

EYE OF THE FLY

ZEBRAFISH AND ZEBRAFISH EMBRYOS (THE EXPLORATORIUM), PRESIDENT BILL CLINTON (AP/PABLO MARTINEZ MONSIVAIS), DRAGONFLY EYE (DAVID L. GREEN), COMPOUND EYE (GERD ALBERT/JUNE KILS), THE TERRIBLE TOWEL (STELERS.COM)

AS I PEER INTO A MICROSCOPE, thousands of tiny lenses, each the size of a pinprick, stare back at me—a perfect replica of an insect's multifaceted eye. Luke Lee hovers nearby, excitedly adjusting the thin spectacles on his nose. "Insect eyes have many tiny, tiny lenses. Each lens is looking at a different angle—back side, front side," the bioengineering professor explains. "This is why you can't catch flies. They can see you coming."

After studying the eyes of dragonflies, Lee and his graduate student assistants built artificial compound eyes with thousands of microlenses out of polymer resin. Their research was published in *Science* last fall. Lee points to many potential applications for artificial compound eyes: When attached to cameras, they

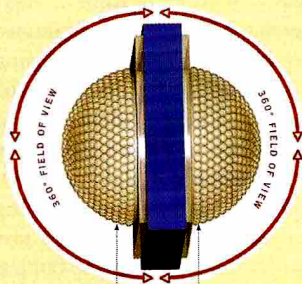
radical departure from the two-dimensional images of most endoscopes. Lee's latest project uses the individual microlenses from the compound eye to build tiny microscopes, each functioning as a "lab on a chip."

Lee's specialty is what he calls "biologically inspired systems." This means studying the complex structures he sees in nature and replicating them in the lab. "How does this insect form the lenses and then connect them to the nervous system? How do they generate such order?" he asks. "They did it without any hot oven or fancy fabrication lab—it's beyond my imagination."

His research wish list is endless—like the elephant nose fish, which emits an electric pulse to help it locate food and potential mates. "They're little fish, but they generate a huge electric pulse. And it's all protein-based. There's no magic metal or magic material," he says. "Can we use this concept to make a new battery?"

Lee says his scientific fascination with nature's design crosses over into the spiritual. As we exit the lab, he tells me his beliefs sometimes invite ridicule from other scientists. "Nature is full of creatures that God created, and I'd like to learn how God created them," he says. "Some people say we human beings are formed by random circumstances, but how could this happen? The more time I spend studying life, the more I see there is an order."

—Carrie Ching



ARTIFICIAL COMPOUND EYE

***Insect vision:** Lee designed artificial compound eyes with 180-degree vision. By putting two of these eyes together (above), he hopes to create surveillance cameras and vitamin-sized medical devices that capture 360-degree vision.*

could aid in military surveillance by offering 360-degree vision. Or with a medical-imaging device the size of a vitamin pill, doctors could get a three-dimensional view of the inside of a patient's body—a

***Kaleidoscope eyes:** The eyes of dragonflies (far left) consist of up to 30,000 tiny lenses, all facing in slightly different directions to create a wide range of vision. The compound eyes of bioluminescent Antarctic krill (left) are one of the most complex vision systems in nature.*



A FALCON CAN SEE AN OBJECT THE SIZE OF A TEACUP CLEARLY FROM A MILE AWAY—EVEN WHEN DIVING TOWARD THE GROUND AT 100 MILES PER HOUR.