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Scientists See Potential In Amniotic Stem Cells

They Are Highly Versatile And Readily Available

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A type of cell that floats freely in the amniotic fluid of pregnant women has been found to have many of the same traits as embryonic stem cells, including an ability to grow into brain, muscle and other tissues that could be used to treat a variety of diseases, scientists reported yesterday.

The cells, shed by the developing fetus and easily retrieved during routine prenatal testing, are easier to maintain in laboratory dishes than embryonic stem cells -- the highly versatile cells that come from destroyed human embryos and are at the center of a heated congressional debate that will resume this week.

Moreover, because the cells are a genetic match to the developing fetus, tissues grown from them in the laboratory will not be rejected if they are used to treat birth defects in that newborn, researchers said. Alternatively, the cells could be frozen, providing a personalized tissue bank for use later in life.

The new cells are adding credence to an emerging consensus among experts that the popular distinction between embryonic and "adult" stem cells -- those isolated from adult bone marrow and other organs -- is artificial.

Increasingly, it appears there is a continuum of stem cell types, ranging from the embryonic ones that can morph into virtually any kind of tissue but are difficult to tame, up to adult ones that can turn into a limited number of tissues but are relatively easy to control.

The newly analyzed fetal stem cells, scientists said, have many of the advantages of both.

"They grow fast, as fast as embryonic stem cells, and they show great pluripotentiality," meaning they can become many kinds of tissues, said study leader Anthony Atala, director of the Institute for Regenerative Medicine at Wake Forest University School of Medicine in Winston-Salem, N.C. "But they remain stable for years without forming tumors," he added, something that embryonic cells are not very good at.

Atala and other scientists emphasized that they don't believe the cells will make embryonic stem cells irrelevant.

"There's not going to be one shoe that fits all," said Robert Lanza, scientific director at Advanced Cell Technology in Worcester, Mass. "We're going to have to see which ones are most useful for which clinical conditions."

George Daley, a Harvard stem cell researcher, echoed that sentiment. "They are not a replacement for embryonic stem cells," he said.

But in the past, even hints that non-embryonic cells might have medical potential similar to embryonic ones have complicated the political push to expand federal funding for the controversial field. And accordingly, opponents quickly pounced on the new results.

"This is wonderful news," said Richard Doerflinger, deputy director of pro-life activities at the U.S. Conference of Catholic Bishops, which opposes research that depends on embryo destruction. "It doesn't require harming anyone or destroying life at any stage."

Last year, President Bush vetoed a bill that would have allowed federal funding of research on stem cells from embryos discarded by fertility clinics. The newly Democratic Congress has promised to send the same or a similar bill to Bush's desk with even greater majorities early this term, with the House slated to vote on the matter this week.

The new work, described in yesterday's online edition of the journal Nature Biotechnology, shows that "amniotic fluid-derived stem cells" can be isolated as early as 10 weeks after conception from fluid extracted during tests widely done to detect birth defects.

In the laboratory, the amniotic cells can mature into all of the major types of cells, dividing at the impressive clip of once every 36 hours yet never showing signs of aging and never becoming tumors -- even after living for more than two years in the lab.

With co-workers from Wake Forest and from Children's Hospital in Boston, Atala coaxed the cells to become brain cells and injected them into the skulls of mice with diseased brains. The new cells filled in diseased areas and appeared to make new connections with nearby healthy neurons.

When coaxed to become bone cells and seeded onto a gelatin scaffold that was then implanted in a mouse, the cells calcified and turned into dense, healthy bone.

Under other conditions they became muscle, fat, blood vessel and liver cells.

Atala said that if 100,000 women donated their amniotic cells to a bank, that would provide enough cells of sufficient genetic diversity to provide immunologically compatible tissues for virtually everyone in the United States. With more than 4 million U.S. births a year, it would not take long to collect that many specimens, he said -- especially because the cells can be found not only in amniotic fluid but also in the placenta, which is discarded after birth.

The rights to certain patent claims relating to the cells have been licensed to Plureon Corp. of Winston-Salem, a privately held company on whose board of directors Atala sits.

Although several stem cell experts applauded the work, some questioned the novelty of the newly described cells. Similar cells have been under study for years with little fanfare, they noted. And though Atala's careful characterization of them is better than any previously done, they said, it is not clear that his cells are truly different than ones others have in hand.

At Children's Hospital in Boston, for example, Dario Fauza, a pediatric surgeon, has been cultivating similar cells and getting them to grow into cartilage, which he has used to repair defective windpipes in newborn sheep. He has also grown the cells into tendon tissue that was used to repair defective diaphragms in sheep.

Fauza is seeking Food and Drug Administration permission to try the method in children diagnosed with birth defects while in the womb. He hopes to grow replacement tissues from their own amniotic cells and use those tissues to repair their defects after birth.

"Typically, you don't do anything until the child is born, and then you are scrambling to fix it," Fauza said. "Why not take out some amniotic fluid, which we do routinely anyway, and engineer a tissue in parallel during the remainder of gestation so he or she will have a tissue by the time he or she is born?"