THE RELATIONS OF MICROBES TO LIFE.

Owing to the fact that some microscopic organisms have been shown to play an important part in many forms of disease, we are somewhat in the habit of looking upon such organisms in general as our enemies, forgetting many useful purposes which they serve. One of the most important processes taking place on the surface of the globe is the destruction of such organic masses as have been the seat of life, but which have suffered death. We have only to think for a moment what the result of a stopping of this destructive process would be, in order to gain a vivid impression in regard to its importance. The living thing can resist the destructive forces. When life ceases, the resisting-power is gone; and, however complex the materials may be of which the organism is made up, they are quickly converted into simple and stable substances. The chief products of the changes are carbon dioxide, water and ammonia, all of which are of high importance, as from them again, under the influence of life, are elaborated the complex materials. Now, we know, that, in the breaking-down of organic matter after death, microscopic organisms play a principal *rôle*. They are the efficient scavengers of the earth. They effect the transfer of the oxygen of the air to the substances to be destroyed, and thus convert useless organic matter into that which is useful.

We thus see, that, while there are microbes which cause disease, there are others constantly at work keeping the conditions favorable to life. Recently the suggestion has been made, and by no less an authority than Pasteur, that the changes which are involved in the life-process of both plants and animals are probably intimately associated with the activity of what may be called life-microbes. Pasteur read before the Academy of sciences a paper by Duclaux, in which some experiments upon the growth of plants in sterilized soils are described. Duclaux's paper begins thus: "The destruction of the organic matter of the soil by microbes, and the production of a new vegetation on the soil, are two phenomena which always accompany one another. Is there any necessary connection between them? Through the labors of Pasteur, we know that microscopic beings can only live at the expense of complex materials elaborated by the plant with the aid of chlorophyl. Can the plant develop in the absence of microscopic beings? in other words, can it, without their aid, utilize the organic matter left by the plant which preceded it on the soil?"

With the object of attempting to answer this question, Duclaux experimented upon peas and beans. These were freed from germs, sown in a soil which was free from germs, and supplied with organic matter of a kind which one would naturally expect to be easily assimilated. The result was, that after one or two months the organic matter was found to be unchanged, and the plants did not thrive any better than when placed in distilled water.

Pasteur, in commenting on these experiments, takes occasion to suggest to Duclaux an experiment on the *rôle* which microbes play in animal life. The experiment is this. A hen's egg, from the surface of which all germs have been removed, is to be hatched in a sterilized space, fed with sterilized food, and supplied with sterilized air. Pasteur believes that the result will be that the chick will not live, and, in general, that life is impossible without the co-operation of microbes.

We must bear in mind that this is merely a suggestion, and that it rests at present upon no experimental evidence. Experiments of the kind suggested will involve great labor and the greatest accuracy. It cannot be denied, that, whether the results should prove favorable or unfavorable to the view of Pasteur, they would be of the highest interest to the chemist and biologist.

THE CLIMATE OF THE EGYPTIAN SUDAN.

In so vast a region of country as the Egyptian Sudan, extending as it does over about sixteen or eighteen degrees of latitude and as many of longitude, with differences of alti-