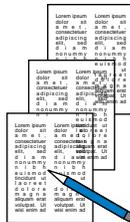


# VISION

▲ A SCHOOL PROGRAM FOR GRADES 4–8



▲ A SCIENCE CURRICULUM SUPPLEMENT



▲ THREE LESSON PLANS



▲ IDEAL FOR A GUEST SPEAKER



## INTRODUCTION

VISION, a series of three lessons for grades 4–8, is part of a nationwide public education program to mark the 25th anniversary of the National Eye Institute, part of the Federal government's National Institutes of Health. This curriculum supplement can be used by a teacher and/or a guest speaker. The lesson plans are designed to be flexible. You may select a few activities for one classroom session, or use the entire supplement for several classes on vision.

### To the Teacher

▲ To arrange for a visit from a vision researcher or eye care professional, contact the public affairs department of your local university, state association of ophthalmology or optometry, medical association, or hospital.

### To the Guest Speaker

- ▲ Contact your local school principal or the science supervisor for the school district to arrange a classroom visit.
- ▲ Share your expertise with students and demonstrate the vital role science plays in their world.

## TIPS FOR THE GUEST SPEAKER

### A few weeks before your visit:

- ▲ Call the teacher.
- ▲ Discuss the lesson plan/s you have selected.
- ▲ Find out how much time will be available for your class session.
- ▲ Discuss the materials you need or will bring with you to the classroom.
- ▲ Make overhead transparencies or posters of the student handouts. This will help the students follow along with the activities.

### In the classroom:

- ▲ Introduce yourself... tell students what you do... where you work... tell them about your training.
- ▲ Make eye contact... students love the personal contact.
- ▲ Smile and relax... tell amusing anecdotes... kids love a good laugh.
- ▲ Organize materials in advance... kids have a hard time waiting.
- ▲ Distribute handouts only when it is time to use them...so students will not be distracted.
- ▲ Use student volunteers to set up and distribute materials...kids love to feel important.
- ▲ Ask if there are any questions after each activity.

### Set guidelines:

- ▲ Students must raise their hands to participate.
- ▲ Set time length for group discussions.
- ▲ Use a prearranged signal to stop discussions (bell, clapping, etc.).
- ▲ Give the entire class time to think about the question before calling on a student to answer.
- ▲ Call on as many members of the class as possible...everyone wants to be involved.
- ▲ Praise good behavior.

Enjoy the students, their enthusiasm, and their sense of wonder ... they have a fascinating perspective on the world.



The National Eye Institute's mission is to improve the prevention, diagnosis, and treatment of eye diseases. Today, the Institute supports more than 80 percent of all eye research conducted in the United States.



# LESSON PLAN #1

## The Eyes and the Great Brain Connection!

**Goal:** Students will identify the parts of the eye and explain the visual system of the brain.

**Materials Needed:** paper, pencils, colored pencils, or crayons.

**Classroom Activities:** Select two to three activities per classroom session.

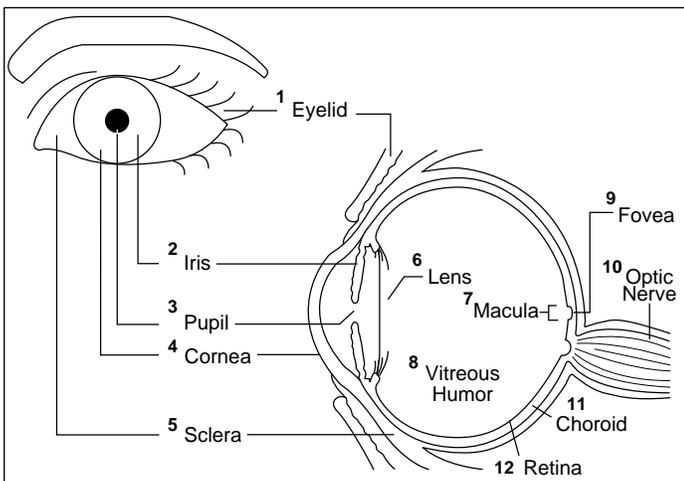
**Activity 1:** Ideal for younger students. Allow 15 minutes for students to work in pairs. Allow 5 minutes for classroom discussion.

Divide the classroom into pairs. Ask students to examine their partner's eyes and to draw a large picture of one eye, putting in as many details as they can. Have them notice the color and texture of the eye, and use crayons to lightly color the drawing. Students can compare the similarities and differences in the color, shape, and texture of each other's eyes. Circulate through the room during this activity and stimulate discussion.

**Activity 2:** Ideal for all ages. Allow 15–20 minutes.

Distribute **Handout: The Anatomy of the Eye**. Ask students to fill in the parts of the eye. Review and discuss the definitions with the students.

Answer key to **Handout: The Anatomy of the Eye**



**Activity 3:** Ideal for all ages. Allow 10 minutes.

**Pupil dilation:** Divide the classroom into pairs. Ask students to observe their partner's pupils automatically get larger and smaller as the classroom lights are turned off for 10 seconds, then turned back on.

Explain that the black spot in the middle of the iris—the pupil—is really a hole through which light enters the eye. The iris is a muscle that expands and contracts to control the amount of light that enters the eye. In bright light, the iris expands and the pupil shrinks so that only a little of the available light enters the eye.

**Activity 4:** Ideal for all ages. Allow 15 minutes.

**Classroom or Take Home Activity:** Distribute **Handout: Optical Illusions**. Review the handout with the class.

**Activity 5:** Ideal for all ages. Allow 15–20 minutes.

**Classroom or Take Home Activity:** Distribute **Handout: Scramble and Word Search**. Review the handout with the class.

**Activity 6:** Ideal for older students. Allow 20 minutes.

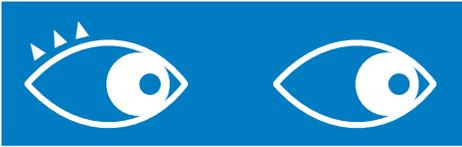
Distribute **Handout: The Visual System**. Review with the students.

