ses tendances", by Prof. L. Malavard; "The mechanical differential analyser, recent developments and applications", by Mr. J. G. L. Michel; "Resistance-network analogues", by Dr. G. Liebmann; "Pédagogie concrète du calcul fonctionnel linéaire", by Prof. J. Brodin; and "Special computers", by Prof. H. Wallman. About 50 per cent of all contributions dealt with various aspects of electronic analogue computers, including differential analysers, simulators, etc., about 30 per cent with electrical analogues, such as electrolytic tanks and resistance-networks and their recent applications, and the remaining 20 per cent with mechanical differential analysers and various special-purpose computers. The review papers and the original communications, together with the discussions on these papers, will be published in full as Proceedings of the International Analogy Computation Meeting, Brussels, 1955, and its editors hope that the volume will be available at an early date.

It was decided during the meeting to form an International Association for Analogy Computation (Association Internationale pour le Calcul Analogique), and the chairmen of the various sessions, representing a good international cross-section, were asked to act as members of the organizing committee. The purpose of the new International Association for Analogy Computation is the furthering of this field by the organization of national and international scientific meetings, and the publication of a multi-language bulletin or periodical devoted to the scientific and engineering basis of analogue computers and to their steadily growing applications. Collaboration will be sought with existing organizations in the fields of electrical and mechanical engineering, and with those working with other computing techniques. The basic organization of the new Association will be in the hands of its first elected president, Prof. J. Hoffmann, and his colleagues at the Université Libre, Brussels.

This first international analogy computation meeting, bringing together people from many countries, was considered by all participants a very stimulating event, and the excellent organization of the meeting by the Société Belge des Ingénieurs des Télécommunications et d'Électronique and the great hospitality enjoyed will be remembered by all.

G. LIEBMANN

CHEMISTRY AND PHYSIOLOGY OF PHOSPHOLIPIDS

SYMPOSIUM IN ONTARIO

DURING October 12–13, some hundred and twenty scientific workers gathered at the University of Western Ontario, London, Ontario, to attend a symposium on phospholipids sponsored by the Biochemistry Division of the Chemical Institute of Canada. The success of the meetings, planned by Prof. R. J. Rossiter and members of the local committee of the Institute, was attested by the enthusiastic response of all participants. The papers and succeeding discussions will be published in full in the *Canadian Journal of Biochemistry and Physiology*.

The first part of the symposium, with Dr. A. M. Wynne (University of Toronto) in the chair, was entitled "Chemistry of Phospholipids" and dealt with current advances in knowledge of the structure and properties of the phospholipids. Dr. Erich Baer (Toronto) outlined the elegant synthetic methods used by his group for preparing optically pure α- or β-isomers of glycerophosphoric acid, glycerylphosphorylcholine, phosphatidic acids, lecithins, glycerylphosphorylethanolamine, glycerylphosphorylserine, and phosphatidyl serine. He also described the 22-step preparation of the first synthetic lipopeptide, L-α-(distearoyl)-phosphatidyl-L-serylglycylglycine. Finally, he reported on the first synthetic preparation of a fully unsaturated lecithin, L-α-dioleyllecithin. Of particular interest is the ability of this substance to render a number of polar compounds soluble in organic solvents, and its property of high stability to atmospheric oxidation. Dr. Baer emphasized the consistency with which the L-configuration and α-structure appear in natural glycerolphosphatides. In discussing Dr. Baer's paper, Dr. C. S. McArthur (University of Saskatchewan) commented on the attempts to prepare lecithins from L-α-glycerylphosphorylcholine by other methods. He also pointed out the possibilities of appreciable phospholipid losses during the dehydration of tissue with acetone prior to lipid extraction.

Drs. J. Folch and F. N. LeBaron (Harvard Medical School) critically reviewed the current state of knowledge of the chemistry of phosphoinositides. It was pointed out that the common feature of this class of lipids is the presence of meso-inositol, phosphoric acid and fatty acids. In some cases carbohydrates or amines are present and often glycerol. The five phosphoinositide preparations discussed include soybean lipositol, brain diphosphoinositide (the only member of the group from which inositol diphosphate has been obtained rather than the usual monophosphoric acid ester), peanut glyceroinositophosphatide, and wheat germ and cardiac muscle glyceroinositophosphatidic acids. Dr. Folch reported on the hydrolysis studies which have been carried out, the difficulties of obtaining uncontaminated preparations, and the appearance of inositol in other lipid complexes, and he emphasized the need for further structural studies. Dr. C. C. Lucas (Toronto) pointed out that the ubiquitous occurrence of inositol in biological material suggests a role as an essential component, and this is strengthened further by the observed lipotropic action of inositol.

