Special Senses: Vision

A nervous system lab activity using
Visible Body's Anatomy & Physiology

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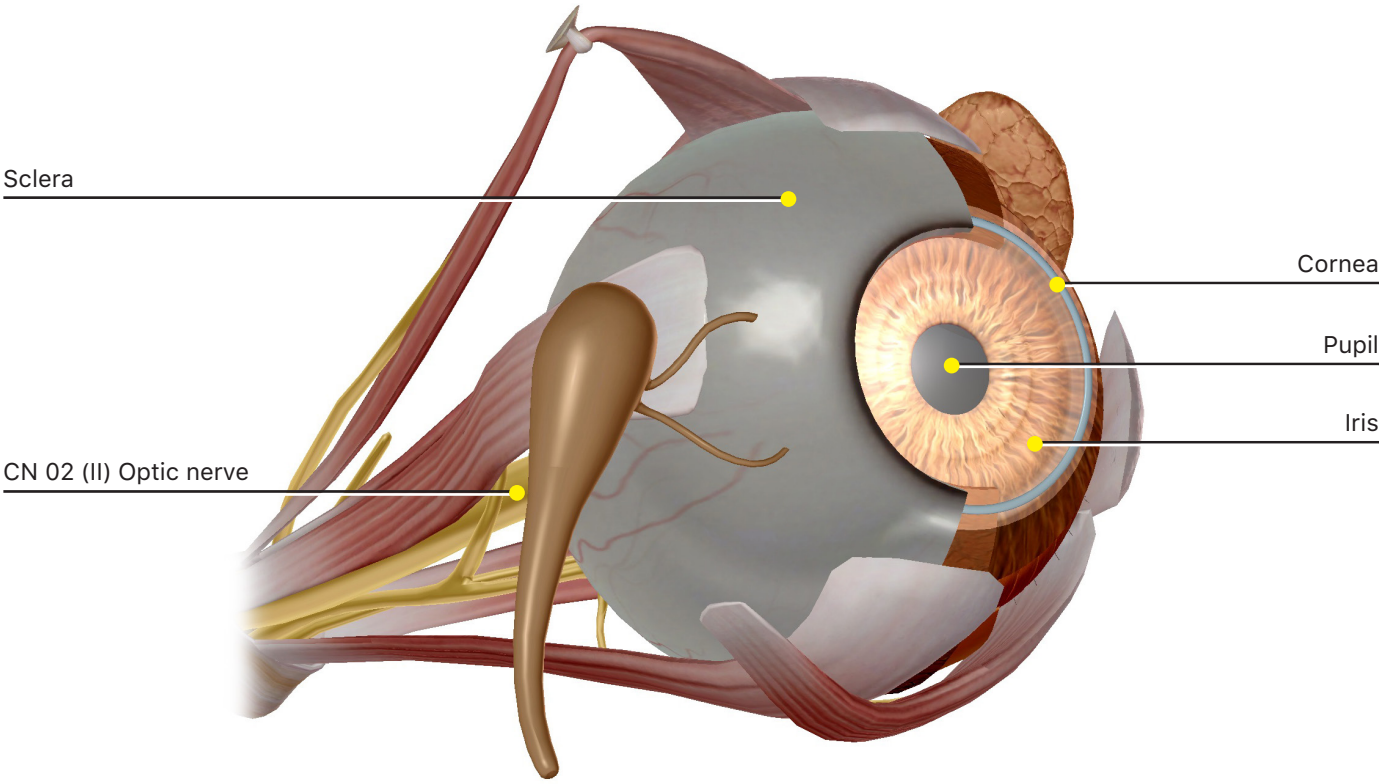
PRE-LAB EXERCISE

Use the modules to guide your exploration of the anatomy and physiology of the parts of the eye. Be sure to use the book icon to learn more about the structures you are exploring.

You are responsible for the identification of **all bold terms**.

A. Use Module 23.9 Eye to guide you as you answer the questions below.



1. The goal of your eye is to take light information and transduce it into a neural signal. Light coming into your eye is refracted, which means it changes its path. In the case of the eye, this means that the light wavelengths come together into a single point. Imagine a dome, where light from the sides is angled toward the center and light from the front takes a straight path. Draw this image below.

2. This refraction is due to the shape of the **lens** and the **cornea**. Look at these two structures of the eye. What do their shapes have in common?

3. The cornea's shape becomes flatter as we age. What would this do to the refraction of the light through the cornea?

4. Observation: The back of the eye is the **retina**. This is where the sensors that will turn the light signal into a neural signal are found.

