obic production of ATP is sufficient for the processes preceding gastrulation and that either the quantity or source of ATP from aerobic metabolism is required for the development at all stages beyond gastrulation. It was shown that lactic acid accumulates in large quantities in embryos subjected to cyanide, thus indicating that the metabolic apparatus for anaerobic ATP production is present. Furthermore, the resumption of oxygen consumption and the diminution of accumulated lactic acid following removal of embryos from the cyanide demonstrated an approximate one day lag corresponding to the one day lag in the resumption of morphogenesis. Thus, it is concluded that aerobic sources of ATP production are required for embryo development from gastrulation on and are not required for the minimal conditions of embryo vitality.

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THE EFFECT OF LIPOIC ACID ON THE DEVELOPING EGGS OF THE SAND DOLLAR N. D. Wolfson and D. S. Fry, Mount Holyoke College, S. Hadley, Mass., and Randolph-Macon Woman's College, Lynchburg, Va.

In addition to its activity as a co-factor in oxidative decarboxylation, lipoic acid disturbs normal morphogenetic and regenerative processes when applied exogenously to several invertebrates. To distinguish between possible effects on cell division and on differentiation, we have applied lipoic acid to the embryos of the sand dollar <u>Echinarachnius parma</u> during several developmental stages.

We observed that the rate and form of cell division were undisturbed by concentrations of lipoic acid which induce marked changes in differentiating embryos. Embryos remaining in  $10^{-5}$  M lipoic acid are arrested as spinning blastulae.

To define the period of maximum sensitivity of the embryos to lipoic acid we used short exposures at various times during development, and found that the early cleavage stages were sensitive to the deleterious action of the lipoic whereas blastulae and subsequent stages were not. We conclude that the cellular components sensitive to the action of lipoic acid are present during early cleavage but presumably remain inactive until gastrulation.

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