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**Review: “Mechanism of freeze-thaw injury and recovery: *A cool retrospective and warming up to new ideas*”**

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### **Highlights**

- Extracellular *versus* intracellular freezing; cellular desiccation, the major cause of various manifestations of FTI
- Older theories for FTI mechanisms
- Structural and functional perturbations in plasma membrane (PM) as the site of FTI
- Post-thaw recovery (PTR) requires ion homeostasis, proteostasis, cell-wall (CW) remodeling, and ROS scavenging – hypothesis for cytosolic calcium and ROS signaling
- Unresolved questions about FTI mechanisms? - role of CW-PM interface; short-term *versus* prolonged freezing; thaw-induced injury; role of tonoplast and ER stress; nature of injury at extremely high freezing stress (e.g. -20 °C to -60 °C range)

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