specialists such as tea-tasters and wine-tasters, represented a further approach.

Reference was doubtless intended to the investigations of Duncan and Cheesman in the observation that "in the domain of psycho-physiology, an up-to-date examination of the application of the Weber–Fechner law to the sense of smell seems desirable", in that the technique of the two workers mentioned is based on the type of statistical approach directly derived from that law, which may be briefly set down in the following terms: "sensation is proportional to the logarithm of the stimulus, it being necessary to increase the stimulus geometrically in order to increase the sensation arithmetically"[1].

The difficulties confronting the would-be measurer of odour intensities and the scientific investigator of odour qualities were mentioned by Dr. McCartney, who made no attempt to belittle them but nevertheless stopped short of the somewhat complacent references of Parry and Sagarin to what the latter has termed "the inherent invalidity of all systems of odour classification".

Dr. McCartney considered that vibratory or wave theories of odour transmission have "overwhelming evidence against them". In regard to the various theories held by Beck and Miles, Cheesman and Duncan, Duranton, Guillot, Le Magnen, McCord and Witheridge, Moncrieff and others, he felt it impossible that "all these theories, which are to some extent mutually exclusive, can stand the test of time". "In any case," he concluded, "the modern theories and the experimental results on which they are based provide ample material for much fruitful discussion. No scientific subject involves mysteries more profound than those of olfaction. And certainly no subject is more fascinating and absorbing."

The next speaker, Dr. G. H. Cheesman, confined most of his remarks to a description of the type of work now being carried out on odour classification at the University of Reading. After referring to the more obvious difficulties of devising a reliably objective, quantitative approach to the inherently subjective field of olfaction, he went on to emphasize the comparatively straightforward character of 'threshold' measurements, which can not only be determined with the minimum subjective interference, but are also susceptible to the psychological technique of factor analysis[2].

Dr. D. R. Duncan, a former collaborator in this work with Dr. Cheesman, and the co-inventor with him of an improvement on the conventional Fair–Wells osmoscope, then described in some detail the main features of the 'odour fatigue' method whereby threshold values are determined. Dr. Duncan had previously read a paper entitled "The Perception and Measurement of Odour" before the British Esperanto Scientific Association[3].

A somewhat radical departure from the domain of determining threshold values was represented by the views of the next speaker, Dr. R. R. Matalon, of the Department of Colloid Science, University of Cambridge. Dr. Matalon harked back to the work of Prof. Henri Devaux, which had been briefly referred to in the introductory talk by Dr. McCartney. Devaux's experiments showed the phenomenon of odour transmission in visible form, as a surface-active effect on a bath of mercury covered with talc, the talc-dusted surface showing characteristic disturbance when subjected to the proximity of rose petals and other odorants[4]. Dr. Matalon went on to connect this fundamental work with the probable action of odorants on the cells or 'receptors' of the olfactory nerve system. It seemed to him that further basic research on these lines is an essential prerequisite to the objective study of odours and any acceptable attempt at scientific classification.

The final statement submitted to the symposium was a written contribution by Dr. J. H. Kenneth, of Edinburgh, whose "Osmics: The Science of Smell" was published in its complete form in 1924.

The discussion started off somewhat slowly, but soon assumed a more interesting character—elucidation being not unmixed with critical comment and the statement of controversial opinions. Some speakers supported, for example, the vibrational theory of odour transmission, while others appeared even to doubt the validity of what is perhaps rather ambiguously described as 'odour fatigue'. The general feeling seemed to be in favour, on one hand, of the continuance of such work as is currently being undertaken by the University of Reading and, on the other, of devising a new type of approach to the subject that would logically continue the line of experimentation first indicated by Devaux. Among those who joined in the discussion were Mr. Jack Pickthall, Mr. E. S. Maurer, Mr. D. W. A. Waite, Dr. A. W. Middleton, Mr. Frank Atkins, Mr. James Bather and the Society's chairman, Mr. F. V. Wells.

