"When we examine the retina, we are looking into a window of the brain."

Henry Tseng’s research finds new ways to look at high-pressure glaucoma patients.
in glaucoma and the same phenomenon in other neurodegenerative diseases, such as Parkinson’s, Alzheimer’s, and amyotrophic lateral sclerosis (ALS or Lou Gehrig’s disease).

Tseng explains apoptosis in this way: “The cell makes a decision to die. For skin cells, you just grow new cells. In nerve cells called neurons, this is a serious decision because there is no regrowth. There is some problem with the circuitry that makes this decision at the cellular or molecular level. This is hard to study in patients, so research must be conducted in the laboratory using animal models.”

Tseng’s research is focused on studying genetic mutations of a protein called optineurin. Tseng says this protein is important for three reasons. “First of all, it is relatively new. No one knew much about this protein before the year 2002, when it became associated with glaucoma. Second, it is unlike any other protein in the body. It’s found all over the body, so why is it causing problems only in the eye? And, third, understanding what the mutations actually do and how they lead to disease will be critical to uncovering the control circuits that regulate neuronal cell death in neurodegenerative diseases.”

Tseng’s lab work uses a model in which the human version of the protein is introduced into transgenic mice. In the last year or so, other doctors from non-ophthalmologic fields have discovered that this protein with different mutations causes other neurodegenerative diseases, such as ALS. Preliminary data also implicate optineurin in Alzheimer’s and Huntington’s diseases.

“Because of this laboratory research,” says Tseng, “we’re starting to realize that glaucoma is not just an eye problem, but a brain problem, too.” Tseng and other researchers are now looking for connections between glaucoma and other neurodegenerative diseases. There may be signaling pathways or control circuits that could be common to these diseases. Tseng reports, “We’re starting to have conversations with neurologists about neurodegenerative diseases that weren’t previously linked with glaucoma.”

One of these doctors is Richard Bedlack, MD, PhD, a neurologist and director of the Duke ALS Clinic. Bedlack confirms that mutations in optineurin have recently been found in ALS patients, and thus—for the first time—a link has been established between ALS and glaucoma. There is little known about the visual status of ALS patients. Bedlack reports that “vision complaints are certainly not common, but this may be due to the fact that so many other things are happening so fast (loss of speech, swallowing, breathing, and limb functions).”

“One of these are affected, they could potentially serve as important biomarkers for following patients with ALS in clinical trials.”

For Tseng, the eye–brain connection is not surprising. “The retina is part of the brain,” explains Tseng, who holds a PhD in neurobiology. “When we examine the retina, we are looking into a window of the brain.” Tseng envisions using eye imaging to diagnose diseases of the brain. “If you don’t need an MRI or CT, you can just look into the eye and see that someone has Alzheimer’s disease—that’s an exciting possibility.”

These newly discovered connections point the way to great possibilities. Focusing on the optineurin protein has provided a way to study glaucoma and other neurodegenerative diseases, but Tseng continues to look at the broader picture for patients. There is the potential for new ways of diagnosing brain diseases as well as new glaucoma treatments that might be good for neurodegenerative diseases, and vice versa.