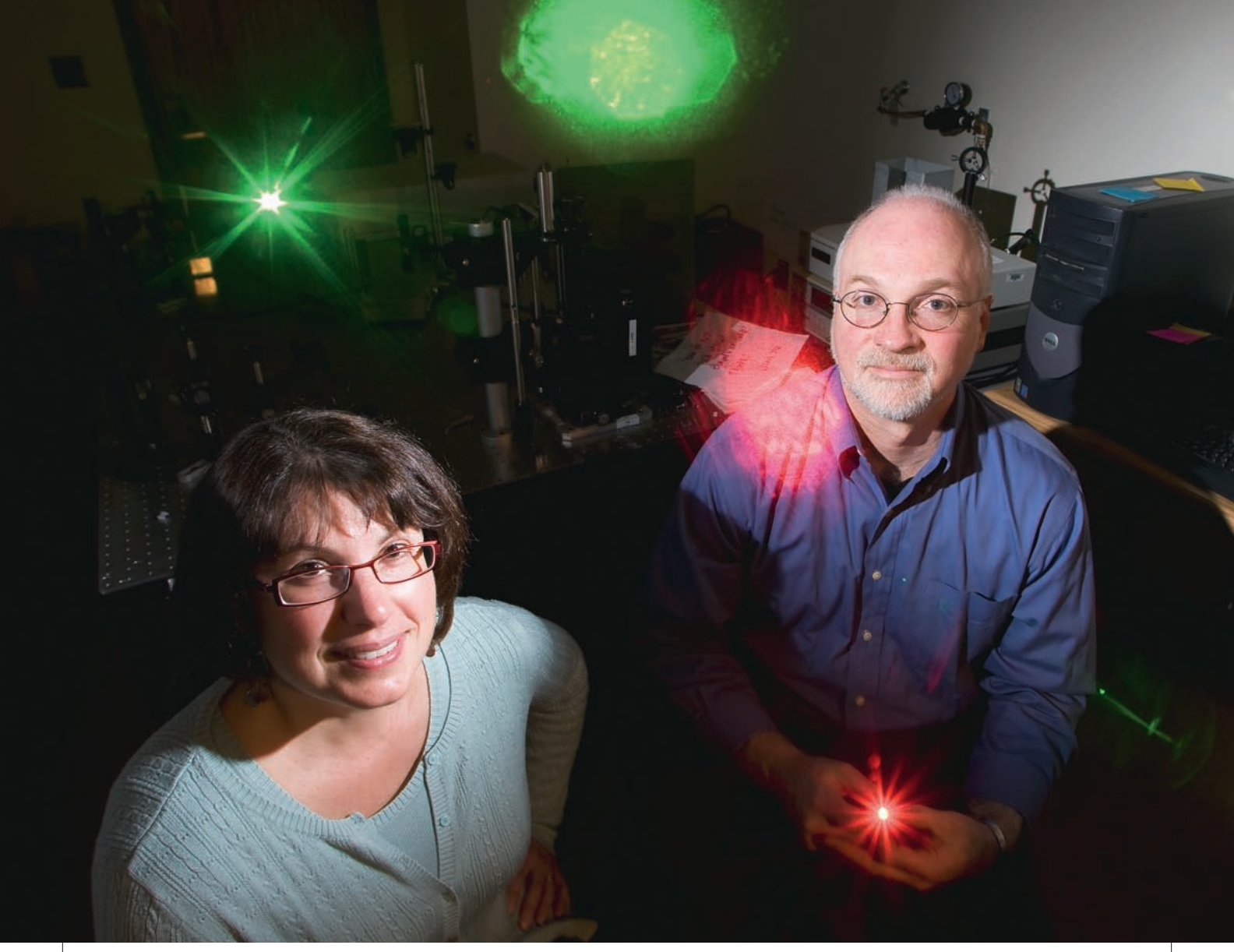

VISUAL SCIENCE

Envisioning Better Eyesight

A new crossdisciplinary collaboration focuses on a way to improve a common procedure that has helped millions see better.

By Tom Rickey

Sometimes, even in vision research, the key to moving forward is seeing things in a new way.

That's what happened about four years ago, when Wayne Knox '79, '84 (PhD), a professor of optics and physics and the director of the Institute of Optics, was presenting his work on using ultrafast lasers to change optical materials like intra-ocular lenses to a group of scientists discussing lasers, optics, and human vision.

▲ **LASER SIGHT: Huxlin and Knox are exploring a new way to improve Lasik, a laser-based vision correction system that traces some of its roots to Rochester.**

Krystel Huxlin, an associate professor of ophthalmology at the Flaum Eye Institute, chimed in with a question: "Have you ever tried this in living materials?"

With that, a collaboration was born. Huxlin and Knox are now developing a new type of laser surgery to improve vision.

