observations on the sensitivity of the hæmolytic system in complement fixation tests and showed the greater reliability of modern modifications in the tests, for example, for syphilis. Mr. I. Dunsford, of the Sheffield Blood Transfusion Service, was able to draw on an extensive practical experience in discussing the difficulties encountered when selecting suitable blood for transfusion purposes. His main point was that no one test should be relied upon when cross-matching blood but that saline and albumin techniques should always be employed, with the addition of the Coombs test in cases where there was a risk of the patient having been immunized by previous transfusions or pregnancies.

In addition to these and other papers, numerous demonstrations were on view all the week. For the first time at an Institute conference a large number of foreign laboratory workers were present, and an evening was spent on discussion of matters of common interest. Another innovation was a demonstration for the public who, generally speaking, are not very knowledgeable about what takes place in the hospital laboratory. This demonstration, the result of much co-operation between local pathologists, technicians and many others, was open for only three hours on each of two successive evenings; but the success of the experiment may be judged by the fact that during this short time more than a thousand people visited it.

PRESERVATION OF FOOD BY IONIZING RADIATIONS

THE traditional methods available for the preservation of food are several and varied in their nature. The almost prehistoric method of drying involving the use of solar radiations—unrecognized as such—was the subject of much research some years ago, and this work was very useful to Great Britain during the Second World War when there was a great shortage of shipping space. Some of the chemical preservatives, studied by the 1924 Departmental Committee of the Ministry of Health, often 'blunderbuss' in function, are virtually unused outside the British Isles where those of more recent introduction have been found acceptable both by the industry and the authorities. The availability of antibiotics—some very specific in their action—has created new problems for those who advise our legislators on the desirability of permitting additions to the schedule of preservatives, for such they are. In the realm of food science, experimentation and development, although more sedate in their progress compared with some of the other branches of science, often outstrip the ability of the manufacturers to take advantage of them.

The initial discovery by Röntgen in 1895 that X-rays can damage and destroy living cells has in more recent years been extended over the broader field of ionizing radiations in general. The situation to date, as recorded in various journals mainly of American origin, is that radiations derived from electrical generators, radioactive elements and nuclear reactions are available which exert a lethal effect upon micro-organisms and insects. Parallel with these observations have been reports of reactions initiated by the exposure of food components to such radiations—breakdown of amino-acids, fats, vitamins and so on. The food technologist faced with a new series of units representing the dosage of the product under treatment has often been in difficulty in grasping the significance of the evidence given in these reports and the very long list of journals in which such reports are sometimes hidden only adds to his confusion. With considerable foresight, the Food Investigation Organization of the Department of Scientific and Industrial Research, as befits its name, has come to the aid of food technologists in providing, through the efforts of Dr. R. S. Hannan, a wealth of information and, let us not delude ourselves, of instruction in its Special Report No. 61 on "Scientific and Technological Problems involved in using Ionizing Radiations for the Preservation of Food"*. The bibliography of some four hundred odd references in this publication will satisfy every collector of reprints and is alone worth every penny of the modest price.

In his survey, Dr. Hannan deals with the ionizing radiations, their generation, their properties and the technical problems associated with their use. Having described the positive advantages of the use of this modern weapon, he very wisely presents for the reader's consideration the various gaps in our knowledge which must be filled before we are able to contemplate using it. The most suitable type of radiation and its optimum dose, the possibility of reactions initiated by such dosage involving the production of undesirable and maybe toxic substances or the destruction of some essential constituent—all these will need to be studied *in extenso* and by teams of workers. We are grateful for the information and for the guidance as to future research, and we look forward to the results of the further researches of Dr. Hannan and his colleagues.

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* Department of Scientific and Industrial Research. Food Investigation Special Report No. 61: Scientific and Technological Problems involved in using Ionizing Radiations for the Preservation of Food. By Dr. R. S. Hannan. Pp. viii+192. (London: H.M.S.O., 1955.) 7*s*. 6*d*.

PHYSICS OF THE IONOSPHERE

THE rapid advances being made in many fields of scientific research leads to a vast amount of published literature in which it is not easy for the student and research worker to discover the real milestones of progress. As a means of partly mitigating this difficulty, there is now an established practice of organizing a conference or symposium at which a particular subject or field of investigation is reviewed and discussed, mainly by those working in the subject. Such a conference forms a suitable focus and also acts as a stimulant to those who otherwise may be rather dilatory in describing their own contributions or putting forward well-founded views on the work of others. The results of such a conference are made of immensely greater value when all the papers which were read and discussed are collected together and published in some recognized standard form.

The conference on "The Physics of the Ionosphere", held under the auspices of the Physical Society at the Cavendish Laboratory, Cambridge, in September 1954 (*Nature*, 174, 866; 1954), meets all these requirements with the publication of the report which is now available*. The report comprises fifty in-

* Physical Society. Report of the Physical Society Conference on the Physics of the Ionosphere, held at the Cavendish Laboratory, Cambridge, September 1954. Pp. iv+406. (London: Physical Society, 1955.) 40*s*.

dividual papers from authors in Australia, Canada, France, Germany, Great Britain, India, Japan and the United States. It is divided into four parts, each of which is introduced by a survey paper, with a most useful selected list of references.

