The Taxonomy & Physiology of the

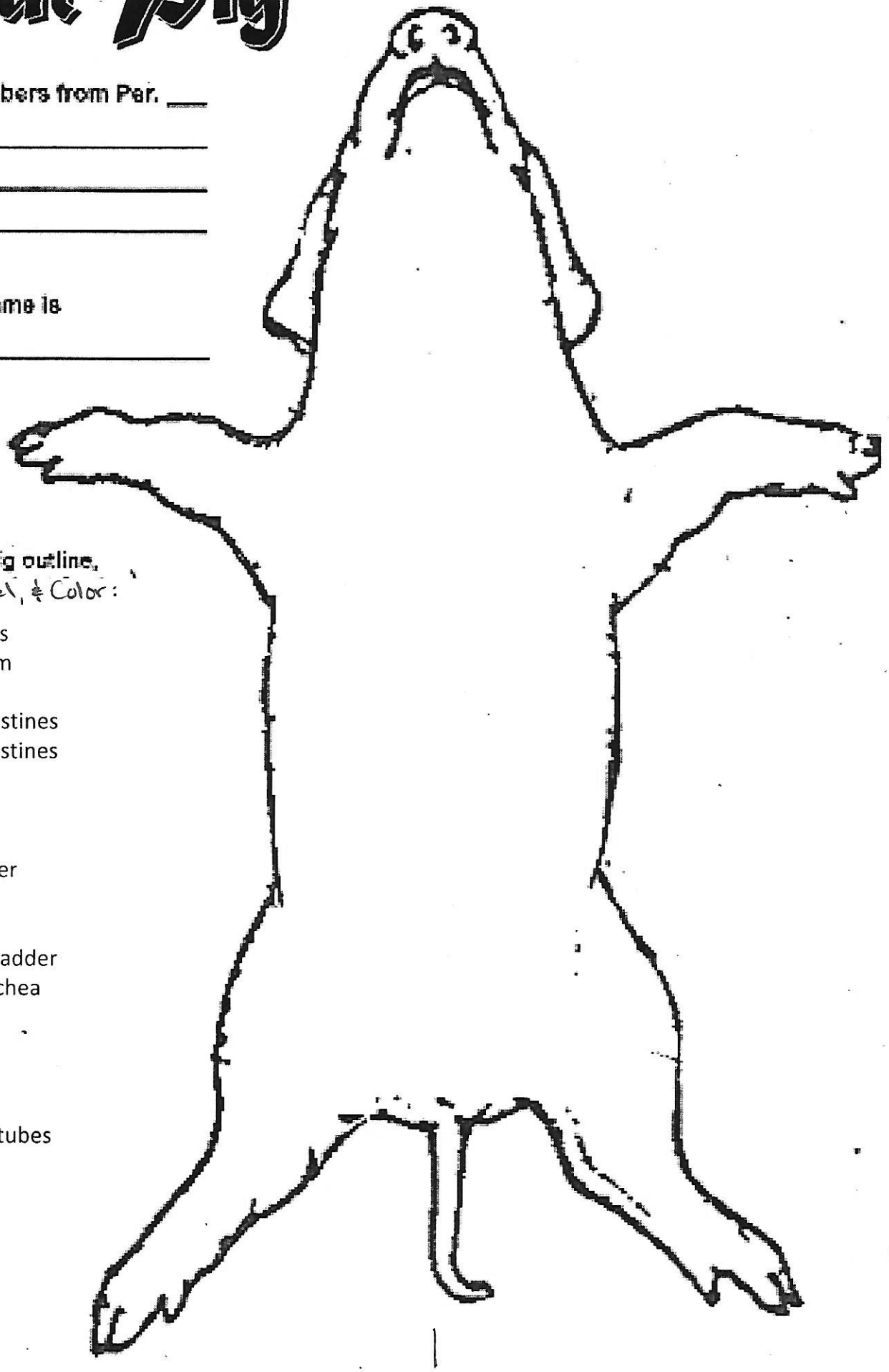
Fetal Pig

Group Members from Per. ___

1. _____
2. _____
3. _____

Our Pigs name is

_____

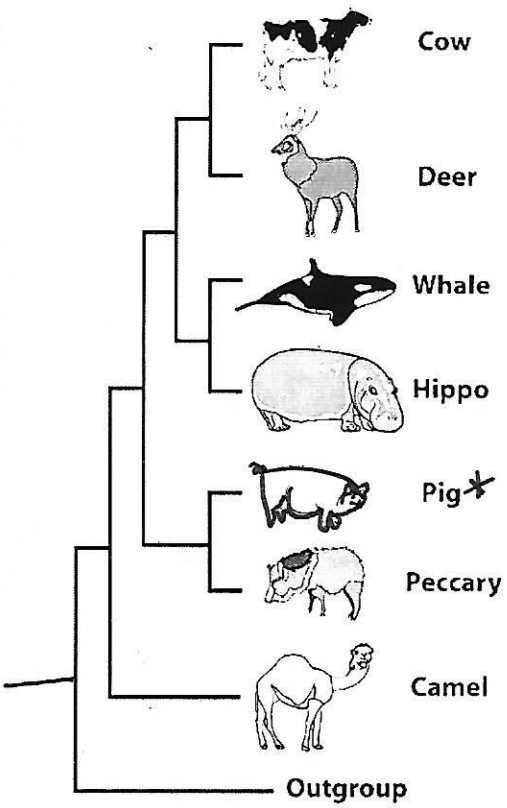


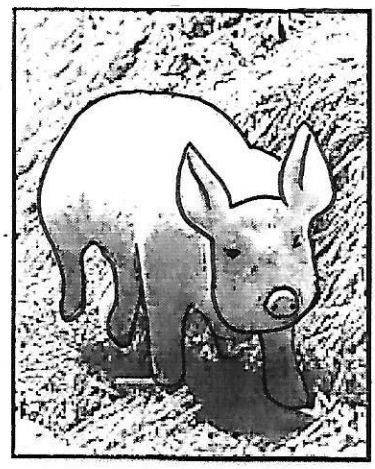
Using fetal pig outline,
Draw, Label, & Color:

A. Esophagus
B. Diaphragm
C. Stomach
D. Small intestines
E. Large intestines
F. Cecum
G. Rectum
H. Liver
I. Gallbladder
J. Pancreas
K. Kidneys
L. Urinary bladder
M. Lungs Trachea
N. Larynx
O. Heart
P. Uterus
Q. Ovaries
R. Fallopian tubes
S. Vagina
T. Spleen

Fetal Pig Taxonomy

Kingdom: Animalia
- Phylum: Chordata
  - Subphylum: Vertebrata
    - Superclass: Gnathostomata
      - Class: Mammalia
        - Subclass: Theria
          - Infraclass: Eutheria
            - Order: Artiodactyla
              - Family: Suidae
                - Genus: Sus
                - Species: scrofa
                - Full scientific name: Sus scrofa
                - Common name: domestic pig





Phylum Chordata

The fetal pig is just one of the many animals that belong to Phylum Chordata, which contains some of the most intelligent animals in Kingdom Animalia. Phylum Chordata includes the protochordates (tunicates & lancelets), and the vertebrates (fishes, amphibians, reptiles, birds, and mammals). They inhabit marine, freshwater, and terrestrial environments and are distributed worldwide.

Although there are differences between these animals, all chordates share the following characteristics at some point in development:

1. **Notochord** – Considered a precursor to the modern vertebrate endoskeleton. In most animals, it becomes the cartilage within the vertebrate column.
2. **Dorsal hollow nerve cord** – A fluid filled nerve that transmits impulses and helps form the central nervous system. Most animals retain the nerve cord into adulthood.
3. **Pharyngeal gill slits** – Move water through the pharynx. In many animals, the slits never actually perforate the pharynx but form vestigial pouches.
4. **Post-anal tail** – Generally provides motility in an aqueous environment. In humans, the post-anal tail is a vestigial structure called the coccyx.

All four characteristics are usually only present during the embryonic stage. The embryo of a pig looks almost identical to the embryo of a human. This similarity gives clues to a shared chordate ancestor. One of the few animals that retains all four characteristics during adulthood is the lancelet of Subphylum Cephalochordata.

Subphylum Vertebrata

The animals of Phylum Chordata are currently grouped into the protochordates and the euchordates. The protochordates consist of the two subphyla (shown below) and the euchordates are in Subphylum Vertebrata:

Phylum Chordata

Subphylum Urochordata	Subphylum Cephalochordata	Subphylum Vertebrata
tunicates & sea squirts	lancelet, e.g.: Amphioxus	all vertebrate animals

Typically, the protochordates lack a cranium to protect the brain. They also lack an endoskeleton of vertebrae. In the lancelet, the notochord serves as the endoskeleton. Tunicates lack the classic endoskeleton, but have a tunic or test that provides support. The vertebrates all possess an axial skeleton and a cranium. Vertebrates include lamprey, hagfishes, sharks, rays, fishes, amphibians, reptiles, birds, and mammals.

In addition to the specific four features listed previously, vertebrates also share the following characteristics:

- **Cephalization**
- **Bilateral symmetry**
- **Metamerism**
- Presence of a true **coelom**
- **Endoskeleton**
- **Striated muscles**
- Integument
- Paired limbs
- **Deuterostome** development
- **Triploblastic** development
- **Organ system** level of organization
- **Closed circulatory system**
- **Complete digestive system**
- **Advanced nervous system**
- **Excretory system of kidneys**
- **Endocrine system**

Class Mammalia

Mammals are some of the most diverse animals living today. They can range in size from the tiny shrew that weighs only 0.002 kg, to the largest living animal, the blue whale, which can weigh up to 115,000 kg. Mammals utilize a number of adaptive strategies for survival. Some are efficient predators while others are herbivores that have specialized digestive systems to process plant matter. Mammals are found in virtually every ecosystem around the world. They inhabit terrestrial, arboreal, freshwater, and marine environments. Certain mammals, such as the bat, have the ability of flight. Some are completely nocturnal while others are diurnal. Despite the wide variety of shapes and sizes of mammals, they all share certain characteristics:

- **Hair**
- **Specialized teeth**
- **Muscular diaphragm**
- **Soft palate and secondary bony palate**
- **Axial & appendicular skeleton**
- **Endothermic**
- **Homeothermic**
- **Four chambered heart**
- **Integument of epidermis, dermis, and glands including mammary glands**

Read: **Why study the fetal pig?**

In many ways the pig is a typical example of a mammal. It possesses all of the classic mammalian characteristics. In terms of physiology, the pig is almost identical to humans. The major organs are all the same and differ only in small ways. For example, the human liver has four lobes whereas the pig liver has five. Given the fact that pigs are quadrupedal and humans are bipedal, there is an amazing similarity in skeletal and muscle structure. Fetal pigs are small and easy to store. They are obtained from slaughterhouses producing pork. Pregnant sows are harvested for their meat and the fetal pigs are taken for educational and research purposes. Basically, this is a recycling of biological material that would otherwise go to waste. A single sow can produce a litter of piglets that can number from seven up to eighteen. For these reasons, they are relatively inexpensive and easy to obtain. Fetal pigs have cartilaginous bones that have yet to harden, so they are not difficult to cut into. Most of the internal structures can easily be seen without the aid of a microscope or magnifying glass. Certain features are easier to see in a fetal pig that has gestated for a longer period of time. Later, you will estimate the age of your pig according to its body length.

