**Alan Pierce**
pierceaj@techtoday.us

## A Technology that Might Partially Cure Blindness

The photo at right is a close-up of my left eye. In 2011 I noticed a bunch of floaters that seemed way more than normal. An eye doctor confirmed my suspicion, finding a small retinal tear in my eye that needed to be treated quickly to prevent me from losing sight in that eye. To correct this, an eye surgeon performed laser photocoagulation surgery to seal the tear.

The laser surgery that I experienced was developed during the 20th century, and for me it was definitely a sight saver. Now in the 21st century, if all goes as planned, we might be on the verge of a major medical breakthrough, optogenetics, that can reverse certain types of blindness.

In 2005 researchers in the field of genetics and optics joined forces to study the brains of mammals using light sensitive proteins. The field of study they founded was named optogenetics. The original Stanford University team of doctors and scientists that developed optogenetics was trying to create light sensitive nerve cells in living brains to study brain function and psychiatric diseases.

To create these proteins Dr. Karl Deisseroth and his team at Stanford used genetic engineering to splice the light sensitive genes of algae, which produce light activated proteins, into a benign virus. When his team added this altered virus to nerve cells, these cells fired when they were exposed to light. This allowed the scientists to control the behavior of the animals, in their study, by shinning a light into a region of their brain using an implanted fiber optic cable.

Today, scientists using the discoveries of this new area of biotechnology have found a way to reverse blindness in animals. The protocol involves injecting a benign virus that has been genetically altered so it can turn certain eye cells that are

Jessica Nunes

**20th century technology is able to prevent blindness in certain types of eye injuries and diseases. A new technology now in clinical trials might actually be able to reverse blindness.**

non-sensitive to light into light sensitive photoreceptors. To perform this biological change the optogenetics scientists are actually employing another new bioscience that goes by the name synthetic biology. The procedure has already been extensively tested on animals, and the FDA has recently approved its use in a human clinical trial.

If the first clinical trial of this optogenetics cell infusion surgery stays on schedule, 15 blind patients will soon go through the surgical eye infusion process. Time will tell if this surgery can fully or partially restore some of the sight the participants in this trial have lost to retinitis pigmentosa; only monochromatic vision can be restored.

Our eyes have two types of photoreceptors that are called rods and cones. Retinitis pigmentosa, the targeted disease in this clinical trial, causes these photoreceptor cells to die slowly, so the patients eventually go blind. If these photoreceptors could be replaced patients should be able to see again.

The infused cells that are injected into these test subjects' eyes will only be sensitive to the blue wavelengths of natural light. So if the images that these cells receive are properly processed, the patients will be able to see again, just not all of the colors of a rainbow. Their sight will be similar to what my generation saw when we watched television before the invention of color TV.

Dr. Zhuo Hua Pan, the scientific director of the Ligon Research Center of Vision at the Kresge Eye Institute, and also an endowed professor in vision and blindness research in the department of ophthalmology at Wayne State University, saw the potential of using optogenetics to restore vision. Dr. Pan felt optogenetics could be used to convert non-light-sensitive retinal neurons into photosensitive cells to do the job once performed by the photoreceptor rods that had died in people suffering from retinitis pigmentosa.

His hypothesis was successfully tested using animals with retinal degeneration. To bring this technology out of the laboratory, it was licensed to RetroSense Therapeutics, a biotechnology company located in Ann Arbor, MI. Many neuroscientists feel that optogenetic research will eventually lead to the cure of many different brain based diseases.

### Recalling the Facts

1. If this technology is successful in restoring monochromatic sight, what do you feel scientists will have to do to restore full color vision? Hint: Research how your smartphone camera creates color images and apply what you find to a biological solution.

2. Synthetic Biology alters DNA to create specific desired traits in an organism. Research how it is performed, life forms that are being changed, and what desired outcomes scientists hope to achieve by changing the natural biological functions of these organisms.

---

*Alan Pierce, Ed.D., CSIT, is a technology education consultant. Visit www.technologytoday.us for past columns and teacher resources.*