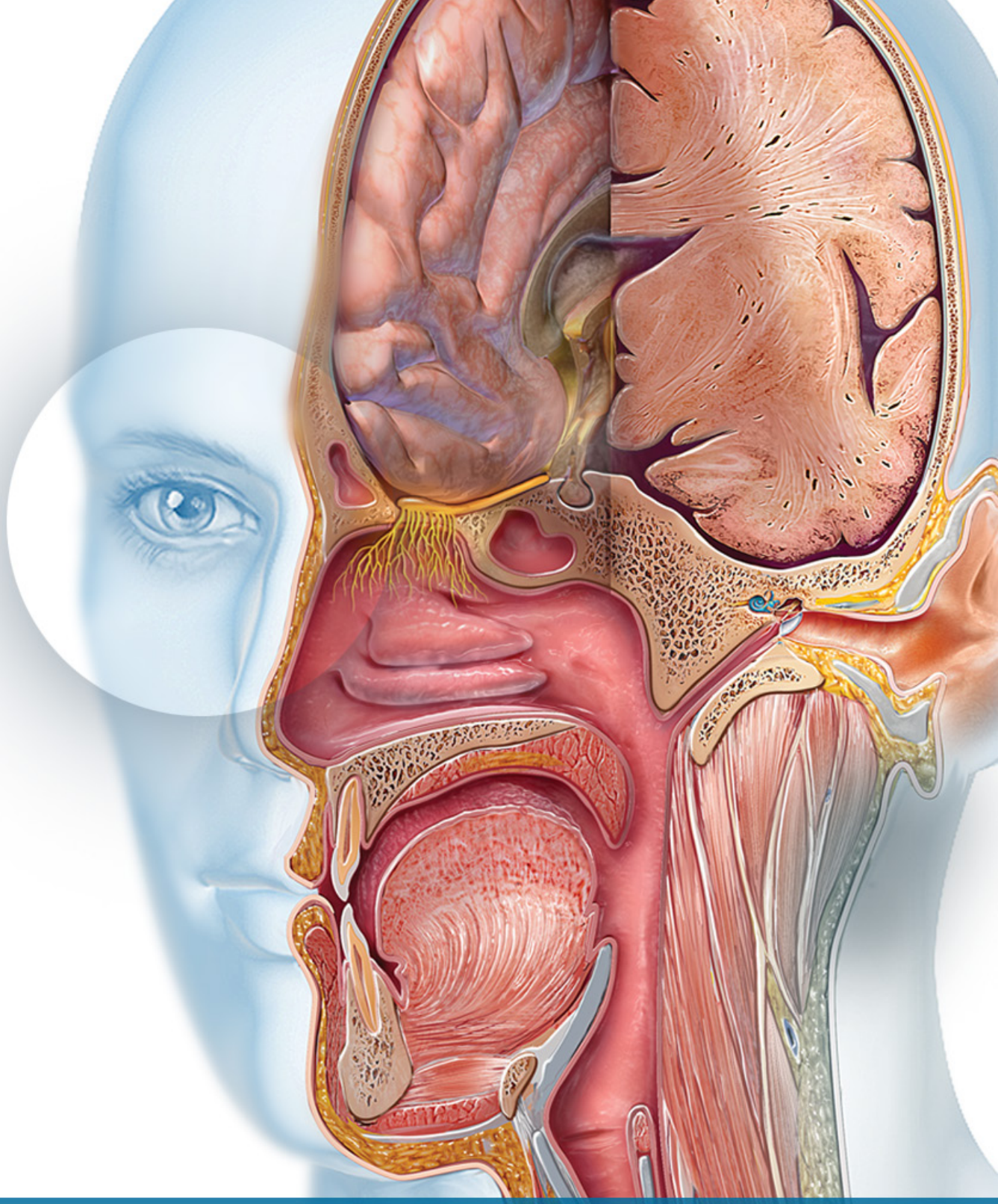

Special Senses: Vision

A nervous system lab activity using Visible Body's Human Anatomy Atlas

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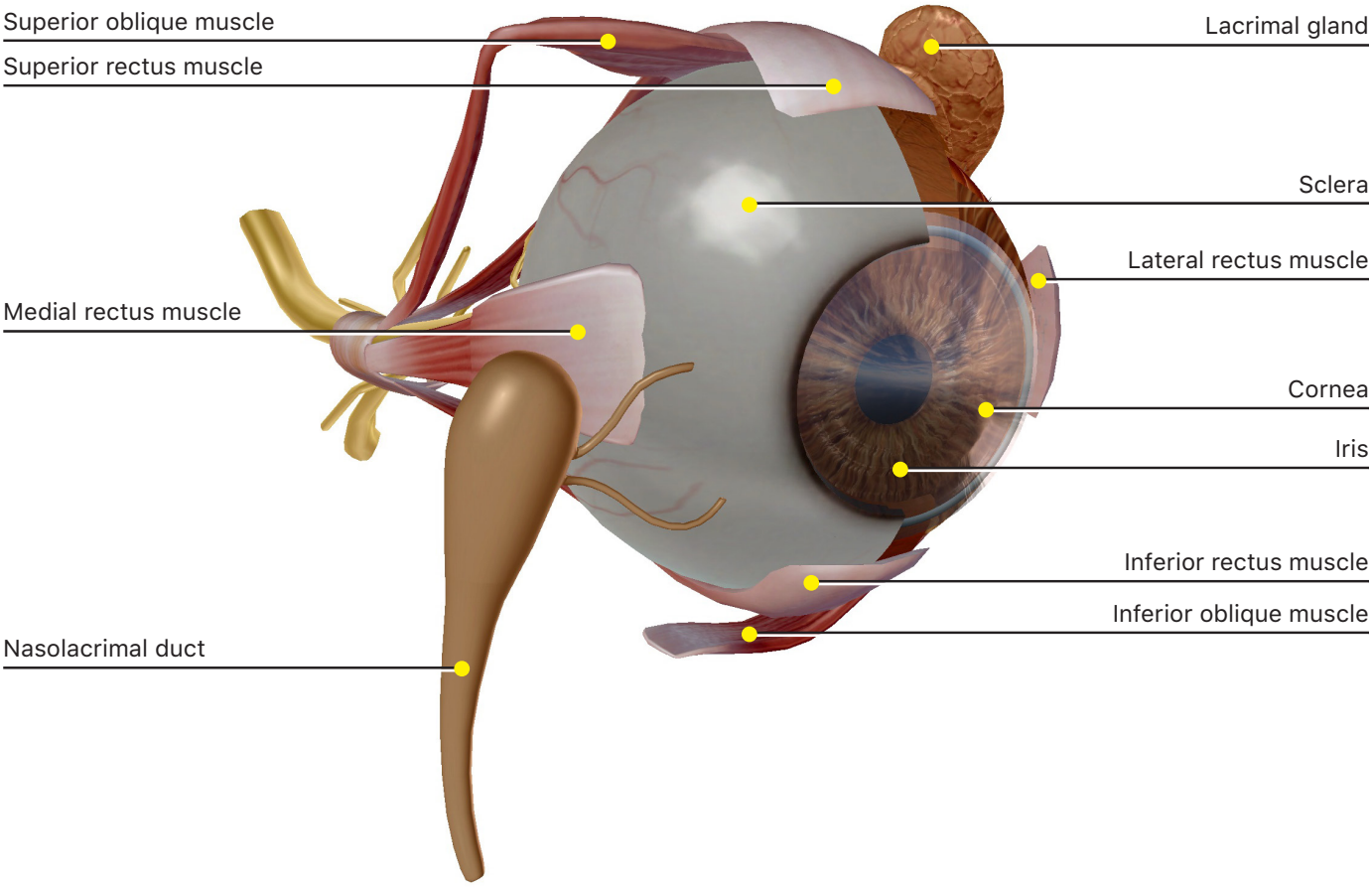
PRE-LAB EXERCISE

A. Overview of the Eye

Go to the Views menu, select Microanatomy, and choose 1. Eye.

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



1. What are the muscles surrounding the eye and what movement does each muscle create?
    a.
    b.
    c.
    d.
    e.
    f.

2. What part of the eye are the muscles attached to?

