

MUSEUM OF VISION
DEDICATED TO PRESERVING OPHTHALMIC HISTORY

HEALTHY EYES,
HEALTHY BODY



 THE FOUNDATION
OF THE AMERICAN ACADEMY
OF OPHTHALMOLOGY

**LET'S
MOVE!**
AMERICA'S MOVE TO RAISE A
HEALTHIER GENERATION OF KIDS

A red silhouette of a person jumping or running, positioned to the right of the text.



The Museum of Vision is an educational program of The Foundation of the American Academy of Ophthalmology. It strives to preserve ophthalmic heritage and inspire an appreciation of vision science, the ophthalmic profession, and contributions made toward preventing blindness. The museum is the only institution in the United States whose sole purpose is to preserve the history of ophthalmology and celebrate its unique contributions to science and health.

For over 30 years the Museum of Vision has worked diligently to preserve ophthalmic heritage through exhibits, historic services and educational resources. Our collection dates from the third century BCE to the present, including over 38,000 artifacts, rare books and archives.

*For more information about the Museum of Vision or to make a donation, visit **www.museumofvision.org** or contact us at **museum@aaio.org**.*

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Introduction

To have healthy eyes and good vision, you need a healthy body. In fact, an ophthalmologist (Eye M.D.) can often tell about your overall health just by examining your eyes. The effects of certain diseases- like diabetes- can be seen through a complete eye exam. There are important steps you can take to keep your body strong which will also go a long way toward preserving your vision. Here you will discover what it takes to keep your eyes and body healthy.

How to Use the Curriculum

The first chapter of this curriculum is an introduction to the eye and the human visual system. The following two chapters focus on eating right and exercise. They contain demonstrations and activities designed to help students understand how these concepts relate to the eye and health.

Who is this Curriculum For?

This curriculum is designed for multiple uses, including classrooms and home schools. While the concepts in this curriculum can be appreciated by children of all ages, it is targeted to students in the 6th, 7th and 8th grades. These children will be best able to grasp the concepts of life science, health and environment.

Let's Move!

This curriculum was created for *Let's Move! Museums & Gardens*, a national initiative to teach kids about healthy choices. *Let's Move!* was launched by First Lady Michelle Obama and is dedicated to solving the problem of obesity within a generation, so that children born today will grow up healthier and able to pursue their dreams. Through *Let's Move! Museums & Gardens*, the Museum of Vision joins thousands of institutions all over the United States helping young people learn about how food choices and physical activity affect their health – including their eye health. Find out all about eye health at www.GetEyeSmart.org.

Special Thanks for this curriculum goes to the American Academy of Ophthalmology and to the medical reviewers of www.GetEyeSmart.org, a great online resource to find out how to improve your eye health at all stages of life.

Introduction

Know Your Eye Care Team

Your Sight Depends on Seeing the Right Eye Care Provider at the Right Time

GetEyeSmart.org wants you to know that when it's time to "get your eyes checked," make sure you are seeing the right eye care professional for your needs. Ophthalmologists, optometrists and opticians each play an important role. Here's a quick look at the three types of eye care providers:

Ophthalmologist

An ophthalmologist — Eye M.D. — is a medical or osteopathic doctor who specializes in eye and vision care. Ophthalmologists are medical doctors who have completed college and at least eight years of additional medical training. They diagnose and treat all eye diseases, perform eye surgery and prescribe and fit eyeglasses and contact lenses to correct vision problems. Many ophthalmologists are also involved in scientific research on the causes and cures for eye diseases and vision disorders.

Optometrist

Optometrists provide vision care ranging from testing your sight to the diagnosis, treatment, and management of vision changes. An optometrist receives a doctor of optometry (OD) degree after completing college and four years of optometry school.

Optician

Opticians are technicians trained to design, verify and fit eyeglass lenses and frames, contact lenses, and other devices to correct eyesight. They fill prescriptions supplied by ophthalmologists or optometrists.

To learn more about keeping your eyes healthy and about the roles of eye care professionals, visit www.GetEyeSmart.org.

Chapter 1. Your Eye Q

Vision is a complex sense. The eyes are the entry to a multilayered visual system that processes millions of bits of information every second. In fact, seventy percent of the body's sense receptors are found in the eyes. Let's take a closer look.

Key Concepts:

- Eye Diagram
- How Do You See?
- How Does the Eye Focus?

