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Injectable Supramolecular Hydrogels for Bioprinting, Wound Healing, and Drug Delivery

Stanford scientists have invented a new suite of adaptable hydrogel biomaterials that are optically transparent and injectable for cell encapsulation, tissue engineering, and drug delivery.

Recent efforts to develop hydrogel biomaterials have focused on better recapitulating the dynamic properties of the native extracellular matrix using adaptable hydrogels in which the binding thermodynamics and crosslink kinetics directly affect numerous bulk dynamic properties such as strength, stress relaxation, and material clearance. However, despite the broad range of bulk dynamic properties observed in biological tissues, present strategies to incorporate dynamic linkages in cell encapsulating hydrogels rely on a relatively small number of dynamic covalent chemical reactions and host-guest interactions.

Stanford scientists have developed supramolecular gelatin hydrogels with cucurbit[8]uril (CB[8])-based crosslinks that display useful properties, including being optically transparent and injectable. Human fibroblast cells encapsulated within these hydrogels remained highly viable and exhibited a well-spread morphology in culture. These CB[8]-based gelatin hydrogels are anticipated to be useful in applications ranging from bioprinting to cell and drug delivery.

Applications

- Wound healing
- Regenerative medicine
- 3D cell culture
- Bioprinting

- Drug delivery

Advantages

- Optically transparent
- Injectable
- Shear-thinning
- Demonstrated ability to encapsulate fibroblasts and keep them viable

Patents

- Published Application: WO2021173698
- Published Application: 20230040418
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