particular environment. We can only hope to approach the fundamental problem of how this happens slowly and by degrees. Great as have been recent advances in our knowledge of the physics and chemistry of protoplasm, we are still seriously hampered by want of knowledge in attacking even the easier problems of ontogeny. But a successful beginning has already been made, and ultimately, with deeper knowledge and improved technique, we may get back to the embryo, and perhaps eventually to the zygote and the mysterious genes.

Thus it seems that in the causal study of ontogeny lies the nexus which is capable of reuniting the divided branches of pure botany—taxonomy, morphology, physiology, genetics; and this seems to be equally true of the zoological field. Taxonomy is the natural arrangement of the end results of divergent developments: on one side it rests on descriptive morphology, on the other on genetics. Morphology, as a branch of science, should no longer be described merely as a comparative study of structure with the object of tracing phylogeny: it must take cognisance of the causal explanation of forms and structures. Physiology is not adequately described as the study of function, in the sense of the particular "functions" of the adult organism. It is a study of all the *processes* of the organism in terms of chemistry and physics. Supported by increasing biochemical knowledge, it is the essential means of explaining ontogeny. Genetics, during the last quarter of a century, has performed the great service of making clear the mechanism of heritable variation, which, as Bateson long ago said, is the primary problem of evolution. But the secret of the production and variation of organic structure can never be discovered until we know the real nature and the working in development of the genes themselves; and this mighty problem, the ultimate solution of which must lie in the distant future, can only be approached through the biochemical study of individual development. Substantial advance in this direction is necessary before we shall be in a position to determine the real nature of possible factors in evolution other than the redistribution and dropping out of genes—how, for example, the environment can, as it almost certainly does, affect the hereditary constitution of a race of organisms.

From a point of view such as this, botany—and indeed biology at large—should be presented to the student, if his imagination is to be stimulated to the greatest advantage. Thus he will be placed in the best position to understand the real significance of the subject, perhaps to add to it by his own work. It is unnecessary to say that the main material for teaching cannot be derived from the direct causal study of ontogeny, for the very good reason that we know extremely little about it. But the material used in teaching can be selected with the object of constantly laying stress on the facts and problems of development, of insisting on the search for causal explanations, and of the necessity of seeking them by experiment, of abandoning the deep-rooted and sterilising fallacy—still unfortunately instilled into our school children—that usefulness to the plant is any explanation of the appearance of a structure. In this way the student will be brought from the outset to view the science of plants in the right perspective; he will be led to interest in the most fruitful lines of research, and his training will stand him in good stead no matter what kind of plant study he may take up, whether it be a branch of pure botany, or one of its manifold applications to agriculture or to industry, remote as these may be, to all appearance, from the central problems of plant life. So perhaps we may hope to retain in the future that sense of community between botanists which can only be real if it is based on some real underlying unity of outlook.

British Geological Photographs.

By Prof. S. H. REYNOLDS, Secretary of the British Association Geological Photographs Committee.

FROM time to time articles and notes have been published in NATURE on the work of the British Association Committee for the collection of British photographs of geological interest. It is, however, twenty-five years (March 10, 1898, vol. 57, p. 437) since the last of these articles, by Prof. W. W. Watts, appeared. The collection at that time numbered 1750 prints; it now numbers 6310. It might perhaps be thought that this large number would afford a fairly complete record of the subject. This is very far from being the case. Even in the districts most fully illustrated, such as the Belfast district, Yorkshire, and parts of the south and west of England, there is still much to be done, while many parts of Ireland and some of Scotland are still quite unrepresented. It is, in fact, only when a district is so fortunate as to possess a resident who is keenly interested in such work (as Mr. G. Bingley for Yorkshire and Mr. R. Welch for Antrim) that a really adequate series of photographs has been taken. The photographic survey of the Island of Eigg carried out by Mr. A. S. Reid should be mentioned in this connexion.

