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Do Centrioles Generate a Polar Ejection Force?

Abstract. *A microtubule-dependent polar ejection force that pushes chromosomes away from spindle poles during prometaphase is observed in animal cells but not in the cells of higher plants. Elongating microtubules and kinesin-like motor molecules have been proposed as possible causes, but neither accounts for all the data. In the hypothesis proposed here a polar ejection force is generated by centrioles, which are found in animals but not in higher plants. Centrioles consist of nine microtubule triplets arranged like the blades of a tiny turbine. Instead of viewing centrioles through the spectacles of molecular reductionism and neo-Darwinism, this hypothesis assumes that they are holistically designed to be turbines. Orthogonally oriented centriolar turbines could generate oscillations in spindle microtubules that resemble the motion produced by a laboratory vortexer. The result would be a microtubule-mediated ejection force tending to move chromosomes away from the spindle axis and the poles. A rise in intracellular calcium at the onset of anaphase could regulate the polar ejection force by shutting down the centriolar turbines, but defective regulation could result in an excessive force that contributes to the chromosomal instability characteristic of most cancer cells.*