[1] See R. W. Moncrieff's "The Chemical Senses", pp. 53–55.
[2] See *Soap, Perfumery and Cosmetics*, 697 (July 1949).
[3] See *Nature*, March 11, p. 394.
[4] See R. W. Moncrieff's "The Chemistry of Perfumery Materials" p. 279.

RHEOLOGY AND THE CONSTITUTION OF MATERIALS

ANNUAL CONFERENCE OF THE BRITISH SOCIETY OF RHEOLOGY

THE annual conference of the British Society of Rheology was held at St. Patrick's Hall, University of Reading, during September 28–30. The general title of the conference was "Rheology and the Constitution of Materials", and the papers on this subject stimulated discussions ranging over a very wide range of materials from metals to polymer solutions. At the annual general meeting of the Society, the change of name from the British Rheologists' Club to the British Society of Rheology was sanctioned, a change which reflects the important part which the Society is playing both as a link between men of science from different fields of work in Great Britain and as a prime mover in the formation of the International Union of Rheology. The officers for 1950–51 are: *President*, Dr. G. W. Scott Blair; *Honorary Secretary*, Dr. E. W. J. Mardles; *Honorary Treasurer*, Dr. J. G. Oldroyd; *Honorary Editor*, Dr. V. W. G. Harrison.

The presidential address, given on September 28 by Dr. G. W. Scott Blair, was on "The Rheology of Uterine Cervical Secretions". Dr. Scott Blair outlined the work which he and his colleagues have done on the relation of the properties of these secretions to the time of œstrus and the course of pregnancy for cows, and also similar studies made in conjunction with Mr. A. F. Clift for women. An emptying and filling capillary micro-viscometer was designed for this work which enabled measurements to be made with only 0·06 ml. of secretion. The original instrument, while giving very satisfactory results, was very tedious to use, and a new instrument giving

automatic methods will shortly be brought into use. A small-scale rotational viscometer was also described; it has been found that the shear in this instrument destroys the rheological properties most nearly related to the changes in hormone condition of the animals.

The presidential address was followed by a paper by L. Grunberg and Dr. A. H. Nissan on "Viscosity, Constitution and Structure", with A. G. Ward in the chair. Mr. Grunberg outlined the history of the formula $\eta = A \exp(B/T)$ and its many variants. After considering the classification of liquids into "normal or dispersion liquids", "polar associated liquids", "ionic liquids" and "metallic liquids", the main part of the paper was concerned with the "normal liquids". In comparing two liquids, the need for choosing suitable conditions in each case was emphasized, and the choice of temperatures at which the vapour pressures are equal was justified on the basis of theoretical arguments. A simpler method involves the comparison of viscosities at equal T/T_B, where T is the temperature for the viscosity measurement and T_B is the boiling point under atmospheric pressure. The results of the application of this method to hydrocarbons and their halogen derivatives were given together with conclusions derived from the study of $E_{visc.}/M$ $(=RB/M)$, where M is the molecular weight. The relation of the heat of mixing to viscosity data for regular solutions was also given. A short contribution was made to the discussion by Dr. A. Nisbet, outlining the theory of viscosity developed by Born and Green.

The opening session on September 29 consisted of a paper by W. G. Harland and W. A. Richardson on "Intrinsic Viscosity", J. G. Oldroyd being in the chair. Mr. Richardson showed how important an exact statement of the procedure followed can be in determining the intrinsic viscosity of solutions. He reviewed the many equations which have been developed to express the concentration dependence of the viscosity of polymer solutions, and also the terminology which has been suggested by different authors. Mr. Richardson expressed the firm opinion that it is better to ensure that the terms used—specific viscosity, intrinsic viscosity, reduced viscosity, etc.—should be those with the greatest chance of widespread adoption, rather than that an attempt should be made to impose a logical and rational new set of terms. Discussion following the paper showed general agreement with Mr. Richardson's views.

