the quantity of plasma albumin in circulation increases to that found immediately after the infusion stopped; but the increase in total circulating dextran is much less. After 24 hours only 8 per cent of the injected dextran has been recovered in the urine and 65–75 per cent remains in circulation within the vessels, so that about 20 per cent is untraced. The explanation of these changes seems to be that the acute overloading of the circulation produced by the rapid injection of this dextran solution is relieved by the loss of intravascular fluid into the interstitial space, with subsequent slow return over the next 8–12 hours. Similar results have been obtained in shocked patients, and two examples of the rapid and lasting improvement in blood pressure and clinical state were described.

All these volunteers exhibited 'reaction' which could be resolved into two phases, urticarial and vasomotor, that were separated in time. Whereas the urticarial phase may be due to the peculiar characteristics of the dextran used, the vasomotor phase seems to be related to the rapid shift of fluid from vessels to interstitial space.

Finally, Mr. A. R. Lockwood briefly reviewed "The Utilization of Dextran and some of its Derivatives". The current utilization of dextran in non-clinical applications depends largely upon the economic separation of the crude polysaccharide from the crude fermenter broths. Solvent precipitation is the only practical means so far employed, but is costly and must usually be followed by spray or roller drying. Some attention has been directed to using the whole fermenter broth—for example, in oil-well drilling muds and edible syrups. Sugar syrups made by the addition of sucrose to *Leuconostoc* pure cultures form an effective way of conveying dextran into a variety of food products without the problem of prior separation.

Derivatives of current interest include the sulphuric polyesters, which have a heparin-like blood anticoagulant action; some of them have been shown recently to be suitable for clinical use. The carboxymethyl ethers are likely to have superior stabilizing powers compared with the neutral polysaccharides. Other ethers and mixed ether/esters have been described, of which the most interesting is the polymerizable allyl derivative. Attention has been directed to the importance of microbial polysaccharides in soil structure; but the exploitation of dextran in this field may have to follow the development of large-scale, low-cost crude dextrans, possibly from the direct fermentation of natural sugar juices.

The discussion at the meeting was opened by Dr. C. R. Ricketts, who said that he thought dextran production might be regarded as the dextran industry now that there are six or eight factories engaged in it. He thought that the present phase of 'tailoring' the molecules of dextran after its initial preparation would be followed by direct production, by fermentation, of the molecular size and form required. The work on the effect of addition of short-chain dextrans and of sugars to the fermentation mixture in modifying the dextran produced provides a fruitful field for simplification in manufacture of the kind suggested and might have an important effect on making preparations for clinical use.

In reply to a question by Mr. D. Armstrong why dextran of a molecular weight of sixty thousand is excreted by the kidney whereas albumin of similar molecular weight presumably is not, Dr. Fletcher said that molecular shape is also important in excretion and that albumin can be re-absorbed back from urine by the kidney whereas dextran cannot. Mr. A. L. Bacharach suggested that in practice this matter is approached empirically and is not based on purely physiological concepts. In commenting that Prof. Stacey's paper showed the advantages of ultrasonics in achieving uniformity of molecular size, Mr. H. F. Frost asked if this method is used commercially, and Mr. Lockwood replied that there has been difficulty in getting large ultrasonic units of suitable types but that they are now being employed. Dr. D. H. F. Clayson asked if the breakdown of dextran in the body is due to attack of the $(1 \rightarrow 6)$ linkages and, if so, could it be controlled by adding inhibitors such as amylase to the blood. Prof. Stacey replied that there is no knowledge yet on either of these points, for no enzymes which could break such linkages have been isolated from body fluids. An inquiry was made by Mr. H. J. Bunker as to the raw materials for the large-scale development of dextran to which Mr. Lockwood referred, and Prof. Stacey replied that any sugar material can be used, including dextrins, and that recent restrictions in production in the Jamaican sugar industry because of over-production suggest that even raw cane sugar might be available for the purpose. Cane sugar undoubtedly must be one of the most important raw materials of the future. Mr. J. Green asked Mr. Wilkinson what was his evidence for saying that the dextran should not have molecular weight above three hundred thousand for clinical use, and the latter said that above this value aggregation of red cells can be demonstrated and this is said to be undesirable; he thought that this tendency might well not be of great importance, since turbulence in the capillaries could be expected to overcome it.