Because of their similarity to humans, pigs have been used extensively in biomedical research. Pigs are susceptible to some of the same diseases as humans, (e.g. influenza). The primary areas of swine research are with the cardiovascular, urinary, and digestive systems. Since pigs are relatively hairless like humans, they have also been used in dermal research.

All vertebrates exhibit **bilateral symmetry**, in which the animal can be divided into an equal mirror image, called the sagittal plane. Other anatomical planes are the frontal plane and the transverse plane (figure 2).

figure 2 - Anatomical terms

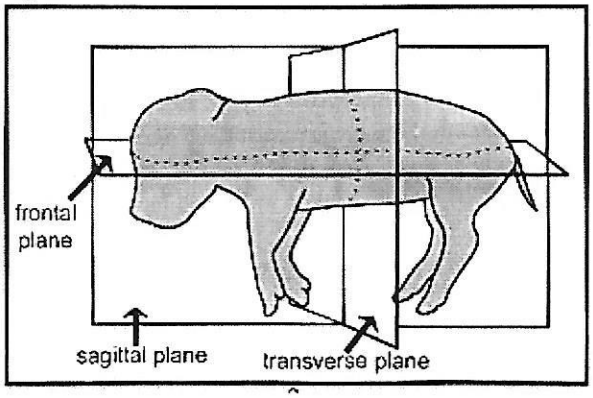
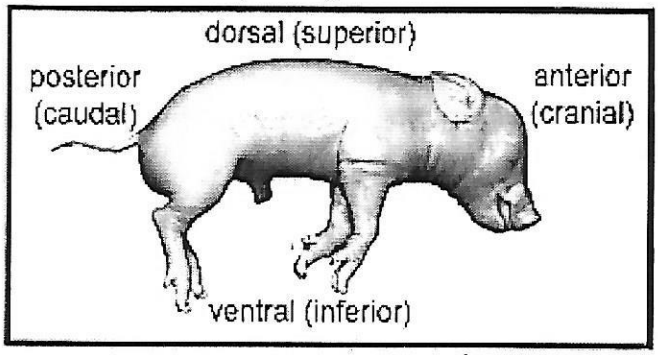


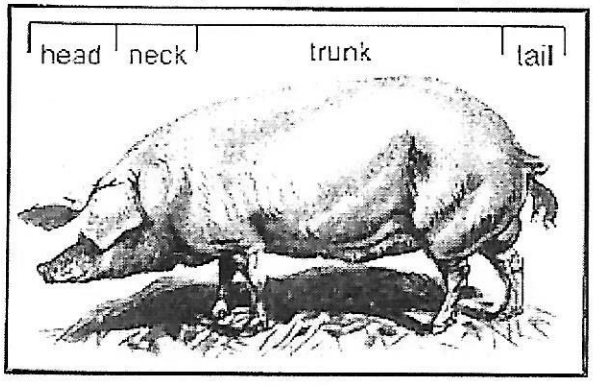
figure 3 - Terms of symmetry



When referring to an animal that is bilateral, you should know the following terms (note: the terms in parantheses are used specifically for animals that are quadrupeds): (figure 3).

- Anterior (cranial) – on or towards the head region
- Posterior (caudal) – on or towards the tail region
- Dorsal (superior) – refers to the upper surface
- Ventral (inferior) – refers to the under surface

figure 4 - Adult pig showing vertebrate body regions



External Features -

Materials:

* Fetal pig * Dissection pan * Ruler (cm) *String
* Protective gloves * Probe * Scissors

1. Obtain a fetal pig, dissection tray, gloves and other items listed above.
2. Optional: wear gloves when handling the specimen. Always: wash your hands.

When you obtain your fetal pig, you may notice a wrinkled appearance in the skin. This is due to the preservation and storage process. Some of the pigs may have pigmented skin.

3. Measure the body of your pig by taking the string from the tip of the snout to the base of the tail along the dorsal side.
4. Mark the length of your string and use your ruler to determine its length.
5. Determine the age of your pig by filling out the chart below and referring to table 1.

Length of your pig:_____ Approximate age of your pig:_____

Table 1 – Determining the age of the fetal pig

age of the fetus (in weeks)	length of the fetus
3	1.1-1.3 cm
7	2.6-3.8 cm
14	22-23 cm
16-17(full term)	~30 cm

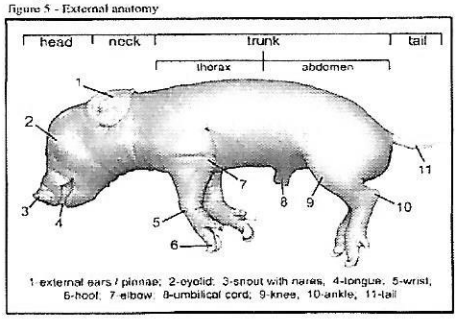
Observations:
Any Qualitative or Quantitative Data

6. Continue your observations of the external anatomy. Use figure 5 to assist in the identification of structures.

Recall that the typical body plan of a vertebrate is the **head, trunk**, and **tail**. The fetal pig is a terrestrial animal, so it also has a **neck** as part of its body plan. The trunk is divided into two parts, the **thorax** and the **abdomen** (figure 3). On the head you will see the fleshy, **external ears** called **pinnae**, the eyes with the upper and lower eyelids, the snout containing the mouth and tongue, and small sensory hairs called **vibrissae**. The pinnae are cartilaginous like human ears. The **snout** is also cartilaginous and contains the nares for the passage of air. The end of the snout is strengthened by a bony region to allow the pig to dig into the soil in search of food. The snout also serves to house many olfactory receptors that give the pig an efficient sense of smell. Pigs have been used to help humans find truffles, a type of mushroom that grows wild in the forest and is considered a delicacy.

Recall that **paired limbs** are one of the typical features of all mammals. When you look at the external anatomy of your pig, you will notice different locations for the **wrists, elbows, knees**, and **ankles** in comparison to humans. This is because the pig is a quadrupedal animal in contrast to the bipedalism of humans.

Figure 5 - External anatomy

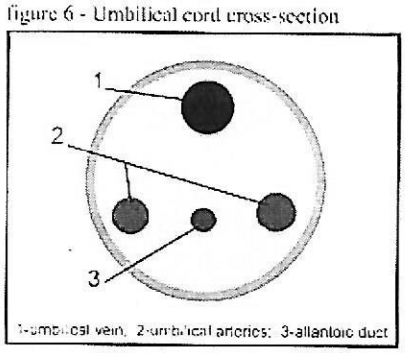


1-external ears / pinnae; 2-eyelid; 3-snout with nares; 4-tongue; 5-wrist; 6-hoof; 7-elbow; 8-umbilical cord; 9-knee; 10-ankle; 11-tail

7. With your scissors, cut off a small portion of the umbilical to see the structures within. Use figure 6 to assist in identification.

One of the most noticeable features of any fetal mammal from Infraclass Eutheria is the umbilical cord. The fetus grows within the uterus and is nourished by the mother through the placenta. The umbilical cord is how oxygen and nutrients are delivered to the growing fetus.

figure 6 - Umbilical cord cross-section



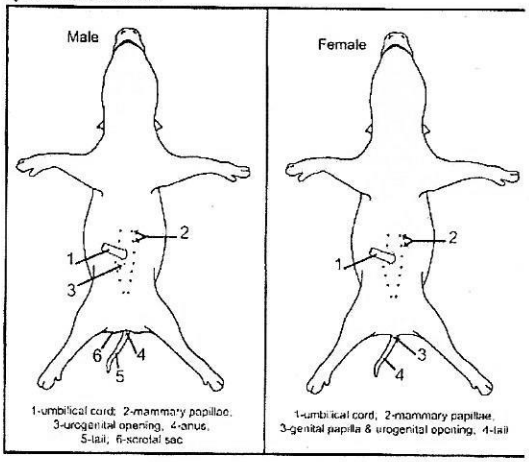
1-umbilical vein; 2-umbilical arteries; 3-allantoic duct

Highly oxygenated blood is transferred to the fetus through the **umbilical vein**. Partially oxygenated blood is removed from the fetus through the **umbilical arteries**. Metabolic wastes are removed through the **allantoic duct** which is connected to the fetus' allantoic bladder.

8. Determine the gender of your pig and observe its structures. Use figure 7 to assist you. Make sure that you observe another student's pig of the opposite gender.
9. Circle the gender of your fetal pig:

male female

figure 7 - Gender differences

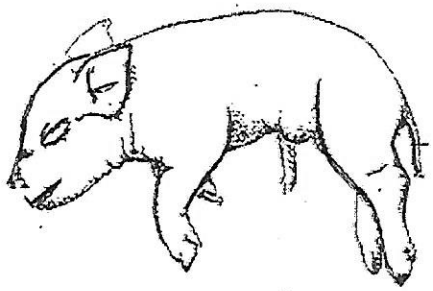


1-umbilical cord; 2-mammary papillae; 3-urogenital opening; 4-anus; 5-tail; 6-scrotal sac

1-umbilical cord; 2-mammary papillae; 3-genital papilla & urogenital opening; 4-tail

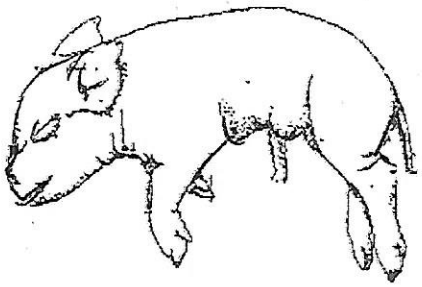
Bath · Examine · Bag

Fetal Pig Dissection: *External*



Using the lateral outline of the Fetal Pig, draw the planes and directions onto the outline:

1. Sagittal
2. Frontal
3. Distal
4. Dorsal
5. Caudal
6. Ventral
7. Transverse
8. Proximal



Using the Lateral Outline of the Fetal Pig, label:

9. Head
10. Neck
11. Trunk
12. Tail
13. Elbow
14. Umbilical cord
15. Nares (external nostrils)
16. Pinnae (external ears)
17. Eyelid
18. Anus
20. Ankle
21. Hoof
22. Wrist
23. Tongue
24. Nictitating membrane

Questions:

1. Is the pig digitigrade, unguligrade, or plantigrade? Explain.
2. Are pigs herbivores, carnivores, or omnivores? Explain.
3. Why is the fetal pig a good specimen to dissect?
4. How many digits doe the pig have?
5. Do you see or fell hair on the surface of the pig's skin?
6. Classify your pig: Kingdom, Phylum, Class, Order, Family, Genus, Species)
7. Is the pig biped or quadruped? Explain.

