

## Royal Society of Canada

## ANNUAL MEETING AT TORONTO

THE annual meeting of the Royal Society of Canada was held at the University of Toronto on May 25-28, under the presidency of Mr. Lawrence J. Burpee of Ottawa, who took as the subject of his presidential address "The Discovery of Canada". The Flavelle Medal for 1937 was awarded to Dr. F. D. Adams, the Lorne Pierce Medal to Prof. Stephen Leacock, and the Tyrrell Medal to Mr. Aegidius Fauteux. Prof. A. G. Huntsman, consulting director of the Biological Board of Canada and editor of its publications, and professor of marine biology in the University of Toronto, was elected president for the year 1937-38.

In Section 1 (French, Literature, History, etc.) fifteen papers were read, and in Section 2 (English Literature, History, etc.) twenty-one papers.

In Section 3 (Chemical, Mathematical and Physical Sciences) 142 papers were presented, 47 by title only. One third were presented to the whole Section, the remainder to four subsections (Astronomy, Chemistry, Mathematics, Physics). Three new fellows were elected to the Section: Profs. A. R. Gordon, of the University of Toronto; R. L. Jeffery, of Acadia University, and W. H. Watson, of McGill University.

The feature of the meetings of Section 3 was its presidential address by John Patterson, director of the Meteorological Service of Canada, in which he outlined recent advances made in this service. The necessity of a continuous forecasting service for the recent expansion in aviation has given a new impetus to research, has led to increase in the number of observation centres, and has increased the personnel. The address was followed by a symposium by A. Thomson and various members of the meteorological staff, in which the results of temperature, water vapour content, and pressure distribution in the upper atmosphere at various Canadian stations were given. Observations at the National Research Laboratory, communicated by D. C. Rose, showed that the advance of polar front is the cause of variations in potential gradient.

Prof. L. Gilchrist presented a paper on resistivity measurements at the Chickamauga Dam site, Tennessee, where underground caverns were located by the proper use of 'Megger' instruments. A survey of methods used to determine overburden above magnetic deposits by magnetic methods with field examples was given by Prof. D. A. Keys. Dr. W. H. Martin dealt with the Raman spectra of some oximes, and pointed out the shift of one Raman line due to addition of hydrochloric acid to certain amines and to mercuric chloride in solution. Prof. J. A. Gray gave the results of the scattering of X-rays at small angles by charcoal, and presented further evidence that some  $\beta$ -rays lose energy when scattered through large angles by nuclei.

The Rev. A. Vachon presented an interesting account of the salinity of the water at different points in the estuary of the St. Lawrence River; from these measurements, arctic currents can be traced, especially along the north shore, and also the course of the water from the Saguenay after it enters the St. Lawrence. Prof. E. H. Boomer, speaking on

phase equilibria in hydrocarbon systems, showed that the behaviour of the systems relative to one another can be predicted qualitatively from the chemical and physical properties of the liquid hydrocarbons used. Results of experiments by Prof. C. C. Coffin on the effect of molecular structure on the rate of uni-molecular gas reactions show that the replacement of hydrogen by chlorine atoms produces a slight decrease in rate, while introduction of a double bond gives a fourfold increase. Prof. W. Lash Miller presented a group of papers on Wilders' bios and yeasts. Of fourteen papers presented by Prof. O. Maass and his students, one on the measurement of the specific heat of propylene in the critical pressure - critical temperature region contained an account of a new type of adiabatic calorimeter, and it was shown that the liquid state of aggregation persists above the critical temperature. Prof. H. Hibbert (with F. B. Pickett and G. F. Wright) reported on the relative acidity of carbohydrate hydroxyl groups; they find that the hydroxyl group attached to the  $C_4$  atom in glucose is more acid than those attached to the  $C_2$ ,  $C_3$  and  $C_6$  atoms.