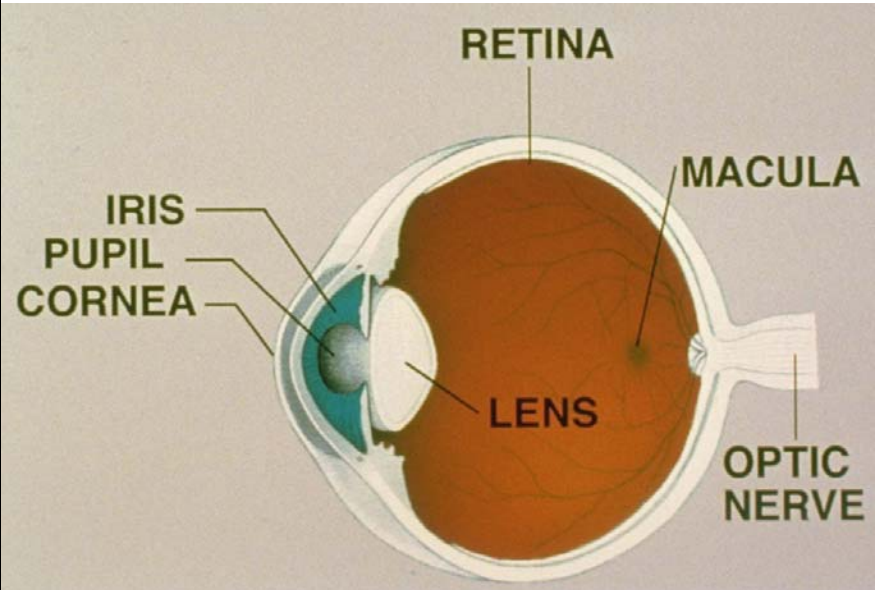
Activity #1

- Can You Name the Parts of the Eye?



Key Concept

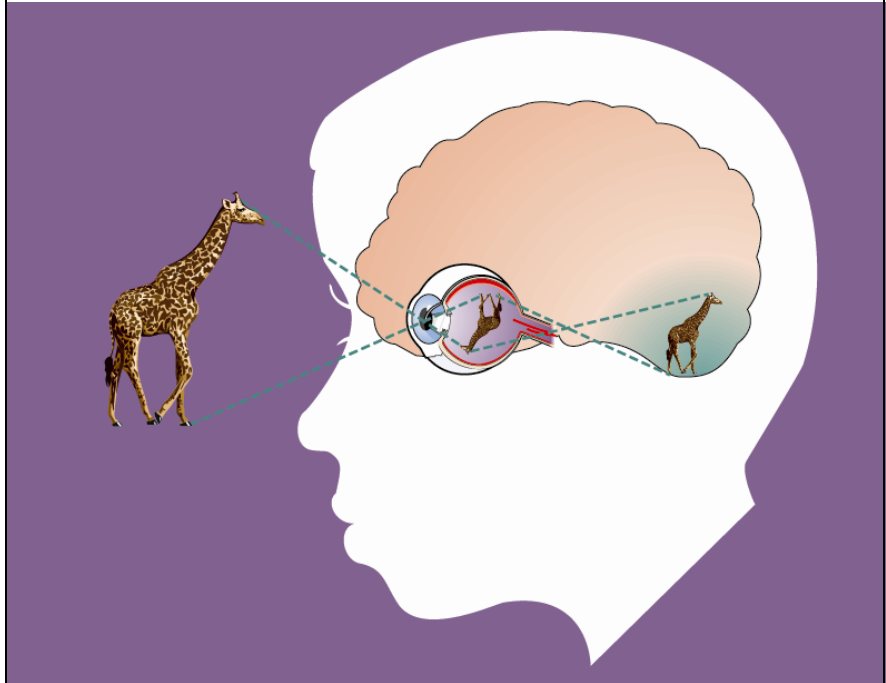
Eye Diagram



- **Cornea:** Curved to bend light into your eye, its tough and clear like a windshield to protect your eye from dust.
- **Pupil:** A hole in the middle of the iris that changes size to let in more or less light.
- **Iris:** The colored part of your eye with two muscles to open and close the pupil.
- **Retina:** The lining inside the back of your eye has light sensitive cells that change light into messages for your brain.
- **Macula:** The center of the retina.
- **Optic Nerve:** Carries messages from the retina to the brain.
- **Lens:** Clear and flexible, the lens changes shape to focus light on the retina

Key Concept

How Do You See?