Read: **The Skeletal System –**

The skeletal system of a pig is typical for many quadrupedal mammals. You will not be using your fetal pig to study this system. The bones of your fetal pig have not yet hardened, or ossified. At this stage of development, they are primarily composed of cartilage. It can be extremely difficult to remove the flesh off of the bones of a fetal pig. For this reason, it is better to study a specimen of some other small mammal that is an adult. This guide provides a detailed illustration for your use.

Once the animal is born, the bones harden. Typically, a bone contains the shaft, or **diaphysis**, and the extremities, or **epiphyses**. The diaphysis is the interior of the bone where marrow is found. The epiphysis is where growth occurs.

The skeleton of a mammal is described as having two major regions: the **axial skeleton** and the **appendicular skeleton** (table 2):

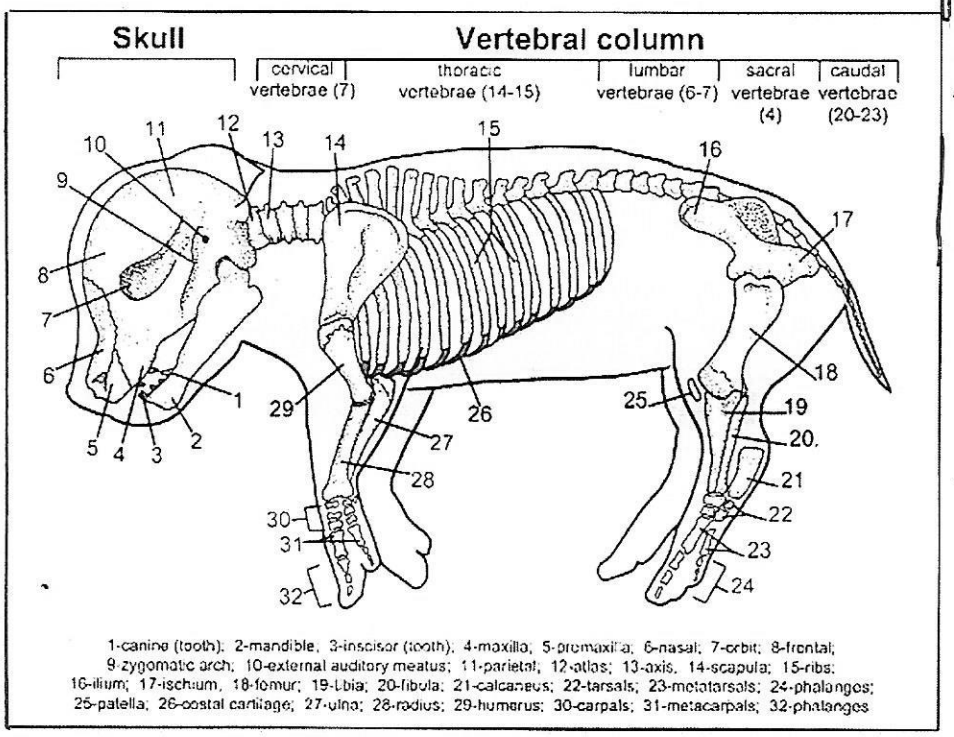
Table 2 - Axial and appendicular skeleton

Axial skeleton	Appendicular skeleton
skull	pectoral girdle
vertebral column	pelvic girdle
sternum & ribs	appendages

The vertebral column is divided into the cervical, thoracic, lumbar, sacral, and caudal vertebrae. The number of vertebrae can vary amongst mammals (table 3).

Table 3 - Vertebrate comparisons

Type of vertebrae	Pig	Human
Cervical	7	7
Thoracic	14-15	12
Lumbar	6-7	5
Sacral	4	5
Caudal	20-23	3-5 (coccyx)



How do pig skeletons compare to humans?

A very important feature of the mammalian endoskeleton is the presence of joints, or **articulations**. They allow for a variety of movements. Several different types of articulations occur:

Synarthrosis – A completely immovable joint. Example: sutures in the skull.
Diarthrosis – A completely movable joint. Example: the knee.
Amphiarthrosis – A joint that has some movement. Example: the vertebrae.

Read:

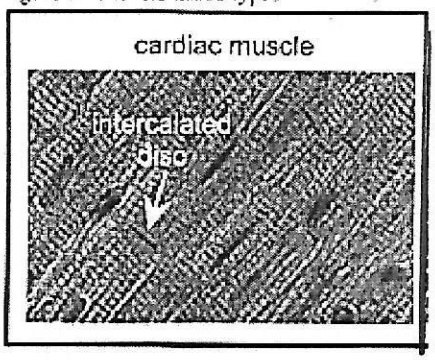
The Muscular System –

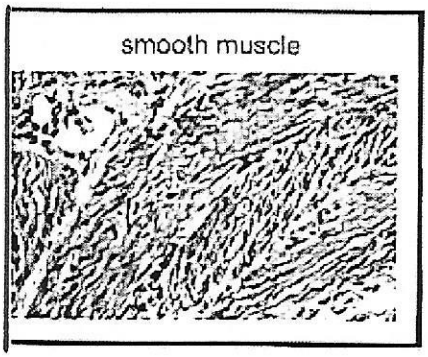
Fetal pigs have many of the same muscles as humans but in different locations due to the fact that they are quadrupeds. This guide addresses only the most superficial muscles in the lateral view. Your instructor may provide a skinned specimen or may require you to skin your own. When skinning a pig, make an incision in the integument. With your forceps, lift the skin and carefully peel it away from the body by cutting with your scalpel. Usually, late term fetal pigs work best for the study of the muscles.

A muscle is typically composed of three parts: the **origin**, the **belly**, and the **insertion**. The origin is the end of the muscle connected to a fixed, typically rigid part of the skeleton. The belly is the middle part of the muscle. The insertion is the end of the muscle that is connected to a movable portion of the skeleton. The muscle contraction across diarthrotic joints is what causes movement. The insertion of the muscle moves closer to the origin of the muscle. The muscle is connected to the skeleton by a **tendon**, a tough connective tissue. An **aponeurosis**, another type of connective tissue, connects the muscles to its point of attachment. Muscle fibers held together by **fascia**, fibrous connective tissue.

Muscles are divided into three types: smooth muscle, skeletal muscle and cardiac muscle. Smooth muscle is the involuntary muscle responsible for visceral activities such as digestion. Skeletal muscle and cardiac muscle both have a striated appearance. They can be differentiated by the intercalated discs present only in the cardiac muscle. As the name implies, cardiac muscle is the involuntary muscle located in the heart. Skeletal muscle is voluntary and is located throughout the body. Notice the contrast between the striated cardiac muscle tissue and the smooth muscle tissue.

figure 9 - Muscle tissue types



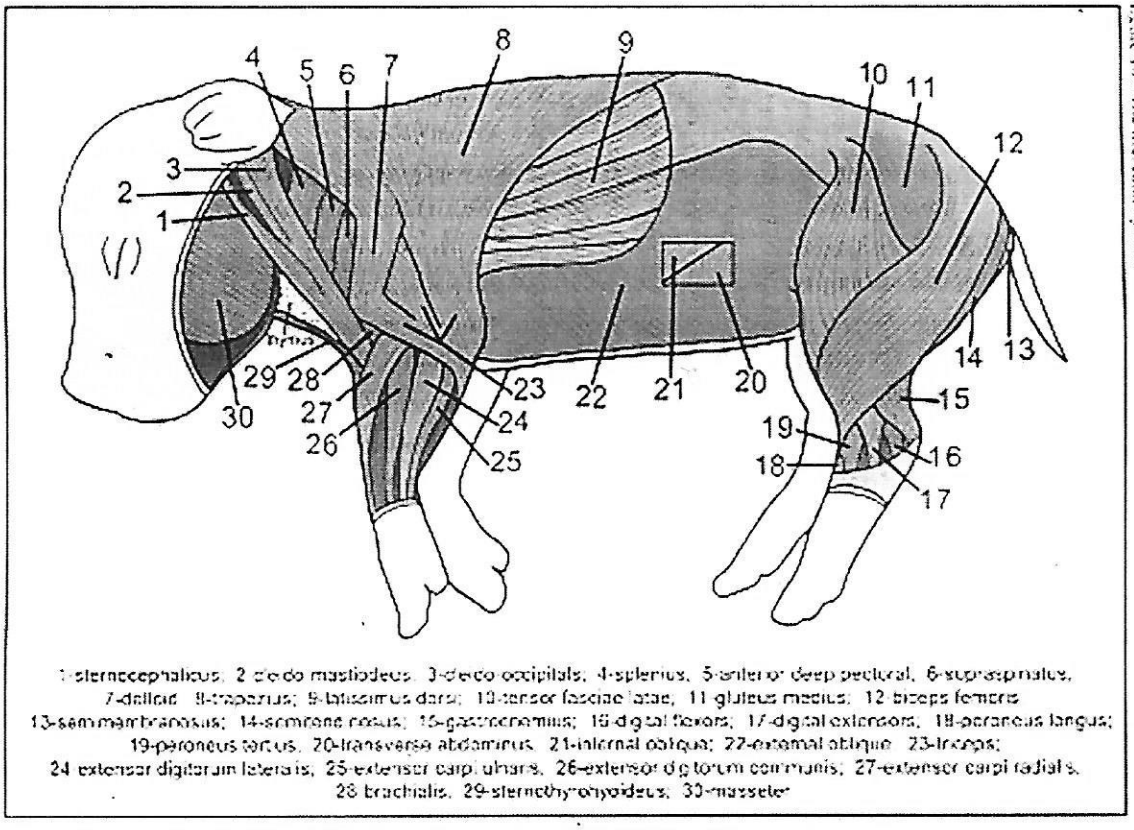


The movement of a muscle is its **action**. There are many different types of actions associated with muscles. Some common actions are listed below:

- **Flexion** – Bending a joint so that the angle of that joint decreases. Example: bending your elbow or knee.
- **Extension** – Extending a joint so that the angle of the joint increases. Example: straightening out your arm or leg.
- **Adduction** – Moving the distal part of the bone toward the median axis of the body. (Ad = to) Example: lowering your horizontally raised arms down to the sides of your body.
- **Abduction** – Moving the distal part of the bone away from the median axis of the body. (Ab = from) Example: raising your arms from the sides of your body to a raised horizontal position.

Most muscles are paired and produce actions that are **antagonistic**. That is, they produce opposing effects. For example, the biceps and triceps are considered antagonists.

Where would you find cardiac and smooth muscles in the body?



