Anatomy of the Human Eye/Pig Eye Dissection
Middle School/High School

This guide is for middle school and high school students participating in the AIMS Anatomy of the Human Eye/Pig Eye Dissection. The program will be presented by an AIMS Anatomy Education Specialist. The primary focus will be the anatomy, physiology and function of the structures of the eye. The important connection between the visual system and brain will also be emphasized. Common pathologies and disorders of the eye will be discussed. During the session, students will have the opportunity to dissect the pig eye but also learn about the human eye and its similarities and differences. Included in this guide, you will find additional resources such as important terminology and pre/post tests for your students.

National Science Education (NSES) Content Standards

Content Standard K-12	Unifying Concepts and Processes: systems order and organization; evidence, models and explanation; form and function (Grades 9-12)
Content Standard A	Science as Inquiry (Grades 9-12; Grades 5-8)
Content Standard C	Life Science: matter, energy and organization of living systems (Grs 9-12) Life Science: structure and function in living systems; diversity and adaptation of organisms (Grades 5-8)
Content Standard F	Science in Personal Health and Social Perspectives: personal and community health (Grades 9-12) Science in Personal Health and Social Perspectives: personal health (Grs 5-8)

Show Me Standards (Science and Health/Physical Education)

Science 3	Characteristics and interactions of living organisms
Health/Physical Education 1	Structures of, functions of and relationships among human body systems
Health/Physical Education 2	Principles and practices of physical and mental health
Health/Physical Education 3	Diseases and methods for prevention, treatment and control
Health/Physical Education 5	Methods used to assess health, reduce risk factors, avoid high-risk behaviors
Health/Physical Education 6	Consumer health issues

Missouri Learning Standards (Grades 5-8)

Life Sciences (6-8.LS1.A.1)	Organisms are made of cells; cells carry out all of the basic functions of life
Life Sciences (6-8.LS1.A.3)	Multicellular organisms are organized by varying levels of complexity: cells, tissue, organs, organ systems
Life Sciences (6-8.LS1.A.4)	Body systems interact to carry out key body functions
Life Sciences (6-8.LS1.B.2)	Environmental and genetic factors influence the growth of organisms

Missouri Learning Standards (Grades 9-12)

Life Sciences (9-12.LS1.A.2)	Interacting systems that provide specific functions within multicellular organisms

Lesson Objectives:
Students will complete a dissection of a pig eye, identifying the major internal and external structures of the eye.

Students will identify and understand the general function of the protective structures of the eye and some of the muscles that move the eye.

Students will increase their understanding of the connection between the eye and brain and how pathology, the disease process, toxins or injury can impact that connection.

(Students will participate in a simulated experience to increase their understanding of common conditions, disorders and diseases of the eye, as well as their corresponding treatment considerations and the role of health care professionals in that treatment.)
In-Person Sessions

(Students will participate in a simulated experience to increase their understanding of the effects of drugs and alcohol on the visual and central nervous systems.)
In-Person Sessions

Materials:
Review of Terminology/Vocabulary Reference Guide
Pre/Post Test

Preserved pig eye
Dissecting pad
Scalpel
Forceps
Scissors
Gloves

Pig Eye Dissection
Terminology/Vocabulary Reference Guide

Anterior chamber	Space in eye behind cornea and in front of iris
Aqueous humor	Thin watery fluid that fills space between cornea and iris (anterior chamber). Continually produced by ciliary body, part of eye that lies just behind iris. Nourishes cornea and lens, gives front of eye its form/shape
Blind spot	Small area on retina without receptors that respond to light. An image that falls on this region will NOT be seen. Location where optic nerve exits eye and is on its way to brain.
Canal of Schlemm	Circular canal between cornea and iris that provides an exit for aqueous humor from eye into bloodstream
Caruncle	Small red portion of corner of eye, contains modified sebaceous and sweat glands
Central retinal artery	Supplies blood to retina as it branches into smaller segments upon leaving optic disc
Central retinal vein	Vessel that carries blood away from retina
Choroid	Thin blood-rich membrane that lies between retina and sclera, responsible for supplying blood to retina
Ciliary body	Thickened part of vascular portion of eye that lies between iris and choroids that produces aqueous humor
Cones	Photoreceptor cells in retina of eye that function best in bright light and provide for color vision
Conjunctiva	Thin transparent tissue that covers outer surface of eye. Begins at outer edge of cornea, covering visible part of sclera and lining inside of eyelids. Flexible membrane that seals off back of eye and attaches to skin at corners of eye. Nourished by tiny blood vessels, contains many tiny tear-secreting and mucus-forming glands that protect eyes from damage due to dryness.
Cornea	Clear dome-shaped surface that covers front of eye
Fovea centralis	Tiny pit located in macula of retina that provides clearest vision of all; contains only cones
Inferior oblique	Ocular muscle that elevates eye and turns it laterally
Inferior rectus	Ocular muscle that primarily rotates eye downward and secondarily rotates top of eye away from nose (laterally)
Iris	Colored part of eye; partly responsible for regulating amount of light permitted to enter eye

Pig Eye Dissection
Terminology/Vocabulary Reference Guide (Continued)

