Designed biomaterials mimicking biology: Potential scaffold for muscle regeneration

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Engineered artificial proteins that mimic the elastic properties of muscles in living organisms are the subject of an article in *Nature* magazine to be released May 6.

"Our goal is to use these biomaterials in tissue engineering as a type of scaffold for muscle regeneration," said co-author Dan Dudek, an assistant professor of engineering science and mechanics (ESM) at Virginia Tech.

The work was conducted when Dudek was a postdoctoral fellow at the University of British Columbia's Department of Zoology where he worked with the lead author Hongbin Li of the University of British Columbia's Department of Chemistry.

According to the Nature press release on the article, "This work represents a step forward in the design at the single-molecule level of potentially useful biomaterials."

The team engineered a synthetic protein to reproduce the molecular structure of titin, the muscle protein "that largely governs the elastic properties of muscle," according to the Nature article. The researchers tested the nanomechanical properties of the new proteins at the single-molecule level and then cross-linked them into a solid rubber-like material.

The authors wrote that synthetic biomaterials display the unique multifunctional characteristics of titin, acting like a spring with high resilience at low strain and as a shock-absorb at high strains. Dudek added that this is "a nice feat when the material at a high strain releases stress instead of tearing apart. The material's spring-like properties are fully recoverable."

Under normal biological circumstances, injuries causing tissue tears larger than a centimeter will not reconnect on their own, Dudek said. The newly designed biomaterial could help in the healing process by acting as a tough yet extensible scaffold, allowing new tissue to grow across the gap.

The new biomaterial is biodegradable. "You only want the scaffold to exist as long as necessary, and then dissolve itself, leaving no side effects," Dudek said.

Producing the synthetic protein is as easy as growing bacteria, but then it must be purified. The expense comes when generating large quantities, Dudek said. "Our next step will be to see if, on the engineering side, we can make use of this in the scaffold matrix."

Provided by Virginia Tech

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