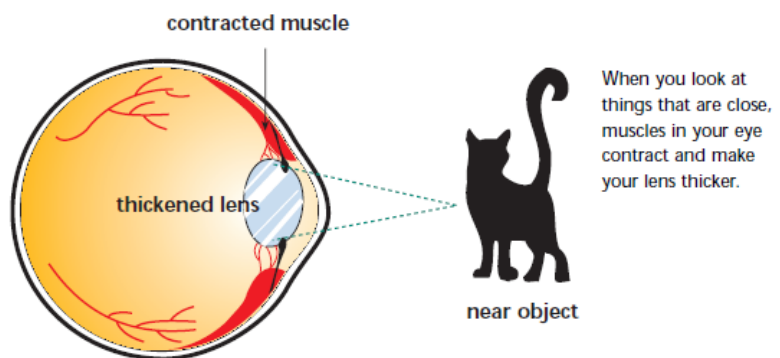
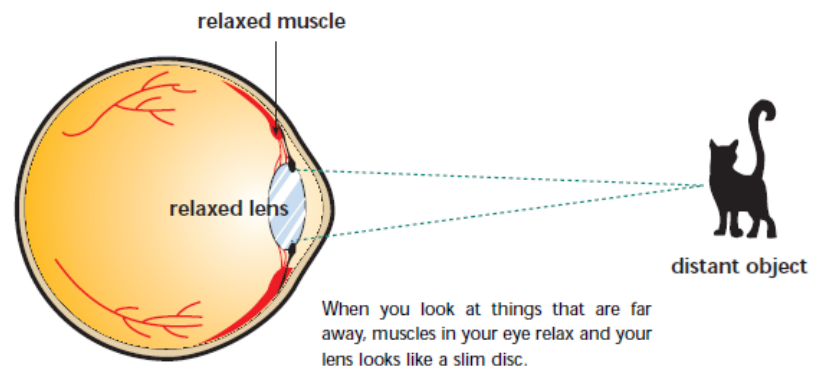


- First, light bounces off objects all around you and enters your eye.
- Then the light passes through your pupil and lens to the retina at the back of your eye.
- The retina contains light sensitive cells called rods and cones that change the picture into nerve signals, these are passed through more cells and finally to the optic nerve.
- The optic nerve carries the nerve signals to your brain.
- Finally, your brain reads the signals and tells you what you're seeing.

Key Concept

How Does the Eye Focus?

- You focus light with your cornea and lens.
- Your curved cornea bends light into your eye.
- Your lens changes shape to bring things into focus.

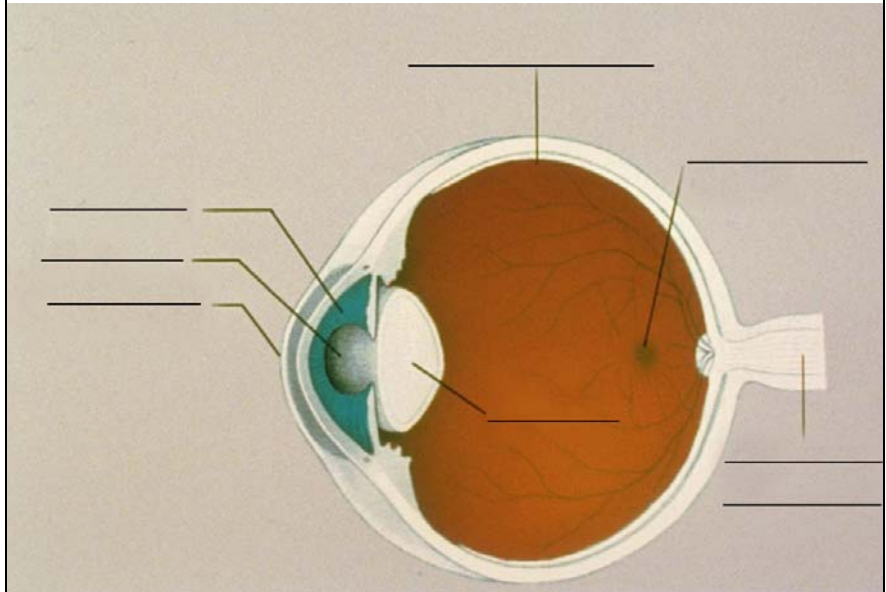


Activity #1

Can You Name the Parts of the Eye?

