there may not necessarily be any immediate application of the results to manufacturing processes. Pure research of this nature has already been done, as is instanced by the following list of published papers :—

Contrast and Exposure in X-ray Photographs through Metals, by R. E. Slade (Trans. Faraday Soc., 1919, vol. xv., p. 52). A discussion of the effects of various qualities of X-rays on the photographic plate, and the possibilities of using plates to detect very small flaws in the examination of large bodies of metal.

The Fundamental Law for the True Photographic Rendering of Contrast, by A. W. Porter and R. E. Slade (*Phil. Mag.*, 1919, vol. xxxviii., p. 187). A consideration of the conditions which must be fulfilled by photographic materials in order that a true reproduction of the tone-values of an object may be obtained in the final print.

The Emulsion for a Process Plate, by R. E. Slade and G. I. Higson (*Phot. Journ.*, 1919, vol. lix., p. 260). A description of the type of silver halide emulsion most suitable for a process plate giving great contrast.

Photomicrography in Photographic Research, by G. I. Higson (*Phot. Journ.*, 1920, vol. lx., p. 140). A description of a special type of photomicrographic apparatus specially designed for high-power work in the examination of emulsions.

The Photometric Constant, by G. I. Higson (*Phot. Journ.*, 1920, vol. lx., p. 161). A mathematical discussion of the relation between the photometric density and the quantity of silver deposit in a photographic plate.

A New Method of Spectrophotometry in the Visible and Ultra-violet and the Absorption of Light by Silver Bromide, by R. E. Slade and F. C. Toy (Proc. Roy. Soc., 1920, A, vol. xcvii., p. 181). A description of a new method free from certain sources of error, by means of which the extinction curve for silver bromide was determined throughout the visible and ultra-violet regions of the spectrum.

Some Problems in High-power Photomicrography, by R. E. Slade and G. I. Higson (Trans. Faraday Soc., 1920, vol. xvi., p. 101). A contribution to the general discussion on the microscope held by the Faraday Society.

A Simple Non-intermittent Exposure Machine, by G. I. Higson (*Phot. Journ.*, 1920, vol. lx., p. 235). A description of a novel and simple form of exposure machine with which a plate can be exposed to a light of constant intensity for a series of known times.

Photochemical Investigations of the Photographic Plate, by R. E. Slade and G. I. Higson (Proc. Roy. Soc., 1920, A, vol. xcviii., p. 154). An experimental investigation of the photochemical behaviour of the silver bromide grain, from which an expression connecting intensity, time of exposure, and effect on the grains can be deduced.

The Absorption of Light by the Goldberg Wedge, by F. C. Toy and J. G. Ghosh (*Phil. Mag.*, 1920, vol. xl., p. 775). An investigation of the neutrality of the Goldberg wedge, showing that this neutrality is confined to the visible portion of the spectrum.

Before the war the manufacturers of cameras made use of wood which had been stained black right through. It was obtained from Germany, and was not procurable in England after the outbreak of war. The research association undertook the investigation of such a staining process, with successful results, as may be seen by reference to English Patent No. 17,638/19. It now remains for the manufacturers to develop the process on a commercial scale. At the same time, a quick process for staining wood brown right through was devised.

The methods of making sensitive emulsions for coating on plates and papers have been brought to a high standard of excellence by the various English manufacturers. To a large extent, however, the methods used are the result of experience, of trial and error; different manufacturers obtain similar results by widely different methods. An inexhaustible field of work is open for the definite correlation of the physical and chemical properties of the materials used with the methods employed and the sensitiveness and other characteristics of the emulsion obtained. A commencement is being made on this line of work, the technical heads of the various firms putting their experience and knowledge at the disposal of the research association. Any useful results obtained in the research laboratories will then be tested on a large scale in the works, since it is more than usually difficult in emulsion-making to pass successfully from the laboratory to the works scale.

There is also need for improved methods of laboratory testing of the raw materials of the industry so as to establish greater confidence between buyer and seller, particularly in regard to gelatine, bromides, raw and baryta-coated papers, and packing materials.

The literature of photography is very scattered, and, doubtless owing partly to the subtle nature of many photographic phenomena, important details have often been overlooked, with the consequence that the results of different workers often appear very contradictory. One of the objects of the research association is to collect and summarise this literature so that it may be placed at the disposal of the members of the association. Progress is being made in this direction, but it is necessarily slow.

Read and Feb. 10 p. 163.

Obituary.

SIR LAZARUS FLETCHER, F.R.S.

