TRANSLOCATION OF THE CLEAVAGE PLANE IN CYLINDRICAL *ECHINARACHNIUS PARMA* EGGS

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The contractile ring (CR) is a temporary organelle that is established by the mitotic apparatus (MA). After the CR is established, it functions independently of the MA. The purpose of this investigation is to learn more of the interaction between the MA and the cortex that produces the CR. About 30 min after fertilization, sand dollar eggs were reshaped into cylinders by confinement in a tapered silicone rubber capillary tube. The position of the MA was controlled by compressing adjacent cell regions with glass balls or stout hooks.

When the cell was compressed after the furrow appeared and the MA was moved slowly and continuously, the cytoplasm, furrow, and MA appeared to move in unison. When the MA was moved intermittently, the cortex and furrow did not move and the MA shifted until one aster was close to but not in the cleavage plane. Subsequently, the furrow moved to the midpoint between the asters of the MA in the new position. Repetition of the manipulations produced cumulative furrow movements of about 60 μm. The furrow could deepen as it moved and the direction of furrow movement was reversed by reversing the direction of MA movement.

Cells were also compressed before furrowing and then released when the furrow developed. Shallow furrows persisted and progressed at a normal rate in the surface of cells that were released from compression as soon as the furrow appeared. When the release was delayed 3-5 min after the furrow first appeared, furrow progress was impeded. Upon release, the furrow instantaneously deepened. In all cells, release resulted in a shift of the cytoplasm and MA toward the previously compressed area, and the MA moved all or part way through the plane of the furrow formed under compression. The new furrow forms in normal relation to the new MA position. In 12 experiments, the maximum and minimum distances between the planes of the old and new furrows were, respectively, 50 μm and 15 μm. When the furrow was shallow immediately after release, the furrows were often joined by a constricted region. When the furrow was deep immediately after release, the shift of the MA was impeded and the distance between old and new furrows was reduced to about 15 μm. In all these experiments the old furrow regressed.

These experiments reveal that although the CR can operate independently of the MA, the presence of the MA can affect the positoning of the functioning CR. The cell can compensate for disturbances in the normal relation between the MA and the CR. The cylindrical cell's ability to form successive cleavage planes 15 μm apart indicates that the functioning CR and the local tensile stress it generates has little effect on nearby furrow establishment. These results would not be expected if the CR were formed by simple condensation of an initially widespread cytoskeletal web.

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