**Just for Fun:** Distribute **Handout: Eye Opening Facts**.

Answer key to **Handout: Scramble and Word Search**

1. dyelie = eyelid
2. siir = iris
3. lpuiip = pupil
4. onarce = cornea
5. rsleca = sclera
6. nesl = lens
7. aclamu = macula
8. stivorue mhuro = vitreous humor
9. ovafe = fovea
10. pocit verne = optic nerve
11. drohcio = choroid
12. tranie = retina





## LESSON PLAN #2

### The Imperfect Eye

**Goal:** Students learn about common visual disorders and diseases.

**Materials Needed:** petroleum jelly, paper towels/wipes, sunglasses (ask students to bring in sunglasses), ping pong balls (one ball for each group of three students), eye patch or blindfold, pitcher of water and a cup, paper clips, paper, and pens.

**Classroom Activities:** Select two to three activities per classroom session.

**Activity 1:** Ideal for all ages. Allow 20 minutes.

Ask students the following questions about their classmates, families, and friends:

- ▲ How many wear glasses or contact lenses?
- ▲ Do they know why?
- ▲ Do any of them have cataracts, glaucoma, age-related macular degeneration, diabetic retinopathy?
- ▲ How old are these people?

Discuss answers to their questions.

**Activity 2:** Ideal for all ages.

Simulate impaired vision with students. Ask students to make observations and record information. Following each of these activities ask students: How did it feel? What activities could you do with impaired vision? What couldn't you do?

**Impairment in both eyes:** Allow 15–20 minutes.

Rub petroleum jelly on a pair of sunglasses. Have students wear the sunglasses while trying some common daily activities (e.g., reading a book or newspaper, pouring water from a pitcher to a cup, making a paper clip chain, signing their names, making a paper airplane).

Discuss the following questions afterward:

- ▲ How did you feel while you were wearing the glasses?
- ▲ What was the most difficult task to do?

**Impairment in one eye:** Allow 10 minutes for each activity.

Following these exercises, explain that vision with one eye results in problems judging depth and distance.

**Pencil Test:** Have students hold a pencil in one hand, extended in front of them. Place the other hand above the pencil and lower one finger down onto the tip of the pencil. Repeat the exercise with one eye closed. (Note: Some students may have difficulty with this exercise since not all students see with both eyes at the same time; covering their better-seeing eye can make this especially difficult.) Discuss the following questions afterward:

- ▲ Did you notice the difference between using one eye as opposed to two eyes?
- ▲ What types of activities would be more difficult to do with only one eye?

**Ball Toss** (works best with eye patch or blindfold)

Divide the class into groups of three. Before they begin, ask students to guess how many balls they will catch with both eyes and with one eye. Draw the sample score card (below) on the blackboard. Ask students to copy the score card and record how many balls they catch.

Have students toss the ping pong ball around in groups of three first with both eyes, then with one eye blindfolded or patched. Ask students if it was easier to catch the ball with one or two eyes. Can they explain why?

**Activity 3:** Ideal for older students. Allow 20 minutes.

Distribute **Handout: The Imperfect Eye**. Review with students. Ask for their comments on the eye disease simulations. How are they different from the normal vision picture?

**Just for Fun:** Distribute **Handout: Eye Opening Facts**.

Ball Toss Score Card		
Number of throws	Catches with both eyes	Catches with one eye
_____	_____	_____
_____	_____	_____
_____	_____	_____



## LESSON PLAN #3

### Eye Safety

**Goal:** Students will identify possible eye injuries, their causes, first aid tips, and ways to prevent injuries.

**Classroom Activities:** Select two to three activities per classroom session.

**Activity 1:** Ideal for all ages. Allow 15 minutes.

Divide students into small working groups and ask them to discuss situations in their homes, schools, or communities that could result in eye injury. Ask them to identify protective eyewear that could be worn to prevent injury.

Discuss their answers. List them on the blackboard.

**Activity 2:** Ideal for younger ages. Allow 15 minutes.

Distribute **Handout: Eye Safety**

Discuss with students how the eye protects itself from injury.

Discuss first aid tips with students.

Review illustration with students. Ask them to identify six activities that are harmful and discuss ways to prevent eye injuries.

**Extension Activity:** Ideal for older students.

Have students prepare a mini-presentation to younger students on eye safety.

Ask the students to write to an eye care professional and request information on first aid tips for eye injuries. Have students review and discuss this information when it becomes available.

**Just for Fun:** Distribute **Handout: Eye Opening Facts**.

### Credits

**Sources used for VISION include the following:**

*The Bright Eye Kids*

Minnesota Society for the Prevention of Blindness and Preservation of Hearing  
St. Paul, MN, 1988

*Eye Facts: Eye Trauma*

UIC Department of Ophthalmology  
The University of Illinois  
College of Medicine at Chicago  
Chicago, IL

*EYE Q's: Activities with Vision*

The Foundation of the American Academy of Ophthalmology  
San Francisco, CA, 1992

*Exploratorium Pathways: The Eye*

*School in the Exploratorium: Idea Sheet, The Eye*  
Exploratorium, San Francisco, CA, 1977

*Flight into Sight*

Stuart R. Dankner, M.D., Pediatric Ophthalmologist Baltimore, MD

*A Guide to Eye Safety*

Krames Communications  
San Bruno, CA

*A Journey Through Your Eyes:*

*A Curriculum Guide*  
American Optometric Association  
St. Louis, MO, 1992

*Protecting Your Eyes At Home, At Work, At Play*

The University of Illinois at Chicago  
Chicago, IL, 1992

*The Optical Illusion Book*

Seymour Simon  
William Morrow and Company, Inc.  
New York, NY, 1984

*Sharing Science with Children: A Survival Guide for Scientists and Engineers*

The North Carolina Museum of Life and Science  
Durham, NC

*Vision for Your Future*

American Academy of Ophthalmology  
San Francisco, CA



## The Anatomy of the Eye

- ▲ **Choroid** (KOR-oyd)  
A layer of blood vessels that feeds the retina.
- ▲ **Cornea** (KOR-nee-uh)  
The clear outer part of the eye's focusing system located at the front of the eye.