3. Locate the **lacrimal gland**. Note that the lacrimal gland, which creates tears, is located opposite to the **nasolacrimal duct**.

a. What is the function of each of the above structures and how does their positioning aid that function?

b. What are tears made of? Why is the composition of tears important to the eye?

4. Locate the **cornea**. Notice that it is transparent, which allows light to pass easily through it. However, the cornea's transparency comes at a cost: the cornea cannot have blood vessels in it, which makes it harder for it to heal when it is torn.

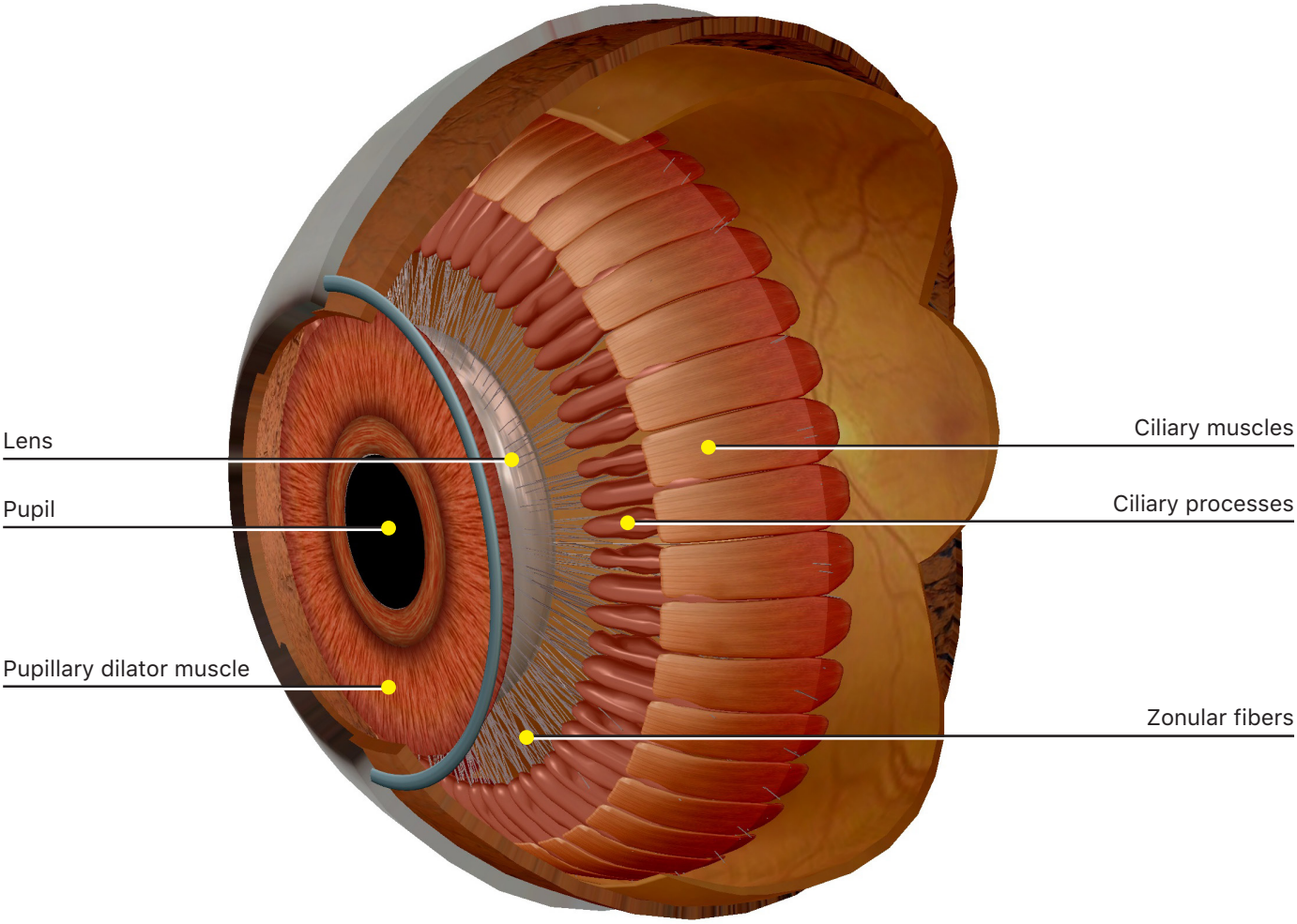
5. Hide the cornea and locate the **iris**. Select the book icon for more information.