Lateral rectus	Ocular muscle that moves eye outward, away from nose
Lens (crystalline lens)	Transparent structure located behind iris that can change shape/contract to alter its shape and to allow precise focusing power of light rays onto retina
Macula lutea	Focusing portion of eye that allows us to see fine details clearly; contains mostly cones
Medial rectus	Ocular muscle that moves eye inward, toward nose
Optic disc	Point inside eye where nerve that leads from eye to brain (optic nerve) leaves eye (also called the blind spot).
Optic nerve	Bundle of nerve fibers that connect retina with brain, carries signals of light, dark and colors to area of brain (visual cortex) which assembles signals into images (i.e., our vision).
Ora serrata	Serrated margin between retina and ciliary body
Orbit	Bony socket that provides protection from injury; where eyeball lies in pads of fat
Posterior chamber	Behind iris and in front of lens
Pupil	Opening in middle of iris through which light passes to back of eye; controls amount of light that enters eye by changing its diameter in response to light conditions
Retina	Light-sensitive nerve layer that lines back of eye; senses light and creates impulses that are sent through optic nerve to brain
Rods	Photoreceptor cells in retina that are responsible for vision in dim light and for peripheral vision; more sensitive to light than cones but do not provide either sharp images or color vision
Sclera	White visible portion of eyeball; tough outer coat that muscles that move eyeball attached to
Superior oblique	Ocular muscle that depresses eye and turns in laterally
Superior rectus	Ocular muscle whose contraction primarily turns eyeball upward and secondarily rotates top to the eye toward nose (medially)
Suspensory ligament	Ligament that supports an organ or body part, especially a fibrous membrane that holds lens of the eye in place
Vitreous humor	Clear gel that fills the main cavity of eye

Disorders/Conditions of the Eye Terminology/Vocabulary

Astigmatism	Condition in which unequal curvatures in parts of the cornea or lens lead to blurred vision
Cataract	Clouding of normally clear lens of eye; similar to a frosted or yellow window. Can make vision blurry, hazy or less colorful. Surgery can replace clouded lens with a new artificial one.
Color Blindness	Inherited condition due to a congenital lack of one or more of cone types
Conjunctivitis or "pink eye"	Inflammation of conjunctiva, clear membrane that covers white part of eye and lines inner surface of eyelids
Diabetic Retinopathy	Eye disease that causes vision loss and blindness in those with diabetes. Affects blood vessels in retina (light-sensitive layer of tissue in back of eye (dark floating spots or streaks in cobwebs, blurriness especially in center of vision, trouble reading or seeing faraway objects). Fluctuations in blood sugar levels may cause a change in vision. Ability to perform visio-dependent tasks can vary between morning and evening and day-to-day.
Glaucoma	Group of eye diseases that gradually steals sight without warning and often without symptoms. Vision loss caused by loss of ganglion cells and damage to optic nerve. It was once thought that high intraocular pressure (IOP) was the main cause of this optic nerve damage. Although IOP is a risk factor, other factors are involved as those with "normal" IOP can experience vision loss from glaucoma. Usually starts with peripheral vision loss.
Homonymous Hemianopsia	Visual field loss or deficit affecting corresponding halves of both eyes. It can be caused by a number of disorders that affect the brain such as a stroke, tumor or traumatic brain injury. Reading, scanning and avoiding obstacles are all difficult tasks.
Hyperopia or Far-sightedness	Occurs when light entering the eye focuses behind the retina instead of directly on it. Caused by a cornea that is flatter or an eye that is shorter; usually results in trouble seeing up close but may also have difficulty seeing far away
Macular Degeneration	Age-related eye disease that blurs sharp central vision
Myopia or Near-sightedness	Occurs when light entering the eye focuses in front of the retina instead of directly on it. Caused by a cornea that is steeper or an eye that is longer; usually results in trouble seeing far away
Presbyopia	Vision condition in which crystalline lens of eye loses its flexibility, focusing on close objects is difficult; occurs with process of aging

Disorders/Conditions of the Eye Terminology/Vocabulary (Continued)

Retinal Detachment	Occurs when sensory and pigment layers of retina separate; most frequent in middle-aged and elderly. Considered an ocular emergency that requires immediate medical attention and surgery; can cause devastating damage to vision if untreated
Retinitis Pigmentosa	Genetic disease that causes gradual vision loss by damaging retina (light-sensitive layer of tissue in back of eye). Night vision, peripheral vision and color vision may all be affected, as well as increased sensitivity to bright lights.

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Anatomy of the Human Eye/Pig Eye Dissection
Pre/Post Test

1. The first structure of the eye that light passes through on its way to the retina is the _____.
2. This is the gelatinous-like fluid that fills the space between the retina and the lens and comprises 80% of the eye's volume _____.
3. This small area near the center of the retina has a high concentration of cones and is responsible for high acuity vision _____.
4. This tough outer covering of the eye is responsible for the "white of the eye" _____.
5. The six muscles which control the movement of the eye are:
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____
   f. _____
6. These cells in the retina respond to bright light and are mainly responsible for the eye's color sensitivity _____.
7. This visual disorder occurs when light rays are focused at a point in front of the retina _____; it is also known as _____.
8. The _____ conducts visual impulses from the retina to the brain.
9. This condition is a clouding of the eye's natural lens which results from a clumping together of some proteins in the eye _____ .
10. This colored circular muscle is responsible for human eye color and adjusts in size to regulate the amount of light entering the eye _____.
11. Which are more numerous in the human eye, rods or cones? _____
12. This is the term used to describe the automatic adjustment of the eye for seeing at different distances, affected mainly by changes in the shape of the eye _____.

Bonus: Are you interested in a career in medicine, science or healthcare?

_____

Anatomy of the Human Eye/Pig Eye Dissection
Pre/Post Test Answers

1. Cornea
2. Vitreous humor
3. Macula
4. Sclera
5. Muscles that control the movement of the eye:
    a. Superior rectus
    b. Inferior rectus
    c. Lateral rectus
    d. Medial rectus
    e. Superior oblique
    f. Inferior oblique
6. Cones
7. Myopia or near-sightedness
8. Optic nerve
9. Cataract
10. Iris
11. Rods
12. Accommodation