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Controlling intercellular flow through mechanosensitive plasmodesmata nanopores KAARE H. JENSEN, JAN KNOBLAUCH, Department of Physics, Technical University of Denmark, KARL OPARKA, Institute of Molecular Plant Sciences, University of Edinburgh, KEUNHWAN PARK, Department of Physics, Technical University of Denmark — In plants, plasmodesmata (PD) are nanopores that serve as channels for molecular cell-to-cell transport. Precise control of PD permeability is essential to regulate nutrient transport; moreover, it is involved in growth, tissue patterning, and defense against pathogens. Callose deposition modulates PD transport but little is known of the rapid events that lead to PD closure in response to tissue damage or osmotic shock. We propose a new mechanism of PD closure as a result of mechanosensing. Pressure forces cause the cell wall, or the dumbbell-shaped ER-desmotubule-complex, to be displaced from the equilibrium position, thus closing the PD aperture. Cell wall elasticity and the filamentous protein tethers that link the plasma membrane to the ER complex play a key role in determining the selectivity of the PD pore. This model of PD control compares favorably with experimental data on the pressure-generated closure of PD.

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