a. What substance in the iris determines eye color?

b. The iris separates the eye into a(n) _____ and a(n) _____.

B. Exploring the Lens and Pupil

Go to the Views menu, select Microanatomy, and choose 3. Lens and Zonular Fibers.



1. Hide the cornea.
2. Hide the iris.
3. The muscle you are looking at is the **pupillary dilator**. What is its function?

4. How does the pupillary dilator's function differ from that of the **pupillary sphincter**?

5. Hide the pupillary dilator, the **pupillary sphincter**, and the **pupil** and look at the **lens**.

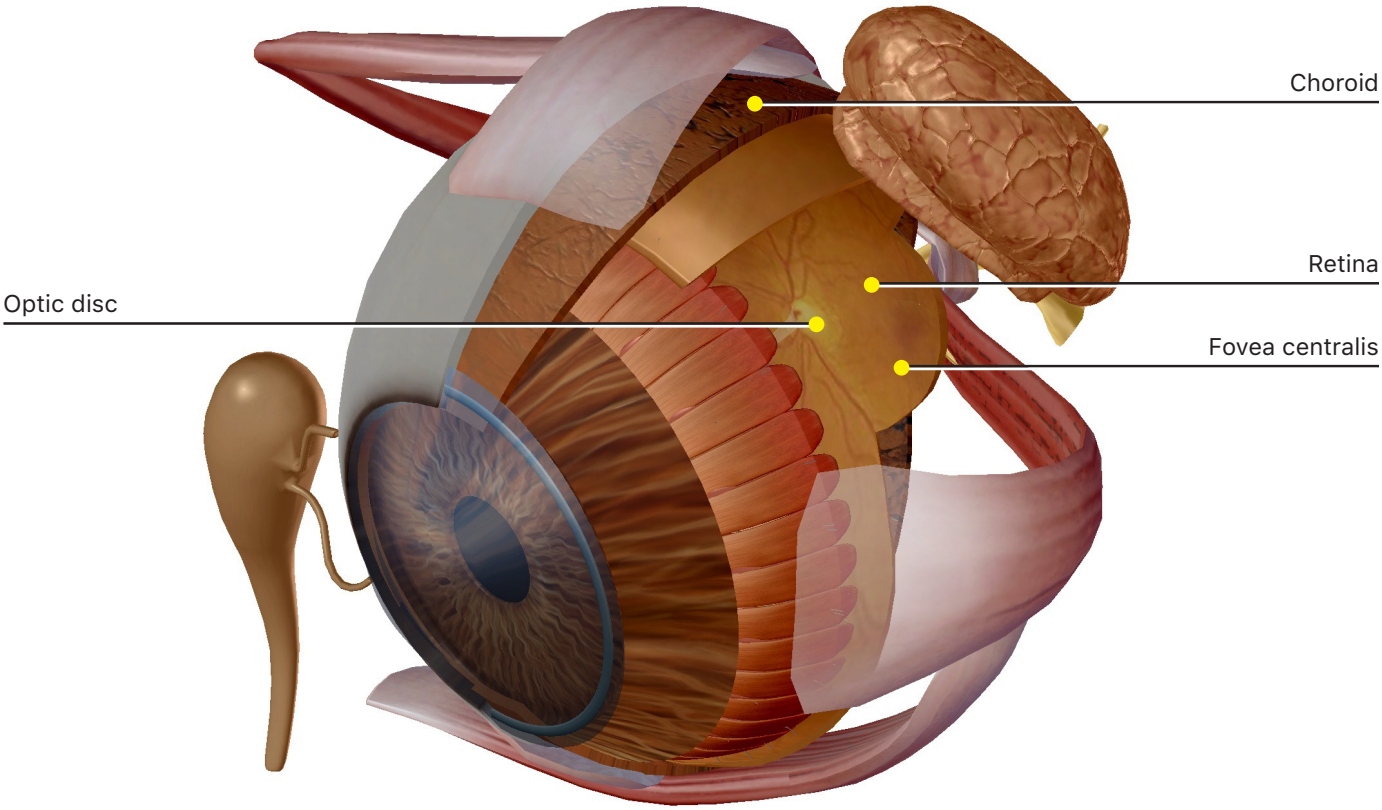
    a. How is the shape of the lens similar to the shape of the cornea (which you saw before)?

    b. Locate the **ciliary muscles**. How are they attached to the lens?

    c. What happens to the lens when the ciliary muscles contract?

IN-LAB EXERCISES

A. Anatomy and Function of the Eye



1. 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 1 cup of water in 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?

i. 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. Locate the **retina** in the app. The retina contains photoreceptors called **rods** and **cones**.

i. What do rods and cones do?

ii. How do rods and cones differ?

iii. What is the relative abundance of rods and cones?

g. Locate the **fovea centralis** in the app. What differentiates this part of the retina from the rest of the retina?

h. Locate the choroid in the app. Note its dark appearance. What causes the choroid's dark color, and why is its color important to its function?