Identify the different parts of the eye:

- Iris**
- Retina**
- Lens**
- Pupil**
- Cornea**
- Optic Nerve**
- Macula**



Chapter 2. Eating Right

We have all heard that eating right will make you healthy. Let's look at some things you should eat and how they help your eyes.

Key Concepts:

- Vitamins
- Minerals
- What Else Should I Eat?

Activity #2

- Can You See a Vitamin?

Activity #3

- Let's Eat Some Vitamins!



Key Concept

Vitamins

A vitamin is something your body needs in order to live and grow. All organisms need vitamins, and when our bodies don't make enough, we go out and eat them. When we eat, our bodies break food down into components like vitamins. Some vitamins are stored in fat for use later when our bodies need them. Some vitamins are stored in water, meaning they don't stick around our bodies very long, so it's important to eat your vitamins! Now some folks prefer to take vitamins in pill form, but our food can provide all we need - if we eat the right things.

There are 13 known vitamins, 3 of which have been proven to help your eyes. Foods rich in vitamins A, C and E are good for your eyes and general health. Vitamin A is good for the cornea. Vitamins C and E can help prevent eye diseases when you get older such as cataracts and age-related macular degeneration. Starting a vitamin-rich diet now will give you healthy habits to follow all your life.

- **Vitamin C:** is stored in water. It can be found in most fruits and vegetables, especially oranges, grapefruit, strawberries, papaya, green peppers and tomatoes.
- **Vitamin E:** is stored in fat. Look for it in vegetable oils (safflower and corn oil), nuts (almonds and pecans), wheat germ and sunflower seeds.
- **Vitamin A:** is stored in fat. It comes from milk, egg yolks and liver. But you can also get Vitamin A by eating foods with beta-carotene. Beta-carotene is converted in the small intestine to retinol- a form of Vitamin A. Beta-carotene can be found in fruits and vegetables that are deep orange or yellow such as cantaloupe, mangos, apricots, peaches, sweet potatoes, squash and carrots.

Key Concept

Minerals

A mineral is neither plant nor animal. Minerals can be pure elements like calcium or a simple combination of elements like salt. Organisms need minerals to help them live and grow. To get them, we need to eat. Rocks and earth are generally made up of many minerals combined together, but we don't need to eat rocks to get our minerals! Instead we can eat plants and animals that have absorbed minerals through the earth and water.

- **Zinc:** is a mineral that is good for your eyes and your whole body. One thing zinc does in our bodies is to bring Vitamin A stored in the liver to our retinas. People with severe vitamin A deficiencies can have trouble seeing at night and can go blind altogether - so zinc does an important job! Good sources of zinc include beef, pork, lamb, oysters, eggs, shellfish, milk, peanuts, whole grains and wheat germ.



Key Concept

What Else Should I Eat?

Lutein, zeaxanthin and omega-3 fatty acids have all been proven to be good for our bodies and especially eyes. But what are they?

- **Lutein and Zeaxanthin:** are carotenoids- that is, natural coloring agents that can do some pretty awesome jobs in plants and the body. There are over 600 known carotenoids. Plants contain carotenoids to help them convert sunlight into nutrients. People can eat carotenoids to get their vitamins; for instance beta-carotene is a carotenoid that becomes vitamin A in the small intestine. Carotenoids like lutein and zeaxanthin are naturally found in our eyes as a defense against ultra-violet light (uv). These important nutrients diminish over time so we need to eat foods that will help us replenish them.

You can get your lutein and zeaxanthin from plants that use a lot of them in photosynthesis. Look for deep yellow and green foods like corn, broccoli, collard greens, asparagus and spinach.

- **Omega-3 fatty acids:** For a body to be healthy you can't eat any fat, right? Well, it turns out there are different kinds of fat- the good kind and the bad kind. The fat used to make fried foods like french fries is generally the bad kind. The good kind helps us to absorb vitamins, especially Vitamin A and E which are good for the eyes. To get your good fat, or the omega-3 fatty acids, eat fish like salmon, tuna and trout.



Activity #2

Can You See a Vitamin?

