New embryonic stem cell line will aid research on nerve condition

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The University of Michigan's second human embryonic stem cell line has just been placed on the U.S. National Institutes of Health's registry, making the cells available for federally-funded research. It is the second of the stem cell lines derived at U-M to be placed on the registry.

The line, known as UM11-1PGD, was derived from a cluster of about 30 cells removed from a donated five-day-old embryo roughly the size of the period at the end of this sentence. That embryo was created for reproductive purposes, tested and found to be affected with a genetic disorder, deemed not suitable for implantation, and would therefore have otherwise been discarded when it was donated in 2011.

It carries the gene defect responsible for Charcot-Marie-Tooth disease, a hereditary neurological disorder characterized by a slowly progressive degeneration of the muscles in the foot, lower leg and hand. CMT, as it is known, is one of the most common inherited neurological disorders, affecting one in 2,500 people in the United States. People with CMT usually begin to experience symptoms in adolescence or early adulthood.

The embryo used to create the cell line was never frozen, but rather was transported from another IVF laboratory in the state of Michigan to the U-M in a special container. This may mean that these stem cells will have unique characteristics and utilities in understanding CMT disease progression or screening therapies in comparison to other human embryonic stem cells.

"We are proud to provide this cell line to the scientific community, in hopes that it may aid the search for new treatments and even a cure for CMT," says Gary Smith, Ph.D., who derived the line and also is co-director of the U-M Consortium for Stem Cell Therapies, part of the A. Alfred Taubman Medical Research Institute. "Once again, the acceptance of these cells to the registry demonstrates our attention to details of proper oversight, consenting, and following of NIH guidelines."

U-M is one of only four institutions – including two other universities and one private company – to have disease-specific stem cell lines listed in the national registry. U-M has several other disease-specific hESC lines submitted to NIH and awaiting approval, says Smith, who is a professor in the Department of Obstetrics and Gynecology at the University of Michigan Medical School. The first line, a genetically normal one, was accepted to the registry in February.

"Stem cell lines that carry genetic traits linked to specific diseases are a model system to investigate what causes these diseases and come up with treatments," says Sue O'Shea, Ph.D., professor of Cell and Developmental Biology at the U-M Medical School, and co-director of the Consortium for Stem Cell Therapies.

Each line is the culmination of years of preparation and cooperation between U-M and Genesis Genetics, a Michigan-based genetic diagnostic company. This work was made possible by Michigan voters' November 2008 approval of a state constitutional amendment permitting scientists to derive embryonic stem cell lines using surplus embryos from fertility clinics or embryos with genetic abnormalities and not suitable for implantation.

The amendment also made possible an unusual collaboration that has blossomed between the University of Michigan and molecular research

scientists at Genesis Genetics, a company that has grown in only eight years to become the leading global provider of pre-implantation genetic diagnosis (PGD) testing. PGD is a testing method used to identify days-old embryos carrying the genetic mutations responsible for serious inherited diseases. During a PGD test, a single cell is removed from an eight-celled embryo. The other seven cells continue to multiply and on the fifth day form a cluster of roughly 100 cells known as a blastocyst.

Genesis Genetics performs nearly 7,500 PGD tests annually. Under the arrangement between the company and U-M, patients with embryos that test positive for a genetic disease now have the option of donating those embryos to U-M if they have decided not to use them for reproductive purposes and the embryos would otherwise be discarded.

The agreement was worked out between U-M's Smith and Mark Hughes, M.D., Ph.D., founder and president of Genesis Genetics and a pioneer in the field of pre-implantation genetic diagnosis. "These are very precious cells, and it would be unconscionable not to take advantage of such an opportunity for medical science and the cure of disease," Hughes says.

"This is another major step forward for medical science in Michigan. It opens up another avenue for researchers to really begin exploring the causes and progression of those diseases, with the ultimate goal of finding new therapies for patients," says Eva Feldman, M.D., Ph.D., F.A.A.N., director of the A. Alfred Taubman Medical Research Institute and the Russell N. DeJong professor of neurology at the U-M Medical School. Feldman sees patients with CMT as part of her clinical practice.

Contributors to the A. Alfred Taubman Medical Research Institute's Consortium for Stem Cell Therapies include the Taubman Institute; the Office of the Executive Vice President for Medical Affairs; the Office of the Medical School Dean; the Comprehensive Cancer Center; the Department of Pediatrics and Communicable Diseases; the Office of the

Vice President for Research; the School of Dentistry; the Department of Pathology; the Department of Cell and Developmental Biology; the College of Engineering; the Life Sciences Institute; the Department of Neurology; and U-M's Michigan Institute for Clinical and Health Research.

A. Alfred Taubman, founder and chair of U-M's Taubman Institute, called the second registry placement a tremendous step for stem cell research. "I consider stem cells to be a modern medical miracle – the most exciting advance in medicine since antibiotics. The progress we have made throughout the state in stem cell research has been nothing short of remarkable," he says.

"This new milestone means much to the University and the state of Michigan, but also to the world. It offers another route for researchers to move ahead in studying these horrible diseases. We hope it is the first of many lines that we can contribute to the global efforts to improve human health."

More information: To see the stem cell line entry in the NIH registry, visit grants.nih.gov/stem_cells/registry/current.htm?id=497

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