2. 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?

f. Locate the **optic disc** in the app. Are there rods and cones present in the optic disc?

3. 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?

4. Creating 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 see more clearly?

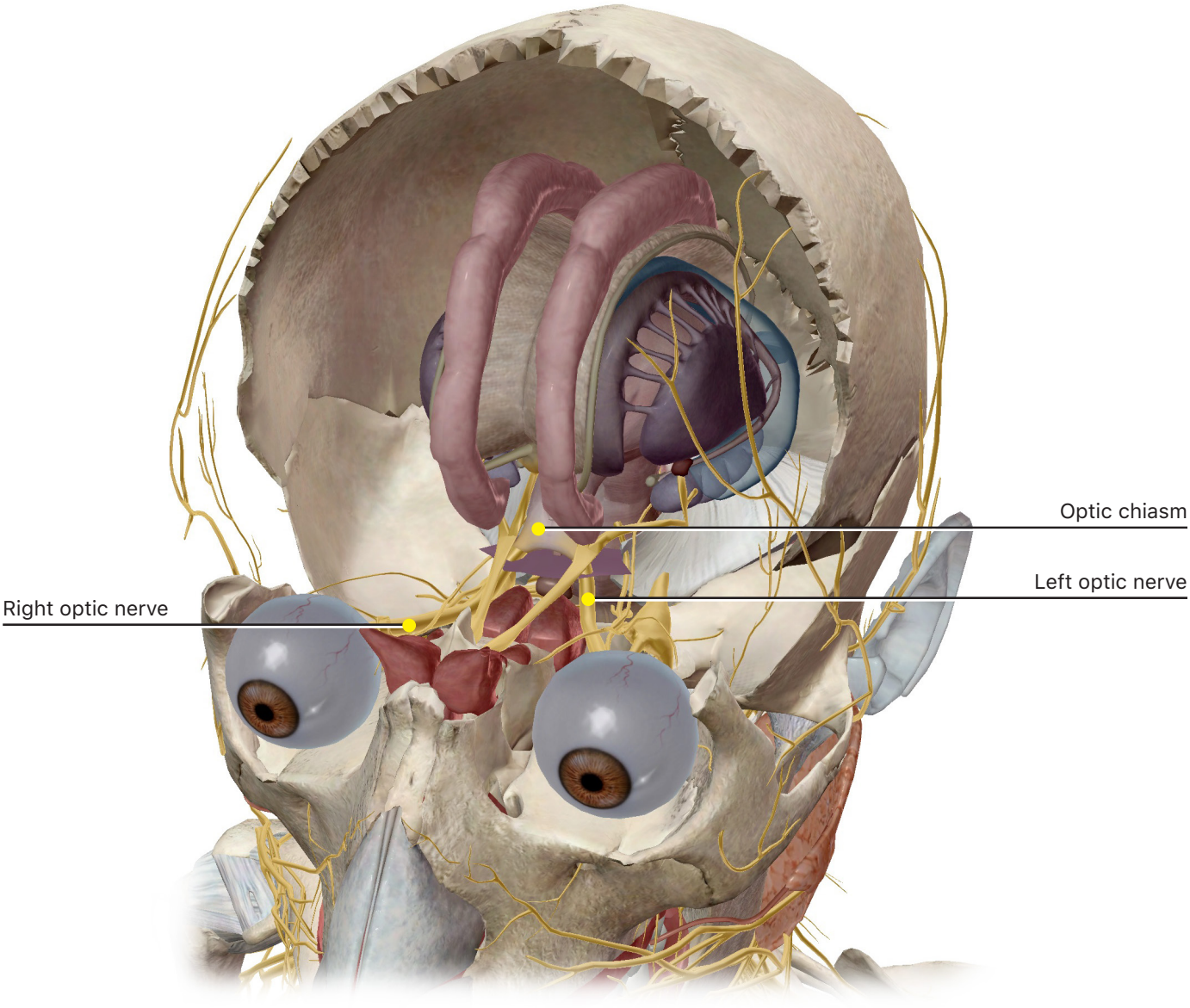
h. Now, for one last experiment, make the hole in the bottom cup larger. This simulates the pupil dilating. What happens to the clarity and brightness of your image?

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

B. Anatomy and Function of the Optic Chiasm

Go to the Views menu, select Regional System Views, and choose 1. Head and Neck.

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



1. Hide the following structures:

    a. Muscles
    b. Vessels
    c. Lymphatic system
    d. Frontal bone
    e. Dura mater
    f. Frontal lobe of the brain
    g. Falx cerebri
    h. Sphenoid

2. Zoom in and find the **optic nerves**. Notice how they both join to the same structure. That structure is called the **optic chiasm**. What happens to the neural tracts at this point? (Use the book icon to help you with this answer.)

3. Convergence

a. You combine information from both of your eyes to create your picture of the visual world. This combination relies, in part, on the ability of your eyes to focus on the same object. Hold your hand with an outstretched finger in front of your nose. Now bring your hand toward your nose slowly.

b. What do you feel your eyes doing as you perform this task?

c. If you go past a certain point, your eyes can no longer physically converge. What happens to the appearance of your finger when this occurs?

