Sample Speaking Outline - Informative Speech

National Award Winning Speech
Written and performed by Sarah Prikryl, University of St. Thomas, 1995-96.

The Bionic Eye

General Purpose: **To inform**
Specific Purpose: **To inform my audience about the research and development of the vision chip implant**

Introduction:

I. Attention Getter

A. Archives of Ophthalmology, June, 1995.
Case studies verifying that
B. Dobree & Boutler, Blindness and Visual Handicap
estimated that 42 million ...
C. New York Times, August 16, 1995
1 million Americans become ....

II. Audience Relevancy

Any one of us could easily lose our sight due to injury or illness and, for the majority of the blind, this condition is permanent.

III. Thesis Statement /Topic Identification

Imagine a computer chip small enough to fit in the human eye. Currently, an important experiment is underway that, if successful, could actually restore sight to the blind. This new breakthrough in Bionic Eye technology is the Vision Chip Implant.

Preview Statement:

To fully understand the significance of the vision chip to bionic eye research, we must first understand the normal vision process and the causes of blindness, then explore the development of the vision chip, and finally, examine the obstacles the researchers are working to overcome.

Body:

I. The Vision Process and Causes of Blindness

A. Vision occurs through a process involving several steps.

(Incorporate 1st visual aid here)

1. Process begins with light (Infoworld, January 15, 1996)
2. Light enters through the pupil...lens...vitreous humour...retina...etc. (New Scientist, August 19, 1995)

(Cover visual)

3. Retinal processing (Science Magazine, February 2, 1996)
4. Brain Involvement (Proceedings of the National Academy of Sciences of the United States of America, July 1995)

B. Causes of Blindness

1. Damage from different factors
   a. (New York Times, August 16, 1995.)
   b. (New York Times, June 21, 1995)
2. Role of Disease in Blindness
   a. Glaucoma - (General Ophthalmology, 1995)
   b. Retinis Pigmentosa - (Dr. Ruben Adler, Archives of Ophthalmology, January, 1996)
   c. Macular Degeneration
      (1.) Houston Chronicle, March 19, 1995
      (2.) Patients Guide to the Retina

Transition to Point II

II. The Vision Chip

A. Development of the Chip

1. Technology now exists ...(Dr. Mark Humayun, Archives of Ophthalmology, January, 1996)
2. Researchers at Massachusetts Ear and Eye Institute are developing microchip.... (New Scientist, August 19, 1996)
3. Cell stimulation theory (1994 National Institutes of Health Neural Prosthesis Conference)
4. Description of the Chip (Dr. Rizzo)

(Overlay visual)

B. Image resolution

1. Image resolution enhancement research (Science, May 5, 1995)

(Resolution visuals)

2. Phosphene theory

Transition to Point III

III. Obstacles (August 19, 1996 New Scientist)

A. Implanting the chip

1. Matching the retina's curve
2. Risk of Scar Tissue

   Description of the retina (The Retina Book)
3. Risks to the chip

B. Testing schedule

Conclusion:

I Summary

In our effort to understand the significance of the vision chip to bionic eye research, we have examined the vision process, as well as the causes for blindness, the developments of the vision chip and the obstacles which the researchers are working to overcome.

II. Reinforcement

Times Educational Supplement, July 7, 1995

III Closing

A. "A bionic eye is decades away" (Dr. Frank Werblin, The Futurist, September/October 1993)

B. Given the astonishing advances made over the past 2 1/2 years, it's very likely that people who have lost their vision due to injury, disease, or even excessive sexual activity, will see again within the near future.

The Bionic Eye (Speech Manuscript)

In June of 1995, the Archives of Ophthalmology presented facts and case studies verifying that vigorous sexual activity can cause tiny blood vessels in the back of the eye to break or cause retinal tears, thus giving credence to the old wives' tale that sex can cause blindness. And I thought my mother was lying to me. Of course sexual behavior is not the only cause of blindness, and the loss of sight is a condition that is becoming more notable every day. It is estimated that 42 million people in the world suffer from total visual impairment, or blindness, as reported by Dr. John Dobree and Eric Boulter in their book Blindness and Visual Handicap. In addition, the New York Times of August 16, 1995, states that each year 1 million Americans become visually impaired due to eye injury. Unfortunately, any one of us could easily lose our sight due to an injury or illness and, for the majority of the blind, this condition is permanent.

But imagine a computer chip small enough to fit into the eye that will enable the blind to see. Currently an important experiment is underway, that if successful could actually restore sight to the blind. This new breakthrough in Bionic Eye technology is the Vision Chip Implant.

To fully understand the significance of the vision chip to bionic eye research, we must first understand the normal vision process and the causes of blindness, then explore the development of the vision chip, and finally, examine the obstacles the researchers are working to overcome.

Vision occurs through a process involving several steps. InfoWorld of January 15, 1996 reports that the vision process begins with light. The August 19, 1995, New Scientist goes on to explain that light enters through the pupil. The lens focuses the light, which then passes through the jelly-like central region of the eye known as the vitreous humour and continues until it comes in contact with the retina. The light then travels through transparent layers of cells, including the ganglion, or nerve cells, that send visual signals, and continues until it finally reaches the light sensitive rods and cones. Stimulated by light, the rods and cones send electrical impulses forward through the ganglion cell layer. Science magazine of February 2, 1996, states this retinal processing is dependent on the responses of the ganglion cells. These ganglion cells are neurons that form the optic nerve and these responses are fed through to the visual cortex, located at the back of the brain. (Cover Visual)

The July 1995 Proceedings of the National Academy of Sciences of the United States of America emphasizes that the brain's involvement in the vision process is fundamental. The brain, as described in the November 17, 1995 issue of Science, decodes messages of visual stimuli, and then translates them into form, color, motion and depth.