BY the death of Sir Lazarus Fletcher, mineralogy loses one who for a long period was recognised as the leading exponent of that branch of science in this country. Born at Salford on March 3, 1854, Sir Lazarus died suddenly from heart failure at Grange-over-Sands on January 6 in the sixty-seventh year of his age. He was educated at the Manchester Grammar School, and afterwards at Balliol College, Oxford, where he held the Brackenbury science scholarship. He obtained first-class honours in mathematical moderations and in the final schools of mathematics and natural science. From 1875–77 he served as demonstrator in physics under Prof. Clifton at the Clarendon Laboratory, and for the next two years he held the Millard lectureship in physics at Trinity College, Oxford. From 1877–80

he was a fellow of University College, Oxford. While at the Clarendon Laboratory he became interested in the study of crystals, and, as the result, when, in 1878, Mr. W. J. Lewis (now professor of mineralogy at Cambridge) retired, owing to ill-health, from the assistantship which he held in the mineral department of the British Museum, Prof. Story-Maskelyne, who was then keeper of minerals, induced Fletcher to apply for the post. He obtained it, and only two years later succeeded to the keepership.

Almost immediately on taking charge of the department Fletcher was called upon to supervise the removal of the mineral collection from Bloomsbury to its present home at South Kensington. What this meant may best be told in his own words[1]: "Some idea of the nature of this task may be formed if it be pointed out that the cabinets of the table-cases at Bloomsbury were to be made use of in the new gallery, but that the glazed table-tops were to be left behind; that the new table-tops were then lying on the gallery floor at South Kensington, and had as yet no supports; that differences of illumination of the old and the new galleries, and differences of construction of the cabinets, made it necessary that the relative positions of the cabinets in the gallery at South Kensington should be completely different from the relative positions in the gallery at Bloomsbury; that every cabinet had for some time to be turned upside down during the process of being fitted to the new floor; that many of them had to be cut in two because of the interference of the structural columns of the gallery, and new mahogany ends had afterwards to be made and fitted to them. Such a series of operations involves great practical difficulties when the specimens to be removed and arranged are numerous, fragile, and require to be cautiously handled, or are small, portable, and of great intrinsic value, and must be kept under lock and key." Once the collections were put in order, Fletcher devoted his attention to selecting and setting out series of specimens to facilitate the study of meteorites, minerals, and rocks respectively, and prepared a corresponding set of elementary hand books which are models of clear and simple exposition of not readily understood subjects. In 1909 he succeeded to the directorship of the Natural History Museum, which had been vacated by Sir E. Ray Lankester two years before. Unfortunately, a severe illness a year or so before his appointment left him with a crippled constitution, and soon he appeared to lose that keenness and energy which had previously characterised him; and by the time, in 1919, he reached the full age for retirement he was a tired man.

Many honours were conferred upon Fletcher by scientific institutions and universities at home and abroad. He was elected a fellow of the Royal Society in 1889, and was a vice-president from 1910–12, and in 1912 he was awarded by the Geological Society the coveted Wollaston medal. In 1894 he was president of the Geological Section of the British Association at its meeting at Oxford. The Mineralogical Society owes him a special debt of thanks, for to him its success and prosperity are largely due; he was its president from 1885–88, and from the latter year until 1909 served as its secretary. To commemorate such long service mineralogists and other friends subscribed and presented him with his portrait. He was knighted in 1916.

Despite the calls of his official duties, Fletcher found time to devote himself to scientific research, mainly to the subject of meteorites, to their history and constitution and the problems presented in the analysis of these bodies, but also to certain isolated, yet exceedingly important, questions in crystallography. Until the publication of his Optical Indicatrix in 1892 the whole theory of the optical characters of biaxial crystals as presented in the text-books was based on faulty and contradictory premises. With characteristic industry he went back to the original source, and read all Fresnel's early papers on this subject, and found that the latter had followed a perfectly logical and convincing course in his approach to his theory, and had departed from it only when desirous of providing a physical basis for his fundamental hypothesis. Fletcher, in his treatise, shows that the wave-surface for a biaxial crystal can in the manner originally put forward by Fresnel be derived from a simple extension of Huyghens's theorem, and his method is followed in all modern text-books on crystallography and the optical characters of crystals. He was gifted with considerable manipulative skill in delicate experimental work, the best example of which was his remarkable investigation of the morphological and chemical properties of the crystallised form of native zirconia, which was first discovered by him, and to which he gave the name "baddeleyite"; he obtained the whole of the requisite information from a study of a single, ill-developed crystal, which was all the material at his disposal, the analysis being made on the tiny fragments that had adhered to the wax of the crystal-holder.

Sir Lazarus Fletcher was twice married, first to Miss Agnes Ward Holme, who died in 1915, leaving a daughter, and afterwards, in 1916, to her sister, Edith; his widow and daughter survive him. A man of studious habit, of quiet geniality, and gifted with a subtle North-country humour, he will be mourned by a large circle of friends.

[1] "History of the Collections in the Natural History Departments of the British Museum" (1904), vol. i., p. 349.

THE death is announced, at the age of seventy-seven, of MR. THOMAS A. O'DONOHOE, known by his work in microscopy and bacteriology. Mr. O'Donohoe made investigations on the tubercle bacillus and on the anatomy, habits, and metamorphosis of the house-fly, and at the time of his death was studying the winter stages of this insect. He was an authority on the optics of the microscope and photographic camera, and did much work on the mounting of objects for microscopic research.