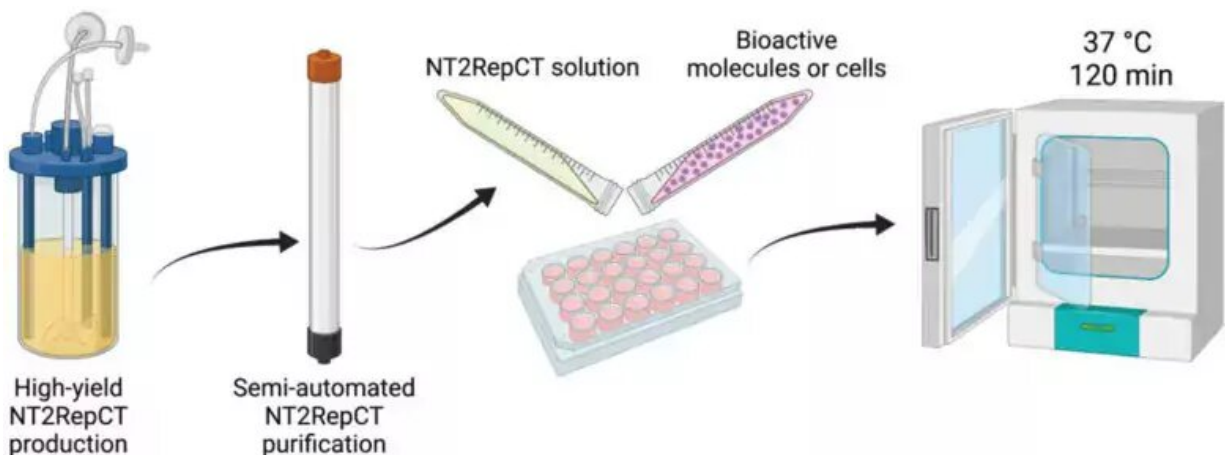


Recombinant and tunable spidroin hydrogels for drug release and cell culture

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Production of bioactive hydrogels. NT2RepCT is produced at high yields in a bioreactor and purified with a semi-automated FPLC system. To form bioactive gels, the NT2RepCT proteins are mixed with cells or GFP and incubated at 37°C for 120 min to encapsulate the cells or GFP, respectively, within the hydrogel. Created with BioRender.com. Credit: Karolinska Institutet

In a new study, researchers at Karolinska Institutet show that recombinant spider silk protein hydrogels have many attractive features. They allow encapsulation of cells and bioactive molecules simply by incubation at 37°C. They are transparent, which allows monitoring of encapsulated cells, and the fibrillar network mimics that of the extracellular matrix. The mechanical properties of these hydrogels match those of different tissues, and the gels can be used for continuous drug

release.

If manufactured from proteins produced in heterologous hosts, artificial spider silk is a promising biomaterial. Researchers at the Department of Biosciences and Nutrition, at Karolinska Institutet, have previously developed a biomimetic spider silk production method, which enables the production of artificial spider silk proteins and fibers, without involving harsh organic solvents.

This was made possible by the design of a small spider silk [protein](#) (spidroin). A big advantage of this mini-spidroin is that it can be produced in large quantities (14.5g purified protein per liter culture in bioreactors) and is possible to purify in a semi-automated process.

Recently, the team discovered that recombinant mini-spidroins form hydrogels within minutes, if incubated at 37°C, i.e., without the use of crosslinkers. The temperature and time range for gel formation are compatible with most bioactive agents and living cells, and the gels are composed of a nano-sized fibrillar network, opening-up possibilities of developing a novel [hydrogel](#) system for cell culture and tissue engineering.

Tunable to match different tissues

The researchers Tina Arndt and Urmimala Chatterjee, show in their new study, published in *Advanced Functional Materials* that human fetal mesenchymal stem cells can be encapsulated in these hydrogels, after which they show high survival and viability. Interestingly, the mechanical properties of the hydrogels can be tuned by changing the protein concentration to match those of different tissues, e.g., muscles and cartilage.

Furthermore, mixtures of recombinant spider [silk](#) proteins and green

fluorescent protein (GFP) form gels, from which functional GFP is gradually released, indicating that [bioactive molecules](#), easily included in the [gels](#), maintain their activity and can diffuse through the gel. This means that the hydrogels have potential applications in drug delivery.

Along the same line, encapsulated ARPE-19 cells are viable and continuously produce the growth factor progranulin, which is released from the cells, then diffuses through the hydrogel and is detected in the cell culture medium over the study period of 31 days.

More information: Tina Arndt et al, Tuneable Recombinant Spider Silk Protein Hydrogels for Drug Release and 3D Cell Culture, *Advanced Functional Materials* (2023). [DOI: 10.1002/adfm.202303622](https://doi.org/10.1002/adfm.202303622)

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