Scientists successfully awaken sleeping stem cells

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Scientists at Schepens Eye Research Institute have discovered what chemical in the eye triggers the dormant capacity of certain non-neuronal cells to transform into progenitor cells, a stem-like cell that can generate new retinal cells. The discovery, published in the March issue of *Investigative Ophthalmology and Visual Science* (*IOVS*), offers new hope to victims of diseases that harm the retina, such as macular degeneration and retinitis pigmentosa.

“This study is very significant. It means it might be possible to turn on the eye’s own resources to regenerate damaged retinas, without the need for transplanting outside retinal tissue or stem cells,” says Dr. Dong Feng Chen, associate scientist at Schepens Eye Research Institute and Harvard Medical School, and the principal investigator of the study. “If our next steps work in animal disease models, we believe that clinical testing could happen fairly quickly.”

Scientists have long been aware of Müller cells (which exist in great abundance in the eye) and have generally assumed that they were responsible for keeping retinal tissue protected and clear of debris. In recent years, however, researchers have reported that these cells sometimes exhibit progenitor cell behavior and re-enter the cell cycle (dividing and differentiating into other type of cells). Progenitor cells are similar to stem cells but are more mature and are more limited in the number of cells types they can become.

But until this study, scientists have not understood what triggers the

transformation. In their study, Chen and her team observed that when the naturally occurring chemicals known as glutamate and aminoadipate (which is a derivative of glutamate) were injected into the eye, the Müller cells began to divide and proliferate. Not certain if these chemicals directly signaled the transformation, they tested them in the laboratory and in mice.

They added each chemical separately to cultures of pure Müller cells and injected each into the space below the retina in healthy mice. In both cases, the cells became progenitor cells and then changed into retinal cells. And with aminoadipate, the newly minted retinal cells migrated to where they might be needed in the retina and turned into desirable cell types. Specifically, they showed that by injecting the chemical below the retina, the cells give rise to new photoreceptors – the type of cells that are lost in retinitis pigmentosa or macular degeneration, as a result, leading to blindness.

The team's next step will be to test this process in animals that have been bred to have diseases that mimic macular degeneration and retinitis pigmentosa. The goal would be to learn if damaged retinas regenerate and vision improves. The team will likely use just aminoadipate because it only binds with Müller cells without the side effects of glutamate, which can actually harm retina cells in large doses.

"We believe that a drug created from the chemical aminoadipate or a similar compound has great potential for healing damaged retinas," says Chen.

Source: Schepens Eye Research Institute