THE SHIRLEY INSTITUTE

ANNUAL GENERAL MEETING

THE thirty-fourth annual general meeting of the British Cotton Industry Research Association was held at the Shirley Institute, Manchester, on December 10, 1953, under the presidency of the chairman of the Association, Mr. N. G. McCulloch. In his speech Mr. McCulloch referred particularly to the statutory levy that came into operation during 1953, as a result of which all cotton processors in Great Britain now contribute to the Institute and are eligible to take advantage of the services which the Institute offers. He hoped that all new members would take full advantage of this opportunity. Mr. McCulloch also emphasized that firms who process rayon and synthetic fibres are encouraged to continue in membership or become new members, since so much of the Institute's work is concerned with, or applicable to, these fibres as well as to cotton. The honorary treasurer of the Association, Mr. J. Lindley, also referred to the levy, and paid special tribute to the generous way in which the industry had responded to the appeal for funds which it had been necessary to make in order to tide the Institute over the period before the first collection of the levy.

Dr. F. C. Toy, director of research, presented his annual report and directed attention to the more important of the year's activities. He mentioned especially two essays in the educational field: the travelling exhibition of the Institute's work on sizing

and weaving, and a course of lectures on card-room planning which had been given at the Institute and attended by more than a hundred and fifty mill representatives. Dr. Toy referred to the importance of work proceeding on mixed fibres, particularly mixtures of natural and synthetic fibres such as cotton and nylon. All in all, he said, the year had been an exciting one, marked by advances on both the scientific and technological fronts.

In the laboratories, which were open for inspection after the meeting, many of the researches attracted particular attention. The most interesting exhibit for spinners was the 'Shirley opener', a machine which had already attracted considerable attention at the exhibition of textile machinery at Belle Vue, Manchester. Separating lint from trash aerodynamically, by the use of stream-line air flow, it saves space and time in the mill. For the more scientifically minded, an apparatus for examining stroboscopically the form of ballooning yarns on spinning machines and for measuring the tension was shown, as were various devices for following the movement of fibres during drafting and measuring the forces involved. In the experimental spinning-room there was further evidence of work designed to improve quality and productivity.

In the Weaving Department, the automatic size-box was on view. By the use of this device, which employs a new principle of control that is independent of such factors as the viscosity of the hot starch paste, or size, which is used for protecting the yarn in weaving, warp yarns can now be prepared for weaving in such a way that there is complete and automatic control, at the machine, of the amount of solid material applied to the yarn. The Institute has for many years concerned itself closely with the problem of finding sizes that give good performance in weaving and with analysing the effects of the lubrication and adhesion provided by the size ingredients, and more recently there has been particular emphasis on the relatively difficult problem of finding sizes for hydrophobic fibres such as nylon and 'Terylene'. A small-scale sizing equipment, in which all the variables are under control and on which small quantities of yarn can be sized rapidly, was shown.

The 'Shirley rayon loom', which has been designed to take account of all the physical and engineering knowledge that has been gained from researches into weaving and loom mechanisms over past years, could not be shown as it is still being developed in co-operation with a loom manufacturer. However, the separate mechanisms, some of which were also shown in the travelling weaving exhibition, were to be seen. These have been designed by physicists and engineers working together, and prototypes have been developed in the Engineering Department.

The staff of the Finishing Department were able to discuss with members their work on physical and chemical problems over a large field. The behaviour of pressure bowls during calendering and mangling has been examined in a preliminary manner photographically, and, in the calender, more carefully and accurately by a photoelastic technique which has given interesting results. The experimental calender and mangle constructed in the engineering shop were shown. The chemical engineering section of the Department is interested in two main problems: drying, with the emphasis on convection and suction dryers; and fluid flow with particular reference to the dyeing of closely wound packages. The experimental equipment in a new and well-equipped laboratory of this section was shown for the first time. Physicists and chemists shared in discussing with members the work on printing. The young science of rheology comes into its own in this branch of the textile industry, since the non-Newtonian materials used for printing on fabrics are used at a wide range of rates of shear. The chemists find great interest in the consideration of starches and gums used in printing pastes.

