MedicalXpress

Swine cells could power artificial liver

February 27 2013

Chronic or acute, liver failure can be deadly. Toxins take over, the skin turns yellow and higher brain function slows.

"There is no effective therapy at the moment to deal with the toxins that build up in your body," said Neil Talbot, a Research Animal Scientist for the USDA Agricultural Research Service. "Their only option now is to transplant a liver."

Talbot thinks a line of special liver cells could change that. In an interview with the American Society of Animal Science, he discussed how a line of pig liver cells called PICM-19 could perform many of the same functions as a human liver.

In 1991, Talbot created PICM-19 from the cells of an 8-day-old pig embryo. The cell line is significant because it is "immortal," meaning the cells can divide an infinite number of times. Many immortal cells lines continue dividing because they are derived from cancer cells; however, PICM-19 cells are derived from epiblast cells, the embryonic stem cells that form in the early stages of embryo development.

This immortal cell line has helped Talbot study how cells differentiate. Cells from the PICM-19 lines naturally differentiate into bile duct cells or hepatocytes. Hepatocytes do the bulk of the work in a liver. Hepatocytes form and secrete bile, store glycogen, control blood glucose, process vitamin D, and metabolize cholesterol and fat.

"The PICM- 19 cells are the cells that really do all the metabolic

functions of the liver," said Talbot.

Hepatocytes also "scrub" toxins from the blood. Talbot said PICM-19 cells could do the same thing inside an artificial liver. There have already been several in vitro tests of artificial liver devices, and the ARS scientists are working on ways to grow the PICM-19 cells without needing "feeder cells." Feeder cells are mouse cells that hold PICM-19 cells in place and provide important molecules for PICM-19 cell growth and maintenance.

Artificial livers are still in development, but Talbot pointed out other applications for PICM-19 cells. Talbot and fellow scientists have used PICM-19 to study malaria, toxoplasmosis and hepatitis viruses. Researchers could also use the cells to study certain cancers of the liver or investigate the changes in the bile duct associated with cystic fibrosis.

Talbot recommends future studies on how PICM-19 cells respond to selective pressures. He said scientists could select for more efficient liver cells by exposing PICM-19 cells to toxins in culture.

"A lot of cells would die, but the survivors would really be tough," Talbot said.

Those tougher cells could make artificial liver devices more effective. Scientists could also use genetic modification to prompt PICM-19 cells to behave like other cells in the body.

"Maybe we want to enable it to make insulin," Talbot said. "It will be like a pancreas."

With PICM-19 cells filling in for livers or other organs, the transplant list could get a lot shorter.

Tom Caperna, an ARS Research Biologist and collaborator with Talbot, presented their work on PICM-19 during the Growth and Development Symposium at the 2012 Joint Annual Meeting. The full symposium summary is titled "Growth and Development Symposium: Development, characterization, and use of a porcine epiblast-derived stem cell line: ARS-PICM-19." It can be read in full at journalofanimalscience.org.

Provided by American Society of Animal Science