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An experimental study of athreptic immunity in carcinoma.¹)

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Since the discovery that a malignant growth could be successfully cultivated by means of transplantation from one animal to another, the experimental study of carcinoma has been possible. The fact that an animal could be inoculated with carcinoma and the further discovery that immunity to inoculations could be produced have suggested the possibility that the processes occurring are analogous to those which are known in bacteriology.

So far as our present knowledge goes, we are justified in the belief that the growth of the tumor in the inoculated animal is due not to anything of the nature of recognisable bacteria or other organisms inoculated with the tumor, but solely to the growth and multiplication of the tumor cells themselves, which are approximately on the same developmental level as the cells of the host. The inoculation of carcinoma is therefore not quite similar to the introduction of microorganisms into the body. In the latter case the individual components of the material injected are of an entirely different type to those found in the host. Experiments have also shown that the immunity produced to carcinoma does not conform to the laws that hold good when dealing with bacterial diseases. In the first place, natural immunity to carcinoma may be met within individuals or it may affect a whole race. Secondly, experimental immunity is not specific. Active immunity to a particular tumour may be produced not only by inoculation of that tumour, but also by a tumour of a different strain and by various organs of animals of the same species;

¹) The experiments detailed in this paper were carried out in the L. C. R. with the exception of those described on pages 16 to 19.
Ehrlich has found immunity to carcinoma can be produced by sarcoma and vice versa. This he has called „Panimmunity“.

How are these facts to be explained? Why is it that some animals are susceptible to carcinoma, whilst others are quite immune, and further how is it that animals can be artificially rendered immune to transplanted carcinoma not only by a tumour of the same strain, but also by normal tissues of the same species? Is the immunity due to the presence of antibodies? Assuming that the enormous cell proliferation of cancer, whether by altering the metabolism of the host or in some other way, causes an animal with a tumour to produce antibodies, the antibodies cannot be said to be specific, because as already mentioned, immunity can be produced with non specific substances such as blood plasma, embryonic tissue, spleen etc., if these are taken from the same species of animal. This question will, however, be discussed later. So far, the formation of antibodies has not been proved) either by complement deviation or precipitation, and the fact that an animal which is naturally immune to transplanted carcinoma, or has been made so artificially, may develop a spontaneous tumour, shows that the experimental facts require further explanation.

Ehrlich put forward a theory in explanation of the facts observed in immunity to carcinoma. His theory was that if an animal is susceptible to carcinoma it means that the implanted cancer cells have found a suitable medium in the organism in which to grow and multiply. In other words, the tumour cell is supposed to possess a great avidity for a specific food material within the host. If the implanted cells find this particular material then they live and the transplantation is successful. On the other hand if the host does not furnish the specific food, the cancer cells die and the graft is unsuccessful. This Ehrlich has called „Atrepsia“.

The following experiment will serve as an illustration of athreptic immunity. If mouse tumour is transplanted into a rat it grows, according to Ehrlich and Apolant, for eight to ten days, after which time it becomes absorbed. If, however, before the eight days have elapsed it is transplanted from the rat to a mouse it grows vigorously. These facts are explained in this way: the transplanted cells grow for several days in the rat, because they have carried with them a certain amount of the specific food. When this becomes used up, the tumour cells being unable to procure more from the new host (the rat), they die of starvation. If, however, before this happens they are retransplanted into a mouse, they