

During this work it has come pretty clearly to light that in acquired immunity the cells themselves which produce these substances, are not changed. Those in the third year will know that leucocytes when washed free from all bacterial poison, will act the same as those from a non-immune animal. The leucocyte seems to be trained by the infective process to attack the organisms, but remains unaltered itself.

In breeding antitoxins, that is by injecting an animal with small amounts of toxin and gradually increasing the dose, with the increased dose we find each time that the animal makes more antitoxin. Ehrlich's idea was that the cells of the blood were the ones that absorbed the toxin and made the antitoxin, and the cells of the blood became so accustomed to making the antitoxin that they went on making more and more after the toxin introduction had ceased. When this was studied, however, we found a different explanation. We found experimentally that it is not the cells of the blood, but the epithelial and connective tissue cells which make the antitoxin. In order to demonstrate this I took a horse and injected a toxin modified by adding a certain amount of antitoxin, and by giving a horse a dose of this modified toxin, I could, at the end of the very first week, get just as much antitoxin as at the end of the three months when pure toxin was injected originally. It was not that the cell became accustomed to making the antitoxin but that they could not respond as readily to the pure toxin as to the modified toxin. Thus in acquired immunity, the cells themselves are not subject to change, but the products of the cells, which gives the immunity. Natural immunity is due to inherited properties.

If we give an injection of bacteria, there is a latent period. During that time the cells absorb the protoplasmic substances or poisons. Then there is a period during which they create the antibodies which are absorbed into the lymph and from the lymph to the blood, so that it is from four to twelve days, depending on the type of toxin or poison, before the beginning of accumulation in the blood. At the period of highest accumulation, the cells cease to produce the antibodies, the lymph no longer adds them to the blood, but the reverse takes place, the antibodies being destroyed in the system and passed out through the excretory organs, and at the end of three to twelve months we have a complete passing off of these antibodies and no trace of immunity remains in the body. Thus there is an actual cycle in this development of immunity.

If we wish to increase the antibodies, all we must do is to repeat the injection, and then as the curve of immunity passes on toward its maximum, if we give a second injection we have a moderately rapid rise with a slow fall. This rise is added to the previous rise and the fall is much slower than the production, and in this way we add to the amount of antibody in the blood. Thus we get better results from three or four successive injections than from one large one. Therefore, in making antitoxins, we give a horse repeated injections until the maximum production of toxins is reached and when the elimination is going on rapidly and the animal is losing immunity instead of gaining.

The opsonic treatment of Dr. Wright rests on the same principles, that is, giving repeated injections of vaccines so as to steadily stimulate the formation of