In the first paper in Part 1, entitled "The Lowest Ionosphere", Prof. A. H. Waynick summarizes the recent radio data which may be used as a guide to the possible physical characteristics of the lowest regions of the ionosphere. These characteristics are primarily concerned with the absorption of short waves and their partial reflexion from the lower ionosphere, and the height of reflexion of very long waves. It is pointed out that great advances in our knowledge of the lower ionosphere is likely to occur in the near future. Recent rocket measurements of X-ray intensities in the neighbourhood of 50 A. suggest that this radiation may well be the primary source of energy associated with the formation of the *E* region. In addition, there now appears to be evidence for postulating the existence of a portion of the *E* region due to meteoric ionization. The remaining nine papers in Part 1 describe work conducted in this field in Great Britain, North America, Germany and India.

The second part of the report, "Irregularities and Movements in the Ionosphere", opens with a survey of existing knowledge by Mr. J. A. Ratcliffe. At all heights in the ionosphere there are randomly distributed irregularities in the electron density. Information on these irregularities—their size, shape and movement—is obtained from a study of the fading characteristics of waves reflected from, or transmitted through, the appropriate part of the ionosphere. The study of the fading observed at spaced receiving stations has contributed greatly to our knowledge of the movement of these irregularities. During recent years, measurements of the propagation of very-high-frequency waves by scattering from the *D* and *E* regions and from auroræ are finding increased application. Observations on the scintillation of radio stars also enable drift movements in the *F* region to be investigated. The sixteen papers collected with the survey in this part of the report form a very complete and up-to-date appreciation of the state of experimental and theoretical knowledge of this subject.

"A Survey of Present Knowledge of the *F*2 Region", by Dr. D. F. Martyn, is the first paper in Part 3, and describes the salient features of the *F*2 region, including the production of its ionization, the recombination coefficients, winds and travelling disturbances, and the storms and anomalies associated with this region. While the other eight papers in this section summarize the present state of knowledge, including theoretical speculation, of conditions in the *F*2 layer, a brief reference is made, in an addendum to the survey, to the wealth of information which was obtained by a rocket ascent in May 1954 to a height of 219 km. A mass-spectrograph was used and data obtained on the composition and pressure in the upper atmosphere. While the results await confirmation, this is undoubtedly an indication of the success of a new technique for exploring the ionosphere.

The fourth and final part of the report deals with "The Mathematics of Wave Propagation through the Ionosphere", and is surveyed by Mr. K. G. Budden. With thirteen other papers, this section describes the mathematical technique used in the study of the properties of the ionosphere, and particularly the variation of ionization density with height, the resulting refractive index and the paths of radio waves in traversing the various ionospheric layers. This section is complementary to the previous three and makes the whole report a comprehensive work of reference which will be of the greatest value to students and research workers for many years to come. The publication of the report must be a very gratifying conclusion to the efforts of Mr. Ratcliffe and his colleagues who were responsible for the conception and organization of this conference.

AUXIN AND PROTOPLASMIC STREAMING

IT has now been known for some considerable time that indoleacetic acid and other growth-regulating substances increase the rate of protoplasmic streaming, but no generally accepted explanation of the phenomenon has yet been advanced. J. M. Kelso and J. S. Turner (*Austral. J. Biol. Sci.*, **8**, 1, 19; 1955) have now reported on the action of various growth-regulating substances on streaming in single cells of the staminal hairs of *Tradescantia virginiana*.

As the rate of protoplasmic streaming in these cells is not affected by change of oxygen concentration in a hanging drop enclosing the hairs over the range 1·5–100 per cent of oxygen in the surrounding gas phase, experiments can be carried out without continuous renewal of the water drop. It was observed that, over the physiological range of concentrations, indoleacetic acid, indolebutyric acid, naphthaleneacetic acid and 2,4-dichlorophenoxyacetic acid, all modify the rate of protoplasmic streaming. These substances, added alone, bring about changes in the rate of streaming within 10 min.; maximum effects are reached in 30 min., and the rates return to the normal in 60–70 min. (exceptions to this rule are noted for naphthaleneacetic acid (high concentrations) and 2,4-dichlorophenoxyacetic acid (low concentrations)). Low concentrations of the auxins stimulate the streaming, high concentrations depress the rate, and intermediate concentrations are without effect.

Auxins thus affect streaming much as they do the growth of stems, the optimal concentrations for stimulation being similar for both processes. The 'total effect' for each growth substance may be estimated as the total extra or diminished distance travelled by a protoplasmic particle in the presence of the applied substance. The maximum positive total effect is given at 1 mgm./l. (1 p.p.m.) for indoleacetic acid and indolebutyric acid, and at 5 mgm./l. for naphthaleneacetic acid. There is a marked *p*H effect for the reaction of streaming to indoleacetic acid, increase in *p*H rendering the applied solution much less effective over the whole range of concentration. The temporary effects of indoleacetic acid on streaming, both stimulation and inhibition, are stabilized near their maximal values, if fructose or malic acid is added with the auxin. These results largely confirm those obtained by Thimann and Sweeney for the *Avena* coleoptile, except that the concentration for indoleacetic acid giving maximal total effect for *Avena* is as low as 0·01 mgm./l. Moreover, for *Avena*, malic acid not only stabilizes the auxin effect but also alters the threshold of response.