POLYSPERMY

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Newport, Oregon, 29 august 1975.

Research paper submmited to Dr J. Green

for the Z 451 and Z 452.

Invertebrate Zoology classses.

Summer term 1975.

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INTRODUCTION.-

Polyspermy ocurrs when more than one sperm enters the cytoplasm of the egg. This brings about a series of events which will have consequences in its development. If polyspermy is "physiological", this means that the egg will ultimatley have normal development because this ocurrs in animals such as birds and reptiles which have developed a mechanism within the egg that permits only one male pronucleus to fuse with the female pronucleus. In the case of "pathological" polyspermy more than one male pronucleus interacts with the female pronucleus and so abnormal development ocurrs. Fortunatly in nature polyspermy is rare, even if the egg is exposed to a dense solution of active sperm, just one is permited to penetrate.

The possibility of a defense system (block to polyspermy) was the opinion of early investigators after their observations; and if in the event of more than one sperm penetration what happens within the egg ?. These two points is what this paper is mainly about.

BLOCK TO POLYSPERMY.

Cortical granules are secretory organelles located located in the peripheral cytoplasm of mature unfetilized invertebrate and vertebrate eggs. The discharge of the cortical granules (cortical reaction) of these eggs at fertilization results in the establishment of the block to polyspermy (Afzelius, B.A., 1956). Nothing is known in mollusks about the nature and course of this

cortical reaction. In the echinoderms this is associated with the separation of the vitelline layer from the egg's surface and its development into a fertilization membrane or activation calyx

The fore mentioned events are effective in preventing multiple sper entry into the egg and hence, may function to avert polyspermy (Longo & Anderson 1970). It is known that protease activity is realesed extracellularly from 30 to about 60 seconds, after insemination.

This timing correspons to the breakdown of the cortical granules, protease prevents polyspermy trough its action on the vitelline layer; the protease hardens the layer and makes it incapable of binding sperm. Sperm that are bound to the vitelline layer before cortical granule breakdown lose their attachment to the layer and by "hardening" the layer the protease aids in establishing the bolck against the polyspermy, (V.D. Vacquier, Mia J. Tegner and D. Epel 1973).

Sulfated acid mucopolysaccharides have been shown to be constituents of cortical granules in the sea urchin and vertebrate eggs. Brief exposure of unfertilized eggs to several quaternary ammonium compounds produced a residual adverse effect on subsequent fertilization in terms of increased vulnerability to polyspermy and reduced fertilizability due to the formation of very stable complexes between sulfated mucopolysaccharides and quaternary ammonium salts. The results sugest that sulfated acid mucopolysaccharides participate in the function of the cortical granules and the establishment of the block to polyspermy at fertilization and possibly in other cellular secretory processes (H. Schuel, J.W. Kelly. E.R. Berger & W.L. Wilson 1969). J. Runstrom & H. Manelli (1964), working with mercurials as mercaptide forminsg substances removed the protection against polyspermy in the urchin eggs,

and found that SH groups are in some ways involved in the protection (block to polyspermy).

There are only some of these studies done on the block to polyspermy.

MORPHOLOGICAL STUDIES OF POLYSPERMIC EGGS.

Nucleo-cytoplasmic interactions involved during fertilization have been studied by Fankhauser (1948) on polspermic eggs of Triturus. Studies of the same nature on Xenopus have also been done by Graham (1966). These investigations have contributed to clarify many of the facets of fertilization which remain unsolved. Frank J. Longo in his paper entitled "An ultrastuctural analysis of Polyspermy in the surf clam, Spisula solidissima" has added further dimension to the nucleus cytoplasmic interactions know--ledge, initiated upon insemination. In his work he mades a comparison between the development of monospermic and polyspermic eggs. One of the salient features in the polyspermic eggs was the"partialy incorporated" spermatozoa found on the cortex of the egg after insemination. They are called "partialy incorporated"because they are not fully incorporated within the cytoplasmic environment, remaining in a fertilization cone on the cortex, wether or not thus develop into a male pronucleus and undergoes additional events of fertilization is not known.

During the process of fertilization chromosomes from all vesiculated pronuclei (usually 8), are frequently aligned on extremely complex spindles in such a manner that they are associated with three or more astral regions. In 50 % of the zygotes under study were found one or several pronuclei which differed morphogenetically from the rest. That is they appeard to be asyn--chronous in their morphogenesis.

This pronucleus is distinguished by the failure of its chromatin to condense into reticular aggregates wich are recognizable as distinct chromosomes. Its nuclear envelope remains until anaphase of the first cleaveage division. Another anomaly occurs at the stage of first cleavege, with the formation of more than one cleavege furrow per zygote. These furrows have a number of forms; they may bifurcate, travel in a tortous path and are highly irregular, As a result of the multiple number of cleavege furrows three to seven blastomeres of various sizes and shapes are formed at the first cleavege division.

All of the features described differ from the normal development of a monospermic egg.

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MMA/gog.