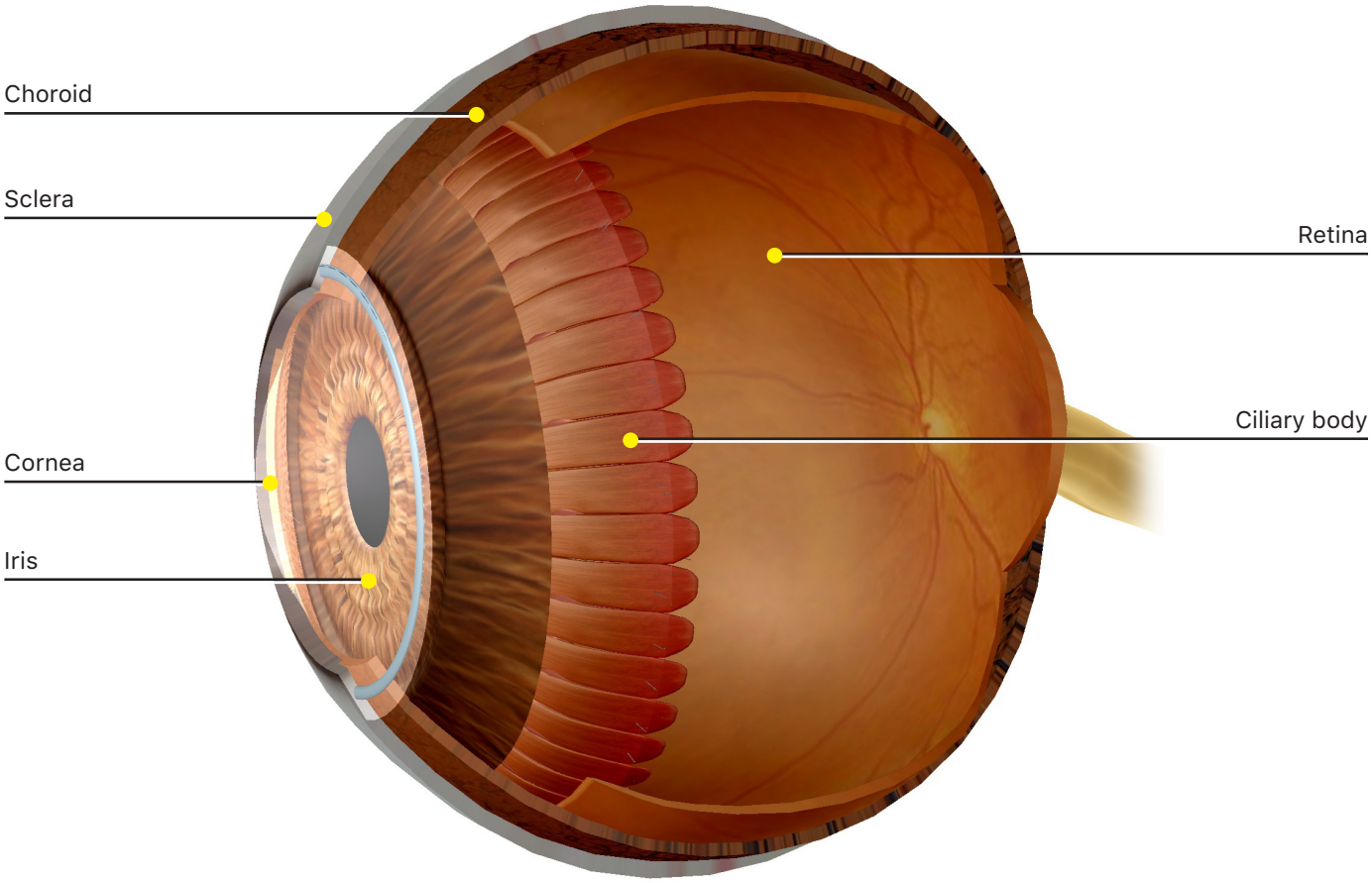
IN-LAB EXERCISES

Use the modules to guide your exploration of the anatomy and physiology of the parts of the eye. Be sure to use the book icon to learn more about the structures you are exploring.

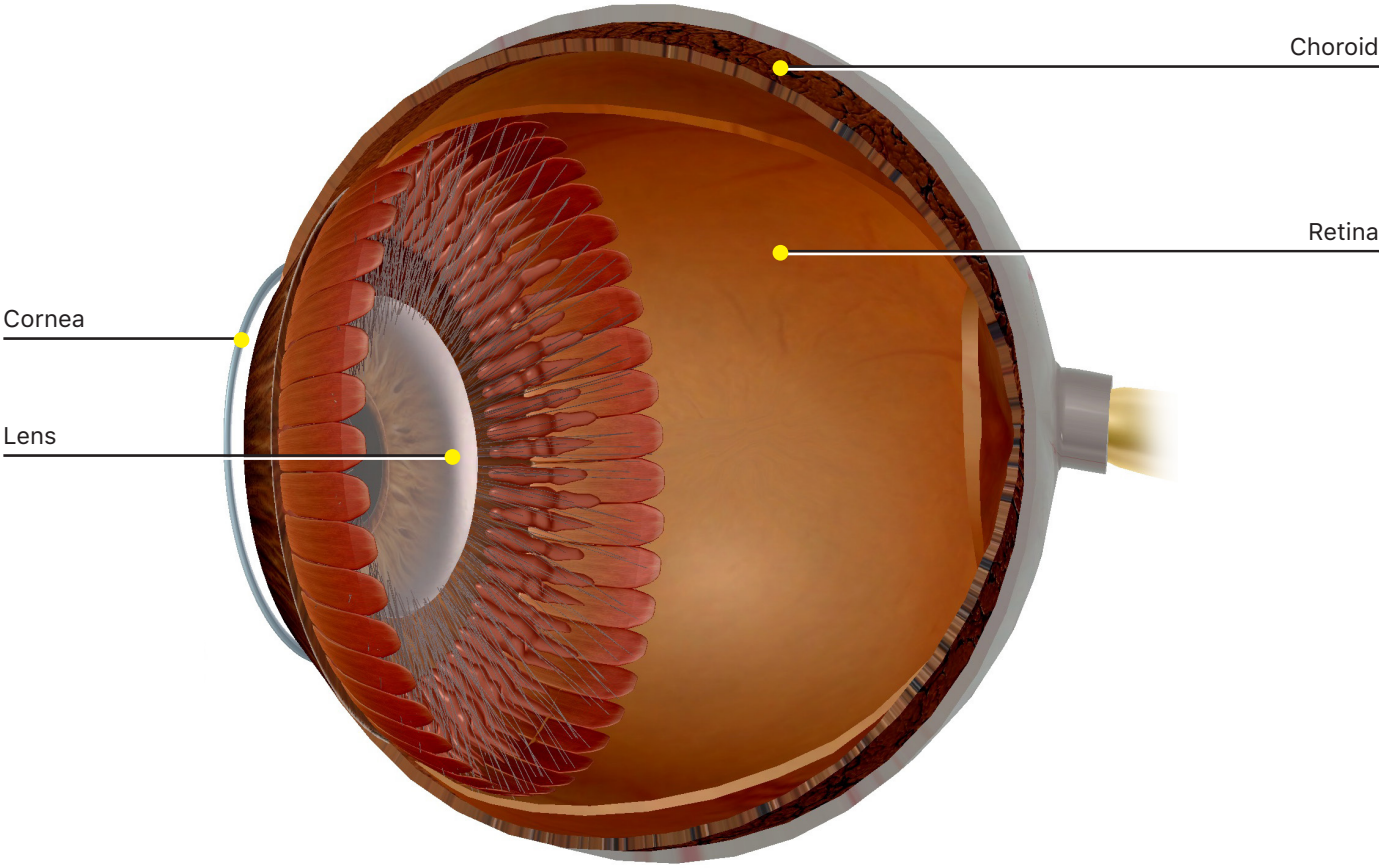
You are responsible for the identification of **all bold terms**.