Description	Students will use chromatography to see the nutrients inside plants
Purpose	To demonstrate the chemical make-up of food
Length of Activity	90 minutes; this activity is best if split between two days
Materials	<ul style="list-style-type: none">-Vegetables, especially dark colored ones like spinach and carrots-Small jars or glasses-Covers for jars, either aluminum foil or plastic wrap-Rubbing alcohol-White paper coffee filters-Shallow pan-Hot tap water-Tape-Permanent marker / pen-Plastic knife or spoon-Plain white paper
Further Suggestion	If you plan to do activity #3, "Let's Eat Some Vitamins!" it is recommended to utilize the same foods (especially spinach) so the students will see the direct link between their food and its nutrients.

Activity #2

Can You See a Vitamin?

It is not possible to see the vitamins and minerals in our food, but we can see the nutrients in plants by using a technique called chromatography. When we eat our vegetables, we are getting these nutrients too.

Steps- Day One:

1. Give students vegetable matter to tear or cut into very small pieces and place each in its own small jar.
2. Have students label the jars with the name of the vegetable.
3. Add enough rubbing alcohol to each jar to cover the vegetables.
SAFETY NOTE: Isopropyl rubbing alcohol can be harmful if mishandled or misused.
4. Using a plastic knife or spoon, carefully chop and grind the leaves in the alcohol.
5. Cover the jars loosely with plastic wrap or aluminum foil.
6. Place the jars carefully into a shallow tray containing 1 inch of hot tap water.
7. Keep the jars in the water for at least a half-hour, longer if needed, until the alcohol has become colored (the darker the better).
8. Twirl each jar gently about every five minutes. Replace the hot water if it cools off.
9. Let stand overnight.

Activity #2

Can You See a Vitamin?

Steps- Day Two:

1. Cut a long thin strip of coffee filter paper for each of the jars.
2. Label the paper using permanent marker/pen with the same name as on the jars so that they match.
3. Remove jars from water, dry off and uncover.
4. Place a strip of filter paper into each jar so that one end is in the alcohol. Bend the other end over the top of the jar and secure it with tape.
5. The alcohol will travel up the paper, bringing the colors with it. Observe the changes over approximately 30 minutes.
6. Remove the strips of paper and let them dry. Tape them to a piece of plain paper to analyze later.

What's Going On?

This technique is called chromatography. Our dissolved plant matter separates as it travels with the alcohol up the filter paper. The more soluble parts of the plant matter travel farthest. If there are different colors on your filter paper then that indicates there are different kinds of molecules in your sample. The most soluble molecules are carotene- they will appear at the top as a yellow-orange. Other molecules you may see include xanthophyll (yellow), chlorophyll (green) and anthocyanin (red). Carotene and xanthophyll are carotenoids which break down further into vitamins in our bodies.

Activity #3

Let's Eat Some Vitamins!

Description	Students will eat vegetables to associate eating with healthy habits
Purpose	To demonstrate that healthy foods are easy to recognize and taste good
Length of Activity	15 minutes
Materials	<ul style="list-style-type: none">-3 small seedless oranges, peeled and separated (may substitute a drained can of mandarin oranges)-1/3 cup chopped pecans-1 lb spinach-1 small red onion sliced (optional)-1 tbs orange juice-1 tsp prepared mustard-1 tsp vinegar-pinch of sugar-pinch of salt-2 tbs olive oil-1 large bowl-1 smaller bowl or liquid measuring cup-1 whisk-Small plates or cups, one for each student-Forks, one for each student
Further Suggestion	If you plan to do activity #2, "Can You See a Vitamin?" it is recommended to utilize the same foods (especially spinach) so the students will see the direct link between their food and its nutrients.

Activity #3

Let's Eat Some Vitamins!

The best way to get your vitamins is to cook your vegetables as little as possible or, in this case, eat them raw! A salad like this one is packed with nutrients and it's easy to make.

Spinach Salad with Oranges (serves 4)

Steps:

1. Place in large bowl oranges, pecans, spinach and red onion (if using)
2. Place in a separate, smaller bowl or liquid measuring cup the orange juice, mustard, vinegar, sugar and salt.
3. Use whisk to stir ingredients in the small bowl or liquid measure until sugar and salt have dissolved
4. Slowly add olive oil to the small bowl or liquid measure while stirring to create an emulsion.
5. Pour salad dressing from the small bowl or liquid measure into the larger bowl.
6. Mix ingredients lightly to coat all ingredients with the dressing.
7. Serve.

