

speedily dissolved, taken up and destroyed by the cells. The significance of these facts was first pointed out by Hæckel, who compared this process of the cells to that occurring in unicellular organisms by which they took in digested, and lived upon lower forms of life which surrounded them. He concluded that the cells of a complex organism nourished themselves by this same means, and that they took up and digested foreign substances in the same manner as the primitive cells. In other words, he theorized that the nutritive function was the same in both, and that the lower forms were sustained through the power of attacking and devouring other microorganisms, while the higher or complex cells used this power to destroy and remove foreign substances. Carl Rosser extended these observations by the means of experiments, and demonstrated that the amoeboid cells of the animal body did really possess this power of taking up and destroying living microorganisms; and, as a result of this, he drew the inference that the complex organism as a whole was protected against the invasions of pathogenic microorganisms by this function of taking up and destroying—*phagocytosis*—and that in its absence or imperfection an animal became susceptible. At this stage of the subject Metschnikoff took it up and followed the conclusions of Hæckel. He maintained with him that the power of attack as witnessed in the primitive or predatory cell had never completely declined through the ascending stages consequent upon development, but that it had remained all along, though in a latent form, since the altered conditions in its media by which the necessary pabulum for sustenance was furnished without effort upon its part, and there was no demand for this power of attacking microorganisms.

In substantiation of these views he proceeded to demonstrate that the latent or potential power of successful attack could be made patent and reinstated by suitable circumstances or exigencies rendering its operation necessary. To illustrate this he employed by means of inoculations attenuated viruses, which, through their mild, gradual, and stimulating influences upon the functions of the cells, caused them eventually to reassert their former or primitive instincts or powers of attack, and overcame and destroyed microorganisms, which at first destroyed them. In this way he argued that the predatory function could be made to exercise itself in all its old vigor, and that by a series of gradually increasing dosage of quantity and quality the cells were drawn out, acclimated, and made superior to the microorganisms. It was from these facts in the history of the cell's life and experiments given that he formulated and advanced the theory that immunity was vital resistance whose processes were *phagocytosis*; that, when an organism was susceptible and invaded by

pathogenic micro-organisms, it was due to an absence or imperfection of this function of the cells; and when, on the other hand, an organism was refractory or exempt, it was because the cells attacked and successfully destroyed them in the beginning. This very plausible explanation, as drawn from these data, is, however, denied, and it is disputed that the cells possess and exercise this function as a means of defence in a complex organism.

Prominent among these opponents stand Klein, who, by experiments with the bacilli of tuberculosis, has shown that the cells in taking up the micro-organisms are themselves destroyed, and, instead of being a means of protection, it is really the reverse process of destruction. On the other hand, a number of experimenters, such as Metschnikoff, Sutton, Ruffer, and Walker, have demonstrated that the cells will take in and destroy as many as fifty living anthrax bacilli, and still continue to live and thrive. In supplement of both of these apparently discrepant observations, Roux has shown that this process of taking in and digesting micro organisms—*phagocytosis*—is never an absolute one, but always a relative process, capable of being modified, increased or decreased by a large number of internal and external conditions and influences affecting the body-cells; that it is always and invariably present and operative in direct ratio to the non-susceptibility of any particular organism, and that it is only complete in all its details in those perfectly refractory, while in the susceptible ones it is partial, incomplete, or even entirely absent or unavailing. Hence, it cannot be denied but that in some instances the cells are destroyed, while in others they are the destroyers. Indeed, this is true in so far that in every acute and immunizing invasion of disease there are numbers of cells destroyed. On the other hand, if the organism be the superior antagonist from the very first, the micro-organism fails to gain admission, and the disease is prevented. In the first of these instances, where the micro-organisms enter and destroy the cells for a time, how is it possible for the latter to ever gain the ascendancy over the germs, and to cast them out, as we know they do? What is the nature of those influences and conditions by which these are effected? The theory of acclimation or toleration cannot be tenable in the case of a cell that is dead, since, as such, it has really ceased to be a part of the vital economy. *The death of the cell furnishes the key to the entire situation*, though its recognition, as such, has long been overlooked and misinterpreted. The influence and rôle of fever as a vital and conservative reaction of the organism has been long misunderstood. The discovery and employment of its principle are the most important advance which has ever been made in connection with the mechanism and rationale