Note: Sometimes, you can obtain fresh eyes from a butcher to perform dissections.

A. Use Modules 23.10 Eye Layers and 23.12 Eye Interior to guide you as you complete the exercises below.



Module 23.12 Eye Interior



1. Identify the following and state their function:

    a. **Sclera**:

    b. **Cornea**:

    c. **Choroid**:

    d. **Ciliary Body**:

    e. **Iris**:

    f. **Retina**:

    g. **Lens**:

2. Create a model eye.

List of supplies:

3 small paper cups

Wax paper

Pin for poking holes in cups

Black marker or black construction paper

a. Cut the bottom out of one of the paper cups and attach the wax paper to it to create a new bottom. Keep the wax paper as smooth as possible. The wax paper will simulate the retina.

b. Take your second cup and use a pin to poke a small hole in the center of the bottom of the cup. This hole is the pupil.

c. Place the wax paper cup inside the cup with the small hole in the bottom.

d. Go to a bright window and adjust the spacing between the two cups. You should be able to see an image on the wax paper, but it will not be quite clear.

e. Take your third paper cup and use a black marker to color the inside, or line it with black construction paper. This dark lining simulates the choroid. Poke a small hole in the bottom of this cup (going through the black construction paper as well as the cup, if you're using construction paper). Look out the same window as before with this cup on the outside of your wax paper cup.

f. How does the black cup affect image clarity?

g. What does the choroid do to help your eye to see more clearly?

h. Now, for one last experiment, make the hole in the bottom cup larger. This simulates the pupil dilating. What happens to the clarity and brightness of your image?

i. What is the purpose of the pupil dilating in low light conditions and constricting in high light conditions?

3. How does the lens work?

List of supplies:
Quart-size zip-top bag
Water
Measuring cups
Newspaper or other paper with small print on it

a. Pour a cup of water into a quart-size zip-top bag.

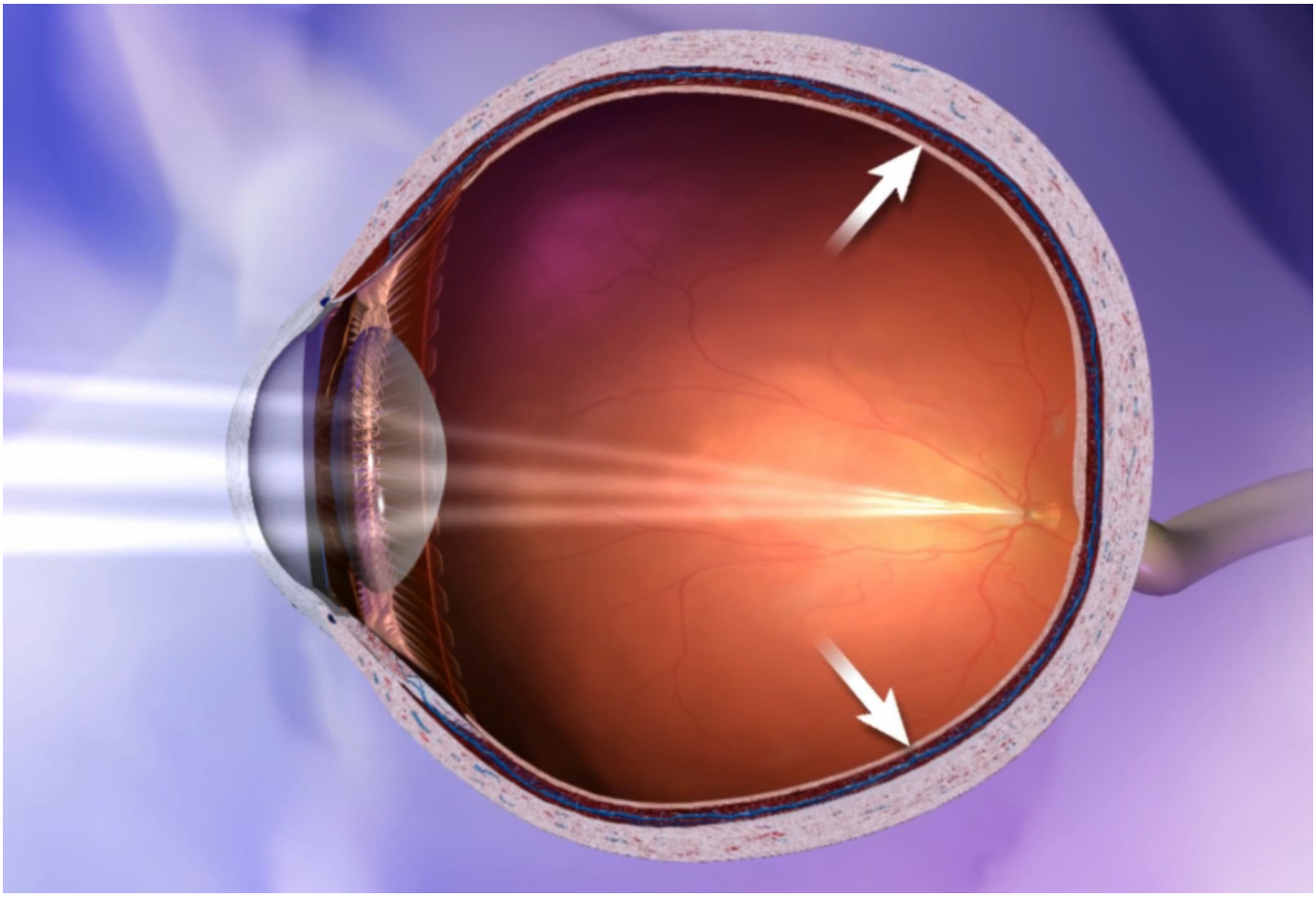
b. Squeeze the excess air out of the bag.

c. Place the bag above a piece of paper that has small print on it (such as a newspaper).

d. Flatten the bag and examine the writing.

e. Squeeze the bag, so the water takes on a ball shape. Hold the bag near the writing. Notice how the print seems larger than it was before? This is how the lens of your eye works. Its shape changes to bend rays of light appropriately, so they converge on your retina. Objects at different distances need different amounts of bending of their light rays. If the eye is unable to focus images on the retina, corrective lenses are needed.