Probably one of the most important pieces of work of the committee has been to preserve a record of temporary geological features. Particularly instructive examples of such records are Mr. C. Buckingham's photographs of the nailbournes of Kent and Mr. P. B. Roberts's series illustrating the progress of a wave of erosion at Bexhill. The nailbournes or winterbournes so characteristic of many chalk districts are temporary streams, which in some cases only flow when an exceptionally wet season has raised the level of saturation. Some years may pass between the successive appearances of a bourne, and during such a period the possibility of its reappearance may be lost sight of and buildings may be erected in its path. This happened, for example, at Croydon during the first few years of the present century. Mr. Buckingham's photographs, two of which are reproduced (Figs. 1 and 2), show in a most instructive fashion the contrast in appearance of

a spot according to whether the bourne is or is not flowing.

Mr. Roberts's photographs illustrate the remarkable wave of erosion which slowly moved eastward along the south-east coast of England in the winter of 1909–10. We see the esplanade at Bexhill prior to the advent of the erosion wave; the preparations made by means of barriers to lessen its effect; the complete ineffectiveness of these barriers, and the appearance of the coast after the erosion wave had passed on (Fig. 3). Equally interesting is the series illustrating the effects of the "cloud-burst" of August 2, 1891, at Bennachie, near Oyne, Aberdeen, contributed by Mr. J. Ritchie. It may incidentally be remarked that the collection includes no record of the Louth "cloud-burst" of May 29, 1920, and photographs illustrating this would be very acceptable.

Attention may be directed to the series of photographs taken in the caves of the Mendips by the members of the University of Bristol Spelæological Society, which has been doing such admirable work during the last few years in the study of the caves of North Somerset. Of late years, many photographs have been received illustrating a subject which was formerly somewhat neglected, namely, the features shown on the weathered surfaces of rocks, many of the subjects being shown approximately natural size. In this connexion, Mr. Bingley's and Dr. G. Abbott's remarkable series illustrating the magnesian limestone concretions of Durham, and Mr. Bingley's set illustrating the fossil footprints from Storeton quarries, Cheshire, deserve special notice. Some of the very best work has been done by photographers working in association with a local natural history society, *e.g.* that of Mr. Welch in connexion with the Belfast Naturalists' Field Club.

It must be admitted that the committee's collection, which is housed in the library of the Geological Survey at Jermyn Street, is less often referred to than could be desired, but there is no doubt that the selected series published by the committee has proved of great value to teachers of geology both at home and abroad. The published series consists of 72 subjects issued in the form of both prints and lantern slides. It appeared in three issues in 1902, 1903 and 1904, respectively. There were 193 subscribers to the series, and the whole was so successfully managed by the secretary, Prof. Watts, that a clear profit of 130*l.* was made, rendering the committee self-supporting. Had not eight whole-plate photographs and twelve lantern slides beyond the number agreed upon been issued to subscribers the profit would have been 235*l.* The expenses for albums, mounting, postage, stationery, etc., from the date of issue to the present time have all been defrayed from this sum, so that the British Association has been put to no expense. The indebtedness of the committee to Prof. Watts was fittingly acknowledged by a resolution unanimously passed at the Cambridge meeting of the Association in 1904. The resolution was as follows: "That this committee desires to record its admiration of the indefatigable energy shown by its secretary, both in carrying out the original aims of the committee and in bringing to a successful issue the publication of a typical series of geological photographs, services to geological science which cannot well be overestimated."

A second series of geological photographs has long been in contemplation and was taken in hand in 1919.

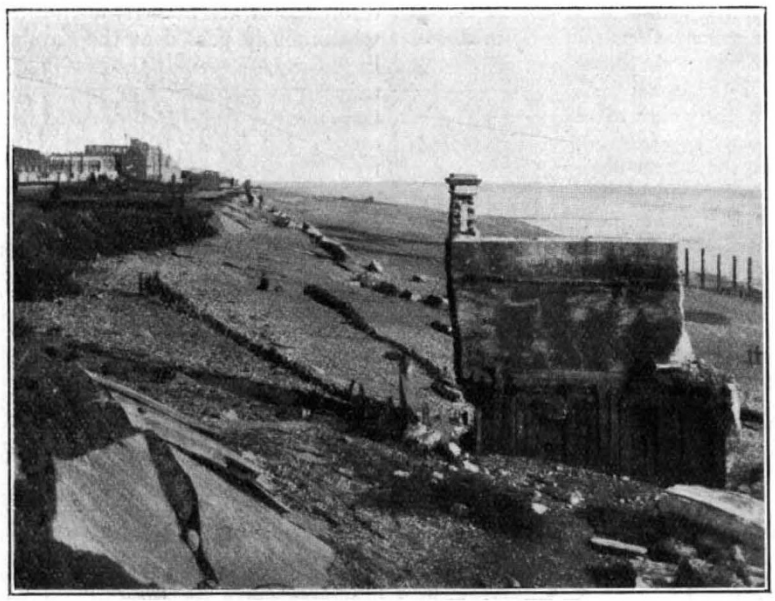
FIG. 1.—Elham nailbourne at Barham, flowing. Jan. 1904.

