



South Florida Science Museum Fetal Pig Dissection Program Curriculum

PROGRAM DESCRIPTION

In order to gain better understanding of mammal anatomy, including humans, students study a fetal pig through dissection. In this advanced dissection lab, our expert educator will provide specimens, equipment and any worksheets. The students will perform a whole-body dissection of a vertebrate, identify the major anatomical features of the vertebrate body in a dissected specimen, and understand the relationship between structure and function in the vertebrate body.

SUNSHINE STATE STANDARDS

Grades 6-8:

SC.6.L.14.1: Describe and identify patterns in the hierarchical organization of organisms from atoms to molecules and cells to tissues to organs to organ systems to organisms.

SC.6.L.14.5: Identify and investigate the general functions of the major systems of the human body (digestive, respiratory, circulatory, reproductive, excretory, immune, nervous, and musculoskeletal) and describe ways these systems interact with each other to maintain homeostasis.

SC.6.L.15.1: Analyze and describe how and why organisms are classified according to shared characteristics with emphasis on the Linnaean system combined with the concept of Domains.

Grades 9-12:

SC.912.L.14.50: Describe the structure of vertebrate sensory organs. Relate structure to function in vertebrate sensory systems.

SC.912.L.15.6: Discuss distinguishing characteristics of the domains and kingdoms of living organisms.

MATERIALS

- Fetal pig specimen (1 per 4 students)
- Dissection trays
- Goggles
- Gloves
- Dissection tools (scalpel, forceps, & probes)

VOCABULARY

Mammal- an animal that has hair, gives live birth, has mammary glands, and is warm-blooded /endothermic

Urogenital- refers to an opening that serves both the urinary (excretory) and the reproductive systems.

BACKGROUND INFORMATION

These pigs were not raised for the purpose of dissection; they are a byproduct of the pork industry. Most pigs were stillborn and would be discarded were they not reutilized for educational purposes.

INTRODUCTION

During the South Florida Science Museum's Fetal Pig Dissection, you will examine in some detail the external and internal anatomy of a fetal pig (*Sus scrofa*). As the pig is a

mammal, many aspects of its structural and functional organization are identical with those of other mammals, including humans. Thus, a study of the fetal pig is in a very real sense, a study of humans.

During these exercises, we ask that you keep a couple points in mind. First, be aware that "to dissect" does not mean "to cut up," but rather primarily "to expose to view." Actual cutting should be kept to a minimum. Tissues are picked and teased apart with needle probes, forceps, and blunt probes in order to trace the pathways of blood vessels, nerves, muscles, and other structures. Never cut or move more than is necessary to expose a given part. Second, pay particular attention to the spatial relationships of organs, glands, and other structures as you expose them. Realize that their positions are not random.

SAFETY AND HYGIENE

1. Practice safe hygiene when dissecting. Do not place your hands near your mouth or eyes while handling preserved specimens. Although the preservatives that are used are non-toxic to the skin, they may cause minor skin irritations. If the preservative gets on your skin, wash with soap and warm water.
2. If the preservative gets in your eyes, rinse them thoroughly with the safety eyewash.
3. Wear lab gloves up until the very end, when you will be instructed to remove them.
4. You should only hold a cutting tool if you are using it. Otherwise all tools should remain in the tray. You will be given proper directions on how to handle the tools.
5. Do not move forward in the dissection until the educator has instructed you to do so.

PROGRAM OUTLINE

Mammalian Characteristics

- hair
- live birth
- mammary glands
- warm blooded /endothermic

External Anatomy

ANATOMICAL ORIENTATION

dorsal: toward the back of the body

ventral: toward the underside of the body

anterior (cranial): toward the head end of the body

posterior (caudal): toward the tail end of the body

lateral: to the side of the body

median: toward the center of the body

right and left: the pig's right and left, not yours!

superficial: lying closer to the body surface

deep: lying under or below

*The terms anterior and posterior are sometimes used synonymously with ventral and dorsal, respectively, for humans.

Regions of the body

head (cranial) region

neck (cervical) region

trunk region (thoracic region)

tail (caudal) region (abdominal region)

Gender

Sometimes, depending on age, you can determine the sex of your piglets.

Female: Look for a single urogenital opening just ventral to the anus (beneath their tail). It should look like a triangular bit of tissue. A prominent genital papilla projects from the urogenital opening.

