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Plants as Architects: Lessons for Multifunctional, Stimuli-Responsive Materials

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Plants are hierarchically organized porous material systems with multiple functions that are intricately driven by water transport and distribution. The interplay between material composition, structural organization, and emergent function in plants offers powerful design principles for the development of next-generation technical material systems. By translating these biological strategies, biomimetic approaches enable the development of multifunctional, autonomously responding devices that extend beyond biology by leveraging responsiveness not only to water but also to diverse external cues such as thermal, pneumatic, solar, or electrical stimuli. Unlocking these possibilities requires advances in material synthesis, precise characterization, and scalable manufacturing methods capable of reproducing hierarchical and functionalized structures from the nano- to the device level.

On the example of exploding fruits and water conductive tissues, this talk highlights recent progress in bio-inspired material research, demonstrating how insights from life sciences can fuel innovation in material systems with life-like adaptive functions. The aim is to stimulate interdisciplinary collaboration within the MIN Materials pillar and inspire synergistic projects that bridge biology and materials science to develop next-generation bio-inspired technical material systems.

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