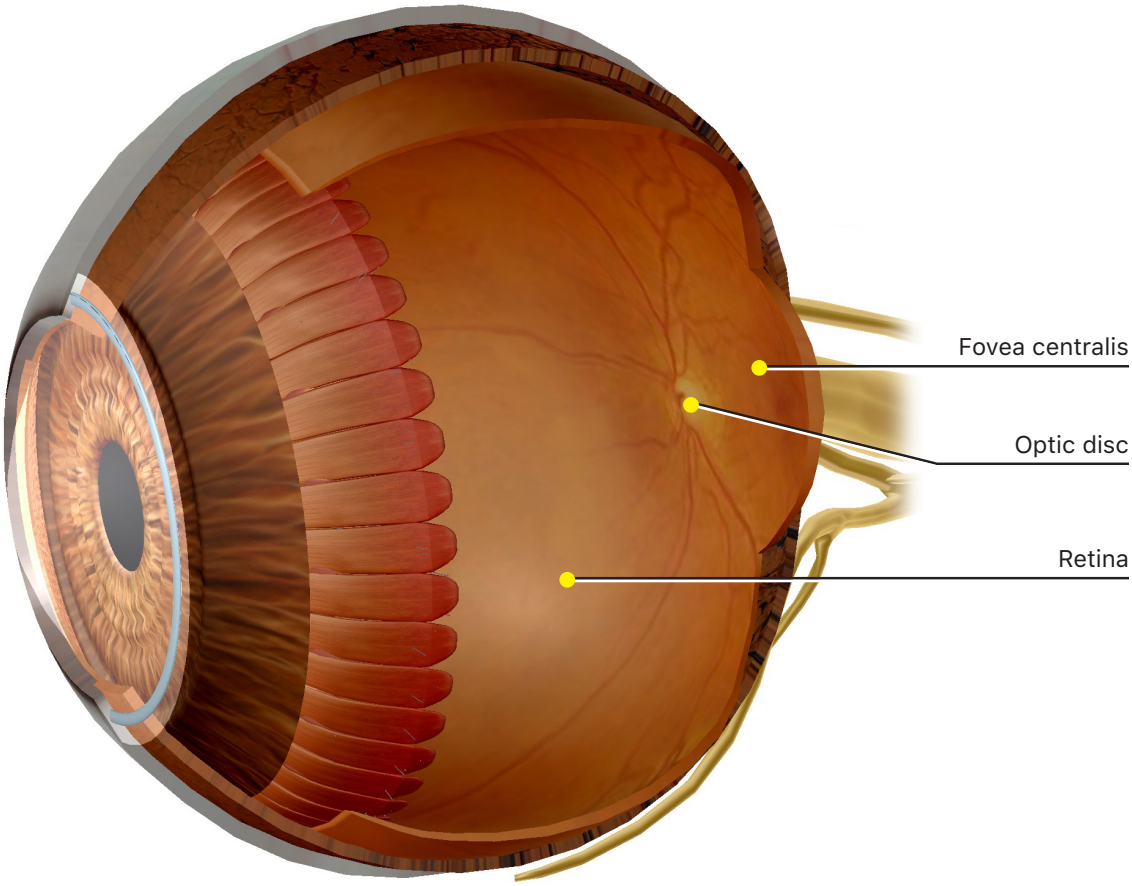
f. Watch the video in **Module 23.16 Types of Vision** to learn more about the lens.



i. When someone is nearsighted, the light is focused _____ the retina; whereas, when someone is farsighted, the light is focused _____ the retina.

Thought question: The sclera and cornea are rigid, helping the eye to maintain its shape and protecting the delicate insides of the eye. While both are rigid, examine the sclera and note that it has blood vessels. Do you see blood vessels on the cornea? What effect do you think the cornea's blood vessels would have on its access to nutrients (and thus, its ability to heal following injury)?

B. Use Module 23.14 Rods and Cones as a guide as you complete the exercises below.



Your retina contains photoreceptors, which take light information and change it into a neural signal. These cells are called rods and cones.

1. How do the two types of receptors differ?

2. These receptors both have pigment in them. As a result, areas of the retina that have a lot of them will appear darker, and those that do not have as many will appear lighter in color. Select the darkest area of the retina—this is the **fovea centralis**, which is located within the **macula lutea**. Since you have the most receptors in this area, it has the highest visual acuity.

3. Now, select the lighter area of the retina. This is the **optic disc**, which is where the axons of all the sensory receptors send their projections. Since the axons are all running through this area, there are no receptors here. This creates a blind spot.

4. How does the blind spot work?

List of supplies:

Piece of paper

Ruler

Pen or pencil

a. To find your blind spot, take a piece of paper and draw a small X on the right side.

b. Take your ruler and measure about 5 inches to the left of the X.

c. Draw a dot there, about the size of a penny.

d. Hold the paper in front of you and close your right eye. Look at the X. Even though you're looking at the X, you should be able to see the dot out of the corner of your eye.

e. Slowly move the paper farther in front of you. Try moving it left and right, or closer and farther away. Remember to keep looking at the X. At a certain point, the dot will seem to disappear out of the corner of your eye.

f. Why does the dot seem to disappear?