Chapter 3. Exercise Helps Your Eyes

Exercise is good for your whole body. Let's look at what exercise does to help your eyes.

Key Concepts:

- What Kind of Exercise?
- Protect your Eyes
- Diabetes and Diabetic Retinopathy
- What a Retina Does

Activity # 4

- Seeing Red

Activity #5

- Seeing the Blood Vessels in Your Eye



Key Concept

What Kind of Exercise?

Exercise or physical activity is anything that gets you moving. There are different kinds of exercise- aerobic, anaerobic and agility.

Eyeballs are held in their sockets by a set of six muscles attached to the eyeball and anchored to the skull. These muscles don't bulk up like your arms or legs so there is no need to perform anaerobic (muscle strengthening) or agility exercises for your eyes.

Aerobic exercise: is what we're interested in for eye health. Aerobic exercise increases your body's consumption of oxygen. The idea is to sustain activity so your heart rate increases and stays steady for at least 20 minutes. Aerobic exercise leads to good blood circulation and oxygen in-take. It also helps keep your weight in the normal range which reduces the risk of diabetes and its effect on the eyes called diabetic retinopathy. Good aerobic exercise includes swimming, biking, hockey, basketball, running or skating.



Key Concept

Protect Your Eyes

During exercise your eyes need special care.

The sun can damage your lens and retina, just like it can damage your skin. Some things to remember:

- **Use a hat and sunglasses:** to block the sun's harmful rays when you are outside. Take special care when the sun's rays are strongest between 10:00 AM and 2:00 PM
- **Don't be fooled by clouds:** The sun's rays can pass through haze and thin clouds. Sun damage to eyes can occur anytime during the year, not just in the summertime.



- **Wear protective gear:** while playing sports be sure to wear helmets, face guards and protective goggles. Almost half of all eye injuries come from playing sports so keep the fun going by wearing protective eyewear.



Key Concept

Diabetes and Diabetic Retinopathy

Diabetes is a disease that affects the body's ability to produce or use insulin effectively to control blood sugar (glucose) levels. Although glucose is an important source of energy for the body's cells, too much glucose in the blood for a long time can cause damage in many parts of the body, including the heart, kidneys, blood vessels and the small blood vessels in the eyes.

When the blood vessels in the eye's retina swell, leak fluid or close off completely — or if abnormal new blood vessels grow on the surface of the retina — it is called diabetic retinopathy. Diabetic retinopathy can progress without you knowing that your eyesight is being affected — until it is too late and you have lost a significant amount of your vision.

- **Being overweight can increase your risk of diabetes.** Exercise, especially aerobic exercise, is important for your whole body.



Normal, healthy retina



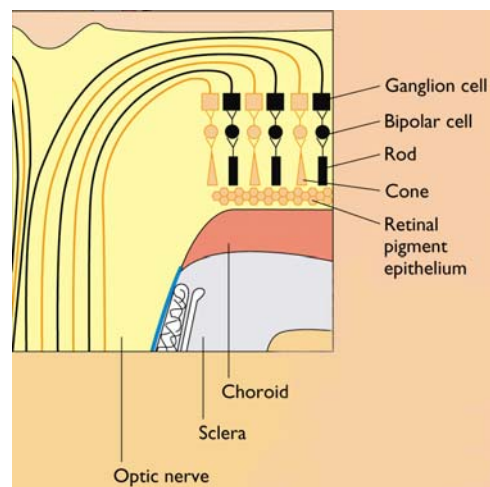
Retina with diabetic retinopathy

Key Concept

What a Retina Does

You already know that in order to see, light rays must be bent or “refracted” so that they can focus directly on our retina, the nerve layer that lines the back of the eye. From the retina, light is picked up by millions of photoreceptors called cones and rods that convert the light waves into useful information including color, shape and motion.

- **More than one layer:** One layer of the retina is brain tissue which begins coding visual information even before messages are sent via the optic nerve to the brain. Another layer is made up of blood vessels which need the oxygen from a good aerobic workout.
- **Cones:** You have about 6 million cones on your retina. Cones work in bright light and help you see color and fine detail. There are three different kinds, each sensitive to a different color: red, green and blue. Your brain mixes the messages from these cones to see all colors. Cones “turn off” in the dark, that’s why it’s hard to see color at night.
- **Rods:** You have about 95 million rods scattered across your retina. Rods “turn on” in the dark to help your eyes gather light. Rods can’t help you see color or detail which is why it’s hard to match your socks in the dark.



