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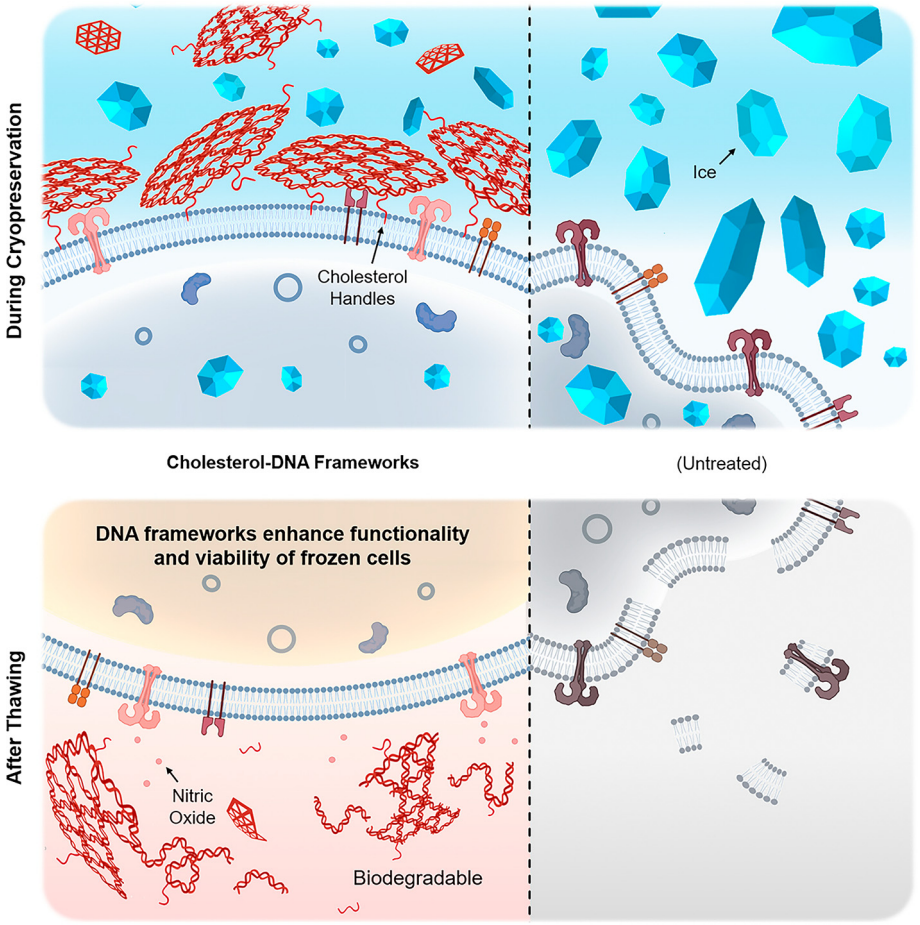
Trends in Biotechnology

Research Article

Membrane-targeted DNA frameworks with biodegradability recover cellular function and morphology from frozen cells



DNA frameworks, nanostructures engineered from DNA, preserve cells by anchoring to membranes, inhibiting cellular ice growth, and degrading autonomously after thawing. These biodegradable cryoprotectants outperform conventional agents, improve recovery and function of frozen macrophage cells, and offer a promising strategy for biopreservation in research and therapeutic applications.

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Highlights

We knitted DNA threads to fabricate nanoscale nets called DNA frameworks (DFs). We preserved macrophages along with a tiny amount of the DFs at cryogenic temperature.

DFs outperformed conventional cryoprotectants in the recovery and maintenance of cellular functionality and morphology of frozen macrophage cells.

The cryoprotective mechanism of the DFs originates from targeted binding to, and protection of, the cell membrane, inhibiting intracellular and extracellular ice growth, and undergoing efficient post-thaw degradation, avoiding toxicity risks.

Unlike conventional cryoprotectants, including dimethyl sulfoxide (DMSO) and glycerol, DNA-based nanomaterials exhibit both cryoprotective efficacy and biocompatibility for longer preservation.

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