1-sternocephalicus; 2-cleido mastoideus; 3-cleido occipitalis; 4-splenius; 5-anterior deep pectoral; 6-supraspinatus; 7-deltoid; 8-trapezius; 9-latissimus dorsi; 10-tensor fasciae latae; 11-gluteus medius; 12-biceps femoris; 13-semimembranosus; 14-semitendinosus; 15-gastrocnemius; 16-digital flexors; 17-digital extensors; 18-peroneus longus; 19-peroneus tertius; 20-transverse abdominus; 21-internal oblique; 22-external oblique; 23-triceps; 24-extensor digitorum lateralis; 25-extensor carpi ulnaris; 26-extensor digitorum communis; 27-extensor carpi radialis; 28-brachialis; 29-sternothyrohyoideus; 30-masseter

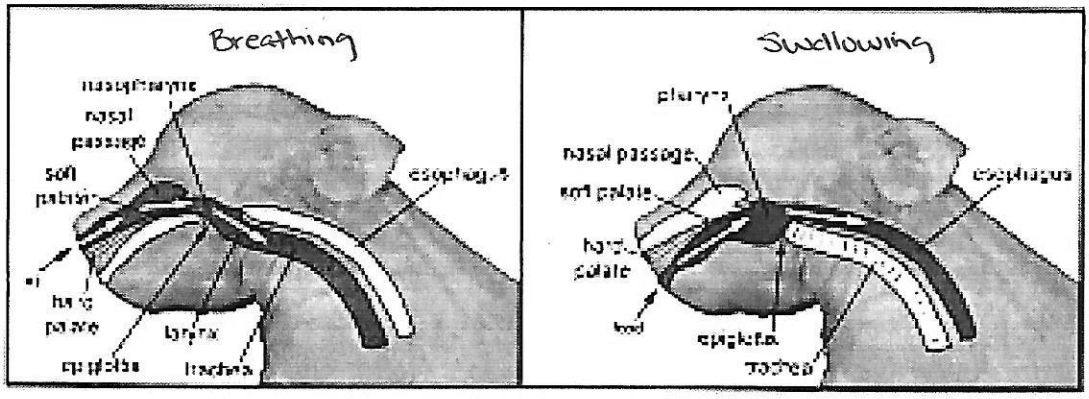
figure 10 - The muscular system

Read: **The Head & Neck Regions -**

Once you have properly cut the mouth open, you should see the **hard and soft palates.** The hard palate contains distinct ridges that the soft palate lacks. The hard and soft palates work together to allow for simultaneous breathing and swallowing by separating the oral cavity from the air passages. Further into the mouth, the **epiglottis** covers an opening called the glottis that leads to the **trachea.** The epiglottis helps direct food down the **esophagus** and air into the **trachea.** During respiration, the epiglottis moves forward to prevent the passage of food or liquid down the trachea. While eating, the epiglottis covers the trachea (figure 13).

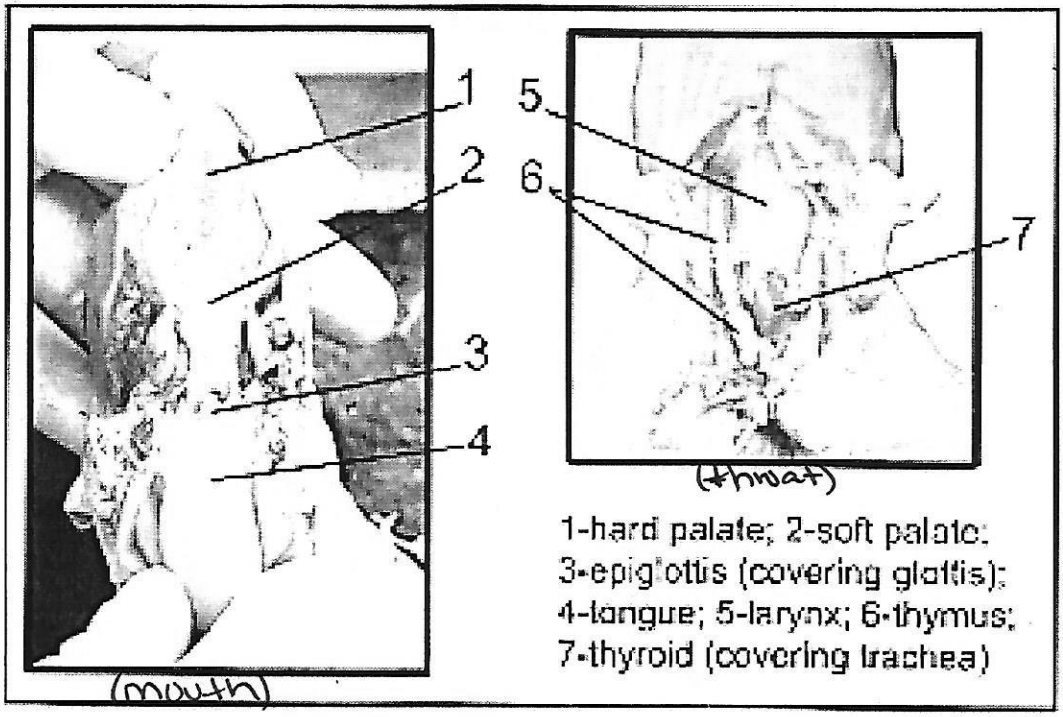
Now take a look at the structures in the neck (figure 14). You may need to remove two strands of muscles called the sternohyoid muscles ~~(shown in figure 16)~~. The **larynx**, sometimes referred to as the "voice box", lies between the epiglottis and the trachea. It is composed of cartilage. Below the larynx you will see a dark brown oval structure called the **thyroid gland.** It is an endocrine gland that regulates metabolism and produces hormones for growth and development. On either side of the larynx and thyroid you will see the **thymus**, a prominent structure in fetal animals that diminishes as the animal matures. It functions in immune responses, containing lymphocytes and T-cells. The thymus is also located just above the heart ~~(figures 15 & 16)~~. It is a diffuse structure that lies on both sides of the trachea.

Figure 13 -



Compare the structures used to breathe vs. swallow.

Figure 14 -

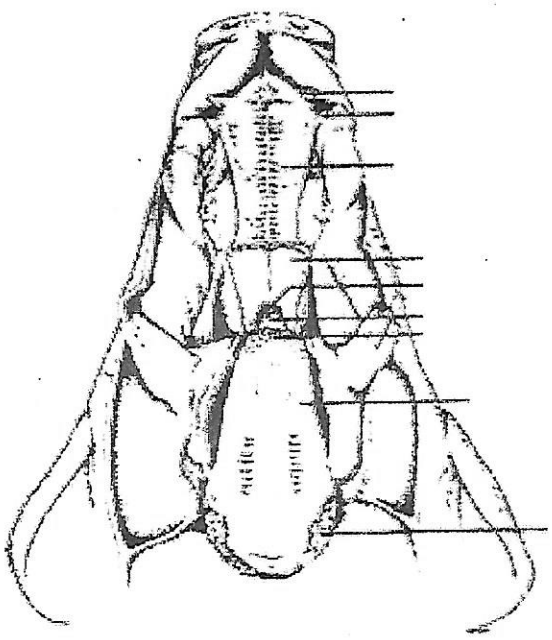


1-hard palate; 2-soft palate; 3-epiglottis (covering glottis); 4-tongue; 5-larynx; 6-thymus; 7-thyroid (covering trachea)

Fetal Pig Dissection: *Mouth*

Color and
Label the diagram: →

1. Incisor
2. Canine
3. Hard Palate
4. Soft Palate
5. Opening to Glottis
6. *Epiglottis*
7. Tongue
8. Papillae



Directions:

9. With scissors, make a 3cm incision in each corner of the mouth. Spread the jaw open to examine the mouth and tongue.
10. Observe the palate on the roof of the mouth. The anterior part of the palate is the hard palate, while the posterior part is the soft palate.
11. Locate the epiglottis, a cone shaped structure in the back of the mouth. **What is the function of this structure?** Above the epiglottis is the round opening called the nasopharynx, which carries air from the nostrils to the trachea. Locate the trachea.
12. Dorsal to the glottis, find the opening to the esophagus. Examine the tongue and view the tiny projections called sensory papillae. **What is the function of these structures?**
13. Examine the teeth. Canine teeth are longer for tearing food, while incisor are shorter and used for biting. **Are pigs carnivores, omnivores, or herbivores?**

Questions:

14. Do you see teeth? Why or why not?

15. What is the difference between hard and soft palates? What are each used for?

16. Find the esophagus, trachea, and epiglottis and what are the jobs of each.

Entering the Body Cavity -

Materials:

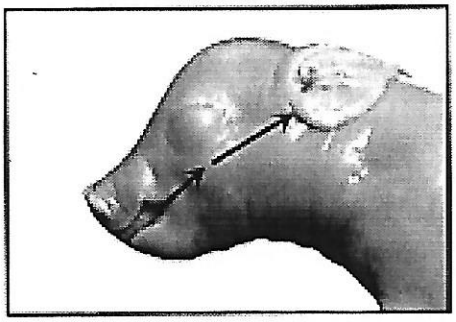
* Fetal pig	* Dissection tray	* Protective gloves	* Scalpel	* Forceps
* Blunt probe	* Sharp probe	* Scissors	* Plastic bag	* Tag

Note: When handling your fetal pig, always wear protective gloves. Make sure you have completed your external observations before proceeding.

1. Begin by entering the mouth. Use your scalpel to cut from the corner of the mouth to the ear (figure 11). You will need to cut through the cartilaginous jaw all the way to the ear.

2. Make sure to cut deep enough so that you can pry the mouth open far enough to see down the throat (figure 11).

Figure 11 - Entering the mouth region

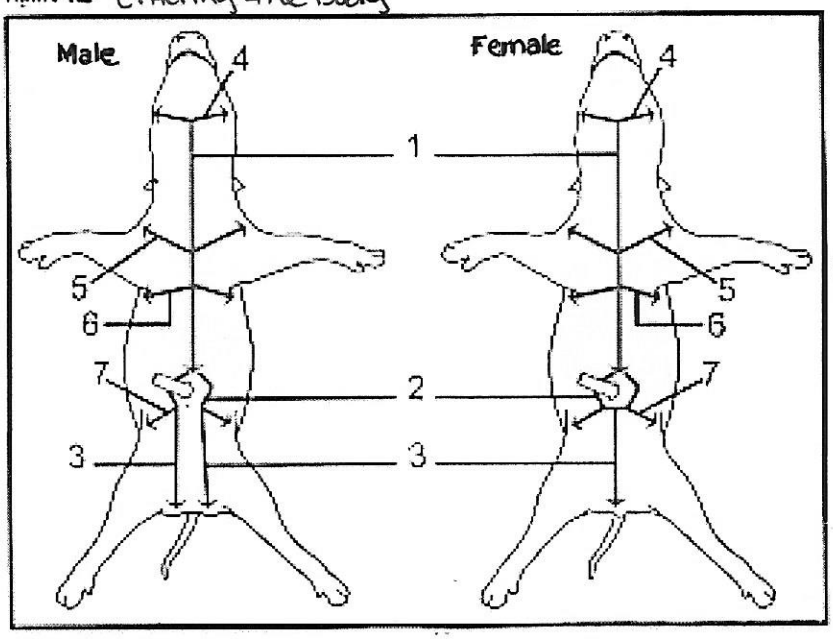


3. Depending on the gender of your pig, you will make incisions according to the graphic in the figure shown below. Cuts are numbered in order.
4. When initially cutting into the body, carefully score the epidermis. Repeat scoring, not cutting too deep, until you begin to see the organs below. Try not to cut into the liver or any other organs. Initially use your scalpel, then lift up on the body wall and cut up with your scissors.
5. You will need to use your scalpel to cut through the sternum on the chest. Once again, do not cut too deep. A gentle sawing motion may be necessary. The sternum is still primarily composed of cartilage and should separate with minimal effort.
6. As you go through your dissection, try not to remove any organs until absolutely necessary. Your dissection will make more sense if you can keep it relatively intact.
7. As you open the body, you will see the umbilical vein holding the umbilical cord to the liver. Take a piece of string and tie it to the umbilical vein near the liver and ~0.5 cm towards the umbilical cord. With your scissors, cut the umbilical vein. You will use these strings to orient yourself while studying the circulatory system.