5. How does peripheral vision work?

List of supplies:

2 pieces of paper

Pen or pencil

a. Write a note on a piece of paper (in regular sized print) and hold it 10 inches in front of a partner. Have your partner read the note out loud

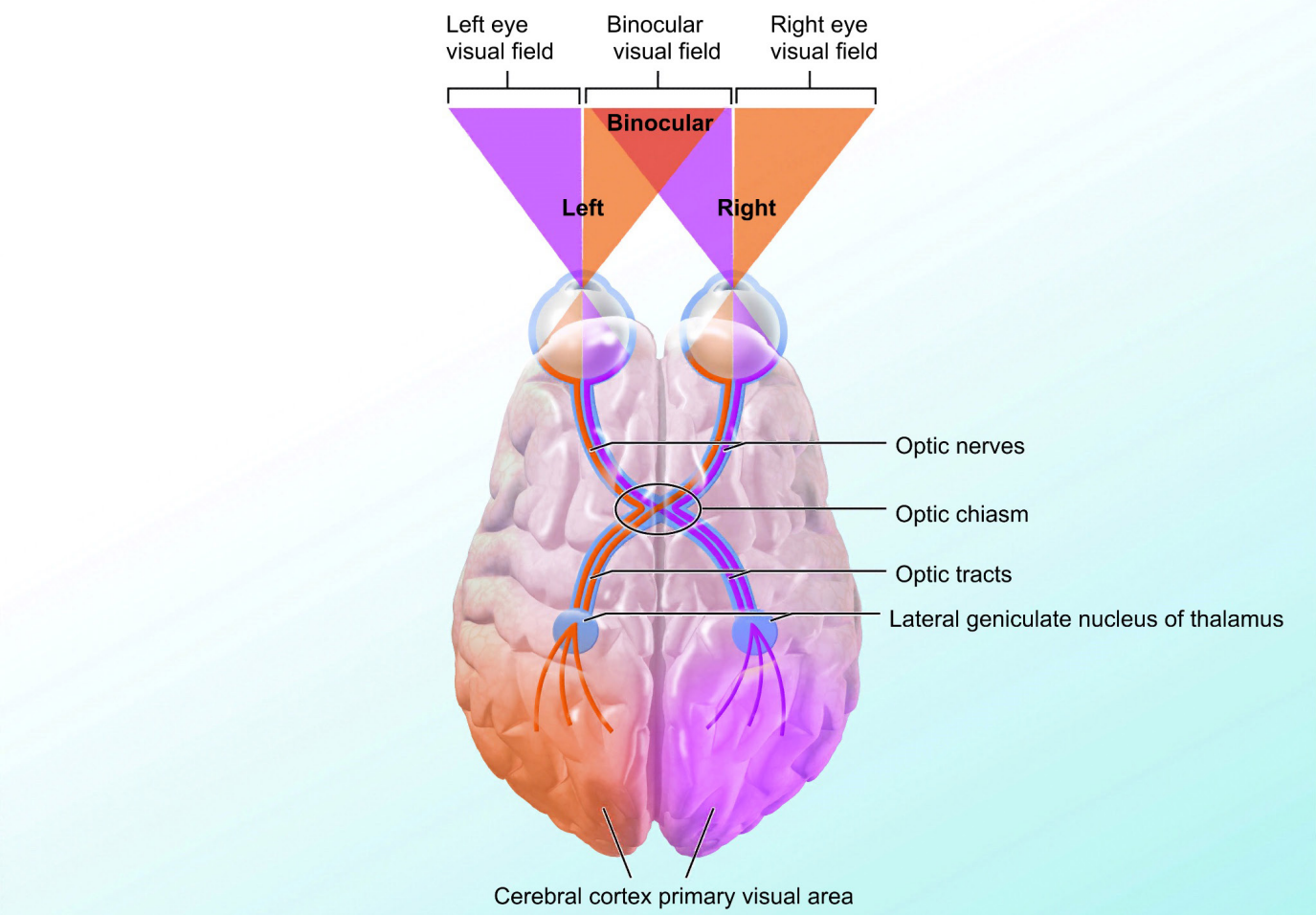
b. Can your partner read the note clearly?

c. Write a different note (on a new piece of paper) and do not tell your partner what it says. Hold it 10 inches from the side of your partner's face (so it is in the peripheral visual field). Have your partner continue to stare forward and try to read it.

d. Can your partner read the note?

e. Knowing what you know about the retina and its photoreceptors, why do you think your partner can't read your note?

C. Use Module 23.18 Optic Chiasm to guide you as you complete the exercise below.



Information from your retina excites the rods and cones and then travels along the **optic nerve**. On its way to the visual cortex, it will pass through the **optic chiasm**. Here, some of the information from each eye moves to the contralateral side of the brain.

1. Close your left eye and move your right arm as far to the right as it can go while still being visible out of the corner of your right eye. Hold it there.

2. Now, move your left arm inward until you can see it out of the corner of your right eye.

3. The position of your two arms represents the visual field of your right eye. Notice that it is large and overlaps part of the visual field of your left eye. The overlapping of visual fields helps you with depth perception.