- ▲ **Eyelid**  
The skin-covered structure that protects the front of the eye; limits light entering the eye; spreads tears over cornea.
- ▲ **Fovea** (FOH-vee-uh)  
The center of the macula; gives the sharpest vision.

- ▲ **Iris**  
The colored part of the eye; regulates the amount of light entering the eye.
- ▲ **Lens**  
The clear part of the eye behind the iris that helps to focus light on the retina. Allows the eye to focus on both far and near objects.
- ▲ **Macula** (MAK-yoo-luh)  
The small sensitive area of retina that gives central vision; contains the fovea.

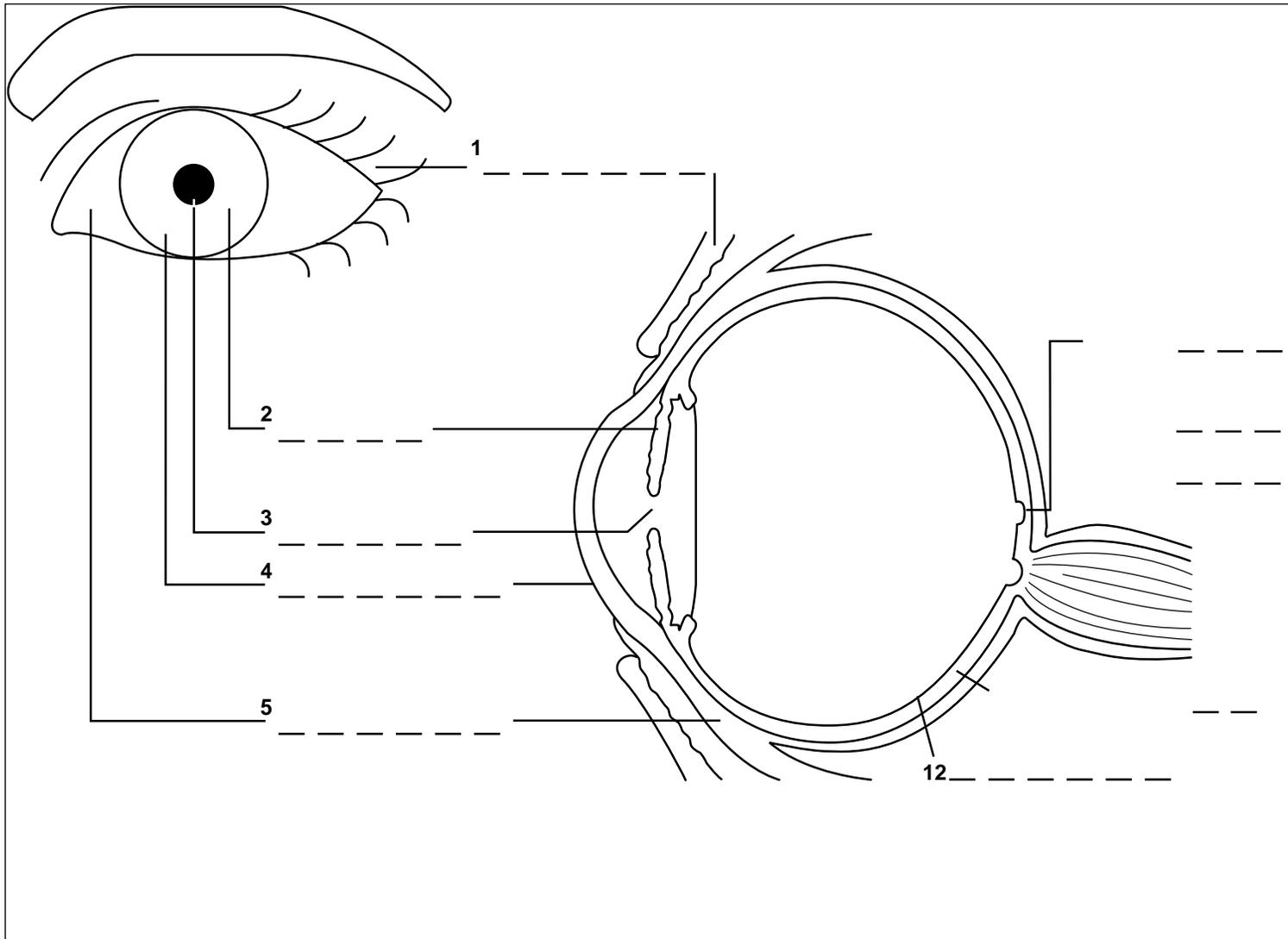
- ▲ **Optic nerve**  
The bundle of over one million nerve fibers that carries visual messages from the retina to the brain.

- ▲ **Pupil**  
The opening at the center of the iris. The iris adjusts the size of the pupil and controls the amount of light that can enter the eye.

- ▲ **Retina** (RET-in-nuh)  
The light-sensitive tissue lining the back of the eyeball; sends electrical impulses to the brain.

- ▲ **Sclera** (SKLEH-ruh)  
The tough, white outer coat of the eye.

- ▲ **Vitreous Humor** (VIT-ree-us)  
The clear gel filling the inside of the eye.





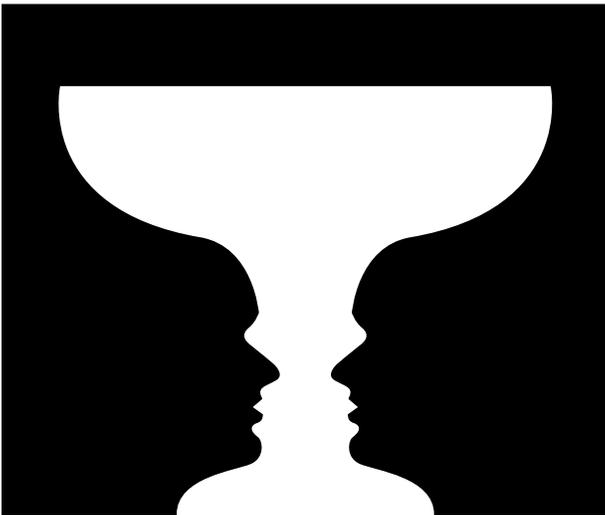
H A N D O U T  
Optical Illusions

Sometimes your eyes play tricks on you. The pictures on this page are called “optical illusions.”