8. Carefully use your scalpel to cut the diaphragm along the body wall. Try to keep it intact.
9. Now that you have the body cavity open, rinse it in a water bucket (or follow the procedures of your lab). Fetal pigs are preserved in formaldehyde or formalyn, so you need to rinse away any trace amounts. Change your gloves at least once during the dissection.
10. Pull apart the ribs and sides of the body. It may be necessary to cut the ribs with your scissors along cuts #5 and #6 (figure 12).
11. Secure your pig to your dissecting tray by either using strings tied at the wrists and ankles or by using T-pins. If using T-pins, push them through each wrist and ankle. For both techniques, you will need to secure down the body wall with T-pins. Always follow the procedures suggested by your lab.
12. Using your forceps, scissors, and scalpel, examine and remove the internal protective membranes, following the text in "The Body Cavity and its Membranes".

Note: Clean-up is part of lab! Your instructor should provide you with plastic bags and tags to store your pig. A good dissection can take some time, so it is necessary to store your pig until your next lab. Clean your dissecting tools and tray. Properly dispose of excess biological tissues and organs. Make sure to wipe down your station with paper towels and disinfectant spray. Always wash your hands after lab.

Figure 12- Entering the body

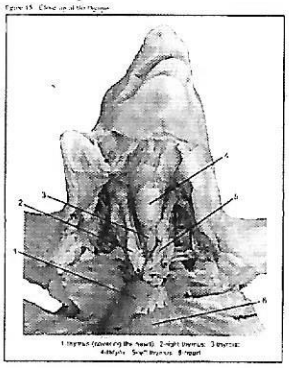


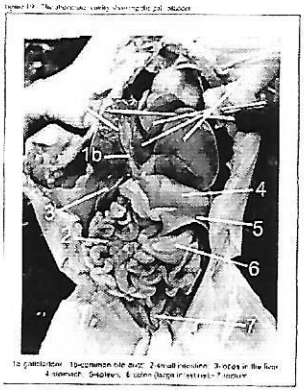
If scalpel is dull, then use scissors pointed up, so you dont damage the organs.

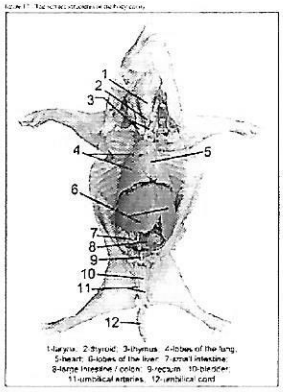
Read:

The Body Cavity and its Membranes

The body cavity, called the **coelom**, is divided into two regions: the **thoracic cavity** and the **abdominal cavity**. They are divided by the muscular **diaphragm** located just above the liver. The thoracic cavity is above the liver and the abdominal cavity is below it. As you cut into the body you will notice several membranes lining the body wall and various organs. They support the internal organs within the coelom. The body wall consists of the **integument** (skin), the **transverse abdominus muscle**, the **external** and **internal oblique muscles**, and the **parietal peritoneum**. The parietal peritoneum (parietal = "wall") is a layer of epithelial tissue that lines the body wall. The tissue covering the internal organs is the **visceral peritoneum** (visceral = "internal organs"). A double layer of peritoneum is referred to as **mesentery**. The protective membranes lining the lungs are called **pleura**. Like the peritoneum of the body cavity, pleura (pleura = "side") consists of the inner **visceral peritoneum** lining the lungs and the outer **parietal pleura**. The membranes covering the heart are the inner **visceral pericardium** directly surrounding the heart and the outer parietal pericardium.







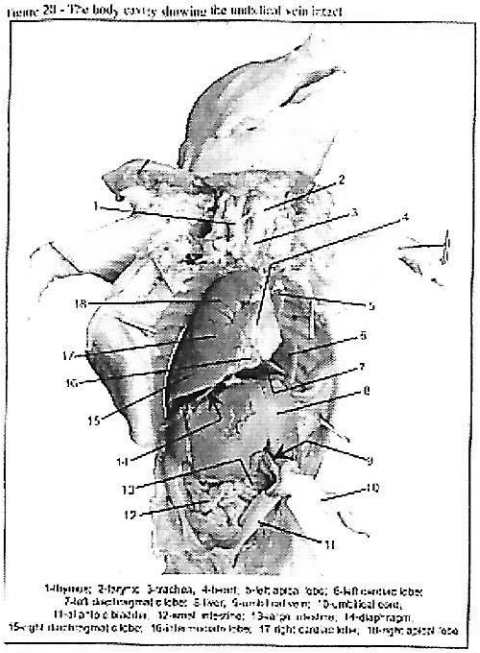


Figure 20 - The body cavity showing the umbilical vein intact

1-thymus; 2-larynx; 3-trachea; 4-heart; 5-left apical lobe; 6-left cardiac lobe; 7-left diaphragmatic lobe; 8-liver; 9-umbilical vein; 10-umbilical cord; 11-left lateral lobe; 12-small intestine; 13-large intestine; 14-diaphragm; 15-right diaphragmatic lobe; 16-right medial lobe; 17-right cardiac lobe; 18-right apical lobe

Use these pics to study!

The Thoracic & Abdominal Cavities – (Highlight the Organs)

The following structures and functions correspond with figure 18 (on page 22).

1. **Larynx** – Commonly called the "voice box" due to its function in producing vocalizations. The larynx contains the vocal cords (to see the vocal cords you may cut open the larynx with your scalpel). It is the connection between the nasopharynx and the trachea and provides a passageway for air (figure 10). The larynx is composed of four cartilages: the thyroid cartilage (along the ventral and lateral walls), the cricoid cartilage (ring-shaped on the dorsal side), the arytenoids (under the epiglottis), and the epiglottis (covers the glottis).
2. **Thymus** – This gland is lumpy and has a light cream color. The thymus functions as part of the lymphatic system and contains lymphocytes such as T-cells. It plays a role in immunological responses.
3. **Heart** – The four-chambered heart pumps blood throughout the body. In a non-fetal animal the heart receives highly oxygenated blood from the lungs and delivers deoxygenated blood back to the lungs once it has circulated throughout the body. Read "The Circulatory System" to learn more about how the heart works.
4. **Thyroid** – The thyroid is a dark brown or red oval structure that is located in proximity to the trachea and the lateral thymus in the throat. It is responsible for regulating metabolism and plays a role in growth and development. The thyroid is part of the endocrine system and produces the hormones thyroxin and triiodothyronine.
5. **Trachea** – The tube is the passageway for air that leads to the lungs. The trachea lies ventral to the esophagus (figure13). It is composed of cartilage and is ribbed in appearance (in contrast to the esophagus that is smooth).
6. **Lungs** – The lungs have a spongy texture and appearance. The lungs function in respiration to add oxygen and remove carbon dioxide from the body. You will notice many lobes of the lungs. How many lobes does your fetal pig have?

   Number of lobes in right lung: _____

   Number of lobes in left lung: _____
   (Humans have five lobes: three in the right lung and two in the left lung). To learn more about the lungs and related structures, read "The Respiratory System" section of this guide.
7. **Liver** – The liver is the most prominent organ of the body cavity. You will notice many lobes of the liver. Recall that the human liver has four lobes. How many lobes do you see? Use your blunt probe to carefully move aside the intestine to see all the lobes.

   Number of liver lobes: _____
   The liver has many functions. It metabolizes carbohydrates and fats. It produces bile and bile salts that emulsify fats in the duodenum. Bile is an alkaline solution of bile salts, bile pigments, cholesterol, and other components secreted by the liver. It is stored in the gallbladder and delivered to the duodenum through the bile duct. In the duodenum, bile functions in the emulsification, digestion, and absorption of fats. The liver also stores and regulates glycogen, iron, copper, and vitamins A, B12, D, E, and K. It produces plasma proteins and enzymes. The liver contains epithelial cells called hepatocytes that contain enzymes that detoxify poisons and toxins such as alcohol.
8. **Gallbladder** – The gallbladder stores and concentrates bile secreted by the liver and delivers it to the duodenum through the **common bile duct**. The gallbladder is a round "pea-green" structure on the under surface of the right lobe of the liver.
9. **Duodenum** – The duodenum is the first portion of the small intestine that continues the digestive process. It receives bile from the common bile duct and is the site of the emulsification, digestion, and absorption of fats. The duodenum also receives pancreatic enzymes such as pancreatic amylase and tyrpsin.
10. **Small Intestine** – The small intestine consists of three parts: the **duodenum** (the first portion), the **jejunum** (the middle portion), and the ileum (the final portion). The jejunum makes up over half of the small intestine. In the fetal pig the jejunum is indistinguishable from the ileum. The jejunum and ileum absorb nutrients and digest chyme. Chyme is the partially digested food that passes from the stomach to the duodenum. The **ileocecal** valve marks the end of the small intestine and the beginning of the large intestine. This valve regulates the passage of material. The length of the human small intestine is ~20 feet. In order to compare the human intestine and fetal pig intestine, cut away the small intestine and measure it. Convert your measurement into feet for a direct comparison.
    Length of the small intestine: _____
    In order to see the interior of the small intestine, cut open a portion of it and place it on a slide or view a prepared slide under a microscope. You will see villi, small finger-like projections that increase the surface area of the inner wall of the small intestine for more efficient absorption. The villi give the interior of the small intestine a velvety texture.
11. **Pancreas** – The pancreas is the major digestive gland of the digestive system in vertebrates. It is located beneath the small intestine. You may need to push aside the small intestine to see it. This structure is cream in color and lumpy in texture. The pancreas has dual functions in the exocrine and endocrine systems. The exocrine function is to secrete pancreatic (digestive) juices into the duodenum through the pancreatic duct. This duct is too small to be easily seen in the fetal pig. Pancreatic juice is a combination of water, electrolytes, and enzymes. These enzymes can break down sugars, starches, lipids, and proteins. The endocrine function is to produce insulin, glucagon, and other hormones that are important in the regulation of sugar levels and the metabolism of fats and carbohydrates.
12. **Stomach** – The stomach is divided into three regions: the **cardiac** end, the **fundus**, and the **pyloric** end. The cardiac region is attached to the esophagus in the anterior end of the stomach. The **cardiac sphincter** regulates the passage of food from the esophagus to the stomach. The fundus makes up the body of the stomach. The pyloric region leads to the duodenum and is the posterior end of the stomach. The **pyloric sphincter** regulates the passage of food from the stomach to the duodenum. If you open the stomach you will see a green substance called **meconium**. This is not chyme since a fetal animal does not eat food, but receives its nutrients from the mother through the umbilical cord. Meconium is a combination of old epithelial cells, mucus, and amniotic fluid. It is stained green from bile coming into contact with the mucus. Within the stomach you will see ridges, called **rugae**, which increase the surface area of the stomach wall.
13. **Spleen** – The spleen is a dark brown flap to the left of the stomach. It is part of the reticuloendothelial system, which is the system of macrophage cells. Macrophage cells engulf and digest foreign cells and dead cells. The spleen's cells phagocytize old red blood cells, platelets, and bacteria. It removes the iron and other useful components before breaking down blood cells. The spleen also serves an immune function by initiating responses by the T-cells and B-cells. It is the site of the largest concentration of lymphatic tissue in the body.
14. **Large Intestine** – The large intestine consists of the coiled **colon** and the straight **rectum**. The entrance to the colon is marked by the **ileocecal valve**. The large intestine digests bacteria, reabsorbs water, and forms feces from chyme.
15. **Rectum** – The rectum is the straight portion of the large intestine. It is responsible for the formation and transportation of feces to the **anus**.
16. **Esophagus** (not pictured) – The esophagus delivers food from the mouth to the stomach. It lies dorsal to the trachea (figure 10). Unlike the trachea, it is smooth and muscular in appearance. The cardiac sphincter marks the end of the esophagus and regulates the passage of food.

