Various aspects of the labelling of ring labelled compounds were dealt with by H. S. Turner (Chemical Research Laboratory, Teddington). The experiments of A. G. Maddock and H. Behrens (Cambridge) on the exchange reaction between iodine and methyl iodide provoked much useful discussion. The kinetics of the process were outlined, and it was shown that there was a chain reaction initiated by radiation which involved the production of free radicals. The branching of vinyl polymers (J. C. Bevington and H. W. Melville, Birmingham), the use of carbon-14 to study the role of oxygenated radicals in the Fischer-Tropsch reaction (E. J. Gibson and A. W. Fletcher, Fuel Research Station, Greenwich),

and the poisoning of solid catalysts used in the synthesis of ammonia (C. Bokhoven, Netherlands) illustrated further applications of the radioisotope technique.

A beautiful illustration of the usefulness of tracers combined with radioactivation analysis was given by P. Albert, F. Montariol, R. Reich and G. Chaudron (France) in their investigations of the purification of aluminium from zinc, copper, sodium and silicon by zone melting. Another interesting metallurgical paper was that by M. C. Inman, D. Johnson, W. L. Mercer and R. Shuttleworth (University of Leeds) describing their careful measurements on the self-diffusion coefficients of copper and zinc into alpha- and beta-brass.

In the first of two important practical applications of neutron sources, C. P. Haigh (Barrow Hospital, Bristol) described a measurement of the neutrons generated in the ²⁴Na(γ,n)²³H reaction as a method of assay for heavy hydrogen. In the discussion on the paper by A. H. Knight (Macaulay Institute for Soil Research, Aberdeen) on the measurement of soil moisture by neutron scattering, no satisfactory reason was found why organic matter in the soil did not have a greater practical effect on the measurements reported. Results obtained on archaeological specimens with the new carbon-14 dating method developed by A. R. Crathorn and W. R. Loosemore (Royal Institution and Atomic Energy Research Establishment) were presented. The method involves the conversion of the specimen into acetylene which is used as the filling gas in a proportional counter. The supplementary method of B. N. Audric and J. V. P. Long (Chemical Research Laboratory, Teddington), utilizing the acetylene dissolved in a liquid phosphor at -78°C., has not yet been used for dating specimens.

Of the two new thickness gauges of interest to industry, that developed by J. L. Putman, S. Jefferson and J. F. Cameron (Atomic Energy Research Establishment) was very ingenious. The method was developed for measuring from the outside of pipes the degree of corrosion on the inside of the pipe wall. The gamma-ray source is cobalt-60 and the scintillation counter detector has a gating circuit so that only radiation which has suffered a change of energy by scattering from the pipe wall is measured. One advantage of this system is that no heavy lead shielding is required. Other industrial applications included the use of phosphorus-32 labelled wool fibres to study the very difficult problem of drafting (D. S. Taylor, Leeds), a study of water flow and velocity measurements (A. Montens, Germany) and the wear of carbide-tipped cutting tools (L. G. Erwall, Sweden). Of the papers dealing with new nuclides for use in industrial gamma radiography, that utilizing thulium-170 (gamma energy 84 keV.) was of most immediate practical importance. In the final paper L. E. Brownell and J. V. Nehemias (University of Michigan) illustrated how a ten-thousand curie cobalt-60 gamma-ray source was used for sterilizing foodstuffs by irradiation, and mentioned briefly the very interesting possibilities of initiating chemical reactions by this means. A short closing address was given by Dr. Henry Seligman, head of the Isotope Division, Atomic Energy Research Establishment, who has been primarily responsible for initiating the two Radioisotope Conferences that have been held.

The papers presented at the Conference, together with the discussions, will be published in book form

in November 1954 by Butterworths. There will be two volumes: vol. 1 will cover medical and physiological applications, and vol. 2 physical sciences and industrial applications.

In addition to the formal papers, there were films illustrating radioisotope techniques used in hospitals and laboratories. By the courtesy of Lord

Cherwell, the Clarendon Laboratory was available for a well-laid-out exhibition covering instruments, laboratory techniques and a representative range of manufacturers' equipment (representing five different countries) of interest to radioisotope users. This was a centre of activity throughout the week.