Should damage occur during any part of the vision process, the consequence is often blindness. This damage can result from a variety of different factors. According to the New York Times of August 16, 1995 one thousand men and women experience eye injuries daily. In addition to injuries, vision loss, as reported by the June 21, 1995, New York Times, can be attributed to overexposure to sunlight.

Disease is also a leading cause of blindness. According to the 1995 edition of General Ophthalmology, Glaucoma has effected an estimated 2 million Americans. Dr. Ruben Adler clarifies in the January 1996 Archives of Ophthalmology, that yet another prevalent eye disease, retinis pigmentosa, possesses retinal degenerative properties which can also lead to permanent loss of sight. The Houston Chronicle on March 19, 1995, reveals that the leading cause of blindness in America is macular degeneration, of which 167,000 new cases were diagnosed just last year. This condition, as explained in the Patients Guide to the Retina (a pamphlet distributed by ophthalmologists) causes the layers of the retina, including the rods and cones, to separate.

Whatever the cause of blindness, ranging from accident to disease, the result is always the same: Loss of sight. However, this condition may not always be permanent if the researchers of "bionic eye" technology can accomplish their goals.

Now that we are familiar with the vision process and the damages that can be inflicted upon that process, it is now easier to explore the developments of the vision chip.

According to Dr. Mark Humayun in the January 1996 Archives of Ophthalmology, the technology now exists to build a retinal prosthesis.

Janet Morgan, in her August 19, 1995 New Scientist article, states that a group of researchers from the Massachusetts Eye and Ear Infirmary and from the Massachusetts Institute of Technology , led by neuro-opthalmologist Dr. Joseph Rizzo and electrical engineer John Wyatt, are developing a microchip which will be used to bypass damaged rods and cones to directly stimulate the ganglion cells.

This theory of cell stimulation is based upon findings reported at the 1994 National Institutes of Health Neural Prosthesis Conference by researchers who discovered that the ganglion cells appear to be directly wired to the rods and cones. Based upon these findings, researchers feel that if the rods and cones are damaged they can be replaced by this vision chip. (Overlay visual)

Dr. Rizzo describes the chip as being 2.2 millimeters square, shaped like a paddle, and encased in a silicon coating. As seen earlier, the cycle continues as before. Light is focused by the lens, and travels through the vitreous humour, until it reaches the retina. Because the rods and cones are damaged, the cycle is therefore broken. This is where the chip comes into play. The chip holds a solar panel linked to microelectrodes. Light hits the panel and generates a signal. The signal is then channeled to these electrodes to stimulate the ganglion cells, therefore bypassing the damaged rods and cones and bridging the break in the cycle.

The next level of development deals with image resolution. Image resolution enhancement research is being conducted at Johns Hopkins University Hospital in Baltimore by the members of the Intraocular Prosthesis Project, as explained in the May 5, 1995 issue of Science. (Resolution visuals)

These researchers discovered that when an electrode is stimulated, the individual sees a spot of light, called a phosphene. The location of this phosphene changes based upon which electrode is stimulated.

As the number of stimulated electrodes increases, more phosphenes appear. The phosphenes come together to produce an image and the resolution of this image improves as the phosphenes multiply.

The final goal of these researchers is to enable these individuals to see a detailed object.

While significant progress has been made in the development of the vision chip, there are still several obstacles, discussed in the August 19,1995 New Scientist, that must be overcome before these developments can be made available.

Because each eye's contour is different, the chip must be bent to match each retina's curve. There is also concern that, because the process involves implanting a foreign object directly into the eye ,there exists the risk that signal-blocking scar tissue may form.

Since the retina, according to The Retina Book, (a medical booklet distributed by ophthalmologists,) is only about "1 millimeter thick and has the consistency of wet tissue paper", there is a danger that it could easily be sliced by the chip's sharp edges. Even the chip itself is at risk after implantation, from corrosion due to salty fluids in the eye. To battle each of these risks, the researchers are working on a variety of transparent silicon coatings that will protect both the retina and the chip.

So, when will these new sight restoring devices be made available? Researchers are still very conservative in their hopes. Extensive testing is still necessary to overcome the obstacles. Researchers are currently working toward their goal of implanting this chip into a human subject. The next step toward that goal, according to Dr. Rizzo, will be to implant the chip into a canine suffering from a type of retinis pigmentosa. If these experiments are successful, testing on human subjects can begin within the next five years.

In our effort to understand the significance of the vision chip to bionic eye research, we have examined the vision process, as well as the causes for blindness, the developments of the vision chip and the obstacles which the researchers are working to overcome.

The Times Educational Supplement of July 7, 1995 states that "the visually impaired have much to gain from technology." and while some people may feel this technology is too far into the future to be of concern to us, the development of a sight-restoring device will be well worth the wait for those who are visually impaired.

Just 2 1/2 years ago neurobiologist Frank Werblin was quoted in the September/October, 1993, issue of The Futurist as saying that "a bionic eye is decades away." Well, Dr. Werblin, it's happening soon than you thought. Given the astounding advances made over the past 2 1/2 years, it's very likely that people who have lost their vision due to injury, disease or even excessive sexual activity, will see again within the near future.

The Bionic Eye - Works Cited

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