Prof. W. H. Watson presented a paper on the electron and the limits to the precision of electromagnetic field specifications, in which the uncertainty relations of the electromagnetic field are applied to determine the corresponding uncertainties in the motion of an electron in the field. Prof. J. L. Synge presented several papers by his associates, of which one on the problems of the beam and the plate in the theory of elasticity, by J. N. Goodier, was of particular interest, as it proved that the engineering theories of beams and plates are good to a high order of approximation under the conditions of use. Prof. A. F. Stevenson gave a paper on a generalization of Oseen's equations for steady flow past a fixed obstacle, with application to the sphere, and Prof. R. L. Jeffery another on sequence integration and non-absolutely convergent integrals for functions of two or more variables. A paper by Prof. W. L. G. Williams and M. S. MacPhail on functions of the complex variable  $z = x + jy$ , where  $j^2 = -1$ , was of particular interest, and mention may also be made of a paper by Prof. S. Beatty and D. C. Murdoch on routine for determining the numbers  $e, m$  associated with a cycle  $f = o(p)$  of an algebraic equation  $F = 0$ .

Prof. H. A. McTaggart demonstrated the ellipticity of the light reflected at the surface of films of oriented molecules. Prof. A. L. Clark gave the result of the experimental determination of the probability of a steel ball falling through one of a number of holes in a plate. Prof. E. F. Burton presented a number of papers describing work done in the McLennan laboratories. The specific heat of tributyrin at low temperatures has been measured by J. O. Wilhelm and A. H. Woodcock, who find that it varies from 0.4 cal./gm. at room temperature to 0.012 at 16° K. H. E. Johns and J. O. Wilhelm have determined the refractive indices for  $\lambda$  5461 Å. of liquid oxygen (1.2242), liquid nitrogen (1.1990) and liquid hydrogen (1.1120). J. M. Anderson has determined the half

lines of several lines in the spectrum of argon II by a modified canal-ray method; all so far measured have a half life of less than  $10^{-8}$  second.

In the Geological Section (4) eighteen papers were presented. Three new fellows were elected: Dr. G. W. H. Norman, of the Geological Survey of Canada; Prof. F. F. Osborne, of McGill University, and Dr. J. F. Walker, provincial mineralogist of British Columbia. Among the interesting papers presented the following may be mentioned.

Prof. G. H. Henderson (of Section 3) described two new types of pleochroic haloes in biotite, and showed that they are invariably associated with minute fissures through the mineral. He indicated that they originated from certain members of the radium family of very short life-period, and suggested that precipitation of minute grains of radium-bearing minerals from the fissure-filling solutions probably accounts for the localization of the haloes.

The last paper of the late Dr. W. H. Collins, formerly director of the Geological Survey of Canada, was presented by H. C. Horwood, who had assisted him with much of his field work. Results of several years of detailed study of the Sudbury district strongly confirm the original conclusions of Dr. A. P. Coleman as to the magmatic origin of the ores, and indicate that secondary processes play a relatively minor part in ore deposition. Dr. Coleman, now eighty-five years of age, was present at the meeting to hear this vindication of his conclusions.

H. C. Cooke presented new data on the age of the Dore series of Michipicoten district, Ontario, based on determinations of the structure of the Keewatin lavas, and concluded that the Dore series is probably of Temiskaming age, and is not interbanded with the Keewatin as previously supposed. W. C. Gussow presented the results of his work during tenure of one of the Carnegie fellowships administered by the Society. These indicate that the gold deposits of the Rouyn area, Quebec, are not primarily related to the granitic stocks, but were deposited from soda-bearing solutions introduced along fissures at some later date. The solutions albited the intrusives and caused profound petrographic changes in them.

In Section 5 (Biological Sciences) sixty papers were presented, in part before the whole section, and in part to two subsections (Zoology and Botany, and the Medical Sciences). Profs. D. L. Bailey and G. F. Marrian of the University of Toronto and Dr. J. H. McDunnough, of the Division of Systematic Entomology of the Dominion Department of Agriculture, were elected fellows of the Section.