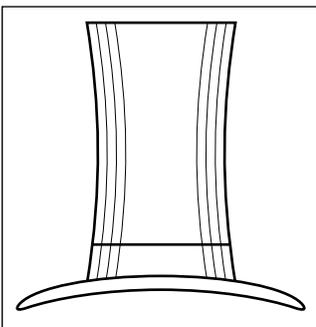
Optical means vision. An illusion is something that isn't what it seems to be. An optical illusion is something that plays tricks on your vision. Optical illusions teach us about how the eye and brain work together to create vision. In our everyday three-dimensional (3-D) world, our brain gets clues about depth, shading, lighting, and position to help us interpret what our eyes see. But when we look at two-dimensional (2-D) images that lack some of these clues, the brain can be fooled.

Can you figure out these optical illusions?

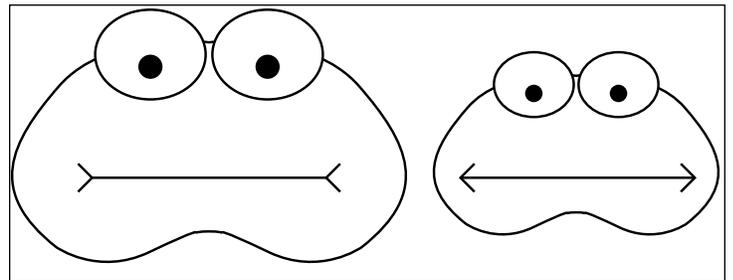
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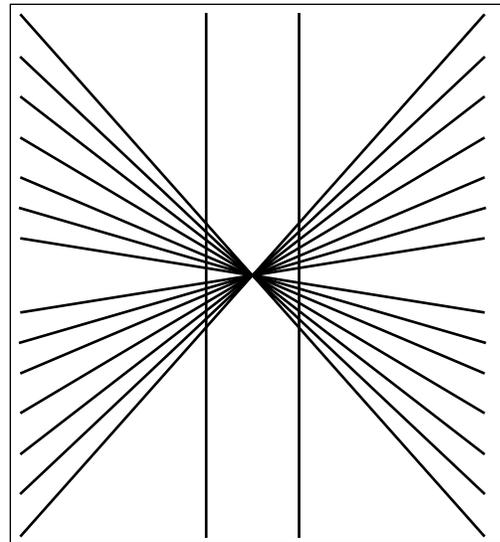
1. Is this a picture of a vase? Or two faces looking at each other? Do you see both?



3. Is the hat taller than it is wide?



2. Which frog has a bigger mouth? Are you sure? Measure to find out.



4. Are the up and down lines straight or bent? Use a ruler to check.

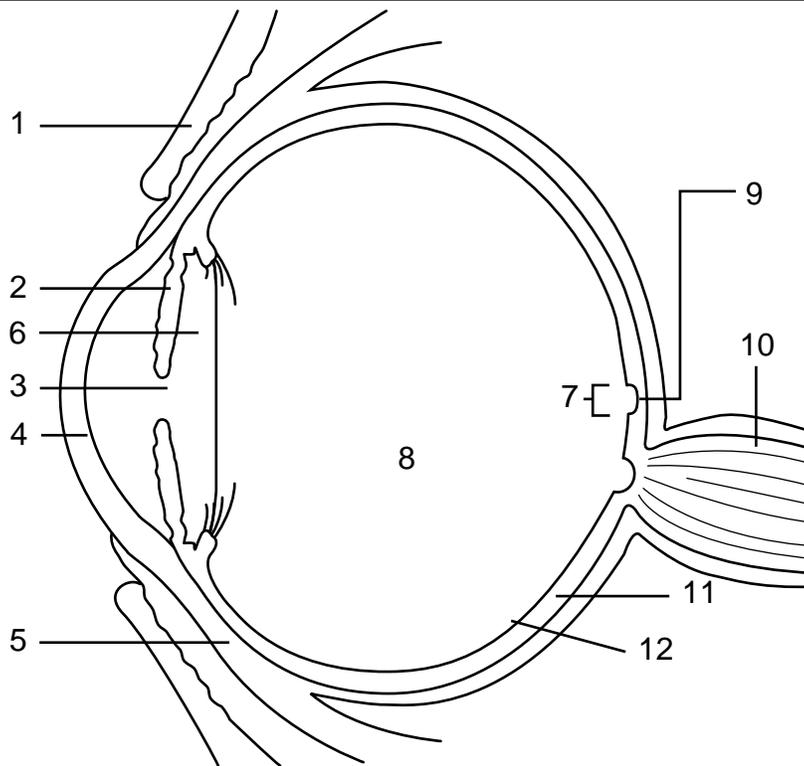


## Scramble and Word Search

### Scramble

Unscramble the parts of the eye listed below. *Hint:* The location of each is shown on the diagram.

1. dyelie \_\_\_\_\_
2. siir \_\_\_\_\_
3. lpuiP \_\_\_\_\_
4. onarce \_\_\_\_\_
5. rsleca \_\_\_\_\_
6. nesl \_\_\_\_\_
7. aclamu \_\_\_\_\_
8. stivorue mhuro \_\_\_\_\_
9. ovafe \_\_\_\_\_
10. pocit verne \_\_\_\_\_
11. drohcio \_\_\_\_\_
12. tranie \_\_\_\_\_



Photocopy from original for best quality.

### WORD SEARCH

Can you find these hidden words?

- IRIS
- EYE
- RETINA
- LENS
- CORNEA
- MACULA
- PUPIL
- CELL
- NERVE

R A C L I N E R V E  
 E E Y E Y T E A O Y  
 R E T N E A C A C C  
 P U P I L U E C L O  
 N E S R N Y N O E R  
 A P I I V A R T N N  
 E I E S P A N Y S E  
 M E I V A N I T E A  
 E A S U O E R T I V  
 T E C R A C U L A P  
 O D D U T I E S D A  
 F L E N L L D L N S  
 D O R V E A M A L E



### Eye-Opening Facts

### History Tells Us...

▲ Abraham Lincoln was farsighted and had a “lazy eye.” His first pair of eye-glasses cost about 38 cents.