4. The function of the optic chiasm

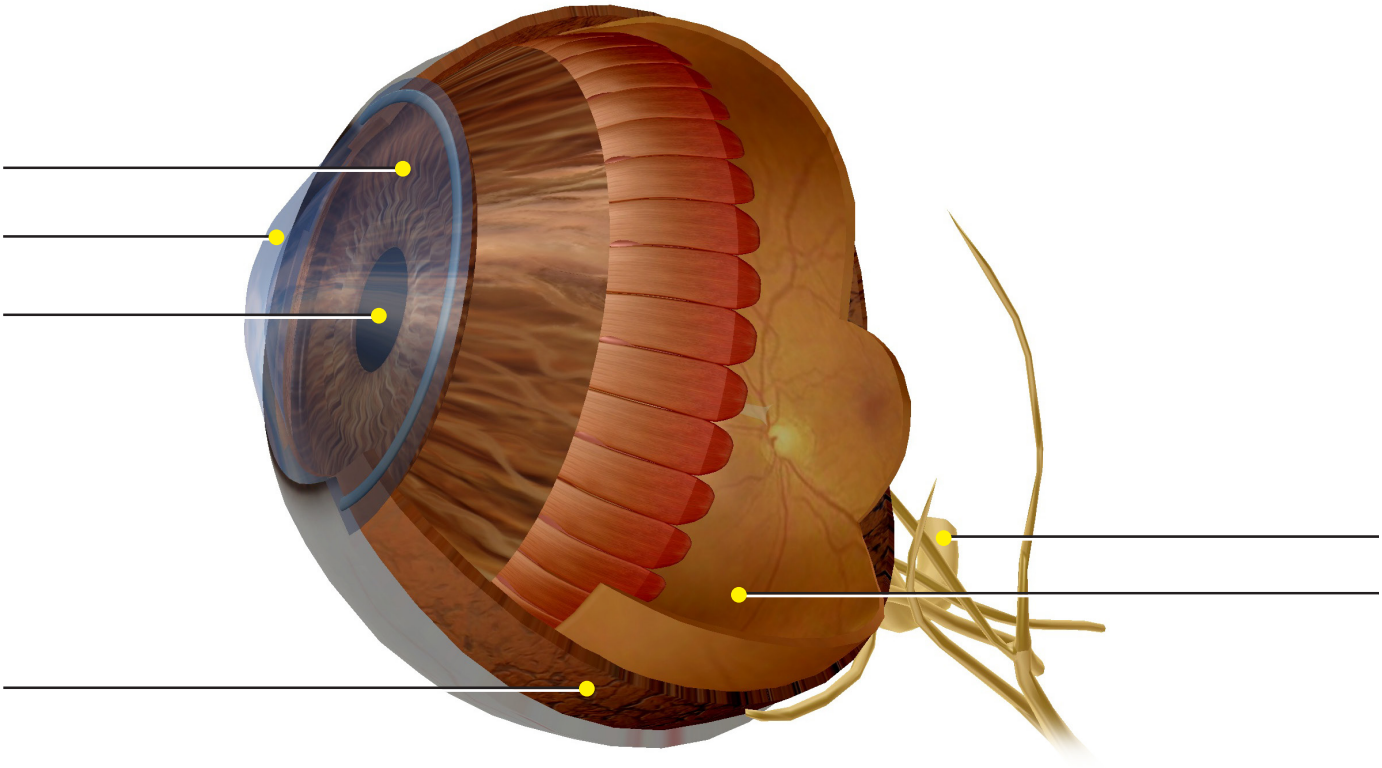
a. Close your left eye and move your right arm as far to the right as it can go while still being visible out of the corner of your right eye. Hold it there.

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

c. 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.

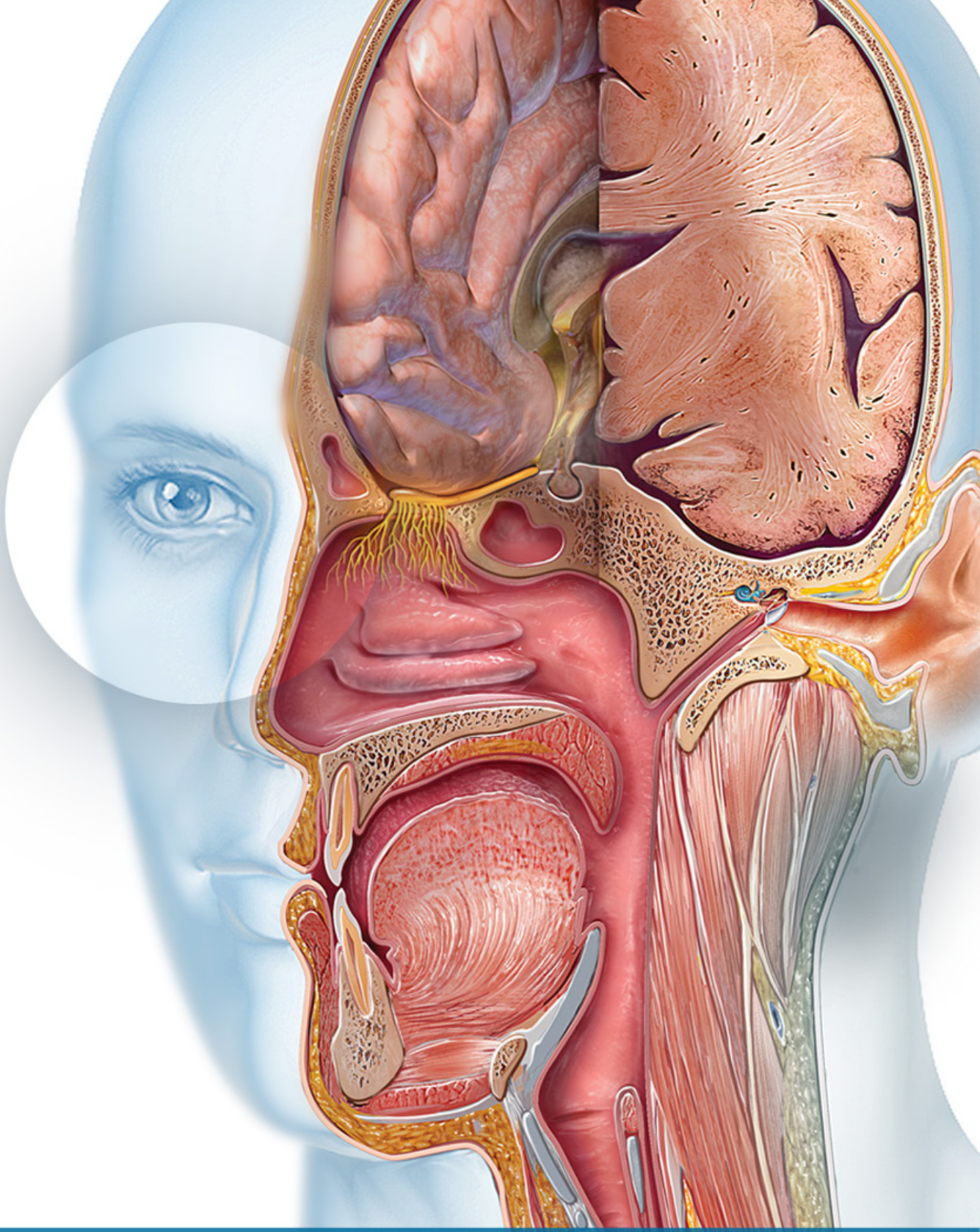
d. Which region has the most overlap between the eyes?