The paper by Dr. F. R. Eirich (Brooklyn) on "Flow Birefringence: Some Results on Concentrated Polymer Solutions" was, in Dr. Eirich's absence, read by Dr. E. W. J. Mardles. A. H. Nissan was in the chair. The relation of the intrinsic viscosity, sedimentation constant, translational diffusion constant and rotatory diffusion constant to molecular size, shape and molecular weight were first discussed. The need for two measurements of this type to enable molecular constants to be calculated was emphasized. Particular attention was given to the combination of the intrinsic viscosity with the rotatory diffusion constant, the latter being determined from the extinction angle, and to the relation of the results to molecular models for chain molecules.

In the afternoon a visit was paid to the National Institute for Research in Dairying, Shinfield, Reading. Dr. Scott Blair and his collaborators showed exhibits illustrating work on the rheology of cheese and butter, including the use of factorial analysis, and also the apparatus used for cervical secretions. A film was shown of the scientific study of cheese testing, and a general tour of the Institute was arranged.

The evening session was devoted to papers by Dr. L. R. G. Treloar on "The Structure and Properties of Rubber", and by H. H. Macey on "The Flow of Clay Systems". Dr. V. W. G. Harrison was in the chair. Dr. Treloar reviewed the theory of rubber-like elasticity and the crystallization of rubber, and illustrated his paper by convincing demonstrations of the various effects. Mr. Macey developed a quantitative theory of the plasticity of clay–water systems based on the forces of interaction between the clay particles. The interaction can be represented by repulsive forces which are compensated at the boundary by surface tension. The theory is able to give both a qualitative and quantitative interpretation of much of the experimental results for plastic clay. Considerable discussion followed Mr. Macey's paper concerning the nature of the water film between the clay particles, and whether any structure is imparted to the water by the forces from the clay particle surface over distances of more than a few molecular diameters.

The morning session of September 30 was devoted to the rheology of metals, with Prof. M. Reiner (Haifa Technical College) in the chair. The first paper, "The Role of Structural Discontinuities in Crystal Plasticity", was given by K. E. Puttick and M. W. Thring. Emphasis was placed on the importance of the rate of strain in measurements of yield of metal. The theories explaining yield in terms of dislocations were described and related to the experimental results. P. Feltham in his paper, "Trends in the Rheology of Metals at High Temperatures", stressed the dangers of approaching so complex a field from a narrow or mechanistic point of view. This was shown to lead to a divorce between 'pure' physical studies, suited to the academic worker, and 'applied' metallurgical studies which are left to the works laboratory. These considerations were illustrated by the inelastic behaviour of metals at high temperatures.

ALAN G. WARD

THE AGRICULTURAL AND HORTICULTURAL RESEARCH STATION, LONG ASHTON

ANNUAL REPORT FOR 1948

THE University of Bristol Agricultural and Horticultural Research Station, at Long Ashton, maintains its tradition of balanced practical research into problems of fruit growing and fruit products. In its annual report for 1948*, Dr. L. C. Luckwill reports that alpha-naphthalene acetic acid (5 p.p.m.), 2 : 4 dichlorophenoxy-acetic acid (1 p.p.m.) and indolyl-acetic acid (5 p.p.m.) all reduced fruit-set without causing damage to the foliage. These substances were applied as sprays shortly after the time of full blossom, and are designed to control superabundant fruiting, with subsequent abscission and loss of too much fruit. Dr. Luckwill has also studied the ecology of orchard cover crops, finding that rye-grass and clover mixtures tend to be replaced by creeping bent. The last-mentioned grass, however, is itself good for the purpose. C. Bould, J. A. H. Tol-

* University of Bristol. Annual Report of the Agricultural and Horticultural Research Station (the National Fruit and Cider Institute), Long Ashton, Bristol, 1948. Pp. 250. (Bristol: The University, 1949.)