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On the Fertilizing Effect of Foreign Blood Serum Upon the Egg of the Sea Urchin

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ON THE FERTILIZING EFFECT OF FOREIGN BLOOD SERUM UPON THE EGG OF THE SEA URCHIN.[1]

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(Abstract.)

In former experiments the lecturer had shown that for the artificial parthenogenesis of the animal egg, as a rule, two different agencies are required. In the first place, it is necessary to bring about an alteration of the surface of the egg (which in many cases results in the formation of the membrane of fertilization). While this alteration of the surface starts the development of the sea urchin's egg, it is often not sufficient to allow the egg to complete its development. For this effect a second influence has to be brought to bear upon the egg. The egg may either be put for a short period of time into a hypertonic solution containing oxygen, or for a longer period of time into sea water free from oxygen. If thus treated properly the sea urchin egg can be caused to develop just as normally as if it had been fertilized by the spermatozoön.

By fertilizing the sea urchin egg with the sperm of the starfish the lecturer had been able to show that the spermatozoön also causes the development by two different agencies, one of which causes the membrane formation.

In looking over the various agencies which induce the artificial membrane formation, the lecturer was impressed with the fact that all cytolytic agencies can be utilized to cause this alteration of the surface, and he came to the conclusion that the membrane formation was, perhaps, brought about by a cytolysis of a specific superficial layer of the egg—the so-called cortical layer. Since we know that foreign blood sera have often a cytolytic effect, it was of interest to apply such sera, and it was found, indeed, that a large number of the sera of foreign animals could be utilized to cause the cytolysis of the cortical layer of the sea urchin egg. When such eggs afterward were treated for a short time with a hypertonic

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solution, they developed into normal larvæ. If unfertilized eggs were treated directly with the hypertonic solution for the same period of time without first having been submitted to a treatment with foreign blood serum, they remained absolutely unaltered, and no development of any kind took place.

It was immaterial whether blood serum or an extract from the tissues of a foreign species was used.

In these experiments it was found that, as a rule, not the eggs of every female were susceptible to foreign sera. The eggs of some females would all form fertilization membranes when treated with ox serum, while of the eggs of other females only a small percentage would form membranes, and, on the whole, the eggs of about 80 per cent. of the females were immune. It occurred to the lecturer that it might be possible to sensitize the eggs of the sea urchin by some agency, so that the eggs of any female would form fertilization membranes under the influence of foreign serum. He found that this could be done by treating the eggs for a few minutes with a hypotonic solution of $SrCl_2$. After such a treatment practically all, or the majority, of the eggs of every female would form a fertilization membrane when treated with ox serum.

It is well known that the cells of an animal are immune against the lysins in its own blood. It was found that it was absolutely impossible to cause membrane formation of the sea urchin egg by extracts from sea urchins of the same or even a related species. We therefore find the same immunity of the cortical layer of the eggs against the lysins of their own body which we find for cells in general.

These experiments throw a light upon the nature of the immunity of the cells of an animal against the lysins of its own body. This immunity is either due to the existence of antilysins in the cells or to an impermeability of the cells to the lysins of their own body or species.

The experiments on fertilization of the sea urchin egg by blood serum seem to indicate that the immunity of the cells against the lysins of their own body or species is due to the impermeability of the cells for these lysins; while their sensitiveness to foreign lysins is due to the fact that foreign lysins can permeate into the cell. The proof for this conclusion lies in the fact that the lysins of the spermatozoön can be carried in two ways into the egg, either by diffusion or mechanically (by the living spermatozoön boring itself into the egg, and thus overcoming the impermeability). Now, the speaker was able to show that in the case of a foreign ~~serum~~ sperm, for instance, that of the starfish, he could fertilize the sea urchin egg not only with the living spermatozoön, but also with a watery extract from the dead spermatozoön; while the sea-urchin spermatozoön had only a fertilizing power when it was living, and could enter the egg. The extract of the dead sea urchin spermatozoön had no fertilizing power at all. These experiments are only intelli-

gible on the assumption that the lysins of foreign sperm can enter the egg by mere diffusion, while the lysins of the sperm of their own species cannot diffuse into the egg. The speaker is of the opinion that these experiments suggest that the natural immunity of the cells of an animal against the lysins contained in its blood is purely due to the impermeability of the cells for the lysins of their own body, and not to the existence of specific antibodies against these lysins.

It remains to be ascertained why it is that the cells are more permeable for foreign lysins than for lysins of their own species.