Abstract: Plasmodesmata are nanochannels that permanently link adjacent plant cells. These intercellular bridges are essential in all aspects of plant life: from distributing photoassimilates for growth, tissue patterning and defense against pathogens. Understanding of plasmodesma architecture and function therefore constitutes a target for potentially transformative enhancement of food and bioenergy crop yield.

Plasmodesmata, however, represent the last major plant organelle with very little functional and structural information. This is mainly due to their nanoscale intricacy, being composed of proteins, membranes and wall material at 20 – 50 nm diameter, and the sparse understanding of the physical processes that mediate and regulate plasmodesmata transport across the cellular- and tissue scales. Current knowledge on Plasmodesma structure – function relations and potential nanoscale tools to be developed in order to study plasmodesma function will be discussed.

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