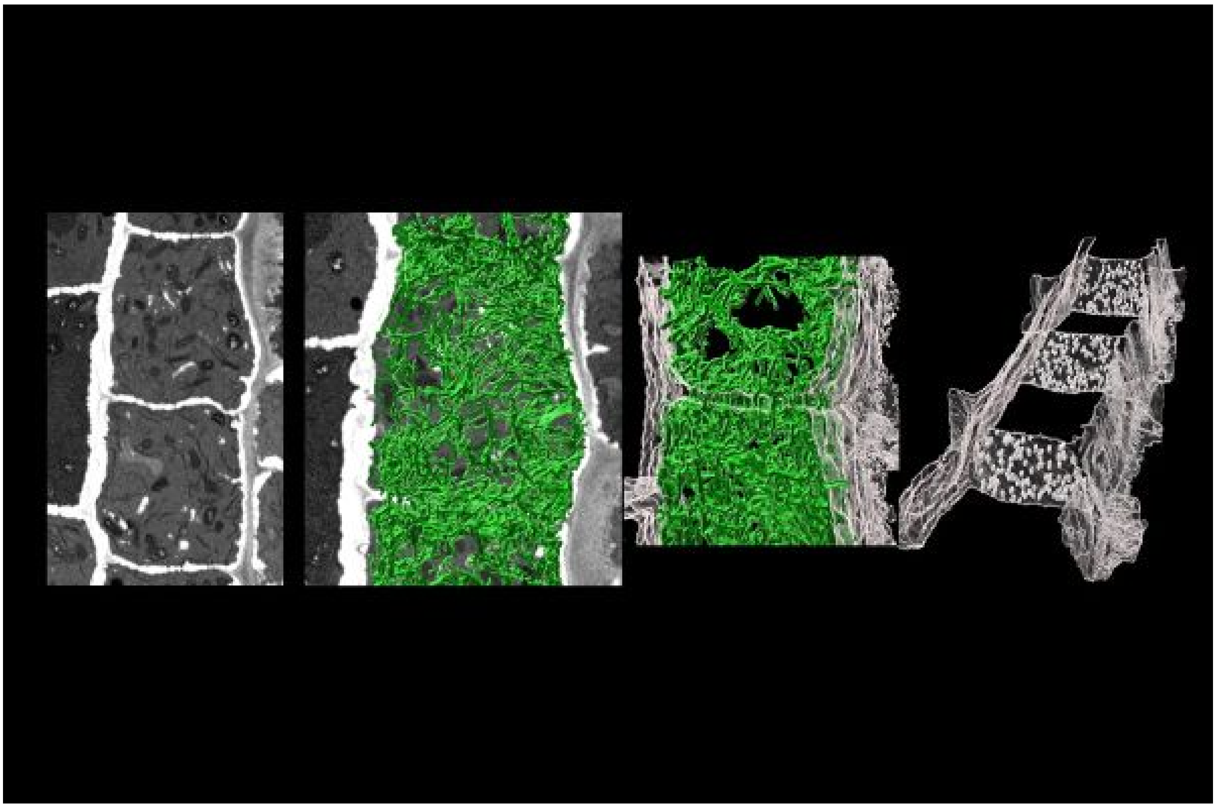

When Separation Creates Connection: How Do Plant Cells Stay Connected While Dividing?

Division and communication are prerequisites for multicellularity, but how are they coordinated? In a recent article, researchers identify the mechanisms that allow plant cells to divide while remaining connected.

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Plants, like animals, are multicellular organisms composed of millions of cells organized into specialized tissues and organs. These cells are formed by cell division, a process that produces two daughter cells with identical genomes from a single parent cell. These daughter cells later differentiate into specific cell types and must communicate to coordinate development and maintain the organism's function. Intercellular communication enables cells to exchange information and molecular signals throughout their lifespan.
In plants, this communication is facilitated by nanoscopic intercellular bridges called plasmodesmata. These structures connect cells and enable the exchange of molecules like

proteins, ions, hormones, and nutrients.
However, a paradox arises: how can daughter cells coordinate with each other while becoming individually autonomous? Since plasmodesmata form during cell division, how are division and connection coordinated?

Plant Cells Bypass the Final Stage of Cell Division to Remain Connected

In plants, unlike animal cells, cell division does not lead to a clear physical separation or ï¿½abscissionï¿½ between daughter cells. During cytokinesis, the final stage of cell divisio
, a cell plate forms to separate the daughter cells. However, as this plate forms, thousand
of nanoscopic openings, or ï¿½fenestrations,ï¿½ appear within it. Some of these fenes
rations stabilize into plasmodesmata, enabling a direct cytosolic connection between cells.
In this study, scientists investigated the molecular mechanisms that allow plant cells t
bypass abscission to form plasmo

The Endoplasmic Reticulum Has an Essential Role in Intercellular Bridge Formation

Now, CNRS and other collaborators have published a study in Science on the plant cells division and connection. By combining cell biology approaches, live cell fluorescence imaging, electron microscopy through close collaboration with the France-Bioimaging Bordeaux Imaging Center and biophysical modelling done by ICFO researcher **Dr. Felix Campelo**, the researchers highlighted the central role of the endoplasmic reticulum (ER) in plasmodesmata formation.
They discovered that in the model plant Arabidopsis thaliana, the formation of plasmodesmata requires the presence of the ER in the fenestrations as the cell plate expands. The ER helps stabilize the fenestrations, which then become plasmodesmata, while its absence leads to their complete fusion and disappearance. However, the ER is a highly dynamic organelle and needs stabilization. The study identified that three members of the Multiple C2 domains and Transmembrane domain Proteins (MCTPs) family, MCTP3, 4, and 6, allow for the attachment and constriction of the ER within the developing plasmodesmata, stabilizing them. Without MCTPs 3, 4, and 6, plasmodesmata formation and intercellular communication are significantly affected.
This research represents two major advances: it addresses the fundamental question of how plant cells ï¿½failï¿½ cytokinesis to enhance communication and reveals a central and unexpected role of the endoplasmic reticulum (ER) in orchestrating intercellular continu

Reference:

Plant plasmodesmata bridges form through ER-dependent incomplete cytokinesis.
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