Living filter offers better way to test new glaucoma drugs

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(Medical Xpress)—When the next generation of glaucoma medications reaches the market, part of the credit might go to the SUNY College of Nanoscale Science and Engineering (CNSE) in Albany.

Working with an ophthalmologist at SUNY Downstate Medical Center, three nanobioscientists at CNSE are creating a model to replicate the workings of a filter in the eye, called the trabecular meshwork. Researchers may use this model to test new treatments for glaucoma.

This spring, the project—called Fake Eyes for Glaucoma Screening—received a $50,000 Technology Accelerator Fund (TAF) investment from the Research Foundation. The money will help the research team develop a commercially-viable prototype of their model.

The idea for the project grew from some conversations between the CNSE team and John Danias, professor of ophthalmology and cell biology at Downstate Medical. Danias asked if his CNSE colleagues could help remove a roadblock in the quest for more effective glaucoma medications.

According to the World Health Organization, glaucoma is the second leading cause of blindness. People develop this condition when excessive pressure in the eye damages the optic nerve. The pressure builds when a fluid called the aqueous humor fails to drain correctly through the trabecular meshwork and out of the eye.

"For reasons that are not well understood, the filter gets clogged," says Susan Sharfstein, associate professor of nanobiosciences at CNSE and principal investigator on the project.

Glaucoma drugs on the market today focus on the aqueous humor itself or on getting that fluid to drain through alternative pathways. None of them addresses the trabecular meshwork; scientists lack a practical way to experiment with drugs that might affect that filter.

"There is no good animal model, because the eyes are very different from species to species," Sharfstein says. Standard cell culture models don't meet the need, since the cells grow on nonporous surfaces, which cannot be used to measure flow. Eyes from cadavers might work, but they are hard to obtain. Also, extracting the correct part of the eye and using it in a system with pressurized liquid demands an extremely high level of expertise, she says.

To fill the need, Sharfstein and her colleagues at CNSE—Drs. Yubing Xie and Magnus Bergkvist—borrowed lithographic techniques from the semiconductor industry to build a scaffold with pores like those in the eye, about 10 nanometers in size. When they culture cells on top of this base, the result is a living filter, about a centimeter in diameter. "We have been able to demonstrate reasonably effectively that this models the situation that happens in eyes," Sharfstein says.

To simulate clogged meshwork, researchers treat the cells with corticosteroids, which increase resistance to flow.

Mounting the disk in a holder, the researchers run pressurized liquid through the mesh—a process that resembles the work of an espresso maker, although at a lower pressure. "Then we look at resistance to the flow," Sharfstein says. "When we treat the cells with drugs, we look at whether that increases or decreases resistance to flow."

Sharfstein and her colleagues hope to develop a commercial product within six to 12 months. A team of CNSE graduate students has formed a company to market the invention; the group recently won the $100,000 grand prize in the New York Business Plan Competition. The start-up might sell the device to other labs or make it the basis of a drug-testing service.

Along with pharmaceutical firms, basic scientists might also use the new product; it could help them better understand the biology of the trabecular network as a cause of glaucoma, Sharfstein says. "We think it has a lot of applications."

Provided by College of Nanoscale Science and Engineering