5 THE RELATION BETWEEN FURROWING RATE AND INITIAL DISTANCE BETWEEN THE MITOTIC APPARATUS AND THE SURFACE IN FLATTENED SAND DOLLAR EGGS

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The division mechanism of animal cells results from interaction between the mitotic apparatus (MA) and the surface. In flattened cells, furrows develop on the free margins but not on the flattened surfaces. When the MA of a flattened cell is excentric, the diametrically opposed furrows do not develop simultaneously; the later furrow appears on the more distant equatorial margin. The purpose of this investigation was to determine whether the furrows which develop in surfaces distant from the MA function at the same rate as furrows which develop in surfaces closer to the MA.

Fertilized sand dollar (Echinarachnius parma) eggs were flattened to 175 μm diameter against the bottom of an operation chamber with a rectangular fragment of coverslip positioned by a micromanipulator 15 to 30 minutes before the anticipated cleavage time. At this time, the MA is small and usually excentric. As the MA expanded, it did not center itself as it normally does, presumably because it was constrained by the upper and lower flattened surfaces which were about 60 μm apart. The rates of movement of the diametrically opposed furrow tips at 17°C were determined by measurements with an ocular micrometer and stopwatches. The period of measurement of each furrow was confined to the first 4 minutes of function, when physical contact between the cell surfaces and the glass surfaces used to achieve flattening did not impede the process.

The rate of movement of the furrow tips in flattened eggs is related to the initial distance between the MA and the equatorial margin. Furrows formed at extreme distances (105 μm or more from the MA) tended to stop and then regress. Furrows formed in more distant margins progressed more slowly than those in closer margins. In 37 cells in which the rates of both furrows were calculated, the correlation coefficient was 0.71537. The mean furrowing rate of the 10 fastest furrows was 12.13 $\pm$ 0.475 S.D. μm/min. The mean distance between the center of the spindle and the equatorial surface before division began was 76.25 $\pm$ 7.07 S.D. μm. The mean rate of the 10 slowest furrows was 2.89 $\pm$ 0.929 μm/min. The mean initial distance between the spindle and the surface which formed the slower furrow was 100.5 $\pm$ 9.19 S.D. μm.

The fact that, in the same flattened cell, furrowing begins later in the more distant margin has been attributed to the time required for a stimulus which originates in the MA to traverse the extra distance. These experiments afforded an opportunity to recalculate the rate of stimulus movement in cases where the time interval between appearance of the furrows in the near and far margins was greater than 2 min. The mean rate for 21 measurements at 17° C was 7.45 $\pm$ 3.19 S.D. μm/min. which is substantially in agreement with the previously published rate of 6.3 $\pm$ 1.8 μm/min. measured at 19° C. (Rappaport, J. Exp. Zool., 183: 115-120, 1973). This investigation was supported by NSF Grant PCM 7902624.

6 ROLE OF Ca^{2+}, KINASES AND PHOSPHODIESTERASES IN POLAR LOBE FORMATION AND CYTOKINESIS IN FERTILIZED EGGS OF ILYANASSA OBSOLETA

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Fertilized eggs of the marine mudsnail, Ilyanassa obsoleta (Nassarius obsoletus) repeatedly form and relax a constriction which resembles a cleavage furrow in a process called polar lobe formation before and during cytokinesis. Our previous work has demonstrated that microinjection of cAMP can cause a constriction to form quickly and that normal lobe formation and cytokinesis do not appear to require exogenous Ca^{2+}, because they can occur even in Ca-free sea water containing 10 mM EGTA (Conrad, G.W., and Davis, S.E. 1977. Devel. Biol. 61:184-201, and 1980. Devel. Biol. 74:152-172).