

TOWARD AN OFF-THE-SHELF THERAPY FOR STROKE: CELLS IN A FREEZER

By Kasra Zarei

kasra-zarei@uiowa.edu

A recently published study by UI researchers could present an off-the-shelf technique to treat patients with stroke using cell-based therapies clinically stored in cryobanks.

According to the Centers of Disease Control, stroke kills almost 130,000 Americans each year. Before therapy is successfully administered for stroke, tissue is cut off from oxygen and dies within hours, leading to numbness, vision loss, or death of the patient.

The research of James Ankrum, University of Iowa assistant professor of Biomedical Engineering, focuses on generating improved cell-based therapies, a type of treatment where instead of using drugs, donor cells are administered to a patient.

His research could present a solution to this prevalent medical emergency. However, it is not all that simple.

“Cells must be controlled such that they provide the predictability of a drug when administered, but also offer the extra benefit of having living, responsive cells to restore tissue function,” Ankrum said.

Ankrum’s lab focuses on mesenchymal stem cells, or MSC’s, a rare cell type most commonly found in the bone marrow that can provide repair functions.

“[The goal] is to develop new techniques that influence the behavior of these cells so that they are ready to be used under specific conditions such as cryopreservation in a hospital, or freezing at a very low temperature,” Ankrum said.

Approved for therapeutic use in Japan and India, MSC-based therapies and applications are already hitting the market, but there are issues that must be addressed to make these therapies predictable.

Ankrum’s recent study in collaboration with Markus Kuehn, UI associate professor of Ophthalmology, focused on treating stroke to the eye using MSC-based therapies.

“For a clinical application this has to happen pretty quick,” Kuehn said. “Currently, stem cells are carefully prepared by specialized laboratories with properly trained individuals. This does not help problems with the eye, and certainly does not help in rural settings where access to specialized clinical technologies and treatments is substantially limited.”

Kuehn said that this process could take up to several weeks.

“We wanted to know if we could take cells directly out of a cryobank, or freezer, and immediately administer them without having any ill effects,” Ankrum said. “We modeled the typical clinical scenario and treatment of stroke to the eye in mice - take cells out, thaw them and immediately inject them into the affected tissue, all within a couple hours.”

There has been debate as to whether freezing MSCs disrupts their ability to function. Ankrum said he and Kuehn looked at the cell therapy ability from multiple angles, all of which were preserved through the cryopreservation process.

“These cryopreserved cells performed as well as fresh cells that had been grown in the lab for days,” said Oliver Gramlich, a UI research scientist that spearheaded the study.

While significant steps are needed to advance this concept to humans and clinical practice, the importance of this finding is that a freezer, on-site in an emergency unit, could potentially be used to store cell-based treatments and immediately use them, contrary to a cell processing facility, which requires an enormous infrastructure.

“If you want a cell-based treatment to be clinically usable, you have to put it in bottles, produce it in large quantities, and store it at the sites to be used,” Kuehn said.

One of the things that was new in Ankrum and Kuehn’s approach was they actually provided the cells after the damage to the mice had been done, opposed to pre-treating them.

“The ability to see something that nobody has ever seen before – that is the opportunity that research offers,” Ankrum said. “You can be the first person in the existence of the world to see some phenomenon.”