"The makeup of the cornea is very much like some of the other biocompatible materials Wayne was working on," says Huxlin. "It's a natural question that came to mind. If you can alter the refractive index of man-made materials, can you do it directly on the living cornea, too? There are a number of technical issues to work through, but it's a very exciting project."

When it comes to lasers, "ultrafast" actually means "ultrabrief." The laser built by Knox's team emits pulses of light just 100 femtoseconds long—just one-tenth of a millionth of a millionth of a second. Put another way, in one second a pulse of light would zoom around the Earth's equator more than seven times. But a pulse from Knox's laser is so brief that it travels only as far as the width of a human hair.

The new technique is under exploration

ADAM FENSTER

in the laboratory and has not been tested yet in people.

As part of the exploration, Huxlin has been analyzing what happens to the eye during the procedure known as Lasik. In the popular practice, which also has roots at Rochester, surgeons use pulses from a more conventional laser to reshape the cornea, the outer surface of the eye that is ultimately responsible for about half the refraction that light undergoes as it moves through the eye and onto the retina. Huxlin has been exploring the long-term effects on the cornea of the procedure, which removes corneal tissue and causes a wound that requires significant healing.

The method proposed by Knox and Huxlin would take a completely different approach. Instead of reshaping the cornea, the team is noninvasively changing the optical properties of the cornea itself. The team uses 100-femtosecond laser pulses in the general wavelength that is used in TV remote controls—called near-infrared—to change the density of the cornea, bringing fibers of collagen more closely together. This in turn increases the cornea's index of refraction, changing the way the cornea bends light. In other words, as in the traditional surgery, rays of light are still redirected in a precise, planned way onto the retina—but instead of manipulating the shape of the cornea to do so, the proposed procedure would change the way light travels through the cornea itself.

In some ways, the partnership between Knox and Huxlin is an outgrowth of earlier work by David Williams, the William G. Allyn Professor of Medical Optics and the director of the Center for Visual Science. He used a technology that removes the twinkle from starlight to measure scores of optical imperfections in the eye and then correct them. The optical company Bausch & Lomb used that innovation in its Lasik system, creating a surgery that can give people vision as good as 20-12 or 20-10, as well as uncommonly fine vision in low-light conditions.

Williams's work also set in motion a longstanding collaboration between investigators from the River Campus, the Medical Center, and Bausch & Lomb in finding new ways to improve human vision.

The new project with Huxlin embodies one of the reasons Knox returned to Rochester nearly nine years ago, after 17 years at Bell Labs. He was excited at the prospect of bringing together the University's strengths in optics and medicine.

"I returned to Rochester largely because I wanted to get move involved with biomedical optics," he says.

"Now there are an astonishing number of projects that reach across campus, from making better bone grafts to improving dentistry to better understanding how the immune system reacts to infections.

"I hadn't even met Krystel when I decided to come back to Rochester, but I knew that collaborators like her were here."

Tom Rickey is a senior writer for Medical Center Public Relations.

NAMESAKES: The University named the David and Ilene Flaum Eye Institute in honor of the Flaums (left); the Adeline P. Lutz Pavilion at the institute recognizes Adeline Lutz (right).

MEDICAL CENTER

Introducing the Flaum Eye Institute

The University honored a few of the prominent supporters of the Eye Institute last fall, recognizing them for their commitment to the institute's growing influence in vision care and research.

In recognition of the ongoing support of Rochester businessman and philanthropist David Flaum and his family, the institute has been renamed the David and Ilene Flaum Eye Institute.

"I'd always been interested in the science of vision and know personally the transformative power of improved sight," says Flaum, who is also a University trustee and a member of the Medical Center's board. "So being a part of something that could positively impact lives was certainly a draw."

Flaum, the founder and CEO of the Rochester-based real estate development company Flaum Management Co., says he's convinced that under the direction of Steven Feldon, chair of the Department of Ophthalmology and director of the institute, Rochester will become home to a top-ranked facility that's also an engine for economic development and job creation.

Also last fall, the Adeline P. Lutz Pavilion was dedicated in honor of Rochester resident Adeline Lutz and her late husband, Walter (Jack) Lutz. Lutz, now 82 years old, began having vision problems in 1987 and has undergone a series of 13 surgeries at the institute.

Because of their relationship with Lutz's corneal surgeon, Steven Ching, a professor of ophthalmology, and the entire staff at the institute, the Lutzes decided to donate most of their savings to the institute.

"They are all like family to me, and I credit Dr. Ching with saving my sight," says Lutz. "Jack and I wanted to repay him and everyone at the institute for their dedication and kindness and ensure that future patients continue to get the very best, the very newest treatments."

"For a patient to support us in this way, it is truly overwhelming," says Ching.

—Kathleen McGarvey