sciences that the peace and prosperity of the world will largely depend. Until recently there have been far too few careers open to young biologists outside the field of the medical sciences. There has been nothing corresponding to the Colonial Service, which has offered to young administrators a life of adventure nicely seasoned with economic security. All members of the British Association will therefore welcome the intention of the Government to inaugurate a Colonial Scientific Service, and will hope that the conditions of service will be such as to attract young men of the highest quality.

Challenge of the Times

We live, indeed, in difficult times. But they are very interesting times; and difficulties are bracing to a nation which has not lost the resilience of youth. We must not get into the way of thinking of our great country as an elderly man who is told by his doctor that if he is very careful of his diet, and avoids all exertion and worry, he may look forward to some years of placid life before he dies. This is a time for adventure; for taking risks. Calculated risks, of course; but not so nicely or so lengthily calculated that they are taken too late. My contacts with universities and with industry are not now so frequent or so close as I should like them to be; but they are enough to convince me that the spirit of adventure in science is as lively as it ever was. It is that spirit which will largely determine the future. Many years hence, when a president of the British Association reviews the progress of the nation from the depths of bankruptcy to new and unsurpassed heights of prosperity and influence, he may well have occasion to refer, as I did at the beginning of this address, to the great influence of the work of a few young men who are now unknown to the public; and he may justly claim that the chief cause of the change was that we had found the right way to combine originality in science with enterprise and speed in its application.

SUMMARIES OF ADDRESSES OF PRESIDENTS OF SECTIONS

RECENT ADVANCES IN THE STUDY OF THE CRYSTALLINE STATE

IN his presidential address to Section A (Mathematics and Physics), Sir Lawrence Bragg points out that X-ray analysis of crystals may be said to have attained its majority this year. Its importance has been recognized by the formation of an International Union of Crystallography, and it takes its place with the other branches of science which have unions of their own. Laue discovered the diffraction of X-rays by crystals in 1911; now most universities have an active centre devoted to the investigation of the arrangement of atoms in matter by means of X-ray diffraction. Sir Lawrence has worked in this field from the beginning, and takes the opportunity which this address affords to review what has been accomplished in little more than a generation. X-ray analysis is a typical border-line subject. Its successes are interesting to the chemist, mineralogist, metallurgist and biologist as well as to the physicist, and this is perhaps its most attractive feature.

In X-ray analysis in general, we are seeking to interpret the manner in which a substance diffracts X-rays owing to the spatial arrangement of its atoms. Two main lines of work may be distinguished. On one hand, there is the analysis of the pattern of the perfect crystal, where the atoms have taken up positions of equilibrium under the influence of the interatomic forces; from the conformation of the structure we can gain a deep insight into the nature of these forces. This study is principally of interest to the chemist, because it presents him with a scale plan of the chemical molecule and of the way molecules or ions are held together by the intermolecular forces to form a solid structure. The results of X-ray analysis have had a profound influence on chemistry and mineralogy and solved many problems. A steady advance has been made in tackling more and more complex molecules, and a stage has already been reached where such compounds as the sugars, strychnine, sterols and penicillin can be analysed, to take a few examples. We would like to pass on to the study of such high complexes as the molecules which form part of living matter—nucleic acids, proteins and others.

The other side of X-ray analysis is concerned with what we might call the 'geography' of atomic arrangement in matter. The perfect crystal is an ideal which is rarely attained. Even if the substance is pure it is composed of a mass of crystals, and we are interested in the size and shape of the crystallites and their growth, in allotropic change, and in their preferred orientation and state of strain after mechanical treatment; if complex, we are interested in the fitting together of the crystallites of different kinds. Metastable structures often exist in which there is partial separation into regions of different composition, while a continuous crystal lattice is preserved though in a distorted form, as in the permanent magnet alloys, in martensite, or in age-hardening alloys. We can study the distortion of the lattice by the thermal waves at high temperatures. Amorphous and semi-crystalline matter can be examined. All these aspects of structure are of prime interest to the physicist and metallurgist. They are vitally interesting to the technologist, because the geography of the structure has a profound influence upon its mechanical, electrical and magnetic properties.

In this address, Sir Lawrence reviews the active centres carrying out X-ray investigations in Great Britain; examples are given of recent work, presenting a picture of what has already been achieved, and indicating the lines of exploration which are now being pursued.

SPECIALIZATION AND CULTURE IN CHEMISTRY

PROF. JOHN READ, president of Section B (Chemistry), deals with some of the problems of increasing specialization in chemistry. The growing burden of new knowledge in chemistry, as in science generally, has created many new problems for the student, teacher and research worker. These problems are largely bound up with the growth of

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