# H A N D O U T

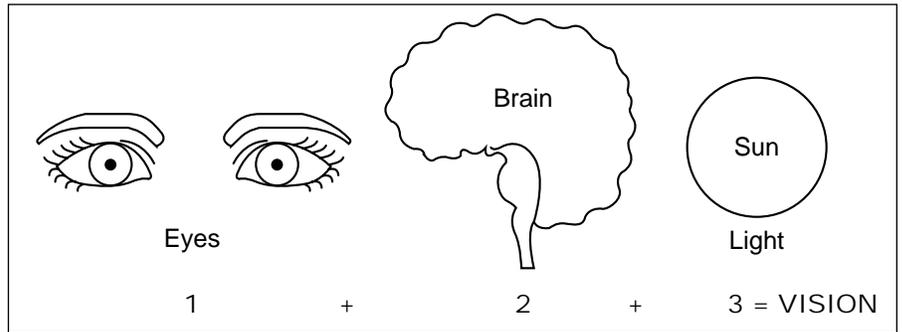
## The Visual System

The human eye is composed of many parts that work together. They receive visual images, focus them properly, and send messages to the brain.

To have vision, you must have three things:

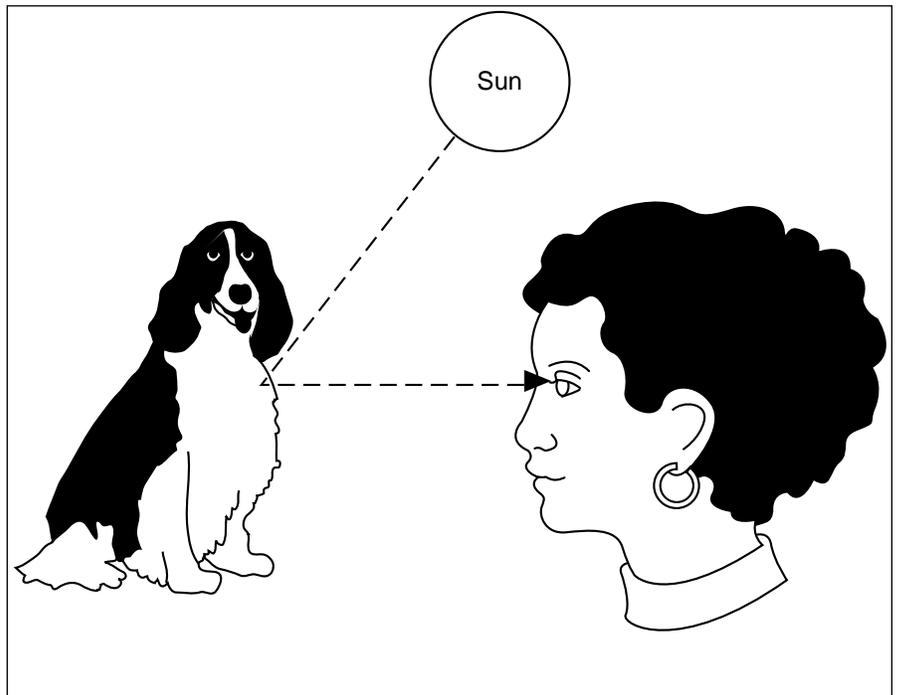
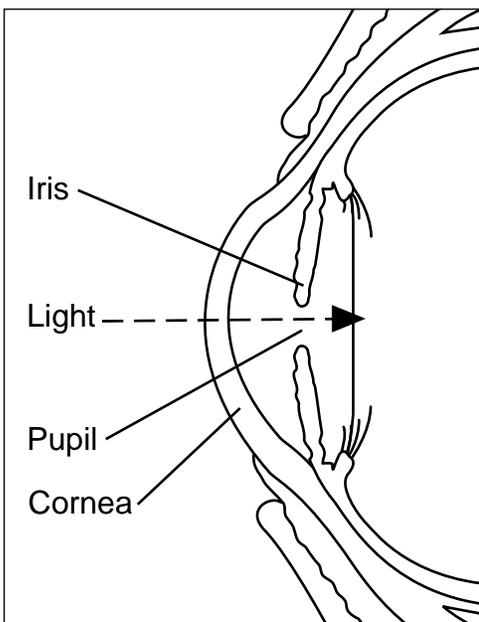
- (1) eyes,
- (2) a brain, and
- (3) light.

So how does all this work? We start with light.



Light rays bounce off an object you are looking at. Let's say the object is a dog. The light reflects off the dog's image and comes back to your eye.

Light then enters through the outer part of the eye, called the **cornea**. The cornea is clear like a window. The cornea helps the eye to focus. "To focus" means to make things look sharp and clear.

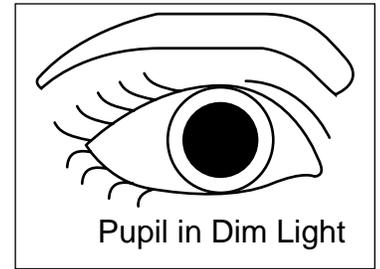
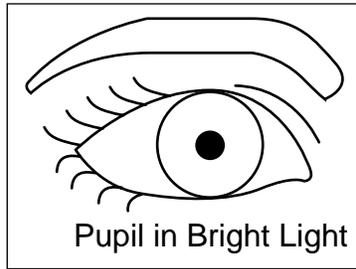


Next, the light rays go through an opening called the **pupil**. The pupil is the dark round circle in the middle of the colored part of your eye. The colored part is called the **iris**. The pupil is really a hole in the iris. The iris controls how much light goes into your eye.

