'Oil for the Joints' Offers Hope for Osteoarthritis Sufferers

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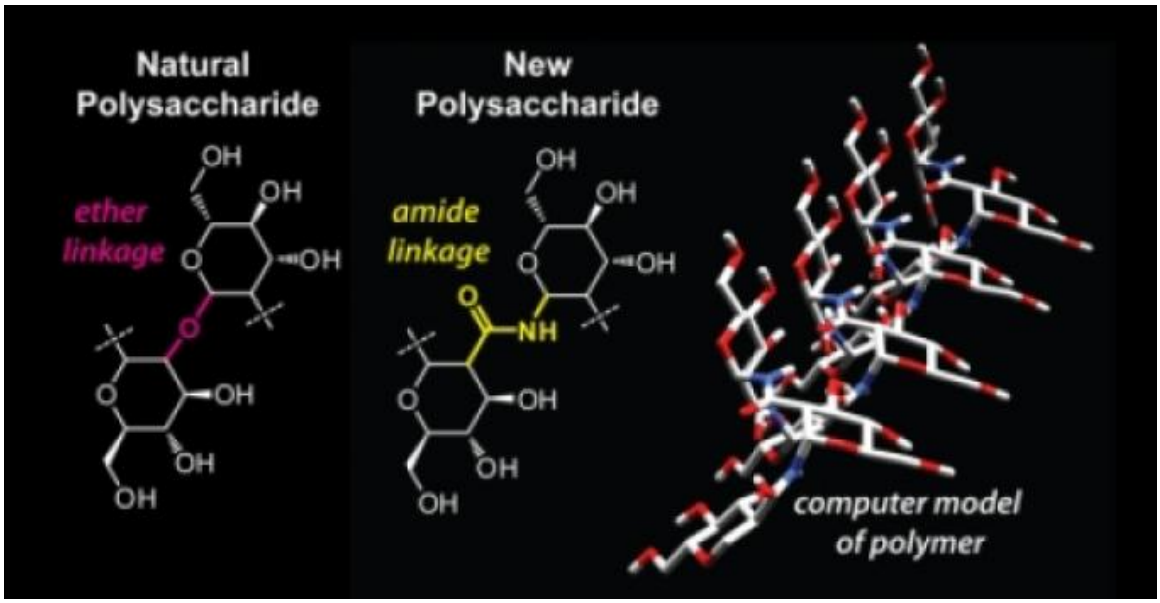
May 2, 2013 — A team of researchers led by a Boston University Biomedical Engineer has developed a new joint lubricant that could bring longer lasting relief to millions of osteoarthritis sufferers. The new synthetic polymer supplements synovial fluid, the natural lubricant in joints, and works better than comparable treatments currently available.

According to Professor Mark W. Grinstaff (BME, MSE, Chemistry), the best fluid supplement now available offers temporary symptom relief but provides inadequate lubrication to prevent further degradation of the cartilage surfaces that cushion the joint.

To achieve both objectives, Grinstaff, Beth Israel Deaconess Medical Center/Harvard Medical School orthopedic surgeon Brian Snyder and a team of Boston University chemistry and engineering students, fellows and clinicians have advanced the first synthetic synovial fluid. They describe the unique polymer and its performance in *Journal of the American Chemical Society*.



Natural polysaccharides (left) contain sugars linked by an ether, in contrast to the new polysaccharides that contain sugars linked by an amide (middle). The researchers are using a 3D computer model of the amide-linked polysaccharide (right) to understand how the new linkage affects the structure, and therefore the properties, of the new polysaccharide.

The most common form of joint disease and a leading cause of disability in the elderly, osteoarthritis (OA) affects about 27 million Americans and 200 million people worldwide. Characterized by pain and swelling, the disease emerges in hand, hip, knee and other commonly used joints where degradation of cartilage and synovial fluid results in bone-on-bone abrasion. Treatments range from anti-inflammatory drugs to total joint replacement. While there's no cure for OA, one treatment -- injection of a polymer to supplement synovial fluid in the joint -- promises to relieve symptoms and slow the disease's progression by reducing wear on cartilage surfaces.

"From our studies, we know our biopolymer is a superior lubricant in the joint, much better than the leading synovial fluid supplement, and similar to healthy synovial fluid," said Grinstaff. "When we used this new polymer, the friction between the two cartilage surfaces was lower, resulting in less wear and surface-to-surface interaction. It's like oil for the joints."

Originally produced last year for another study, the new polymer mimics some of the properties of natural polysaccharides, large compounds that link repetitive sequences of sugar molecules in a chainlike pattern.

"You put it between your fingers, and it's slippery," Grinstaff observed. "Once we made it, we wondered if we could use it as a lubricant and where it would be useful. That's how we thought of using it as a potential treatment for OA."

Another advantage of the biopolymer is its large molecular weight or size, which prevents it from seeping out of the joint, enabling longer lasting cartilage protection. Unlike the leading synovial fluid supplement, which lasts one or two days, the new polymer remains in the joint for more than two weeks.

The research is supported by the Wallace H. Coulter Foundation and Flex Biomedical, a startup cofounded by Grinstaff and Snyder.