Male: Look for the scrotum, a sac-like swelling containing the testes and located ventral to the anus. The male urogenital opening is faintly visible just posterior to the umbilicus. Both have mammary papillae (nipples) because every mammal during the early stages of development is female. It takes additional hormones for the fetus to become male.

Umbilical Cord

The umbilical cord transports nutrients from the mother pig to the piglet in utero. It connects the fetus to the placenta of the mother and later becomes the navel. Cut off the very tip (0.5 cm) of the umbilicus to more clearly see the following:

- umbilical arteries: two arteries, carry deoxygenated blood from fetus to placenta
- umbilical vein: a single large vein, carries oxygenated blood from placenta to fetus

Head (find the following)

pinna (auricle): external ear
external nares (nostrils)
upper and lower eyelids
nictitating membrane (third eyelid)

Eyes

No pigmentation to the eyes yet. Pigmentation begins to appear after they are born.

Appendages

1. On the forelimb find the shoulder, elbow, wrist, and digits.
2. On the hindlimb find the hip, knee, ankle, heel, and digits.

Similarities between pigs and humans

Muscles

almost every muscle found in humans is also found in pigs (with some differences in size and location because pigs are quadrupeds and humans are bipeds)

Internal Organs

pigs have all the same thoracic and abdominal organs as humans with some variations (ex: liver and large intestine)

PIG:

Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Artiodactyla
Family: Suidae
Genus: *Sus*

HUMANS:

Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Primates
Family: Hominidae
Genus: *Homo*

DISSECTION- INTERNAL ANATOMY

4 members to a group

2 members hold the legs

CUTS DEPEND ON THE SEX! (Demonstrate on board)

Cut from anus to the diaphragm, make slits on the sides (like book covers)

Cut from the diaphragm to the throat region

****Superficial dissection-** trachea, heart, lungs, diaphragm, liver, spleen, intestines, umbilical artery, umbilical vein, urinary bladder

****Deep dissection-**

Liver (the largest organ in the abdominal cavity)

Same functions as humans (produces red blood cells, produces bile, filters blood)

Pigs have 5 lobes, humans have 4 lobes

Gall Bladder

Located under right lateral lobe of the liver (a small, usually greenish sac)

Stores bile secreted by the liver

Digestion starts at the mouth → esophagus → stomach → small intestine → large intestine/colon → rectum → anus

Stomach

Pigs have ruminant stomachs (aka chambered – esophageal, cardiac, pyloric)

Light colored sac

Nothing in it: they haven't eaten yet (fetal)

Note the folds (rugae). Many glands that secrete pepsinogen and hydrochloric acid are embedded in the wall of the stomach.

Small Intestine

Minerals and water are reabsorbed

Lightly packed and coiled

Large Intestines

More absorption and waste packaging

Pigs have spiral large intestine, humans have straight

Spiral valve intestines- allow the food to stay in their systems much longer, allowing for greater reabsorption of minerals, greater digestion and sometimes decreases the metabolism of the animal (they don't have to eat as often as humans).

Pancreas

Between the stomach and the small intestine

Secrets digestive enzymes and other substances into the small intestines

Spleen

Elongated, thin, red-brown organ which lies across the stomach

Not part of the digestive tract, largest organ of the lymphatic system

Stores and release red blood cells into the bloodstream, recycles old red blood cells from circulation, and produces and white blood cells

Can be permanently removed with little or no serious effects

Kidneys

Part of the excretory system

Two bean shaped organs

Removes metabolic waste from the blood and monitor and adjust the composition of the blood (particularly water and salts. This way, the cells of the body are bathed in a fluid of constant composition.

In humans, the kidneys filter 1500 liters of blood a day

Urinary Bladder

Part of the excretory system

Elongated shape, located between the umbilical cord arteries at the base of the umbilical cord

Here, urine is temporarily stored

Reproductive System

Males have testes located where the hind legs attach to the hip

The small tube lying across the top of the bladder is the penis

Females have 2 small ovaries located just above the umbilical cord

They have what's called a uterine horn (allows them to have 8-10 piglets per litter (we don't have this)

Respiratory System

Trachea

Looks like a vacuum hose (cartilaginous rings so it doesn't collapse)

Lungs

Right lung has 4 lobes, left lung has 2 lobes

Trachea → Branchiole tubes → Branchioles → alveoli (sacs for gas exchange)

Circulatory System

Heart

4 chambered heart

2 atrium at top are small – pump blood to lungs

2 ventricles are divided by the coronary artery – pump blood to body

