Retinal Device Helps Study Blood Flow in Mice

The eye of a mouse is a window to its bloodstream. At least that's what a group of researchers found from the Wellman Center for Photomedicine, which is affiliated with Massachusetts General Hospital and Harvard Medical School. They built a flow cytometer that can trace fluorescently tagged cells through the blood vessels of a mouse retina (Opt. Lett. **32**, 3450).

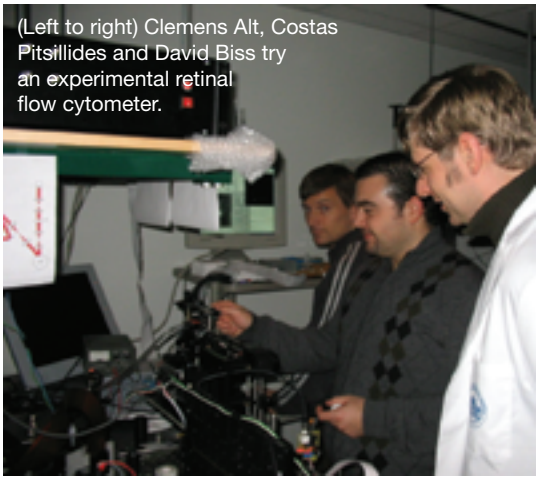
The device uses the blood flow of the retina as a representation of the blood flow throughout the body, said Clemens Alt of the Center. It's a tool to help the researchers learn about the blood constituents as they move through the body.

An earlier generation of the cytometer enabled scientists to evaluate the flow in a tiny blood vessel in the mouse ear, said David Biss, a Wellman researcher who was not a co-author of the *Optics Letters* paper but is involved in follow-up research. The first-generation device shone laser light through a stationary slit that was positioned above a single blood vessel in the ear, and it counted blood cells tagged with a fluorescent substance as they traveled past the slit.

The flow through the first version of the cytometer was about 1 µL per minute, which is low enough that a study of the animal's total blood volume could be inaccurate. The retina of a mouse has bigger blood vessels and thus much more blood flow than its earlobe.

Because the mouse retina has blood vessels radiating out from the optic nerve head, the researchers designed the new cytometer to scan in a circle. The experimental setup used a red He-Ne laser operating at 635 nm and a supply of mouse lymphocytes that were tagged with a lipophilic fluorescent dye and injected into the bloodstreams of the mouse subjects.

Although they are not measuring precise volumes with the second-generation device, the researchers found that it counts about five times as many blood cells as the original cytometer. Thus, they concluded that they are probing a larger volume of fluid.



(Left to right) Clemens Alt, Costas Pitsillides and David Biss try an experimental retinal flow cytometer.

The cytometer scans 5,000 circles per second because the cells in arteries move about 5 mm per second. The typical measurement takes about a minute to perform.

This is more of a research tool than a clinical tool, according to Alt. The Wellman research group is primarily interested in studying the flow of immune cells through the mouse and the effects of various drugs on those cells. In-vivo flow cytometry makes it easier to study the effects of medication over a prolonged period of time.

Biss and the other Wellman researchers are working on a next-generation retinal flow cytometer that will use multiple light colors to study more than one type of tagged blood cell at a time. They are also continuing to improve the device's efficiency and sensitivity.

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