ScienceDaily
Your source for the latest research news

July 11, 2008

Umbilical Cord Stem Cells Transport Anti-Cancer Drugs Directly To Tumors

ScienceDaily — Kansas State University researchers are working on a method of delivering cancer drugs that promises to be more efficient and reduce the side effects patients have to deal with.

"Although chemotherapy has saved many lives, it often has undesirable side effects," said Deryl Troyer, professor of anatomy and physiology at K-State's College of Veterinary Medicine. "The people most excited about this research are people who have gone through chemo, because our approach may circumvent many of those side effects."

Troyer and two K-State faculty – Duy Hua, university distinguished professor of chemistry, and Masaaki Tamura, associate professor of anatomy and physiology – received a $380,000 grant from the National Institutes of Health. They are studying how stem cells can be used to deliver anti-cancer drugs directly to breast cancer cells via nanoparticles. The researchers have studied the method in vitro but soon hope to study the method in preclinical models. The research is a part of the program of the Midwest Institute for Comparative Stem Cell Biology at K-State and has received support from K-State's Terry C. Johnson Center for Basic Cancer Research.
The researchers are using stem cells isolated from Wharton's jelly, the substance that cushions blood vessels in the umbilical cord. These types of stem cells can be harvested noninvasively and therefore are not controversial.

"Billions and billions of these cells are disposed of every day," Troyer said. "We think these cells have a lot of advantages, including their ability to be harvested in large numbers very rapidly."
Troyer said the stem cells display a sort of homing ability in that they tend to travel to tumors and other pathological lesions. The researchers are using these stem cells as delivery systems by loading the cells with nanoparticles that contain anti-cancer drugs.
"We are using the cells as stealth vehicles," Troyer said.

Hua is fabricating the nanoparticles and some of the small-molecule drugs for the research. The tiny capsules carrying the drugs are nanogels made up of two polymers. The nanogel has a dye molecule that allows the researchers to follow it through the body using a fluorescent microscope. The nanogel capsules are loaded into a stem cell, which responds to proteins sent out by the cancer cells by homing to them, Hua said. As the stem cells reach the cancer tissues, another chemical that induces cell death of the stem cells will be administered -- only stem cells are engineered to respond to this additional drug. This means that the nanogel-encapsulated drugs will be released from the stem cells directly at the cancer tissue.

"The nanogel can be viewed as a very tiny piece of paper that wraps around the anti-cancer drug like a candy wrapper," Hua said. "Over time or under certain conditions, the paper unwraps and releases the candy. Most anti-cancer drugs, including ours, are insoluble in water. However, the nanogel is water soluble."

Because the drugs are going directly to cancer cells, Troyer said this method potentially can cause fewer side effects than less direct methods like intravenous chemotherapy. Troyer said that this research will make existing but underused cancer drugs more useful to the doctors who treat people with cancer.

"Many potent small-molecule drugs are sitting on a shelf collecting dust," Troyer said. "Often they are insoluble or have many toxic effects. We hope to deliver some of these compounds in a more targeted manner via the combination of stem cells and nanoparticles. Although nanotechnology has made enormous strides toward more focused drug delivery, there is always room for improvement."