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Mechanics of Cellulose Synthase Complexes in Living Plant Cells[1]

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The polymer cellulose is one of the major components of the world's biomass with unique and fascinating characteristics such as its high tensile strength, renewability, biodegradability, and biocompatibility. Because of these distinctive aspects, cellulose has been the subject of enormous scientific and industrial interest, yet there are still fundamental open questions about cellulose biosynthesis. Cellulose is synthesized by a complex of transmembrane proteins called "Cellulose Synthase A" (CESA) in the plasma membrane. Studying the dynamics and kinematics of the CESA complex will help reveal the mechanism of cellulose synthesis and permit the development and validation of models of CESA motility. To understand what drives these complexes through the cell membrane, we used total internal reflection fluorescence microscopy (TIRFM) and variable angle epi-fluorescence microscopy to track individual, fluorescently-labeled CESA complexes as they move in the hypocotyl and root of living plants. A mean square displacement analysis will be applied to distinguish ballistic, diffusional, and other forms of motion. We report on the results of these tracking experiments.

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