British Institute of Radiology

ANNUAL CONGRESS AND EXHIBITION

THE eleventh Annual Congress and Exhibition of the British Institute of Radiology was held, as usual, at the Central Hall, Westminster. The Congress was opened on December 8 by the president, Dr. R. J. Reynolds, in the presence of Her Majesty Queen Mary, who, before the opening ceremony, made a tour of the Exhibition and took a great interest in the various items shown.

The papers read at the Congress dealt with X-rays in industry, the medical ones treating the use of X-rays in industrial diseases, and the physical papers dealing with X-rays in industrial research. The latter symposium, held on December 9, was opened by Dr. G. Shearer, who pointed out that technical advances in materials followed largely on advances in the detail with which the materials could be studied. Great progress had followed improvements in the microscope, while the development of the 'X-ray microscope', which revealed the inner structure of materials, had resulted in further striking developments. Among the main properties of solids revealed by X-ray methods were their compositions, grain sizes, the orientations of the constituent crystals and their states of perfection. As examples, he quoted the importance of grain size in paints and electrolytic deposits, and stated that imperfectly formed crystals were desirable in steels intended for permanent magnets and perfectly formed crystals for transformer steels.

Dr. H. J. Gough and Mr. W. Wood read a paper on the use of X-ray methods in the investigation of failure in service, which dealt with one phase of the problem of fatigue. Stressing the importance in design of an accurate knowledge of the strengths of materials, the authors pointed out that apparent strengths depended markedly on whether the stresses were continuous or cyclic. From a knowledge of atomic constitution it was possible to deduce values for the strengths of materials, but these were usually found to be far greater than those obtained in practice. It had been thought that the discrepancy was possibly due to flaws, but in that case it was difficult to understand how relatively consistent values of the strengths could be found. Even before X-ray studies were undertaken, it had been found that the failure might be due to some change in the micro-structure of materials, particularly of metals. X-ray studies of stressed metals had shown that the sizes of the crystal grains remained constant over the region in which Hooke's law was obeyed, but at the yield-point there was a break-down in the crystal grains, which continued until a more or less homogeneous 'crystallite' structure was obtained. This breaking-down of grains seemed to give a power of accommodation to the material, and fracture only occurred when all the grains had broken down and the accommodatory power ceased. With cyclic stresses similar phenomema were observed, with the important difference, at present not understood, that deterioration of the material in this case is local, whereas with continuous stresses it is general. The authors stated that many problems remained unsolved, one of the most important being the reason for the crystallite structure, which implies a kind of 'crystal molecule'.

Dr. W. T. Astbury discussed X-rays and wool fibre, pointing out that wool, in common with other organic materials such as hair, horn, muscle, etc., consists of bundles of long polypeptide chains somewhat like a 'sliver' of wool on a minute scale. Wool, he said, is characterized by great elasticity and in favourable circumstances can be stretched to twice its natural length, and will recover when the stress is removed. Study of the material by X-rays and by other methods showed that wool has a kind of 'step-ladder' structure consisting of long chains of molecules, cross-linked by side chains. The chains were normally folded, but in the presence of water the chains could be straightened and would recover. This accounted for the power of recovery of shape by woollen garments after stretching when wet. At higher temperatures (steam) the side-chains were hydrolysed, and the material largely lost its power of recovery. This fact was made use of in various industrial processes including the 'permanent' waving of hair. X-ray studies had revealed clearly two definite states, normal and hydrolysed, and had shown the underlying nature of the change.

Dr. A. J. Bradley and Mr. H. Lipson read a paper on a "Rapid Survey of Ternary Alloy Systems by X-rays", pointing out that at present it is not known why the various alloys of three metals, for example, copper, nickel and iron, have such varied properties. The crystalline form of the alloys is usually cubic and most commonly consists of face- or body-centred cubes, and often a mixture of both. Although microscopic examination will show the main features of the systems, careful X-ray examinations are necessary to find the complete diagram, as in many cases the various zones are very narrow. The authors stressed the particular necessity of studying the alloys in great detail so that the finer points should not be missed.

The twentieth Silvanus Thompson Memorial lecture was given by Prof. J. A. Crowther, his subject being "The Biological Action of X-rays: a Theoretical Review". Pointing out that, on account of simplicity of experiment, most recent research had been carried out with single-celled materials, Prof. Crowther said that the cells showed marked variations in radio-sensitivity during their life-history, young cells being more sensitive than older ones and cells about to divide being particularly sensitive. Lethal doses of X-rays ranged from 40 röntgens for the most sensitive states to 35,000 röntgens in the insensitive states. Intermediate doses, insufficient to cause the death of the cell, may prevent normal cell-division and may produce mutations. It appears that the sensitive unit is not the complete cell or its nucleus, but some smaller structure, possibly sub-microscopic in size. This might account for the insensitivity of normal cells, which are virtually homogeneous structures.

Considerations of the energetics show that such effects can only reasonably be expected on the basis of a localized quantum action. Two theories of the mechanism of radiation-action had been put forward,

one based on the possibility of a poison being formed, and one suggesting a direct or 'bullet' action, which may be due to the direct action of the quantum of radiation energy, to the production of an ion-pair or to the passage of an electron track through the sensitive part of a cell. Consideration of wave-length effects should ultimately show which is the true explanation.