Cross section of a retina

Activity #4

Seeing Red

Description	Teacher demonstration
Purpose	Students will analyze photographs to see red eye and locate the retina
Length of Activity	15 minutes
Materials	Ask students to bring in pictures from home of themselves, family or friends with red eye. You may also show the images on page 23
Further Suggestion	<p>During this activity students may bring in photographs of animals wondering why their eyes glow white or yellow instead of red.</p> <p>Some animals have a special reflector in the backs of their eyes that double the amount of light their eyes can use. This reflector is called a <i>tapetum</i> and it lies in front of their retinas. When you see an animal at night or if you take a flash photograph it looks like its eyes glow, but what you're really seeing is the tapetum reflecting light. Animals with tapetums include dogs, cats, raccoons, cows, sharks, deer and moths.</p>

Activity #4

Seeing Red



Activity #4

Seeing Red

Have you ever seen a picture where a person's pupils looked red? Did you know that you were looking at their retinas?

Steps:

1. Distribute photographs to all students that demonstrate red eye.
2. Ask where the red is located (in the pupil).
3. Remind students that the pupil is clear. Then ask what is on the other side (the retina).
4. Ask why the retina appears red (the layer of blood vessels in the retina make it red).

What's Going On?

In low light our pupils get larger or dilated to help our rods gather more light. If you take a picture with flash when a person's pupils are dilated, the flash will bounce off the back of their eyes or retina. Human retinas are red due to the layer of blood vessels there – hence it looks like the person has red eyes.

Many modern cameras reduce the possibility of red eye by having the flash go off twice. The first time is to cause the eye's pupil to contract; the second time is to take the picture.

Activity #5

Seeing the Blood Vessels in Your Eye

Description	Students will see their own retinas
Purpose	To locate and identify the layer of blood vessels in the retina
Length of Activity	20 minutes
Materials	<ul style="list-style-type: none">-A mini flashlight or pen light-A room which you can darken- ambient or dim light is fine.-A sheet of black construction paper-Eye protection such as goggles with clear lenses (recommended)

Activity #5

Seeing the Blood Vessels in Your Eye

You can use a dim point of light to cast a shadow of the blood supply of your retina. This will allow you to see the blood supply of your retina, and even your blind spot.

Steps:

1. Darken the room. Turn off the lights and close the shades, if possible. Dim light or ambient light is fine.
2. Put on eye protection or goggles, if using.
3. In one hand hold the black sheet of construction paper in front of your face so that the paper fills your field of view.
4. In the other hand, hold the mini flashlight or pen light in front of one eye, about $\frac{1}{2}$ inch in front of and slightly below the center of the pupil. Be careful not to poke yourself in the eye!
5. Turn the flashlight or pen light on and move it slowly from side to side a short distance, about a $\frac{1}{4}$ inch. Do not move your eye or follow the motion of the light.
6. Keep doing this for 20 seconds. Notice the pattern that appears. It will look like the branches of a tree or the branching of a river viewed from high above.

What's Going On?

The pattern you see are the arteries and veins that supplies blood to your retina. It spreads out from the dark area called your blind spot. When you exercise, you are increasing circulation and driving oxygen here.

In the retina, the blood supply is the top layer. Your light is causing a shadow from the blood supply layer to the other layers underneath. As you move the point of light, the shadow moves, making it visible to you. Normally, there would be no shadow and your brain would ignore seeing the blood supply.

Additional Resources

EyeSmart

<http://www.geteyesmart.org>

To find out how to improve your eye health at all stages of life.

Museum of Vision

<http://www.museumofvision.org/education>

To download more curricula related to vision.

Let's Move!

<http://www.letsmove.gov/>

America's move to raise a healthier generation of kids.

EyeCare America

<http://www.eyecareamerica.org>

To learn about referrals for eye care provided at no cost for those who qualify.

National Eye Institute, See All You Can See

<http://isee.nei.nih.gov/index.asp>

For more activities for kids.

National Eye Institute, Resources for Children

http://www.nei.nih.gov/sports/resources_children.asp

For more activities for kids.