*Continued on next page*

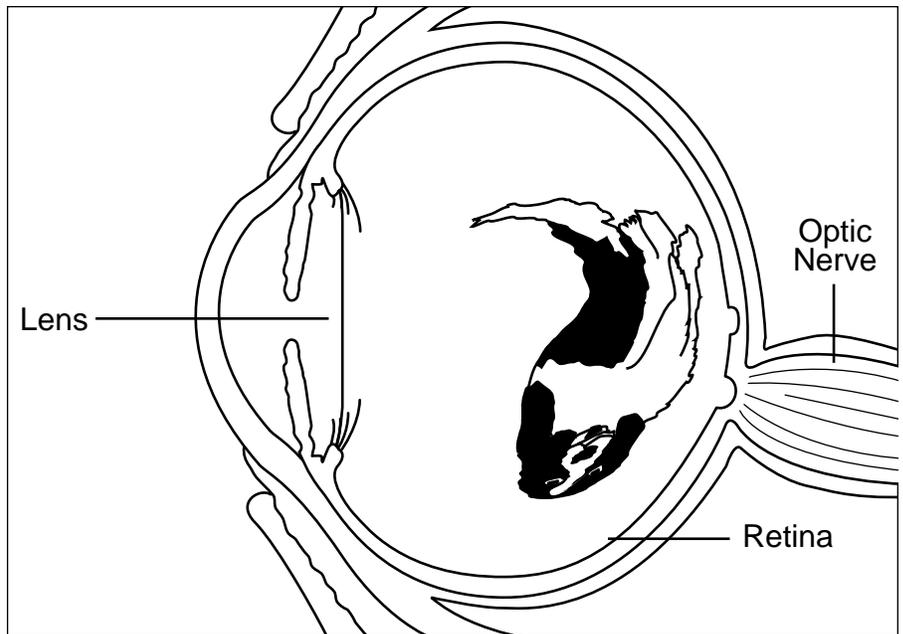
## HANDOUT: The Visual System (continued)

When the light is bright, the iris closes the pupil until the right amount of light gets in. When the light is dim, the iris opens the pupil to let in more light. All of this happens automatically. You do not have to tell your eye to do it!



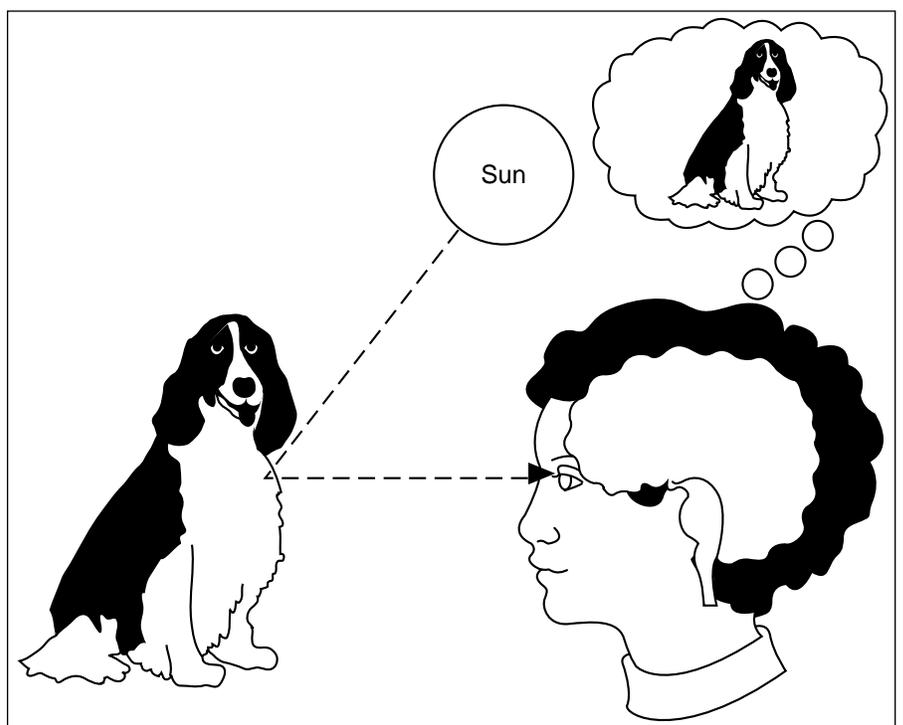
Your eye has a **lens** to focus the rays of light. The lens of the eye is behind the iris. Light passes through the lens on its way to the back of the eye.

The back of the eye is very important. Lining the inside of the eye is the **retina**. The retina includes 130 million tiny light-sensitive cells that send messages to other cells. These cells come together at the back of the eye to form the **optic nerve**. The optic nerve is part of the brain.



Fortunately for you, your brain decides how you see. The retina sees the world upside down, but the brain turns it right side up.

When you look at an object, each eye sees a slightly different picture. The brain combines the images, or pictures, that each eye sees and makes them into one picture.



# H A N D O U T

## The Imperfect Eye

### Some Problems of Childhood

**S**trabismus is also called "crossed eyes" or "wall eyes." One eye is turned too far in one direction. Sometimes, a baby's eyes may cross occasionally in the first few month of life. Infants whose eyes are constantly turned should be examined by an eye care professional. The problem usually can be helped.



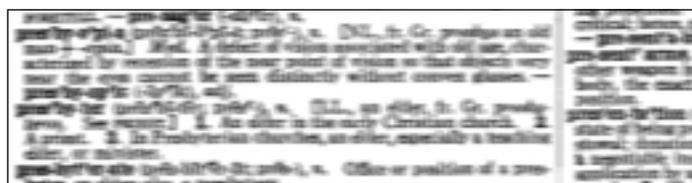
**A**mblyopia is also called "lazy eye." It happens when normal vision does not develop in one eye because the "lazy eye" sends a poor message to the brain. This problem usually can be helped with glasses, eye drops, or a patch. The patch is usually put over the stronger eye, but can be sometimes put over the weaker eye.



*Simulation of normal vision*



*Simulation of myopia*



*Simulation of presbyopia*

### Refractive Errors

**L**ike any other part of the body, the eye grows, works, tires, and ages. It can be injured. It can become diseased. However, most vision problems are not diseases but refractive errors. These are minor flaws in the way the eye is built that causes it to focus incorrectly.