The recent progress in the chemistry of sphingolipids was comprehensively reviewed by Dr. H. E. Carter (University of Illinois). He outlined the classical evidence for relative positions of functional groups on sphingosine and described his synthesis of tribenzoyl-D-*erythro*-dihydrosphingosine, which has properties conforming to those of the tribenzoyl derivative of the naturally occurring material. The application of infra-red techniques to establish the *trans*-structure of the double bond was mentioned, and the structure of sphingosine has finally been proved to be D-*erythro*-1, 3-dihydroxy-2-amino-4-*trans*-octadecene. This would appear to be confirmed by the recent reports of the synthesis of sphingosine. Dr. Carter pointed out the difficulties encountered in establishing the *erythro*-configuration of sphingosine as it occurs in cerebrosides due to possibilities of inversion during hydrolysis. However, he showed that the analogous compound, phrenosine, contains sphingosine bearing the *erythro*-configuration, and he gave further information regarding cerebrosides and cerebroside sulphuric ester, although the configuration of the galactosidic bond remains unsolved. The steps which have led to the elucidation of the structure

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of sphingomyelin were then described, and mention was made of the complex glycosides of sphingosine, including gangliosides, hæmatosides, globosides, strandin, and polycerebrosides. Most of these glycolipids contain hexosamine or neuraminic acid. Finally, Dr. Carter reported the finding of phytosphingosine in corn phosphatides and preliminary evidence favouring the view that corn phosphatides contain phytosphingosine as phytosphingolipids rather than as simple phytocerebrosides.

Dr. J. F. Berry (Western Ontario) re-emphasized the importance of the techniques presented by Dr. Carter for approaching the characterization of sphingolipids and the nature of the complex bonds in proteolipids and lipopeptides. He described preliminary studies on the successful paper-chromatographic separation of intact tissue phospholipids, and stressed the importance of these techniques in identifying and purifying new phospholipids.

The second part of the symposium, with Dr. W. R. Bloor (University of Rochester, New York State) in the chair, was devoted to "Metabolism and Function of Phospholipids". Dr. E. P. Kennedy (University of Chicago) introduced his account of the biological synthesis of phospholipids by emphasizing the contribution made by the advent of isotope tracer techniques and their application to studies in cell-free enzyme preparations. He reviewed the evidence pointing to L-α-glycerophosphate as a precursor to phospholipids, a point demonstrated by the incorporation into phospholipids of glycerophosphate labelled with phosphorus-32. Dr. Kennedy's group provided the next logical step by the isolation and partial purification of a rat liver enzyme, glycerokinase, which synthesizes L-α-glycerophosphate from adenosine triphosphate and glycerol. Dr. Baer's suggestion that natural glycerophosphatides are of the L-α-configuration was given support by this finding and by the observation that only the L-α-glycerophosphate can be incorporated into phospholipids. Kornberg's earlier work was reviewed, which demonstrated the activation of fatty acids to acyl-coenzyme A derivatives with adenosine triphosphate, and the attachment of these acyl-coenzyme A esters to L-α-glycerophosphate to form phosphatidic acid, the function of which was the subject of much discussion during the remainder of the symposium. Kornberg had earlier suggested that phosphorylcholine could be incorporated into lecithin by condensation with phosphatidic acid, inasmuch as the incorporation of a phosphorylcholine unit into lecithin was demonstrated. Dr. Kennedy's group has found that large amounts of adenosine triphosphate are necessary to accomplish this reaction in mitochondria. Further scrutiny reveals that the active co-factor is a cytidine triphosphate contaminant of the adenosine triphosphate preparation. Dr. Kennedy and his co-workers have demonstrated a condensation between cytidine triphosphate and the phosphorylcholine unit with the formation of cytidine-diphosphorylcholine, which was isolated chromatographically, estimated in tissues by isotope dilution techniques, and chemically synthesized. Labelled synthetic cytidine-diphosphorylcholine, as well as cytidine-diphosphorylethanolamine, have been shown to act as precursors for the isotope in phosphatidyl choline and phosphatidyl ethanolamine, respectively. Furthermore, tissue enzymes have been found that are able to synthesize the cytidine diphosphate bases. This reaction is reversible and is also completely specific for cytidine triphosphate and represents the first co-enzymatic role found for this nucleotide. Enzymes have previously been described that are able to phosphorylate choline or ethanolamine from adenosine triphosphate. Dr. Kennedy pointed out the bearing such metabolic pathways might have upon the biosynthesis of other phospholipids and on the lipotropic effect of choline.

