

Human Tissue Research Essential to the R&D Process

This eye bank research facility allows access to fresh, highly specialized ocular tissue.

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Before a new ophthalmic drug or device comes to the market, it first must undergo years of testing. This process may begin with proof-of-concept research on mice, rabbit, or pig eyes and end in phase 3 human clinical trials. Along the way, human ocular tissue provides an important bridge between delineating a drug's or device's effect on animal eyes and physicians' willingness to expose patients to its use.

Although research using animal eyes can approximate what would happen in a human eye, there are limits to its relevance. Rabbits have thinner corneas than humans, and pigs have thicker ones. There are no good animal models for age-related disease, in part because research animals are young. Even if one could obtain tissue from an animal near the end of its natural life span, that tissue still would not be the same as that from a 70- or 80-year-old human eye. Research on human tissue provides important insights into how aged ocular structures react to injury, how rapidly drugs penetrate human corneas, and where and how drugs metabolize and accumulate.

LARGEST EYE BANK IN THE WORLD

The Lions Eye Institute for Transplant and Research (LEITR) in Tampa, Florida, is an innovative facility that has greatly expanded the model of traditional eye banking. As the largest eye bank in the world, LEITR provides many corneas for transplantation, yet the organization has also dedicated significant resources to providing ocular tissue—healthy and diseased—for research.

Investigators may obtain whole globes, corneas, lenses, sclera, retinas/retinal pigment epithelium, and other tissues (Figures 1-3). These supplies can be shipped, but LEITR also



Figure 1. Laboratory circulator Nancy Rivera prepares and logs supplies for the precut procedure.



Figure 2. A donor cornea is evaluated at the slit-lamp microscope.

has state-of-the-art laboratory facilities and sleeping quarters on site (Figure 4). The latter allows researchers to have access to tissue as soon as possible after the donor's death, and the investigators can immediately begin imaging it and preparing it for further analysis.

I recently traveled to LEITR to explore applications for a microneedle that can inject therapeutic agents for macular degeneration into the suprachoroidal space. Researchers from several academic institutions and companies are working with LEITR to understand the progression of glaucoma and the impact of femtosecond laser-created incisions on the corneal endothelium.

QUALITY TISSUE IS KEY

As mentioned previously, one of the great advantages of LEITR is that investigators can obtain tissue just 4 to 6 hours after the donor's death. Because the process of cell



Figure 4. The laboratory's sleeping suite for researchers.



Figure 3. The tissue is prepared to begin the precut procedure.

autolysis begins upon death, many changes have occurred in intraocular tissues by just 36 hours postmortem. Corneal tissue can certainly be preserved for later use, but ocular tissue—particularly the retina—no longer behaves exactly like normal, living tissue.

Owing to its location, LEITR has a donor base with high rates of macular degeneration, glaucoma, and other age-related diseases. Some of the research currently underway there involves the analysis of cellular changes in the trabecular meshwork at various stages of glaucoma. Investigators' ability to obtain ample high-quality tissue and stratify it by its trabecular meshwork or retinal status would have been unthinkable just a few years ago. Now, multiple pairs of such eyes can be obtained in a day or two, jump-starting research that would otherwise have been difficult or impossible.

CONCLUSION

LEITR is going well beyond eye banks' traditional mandate of restoring sight one eye at a time to helping the ophthalmic community better understand sight-threatening conditions. Compared with animal models, human tissue is of far greater relevance to human health and offers researchers opportunities to make greater progress in curing diseases that affect millions of people. ■

For more information about LEITR, please visit www.lionseyeinstitute.org.

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