Prof. E. M. Walker gave the sectional presidential address on "*Grylloblatta*, a Living Fossil", and showed a very interesting cinematograph film of this prehistoric beetle from the Canadian Rockies, proving, *inter alia*, that the heat of the hand rapidly causes its complete prostration, while contact with ice leads to slow recovery. Prof. A. G. Huntsman traced the cause of the scarcity of salmon which occurs periodically in the Atlantic provinces every nine or ten years, as due to a succession of dry summers (also occurring periodically) which result in such lowering of the water of salmon streams that the young salmon parr are clearly exposed to kingfishers and mergansers, which take an unusually large toll. He also communicated an account of W. H. Johnson's study of the effect of light on the marine copepod *Acartia clausi*, which shows that movement is brought about by changes in intensity

of light (upwards with diminution, downwards with increase of intensity), rather than by the degree of intensity itself; under static light conditions, the animals gradually become uniformly distributed.

Dr. J. W. MacArthur reported from his studies of finger and palm prints that left and right hands are as different in identical as in fraternal twins, while hands of the same side are quite similar in identical twins, but show large and increasing differences in the series: fraternal or sib pairs, parents and children, and unrelated persons. By such comparisons, the twin type can be correctly diagnosed in about half the pairs from their own prints alone, and in nearly all when prints of their parents and sibs are also available.

Prof. G. W. Scarth presented a paper by D. Siminovitch showing that the cells of plant tissues frozen internally with intra-cellular ice formation always die, while those dehydrated by external (inter-cellular) ice will survive, even after extreme dehydration of the protoplasm. Prof. Marie-Victorin and the Rev. J. Rousseau gave a paper extending the former's theory of the development of the flora of the St. Lawrence valley. R. B. Thomson described comparative studies of the 'inversed' bundles of male and female cone scales in a series of conifers, confirming the view that these are homologous structures which during growth come to assume different positions in association with the function of the scales as sex organs. Prof. W. P. Thompson presented several papers by himself and co-workers dealing with genetic problems in wheat and other cereals. Prof. A. H. R. Buller reviewed the life-history of the wheat rust, and reported new discoveries concerning the fusion in pustules on the barberry leaf of pycnia with a hypha of opposite sign.

Prof. J. W. MacArthur presented a paper by C. K. Gunn giving an account of a strain of rats which has, as a monofactorial autosomal recessive mutant character, acholuric jaundice resembling that in man in its chief clinical and genetic features. A paper by A. E. Allin (presented by Prof. D. T. Fraser) showed that, in general, skin sensitivity to diphtheria toxoid develops within three weeks during an attack of diphtheria in those who are initially non-sensitive, and increases at this time in those initially sensitive in some degree.

Prof. G. F. Marrian (with G. C. Butler) showed that an ether-soluble fraction from two women with adrenal tumours contained unusual amounts of pregnandiol, and also a triol,  $C_{21}H_{36}O_3$ , melting at  $243-244^\circ C$ . R. G. Sinclair adduced evidence that the red blood cells of the dog and the cat do not take part in fatty acid transport. E. G. Young gave an interesting account of prolonged study of purine metabolism in the Dalmatian coach hound from early age to adolescence.

Prof. C. C. Macklin described the detailed histology of the pulmonic alveolar walls of the adult cat, illustrating his paper by beautiful slides from photomicrographs, and stressed the presence of many 'bare areas' devoid of nuclei.

Prof. F. G. Banting presented a number of papers from workers in the Banting Institute of the University of Toronto. W. R. Franks and H. J. Creech have succeeded in forming chemo-antigens by coupling 1:2:5:6-dibenzanthracene and similar compounds to proteins, and injecting the products into rabbits, guinea pigs, and rats; formation of haptene specific antisera was demonstrated by precipitin reactions and by specific inhibition with

the prosthetic substances. H. F. Richardson showed that death from intra-venous air embolism in dogs depends on the rate of injection; at very slow rates surprisingly large amounts of air can be injected before death ensues (through failure of the pulmonary circulation). B. C. Coles showed that the type of death in cases of criminal abortion, commonly ascribed to small amounts of air found in the heart at post-mortem, may be due rather to lethal amounts

of toxic substances (such as potassium soaps) in the douche solution having entered the blood stream from the uterine cavity. According to D. Irwin, the tissue response to different samples of quartz is practically identical. W. R. Franks, L. D. Proctor and A. Duncan described a photo-electric dust estimator, designed to measure accurately and rapidly dust retainable by the lungs and therefore to estimate the dust hazard.