Dealing with the two theories as to the mechanism, Prof. Crowther pointed out several objections to the poison theory: the objection that the amount of poison was small (100 r. producing a concentration of the order of 1 poison molecule in 10^8 normal molecules) was not considered valid, but other evidence concerning temperature effects, variations of effects with dosage rates and times seemed to point against the theory. Further, the known survival and mortality curves could only be considered consistent with the poison theory on the basis of certain unlikely assumptions. On the other hand, the 'bullet theory' rationally explained most of the observed facts, including the insensitiveness of the reactions to temperature variations. In due course it might be hoped that the mechanism would be understood, and at present Prof. Crowther thought that possibly the root cause of radio-biological action might be found in the variations of the electric charges on colloidal particles when irradiated.

The Research Section of the Exhibition contained exhibits from fourteen individuals and institutions, illustrating research in technical, biological and physical problems, and included examples of early apparatus and radiographs. In the Industrial Exhibition was shown a commercial X-ray tube for operation at 1,000 kilovolts. In this tube the electrons are excited in three stages, each of 400 kilovolts, and the tube may be operated either with one pole earthed or in the balanced arrangement.

Nicotinic Acid and the Pellagra-Preventing Vitamin

IN an address to the Birmingham University Biochemical Society, on December 9, Dr. Leslie Harris, of the Cambridge Nutritional Laboratory, referred to the findings in some current work on the chemical nature of the pellagra-preventing factor.

Dr. Harris said that the suggestion of a connexion between nicotinic acid and 'vitamin B' is not a new one. About twenty-four years ago, Funk in England and Suzuki in Japan succeeded in isolating nicotinic acid from active 'anti-neuritic' concentrates, and it was once supposed that nicotinic acid might in some way be related to vitamin B_1. But later investigations proved conclusively that pure nicotinic acid itself had no anti-neuritic action, and there the matter was left for some years, although the possible physiological importance of nicotinic acid was emphasized by the discovery of Euler that the acid amide of nicotinic acid is a component of cozymase. Recently, however, it has been found that nicotinic acid or its amide has a growth-promoting action for certain micro-organisms (Knight, Mueller, Holiday), and for pigeons or rats kept on various diets deficient in some portion of the B_2 complex (Funk and Funk; Frost and Elvehjem). Special importance attached to the statement of Elvehjem and his co-workers that nicotinic acid or its amide was curative of 'blacktongue' in dogs; and work has now been done to link these new results with observations made at the Cambridge Nutritional Laboratory a year or so back. Here experiments by Birch, György and Harris showed that what had hitherto been called 'vitamin B_2' consisted in reality of three distinct factors, namely, lactoflavin, vitamin B_6 (the 'rat dermatitis factor') and the pellagra-preventing (P.P.) factor proper. The latter appeared to be identical with the 'anti-blacktongue' factor for dogs. More recently, Harris confirmed these results as to the tripartite nature of the 'vitamin B_2' complex and showed furthermore that monkeys also developed a disease ('monkey pellagra') analogous with human pellagra when restricted to a diet deficient in the P.P. factor but containing the other known constituents of the B_2 complex.

A trial of nicotinic acid on monkeys which were developing symptoms of nutritive failure on a diet deficient in the P.P. factor has now indicated that this substance has in fact a curative action: further work is needed, however, to ascertain whether nicotinic acid is the *sole* deficiency in such a diet. Nevertheless, these results and the findings of other workers seemed sufficiently encouraging to warrant a trial on human beings suffering from pellagra.

Through the collaboration of Dr. A. Hassan of the Faculty of Medicine, Cairo, tests under controlled conditions have been made on pellagrins in Egypt. In preliminary trials, two cases of spontaneously occurring pellagra at the Khanka Asylum and three at Abuzaabal Prison were examined, together with three controls. All variables, such as the composition of the basal diet, the amount of work done daily, and the extent of exposure to sunlight were kept unaltered for all subjects. Nicotinic acid given by mouth up to a maximum level of $\frac{1}{3}$ gm. daily was found to hasten the subsidence of the erythema in all the cases. At the asylum, the general condition of the pellagrins was likewise improved, but at the prison the beneficial effect seemed largely limited to the specific action on the erythematous lesions. It may safely be concluded therefore that the nicotinic acid duly rectified a deficiency in these pellagra-producing diets. The results make it seem likely that the prison diets were deficient in some additional factor, and in fact the asylum diet did contain more meat, more greens, was better prepared and included some wheaten bread—the bread at the prison consisting of one quarter of maize. The possibility has therefore still to be borne in mind that nicotinic acid is not the *sole* major deficiency in some pellagra-producing diets—in other words, that pellagra as sometimes seen may be accompanied by more than one dietary error. Apart from this, it seems probable that nicotinic acid (or amide) is the less active form, or 'precursor' of a more active variation of the P.P. vitamin, which can be formed from it within the animal body.