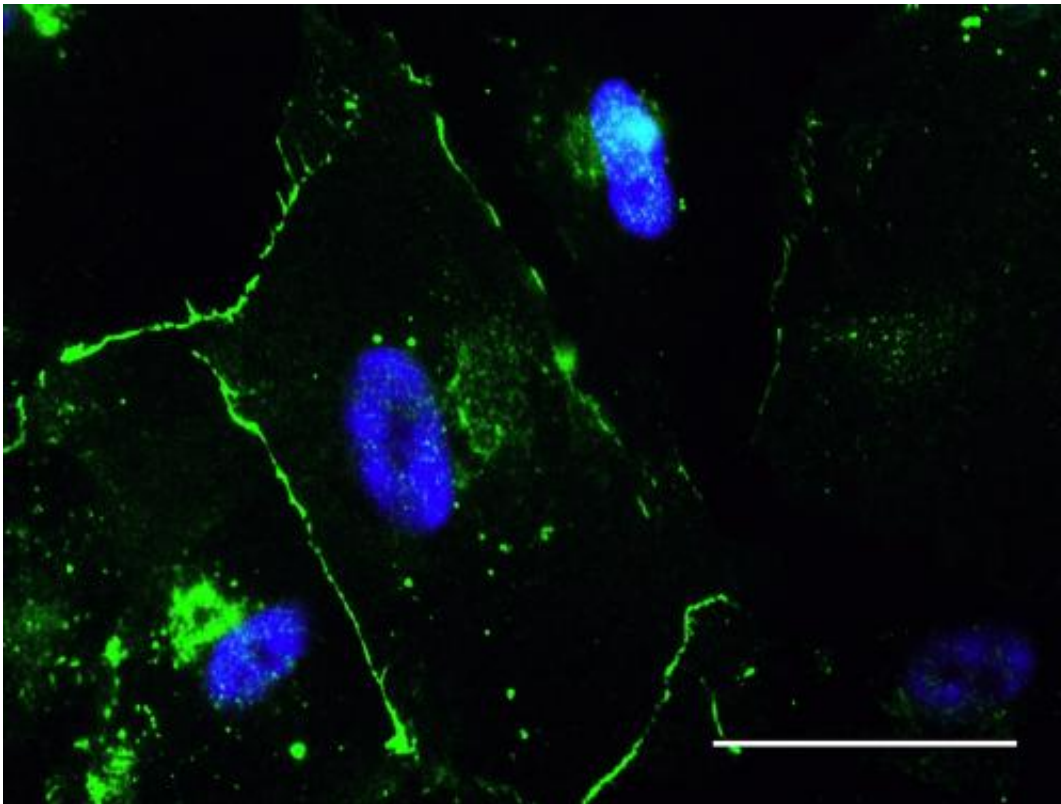


Study shows amniotic fluid stem cells, heart cells pass signals without touching

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The transfer of dye from one amniotic fluid stem cell to another demonstrated functional gap junction communication in amniotic cells exposed to heart cells. The experiments by the Rice University/Texas Children's Hospital lab of bioengineer Jeff Jacot contributed to research in repairing newborns' heart tissues with stem cells from the mother's amniotic fluid. Credit: Jacot Lab/Rice University

Stem cells drawn from amniotic fluid show promise for tissue engineering, but it's important to know what they can and cannot do. A new study by researchers at Rice University and Texas Children's Hospital has shown that these stem cells can communicate with mature heart cells and form electrical couplings with each other similar to those found in heart tissue. But these electrical connections alone do not prompt amniotic cells to become cardiac cells.

The study led by bioengineer Jeff Jacot, who has a joint appointment at Rice and Texas Children's, is part of ongoing research into repairing the hearts of infants born with [congenital defects](#). Jacot's lab is designing scaffold patches that can be implanted into infant hearts. The patches, seeded with stem cells from the mother's own amniotic fluid, would ideally prompt the growth of healthy tissue that would not be rejected.

But to get there, researchers have to figure out how signals that are passed from cell to cell might guide stem cells to differentiate into heart tissue.

In a paper that appears today in the *Journal of Cellular and Molecular Medicine*, Jacot and his team found that amniotic fluid stem cells that are cultured with but physically separated from rat [heart cells](#) (to keep them from fusing) don't differentiate into heart cells. But the stem and heart cells do communicate through channels in the [thin membrane](#) that allow ions and small molecules to pass.

"People have suggested that if [amniotic fluid cells](#) are in an environment where they're near heart cells, something happens that causes differentiation of the amniotic fluid cells into [cardiac tissue](#)," Jacot said. "We found that isn't the case."

He said researchers have seen other types of stem cells take on the characteristics of [cardiac cells](#) and determined it was because the cells

had fused together. "You get a single cell with proteins from both the stem cells and the heart cells," he said.

Jacot wanted to see if [amniotic cells](#) could take on the characteristics of heart cells if they weren't allowed to fuse. "We showed there's no evidence of actual cardiac differentiation, although there were some changes in protein expression (among the stem cells)," he said. But the stem cells "become electrically coupled to each other, like cardiac cells do with each other. That was the main finding: We do get very good electrical coupling, which we call functional gap junction connections.

"Electrical ions or really small molecules that are in one cell can diffuse directly into a cell next to it," he said. "It's like they put holes in their membranes when they're up against each other."

Knowing what signals are passed is of great value as researchers figure out how to prompt stem cells to differentiate into the desired tissue, Jacot said.

He said other labs are studying how injecting amniotic fluid stem cells directly into hearts can help recovery after a heart attack. "There are a lot of people doing this with bone marrow-derived stem cells in the U.S., including two of the biggest groups in Houston, the Methodist Hospital and the Texas Heart Institute," Jacot said. "They seem to find what we call paracrine signaling effects, where the stem cells draw in more blood vessel-forming cells. There's some discussion as to whether they stabilize the cells, but don't seem to actually make new [heart tissue](#)."

Jacot said there are probably many ways to get amniotic fluid stem cells to differentiate into viable tissue for medical uses, and the new results are just a small step toward the goal of finding the best way.

"What we've observed is a little removed from any kind of translational

therapeutic aspect," he said. "But we feel what we've observed will help us understand amniotic fluid stem cells in this environment."

More information: [onlinelibrary.wiley.com/doi/10 ...
/jcmm.12056/abstract](https://onlinelibrary.wiley.com/doi/10.1002/jcmm.12056/abstract)

Provided by Rice University

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