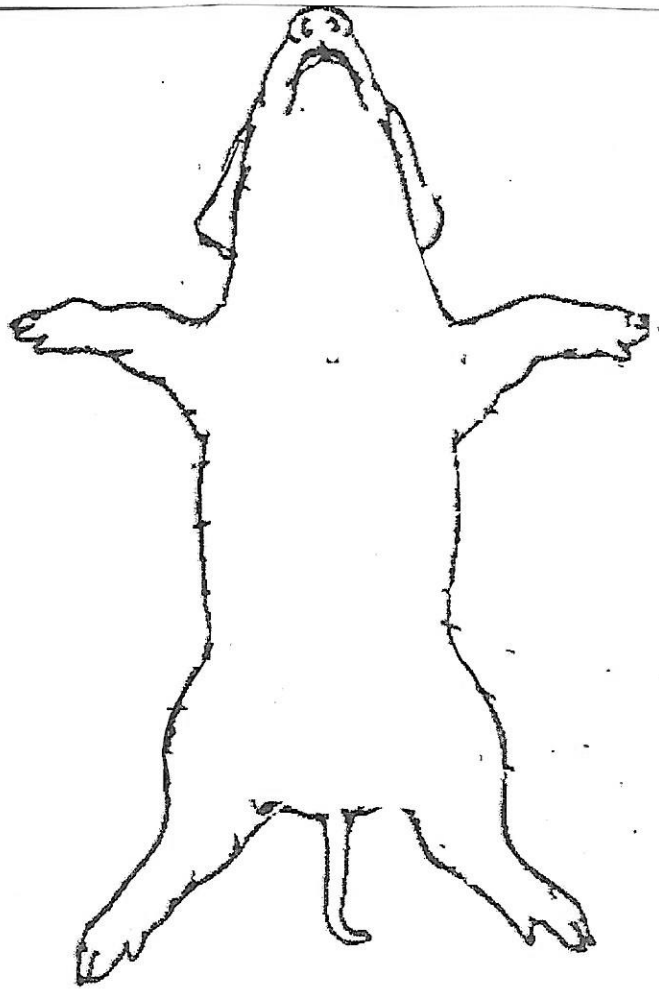
The Digestive System

The digestive system consists of the **alimentary canal**, which runs from the mouth to the anus. It processes food into energy. Food enters the mouth and the chewing action of the teeth mechanically breaks it down. The salivary glands chemically break down the food through enzymatic action. It moves through the **pharynx**, through the **esophagus**, and into the **stomach**. Within the stomach, the food is mixed with acidic gastric juices and is further broken down. From there it passes into the **duodenum** (the first portion of the small intestine), through the **jejunum** (the second portion of the small intestine), through the **ileum** (the final portion of the small intestine), through the **large intestine** (the coiled portion is called the colon), and out through the **rectum** and **anus**. Several digestive glands are associated with this process: the liver, the **gallbladder**, and the **pancreas**.

Fetal Pig Dissection: *Digestive System*

Using the posterior Fetal Pig Outline, draw and label: and color.

1. Stomach
2. Pylorus
3. Gallbladder
4. Colon
5. Rectum
6. Liver
7. Spleen
8. Duodenum
9. Pancreas
10. Small intestine



Directions:

11. Locate the diaphragm, separating the abdominal and thoracic cavity.
12. Find the brownish-colored liver and count the number of lobes, **what is the function of the liver?** Then locate the gallbladder.
13. Find the esophagus, and follow it to the stomach.
14. Cut open the stomach and note its texture of the inner walls.
15. At the end of the stomach, there is a sphincter to the duodenum.
16. Locate the pancreas inferior to the stomach.
17. Identify the small intestines, and notice it's coiled and held together by a tissue called mesentery. Carefully cut the mesentery and **uncoil the small intestines to measure the length**. Then remove a 3cm piece, rinse and note the villi texture inside.
18. Locate the large intestine (colon) **and measure the length. Which intestines is longer?**
19. Find the spleen, a long, reddish- brown organ wrapped around the stomach.

Questions:

20. Look at the stomach and describe its shape.
21. What is the total length of the digestive system in centimeters? From esophagus to rectum.
22. What is the function of the pyloric and cardiac valves of the stomach?

Read:

The Respiratory System –

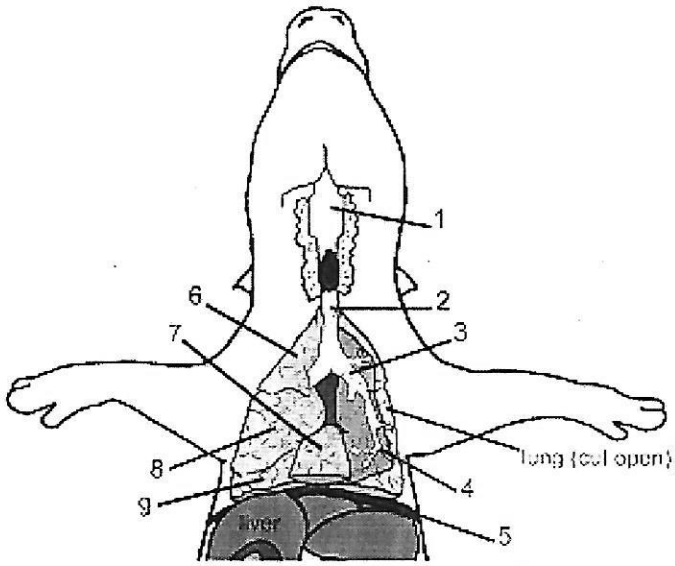
The respiratory system is responsible for the inspiration of air and gas exchange in the body. Air is inhaled through either the **mouth** or the **external nares** into the **nasopharynx**. It passes through the **larynx**, passes through the **trachea** and into the **lungs**.

The lungs are the major organ of the respiratory system in air-breathing vertebrates. They are enclosed in the **pleural cavity** by the **visceral** and **parietal peritoneum** and consist of several lobes. In humans there are three lobes in the right lung and two in the left lung. Your fetal pig has seven lobes. The right lung contains the **right apical lobe**, the **right cardiac lobe**, the **right diaphragmatic lobe**, and the **intermediate lobe**. The left lung contains the **left apical lobe** (sometimes called the cranial lobe), the **left cardiac lobe**, and the **left diaphragmatic lobe**. The apical lobe lies cranial to the middle cardiac lobe. The diaphragmatic lobe is most caudal, lying just above the diaphragm. The intermediate lobe lies in between the right and left cardiac lobes, but is still considered part of the right lung system.

Once in the lungs, the air goes through a series of channels that progressively get smaller. The trachea divides into the **bronchi**, which then divide into smaller **bronchioles**. The bronchioles empty into small air cells called **alveoli**. They converge with a network of **capillaries**

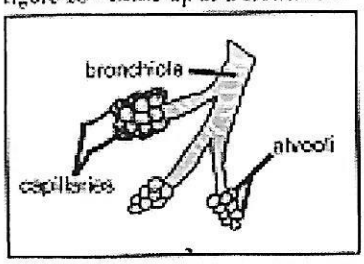
Draw a flow chart of how we (humans) breathe

Figure 27 - The respiratory system



1-larynx; 2-trachea; 3-bronchus; 4-bronchiole; 5-diaphragm; 6-right apical lobe; 7-intermediate lobe; 8-right cardiac lobe; 9-right diaphragmatic lobe

Figure 28 - Close-up of a bronchiole



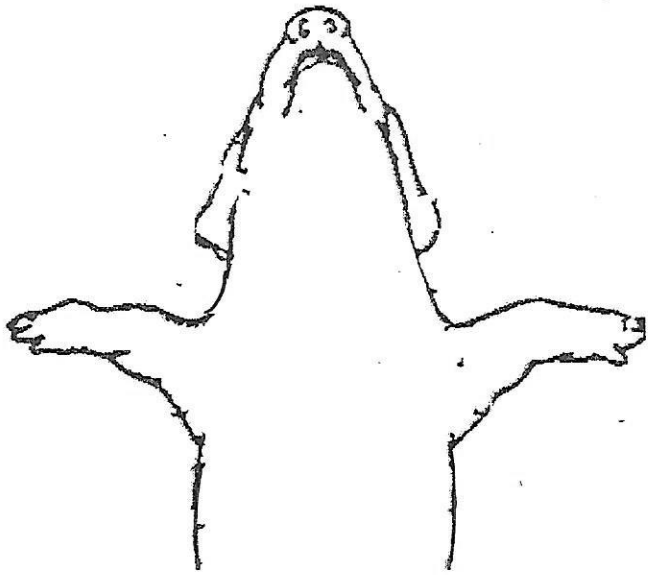
that deliver oxygen via the blood to the rest of the circulatory system and return waste carbon dioxide to be exhaled.

In mammals, the process of breathing is done through **negative pressure breathing**. Air is pulled down into the lungs through the contraction of the **diaphragm** and results in inhalation. When the diaphragm relaxes and moves up, the lungs are restored to their smaller volume, which results in exhalation.

Explain how the Circulatory and Respiratory Systems work together to exchange Oxygen and Carbon dioxide.