PUTTING IT ALL TOGETHER



1. When a photon enters the eye, what are the structures it passes on its way to being a fully processed neural signal in the visual cortex of the occipital lobe on the brain? Fill in the blanks in the diagram above and in the paragraph below.

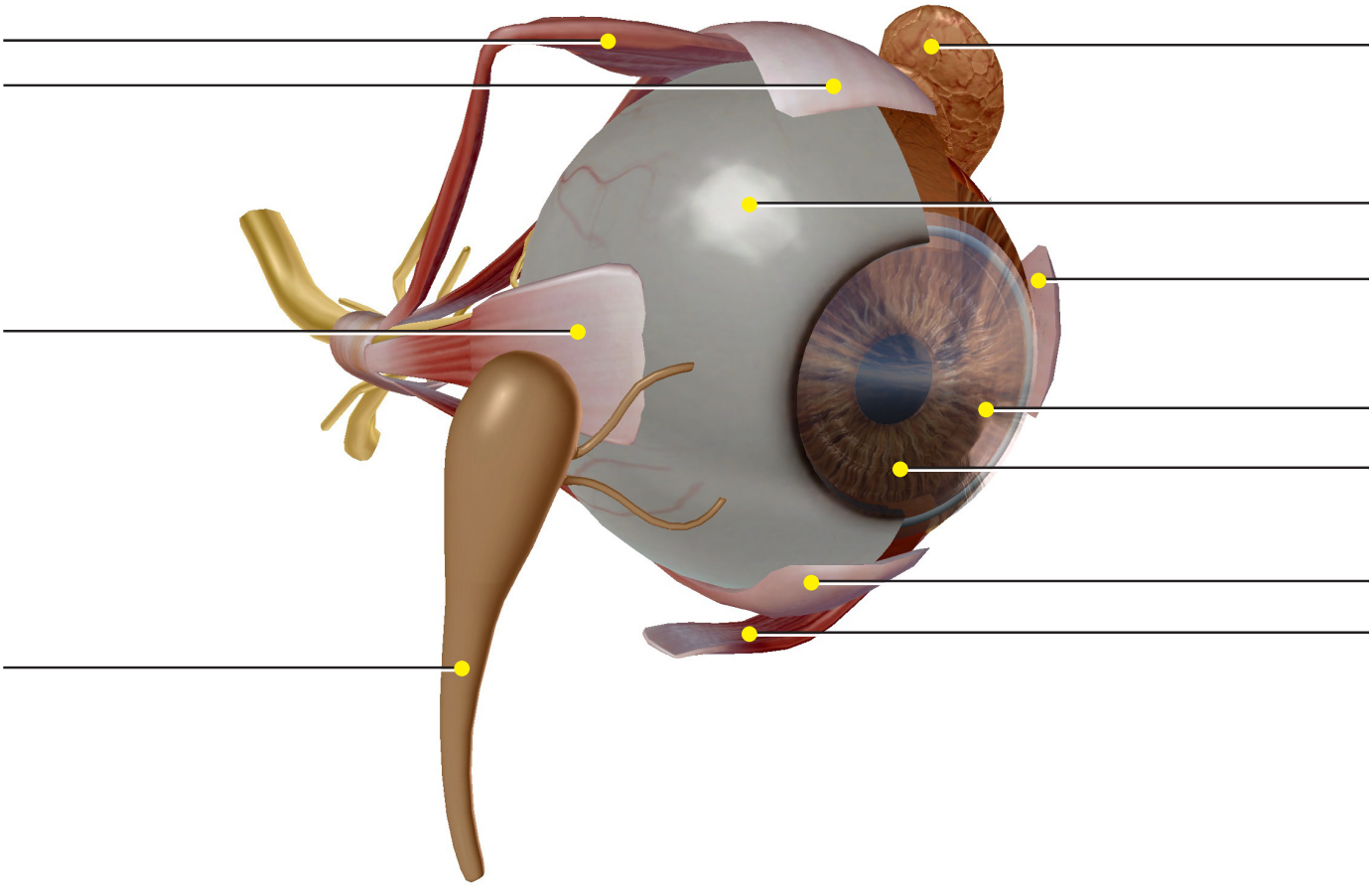
The photon enters through the _____ of the eye. It passes the _____, which gives the eye its color, on its way through the _____, a hole created by the _____, which can dilate or constrict to adjust for ambient lighting. It then passes through the _____, which focuses the light onto the _____. The retina's photoreceptors for dim light are called _____, and its photoreceptors for color are called _____. A special layer called the _____ prevents stray photons from activating more receptors. This information is transduced into a neural signal that travels via the _____ nerve. Information from each eye is divided at the _____ chiasm into a subset that travels to the contralateral visual cortex and another subset that travels to the ipsilateral visual cortex.



