Medical Xpress

Researchers use stem cells to identify cellular processes related to glaucoma

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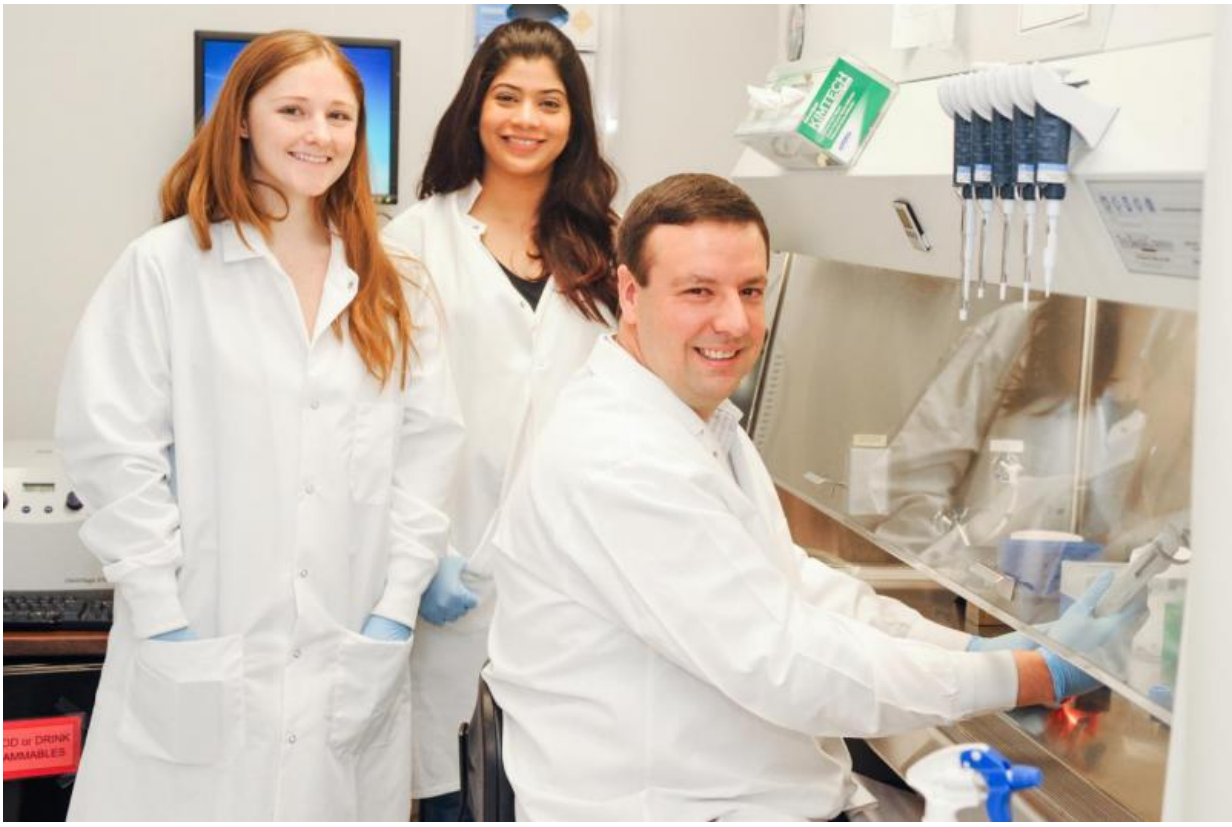

Assistant Professor of Biology Jason Meyer, Ph.D. (seated) with IUPUI graduate students Sarah Ohlemacher (left) and Akshayalakshmi Sridhar Credit: School of Science at Indiana University-Purdue University Indianapolis

Using stem cells derived from human skin cells, researchers led by Jason Meyer, assistant professor of biology, along with graduate student Sarah

Ohlemacher of the School of Science at Indiana University-Purdue University Indianapolis, have successfully demonstrated the ability to turn stem cells into retinal ganglion cells (RGCs), the neurons that conduct visual information from the eye to the brain. Their goal is the development of therapies to prevent or cure glaucoma.

In addition to glaucoma, a group of degenerative diseases that damage the eye's optic nerve and can result in vision loss and blindness, this work has potential implications for treatment of optic- nerve injuries of the types incurred by soldiers in combat or athletes in contact sports.

In the study, which appears online in advance of publication in the journal *Stem Cells*, the IUPUI investigators took skin cells biopsied from volunteers with an inherited form of glaucoma and from volunteers without the disease and genetically reprogrammed them to become pluripotent stem cells, meaning they are able to differentiate into any cell type in the body. The researchers then directed the stem cells to become RGCs at which point the cells began adopting features specific to RGCs—features that were different in the cells of individuals with glaucoma than in the cells that came from healthy individuals.

Glaucoma is the most common disease that affects RGCs, which serve as the connection between the eye and the brain, sending information taken in by the eye to the brain for interpretation. When these cells are damaged or severed, the brain cannot receive critical information, leading to blindness. The National Institutes of Health's National Eye Institute estimates that glaucoma affects more than 2.7 million people in the United States and more than 60 million worldwide.

"Skin cells from individuals with glaucoma are no different from skin cells of those without glaucoma," said Meyer, a cell biologist and stem cell researcher, who also holds an appointment as a primary investigator with the Stark Neurosciences Research Institute at the Indiana University

School of Medicine. "However, when we turned glaucoma patients' skin cells into stem cells and then into RGCs, the cells became unhealthy and started dying off at a much faster rate than those of healthy individuals.

"Now that we have produced cells that develop features of glaucoma in culture dishes, we want to see if compounds we add to these RGCs can slow down the degeneration process or prevent these cells from dying off. We already have found candidates that look promising and are studying them. In the more distant future, we may be able to use healthy patient cells as substitute cells as we learn how to replace cells lost to the disease. It's a significant challenge, but it's the ultimate—and, we think, not unrealistic—long-range goal."

More information: "Stepwise Differentiation of Retinal Ganglion Cells from Human Pluripotent Stem Cells Enables Analysis of Glaucomatous Neurodegeneration" *Stem Cells*, 2016. onlinelibrary.wiley.com/doi/10 … 2/stem.2356/abstract

Provided by Indiana University-Purdue University Indianapolis School of Science