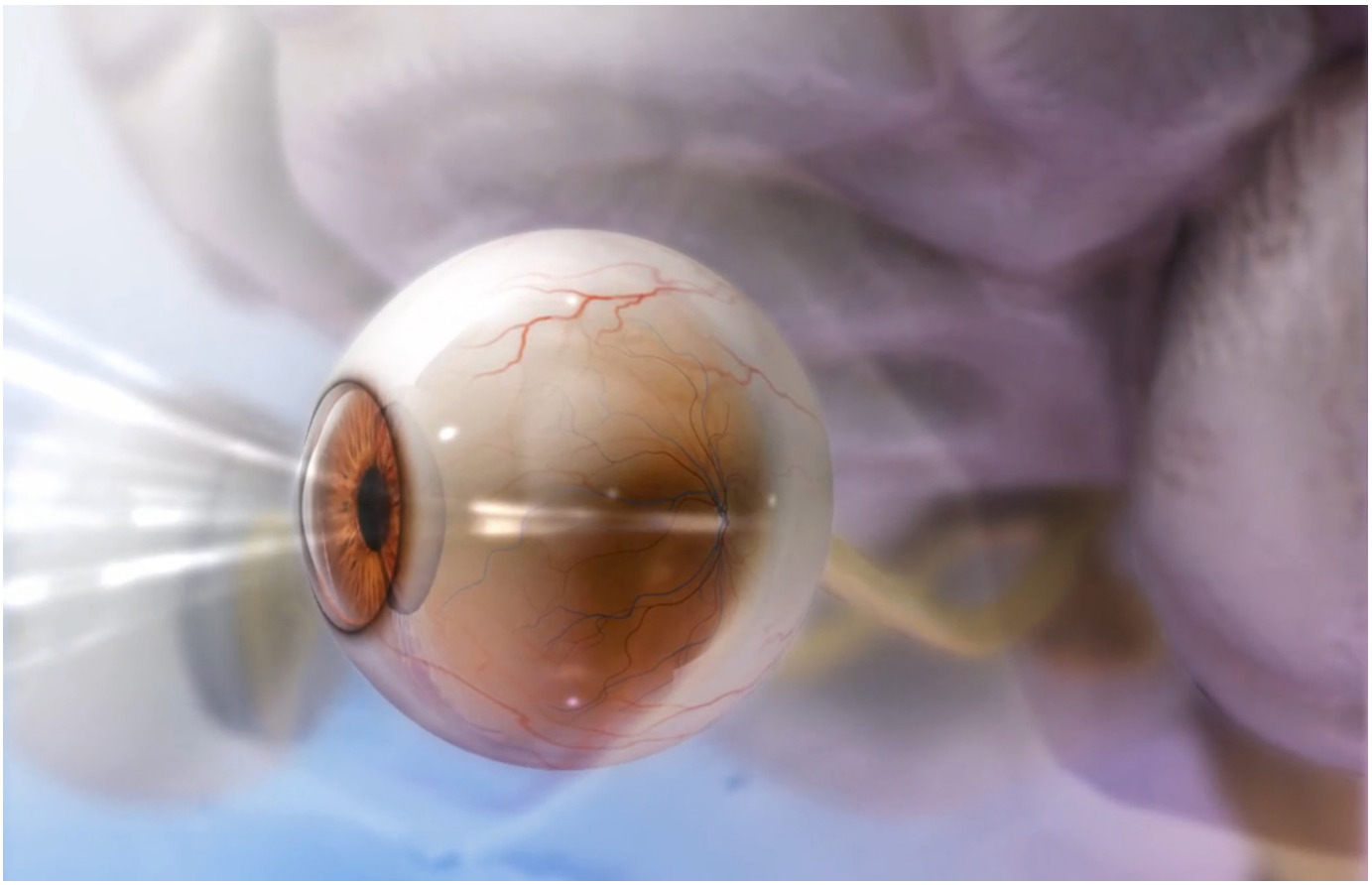
4. Which region has the most overlap between the eyes?

5. Using two different colors for the different hemispheres of the visual cortex, trace the information to its corresponding location within the visual field. Fill in the picture below

TIME TO PRACTICE!
TAKE QUIZ 23.B EYE DISSECTION.

PUTTING IT ALL TOGETHER

1. Watch **Module 23.15 Vision.**

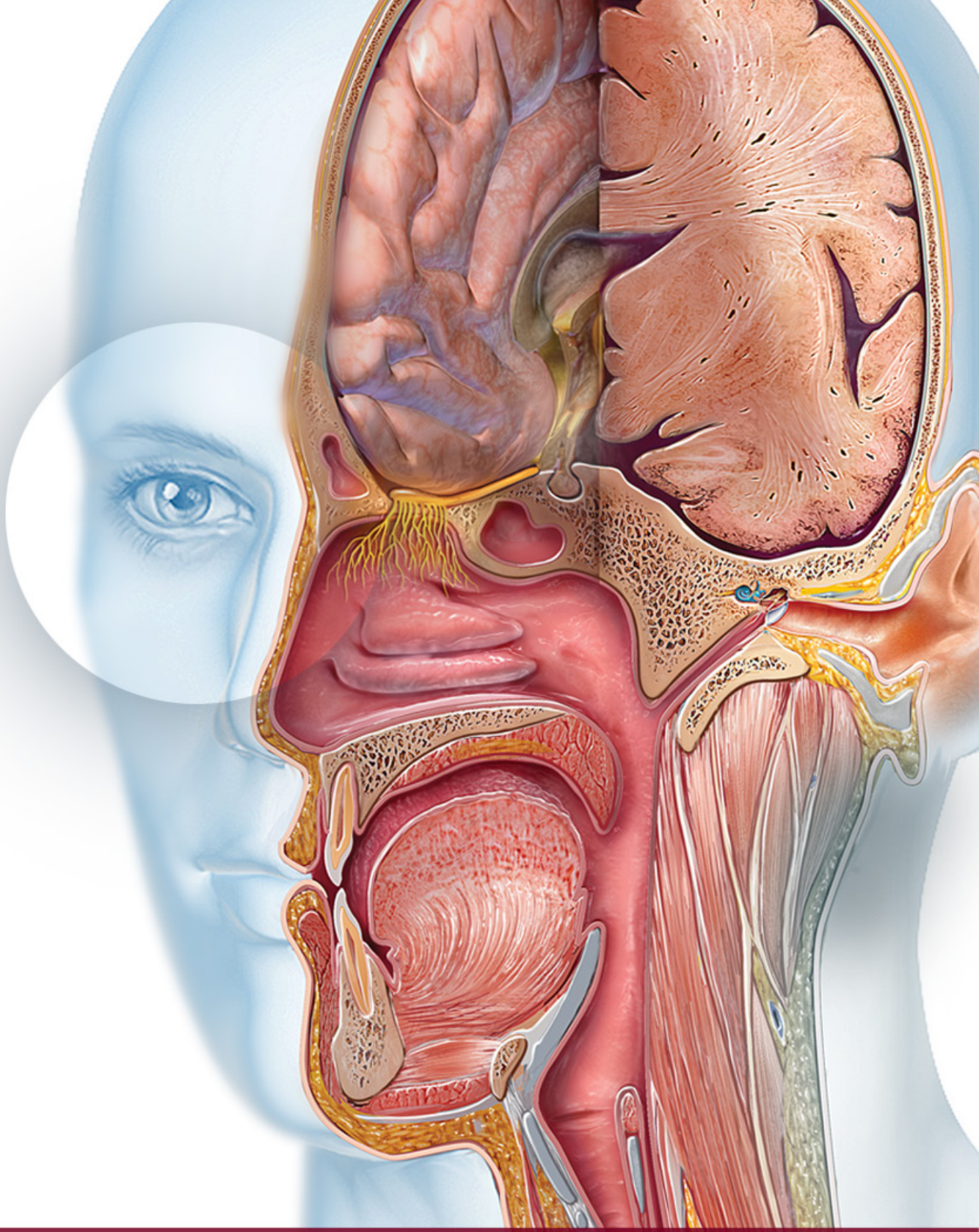


a. State how light that enters the eye is transduced into a neural signal.

b. List the structures light passes through on its way to the retina, in order.

c. Which lobe of the brain does visual information travel to?

