

# Researchers break nano barrier to engineer the first protein microfiber

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Researchers at the New York University Polytechnic School of Engineering have broken new ground in the development of proteins that form specialized fibers used in medicine and nanotechnology. For as long as scientists have been able to create new proteins that are capable of self-assembling into fibers, their work has taken place on the nanoscale. For the first time, this achievement has been realized on the microscale—a leap of magnitude in size that presents significant new opportunities for using engineered protein fibers.

Jin Kim Montclare, an associate professor of chemical and biomolecular engineering at the NYU School of Engineering, led a group of researchers who published the results of successful trials in the creation of engineered microfiber proteins in the journal *Biomacromolecules*.

Many materials used in medicine and [nanotechnology](#) rely on proteins engineered to form fibers with specific properties. For example, the scaffolds used in tissue engineering depend on engineered fibers, as do the nanowires used in biosensors. These fibers can also be bound with [small molecules](#) of therapeutic compounds and used in drug delivery.

Montclare and her collaborators began their experiments with the intention of designing nanoscale proteins bound with the cancer therapeutic curcumin. They successfully created a novel, self-assembling nanoscale [protein](#), including a hydrophobic pore capable of binding small molecules. To their surprise, after incubating the fibers with curcumin, the protein not only continued to assemble, but did so to a degree that the fibers crossed the diameter barrier from the nanoscale to the microscale, akin to the diameter of collagen or spider silk.

"This was a surprising and thrilling achievement," said Montclare, explaining that this kind of diameter increase in the presence of small molecules is unprecedented. "A microscale fiber that is capable of delivering a small molecule, whether it be a therapeutic compound or other material, is a major step forward."

Montclare explained that biomaterials embedded with small molecules could be used to construct dual-purpose scaffolds for tissue engineering or to deliver certain drugs more efficiently, especially those that are less effective in an aqueous environment. Using microscopy, the team was able to observe the fibers in three dimensions and to confirm that the curcumin, which fluoresces when bound to structural protein, was distributed homogeneously throughout the fiber.

Despite the enormity of the jump from nano- to microscale, the research team believes they can devise even larger fibers. The next step, Montclare says, is developing proteins that can assemble on the milliscale, creating [fibers](#) large enough to see with the naked eye. "It's even possible to imagine generating hair out of cell assembly," she says.

**More information:** "Engineered Coiled-Coil Protein Microfibers." *Biomacromolecules*, 2014, 15 (10), pp 3503–3510 [DOI: 10.1021/bm5004948](#)

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