

amateurs in meteorology were arranged, five of which were vacation courses at the Field Study Centres of Malham Tarn, Preston Montfort and Dale Fort, and three week-end courses at Lasham, Longmynd and Dunstable. Grants for youth service in the new quinquennium will be substantially for refurbishing

and improving existing youth clubs. A grant of £12,750 payable over 5 years from the beginning of 1960 has been promised to the Central Council for the Care of Cripples to establish and develop the Homecrafts Advisory Association for the Disabled.

THE REGIONAL RESEARCH LABORATORY, HYDERABAD

THE annual report for 1959-60* of the Regional Research Laboratory, Hyderabad, is a substantial attractively produced volume printed on hand-made paper manufactured by the Laboratory. It includes lists of research staff, auxiliary technical staff and administrators' staff and of publications and patents, and gives fairly full details of research projects in progress. Most of the projects relate to some industrial process or product, but increasing emphasis is laid on the fundamental aspects of applied problems. A Specialists' Committee, under the chairmanship of Prof. M. S. Thacker, has been appointed to examine the research programmes and make recommendations broadly on the future scope of the research programmes undertaken by the Laboratory.

The work of the Laboratory continues to range over a wide field. In oils and fats, the keeping quality of castor oil and cottonseed oil claimed much attention, as well as the preparation of derivatives. A series of programmes on surface coatings dealt with dehydrated castor oil, its isomerization and styrenation, and the preparation of varnishes from dehydrated castor oil, as well as the preparation of alkyds, emulsion paints, the weathering of paints and the use of cashewnut shell liquid. Syntheses in the quinoline, isoquinoline and thieno-pyrimidine series were directed to the preparation of compounds of potential pharmacological interest, while a process for the manufacture of phenylacetic acid was re-examined, and 8-hydroxyquinoline and 5-chloro-7-iodo-8-

hydroxyquinoline synthesized for treatment of amoebic dysentery. Schemes relating to essential oils and aromatic chemicals deal with palmarosa oil, Indian cinnamon leaf oil and the utilization of Indian turpentine. In addition to entomological work on insecticides, investigations have been carried out on the effect of X-rays on the biological and biochemical characteristics of the spermatozoa of insects.

In biochemistry, the microbiological production of calcium and ferrous gluconate and of citric acid, the effect of cell concentration on the biological properties of individual cells in cell suspensions, and the biosynthesis and metabolism of proteins and nucleic acids have been examined. Programmes dealing with fuel cover the low-temperature carbonization of non-caking Indian coals and the utilization of products of the low-temperature carbonization of coal. Activated carbons and bleaching earths continue to receive attention, and there are programmes dealing with titanium pigments, the manufacture of white cement from feldspar and the preparation of catalysts for the low-pressure hydrogenation of tar. Physico-chemical investigations dealt with the mineralogical composition of the bleaching earths, spectro-photometric work on tar acids from low-temperature carbonization, the surface properties and heat of wetting of absorbents and catalysts.

Under chemical engineering is included work on the vapour-liquid equilibrium of fatty acids and tar acids; the fluidized activation of carbon; pilot plant production of lævulinic acid and loughinin (a synthetic flavouring agent); and pilot-plant investigations in the milling of cotton seed and castor seed.

* Regional Research Laboratory, Hyderabad. Annual Report, 1959-60. Pp. xiv + 217. (Hyderabad: Regional Research Laboratory, 1961.)

BIORHEOLOGY AND MICROCIRCULATION

FOLLOWING a reception at the Hadassah Visitors' Club, a seminar on biorheology and microcirculation was opened on April 24 at the Medical School, Jerusalem, by Dr. K. J. Mann, the general director of Hadassah, and delegates were also welcomed by Prof. M. Rachmilewitz, dean of the medical school, Hebrew University.

Dr. E. Davis (Jerusalem) introduced the symposium with a paper on the general nature and problems of microcirculation as studied by optical and electron microscopy. A main problem is how the capillaries change in diameter—whether passively in response to changes in blood content, or actively in response to nervous or chemical stimuli. How red cells pass through the apparently intact capillary is also still a mystery, nor are the spontaneous changes in calibre

and rate of flow of blood in the small vessels understood.

Introducing the biorheological aspect, Dr. G. W. Scott Blair (Reading, England) outlined briefly the history of the application of rheology, "the study of the deformation and flow of matter", to biological systems. Poiseuille, a pioneer of rheology, and Bingham, who named this branch of physics and organized the first society of rheologists, both worked on problems of blood-flow. Biorheologists now study many other systems, such as muscle, protoplasm, cervical mucus, synovial fluids, bronchial mucus, intraocular and cerebrospinal fluids, strength of bones, etc.

Dr. H. Harders (Hamburg, Germany) stressed the technical difficulties involved in direct microscopic observations of microcirculation *in vivo*. But the

importance of such studies is undisputed. Many diseases have microcirculatory aspects, and some, such as sickle-cell disease, cold haemagglutination syndrome, polycythaemia and haemorrhagic thrombocythaemia, are primarily disturbances of microcirculation. The influence of vaso-active drugs and of smoking can be studied by microscopic examination of capillaries. Dr. Harders concluded by predicting that microvascular observations would, in future, play an essential part in routine examinations.

Dr. J. W. Irwin (Boston, Massachusetts) showed, with a film, the pulmonary microcirculation in the living rabbit. The arterioles, capillaries and venules could be seen, and the pulsating flow was readily observed. Pharmacological reactions were also demonstrated. A capacitance electromanometer was shown which could be used, provided that the tip of the microcannula was less than 20μ in diameter, but a more efficient manometer would be needed if true capillary pressures were to be studied.

