Engineers, surgeons make biomaterial for wounds

Cornell University
By Anne Ju [1]

A compound found in sunless tanning spray may help to heal wounds following surgery, according to a study by Cornell biomedical engineers and plastic surgeons at NewYork-Presbyterian Hospital/Weill Cornell Medical Center.

Results published online May 31 in Proceedings of the National Academy of Sciences show that a sticky gel of polyethylene glycol and a polycarbonate of dihydroxyacetone (MPEG-pDHA) may help to seal surgical wounds.

Procedures to remove cancerous breast tissue, for example, often leave a hollow space that fills with seroma fluid and must typically be drained by a temporary implant. "This is an unpleasant side effect of surgery that is often unavoidable," said co-author Dr. Jason Spector, a plastic surgeon at NewYork-Presbyterian Hospital/Weill Cornell Medical Center."The new substance would act to glue together the hole left behind to prevent seroma buildup."

DHA sticks to certain compounds (amines) in biological tissues. Its sticky properties allow sunless tanners to adhere to the skin without being wiped off. Because it is biodegradable and water soluble, DHA does not stay tacked onto the body's tissues forever. Currently used "bio-glues" are made from animal products and take a long time to degrade in the body -- factors that raise the risk of infection.

"DHA is a compound that is naturally produced in the body," said lead author David Putnam, associate professor of biomedical engineering on Cornell's Ithaca campus. "The glue is broken down, or metabolized, and then safely removed by the body."

Putnam's lab has worked to create safe, synthetic compounds from chemicals found in nature. DHA is an intermediary compound produced during the metabolism of glucose, a sugar used by the body for fuel.

To create MPEG-pDHA, Putnam and colleagues first bound the single molecule monomer of DHA, which is highly reactive, to a protecting group molecule, making it stable enough to manipulate. This allowed the engineers to bind the monomers together to form a polymer, or chain of molecules, along with MPEG. Doing so allows the polymer gel to be injected through a syringe.

"Making a polymer from DHA has eluded chemical engineers for about 20 years," Putnam said.

Now in gel form, the compound has the ability to stick tissues together like an internal Band-Aid, preventing the pocket from filling with seroma fluid, Putnam said.

The researchers found that the gel prevented or significantly lowered fluid buildup in rats that had had breast tissue removed.

"The next step would be to test the gel on larger animals and then in clinical trials in human surgical cases," Spector said.

Previous results published by Putnam and Spector in the August 2009 issue of the Journal of Biomedical Materials Research showed that the gel also prevented bleeding in a rat liver.

"This is another aspect of the compound that would be greatly beneficial if proven to be applicable in humans," Spector said. "The gel could speed the healing and decrease bleeding within the body."

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Other co-authors include Cornell's Peter Zawaneh, Weill Cornell's Sunil Singh and Peter Henderson and Robert Padera of Brigham and Women's Hospital.

SOURCE [2]

Links:
[1] mailto://www.news.cornell.edu/stories/June10/amj8@cornell.edu
[2] http://www.news.cornell.edu/stories/June10/PutnamBiomaterial.html