BIONIC EYES

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ABSTRACT

For those millions of us whose vision isn't perfect, there are glasses. But for those hundreds of thousands who are blind, devices that merely assist the eyes just aren't enough. What they need are alternative routes by which the sights of the world can enter the brain and be interpreted. Technology has created many path ways for the mankind. Now technology has improved to that extent wherein the entire human body can be controlled using a single electronic chip. We have seen prosthetics that helped to overcome handicaps. Bio medical engineers play a vital role in shaping the course of these prosthetics. Now it is the turn of artificial vision through bionic eyes. Chips designed specially to imitate the characteristics of the damaged retina and the cones and rods of the organ of sight are implanted with a microsurgery. Linking electronics and biotechnology, the scientists have made the commitment to the development of technology that will provide or restore vision for the visually impaired around the world. Whether it is Bio medical, Computer, Electrical, or Mechanical Engineers all of them have a role to play in the personification of Bionic Eyes. There is hope for the blind in

the form of bionic eyes. This technology can add life to their vision less eyes.

INTRODUCTION

A bionic eye works by stimulating nerves, which are activated by electrical impulses. In this case the patient has a small device implanted into the body that can receive radio signals and transmit those signals to brain through nerves and can interpret the image. One of the most dramatic applications of bionics is the creation of artificial eyes. Early efforts used silicon-based photo detectors, but silicon is toxic to the human body and reacts unfavourably with fluids in the eye. Now, scientists at the Space Vacuum Epitaxy Centre (SVEC) based at the University of Houston, Texas, are using a new material they have developed, tiny ceramic photocells that could detect incoming light and so repair malfunctioning human eyes.

CORNEAL TRANSPLANTS

Surgical removal of opaque or deteriorating corneas and replacement with donor transplants is a common medical practice. Corneal tissue is a vascular; that is, the cornea is free of blood vessels. Therefore, corneal tissue is seldom rejected by the body's immune system. Antibodies carried in the blood have no way to reach the transplanted tissue, and therefore long-term success following implant surgery is excellent.

THE SURGERY

This concept of Artificial Vision is also interesting to engineers, because there are a number of technicalities involved in this surgery apart from the anatomical part. The microsurgery starts with three incisions smaller than the diameter of a needle in the white part of the eye. Through the incisions, surgeons introduce a vacuuming device that removes the gel in the middle of the eye and replaces it with saline solution. Surgeons then make a pinpoint opening in the retina to inject fluid in order to lift a portion of the retina from the back of the eye, creating a pocket to accommodate the chip. The retina is resealed over the chip, and doctors inject air into the middle of the eye to force the retina back over the device and close the incisions. During the entire surgery, a biomedical engineer takes part actively to ensure that there is no problem with the chip to be implanted. Artificial retinas constructed at SVEC consist of 100,000 tiny ceramic detectors, each 1/20 the size of a human hair. The assemblage is so small that

surgeons can't safely handle it. So, the arrays are attached to a polymer film one millimetre by one millimetre in size. A couple of weeks after insertion into an eyeball, the polymer film will simply dissolve leaving only the array behind. ASR implants and will be reorganizing a new company under the same name. The ASR microchip is a 2mm in diameter silicon chip (same concept as computer chips) containing ~5,000 microscopic solar cells called "Micro photodiodes" that each have their own stimulating electrode.

WORKING PROCEDURE

An artificial eye provokes visual sensations in the brain by directly stimulating different parts of the optic nerve. A bionic eye works by stimulating nerves, which are activated by electrical impulses. In this case the patient has a small device implanted into the body that can receive radio signals and transmit those signals to nerves. The Argus II implant consists of an array of electrodes that are attached to the retina and used in conjunction with an external camera and video processing system to provide a rudimentary form of sight to implanted subjects The Argus II Retinal Prosthesis System can provide sight, the detection of light, to people who have gone blind from degenerative eye diseases. Diseases damage the eyes' photoreceptors, the cells at the back of the retina that perceive light patterns and pass them on to the brain in the form of nerve impulses, where the impulse patterns are then interpreted as images. The Argus II system takes the place of these photoreceptors. The second incarnation of Second Sight's retinal prosthesis consists of five main parts:

- Digital Camera - built into a pair of glasses, captures images in real-time sends images to microchip.
- Video processing microchip - built into a handheld unit, processes images into electrical pulses representing patterns of a blister forming on the skin after a burn. Within that little blister, we place the artificial retina. A light-sensitive layer covers 65% of the interior surface of the eye. Scientists hope to replace damaged rods and cones in the retina with ceramic micro detector arrays.

FUTURE SCOPE

Researchers are already planning a third version that has 1,000

electrodes on the retinal implant, which they believe could allow for facial-recognition capabilities and hope to allow the user to see colourful images. Scientists believe the immediate goal after achieving above is to develop a functioning artificial retina with resolution that mimics human sensors. Once this step has been achieved, they say, then attention can be brought to bear on colour vision, followed by the replacement of some of the interconnecting neural cells that lead to the optic nerve. So, let us hope to reach all these goals as soon as possible. The researchers note the device has some limitations, and it will not restore perfect vision. However, they are sure it will give people the advantage of having a general sense of their surroundings. Hopefully, the technology may enable people to recognize faces and facial expressions. “The thing is to significantly improve the quality of life for blind patients".

CONCLUSION

Restoration of sight for the blind is no more a dream for people today. Bionic Eyes have made this true. Though there are a number of challenges to be faced before this technology reach the common man, the path has been laid. This paper has tried to present the concept of Artificial Vision called “Bionic Eyes”. It is just a matter of time, may be 4-5 years that the blind will be able to see through these Bionic Eyes, with thanks to Science and Technology.

• Artificial retinas can restore sight lost due to retinal diseases.• There is so far no downside to getting retinal implants• Retinal implants may confer vision outside our normal range.