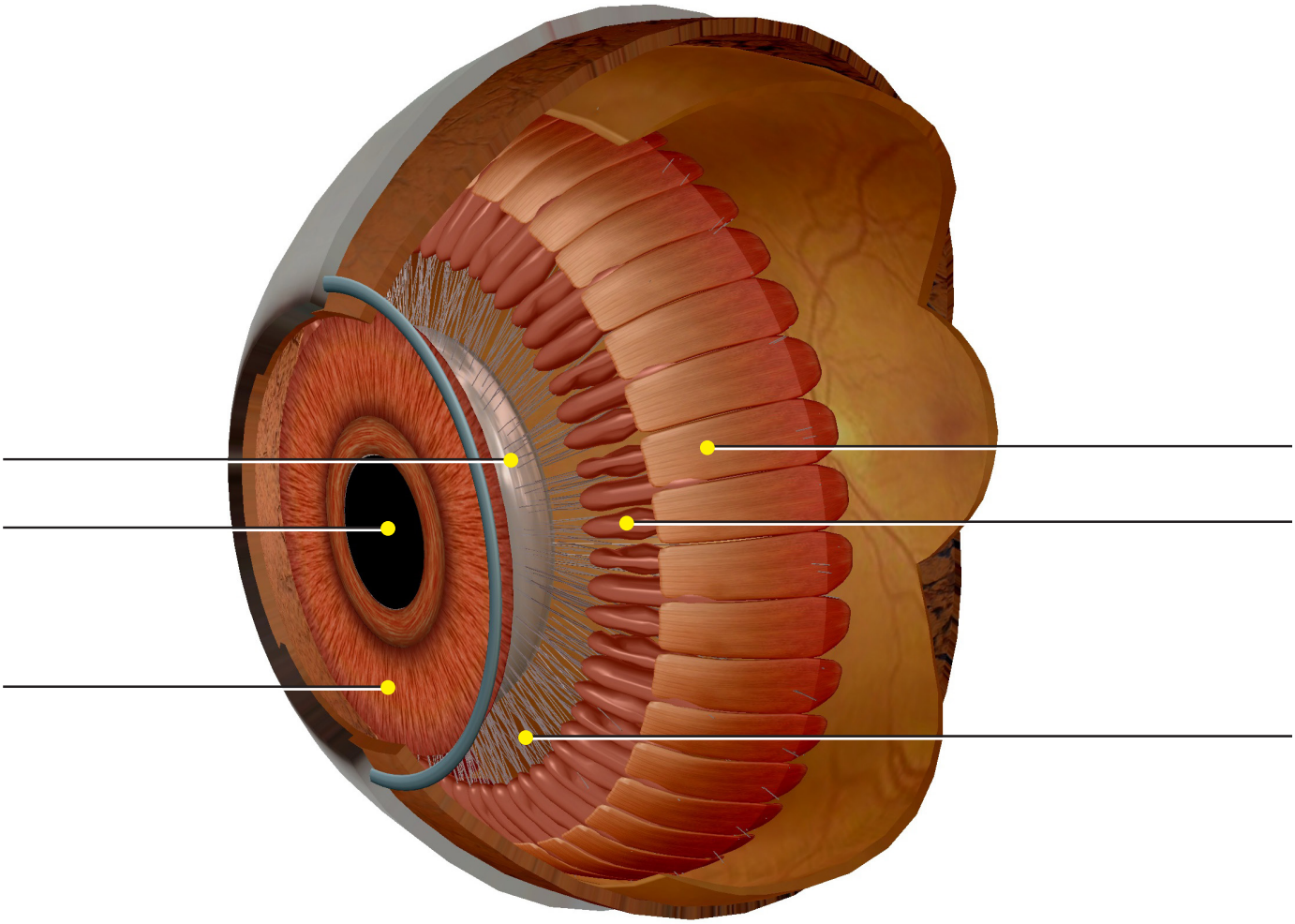
Student Practice

Label the structures in the following figures.

