Solar-powered optical implant

Tonya Ruggieri

Department of Electrical, Computer, and Biomedical Engineering

Solar-powered optical implant: There are several devices in the developing stages for individuals suffering from blindness or other vision-impairing disorders such as macular degeneration, and retinitis pigmentosa . With these disorders, the photoreceptors of the eye become damaged, and since they are the initiators in detecting light and signaling neurotransmitters to respond to the light stimulus, vision is not possible without them (Ryser 2006). One such device that can potentially help suffering individuals is the solar-powered retinal implant designed by Laxman Saggere, an engineer at the University of Illinois at Chicago.

This implant consists of several components including the solar cell, piezoelectric layer, neurotransmitter reservoir, flexible silicon disc, and fluid-filled port. When low intensity light hits the retina, the solar-powered actuator flexes. Multiple actuators on the single chip of the implant pick up on the image and allow several pixels to transfer into the brain where the image is processed. Each actuator is made up of a flexible silicon disc that is 1.5mm in diameter and 15 micrometers thick. A voltage, or potential difference, is produced when light contacts the silicon solar cell located directly next to this silicon disc. Connected to the solar cell is a layer of piezoelectric material called PZT, or lead zirconate titanate. This layer of PZT changes shape due to this potential difference, and pushes down on the silicon disc. A reservoir of neurotransmitters sits underneath this disc in the fluid-filled port. When the silicon disc is pushed, some of these neurotransmitters are released onto the nerve cells on the top of photoreceptors. The nerve impulse created travels on into the brain. This is the beginning of many chemical reactions required in the process of seeing an image (Bowles 2006).

According to an article on Qj.net by T. Kelly describes the pros and cons of this new device. One of the benefits of this new design is the fact that a solar cell is much more energy-efficient than a battery. Secondly, this implanted chip is much smaller and requires less invasive surgery compared to completely prosthetic eyes and traditional implants. Also, unlike traditional optical implants which heat up the retinal cells, this design does not heat the cells. Traditional implants apply an electric charge directly to cells in order to create an impulse that travels to the brain. This implant, however, would simply use a solar cell that flexes in order to send neurotransmitters that are responsible for creating the nerve impulse sent to the brain.

However, optical implants generally range from $800 to $2000 per eye depending on the extent of coverage of a particular health insurance plan. Since most of the population cannot afford this type of technology, cheaper, faster, and more effective methods of production must be incorporated to make it more readily accessible. While using a solar cell rather than a battery is more energy-efficient, it is not nearly enough to counteract the cost of producing such a delicate piece of technology. There also arises the question of whether or not complications will arise if the fluid fill port “runs” out of chemicals which the photoreceptors need in order to work effectively. However, a solution to this problem has not yet been developed (Ryser 2006).

Yet another issue with this implant is the fact that it cannot be implemented in helping all people with chronic and life-hindering vision disorders. This implant is designed to fix problems concerning the retina of the eye. Therefore, individuals suffering from vision loss due to corneal disfigurements, optical muscle disorders, and damage to the optic nerve will not benefit from this new invention. Also, according to an article from Lighthouse International, numerous individuals with diabetes suffer from a detachment of the retina due to the growth of scar tissue, termed retinopathy. Since this implant is designed for individuals with intact retinal tissue, this ever-growing population of people with diabetes cannot benefit from it (Faye 2008).

Saggere designed this additional component in 2006 to complement an optical implant he designed just a year earlier. Although he spent most of his career studying and mastering mechanical engineering, he is a member of the International Society for Optical Engineering (SPIE) and therefore is credited for many developments in the biomedical engineering field. In 1987 he received his B.E. in mechanical engineering at Osmania Univeristy in Hyderabad, India. In 1993 he received his M.S. at the University of Rhode Island. In 1997 he received his M.S. in aerospace engineering and in 1998 he received his Ph.D. in mechanical engineering, both from the University of Michigan.

Works Cited

“Solar-Powered Retinal Implant.” eurekalert.org. 12 September 2008. <http://www.eurekalert.org/pub_releases/2006-04/ns-sri041906.php>.

“Solar-Powered Implant Could Restore Vision.” optiboard.com. 12 September 2008. <http://www.optiboard.com/forums/showthread.php?t=16965>

“The Solar Eye.” qj.net. 12 September 2008. <http://gadgets.qj.net/The-Solar-Eye/pg/49/aid/28458>.

“Diabetes, Vision Loss and Aging.” lighthouse.org. 12 September 2008. <http://www.lighthouse.org/medical/eye-disorders/diabetes-related-eye-disease/aging/>