10973 P

Intake and Loss of Radioactive Cations by Certain Marine Eggs.*

S. C. Brooks.

From the Department of Zoology, University of California, Berkeley.

In another paper,[1] three phases of intake of radioactive alkali metal ions by Nitella[2] have been provisionally identified. Most of the intake and loss of ions by the protoplasm of Nitella appears to be in the nature of ion exchange. In the first few minutes the inorganic ions present in the protoplasm before the experiment are replaced by "tagged" ions, these ions moving at rates approximately 1×10^{-7} $GM.cm^{-2}sec^{-1}$, like that of water, rather than the previously supposed rates of 1×10^{-9} or thereabouts. This is the process termed "induced accumulation".[3] The total amount of ions corresponds approximately to the number of available salt linkages in the known volume of the protoplasm. The following loss of ions is subsequently encountered repeatedly, and it may be surmised to be due to the displacement of the tagged ions from protoplasmic salt linkages by organic ions produced in metabolism. The ions used, Na, K, and Rb, are known to modulate some phases of metabolism. The organic ions so produced appear to be replaced by tagged ions from the surrounding medium, giving "primary accumulation".[3] The presence of interrelated slow and fast processes may account for the periodic oscillation of the tagged ion content of the protoplasm found throughout at least 110 hours.

Similar experiments were done with eggs of *Urechis caupo, Pisaster ochraceus* and *Patiria miniata.* The induced accumulation of ions is shown in Table I, which also shows the calculated number of salt linkages in the same volume of protoplasm. This shows correspondence between the equivalents of cations taken up by induced accumulation and the calculated salt linkages of the protoplasm. The latter figures were obtained from the observed amounts of protein and fat in these eggs.[4] The general finding that fertilization increases the induced accumulation suggests that some salt linkages formerly masked are activated in the ensuing changes.

* This investigation has been aided by grants from the American Philosophical Society and from the Board of Research of this University.

1 Brooks, S. C., *J. Cell. Comp. Physiol.*, in press.

2 Brooks, S. C., Proc. Soc. Exp. Biol. and Med., 1938, **38**, 856.

3 Steward, F. C., *Protoplasma*, 1935, **18**, 208.

4 Leitch, J. L., *J. Cell. Comp. Physiol.*, 1934, **4**, 457.

TABLE I.
The Equivalents of Cations in 20 mm³ of Eggs as Shown by the First Pronounced Maximum Attained After 15 or 30 Minutes Immersion in Solutions Containing Tagged Cations; Together with Theoretical Maximum Contents.

Radioactive ion	Species used	State of eggs	Equivalents in 20 mm³ Observed $\times 10^7$	Equivalents in 20 mm³ Calculated $\times 10^7$
Na	*Urechis caupo*	Unfertilized	18	96
,,	,, ,,	Fertilized 60 min	32	,,
K	*Pisaster ochraceus*	Unfertilized	19	137
Rb	,, ,,	,,	66	,,
,,	*Patiria miniata*	,,	62	—

The later course of cation absorption markedly shows loss phases and also primary accumulation, a reoccupation of salt linkages originally occupied by inactive cations. The rhythm of oscillations is characteristic of any given lot of eggs, regardless of the fertilization. Different lots give other rhythms, maxima usually recurring at intervals of 1-2 hours. KCN, 0.001 M, inhibits these oscillations, which therefore depend upon metabolic processes which are independent of fertilization.

It is stressed that these features of cation absorption are general for protoplasm, both plant and animal, and can be interpreted best in terms of ion exchanges, including organic ions produced possibly as so-called "waste products".

10974 P

Effect of Certain Radioactive Elements on the Metabolism of Cells.

MATILDA MOLDENHAUER BROOKS.

From the Department of Zoology, University of California, Berkeley, Cal.

In order to see whether there is any effect by the addition of radioactive elements on the metabolism of cells, radioactive Na or K was added to solutions containing *Nitella* or *Elodea* or red blood cells and the oxygen consumption was measured by the Warburg method.

For *Nitella* and *Elodea,* the solutions of NaCl and KCl were .01 M at 25°C. For red blood cells, isotonic solutions of NaCl were used, namely, 1.12% at 37°C. The solutions had activities from 2.2 to 12 mC/liter, keeping the concentrations the same. Both sheep and chicken defibrinated blood was used. CO_2 was absorbed by KOH