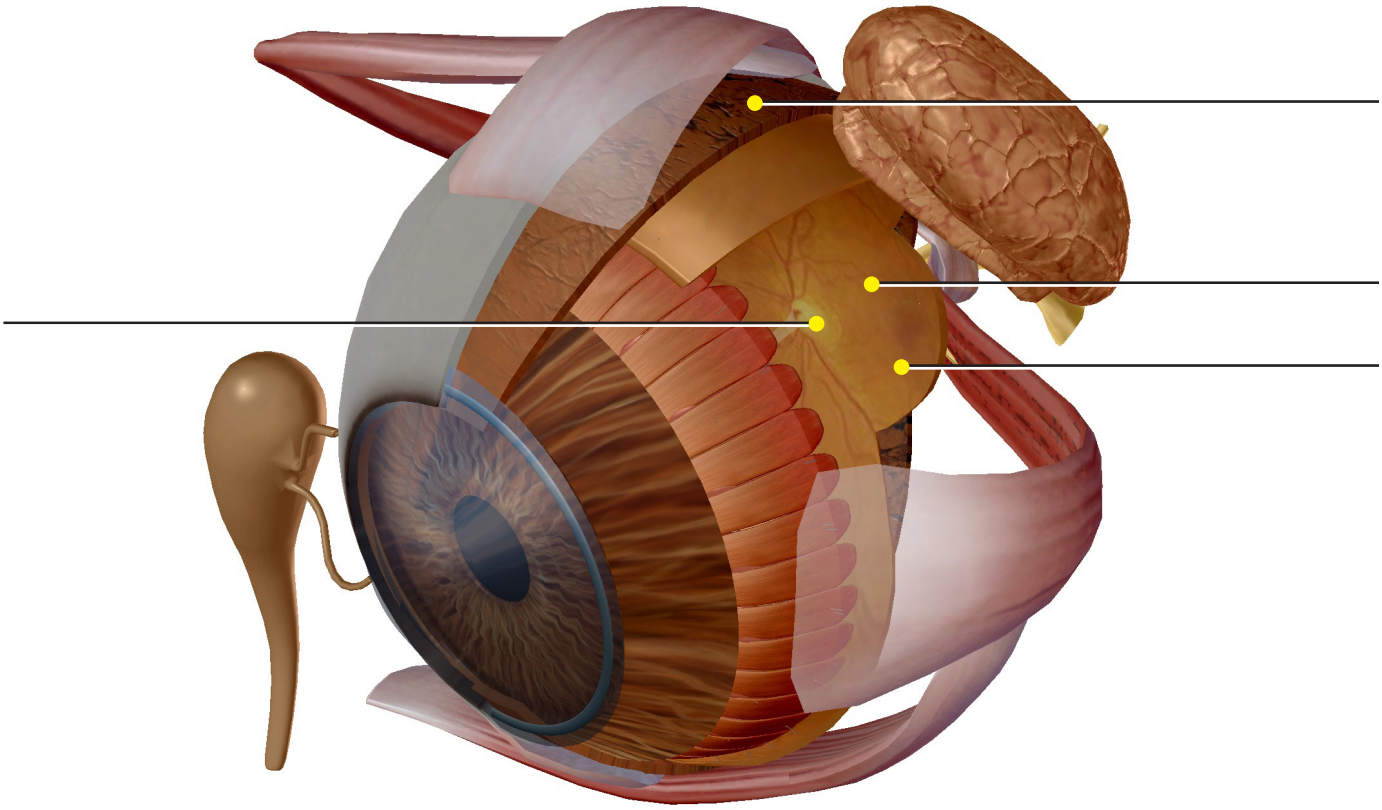
Source: Microanatomy Views: View 1: Eye



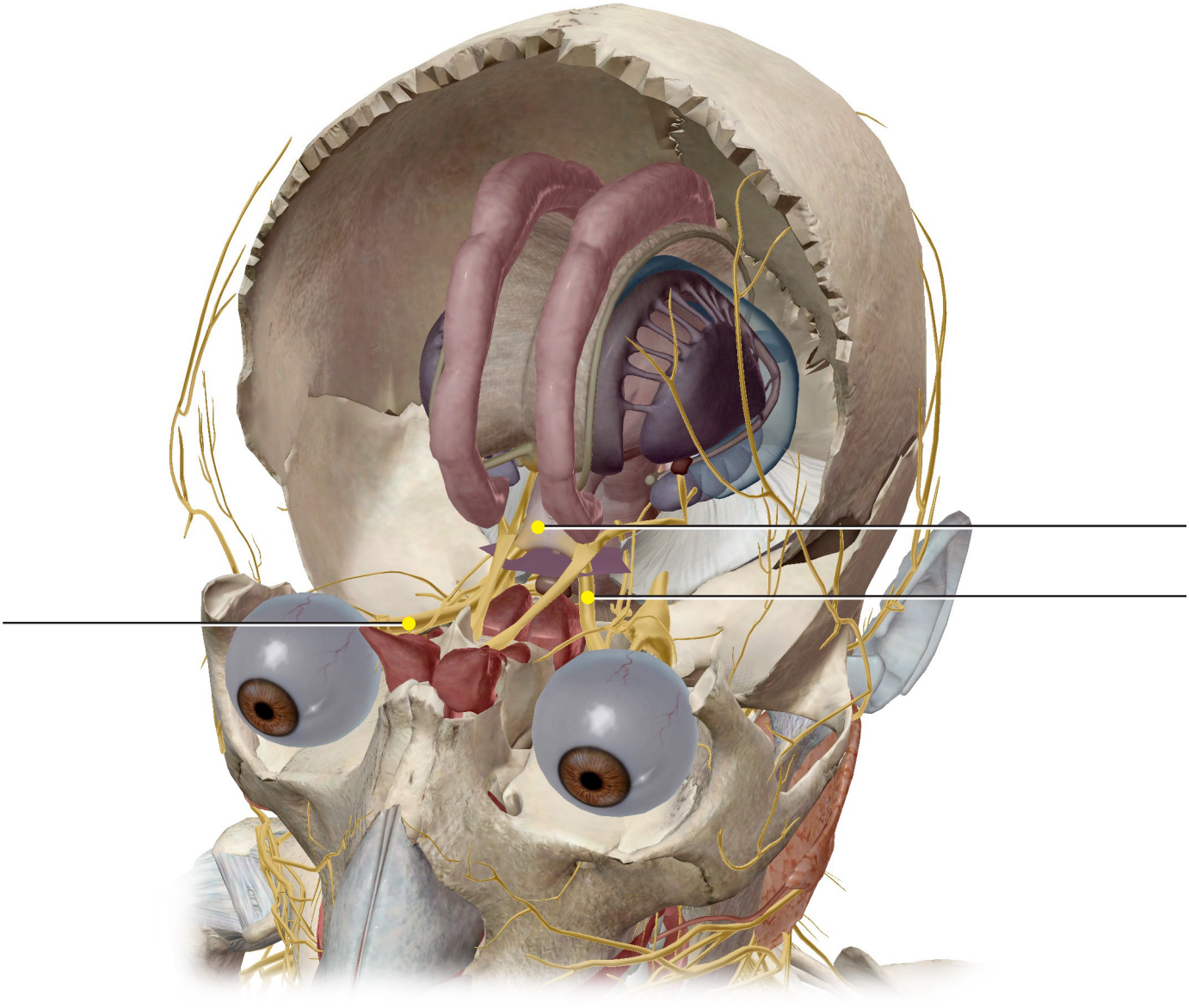
Source: Microanatomy Views: View 3: Lens and Zonular Fibers



Source: Microanatomy Views: View 2: Anatomy and Function of the Eye



Source: Regional System Views: View 1: Head and Neck



Source: Microanatomy Views: View 2: Anatomy and Function of the Eye