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Sight is one of the most fundamental abilities and is crucial to the survival of most mammals. Without this ability it would be impossible for these creatures to find food, negotiate the terrain in which they move about, or properly choose a mate.

Sight is no less fundamental to human life. In fact, the way in which we communicate and entertain ourselves revolves around our ability to see.

The specific details of how sight occurs within the eye are intricate and complex, to say the least, but a sufficiently detailed overview of the process by Professors Rachel Casiday and Regina Frey¹ shows that light (photons) acting on chromophore 11-*cis*-retinal in the membranes of rod or cone cells causes the chromophore to change shape and thus sets off a biochemical cascade that results in an electrical impulse sent to the brain. The irreducible complexity of this biochemical process has often been used as an argument

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for Intelligent Design.² It has, therefore, been troubling for proponents of Intelligent Design that the very argument of design has been turned on its head and used to attack one of its most prized examples of design, the eye. The argument against Intelligent Design put forward by Richard Dawkins³ and others is as follows: The eye is designed back to front. It so happens that the nerve cells that take the impulses from the rod and cone cells to the brain travel over the surface of these cells. In fact, a whole network of blood vessels that services the light-sensitive cells lies between these cells and light coming from the lens. In other words, it is like designing a camera in which the wires pass in front of the photosensitive cell. This would surely obscure the image. Most people would conclude that the camera was poorly designed.

Since the eye is in fact arranged in such a back-to-front way, Dawkins argues, no intelligent being would have designed it so poorly. Therefore

the eye must be the product of blind evolution.

No scientific data was found to undermine this argument until 2007, when Kristian Franze et al.⁴ proved that there was indeed a structure in the eye that took light from the surface of the retina directly to the rod and cone cells through the mesh of nerves and blood vessels without causing the light to become distorted. They discovered that Muller cells, which had long been known to science, had an additional function in that they acted much like



optic fibers, channeling the light in a much more sophisticated way to the photoreceptors than could have been imagined.

Franze et al. performed experiments on the living retinas of guinea pigs to measure their ability to transmit light. They looked at the retinas under a modified transmission microscope and found that while most of the retina reflected the light, there were distinct dark holes that didn't reflect much light at all. Further experiments showed that when light was shone onto the top of the retina, bright spots on the

other side correspond in frequency and pattern to the dark spots seen before. This led them to believe that these dark and bright spots were the result of light being transmitted, in a highly efficient way, through the retina by a structure within it.

Continuing research showed that in fact it was the Muller cells in the retina that were transmitting the light. More testing disclosed that Muller cells are funnel shaped and act as optical fibers. As such they have a significantly higher refractive index (1.380) than the surrounding

tissue (1.358). This difference is analogous to the difference in refraction between the core and the cladding of an optical fiber, which gives the optical fiber the ability to keep light waves within its core. The low scattering ability of the Muller cells is enhanced by the fact that highly scattering organelles such as mitochondria occur at low rates and are sometimes absent.

The light-transmitting property of Muller cells overcomes the counterintuitive structure of the mammalian retina. It also provides a definitive rebuttal to the Dawkins

argument about the origin of the eye. Some may argue that this function of the Muller cells, though fascinating and elegant, is nature's improvement on a previously less-than-perfect evolutionary step.

Though a human intelligence might have designed the eye differently, however, it turns out that the design found in nature is the best for the job. Exposing the delicate photoreceptor cells to the highly energetic light of the sun is a dangerous thing. Not only does the metabolic process that turns light into an electrical impulse produce a lot of heat, but the light itself produces heat, which can damage the cone and rod cells. The layer of tissue under these cells, called the choroid, is full of capillaries in such a concentration as to give it the highest blood flow per gram of any tissue in the body. The choroid provide for the cooling needs of these cells and prevent their overheating by acting as a heat sink. It is therefore necessary that the rod and cone cells come into direct contact with this tissue to allow for maximum conduction of heat away from the rod and cone cells. The so-called backward orientation of the retina allows for this necessity.⁵

Though the discussion of whether the world around us is the product of random chance or an all-powerful Creator still continues, this discovery of the fiber optic function of Muller cells strengthens people of faith in their conviction that God made this world and puts yet another crack in Darwin's increasingly fragile macro-evolutionary theory.

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REFERENCES

¹ Rachel Casidey and Regina Frey, "I Have Seen the Light! Vision and Light-Induced Molecular Changes," Department of Chemistry, Washington University, St. Louis, Missouri <http://www.chemistry.wustl.edu/~edudev/LabTutorials/Vision/Vision.html>, accessed June 21, 2009.

² See, for example, Michael Behe, *Darwin's Black Box* (New York: Free Press, 1996).

³ Richard Dawkins, *The Blind Watchmaker* (New York: Norton and Company, 1986), p. 93.

⁴ Kristian Franze, et al., "Muller Cells Are Living Optical Fibers in the Vertebrate Retina," *Proceedings of the National Academy of Sciences* 104:20, pp. 8287-8292.

⁵ Peter W. V. Gurney, "Is Our 'Inverted' Retina Really 'Bad Design?'" *Journal of Creation*, vol. 13 (April 1999), pp. 37-44.

