Researchers develop thermo-responsive protein hydrogel

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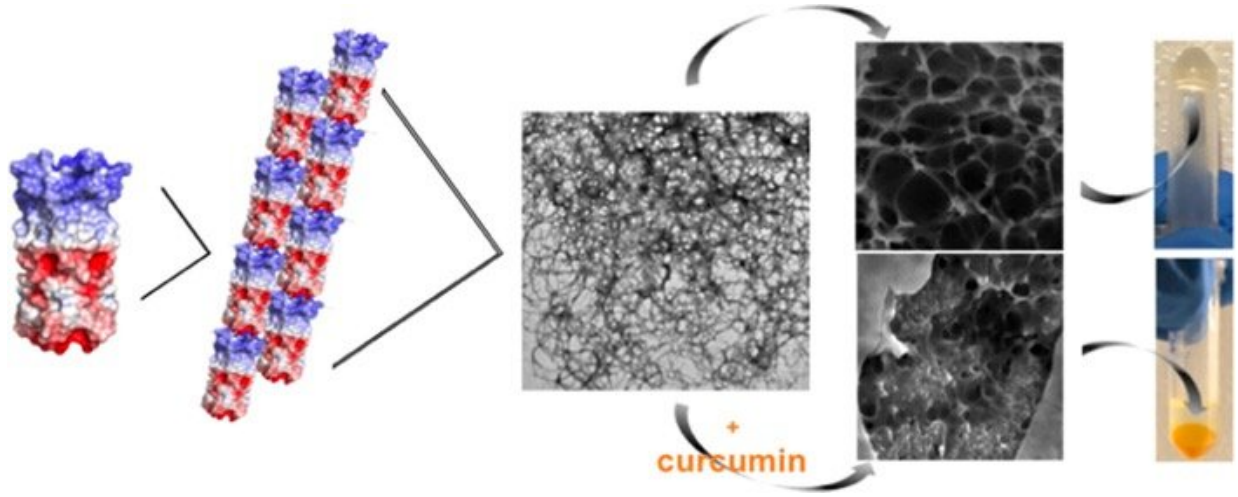

An illustration of how an engineered Q protein self-assembles to form fiber-based hydrogels at low temperature. These hydrogels have a porous microstructure that allows them to be used for drug delivery applications. Credit: NYU Tandon

Imagine a perfectly biocompatible, protein-based drug delivery system durable enough to survive in the body for more than two weeks and capable of providing sustained medication release. An interdisciplinary research team led by Jin Kim Montclare, a professor of biomolecular and chemical engineering at the NYU Tandon School of Engineering, has created the first protein-engineered hydrogel that meets those criteria, advancing an area of biochemistry critical to not only to the

future of drug delivery, but tissue engineering and regenerative medicine.

Hydrogels are three-dimensional polymer networks that reversibly transition from solution to gel in response to physical or chemical stimuli, such as temperature or acidity. These polymer matrices can encapsulate cargo, such as small molecules, or provide structural scaffolding for tissue engineering applications. Montclare is lead author of a new paper in the journal Biomacromolecules, which details the creation of a hydrogel comprised of a single protein domain that exhibits many of the same properties as synthetic hydrogels. Protein hydrogels are more biocompatible than synthetic ones, and do not require potentially toxic chemical crosslinkers.

"This is the first thermo-responsive protein hydrogel based on a single coiled-coil protein that transitions from solution to gel at low temperatures through a process of self-assembly, without the need for external agents," said Montclare. "It's an exciting development because protein-based hydrogels are much more desirable for use in biomedicine."

The research team conducted experiments encapsulating a model small molecule within their protein hydrogel, discovering that small molecule binding increased thermostability and mechanical integrity and allowed for release over a timeframe comparable to other sustained-release drug delivery vehicles. Future work will focus on designing protein hydrogels tuned to respond to specific temperatures for various drug delivery applications.

The paper, "Thermoresponsive Protein-Engineered Coiled-Coil Hydrogel for Sustained Small-Molecule Release," is published by *Biomacromolecules*.

More information: Lindsay K. Hill et al, Thermoresponsive Protein-Engineered Coiled-Coil Hydrogel for Sustained Small Molecule Release, *Biomacromolecules* (2019). DOI: 10.1021/acs.biomac.9b00107