

unwanted maxima of the second kind, and Kryukova has attributed these to stirring of the solution in the vicinity of the drop. Kinks in the plastic tube which joins the capillary to the reservoir can be discouraged by a specially bent capillary assembly. The introduction of the horizontal capillary by Smoleš is of considerable interest, for the resultant current-voltage curves are smoother than those obtained with the vertical capillary, disturbances are absent and the oscillations due to drop formation are greatly reduced. Current-time curves of single drops show that the horizontal electrode obeys the Ilkovič equation more exactly than the vertical one. The horizontal electrode is conveniently achieved by bending the tip of a vertical capillary, so that the last 2 mm. or so is in the horizontal plane. The control of drop-time by the use of a small electromagnetic hammer is now proving useful, not only for the synchronization of the twin-electrode systems employed in subtractive or derivative polarography, but also for any circumstances in which it is desirable to reduce the drop weight from its natural value. The streaming-mercury electrode, originally introduced for oscillographic experiments, has proved useful in ordinary polarography, and an equation for its diffusion current has been introduced by Ríus, Llopis, Polo and Koryta.

Small fluctuations in the potentials of the two mercury pools as well as in the rate of flow of mercury through the twin capillaries have proved a practical hindrance to the elegant subtractive method. On the other hand, derivative curves are readily obtained by means of two synchronized electrodes immersed in one solution and differing in potential by about 10 mV. throughout the polarogram. Vogel and Říha have obtained derivative curves from a single capillary by means of a condenser-resistance circuit (their publication appeared about a year before that of Lévêque and Roth), and in this case it is necessary for the applied voltage to vary linearly with time. In yet a third method, a single capillary can be made to yield derivative curves by the use of a mirror galvanometer having a special 'two-coil' suspension. Here, the passage of electrolytic current through the first coil induces its time-derivative in the second one. The general advantage of the derivative curve is that its maximum gives information both on the half-wave potential (the quality) and on di/dE (the quantity) of the electroactive substance. On the other hand, the sensitivity is only about 5 per cent of that obtainable from the normal polarogram. Furthermore, apart from the method, which employs twin capillaries, the half-wave potential depends on both the rate and direction of the applied voltage. Any discussion of derivative polarography would be incomplete without reference to the square-wave polarograph developed at Harwell by Barker and Jenkins; in its sensitivity, this instrument greatly exceeds any polarograph which has so far been developed.

Attention was directed by Prof. Heyrovsky to the little-known Kalousek method for studying the reversibility of electrode processes. By means of a commutator, the electrode is subjected to alternate cathodic and anodic polarization at between 5 and 10 cycles/sec. In these circumstances, a metal such as zinc undergoes cyclic deposition and dissolution. In acid solution, the resultant single anodic-cathodic wave shows the reduction process to be reversible. On the other hand, the formation of a double wave in alkaline zinc solutions indicates an irreversible process.

During recent years, polarography has been successfully combined with the chromatographic technique of separation, a method known as 'chromatopolarography' having been devised by Kemula. Industrially, the polarograph is finding an ever-increasing application as a continuous service indicator. For such purposes, the mercury-pool anode is unsatisfactory, since the whole of the mercury is eventually converted to calomel. To meet this difficulty, the dropping-mercury electrode in halide solution has recently been introduced as a stable reference anode. The continuous determination of oxygen constitutes one of the more prominent examples of the continuous service application, and in this particular example the mercury-pool cathode has proved to be about a hundred times more sensitive than the dropping-mercury cathode.

An interesting biochemical application of polarography is to be seen in the apparatus of Šerák. Here, the oxygen uptake of tissue preparations can be accurately followed over a period of time. In the medical field, the polarographic diagnosis of cancer is based on Brdička's protein test, now almost twenty years old, in which, after precipitating the bulk of the proteins from the patient's serum, the filtrate is examined polarographically in the presence of hexamminocobaltic chloride in ammoniacal solution. When the patient is suffering from cancer or some feverish condition, an exceptionally large protein wave, due to muco-proteins, is observed. Prolonged experience of this test suggested that it is 80 per cent certain, but the modified test recently introduced by Ballo-Helaers appears to be 100 per cent certain; this modification involves graded alkaline denaturation, before precipitating the proteins with sulphosalicylic acid.

In theoretical polarography, a new field has been opened up by Wiesner and Brdička's discovery of the kinetic current, which depends upon the rate at which depolarizer is being formed at the electrode surface. Kinetic currents are independent of reservoir height and possess temperature coefficients of the order of 30 per cent per deg. C. Such investigations have led to important information about rate-constants; for example, all four rate-constants of the mutarotation of α - and β -glucoses are derived in this manner. Brdička's study of the reduction waves of weak acids has also led to the consideration of the absolute rate of recombination of ions.

The cathode-ray oscillograph is finding increased uses in polarography. In this way, it is possible to follow the polarographic current-voltage curves on one mercury drop of 5-8 sec. duration. In an alternative approach, the potential-time curves are obtained.

THE GEOGRAPHICAL ASSOCIATION ANNUAL CONFERENCE

THE annual conference of the Geographical Association, held at the London School of Economics and Political Science during January 3-6, was noteworthy this year for two main aspects, namely, the emphasis given to papers on London and the London Basin and the unusually large number of members who were present. All the lec-

tures were very well attended and in several cases the seating accommodation in the lecture-theatre was over-full. The annual dinner, with the president, Mr. L. S. Suggate, in the chair, attracted more members than ever before, and the excursions on the last day of the conference, though more numerous than previous years, were considerably over-subscribed.