Dr. J. Weinman and Dr. M. Manoach (Jerusalem) described photoelectric techniques for studying the peripheral circulation in man. Living tissue is transparent to those wave-lengths of red and infra-red radiation at which measurements of extinction coefficients of blood are generally made. Quite cheap incandescent lamps and photoconducting cells may be used as radiation sources and detectors to follow pulsating flow of blood and vasomotor action. Photocells and light sources are combined in a small unit, attachable to any part of the body. Such stimuli as postural gravitational changes and smoking may be studied in this way.

The last session at Jerusalem was opened by Prof. A. Katchalsky (Rehovot), who described differences in osmotic fragility under normal and gradual conditions of haemolysis. Under normal haemolysis, stresses develop rapidly and rupture the cell membrane. Under slow haemolysis a higher hypotonicity is required. The membrane behaves as a Kelvin body with a characteristic retardation time. Dr. D. Danon (Rehovot) showed two phase-contrast microcine films illustrating deformation, shearing and haemolysis of normal human erythrocytes under gradually decreasing salt concentration. Mixed ion exchangers and also dialysis through a 'Cellophane' membrane were used to reduce salt concentrations. Dr. G. Segré and Dr. A. Silberberg (Rehovot) studied the radial distribution of rigid macroscopic spheres in a Poiseuille field of flow, showing that particles undergo a sideways displacement, both from the centre outwards and from the tube wall inwards. Although these results should be applied with caution to flow of blood, M. G. Taylor, scanning a capillary optically and measuring absorption along a diameter, has shown a similar 'tubular pinch' effect.

The second part of the programme, held at the Weizmann Institute of Science, Rehovot, opened with a paper by Dr. S. Lazarus, Dr. H. N. Munro and Dr. G. H. Bell (Glasgow) on capillary strength tests in scurvy and their reactions to vitamins C and P therapy. Both positive and negative pressure tests were used on three small groups of subjects of about the same age: (1) fifteen cases of scurvy; (2) twenty-nine hospital in-patients without scurvy; and (3) twenty well-nourished hospital visitors. Negative pressure tests were inconclusive, but positive pressure tests showed some weakness in the capillaries of scurvy patients, though more than a quarter of them fell within the normal range of

group (3) subjects. Treatment with vitamins C and P did not increase capillary strength. The authors tentatively suggested that it was not scurvy which produces capillary weakness, but that subjects with already weak capillaries are perhaps more prone to develop scurvy.

Dr. S. Ben Hador, Dr. E. Davis, Dr. J. Landau and Dr. M. Ivri (Jerusalem) discussed the effect of adrenaline on the small blood vessels of the conjunctiva and nailfold, concluding that these vessels are more sensitive to adrenaline in the presence of hypertension than when blood pressure is normal. As an example of the results presented: injecting 0.4 mgm. adrenaline produced severe thinning in the small vessels of the nailfold in two of seven healthy subjects, and appreciable thinning in two more cases; whereas, among eleven hypertensives, severe thinning appeared in six, and appreciable thinning in five, cases. Among ten arteriosclerotics, there was no severe thinning and there were six cases of appreciable thinning.

Dr. J. W. Irwin (Boston, Massachusetts) discussed microcirculation of the inner ear, and showed a film demonstrating this in living guinea pigs. A remarkable and unexplained finding is that the chemical components of endolymph and perilymph, which the author considered as part of the circulation of the inner ear, appear to differ, although these fluids are separated in one area only by a two-cell thick membrane (Reissner's membrane).

Dr. E. Davis, Dr. S. Ben Hador, Dr. J. Landau and Dr. M. Ivri (Jerusalem) then described observations and experiments on vasomotion in human capillaries. The number of spontaneous changes a minute in calibre or velocity of blood-flow in capillaries is defined as the 'vasomotor count'. In healthy subjects and in arteriosclerotics, the vasomotor count lies normally between 0 and 14, but in hypertension and in diabetes mellitus, two-thirds of the cases showed values greater than 14. Injections of 0.4 mgm. adrenaline showed no change in vasomotor count in healthy subjects, but increases in 7 out of 11 cases of hypertension and also 3 out of 9 arteriosclerotics. The increased vasomotion of hypertension may reflect increased sensitivity to adrenaline.

In the final paper, Dr. G. W. Scott Blair (Reading, England) briefly outlined the history of rheological theory, from Hooke's law of elasticity (stored energy) and Newton's concept of viscous flow (dissipated energy) to modern theories of entropy-high elasticity. Living organisms maintain themselves by preventing fatal rises in entropy through drawing 'negative entropy' from their surroundings. In a steady, as distinct from a static, state a system undergoing an irreversible process requires a rate of increase of entropy having the minimum possible value consistent with external conditions. Dr. Scott Blair predicted that it is along the lines of Onsager and Prigogine's 'irreversible thermodynamics' that rheological theory must develop if it is to deal with studies of living systems.

Prof. M. Reiner (Haifa), who presided at one of the sessions, discussed the function of models in biorheology and, in a final general discussion, views were expressed concerning the future international organization of biorheology, especially the part which might be played by the new international journal *Biorheology*, shortly to appear.

Apart from the technical sessions, there were many pleasant social activities at which the traditional Israeli hospitality was seen to its full advantage.

G. W. SCOTT BLAIR