

SUGGESTED REFERENCES

- *The Incredible Human Body: The Five Senses*
Discovery School
<http://School.discovery.com/lessonplans/programs/humanbody>
- *Facts About Age Related Macular Degeneration*
http://www.nei.nih.gov/health/maculardegen/armd_facts.htm
- A Guide to Retinitis Pigmentosa
http://www.brps.demon.co.uk/Graphics/G_Guide.html
- University of Southern California
Keck School of Medicine
<http://www.usc.edu/hsc/info/pr/>
Information on the retinal prosthesis
- Information on the Boston Scleral Lens
News, Events and Publications
- Boston Foundation for Sight
<http://www.bostonsight.org>

NATIONAL SCIENCE EDUCATION STANDARDS

- | | |
|---|--|
| <p>5 - 8
Life Science
Structures and functions in living systems</p> <p>Science and Technology
Abilities of technological design</p> | <p>9 -12
Life Science
The cell
Matter, energy, and organization in living systems</p> <p>Science and Technology
Abilities of technological design</p> |
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*Source: National Science Education Standards, National Academy Press

CREDITS

The producers thank the Boston Foundation for Sight and the Keck School of Medicine of the University of California for materials used in this program, with special recognition of Perry Rosenthal, M.D., Mark Humayun, M.D., Ph.D., Eugene de Juan, Jr. M.D., Robert Greenberg, M.D., Ph.D., and Gretchen Van Boemel, Ph.D.

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VOLUME 33 ISSUE 6

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SYNOPSIS

Our eyes enable us to view the world around us and to complete many everyday tasks. While people may take vision for granted, it is a complicated process that requires numerous components of the human eye and brain to work together.

This edition of SCIENCE SCREEN REPORT explores how the eyes work to create vision. It also discusses complications that can interfere with eyesight, and some medical breakthroughs that are helping people regain good vision.

CURRICULUM UNITS

- ANATOMY
- BIOCHEMISTRY
- BIOLOGY
- PHYSIOLOGY

RUNNING TIME

15:25

BACKGROUND

Vision is a complicated process that requires numerous components of the human eye and brain to work together. Visual perception begins when light rays enter the cornea and lens. The cornea and lens then bend the rays of light and bring them into focus upon a thin transparent layer of nerve tissue called the retina. The retina captures the image as if it was film in a camera and sends it to the brain to be developed. The retina is connected to the brain by the optic nerve.

Perhaps the most common eye problem is that of poor vision. This occurs when the cornea or lens becomes misshapen, causing certain areas of the retina to receive less light. Contact lenses or glasses help correct this condition by bending the light before it enters the eye. Lasik surgery is another option that has had success in correcting poor vision, using a special laser to reshape the cornea.

Many complications and diseases can affect our eyesight and cause blurred vision, tunnel vision, and blindness. Macular degeneration affects a part of the retina called the macula. This allows us to focus clearly and to see with sharp, straight-ahead vision. Instead of seeing straight ahead, people with macular degeneration have only the outermost peripheral vision, seeing out of the corner of their eye. They see a dark, distorted patch where the center vision is blacked out. Fortunately, a procedure called photodynamic therapy can help some patients. Others may require surgery.

Glaucoma is another eye disease caused by pressure within the eye and on the optic nerve that can lead to blindness. However, if it is detected early on through annual eye exams, special eye drops may alleviate the pressure. If not, surgery is needed.

However, there are some eye diseases that cannot be treated. One of these is retinitis pigmentosa. This blocks out all peripheral vision, allowing the person to see only in tunnel vision. Most people with this disease eventually go blind.

Fortunately, medical breakthroughs are unveiling ways for people who are legally blind to see again. Those who are blind due to corneal related complications may benefit from the Boston Scleral Lens. This looks like an extra large contact lens that fits over the sclera part of the eye and then arches over the cornea.

Other revolutionary research may offer future hope for blind people suffering from retinal diseases. A new microelectronic retinal implant, or retinal prosthesis, is currently being tested. It is designed to restore vision by taking over the job of the damaged retina cells. However, more research is needed before it becomes a commercial product.

Further hope to restore and improve vision can be expected in the future, as scientists continue to investigate new ways of restoring good vision for people with vision-related problems.

ADVANCED ORGANIZERS

Prior to viewing this video, students should have some understanding of the following Benchmarks*:

Benchmark 1: The Nature of Science

1. When similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, and it often takes further studies to decide. Even with similar results, scientists may wait until an investigation has been repeated many times before accepting the results as correct. (Section A)
2. New ideas in science sometimes spring from unexpected findings, and they usually lead to new investigations (Section B).

Benchmark 3: The Nature of Technology

Technological problems often create a demand for new scientific knowledge, and new technologies make it possible for scientists to extend their research in new ways or to undertake entirely new lines of research. The very availability of new technology itself often sparks scientific advances. (Section A)

Benchmark 8: The Designed World

Technology has made it possible to repair and sometimes replace some body parts. (Section F)

*Benchmarks can be researched at www.project2061.org/tools/benchol/bolnav.htm

CRITICAL THINKING EXERCISES

After showing the video, ask your students the following:

1. Survey students who wear glasses, contacts, or teachers who have had Lasik surgery. Create a bar graph depicting the results.
2. The most common form of macular degeneration is age-related macular degeneration (AMD). There are two types of AMD. Identify and distinguish between these two forms.
3. Investigate breakthroughs in vision research such as the Boston Scleral Lens and the retinal prosthesis. For information visit the Boston Foundation for Sight, www.bostonsight.org, and the University of Southern California's Keck School of Medicine, www.usc.edu/hsc/info/pr/
4. Have each student choose two eye diseases/complications listed on the chart created prior to showing the video (see Advanced Organizers). Have them compare and contrast the two diseases/complications.
5. Have students illustrate and label the anatomy of the eye, and then write a description of how the eye and the brain work together to make vision possible. For information visit: Vision and Eyesight, <http://www.sciencejoywagon.com/physicszone/lesson/09waves/optics/eyes/>
6. This lesson has several activities:
 - a) Prepare students to experience what it may feel like to be blind. Pair up students. The blindfolded student will be guided by the partner - (then switch). Have the pair walk down the hall or inside the classroom while other students observe their movements.
 - b) Have students discuss the experience of relying on someone else to get from one place to the next while blindfolded.
 - c) What resources are available to assist blind people in functioning in our every day world? (guide dogs and guide horses, braille, canes...) visit website: The Guide Horse Foundation <http://www.guidehorse.com/>

VOCABULARY

Air tonometry

Cornea

Computer tomography

Drusen

Glaucoma

Hyperopia

Lasik

Macular degeneration

Myopia

Optic nerve

Optometrist

Peripheral vision

Photodynamic therapy

Photoreceptor cells

Retina

Retinitis pigmentosa

Retinal prosthesis

Sclera

CAREER POSSIBILITIES

■ BIOLOGIST

■ ENGINEER

■ NEUROLOGIST

■ OPHTHALMOLOGIST

■ OPTOMETRIST