

NOTES.

ON LUMINOUS BACTERIA¹.—Many instances of light production occur in Nature amongst plants and animals. This luminosity is most strikingly exhibited by marine animals and by minute vegetable cells belonging to the group of the Bacteria. Light-production by living protoplasm is a process intimately bound up with the life of the organism, as in the case of the luminous Bacteria. The luminosity of mineral and other inert bodies is dependent on an extraneous light source.

Amongst light-producing organisms our knowledge of the process is most exact in the case of the Bacteria. Their simple semicellular structure, and the fact that modern bacteriological methods enable us to isolate and study particular organisms, renders it somewhat more easy to study the conditions under which light-production can best occur. The observations which are embodied in this paper were made on luminous Bacteria. These organisms are to be found mainly in sea-water and on dead marine animals. They are widely distributed in this respect. We have obtained and studied the most important types. About twenty-five varieties have been described, but it is probable that some of these are very closely related, if not identical. A hitherto undescribed form has been isolated from sea-water in the course of investigations made by one of us at Plymouth. It belongs, like most of the other species, to the group of the Bacilli. The temperature-conditions as regards growth vary considerably, and range from zero to 37° C.

The luminosity of the sea is mainly due to higher forms of marine life and not to Bacteria, at any rate in northern latitudes. On the other hand the phosphorescence of dead objects, such as fish, &c., is due to bacterial forms of life.

We have not been able to confirm the statements that luminous

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Bacteria have direct infective properties as regards crabs and other marine animals.

These organisms require particular and exact conditions in order to exhibit their luminous properties. They must have a suitable nutrient soil containing such proportions of salts as shall render the medium isotonic. For example, sodic chloride, if present to the extent of 3 per cent., will render the organisms luminous and ensure their remaining so for some time. In this manner they can be readily cultivated and studied in the laboratory.

The luminosity appears to be a function of the living cell and can be disturbed by any process which interferes with the vitality of the cell itself. The dead cell is non-luminous, whilst antiseptics which kill the cells inhibit at the same time their luminosity.

A supply of free oxygen is essential; in the absence of oxygen the organisms live but are non-luminous. There is no evidence of a bacterial product as the source of the light. The process appears to be the result of an active oxidation occurring within the cell. The light produced is confined to a small portion of the visible spectrum, and invisible radiations have not been detected. As the spectrum of none of these luminous organisms extends even to the red, it may safely be assumed that no heat radiations are emitted. The light is produced without heat. No invisible radiations allied to the X-rays were detected. Photographs have been obtained by the aid of the light emitted by these organisms. The time-exposure required is, however, considerable.

An exposure to the temperature of liquid air does not destroy the luminosity of the organisms. It has been found possible to triturate Bacteria at the temperature of liquid air by means of special methods devised at the Jenner Institute of Preventive Medicine. The luminous Bacteria mechanically broken up in this manner ceased to phosphoresce. The luminosity, therefore, is due to the vital processes of the cell, and essentially depends for its origin on the *intact* organization of the cell.

We have brought these results forward because this interesting group of organisms have not hitherto been studied in this country so far as we can trace.

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