*Myopia*, also called nearsighted, means that a person sees nearby objects more clearly than objects that are far away. It occurs when the eyeball is too long or the cornea is too rounded and light is focused in front of the retina instead of directly on it. Eyeglasses or contact lenses can correct the problem.

*Presbyopia* means "old man's eyes." It happens when the lens of the eye becomes hard and less flexible with age. It then becomes harder to bring nearby objects into focus. Everyone becomes presbyopic, usually between 40 and 50 years of age.

## HANDOUT: The Imperfect Eye (continued)

### Common Eye Diseases

**M**ore than 10 million people in the United States are blind or have vision problems that cannot be fixed or corrected with eyeglasses.

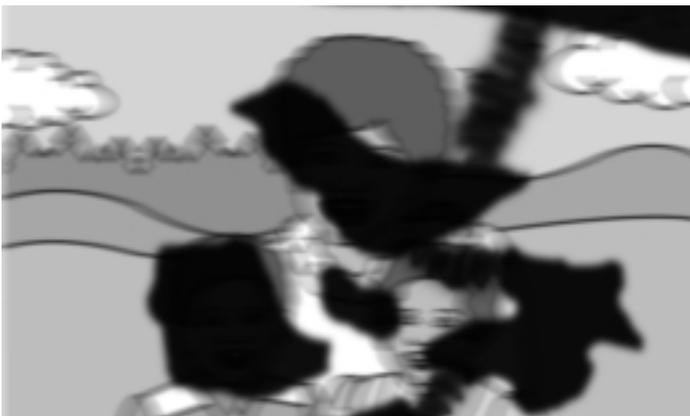
Many eye diseases are detected during an eye exam through dilated pupils. This means drops are put into the eyes during the exam to enlarge the pupils. This allows the eye care professional to see more of the inside of the eye.



*Simulation of age-related macular degeneration*



*Simulation of cataracts*



*Simulation of diabetic retinopathy*

*Age-related macular degeneration (AMD)* is the leading cause of blindness in older people. It affects a tiny area in the middle of the retina called the macula. AMD can destroy the central vision. This vision is needed for doing common daily tasks such as reading and driving. Scientists are learning what causes AMD and how it can be better treated.

*Cataracts* form when the lens of the eye grows cloudy. In a commonly performed operation, the cloudy lens is often replaced with a plastic lens. It is a very safe and successful type of surgery. In fact, it is the most common surgery for people over age 60.

*Diabetic Retinopathy.* People with diabetes are at high risk for diabetic retinopathy. This disease damages the blood vessels in the eye. It is a leading cause of blindness in adults, but treatment using lasers or surgery can prevent serious vision loss. People with diabetes should have an eye exam through dilated pupils at least once a year.

## HANDOUT: The Imperfect Eye (continued)



Simulation of glaucoma

*Glaucoma* is called the “sneak thief of sight,” because it does not give any warning signs. This blinding disease damages the optic nerve. Glaucoma is treated with medication, lasers, and surgery. Blacks over age 40 and everyone over age 60 are at high risk for glaucoma. These people should have an eye exam through dilated pupils at least once every two years.

### Low Vision



**L**ow vision is a vision problem that cannot be corrected with contact lenses or glasses. While some vision remains, everyday tasks such as reading the newspaper or driving may be difficult

or impossible. Visual aids such as magnifying glasses, talking watches, computers that read out loud, and special video devices assist people with low vision.

### Legal Blindness

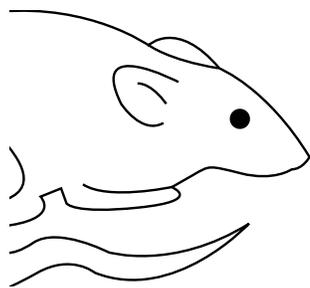
**L**egal blindness means that a person has either a visual acuity of 20/200\* or worse in their good eye while wearing glasses or contact lenses, or their visual field is limited to 20 degrees in diameter or less in the good eye. This is called tunnel vision.

A person who is legally blind can receive financial assistance under Federal government programs.

\* 20/200 means that a person must be 20 feet from an eye chart to see what a person with normal vision can see at 200 feet.

Photocopy from original for best quality.

### From Vision Research to Eye Care



**U**sing American tax dollars, scientists learn how diseases hurt our eyes and find new ways to stop or treat them. The National Eye Institute, one of the Federal government's National Institutes of Health, conducts and funds research to find better ways to prevent, detect, and treat eye diseases.

The research process starts with basic research in the laboratory conducted by scientists who study molecules and cells, the building blocks of life. In addition, they study animals that have diseases similar to those seen in humans. These scientists generate the clues that lead to new drugs and other treatments to fight disease.

For example, a National Eye Institute scientist found that a drug that was tested in rats controlled uveitis, an inflammation inside the eye. But before doctors could give this drug as a standard treatment to their patients, researchers had to first test it in human volunteers.

This test was called a clinical trial, an experiment that tells us how safe and effective a drug is in humans. Half of the patient volunteers took the new uveitis drug, while the other half used a standard treatment. The scientists found that in certain types of uveitis, the new drug worked as well as the standard drug, but with fewer side effects. The new drug is now used as one of the treatments for uveitis.