Bath · Examine · Clean Up · Bag

Fetal Pig Dissection: *Respiratory System*



Using the posterior pig outline, draw and label: and color!

1. Diaphragm
2. Lungs
3. Larynx
4. Pharynx
5. Trachea
6. Epiglottis
7. Bronchi
8. Thyroid

Directions:

9. Examine the diaphragm, what is it's function?
10. Extend the Cut #1 up under the pigs throat and make two more lateral incisions and fold back the flaps.
11. Carefully isolate the heart from other tissue, and locate the two lungs surrounding the heart.
12. Find the trachea, observe the cartilaginous rings, which keeps it from collapsing.
13. Notice the trachea branches into bronchial tubes.
14. Lying ventral to the trachea, locate the pinkish-brown V-shaped structure called the thyroid gland.
15. Anterior (on top) of the trachea, locate the larynx (vocal cords)
16. Locate the epiglottis, and locate the pharynx

Questions:

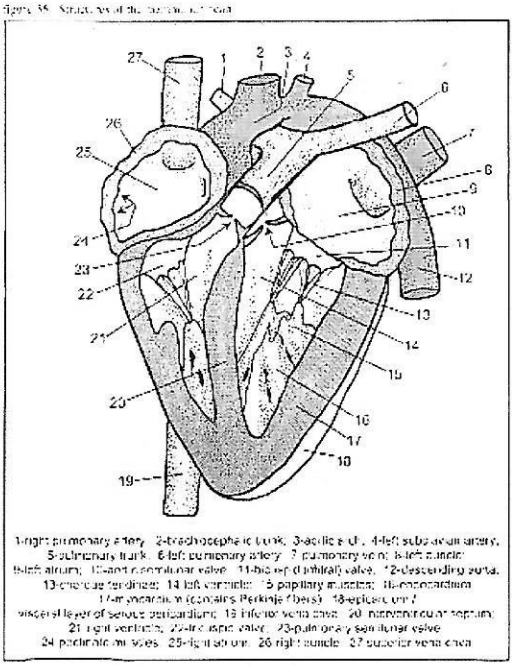
17. What is the function of the thyroid gland?

18. What is the pathway of breathing oxygen and exhaling carbon dioxide?

Read:

Structures of the Heart

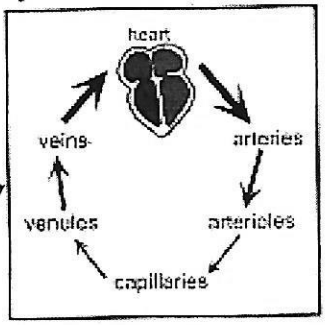
In order to understand circulation, it is necessary to first learn about the heart. The fetal pig's heart will demonstrate some structures, but a larger heart is used for smaller structures such as the various valves inside of the heart. Many labs study a sheep or cow heart. There are detailed guides specifically written for the larger mammalian heart.



1-right pulmonary artery, 2-brachiocephalic trunk, 3-aortic arch, 4-left subclavian artery, 5-pulmonary trunk, 6-left pulmonary artery, 7-pulmonary veins, 8-left auricle, 9-left atrium, 10-coronary sinus, 11-bicuspid (mitral) valve, 12-descending aorta, 13-chordae tendineae, 14-left ventricle, 15-papillary muscles, 16-epicardium, 17-myocardium (contains Purkinje fibers), 18-epicardium (visceral layer of serous pericardium), 19-inferior vena cava, 20-interventricular septum, 21-right ventricle, 22-tricuspid valve, 23-pulmonary semilunar valve, 24-pectinate muscles, 25-right auricle, 26-right auricle, 27-superior vena cava

The Circulatory System –

Figure 29 - General circulatory plan



When studying the circulatory system, it is better to work with injected fetal pigs. Arteries are injected with red latex, and veins are injected with blue latex. The heart is located in the pericardial cavity and is covered by the parietal and visceral peritoneum. You will need to carefully remove the peritoneum by pulling it up with your forceps and cutting it away with your scalpel. When viewing the circulatory system, remove the major organs in the abdominal cavity. Study the venous system first, since many veins lie on top of the arteries. You may not be able to identify all of the arteries and veins shown in the illustrations. However, you should be able to identify the most prominent structures. Use the illustrations and photographs to assist you.

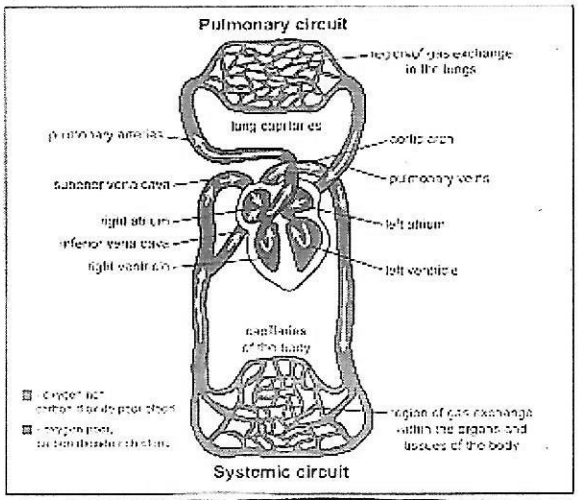
One of the features of mammals is the four-chambered heart. Through the periodic contractions of the chambers blood is pumped out through the arteries into the body. Having four chambers allows for **double circulation** of blood through two separate circuits, the **systemic circuit** and the **pulmonary circuit**. The systemic circuit runs throughout the body. The left atrium and left ventricle are responsible for the flow of blood in the systemic circuit. The pulmonary circuit runs through the lungs to obtain oxygen and deposit the waste gas, carbon dioxide. The right atrium and right ventricle are responsible for the flow of blood in the pulmonary circuit. This is in contrast to other vertebrates such as the fish that only has a single circuit circulatory system.

The heart of a fetal pig is very similar to the human heart. One exception is that the fetal pig heart has the **azygous (hemiazygous)** vein that human hearts lack. This vein drains the **intercostals** into the coronary sinus (figures 24 & 27). There are other differences, but for purposes of comparative anatomy, the fetal pig makes a good model animal to study.

General Plan of Circulation – Adult Mammals –

Blood flows through a series of vessels to transport oxygen and carbon dioxide throughout the body. In general, arteries and arterioles are thick-walled vessels that carry oxygen-rich blood away from the heart. Veins and venules are thin-walled vessels that carry oxygen-poor blood back towards the heart. The capillaries are where the gases are exchanged with the cells of the body.

Figure 37 - Adult circulation showing the systemic and pulmonary circuits



Draw the flow of blood:

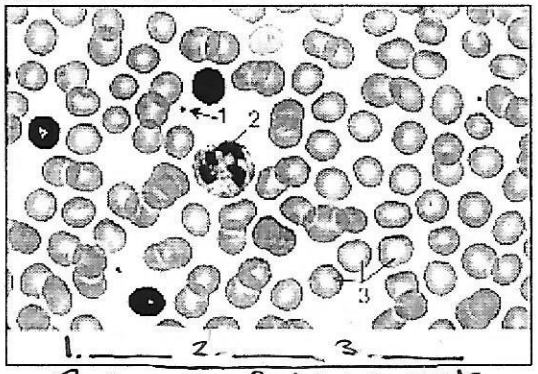
Difference of Veins and Arteries

About the Circulating Fluid of the Body: the Blood –

In order to better understand the heart and the circulatory system, it is necessary to know some facts about the circulating fluid of this system, the blood. The main function of the blood is to transport gases (oxygen and carbon dioxide) and nutrients throughout the body.

Blood consists of two main components: the non-formed liquid element and the formed cellular elements. The non-formed liquid element is **plasma**, which is made up of 91.5% water and 8.5% solutes. These solutes include proteins (such as globulins, albumins, and fibrinogen), urea, uric acid, fatty acids, glucose, glycerides, glycerol, enzymes, hormones, electrolytes, oxygen, and carbon dioxide. The formed elements include the red blood cells called **erythrocytes**, the white blood cells called **leukocytes**, and the **platelets** referred to as **thrombocytes**. The erythrocytes are the non-nucleated biconcave cells that contain the main oxygen transporting protein called hemoglobin. This portion of the cell holds the pigment that gives blood its red color. The leukocytes are the nucleated cells that lack hemoglobin. These cells are less numerous than the erythrocytes and play a major role in the body's immune responses. The platelets are small, non-nucleated cell fragments. They aid in the clotting of the blood.

Figure 38 - Components of blood in mammals



3 types of blood cells

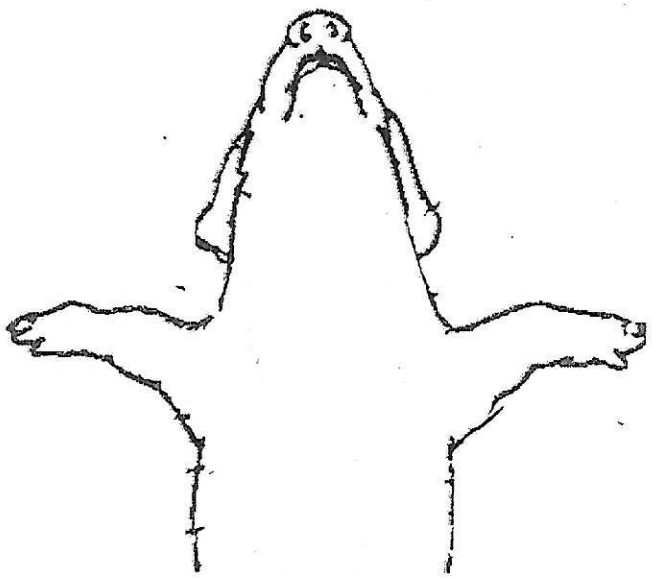
Don't Destroy the Heart

Fetal Pig Dissection: *Circulatory System*

Draw and label: and color.

1. Anterior vena cava
2. Right and left atrium
3. Atrioventricular valve (tricuspid)
4. Pulmonary valve
5. Aortic valve
6. Pulmonary trunk
7. Arch of aorta
8. Right and left ventricle
9. Septum
10. Atrioventricular valve (bicuspid or mitral)

Then using arrows, show the flow of blood through the heart.



Directions:

11. Locate the heart, mammals have a four chamber heart. **How many chambers would a pig have?**
12. Locate the left and right side of the heart, **which side would have more cardiac muscle and why?**
13. Locate the left and right atrium and left and right ventricle.
14. Anterior to the heart is a large vein that enters the right atrium, this vein is the anterior vena cava
15. Lift he heart to observe the posterior vena cava.
16. Find the pulmonary veins and artery.
17. Find the aorta
18. Remove the heart.
19. Holding the heart, carefully cut the heart into dorsal and ventral halves * Caution: Sharp object*
20. Study the internal features.

Questions:

21. What are the structures that prevent blood form mixing between left and right sides of the heart. Explain what prevents the blood from flowing backwards.

