“Eye diseases dramatically impact quality of life, and the older you get, the higher your chances of developing an eye disease like glaucoma.”

Dr. Philippe Monnier

Krembil scientists believe neogenins may also play a critical role in multiple sclerosis (MS) and in stroke, says Mr. Charish, a PhD student at the University of Toronto. “Other members of the lab have also looked at MS and stroke models, and we see potential applications of the therapy in these diseases as well,” he says. Dr. Monnier says the application of hIG produced an unexpected finding: neogenins were also responsible for maintaining the blood–brain barrier – a protective membrane that prevents harmful substances from entering the brain.

“The blood–brain barrier prevents a lot of bad things from happening. For example, it prevents the immune system from going into your brain,” he says. “In multiple sclerosis, the immune system is somehow able to cross the barrier and attack the brain. So if we can restore the barrier, then we prevent immune system cells from [targeting] the brain.”

Krembil is now working to take hIG from the lab into clinical practice. Dr. Monnier and his team are preparing to test hIG for preclinical safety. They have also partnered with a pharmaceutical company to eventually produce and market hIG as a drug.

“Our goal is, in four to five years, to be able to turn hIG into a drug that can be administered to patients,” says Dr. Monnier.

Dr. Dr. Monnier is also a project lead in Dr. Monnier’s research into neogenin blockers for retinitis pigmentosa, notes that the study findings – and, most importantly, the potential for a cure – also have implications that go beyond the eye.

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Are your eyes also the windows to your brain?

Dr. Efrem Mandelcorn is exploring whether a simple eye test could help detect Alzheimer’s earlier

Shelley White

The test takes about a minute … two minutes, tops. Perched on a stool, face supported on a chinrest, the patient looks into the optical coherence tomography (OCT) machine. A white cross on a black background is in her field of vision, with red lines that move up and down, back and forth. Dr. Efrem Mandelcorn, clinician investigator at the Krembil Research Institute and a retinal surgeon at the Donald K. Johnson Eye Institute’s Retina Clinic, directs a laser into the patient’s eye. He’s using light waves to take cross-sectional pictures of the patient’s retina and optic nerve. It’s painless, it’s simple and it’s over very quickly.

OCT has been used in ophthalmologists’ offices to diagnose eye diseases like glaucoma for years. But researchers like Dr. Mandelcorn are hoping this simple test could be used someday to help doctors diagnose neurodegenerative disorders such as Alzheimer’s disease, Parkinson’s disease and amyotrophic lateral sclerosis (ALS), even before patients show symptoms.

“We have very good technology to look at the eye,” explains Dr. Mandelcorn. “You can look at what’s called the retinal nerve fibre layer, which goes right to the optic nerve. It is a direct connection from the eye to the brain – a window to the brain.”

Dr. Mandelcorn says that some smaller studies showed that when looking at images of the optic nerve head, the upper or “superior” portion of the nerve is thinner in late Alzheimer’s, more so than in a control group of subjects the same age.

If this nerve fibre layer loss could be proven to be a biomarker – an accurate early indicator of Alzheimer’s – then a simple eye test could become a valuable diagnostic tool for neurologists.

“The idea is that if you can find a pattern of nerve fibre layer loss on an OCT scan, which is exquisitely detailed, you
As our population ages, dementia is becoming the single greatest cause of neurodegenerative diseases. In partnership with the Ontario Brain Institute, ONDRI will employ more than 210,000 participants enrolled for up to three years – people who have been clinically identified as having these diseases.

"It’s to get an idea of the features, the phenotypes of these individuals and how they change from year to year [as the disease progresses]," says Dr. Greenberg. "In partnership with the Ontario Brain Institute, ONDRI will employ more than 50 investigators at 13 sites around the province to study five neurodegenerative diseases. These are some of the most pervasive and debilitating diseases that humans can face: Alzheimer’s disease, Parkinson’s disease, ALS, frontotemporal lobar degeneration (a group of neurodegenerative diseases that cause dementia) and vascular cognitive impairment (resulting from stroke). Each of these diseases has one symptom in common: dementia. (Although not everyone with Parkinson’s or ALS gets dementia, it is associated with these diseases.)"

As part of the study, researchers will do eight assessments with each participant. One is gait and balance, another is neuroimaging. Other tests include neuropsychology (measuring cognitive skills such as attention and memory) and genetics (blood samples taken to compare all participants genetically). There are two oculard tests. One involves eye tracking or measuring eye movements while people follow a light. Dr. Mandelcorn is an investigator for the other ocular test, the OCT imaging described earlier.

He likens ONDRI to a Rubik’s Cube: each row of colours represents a different assessment or a different disease or a different period of time in the study. As you move the squares and mix up the colours, it’s like the researchers detecting patterns in how the factors intersect and interact. Each investigator has his/her own platform,” he explains. “If you get all this rich data from all these different platforms, you can then tease out what happens over time, what happens between diseases, what happens within the same disease.”

But the question could be asked: “If a doctor were able to predict if someone was going to develop Alzheimer’s, ALS or Parkinson’s before it happens, how could that help someone?” After all, there are no cures for any of these diseases as of yet.

“From a basic science perspective, you want to catch something early while the brain is still normal,” says Dr. Mandelcorn. “If you catch it late, then those brain cells are gone. Theoretically, if you catch something early, then you can preserve cells. And what that means for patients is, instead of getting dementia or Alzheimer’s now, they get it five or 10 years later. For them, for their families and for the health system, it could be very significant.”

Dr. David Tang-Wai is a neurologist, co-director at the UHN Memory Clinic, clinician investigator at Krembil Research Institute and one of the recruiting physicians with the study. His job is to recruit patients with early Alzheimer’s disease or mild cognitive impairment to participate in the study. He says that finding a cheaper, faster way to diagnose Alzheimer’s would be a major step forward when it comes to drug research, and for the health system, it could be very great.”

Dr. David Tang-Wai

"If you really want to be sure about it, you have to wait until the patient dies and [then] look into an autopsy… so if an eye test works, this is great."

- Dr. David Tang-Wai