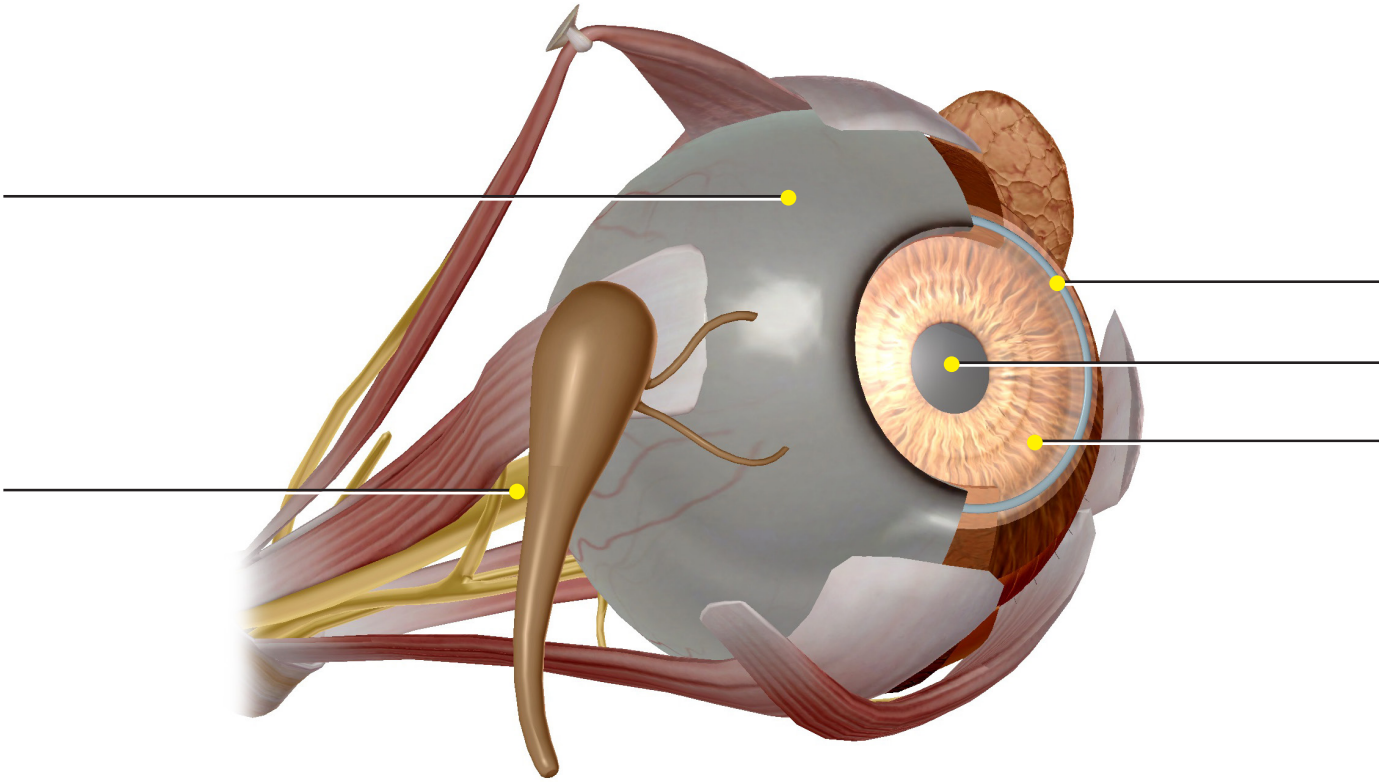
d. Examine the pathway of information shown in **Module 23.18 Optic Chiasm**. What is the neural pathway from each individual eye to the brain and what does this allow for?