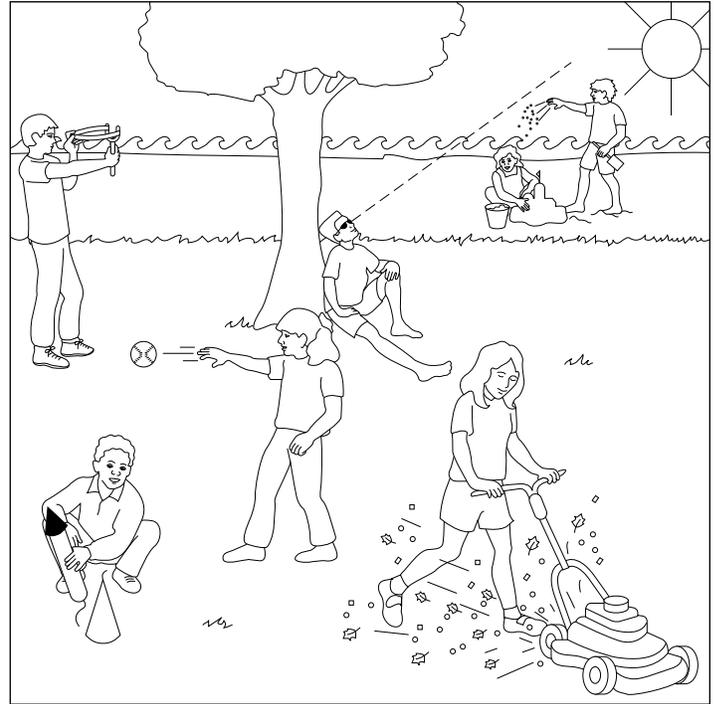


## Eye Safety

**E**ye injury is the leading cause of blindness in children in the United States. Each year millions of eye injuries occur. These usually happen at home and school, often during sports and hobby activities. However, 90 percent of these injuries could be prevented.

### How Your Eyes Are Protected

- ▲ Your eyes lie in bony sockets that protect them from getting hit.
- ▲ Eyebrows help keep light from getting in your eyes.
- ▲ Eyelids close to keep things from getting in your eyes.
- ▲ Eyelashes grow along the outside of the eyelids; they also keep things from getting in your eyes.
- ▲ Tears help keep the eyes moist. Tears also help to wash away things that can irritate your eyes.



### What to Do If...? First Aid Tips

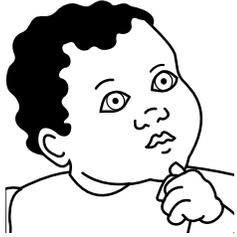
- ▲ If something gets into your eye, such as sand or dust, do not rub your eye. Wash your eye with water to get the object out.
- ▲ If your eye gets hit by a ball or a fist, put cold cloths on your eye for 15 minutes. This will make the swelling go down and the eye won't hurt so much. You should also go to the doctor.
- ▲ If an object, such as a stick or a pencil, gets stuck in your eye, do not pull it out. Put a loose bandage on your eye. This is very serious. You need to go to the doctor right away.
- ▲ If a chemical, such as cleaning fluid or battery acid, splashes in your eyes, wash out your eyes with water for at least 10 minutes. You need to go to the doctor right away.

**F**ind six things in the picture above that can be dangerous to your eyes.

*Answers: Mowing the lawn with debris flying; using a slingshot; lighting or playing with fireworks; throwing a ball over someone's head; looking at the sun, even with sunglasses; and throwing sand can all be dangerous to the eyes.*

## Eye Opening Facts

### Did You Know That...

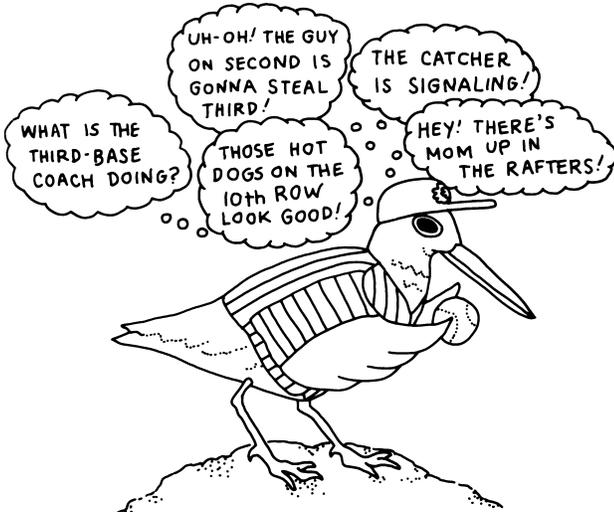


▲ Babies have very poor vision at birth. They learn to see the same way they learn to talk — both habits and muscles must be developed.

▲ Your eyes sometimes look red in a photograph because light from the flash reflects off the choroid, blood vessels that nourish the retina. To avoid this reflection, ask your subjects to look slightly to the side of the camera.

### Those Amazing Animal Eyes...

▲ With players on base, a baseball pitcher has to crane his neck to check base runners and his catcher's signal before delivering the pitch. However, if a type of bird called an American woodcock was standing on the mound, it could see all the bases, home plate, the entire outfield, and the entire stadium, including most of the ceiling of an astrodome — without moving its head.



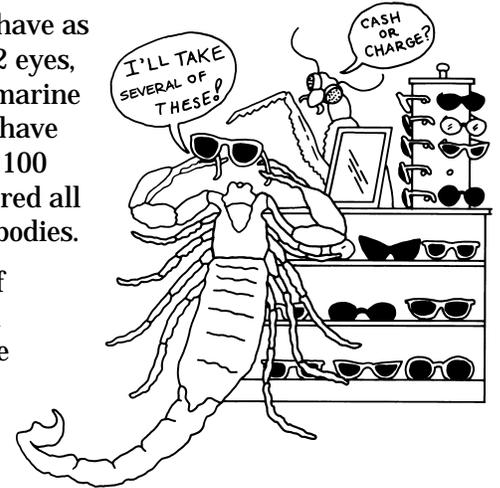
### Those Amazing Animal Eyes...

▲ Scorpions have as many as 12 eyes, and some marine flatworms have more than 100 eyes scattered all over their bodies.

▲ The eyes of hawks and eagles have special retinas with many small,

light-sensitive cells. This gives them vision almost eight times better than humans and helps them see small rodents from high above.

▲ Tropical fish and many brightly colored animals have more color vision cells than humans. These extra cells allow them to see colors humans cannot.



### Did You Know That...

▲ A person blinks once every five seconds. That means most people's eyes are shut for nearly 30 minutes while they are awake each day.

▲ Each of your eyes weighs 1/4 ounce, measures less than one inch in diameter, and is shaped like a slightly flattened ball.

▲ More than one-half of all people in the United States use some type of lens to correct their vision.



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A School Program

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