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Skeletal stem cells may grow bones and cartilage

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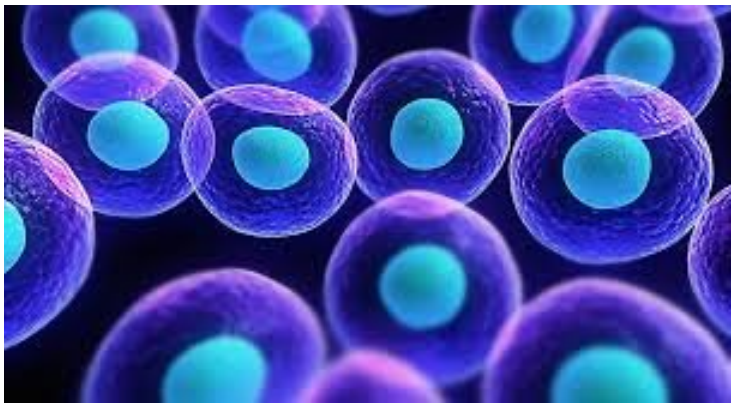
The newfound cells could one day be used to repair joints and treat osteoporosis



Scientists found the stem cells, which give rise to bones, cartilage and the spongy bone that harbors bone marrow, in fetal bones, adult bones and fat. The researchers also reprogrammed adult cells into skeletal stem cells.

A ready supply of such cells could one day help doctors repair or replace joint cartilage, heal broken bones more quickly, build up bone in osteoporosis patients and even grow new bone and cartilage for reconstructive surgeries.

Those applications are still far in the future, says Clifford Tabin, a developmental geneticist at Harvard Medical School who was not involved in the study. “The current study is an extremely important advance,” he says, “but there is work to be done before [skeletal stem cells] can contribute to changing the landscape of orthopedic medicine.”

Other stem cells collected from fat and cartilage can be coaxed into making bone or cartilage under special circumstances, but those cells are not the dedicated skeletal cells discovered in the new study, says co-author Michael Longaker, a plastic surgeon at Stanford University School of Medicine.

Longaker’s team found skeletal stem cells in the rapidly growing portion of a fetal femur and transferred them to lab dishes where they could multiply. Continued self-renewal is an important characteristic of stem cells. To determine whether the cells could make more of themselves indefinitely, researchers performed a series of stem cell transplants into mice under the outer layer of the rodents’ kidneys.

The transplanted human skeletal stem cells grew into bones on the mice’s kidneys. Stem cells from those newly grown bones were transplanted into another mouse, where the stem cells again made bones.

The skeletal stem cells could form bone, cartilage and spongy bone, but didn’t make fat or other tissues. That result shows these stem cells are specific to the skeleton.

Longaker's team tracked down adult skeleton stem cells by cataloging the types of RNA produced in the fetal skeletal stem cells. Different types of RNA are copies of genetic instructions encoded in DNA, which determine a cell's identity and function. Skeletal stem cells in adult bones and fat that make the same RNAs also made bone, cartilage and spongy bone when transplanted into mice.

The team also manipulated embryonic-like stem cells, or induced pluripotent stem cells, into becoming the skeletal stem cells. The ability to grow skeletal stem cells in a dish "is particularly promising, as you can grow as many of these as you wish," Tabin says.