Cushioning the Blow of Joint Pain

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For many people, stiff, aching joints are the first sign of age. For more than 20 million Americans, it is also the first sign of osteoarthritis, a disease characterized by loss of the lubricating and load-bearing tissue that lines the joints and that is behind an estimated $128 billion each year in health care costs and lost productivity.

"Since the lifespan of most joint replacements is limited typically to 15 or 20 years, restoring joint function with living tissue is almost always preferred," said Clark Hung.

The trouble is, that this tissue, known as articular cartilage, is made up of a network of chondrocyte cells embedded in a stiff matrix of collagen and other substances that is subjected to daily, repetitive mechanical deformation and a lack of nutrient-rich blood flow. Because of this, damaged tissue does not heal easily and replacement cartilage with natural properties has proved difficult to grow in a lab. Until now.

By growing chondrocytes under mechanical loads that mimic the conditions inside joints, Hung and Gerard Ateshian, professor of mechanical engineering and biomedical engineering, have been able to culture tissue that is almost identical to the body's own. The tissue loading helps transport nutrients to the chondrocytes. As a result, their engineered tissue grows faster, is more durable, and, they anticipate, will provide better restoration of the joint.

Hung has so far succeeded in growing bovine and canine articular cartilage and foresees a near future in which human cartilage will routinely be produced in the lab using his method. Good news for anyone who plans on growing older.

In August of 2010, the American Society of Mechanical Engineers (ASME) named Hung to its most recent class of fellows.

"Becoming a fellow in ASME is particularly fitting," Hung says, "as I came to Columbia to build a research program in cell and tissue engineering that capitalized on the institution's long-standing strengths in the area of biomechanics."

Hung serves on the ASME's executive committee of the bioengineering division and he is an associate editor for its *Journal of Biomechanical Engineering*. The organization has more than 100,000 members. Hung joins the group's select group of fellows, which includes just 3,012 members.

Hung is also a member of Columbia's Bioreactor Core faculty that includes Gordana Vunjak-Novakovic, Elisa Konofagou, Helen Lu, and Jeremy Mao. Their group is funded by the National Institutes of Health to support advanced research into functional tissue engineering, stem cells, and the study of disease.

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