[*Photos by C. Buckingham, 108 High Street, Godalming.*

FIG. 2.—Elham nailbourne at Barham, bourne dry. Jan. 1905.

Subjects were selected and circulars were sent to all former subscribers and to almost every university and other body likely to be interested abroad as well as at home. The number of applications for such a second series proved, however, to be quite inadequate to justify proceeding further in the matter, which is at present in abeyance. The earlier series is still obtainable through the secretary. There is a small duplicate collection of lantern slides and two albums of prints which may be borrowed.

A circular setting forth the objects of the committee and containing also hints on the taking, printing, etc. of geological photographs can be obtained from the secretary, at the University, Bristol.



[*Photo by P. B. Roberts, 9 Westbury Hill, Westbury-on-Trym, Bristol.*

FIG. 3.—Coast erosion at Bexhill-on-Sea. Winter 1909–10.

In the foreground is seen a ruined bastion, and a row of large blocks, the remains of the sea-wall, extend away from it to join the part of the esplanade which is still intact. In the considerable inlet formed by the cutting back of the coast, two barriers of hurdles have been erected in the hope of checking further destruction.

Obituary.

DR. O. KLOTZ.

THE death is announced, at the age of seventy-one, of Dr. Otto Klotz, Director of the Dominion Observatory at Ottawa. He seemed to be in excellent health when he attended the Rome meetings of the Astronomical and Geophysical Unions in May 1922, and his death adds one more to the unexpected losses which have sadly diminished the number of working seismologists in recent years. He had been Director of the Dominion Observatory for some half-dozen years. Dr. W. F. King, who founded that Observatory in 1903, and also started the Canadian Geodetic Survey and other Canadian enterprises, died on April 23, 1916, making a break in the four names which had appeared on the front page of the Journal of the Royal Astronomical Society of Canada (Chant, King, Stupart, Plaskett) since its first number in 1907. Dr. Klotz's name, with the title of Director of the Dominion Observatory, appears on No. 2 of vol. xii. (Jan. 1918), while Mr. Plaskett becomes the Director of the Dominion Astrophysical Observatory, taking charge of the new 72-inch reflector at Victoria, B.C.

In recent years, however, Dr. Klotz's writings have been chiefly seismological. He has published a useful volume of seismological tables, and shown great discernment in making known matters of interest. For example, when Galitzin directed attention to the possible interpretation of the Pamir earthquake of February 18, 1911, as due to the fall of a huge mass of rock, Klotz promptly published a translation of this important paper.

In earlier life Klotz had done much survey work. In 1892 the longitude Greenwich-Montreal was determined by McLeod and Klotz as Canadian observers, Turner and Hollis as English. The observers did not often meet, being usually at opposite ends of a cable, or land-line; but the brief and rare meetings afforded opportunities for hearing something of Dr. Klotz's previous adventures in surveying, usually conducted by long journeys in small boats up and down the Canadian rivers, in territory which could scarcely yet be regarded as civilised. Some dozen years later he was able to extend the arc (carried from Greenwich to Montreal and thence across Canada) to Australia and New Zealand, by means of the new Pacific Cable. The cable was completed on December 8, 1902, and very early use of it was made for this longitude work. As a result of the operations, Dr. Klotz was able to give the longitudes of Vancouver, Fanning, Suva, Norfolk, Southport (Queensland), Brisbane, Doubtless Bay, and