In the Rayon and Silk Departments two problems of great interest to the chemist are under consideration. In the Rayon Department, work has proceeded for some years on the fractionation of regenerated celluloses according to their molecular weight, using osmotic and viscometric methods for the determination of molecular weight, together with an ultra-centrifuge designed and built at the Institute. This work has now reached the interesting stage where the physical properties of fibres prepared from specific fractions are being examined. In the Silk Department, the recent rapid developments in paper chromatography have been of considerable help in the problem of elucidating protein structure, with particular reference to the main constituents of the silk fibres fibroin and sericin. The more chemically minded visitors also found plenty to interest them in the fundamental work of the Chemistry Department, where the particular interest for many years has been the light shed on the structure of cellulose by studies of its oxidation.

The Physics and Physical Testing Departments are now housed in the new building, completely occupied for the first time in April 1952; some members were still interested in the design of the building, and particularly in the disposal of services and the means adopted for ensuring controlled humidity and temperature throughout the laboratories. Many were interested in the activities of the Testing Department, for it is there that much of the work on quality control is carried out, and particularly in the design of instruments. It is there also that much of the programme on blended fibres will be done, since the accumulated knowledge on the structure and mechanics of textiles lies there. Much of the more fundamental work on the physical properties of textile materials is done in the Physics Department; but perhaps of greatest interest to visitors was the work on the 'barrier' properties of textiles. Textile materials are almost invariably used as a barrier to something; it may be to heat, light, sound, water, water vapour, etc. Much work has been done, and will continue to be done, on the production of textiles which allow the passage of water vapour but not of water. More recently work on the properties of textiles as a barrier to dirt has been started, and it is hoped that in time much information will be obtained on the mechanism of soiling. In the meantime, members showed interest in an apparatus which has been developed in the course of this work for the convenient and rapid measurement of atmospheric dirtiness. Not entirely dissociated from soiling is the topic of static electricity, its cause, formation and dissipation. This has been a subject of fundamental interest for some time, and the apparatus used was available for inspection.

Lastly, mention must be made of the work being done on the cotton fibre. In addition to the large amount of co-operative work with the Raw Cotton Commission, Empire Cotton Growing Corporation and other bodies, in which physical and practical tests of cotton, new and old, are carried out, there is

great interest at the Institute and in the industry in the question of instrumentation, and particularly the possibility of forecasting the spinning properties of cotton from physical measurements. Members could see a range of such instruments, including some of foreign manufacture and some made at the Institute. The problem is not an easy one, and indeed may not be completely soluble; but advance has been made, and broad differences in the spinning properties of cotton can now be detected rapidly with the aid of purely physical tests.

OBITUARIES

Prof. H. H. Dixon, F.R.S.

THE death of Prof. Henry H. Dixon on December 20 severs a link with a past generation of botanists and with a classic advance in botany. He was born on May 19, 1869. He was one of a family of seven brothers and two sisters; two of his brothers, and previously his father's brother, were university professors. He had a distinguished career as a student in Trinity College, Dublin, being a classical scholar of some note; he then added to his laurels by obtaining a natural science 'moderatorship', taking first-class honours, and continued his studies under Strasburger in Bonn, under whom he commenced research in the two major fields to which he contributed so much in later life.

Bonn was a centre of cytological work and, though it is often forgotten now, Dixon was a contributor of some note in the Strasburger school to the work then being done on meiosis. A later paper communicated to the Royal Irish Academy in 1895 was probably the first expression of the view that the appearance of bivalents is due to the approach together of chromosomes, rather than to the splitting of some pre-existent structure, thus giving the first indication of a 'reduction division'. His observation of "waves of nuclear division" passing across endosperm suggested a mitotic hormone, an observation which has yet to be investigated more fully.