Dr. G. C. Butler (Toronto), in discussing Dr. Kennedy's paper, raised the pressing point of the nature of the acceptor for phosphorylcholine. Phosphatidic acid, triglycerides and diglycerides are prominent among the suspected compounds. However, attempts to demonstrate any of these compounds as intermediates have met with failure.

Dr. L. E. Hokin (McGill University) presented the results of his studies on the metabolism of phospholipids *in vitro*, in which he has found that cholinergic drugs and pancreozymin in the pancreas, and acetylcholine and adrenalin in the salivary glands, all stimulate the secretion of protein. In each case, the high secretion of protein is accompanied by an increased incorporation of phosphorus-32 into the phospholipids. These studies were carried out with actively respiring tissue slices. The observed effects were only slight in homogenate preparations, and were not accompanied by changes in respiration or labelling of acid-soluble phosphorus compounds. Dr. Hokin has extended these studies to include guinea pig brain-cortex slices, where a similar stimulation of the incorporation of phosphorus-32 into phospholipids was obtained with acetylcholine. This was abolished in the presence of atropine. In both pancreas and brain slices, incubated with phosphorus-32 and glycerol labelled with carbon-14, acetylcholine stimulated primarily the incorporation of phosphorus-32 with little effect on the incorporation of carbon-14. This was taken to indicate an increased turnover of a phosphorus-containing portion rather than increased total synthesis of phospholipid. By mild alkaline hydrolysis of the lipid extracts and paper-chromatographic separation of the products according to the technique of Dawson, Dr. Hokin has demonstrated that acetylcholine maximally stimulates the incorporation of phosphorus-32 into phosphatidic acid and phosphoinositide in brain and pancreas. Appreciable effects were noted on phosphatidylcholine in brain and on phosphatidylethanolamine in pancreas.

Dr. R. J. Rossiter (Western Ontario) pointed out two additional physiological conditions, namely, starvation and cold stress, which produce changes in lipid labelling from one substrate and not from another. In these cases, phospholipid labelling from acetate-1-^{14}C is decreased, with no change in labelling from glycerol-1-^{14}C, glycine-2-^{14}C, or inorganic phosphorus-32. In addition, Dr. Rossiter gave details showing a greater incorporation of glycerol-1-^{14}C into the glycerol portion of phosphoglycerides than into the glycerol portion of phosphatidic acid. This supplies further evidence tending to negate the suggestion that phosphatidic acid might function as an acceptor of phosphorylated base.

Dr. J. M. R. Beveridge (Queen's University, Kingston, Ontario) reviewed the current views on the function of phospholipids and, among other functions, discussed their role as a structural element. Although there is little to support the notion that phospholipids act as intermediates in the resynthesis of triglycerides during fat absorption, it is considered that they are involved in this process in some manner.

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Dr. Beveridge gave evidence contrary to the belief that phospholipids comprise a vehicle for the transportation of fatty acids, although he pointed out that the phospholipids as β-lipoproteins may play a part in the transport of neutral fat. Finally, he quoted from the literature in support of the theory that choline-containing phospholipids facilitate the oxidation of fatty acids. He emphasized that no single function of the phospholipids could be stated in a positive manner. Dr. O. F. Denstedt (McGill University) commented on the physico-chemical function of phospholipids at biological interfaces.

JAMES F. BERRY

MELTING OF SOLIDS

SYMPOSIUM IN OTTAWA

A SYMPOSIUM on melting, diffusion and related topics was held during October 24–25 at the National Research Council Laboratories, Sussex Drive, Ottawa, under the chairmanship of Dr. D. K. C. MacDonald. The meeting was held at the invitation of the Low Temperature and Solid State Physics Group of the Division of Pure Physics, National Research Council of Canada, for the purpose of bringing together scientists within easy reach of Ottawa interested in melting from the different points of view of chemist, geophysicist, metallurgist and physicist. Twelve lectures were given; fifty minutes was allotted to each, of which about twenty was reserved for questions and discussion. It was found that this schedule allowed each speaker time for an adequate exposition of his subject, while preserving the balance of lecture and discussion.

