FURROWING IN CONICAL SAND DOLLAR (ECHINARACHNIUS PARMA) EGGS

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The purpose of this investigation was to test a computer model of the cleavage stimulus pattern that establishes the division plane. The division plane normally develops perpendicular to the spindle axis at a point approximately equidistant from the aster centers. The model (Harris [1990] Annals N.Y. Acad. Sci. 582, 60-77) predicts that when the distances from the aster centers to the nearest surface is unequal, the area of maximum aster effect is closer to the aster that is nearest to the surface rather than at the midpoint between the aster centers. In these experiments the distances were made unequal by reshaping the spherical egg into a cone and orienting the mitotic apparatus in or parallel to a perpendicular extending from the center of the base to the vertex.

Capillary lumens were reshaped into conical surfaces by melting the glass wall with a loop of incandescent wire. Eggs were sucked into the conical portion of the capillary and the base was flattened by pressing against it with a pipet nozzle. Eggs were photographed at the time that furrow establishment was in progress and shortly afterward when the surface indentation of the early furrow became visible. The distances between the point where a plane through the early indentation intersected perpendicularly with the mitotic axis and each of the astral centers were measured with an ocular micrometer.

In 33 of 33 conical eggs the furrow developed closer to the aster nearest the vertex of the conical part of the egg. The ratios of the distances between the division plane and the closer and more distant aster centers were determined. The mean of the ratios of all conical eggs was significantly different from the mean of the ratios of cylindrical eggs having the same diameter as the base of the conical eggs ($p<0.001$; $t=7.467$ with 32 degrees of freedom) The means of the ratios of distance in conical eggs with different vertex angles (approximately 19 degrees and 34 degrees) were significantly different ($p<0.001$; $t=9.613$; 22 degrees of freedom).

These results are consistent with the prediction of the computer model, and they suggest that the division plane forms in the region where astral influence is greatest.

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