New method to grow synthetic collagen unveiled

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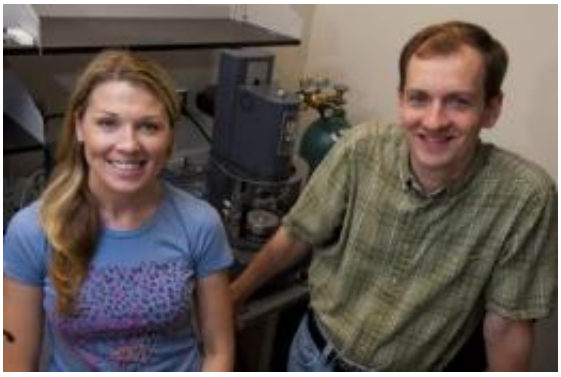

Rice University researchers Lesley O'Leary (left) and Jeffrey Hartgerink have unveiled a new method for making synthetic collagen, which could prove useful for regenerating new tissues and organs from stem cells. Credit: Jeff Fitlow/Rice University

In a significant advance for cosmetic and reconstructive medicine, scientists at Rice University have unveiled a new method for making synthetic collagen. The new material, which forms from a liquid in as little as an hour, has many of the properties of natural collagen and may prove useful as a scaffold for regenerating new tissues and organs from stem cells.

"Our work is significant in two ways," said Rice's Jeffrey Hartgerink, the lead author of a new paper about the research in *Nature Chemistry*. "Our final product more closely resembles native collagen than anything that's

previously been made, and we make that material using a self-assembly process that is remarkably similar to processes found in nature."

Collagen, the most abundant protein in the body, is a key component of many tissues, including skin, tendons, ligaments, cartilage and blood vessels. Biomedical researchers in the burgeoning field of regenerative medicine, or tissue engineering, often use a combination of stem cells and collagen-like materials in their attempts to create laboratory-grown tissues that can be transplanted into patients without risk of immunological rejection.

Animal-derived collagen, which has some inherent immunological risks, is the form of collagen most commonly used in reconstructive and cosmetic surgery today. Animal-derived collagen is also used in many cosmetics.

Despite the abundance of collagen in the body, deciphering or recreating it has not been easy for scientists. One reason for this is the complexity collagen exhibits at different scales. For example, just as a rope is made of many interwoven threads, collagen fibers are made of millions of proteins called peptides. Like a rope net that can trap and hold items, collagen fibers can form three-dimensional structures called hydrogels that trap and hold water.

"Our supramolecules, fibers and hydrogels form in a similar way to native collagen, but we start with shorter peptides," said Hartgerink, associate professor of chemistry and of bioengineering.

With an eye toward mimicking collagen's self-assembly process as closely as possible, Hartgerink's team spent several years perfecting its design for the peptides.

Hartgerink said it's too early to say whether the synthetic collagen can be

substituted medically for human or animal-derived collagen, but it did clear the first hurdle on that path; the enzyme that the body uses to break down native collagen also breaks down the new material at a similar speed.

A faculty investigator at Rice's BioScience Research Collaborative, Hartgerink said scientists must next determine whether cells can live and grow in the new material and whether it performs the same way in the body that native collagen does. He estimated that clinical trials, if they prove warranted, are at least five years away.

More information: www.nature.com/nchem/journal/v … full/nchem.1123.html

Provided by Rice University