of specific modification became clear to me, and in the two hours of my fit I had thought out the main points of the theory."

If this had been only a fortunate guess it would have little interest, for no one cares to ask whether Empedocles, or Wells, or Mathew, or Darwin, or Herbert Spencor, or Wallace first had this happy thought. It was because Wallace had spent years of hard work in gathering facts and in pondering them that he was able to see that this sudden product of his 'fit' was worthy of further examination, and because he devoted the rest of his life to its application to new discoveries that he is held to be the joint discoverer of the law of Natural Selection.

The origin of species by means of natural selection is now universally accepted as a demonstrated principle. "This," says Wallace, "is, of course, partly due to the colossal work of Herbert Spencer; but for one reader of his works there are probably ten of Darwin's, and the establishment of the theory of the *Origin of Species by Means of Natural Selection* is wholly Darwin's work. That book, together with those which succeeded it, has so firmly established the doctrine of progressive development of species by the ordinary processes of multiplication and variation that there is now, I believe, scarcely a single living naturalist who doubts it. Probably so complete a change of educated opinion, on a question of such vast difficulty and complexity, was never before effected in so short a time. It not only places the name of Darwin on a level with that of Newton, but his work will always be considered as one of the greatest, if not the very greatest, of the scientific achievements of the nineteenth century, rich as that century has been in great discoveries in every department of physical science."

To this we must add that, so long as the 'Origin of Species' holds its place on the shelves of students, close beside it we shall find the 'Malay Archipelago;' for the writer of this review has no doubt that Wallace will be one of those to whom future generations will say: "Friend, Go up higher."

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The Principles of Bacteriology. By DR. FERDINAND HUEPPE. Translated by PROFESSOR E. O. JORDAN. Chicago, The Open Court Publishing Co. Pp. 455.

American bacteriologists certainly owe a debt of gratitude to Professor Jordan for putting into clear English this valuable contribution to the science of bacteriology of Professor Hueppe, of Prague. Hueppe's contribution to bacteriology in this volume is no ordinary one. The book is not simply a review of facts, but is decidedly original. From the first to the last the author and his opinions are decidedly in evidence. Whether or not one is inclined to agree with him in all his conclusions, no one will question the force of the arguments with which he upholds his opinions.

After giving some general information in regard to bacteria (in which the author accepts the conclusion that the tuberculous bacillus is not a bacterium at all) he deals in successive chapters with the vital phenomena of bacteria, pathogenic bacteria, the cause of infectious diseases, cure by combating the cause, immunity, prevention and history. The chapter upon vital phenomena of bacteria is especially valuable, since it treats, in a comprehensive manner, of the somewhat obscure subject of the chemistry of bacterial poisons and bacterial nutrients.

But the most suggestive part of the work begins with the chapter upon the cause of infectious disease. Here he sets himself in opposition to the school of Koch by denying that bacteria can in any proper sense be regarded as the cause of disease, and especially repudiating the idea that definite species of bateria are the 'specific' cause of 'specific' diseases. No one can question Hueppe's thorough acquaintance with the facts of modern bacteriology, and it seems a little strange that he can hold a position so generally at variance with that of most bacteriologists. But we soon learn that his position is not so different from that of Koch as at first appears, and perhaps not so different as Hueppe tries to make it appear. Hueppe is, of course, fully aware that diseases are produced in animals by inoculating them with certain bacteria cultures. His criticism is simply against the claim that they are the *cause* of the disease and

that definite species cause definite diseases. That they *provoke* diseases he recognizes; that they *cause* them he denies. His own position is essentially as follows: Disease and health alike are attributes of the activity of living cells.

Health is the result of the normal activity and disease of the abnormal activity of these cells, and it is hardly more correct to say that disease is caused by bacteria than to say that health is caused by their absence. Disease is a process, not an entity, and is really caused by some condition of the living cells which makes them liable to act abnormally when stimulated. No disease can appear in the body except such as are predisposed in the living cells. The bacteria serve as a stimulus just as the spark serves as a stimulus for gunpowder. The spark is not the cause of the explosion, though it may excite it. There is a certain amount of resistance to be overcome before the cells will start to act abnormally, and the bacteria simply overcome this resistance. We are learning to appreciate more and more fully that one animal may be predisposed to a disease while another is more resistant, a fact in itself which shows that we are speaking very loosely when we say that the bacteria cause the disease. According to Hueppe disease is the result of a number of factors of unequal weight. External conditions constitute one factor, the condition of the body cells a second, and the presence of certain bacteria a third. When together they produce disease. Break the chain as one link and there is no disease. The school of Koch has paid attention to one of these links, the school of Virchow to the second, while Petinkoffer is trying to study the third, *i. e.*, external conditions. Hueppe insists that neither one causes the disease, but all three together. Disease is a vital activity, and while bacteria are needed to stimulate it they don't properly cause it.

This conception, of course, largely determines the position which Hueppe takes in the other topics considered. The question of combating the disease by combating the bacteria is only one side of the matter. Prevention involves something more than simply looking after the bacteria. Hygienic measures are misdirected if they look simply toward the destruction of bacteria. The disinfecting mania which developed a few years ago he regards as exaggerated and largely needless. Hygienic measures in the past have been very useful and produced a decided improvement in public health, but this has not been because they have destroyed the 'specific' bacteria. Rarely do we succeed in this object. Sanitariums for tuberculosis pay little attention to the matter of germs. The success has resulted from the fact that hygienic measures and cleanliness, together with fresh air and sunlight, have improved the *general health*, given the cells greater vitality and made the individual less disposed to acquire the disease. They are successful because they have been directed to the second link in the chain rather than the third.

It is a question whether his position is quite so much at variance with generally accepted belief as Hueppe is inclined to think. In denying that distinct bacteria are 'specific' he fails satisfactorily to reconcile this position with the fact that definite species do provoke definite diseases. He fails to make it clear just how the bacteria act to produce distinct diseases if they are not specific. It is a somewhat curious position to assume that the silk worms have always had a special predisposition to pebrine, but that this disposition only appeared when the pebrine organism made its appearance, especially as it appears that all individuals yield to the attacks of this germ. But apparently Hueppe would assume that the animals have had this predisposition to a disease which never had a chance to develop until the proper organism produced the stimulus. Hueppe has perhaps just as truly overdrawn the case from his point of view as Koch did from his own standpoint. But certainly all bacteriologists may read with profit this somewhat new setting-forth of the problem of bacterial diseases, and Hueppe is certainly to be thanked for bringing forward so forcibly the part which the vital activity of the organism plays in the matter of disease. He has certainly done a valuable service in pointing out that the problem of the physician and bacteriologist is to be directed toward the man and not the bacterium.

H. W. C.