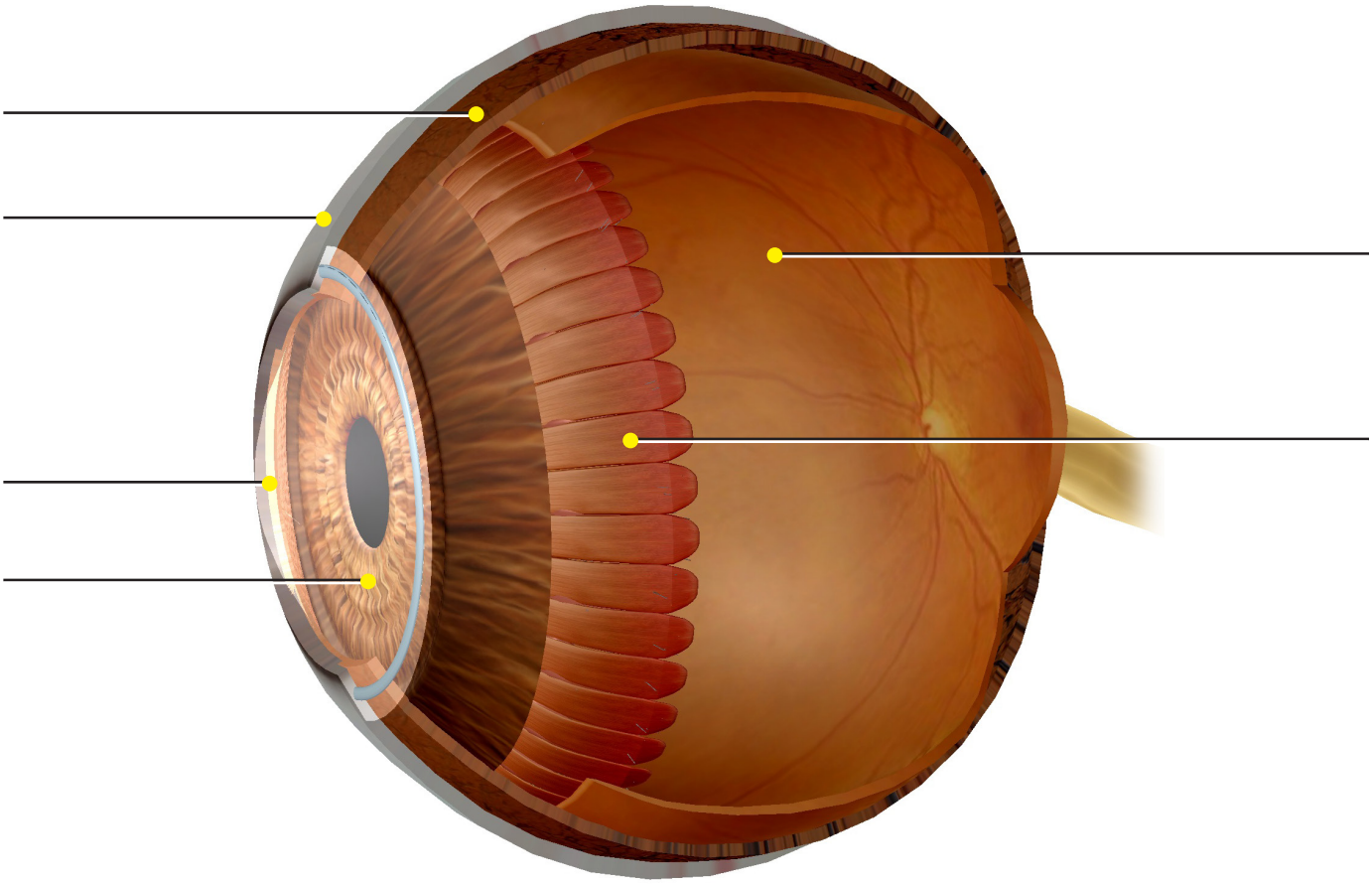
Student Practice

Label the structures in the following figures.

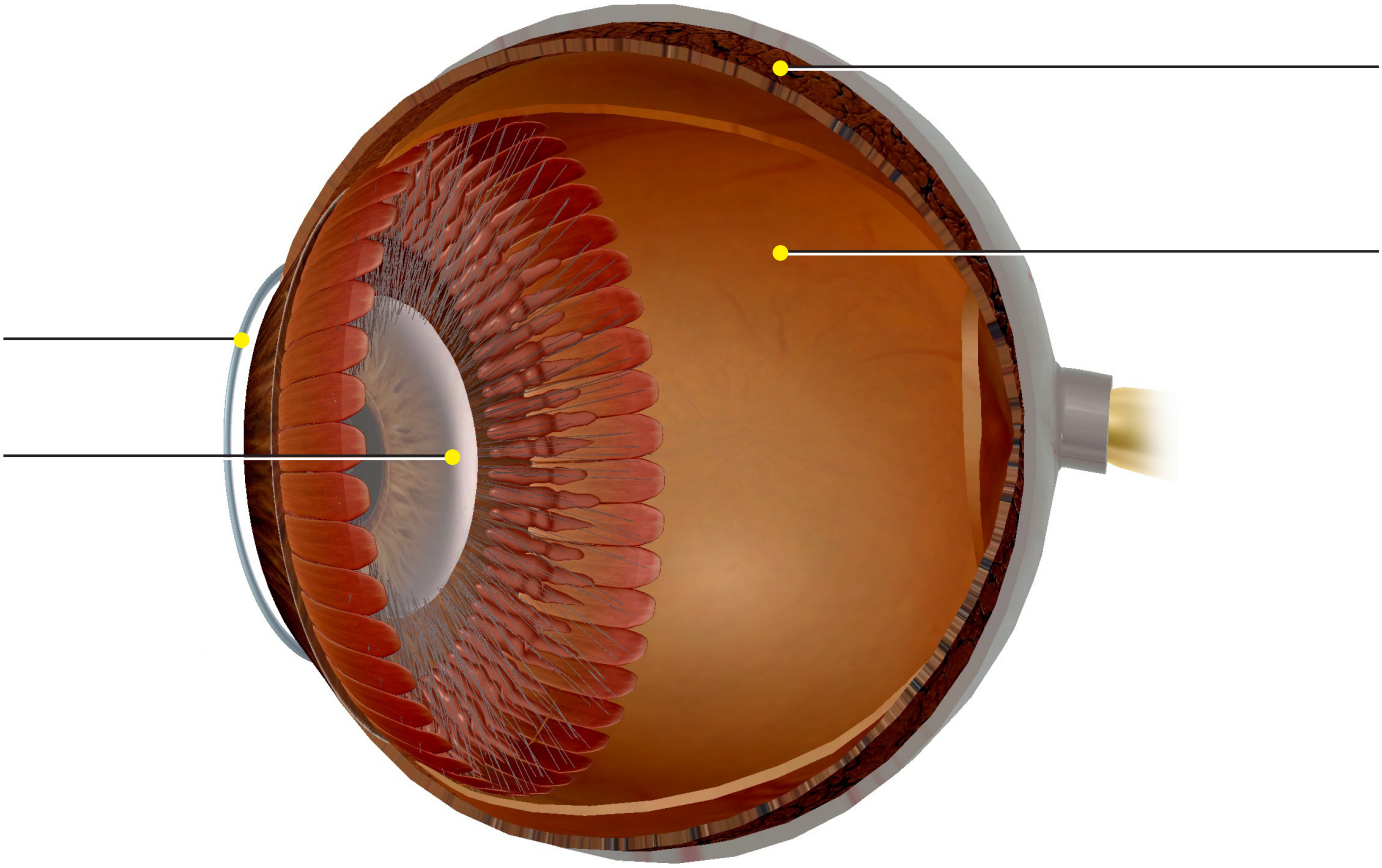
Module 23.9 Eye



Module 23.10 Eye Layers



Module 23.12 Eye Interior



Module 23.14 Rods and Cones