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A Simple Injectable Hydrogel That Boosts Vaccine Effectiveness

Stanford researchers have developed a simple injectable hydrogel that slowly releases vaccine components over time, helping the body build stronger and longer-lasting immunity.

Many modern vaccines, especially protein-based (subunit) vaccines, are among the safest available, but often require multiple doses to generate strong protection. This can be challenging during pandemics, in low-resource settings, or when patient follow-up is difficult. Existing approaches to address this through sustained delivery require either complex manufacturing, implantable devices, or non-standard administration methods, all of which create meaningful barriers to commercial development and clinical adoption.

This technology solves that problem with a ready-to-mix hydrogel made from two widely used, commercially available materials. After injection, the gel slowly releases vaccine antigens and adjuvants over several weeks, mimicking a natural infection and giving the immune system more time to respond. All components carry FDA "Generally Recognized as Safe" (GRAS) status, supporting a streamlined regulatory path. The technology has been validated in vivo and is applicable across vaccines for both infectious diseases and cancer.

Stage of Development
Proof of concept - in vivo

Applications

- Subunit protein vaccines for infectious diseases and cancer
- Single-dose or dose-sparing vaccine strategies
- Pandemic preparedness and rapid vaccine deployment

Advantages

- Simple physical mixing – no chemical synthesis required
- Uses commercially available, FDA GRAS-listed components, supporting an accelerated regulatory pathway
- Injectable and self-healing hydrogel depot

Publications

- Priya Ganesh et al. (2025). Enabling global access to potent subunit vaccines with a simple and scalable injectable hydrogel platform. Biomater. Sci., 2026, 14, 173-185

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