J. E. JOHNSTON

CHEMISTRY IN RELATION TO THE DEVELOPMENT OF THE NERVOUS SYSTEM

THE Mental Health Research Fund organized the First International Neurochemical Symposium at Magdalen College, Oxford, during July 13-17. The Symposium was planned as part of a series, and the field selected for the first meeting was "Chemistry in Relation to the Development of the Nervous System". The organizing committee consisted of J. Elkes (Birmingham), L. Flexner (Philadelphia), J. Folch-Pi (Boston), G. W. Harris (London), S. S. Kety (Washington), D. Richter (Cardiff) and H. Waelsch (New York).

The Symposium was attended by approximately seventy scientific workers, forty being from abroad—from Belgium, Canada, Denmark, Germany, Italy, Norway, Sweden, the United States and U.S.S.R. It was arranged in morning and afternoon sessions, and on two days there was also an evening session. Each session started with one or two reviews, followed by communications on recent research; there was always a lively and full discussion, and this was recorded. The transcription of the Symposium will be published in the near future by the Academic Press, New York.

The first morning session, under the chairmanship of Sir Geoffrey Vickers, was characterized by two features: the regrettable absence of Dr. R. Lorente de N6 (New York), and the view expressed by the two anatomists in discussing some aspects of the early development of the nervous system (Prof. J. D. Boyd, of Cambridge) and of the vascular patterns of the nervous system (Dr. Horne Craigie, of Toronto) that chemical inductors are required for explaining the morphological development of the nervous system. Prof. Boyd emphasized the importance of the tissue and the spaces underlying the ectoderm in the development of the dorsal plate and the differentiation of the neural tissue, illustrating his points with a wealth of material from sheep embryos. Dr. Horne Craigie showed the wide range of vascular patterns presented in the development of a variety of species, and posed the question of the extent to which the pattern is determined by underlying changes.

The afternoon session, with Dr. R. W. Gerard (Chicago) in the chair, opened with a review of experimental neuroembryology in the chick by Dr. V. Hamburger (St. Louis), and an account of the functional development of the nervous system in the dogfish by Dr. H. P. Whiting (Bristol). Dr. Hamburger took up the theme of the morning session and reported on the dramatic changes in the growth of spinal and sympathetic ganglia produced by the influence of transplanted limb buds and tumour tissue. Dr. Whiting presented experimental evidence

for dividing the developmental steps into the classical divisions of myogenic, neurogenic and reflexogenic, and in general supported the Coghill thesis of segregation of reflexes. There followed a communication by Dr. J. L. Malcolm (London) on his investigations into the appearance of inhibition and facilitation in the developing spinal cord of kittens. He showed that, during the first two post-natal days, an impulse sent in through the dorsal lumbar roots leads only to a single spike in the corresponding ventral root, but that later, with the appearance of after-discharge in the ventral root, facilitation and inhibition can be demonstrated. The session ended with a communication from Dr. D. Hill (London), in which he emphasized the important practical aspects of cerebral maturation as marked by the milestones which can be demonstrated by the electroencephalogram rhythms.

The second day started, under the chairmanship of Dr. S. S. Kety, with a detailed review by Dr. Folch-Pi of the composition of the whole brain of mice during post-natal maturation, with particular reference to phospholipids, a review which was based to a great extent on the extensive work done in his own laboratory. This review was followed by Dr. H. Klüver's (Chicago) careful fluorospectrographic analysis of porphyrins in the central nervous system. They are not present in the central nervous system of reptiles, amphibians and fishes, and are found in warm-blooded animals only after birth—for example, in rats at the age of 20-25 days, a time which is associated with a number of functional advances. Porphyrins occur first in the ventral roots and last in the cerebrum; Dr. Klüver thinks their presence is related to the developing oligodendroglia. These photodynamic substances may be affected by the amount of light known to be transmitted through the skull in some species, and the interesting question arises as to the extent to which light may, by these means, affect nervous system activity and also, perhaps, the sexual cycle. Dr. P. Diezel (Heidelberg) presented histochemical evidence of the distribution of iron throughout the brain substance, and pointed out the considerable amounts which appear in the glial cells during development, while Dr. G. Brante (Eskilstuna) reported on the presence of polysaccharide substances in the nervous tissue of developing mice. Dr. A. F. W. Hughes (Cambridge) described his technique for the refined densitometry measurements of ribonucleic acid in the developing chick embryo, and was able to demonstrate its appearance and distribution in the ventral horn cells and its relationship to the Nissl substance. The morning session finished with an account by Dr.