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Electrical Potential Difference Across the Nuclear Membrane of the Starfish Egg.*

SAMUEL GELFAN.

From the Department of Physiology and Pharmacology, University of Alberta, and the Marine Biological Laboratory, Woods Hole.†

An electrical potential difference has been demonstrated to exist across the membrane of the intact germinal vesicle of the starfish egg *(Asterias forbesii)*. For the measurement of this P. D. non-polarizable microelectrodes (Ag-AgCl-sea water) 1-3μ in diameter, a potentiometer and a highly sensitive moving coil galvanometer were used. The eggs were placed in a hanging drop of sea water over a moist chamber, and the electrodes were introduced into the egg by means of a micromanipulator. The measurements were accurate to within one millivolt.

In attempting to enter the germinal vesicle, an invagination at the point where the pressure was applied by the microelectrode, and general flattening of the nucleus would be produced. As the latter was pierced by the electrode, the invagination and flattening, however, would suddenly disappear, the nucleus immediately resuming the original spherical form. This physical reaction constituted the visual criterion for the penetration of the germinal vesicle. Corollated with this criterion was the instantaneous deflection of the galvanometer as the electrode penetrated the nucleus.

The interior of the nucleus was always positive with respect to the cytoplasm or the sea water medium. The magnitude of the potential across the nuclear membrane varied from 4 to 21 mv., the average of over 100 recorded measurements being 10 mv. The size of the potential depended considerably upon the condition of the animals and the eggs. In eggs that were in relatively poor condition the potentials varied from 5 to 10 mv., whereas the measurements of eggs in good condition varied from 15 to 20 mv. The potentials were fairly constant in any series of measurements. The variations were rather in different animals collected at different times. The degree of maturation of the eggs, and the injury produced by the

* These experiments were performed two years ago when the author was a Donnelly Research Fellow in Physiology at the University of Chicago.

† The author is grateful to Dr. G. H. A. Clowes for his kindness in granting the use of the Eli Lilly Co. laboratories at the Marine Biological Laboratory for these experiments.

insertion of the microelectrodes into the nucleus also influenced the magnitude of the P. D. In a normally maturating egg the P. D. disappears as the membrane breaks down. These experiments clearly indicate that the intactness of the germinal vesicle is essential for maximal voltage.

If maturation of the eggs were inhibited, according to the method described by Lillie,[1] by placing them for 70 seconds in sea water at a temperature of 32°C (controls at this time maturating 95-100%), uniform potentials varying from 15-20 mv. were obtained.

With one electrode inside the germinal vesicle, the magnitude of the potential was the same, whether the other electrode was in the cytoplasm or in the sea water. It is also interesting to note that in many experiments in which one electrode was in the cytoplasm and the other in sea water, no measurable potential could be demonstrated between the cytoplasm of this egg and the sea water during all stages from immaturity to the second cleavage stage.

Varying the hydrogen ion concentration of the sea water from pH 8.2 (normal) to pH 6.0 had no significant effect on the electrical potential across the germinal vesicle membrane as compared with the controls. However, when the KCl concentration of the sea water (maintaining isotonic conditions) was increased, the magnitude of the potential was reduced. This depression was most pronounced in a mixture of ½ sea water and ½ isotonic KCl (pH 8.0); in this medium the P. D. was only 10-20% of the control measurements.

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Purification of Poliomyelitis Virus by Adsorption and Elution.*

ALBERT B. SABIN. (Introduced by W. H. Park.)

From the Department of Bacteriology, New York University, and Bellevue Hospital Medical College.

The exact nature of filterable viruses is considerably obscured by their close association with substances derived from the tissues in which the virus is found. The purpose of this communication is to describe a method whereby the virus of poliomyelitis

[1] *J. Exp. Zool.*, 1908, **5**, 375.

* Supported by a grant from the International Committee for the Study of Infantile Paralysis.