Dixon's interest in cytology and his contributions to it were, however, completely overshadowed by the importance of his work on movements of water and on the status of water, or water relations, in the plant.

His life-long friendship with Prof. J. Joly had, as one of its fruits, the close collaboration between himself, a botanist, and a physicist, and from this emerged the classic theory, spoken of as the 'cohesion theory', to explain the rise of water (sap) in trees and other plants. This hypothesis was developed in the 1890's and extended by notable contributions on the cohesion of water and of sap and by a series of papers on the osmotic relations of plant tissues.

Dixon's originality of mind showed itself in many suggestions which were not followed up in the rather small School of Botany of Trinity College, Dublin. As early as 1892 he had shown how to grow seedlings in sterile culture, and foreshadowed, had the method been developed more fully, the tissue- and root-culture techniques so much used at the present time. He suggested the differential manometer for estimation of respiration-rates in 1902, though he did not develop it as a research instrument. Prof. Dixon also suggested (in a letter in *Nature*) the mutagenic effects to be expected of cosmic radiation, before Müller and the genetical world had come to accept or even consider this view.

In later years his work on transport of solutes and on permeability caused him to suggest hypotheses which, while not accepted later by himself or others, proved to be an effective stimulus both to his own student, Mason, and many other workers elsewhere.

Recognition of Prof. Dixon's qualities came relatively early; he succeeded to the chair of botany in Trinity College in 1904 and was elected to fellowship of the Royal Society in 1908. He was awarded the Boyle Medal of the Royal Dublin Society in 1917 and gave the Croonian Lecture before the Royal Society in 1937. He had been president of the International Botanical Congress and of the Royal Dublin Society, and also of Section K (Botany) of the British Association. He was an honorary fellow of Trinity College, Dublin, an honorary member of the American Society of Plant Physiologists, a Commissioner of Irish Lights and played an active part in many other national and international organizations.

The importance of the School of Botany in Trinity College, Dublin, under his guidance causes one to forget that the staff of this School during sixty years has been only two—the professor and his assistant. No memoir, however short, would be adequate if it referred merely to Prof. Dixon's academic distinction without mention of his very genial personality and of the atmosphere of the School of Botany in Trinity College, Dublin, which he created and which, unfortunately, owing to its small size, so comparatively few of the younger generation of botanists have been able to enjoy.

T. A. BENNET-CLARK

HENRY DIXON began his university course in natural science under two good men, E. P. Wright, Sir Almroth's uncle, and H. W. Mackintosh, a wonderful lecturer, who looked down his microscope and saw the marvellous works of his Creator. He knew and taught that life begins with a single cell and develops in an orderly manner.

Wright, systematist and traveller, enriched both the Herbarium, which housed Harvey's type specimens of algæ, and the lovely Botanic Gardens. Dixon, soon his successor, opened his own professorial sessions with an introduction to the microscope and went on to unicellular organisms. He illustrated the great ideas of evolution and heredity by precise studies in cytology and morphology. No one could escape a knowledge of bacterial and fungal infection, or of elementary ideas in general physiology.

It was my good fortune to begin under Wright and Mackintosh, and to be in Prof. Dixon's first class. I accordingly witnessed the development of his fine course, published as "Practical Plant Biology" (1922 and 1943). Years afterwards a distinguished surgeon told me that it was the first thing that had really made him think. For the practical classes, which might run to 150, about a dozen demonstrators were taken on.

The successes of later years stemmed from Dixon's careful planning of the School of Botany, opened in 1907, which replaced the few residential rooms in the Front Square. The new Herbarium was added in 1912. The moving of collections and elimination of insects was heavy work. Into the eight-acre Botanic Gardens, moved to Balls Bridge in 1806, Dixon had up to some twenty years ago introduced more than seven thousand species, including Arthur Kerr's notable collection of Siamese orchids which Sidney Wild, the head gardener, tended so sedulously.