

The Living
BODY

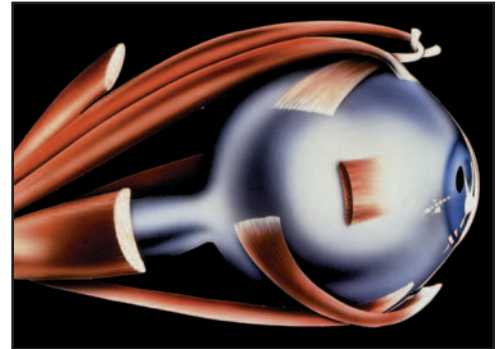
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Eyes and Ears

Summary

The dramatic framework of this program shows a reckless young driver tearing through the countryside and nearly causing disaster. The program shows how the eyes and ears provide vital information to the brain—information which in this instance can make the difference between life and death.



Sound arrives at the end of the ear tunnel and travels to the eardrum, where it is passed on to the three tiny bones in the middle ear which transmit the vibrations to the inner ear. The human ear has its own volume control: it can amplify sound more than 100 times or reduce very loud sounds to protect the delicate mechanisms of the inner ear.

The ear can process a range of notes and pitches simultaneously. Complex sounds are heard as separate elements, all playing together. The cochlea, which is the ear's frequency analyzer, is a spiral tube lined with specialized cells that detect the frequency of sounds. The nerve fibers connecting these cells form the acoustic nerve. Thus, when a sound reaches the ear, it triggers a pattern of nerve messages that are interpreted as a certain frequency. The brain is not equally sensitive to all frequencies: it is largely insensitive to certain low frequencies, in particular those generated by the voice itself, so that we do not deafen ourselves when speaking; it is most sensitive to signals at 3000 cycles per second—the pitch of the human scream.

Light waves are analyzed for brightness and color. Light first passes through the cornea, is then focused by the lens on the retina, and the patterns of light are then transmitted to the brain through the optic nerve. The iris adjusts the amount of light entering the eye. The lens, located behind the iris, is transparent, and changes its shape to bring an image into focus on the retina. When focused on nearby objects, the lens is very curved; when focused on more distant things, it flattens out.

The surface of the retina is covered with blood vessels, nerve cells, and specialized light-detecting cells. These rods and cones contain a chemical pigment that is bleached out every time a light ray hits. Most of the retina contains rods that detect brightness but not color. That is why night vision is monochromatic. The retina's center contains many more cones than rods, which are packed closely together to give accuracy of vision. Unlike rods, cones detect color, some responding mostly to red, others to blue, others to green. The human eye can detect about two hundred colors with just these three types of cone.

Objectives

1. To illustrate the critical role played by sight and hearing in human survival.
2. To describe the various components of the human ear and eye, and how they work.
3. To examine the human ear's ability to analyze the frequency of sound.
4. To explain how patterns of light rays are detected and transformed into visual images.

Recall Questions

1. How is the direction of sound determined by the brain?
2. What structure in the ear enables humans to perceive three dimensions?
3. Low and high notes affect the cochlea differently. Describe these effects.
4. What enables the eye to be mobile?
5. The tiny muscles of the iris respond to variations in the amount of light. To what other factor do they respond?
6. How does the brain use eye muscle movements to calculate the distance of objects?

Interpretive Questions

1. What do you think a rock concert would sound like if the cochlea could detect only one frequency at a time?
2. Why are human beings sensitive to some frequencies and can't detect others at all?
3. What causes color blindness in some people?
4. Explain near- and far-sightedness in terms of the focusing mechanisms of the human eye.

Vocabulary Required for Effective Viewing

- acoustic nerve
- amplify
- cochlea
- cornea
- eardrum
- frequency
- iris
- lens
- optic nerve
- pitch
- pupil
- retina
- rods and cones
- vibration
- volume



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