A contrast soon became apparent between the working concepts of the physicists and chemists and those of the metallurgists. The physicists and chemists tended to regard both solid and liquid as homogeneous down to atomic dimensions, and thought in terms of thermodynamics and statistical mechanics. Thus, in his introductory lecture, Dr. MacDonald discussed self-diffusion and melting, using the model of 'hole' formation in the crystal lattice, and outlined the evidence which suggests that melting occurs when the hole concentration has risen to the order of 10^{-3}. J. S. Dugdale (National Research Council) gave a comprehensive review of both experimental and theoretical work on the behaviour of the melting curve at high pressures. Two papers from Chalk River described investigations of structure and diffusion in liquids using slow-neutron diffraction: D. G. Henshaw and D. G. Hurst have determined radial distribution functions in liquid helium, which show marked increase in short-range order with increase of pressure; and B. N. Brockhouse has made some preliminary measurements of the energy distribution in neutrons scattered from liquids, data which, after suitable analysis, can give information about self-diffusion and time-dependent pair distribution functions in the liquid. J. A. Morrison (National Research Council) described experiments on surface melting in adsorbed layers of argon and nitrogen on substrates of titanium oxide, with an anomaly in specific heat becoming rapidly sharper as the thickness of the layer increased. The interpretation of these results was discussed by D. C. Patterson (University of Montreal), using an order–disorder model for melting, and later by the meeting at large.

W. B. Pearson (National Research Council) described experiments on dilute alloys illustrating the effects of lattice distortion upon melting temperatures. The other metallurgists were concerned to make plain the inhomogeneous nature of the melting process, making use of photographs of the melting and freezing interfaces in metals. A. Rosenberg (University of Toronto) showed that freezing in 'pure' lead takes place by lamellar growth, and that melting appears to be the same process in reverse; this was effectively illustrated in a film using suitable space and time magnification. J. W. Rutter (University of Toronto) described the freezing of impure metals and showed how the formation of impurity substructures depends upon the concentration of impurity, rate of freezing, and temperature gradient in the liquid. E. H. McLaren (National Research Council) has used precision (10^{-4} deg. C.) resistance thermometry for investigating the freezing and melting temperatures of zinc and tin, and has found that differences of freezing technique and thermal history can cause changes up to about 10^{-2} deg. C. In a brief, provocative talk, W. C. Winegard (University of Toronto) emphasized the difference of outlook of physicist and metallurgist and criticized the theories of the former for taking no account of the impurities and dislocations which are known to play an important part in melting. A lively discussion followed, profitable because the participants had already listened to uninterrupted expositions of each other's work.

Any doubts of the usefulness of even the crudest of fundamental theories was dispelled by R. J. Uffen (University of Western Ontario), who described how knowledge of the physics of condensed phases is used in attempts to deduce the composition and state of the Earth's mantle and core. For this purpose not nearly enough is yet known about the physics of high pressures, and bold extrapolations from laboratory pressures have to be made. The success of the symposium makes it probable that similar meetings will be arranged for the discussion of other subjects related to work in low-temperature and solid-state physics.

T. H. K. BARRON

CHEMICAL COMPOSITION OF PARTHIAN COINS

AN outstanding example of the value of accurate and complete chemical analyses in the investigation of ancient metals, when these are afterwards interpreted by an ingenious mind, is given in a monograph on the "Chemical Composition of Parthian Coins", by Earle R. Caley, published by the American Numismatic Society, New York (Numismatic Notes and Monographs, No. 129; 1955). The author has made a large number of analyses of Parthian silver and bronze coins not only for the major constituents but also for minor impurities. There is internal evidence that these are reliable, and much new light is thrown on a field of historical metallurgy concerning which knowledge has hitherto been most meagre.

An elegant piece of detective research has revealed, practically beyond doubt, the materials from which the debased silver coins of the King Orodes I (57–38/37 B.C.) were made. From analyses of silver coins of the highest fineness for the time, it is shown that

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