evoke melanophore response, but that light reflexly activates secretion of the pituitary gland as a whole.

(3) Functional changes associated with seasonal periodicity in mammals are of two principal types. One is the anœstrous inactivity and partial retrogression of the gonads. The other is winter sleep, which involves a greatly reduced basal metabolism. Both these phenomena have features which are highly reminiscent of the results of removing the pituitary gland. Dr. Charles obtained some evidence that amphibia have a low basal metabolism in darkness.

On the basis of these indications and others which we obtained during the past four years at Cape Town, it had been my intention to probe more deeply into the possible significance of the pituitary in connexion with seasonal phenomena. This body of investigations has now been interrupted, and I proffer these somewhat speculative remarks for the encouragement of others who are interested in the same problems. I believe that our work provided substantial evidence that the reflex activation of the pituitary by light is not confined to the secretions which control colour change. Perhaps the prolongation of the day in the arctic regions might suggest a clue to Prof. Seligman. The growth principle of the anterior lobe involved in acromegaly is not the same substance as that which activates the ovary, nor is it the same as that which influences basal metabolism by activating the thyroid. However, it is now certain that the functional relations of at least four of the six or more hormones secreted by the pituitary gland are alike in mammals and amphibia. A comparison of the effect of continuous illumination and total darkness respectively upon growth and metamorphosis in the latter would be well worth undertaking.

LANCELOT HOGBEN.

Department of Social Biology,
University, London, Aug. 10.

[1] NATURE, **128**, p. 221, Aug. 8, 1931.

Biological Effects of Cosmic and γ-Radiation.

ACTINIC rays have been an important normal factor in the environment of organisms during the course of evolution, and now it is clear that rays of another category, the cosmic rays, must be regarded as having formed part of the normal environment. It is a working assumption in all bionomical investigations that every factor in the environment must be considered in regard to its possible effect upon the life of an organism: it is also possible—or even probable—that every factor in the environment has an effect upon, or is utilised by, some organism. Hence the practical demonstration of the continuous earthly incidence of the so-called cosmic rays brings a 'new' factor into the field of biology, and its effect needs to be assessed. Since it may now be accepted that these rays are and have been continuously incident upon and in the surface layers of waters (although the degree of their penetration into sea-water has apparently not yet been determined) as well as upon the land, most organisms are, or have been in time, subjected to them, and it is reasonable to look for some biological response.

It is difficult to connect any definite biological processes with the new kind of radiation now described, but the resemblance of the cosmic rays to hard γ-radiation [1] gives us one preliminary approach to an estimation of the biological effects of these rays; for it is known that one important effect of γ-rays is to inhibit such pathological growths as occur in mammals in cancerous tissues. The effect of the addition of γ-rays to an organism—which is exhibiting abnormal growth—suggests that possibly these rays are supplying and substituting a deficiency in that organism, and that the deficiency is some kind of ray similar to the γ-rays. The likeness of these to cosmic rays further suggests that the rays entering the earth from space may be a normal biological requirement of certain organisms, for example, mammals.

The occurrence of pathological growth in an organism, which *ex hypothesi* requires and is being subjected to a bombardment of cosmic rays, may be explained by a peculiar and pathological shielding or absorbing effect of parts or the whole of that organism.

Preliminary experiments indicate that γ-rays of such an intensity as will inhibit pathological growth, that is, as emitted from a radium needle, have little or no effect on adults or developing eggs of the few invertebrates which we have so far examined, though many more experiments are needed to provide a satisfactory basis for such an important statement. The failure of γ-rays of low intensity to affect tissues is perhaps to be expected if these rays are not markedly different from the normally incident cosmic rays. On the other hand, the simple experiment of shielding animals normally subjected to cosmic rays from these rays has not yet been tried. The occurrence, however, of animals on the sea-bottom at depths which are possibly too great to be affected by such rays [2] gives us either a natural negative experiment or an instance of adaptation to the absence of these rays comparable with that of animals living in darkness. The variation of these rays in intensity with depth may very well provide an important environmental factor in the life of aquatic animals.

Research on this new and recondite biological factor will be expensive and will require close collaboration between the biologist and physicist, but there can be little doubt that it is worth undertaking, even if it should happen that only negative results are obtained.

J. H. ORTON,
S. T. BURFIELD.

Zoology Department,
Liverpool University.
June 28.

[1] NATURE, **128**, Supplement, July 18, 1931.
[2] NATURE, **126**, p. 29, July 5, 1930.

Mineral Content of Eyes.

IN the course of an investigation into the mineral content of vertebrate tissues, mostly human, by the spectrographic method of analysis already described in NATURE,[1] the choroids of an ox's eyes were found to contain a notable quantity of barium, the percentage in the tissue dried at 100° being estimated at nearly 1·5; a trace of strontium was also present. The choroids of a sheep's eyes analysed at the same time gave no indication of barium, though a trace of strontium was present.

Many analyses of parts of vertebrates' eyes have since been made and certain facts have been ascertained; it is evident, however, that much remains to be done on these lines in extension of the work. The chief facts so far ascertained are as follows:

Human choroids and the choroids of sheep, pigs, horses, dogs, and the common commercial varieties of sea fish gave no indication of barium, neither did the choroids of calves contain the minimum amount detected by this method of analysis. Traces of strontium were nearly always present, the fishes' choroids containing more than those of the land animals.

The choroids of all the cattle, 13 in number, of three years old and upwards, so far analysed contain barium, and the quantity increased with the age of the animals; it is present in oxen, cows, and bulls.

The barium is present in largest quantity in the