## Recent Aeronautical Research

THE report of the Aeronautical Research Committee, issued recently\*, deals with a period of nearly two years, from April 1935 until December 1936. This is to cover a change of procedure, future reports being issued for the calendar year. The report opens with a well-merited tribute to the memory of Sir Richard Glazebrook and Sir Joseph Petavel, who died during the period under review. They were both original members of the Advisory Committee for Aeronautics, appointed in 1909, and all who have had any connexion with aeronautics will appreciate how much the development of the science owes to them.

The outstanding feature of the period under review has been the increase in, and the still further demands for, high performance of aircraft. The major part of the Committee's activities are obviously directed towards this object. It is emphasized that the more recent equipment at the National Physical Laboratory and the Royal Aircraft Establishment, although elaborate and expensive, have made possible advances in the fundamentals of aircraft aerodynamical design to an extent that could never have been accomplished by the trial-and-error methods of full-scale experimental flight alone. The compressed air tunnel and the one-foot high-speed tunnel at the former, and the 24-ft. wind tunnel at the latter, are cases in point.

The 24-ft. tunnel at the R.A.E. has been used principally for the investigation of engine-cooling problems. At high translational speeds, theory shows it should be possible to provide enough cooling without adding at all to the drag of the complete aeroplane, and this prediction has been supported by experimental results. As the induced drag at high speeds is very small, it follows that a well-designed aircraft travelling at high speed need have a drag very little higher than that due to the friction between its exposed surfaces and the air.

Aeroplane speeds are now almost approaching the range in which compressibility becomes important, and the Committee, by undertaking research on compressibility effects, is taking steps to have information available by the time it is required. The apparatus used for this work is a one-foot high-speed tunnel, run from the exhaust of the compressed air tunnel. Tests on thick aerofoils have been done, and suggest that it may be necessary to take account of 'compressibility drag' when speeds of flight exceed four hundred miles per hour.

Much of the time of the compressed air tunnel has

been devoted to investigations of surface friction. At the Reynolds numbers of flight a surface roughness corresponding to excrescences of the order of one-thousandth of an inch in height may be enough to increase the friction substantially. This measure of roughness is inappreciable at Reynolds numbers corresponding to those in ordinary atmospheric tunnels, so that although roughness may produce a difference in the behaviour of an actual aeroplane, the cause was not appreciated until this problem had been worked out.

Drag measurements have also been made in flight by means of a comb of small pitôt tubes which determine the difference in relative velocity between the air in the wake of the wing and the free air. It can also be applied in the compressed air tunnel, which will enable profile drag to be determined at Reynolds numbers of the order of those reached by fast modern aeroplanes.

Another problem has been to determine where on aeroplane wings the change from laminar to turbulent flow in the boundary layer takes place. As the drag associated with the turbulent boundary layer is considerably greater than that of the laminar layer, it is important to keep the transition point on the wing as far back as possible. It is suspected that protuberances in the surface of a wing near its leading edge may promote an early transition point and so increase the drag.

Modern high-speed machines have introduced other problems, particularly of stability. For example, directional stability is often unexpectedly good, although longitudinal stability is not so satisfactory. Further, increasing speed inevitably implies higher wing loading and thus introduces landing problems. The properties of flaps and other aids to stability, particularly when landing and taking off, have been studied, and work on gusts in the atmosphere is continuing.

Structural problems following upon the recent development of 'stressed skin' bodies and wings have shown that stabilizing members for flat, or slightly curved, sides of bodies need to be carefully studied for optimum efficiency. Tubular members are stronger for a given amount of material, but their use presents practical difficulties.

In aero-engine work, attention has been paid to the development of bi-fuel systems, which at the moment appear to be necessary with the use of 100 octane fuel. Direct fuel injection, supercharging, high boiling point liquids for cooling, spark ignition, and the compression ignition engine have been subjected to investigation in various details, but nothing revolutionary is proposed.

\* Aeronautical Research Committee. Report for the years 1935-36. Pp. 60 + 7 plates. (London: H.M. Stationery Office.) 4s. net.