

FURROW ESTABLISHMENT BY THE MOVING MITOTIC APPARATUS  
IN SAND DOLLAR (ECHINARACHNIUS PARMA) EGGS

R. Rappaport  
Mount Desert Island Biological Laboratory  
Salsbury Cove, ME 04672

In normal cells, the geometrical relation between the mitotic apparatus (MA) and the surface remains static while the division mechanism is established in the equatorial cortex. Although the length of the aster rays and the distance increases between the asters, the ring of cortex that will become the contractile ring is fixed in the plane of the metaphase plate. This circumstance has encouraged the idea that furrow establishment requires the stable arrangement, and it may depend on mechanical connections capable of generating localized tension in the equatorial surface. These experiments were designed to determine whether furrows can be formed when achievement of a stable, unvarying relation between the MA and the surface is prevented by keeping the MA in reciprocating motion during the period when the furrow is established.

Sand dollar (Echinarachnius parma) eggs were reshaped into cylinders by confining them in 82 or 85  $\mu$ m diameter capillaries made of transparent silicone rubber. The MA always oriented parallel to the capillary axis, and it was propelled back and forth by alternately compressing or pushing inward the polar surfaces with glass balls.

The method kept the MA in constant motion except for the instant when the direction of motion was reversed. The manipulation began when the normality of the MA was first clearly observable or at least 10 min before the furrow appeared. In three groups of experiments, the midpoint between the asters was moved 25, 50 and 75  $\mu$ m. Furrows developed and deepened in all the experimental cells, and they were rapidly completed when the motion ceased. Usually the degree of furrow acuteness appeared inversely proportional to the distance the midpoint between the asters was moved. Chronic manipulation often caused the polar surface to behave flaccidly.

Since the position of the furrow in sand dollar eggs of this shape and dimension is fixed 4 min before the furrow appears (Rappaport, R., J. Exp. Zool. 217: 365-375, 1981), the MA in these experiments was in motion before, during and after the period of furrow establishment. These results indicate that furrow establishment is not dependent on the normal stable relation between the MA and the surface or upon normal cytoplasmic organization. They imply that stable mechanical connections are not involved, and that the effect of the MA can be distributed over a wider than normal part of the surface and cause varying degrees of cortical contraction.

This work has been supported by National Science Foundation Grant No. MCB-8903341.