

A sharp eye for cutting-edge research

BY PATRICIA PYKE

Jeff Jessing is blessed with perfect eyesight. He also has a clear vision to manufacture an ultra-sharp, inexpensive microsurgical blade to improve the outcome of eye surgery, which millions of people undergo each year for cataract removal and lens replacement and for vision correction.

Jessing, an electrical engineering professor at Boise State, holds up a shiny gray sliver of a silicon blade that he expects will cost a fraction of the price of current ophthalmic instruments and will perform with superior results.

Director of the Idaho Microfabrication Laboratory at Boise

State, Jessing has applied his expertise

in designing silicon structures, best known for use in integrated circuits, to a medical application. He has partnered with renowned ophthalmologist Dr. Mark Humayun and a team of surgeons at the Doheny Retina Institute at the University of Southern California.

While the blades are probably three to five years away from commercial use and must still undergo further process development, refinement and rigorous scientific testing, the initial indications portend success.

Jessing holds a silicon wafer that will enable batch processing of ultra-sharp surgical blades. Inset: A surgeon at the Doheny Retina Institute at USC tests one of the Boise State blades on a pig eye.

"We've had several surgeons at Doheny put these in holders and then cut – for instance, canine eyes or pig eyes," says Jessing, "and, this is a little subjective at this point, but the comment of one of the surgeons there was, 'Wow, this is the sharpest knife I have ever used.'"

How sharp is sharp?
"I can etch that tip to ... where the edge is so sharp that one silicon atom is sitting at the edge of that [blade]," says Jessing.

That's much sharper than the 5-10 micron radius of curva-

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ture needed for a blade used in laser-assisted in situ keratomileusis (LASIK) to correct nearsightedness and astigmatism.

"A typical human hair is 80-100 microns in width, so slice up a human hair into a hundred slivers and that's one micron," explains Jessing.

Sharpness is key in promoting healing of the cornea. For example, in LASIK the surgeon slices a flap in the cornea and folds it back to allow a computer-controlled laser to reshape the surface underneath. Poor healing of the corneal incision can result in visual distortions including glare, halos, double vision and diminished nighttime vision.

In eye surgery, says Sean Caffey, a researcher at USC, "a sharper knife causes less trauma to the surrounding tissue, and therefore decreases the inflammatory reaction in the eye."

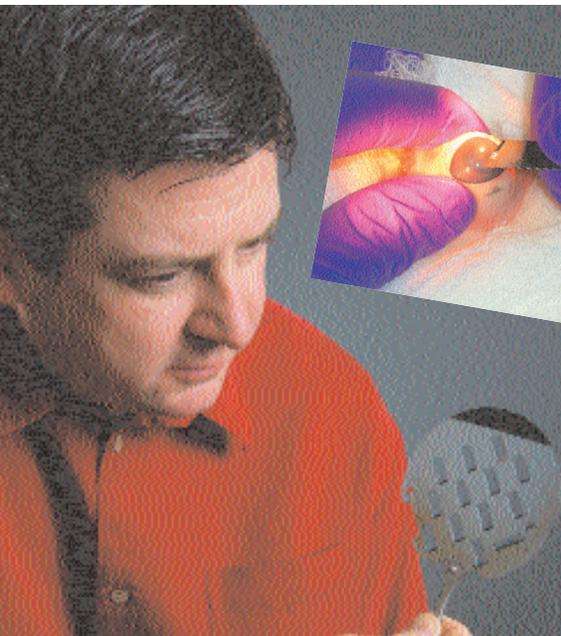
Like integrated circuits, silicon blades can be manufactured in a batch process with 60-100 blades on a 6-inch wafer, resulting in much lower costs than blades currently in use. A typical disposable, steel LASIK blade costs about \$75. Diamond blades – extremely fragile instruments that are the gold standard for cataract surgery – cost even more.

"As opposed to several thousand dollars for a diamond blade," says Jessing, "how about a dollar or two for the same or higher performance silicon blade?"

Jessing set his sights on making a significant contribution to medical research after his wife and son were both diagnosed with life-threatening medical conditions a few years ago. At the time, Jessing was enjoying his job as a researcher at the prestigious Sandia National Laboratories in Albuquerque, N.M., where he designed circuits for nuclear weapons and defense systems.

After his wife's cancer was initially misdiagnosed, Jessing says he "was frustrated and [wanted] to do something more directly to help people." Designing micro-systems to effect medical advances seemed a good match.

"It's a feel-good field," he says, "because [we're] contributing to the betterment of humankind directly."



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