CLEAVAGE FURROW ESTABLISHMENT IN CYLINDRICAL SAND DOLLAR EGGS

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In animal cells the mitotic apparatus (MA) accomplishes both chromosome distribution and establishment of the physical mechanism which carries out cytokinesis. In spherical cells, the cytokinetic mechanism is generally considered to be irreversibly established in the cell surface by anaphase when the achromatic portion of the MA achieves maximum development. However, the time of appearance of the furrow can be delayed or advanced by altering the cell's geometry by methods which do not affect the schedule of mitotic events. This apparent dissociation between mitotic timing and the initiation of division implies that cytokinesis is not associated with a specific phase in the chain of mitotic events and suggests that the custom of relating the events of cytokinesis to those of mitosis may not be useful. The principal goal of this investigation was to determine when the position of the cleavage furrow is determined in real time, rather than in relation to mitosis.

The geometrical relations of cell components and the orientation of the division plane were standardized and controlled by reshaping the cells into cylinders. E. parma eggs were denuded by glycine treatment and confined in capillary tubes (approximately 300 μm long by 85 μm i.d.) immediately before completion of first cleavage. The cell usually oriented so that its long axis coincided with that of the capillary. After completion of the first cleavage and before the second, the mitotic apparatus of the two blastomeres oriented parallel to the capillary axis and division subsequently occurred simultaneously in the cells whether or not their volumes were equal provided the distance between astral centers was equal. In this circumstance, events in one blastomere can serve as a time control for the other. Temperature was maintained at 16°.

The time when the furrow position is determined was ascertained by aspirating the MA from one cell and measuring the time between the operation and the appearance of the furrow in the control cell. When the interval between MA removal and control furrowing was four minutes or less the furrow always developed in the operated cell. When the interval was five minutes or more, furrows never developed. The position of the furrow is apparently irreversibly established four minutes before it becomes visible. When one aster is removed more than four minutes before the control furrow appears, no furrow develops in the operated cell, indicating that both asters are necessary for this activity of the mitotic apparatus. Removal, sequestration or continuous stirring of the polar portion of one aster during the period of furrow establishment does not prevent division. When the mitotic apparatus is skewered with a glass needle through its long central axis and the needle is moved back and forth in the polar direction continually during the period of furrow establishment, division ensues even though the normal radiate appearance of the apparatus is absent in the central axis and at the poles of the cell. This investigation was supported by NSF Grant PCM-7902624.

RENAL AMMONIAGENESIS IN THE DOGFISH (SQUALUS ACANTHIAS): ROLES OF GLUTAMINASE AND GLUTAMINE SYNTHETASE

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An increase in renal ammoniagenesis is well documented as part of the kidney's response to acidosis in mammalian species. Glutamine is the major source of urinary ammonia in these animals but the regulation of ammonia production, while well studied, is still unclear (Goldstein, Int. Rev. Physiol., Vol. 11, 283-316, 1976). In comparison, the role of the kidney in the acid-base balance of fish has received little attention. Previously, we have shown that in dogfish, although the absolute urinary ammonia concentration is low, the kidney does respond to acid loading by significantly increasing renal ammonia excretion (King and Goldstein, Bull. MDIBL. 19:77-80, 1979). The current study was