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Columbia scientists turn yogurt into a healing gel that mimics human tissue

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Source: Columbia University School of Engineering and Applied Science

Summary: Scientists at Columbia Engineering have developed an injectable hydrogel made from yogurt-derived extracellular vesicles (EVs) that could revolutionize regenerative medicine. These EVs serve both as healing agents and as structural components, eliminating the need for added chemicals. The innovation leverages everyday dairy products like yogurt to create a biocompatible material that mimics natural tissue and enhances healing.

FULL STORY

A yogurt-based hydrogel that heals and mimics living tissue could soon transform regenerative medicine, thanks to EVs doing double duty as building blocks and healing agents. Credit: Shutterstock

Researchers from Columbia Engineering have established a framework for the design of bioactive injectable hydrogels formulated with extracellular vesicles (EVs) for tissue engineering and regenerative medicine applications.

Published on July 25 in *Matter*, Santiago Correa, assistant professor of biomedical engineering at Columbia Engineering, and his collaborators describe an injectable hydrogel platform that uses EVs from milk to address longstanding barriers in the development of biomaterials for regenerative medicine. EVs are particles naturally secreted by cells and carry hundreds of biological signals, like proteins and genetic material, enabling sophisticated cellular communication that synthetic materials cannot easily replicate.

In this study, Correa and colleagues designed a hydrogel system where EVs play a dual role: they act as bioactive cargo but also serve as essential structural building blocks, by crosslinking biocompatible polymers to form an injectable material. Using an unconventional approach that leveraged milk EVs from yogurt, the team was able to overcome yield constraints that hinder the development of EV-based biomaterials. The yogurt EVs enabled the hydrogel to both mimic the mechanics of living tissue and actively engage surrounding cells, promoting healing and tissue regeneration without the need for additional chemical additives.

"This project started as a basic question about how to build EV-based hydrogels. Yogurt EVs gave us a practical tool for that, but they turned out to be more than a model," said Correa who led the study with Artemis Margaronis, an NSF graduate research fellow in the Correa lab. "We found that they have inherent regenerative potential, which opens the door to new, accessible therapeutic materials."

Correa directs the Nanoscale Immunoengineering Lab at Columbia University, where his research focuses on drug delivery and immunoengineering. He is also a member of the Herbert Irving Comprehensive Cancer Center and collaborated on this project with Kam Leong, a fellow Columbia Engineering faculty member. The study was further strengthened through international collaboration with researchers from the University of Padova, including Elisa Cimetta (Department of Industrial Engineering) and graduate student Caterina Piunti. By combining Padova team's expertise in agricultural EV sourcing with the Correa lab's experience in nanomaterials and polymer-based hydrogels, the team demonstrated the power of cross-disciplinary, global partnerships in advancing biomaterials innovation.

By using yogurt-derived EVs, the team defined a design space for generating hydrogels that incorporate EVs as both structural and biological elements. They further validated the approach using EVs derived from mammalian cells and bacteria, demonstrating that the platform is modular and compatible with diverse vesicle sources. This could open the door to advanced applications in wound healing and regenerative medicine, where current treatments often fall short in promoting long-term tissue repair. By integrating EVs directly into the hydrogel structure, the material enables sustained delivery of their bioactive signals. Because the hydrogel is injectable, it can also be delivered locally to damaged tissue.

Early experiments show that yogurt EV hydrogels are biocompatible and drive potent angiogenic activity within one week in immunocompetent mice, demonstrating that agricultural EVs not only enable fundamental biomaterials research but also hold therapeutic potential as a next-generation biotechnology. In mice, the material showed no signs of adverse reaction and instead promoted the formation of new blood vessels, a key step in effective tissue regeneration. Correa's team also observed that the hydrogel creates a unique immune environment enriched in anti-inflammatory cell types, which may contribute to the observed tissue repair processes. The team is now exploring how this immune response could help guide tissue regeneration.

"Being able to design a material that closely mimics the body's natural environment while also speed up the healing process opens a new world of possibilities for regenerative medicine," said Margaronis. "Moments like these remind me why the research field in biomedical engineering is always on the cusp of something exciting."

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Materials provided by **Columbia University School of Engineering and Applied Science**. *Note: Content may be edited for style and length.*

Journal Reference:

1. Artemis Margaronis, Caterina Piunti, Ryan R. Hosn, Sarah Bortel, Satya Nayagam, James S. Wang, Daniella Uvaldo, Kam Leong, Elisa Cimetta, Santiago Correa. **Extracellular vesicles as dynamic crosslinkers for bioactive injectable hydrogels**. *Matter*, 2025; 102340 DOI: 10.1016/j.matt.2025.102340

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