# New transitional stem cells discovered

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Pre-eclampsia is a disease that affects 5 to 8 percent of pregnancies in America. Complications from this disease can lead to emergency cesarean sections early in pregnancies to save the lives of the infants and mothers. Scientists believe pre-eclampsia is caused by a number of factors, including shallow placentas that are insufficiently associated with maternal blood vessels. Now, researchers from the University of Missouri, in an effort to grow placenta cells to better study the causes of pre-eclampsia, serendipitously discovered a previously unknown form of human embryonic stem cell.

R. Michael Roberts, a Curators Professor of Animal Science and a professor of biochemistry, and his colleagues, says these new stem cells can help advance research on pre-eclampsia and a number of other areas of the human reproductive process.

"These new cells, which we are calling bone morphogenetic protein (BMP) -primed stem cells, are much more robust and easily manipulated than standard embryonic stem cells," Roberts said. "BMP-primed cells represent a transitional stage of development between embryonic stem cells and their ultimate developmental fate, whether that is placenta cells, or skin cells or brain cells. We can use these new stem cells for future research to better understand how embryos are organized and what causes diseases like pre-eclampsia and other prenatal problems."

Embryonic stem cells are pluripotent, meaning they can develop into a number of different types of cells such as muscle cells, bone cells, skin cells, etc. For their study, Roberts and his colleagues were attempting to

grow placenta cells from embryonic stem cells by adding a substance called BMP-4 for a shorter period of time than had been done previously. They also added two other drugs that temporarily inhibited key biochemical pathways associated with the pluripotent state of the stem cells.

Instead of forming placenta cells, the stem cells grew into what was a previously unobserved state, referred to by the MU scientists as "BMP primed" stem cells. They found these cells to be much easier to work with in a laboratory setting than traditional stem cells because they are easier to grow and are more uniform, meaning that all the cells in the culture are quite similar to each other in the way they express their genetic information.

"Previously, the common thought was that embryonic stem cells transitioned straight from stem cells to their end products," Roberts said. "These new stem cells made us realize that embryonic stem cells exist in a number of different transitional states, which likely resemble those encountered in the early stages of embryos. This should open the door for future stem cell research that is much more efficient. We now have new stem cells that are easier to manipulate since they are already at the key transitional precipice before changing into placenta cells, skin cells or any other kind of cell that makes up the human body."

**More information:** Yang, Y., Adachi, K., Sheridan, M. A., Alexenko, A. P., Schust, D. J., Schulz, L. C., … Roberts, R. M. (2015). Heightened potency of human pluripotent stem cell lines created by transient BMP4 exposure. *Proceedings of the National Academy of Sciences*, 201504778. DOI: 10.1073/pnas.1504778112

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