Mr. W. F. Grimes, director of the London Museum, opened the conference with an excellent summary of the present knowledge of London's prehistory. The London theme was taken up later by a series of papers ranging from Mr. A. F. Green's fascinating analysis of the problems of London's underground drainage to Prof. S. W. Wooldridge's interesting commentary on the relationship of London's railways to the relief and structure. Dr. J. H. Bird presented a critical résumé on the activities of the London docks, and Dr. M. J. Wise analysed the role of London in the industrial geography of Britain with particular reference to the recommendations of the Barlow Commission. Both these papers were followed by excursions, one to the docks and the other to industrial areas of East London. The past and present agricultural development of the London Basin was the subject of Dr. H. C. K. Henderson's paper, which was followed by a traverse by motor coach across the northern part of the London Basin to Luton. Another excursion crossed the southern part of the basin and in the afternoon visited the National Institute of Oceanography at Wormley, near Godalming.

Teaching matters were fully discussed by Mr. Suggate in his presidential address on "Some Aspects of Teaching Geography in the Grammar School". His paper was most enthusiastically received by a very large audience, conscious of the very great contribution that Mr. Suggate has made to the development of geography in school. Another very large audience heard a stimulating and provocative paper on river development by Dr. G. H. Dury, who commented, as an examiner, on mistakes commonly found in school examination scripts. Later he took a large party of members to examine a series of river meanders in Enfield. "Sample Studies" was the title given to a meeting sponsored by the Secondary Schools Committee of the Association. The subject was introduced by Mr. R. C. Honeybone, who stressed the value of the approach as one of many ways of teaching geography in a geographical manner and outlined its pitfalls. Mr. D. J. Cadman followed this introduction by a lesson to third-form boys on the Vauxhall Works at Luton as a sample of the British automobile industry.

Prof. A. E. Smailes presented an account of the Association's summer school held last August in Aix-en-Provence; Prof. P. W. Bryan showed two films on Snowdonia and Anglesey; and Prof. A. L. Banks read a paper on what is to most geographers an unusual topic, "Some Aspects of Medical Geography". This last was a combined meeting with the Institute of British Geographers and the Royal Geographical Society, and was held at the Society's house in Kensington.

In addition to the usual large and representative publishers' exhibition, the Association's Standing Committee for Visual Aids in collaboration with the National Committee for Visual Aids in Education and the Educational Foundation for Visual Aids mounted an exhibition of sample study material, projectors and recently published film-strips.

R. C. HONEYBONE

THEORETICAL PHYSICS

SYMPOSIUM AT ST. ANDREWS

THE presence of Prof. W. Heisenberg (Göttingen) as Gifford Lecturer in the University of St. Andrews was used to organize a short, rather informal, conference on theoretical physics during November 18-20. Unfortunately, Prof. Heisenberg had to return to Germany sooner than had been expected and so, regrettably, was unable to be present, but about fifty physicists, mainly from British universities and government establishments, attended. Four sessions were held, one of which was devoted to an informal discussion on the teaching of theoretical physics.

Dr. J. Hamilton (Cambridge) introduced the first session on field theory. In view of the recent confirmation of the existence of the antiproton, his talk was devoted to an account of calculations performed in Cambridge, in conjunction with Bethe, on the possible modes of annihilation to be expected for this particle. He showed that the application of general principles of conservation of angular momentum, isobaric spin and parity is sufficient to make predictions concerning this process in the presence of very light nuclei. In general, the annihilation is expected to occur with the production of π -mesons, the ratio of π^- to π^+ to be expected depending simply on the quantum numbers of the nucleon involved.

Dr. T. H. R. Skyrme (Harwell) gave an account of a relativistic variational method for calculating the properties of a real nucleon in $PS-PS$ theory, and Dr. J. S. R. Chisholm (Cardiff) reported work on the S -matrix in neutral pseudoscalar derivative coupling theory. Dr. J. W. Leech (Queen Mary College, London) described a method for the calculation of long-range interatomic forces; an earlier treatment of this problem by Casimir and Polder led to an inverse seventh power potential, but he finds the dependence to be an inverse third power. Dr. W. K. Burton (Glasgow) described work done in conjunction with de Borde on the method of functional integration for Fermi systems. Dr. D. L. Pursey (Edinburgh) discussed the possibility of having an acceptable theory which, although not covariant in every respect, leads only to covariant observable predictions. Finally, the session on field theory was concluded by Dr. C. G. Kuper (Liverpool), who discussed roton excitation in liquid helium.

Prof. H. A. Bethe (Cambridge and Cornell) introduced the session on nuclear physics by an appreciation of the nuclear model of Brueckner and collaborators. This model uses a generalized Hartree-Fock method and attempts, with considerable success, to deduce a self-consistent nuclear potential from the force between two free nucleons. A principal aim of the theory is to show that, using only such two-body forces, one can achieve nuclear saturation. Prof. Bethe gave an account of his own independent calculations on nuclear energy and radius, in which he has succeeded in taking complete account of the Pauli principle, and he also reported success, with Goldstone (Cambridge), in dealing with the repulsive core of the two-body nuclear potential. Preliminary numerical calculations (not taking account of the repulsive core), using a minimization procedure for the energy, show fair agreement for nuclear binding energy, but a nuclear radius one-third that of the actual radius. Proper treatment of the repulsive core,