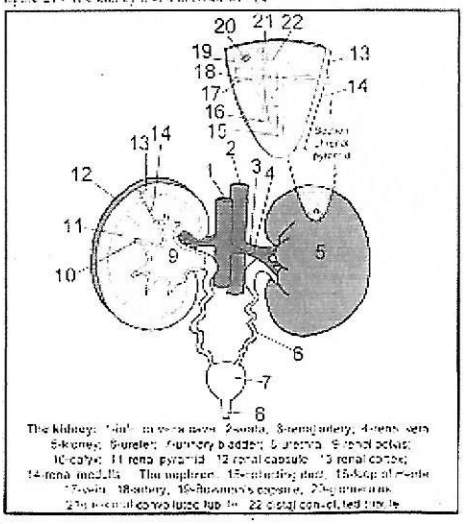
22. Which blood type (A, B, AB, O and Rh antigens) can be donated to all others, and why?

Read:

The Urogenital System -

The urogenital system consisting of the excretory system and the reproductive system, differs between the male and female. The excretory system removes liquid nitrogenous waste from the body in the form of urine. The reproductive system produces young.
Note: To see the structures of the urogenital system you will need to remove the liver, stomach, small and large intestine, and spleen. Take care not to remove any of the arteries and veins. In order to see the reproductive structures you will need to cut through the pelvic girdle and spread it apart. Take care not to cut through any of the organs. Some of the reproductive organs may be difficult to find. Have some patience and proceed through your dissection in a methodical manner.

Summarize the Excretory System:



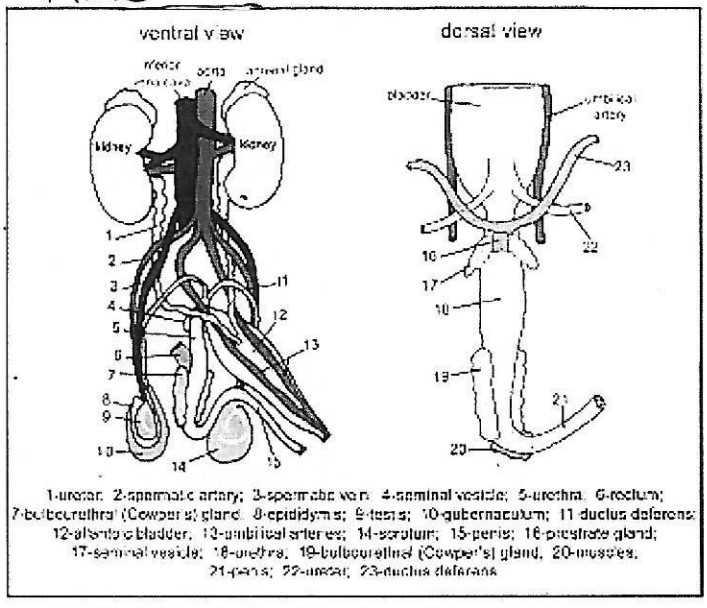
The Urinary System -

The most noticable organs in the urogenital system are the **kidneys**, bean shaped organs in the lumbar region of the body cavity. They are covered by a membrane called **peritoneum**. With your forceps and scissors or scalpel, carefully remove the peritoneum. There may also be fat tissue covering the kidney that will need to be removed. **The kidneys are pocketed** between the muscle wall and the viscera. You will see the **renal artery** and **renal vein** leading to each kidney. The renal arteries and veins transport blood to and from the kidneys. The kidneys function in the excretion of hydrophilic substances such as ions, water, urea and other nitrogenous wastes. They play a role in homeostasis by regulating the volume and composition of blood. On top of the kidneys are the adrenal glands, which produce hormones that aid the body during stressful situations.
The kidneys are composed of several parts: the renal cortex, the renal medulla, and the renal pelvis. The **renal cortex** is the outer layer of the kidney and contains the cortical nephrons and renal corpuscles. The **renal medulla** contains the renal pyramids, triangular and striated structures that contain tubules and blood vessels, various blood vessels, and **calyces**. The calyces lead to the **renal pelvis**, the expanded portion of the **ureter**. The ureter leads to the **urinary bladder**. In the fetal pig the urinary is called the **allantoic bladder** that lies between the **umbilical arteries**. In the fetal pig the allantoic bladder leads to the allantoic duct into the umbilical cord (figure 4). In non-fetal animals, the urinary bladder leads to the urethra, which then leads to the external environment through the **urogenital opening**.

What happens when kidneys fail to filter?

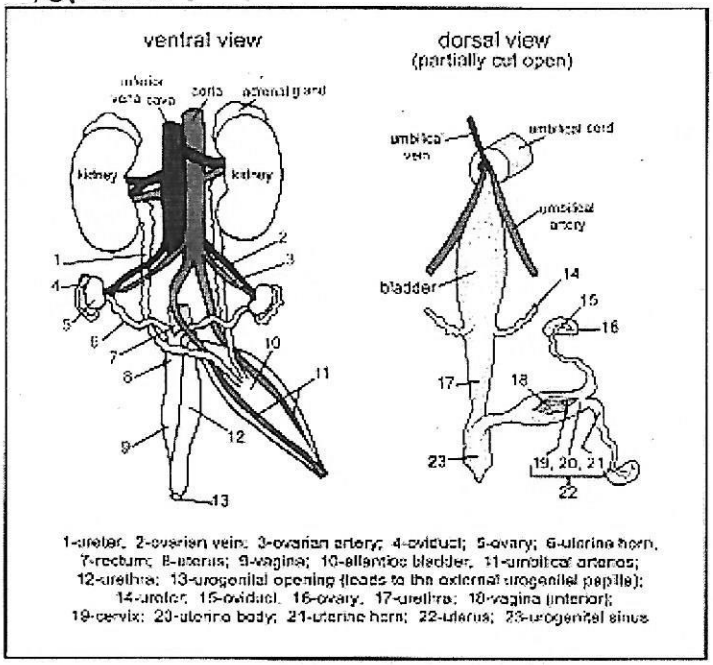
Compare Male to Female Urogenital Systems:

Male



1-ureter, 2-spermatic artery; 3-spermatic vein; 4-seminal vesicle; 5-urethra; 6-rectum; 7-bulbourethral (Cowper's) gland; 8-epididymis; 9-testis; 10-gubernaculum; 11 ductus deferens; 12-allantoic bladder; 13-umbilical arteries; 14-scrotum; 15-penis; 16-prostrate gland; 17-seminal vesicle; 18-urethra; 19-bulbourethral (Cowper's) gland; 20-muscles; 21-penis; 22-ureter; 23-ductus deferens

Female



1-ureter, 2-ovarian vein; 3-ovarian artery; 4-oviduct; 5-ovary; 6-uterine horn; 7-rectum; 8-uterus; 9-vagina; 10-allantoic bladder; 11-umbilical arteries; 12-urethra; 13-urogenital opening (leads to the external urogenital papilla); 14-ureter; 15-oviduct; 16-ovary; 17-urethra; 18-vagina (interior); 19-cervix; 20-uterine body; 21-uterine horn; 22-uterus; 23-urogenital sinus

If you have a Male, go look at a female pig - Vice Versa.

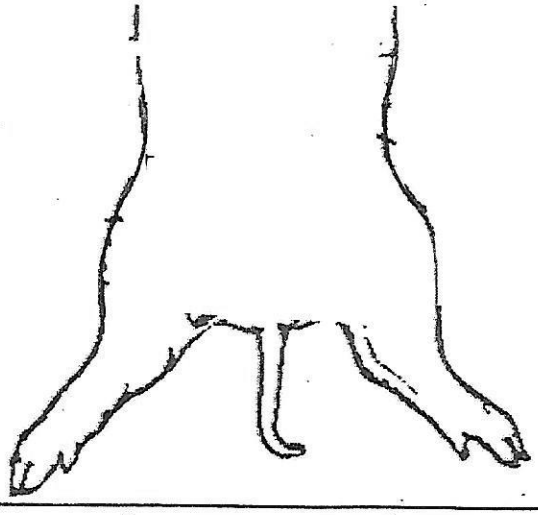
Fetal Pig Dissection:
Excretory (Urinary) and Reproductive Systems

Directions:

1. Remove the digestive organs and locate the kidneys- large, bean shaped. **What are the kidneys function?**
2. Find the ureters, which are tubes from the kidney to the urinary bladder.
3. Lift the urinary bladder to view the urethra.

Using the posterior outline, draw and label: and color!

4. Urinary bladder
5. Kidney
6. Renal Artery and Vein
7. Ureters
8. Urethra

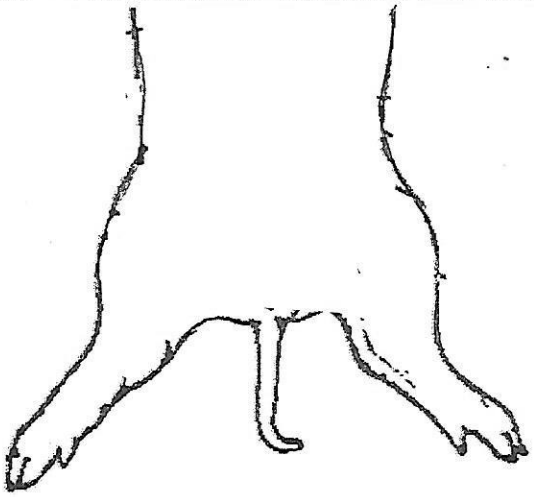


Directions (Male):

9. Locate the two scrotal sacs at the posterior of the pig. Observe testis in each sac if the pig is mature enough.
10. Sperm in the testes passes through the vas deferens , find the vas deferens.
11. Follow the urethra to the penis.

Using a posterior outlines, draw and label :

12. Scrotum and color!
13. Testis
14. Penis
15. Vas Deferns

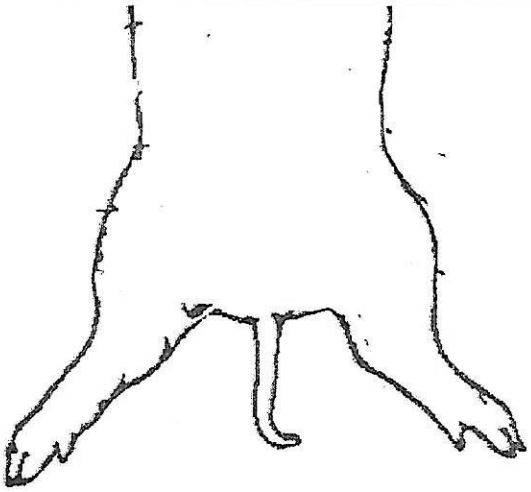


Directions (Female):

16. Find the two bean shaped ovaries posterior of the pig.
17. Follow the fallopian tube to the uterus, which is dorsal to the bladder.
18. The uterus leads to the vagina.

Using a posterior outlines, draw and label :

19. Ovaries and color!
20. Vagina
21. Fallopian tubes
22. Uterus



Read:

The Nervous System -

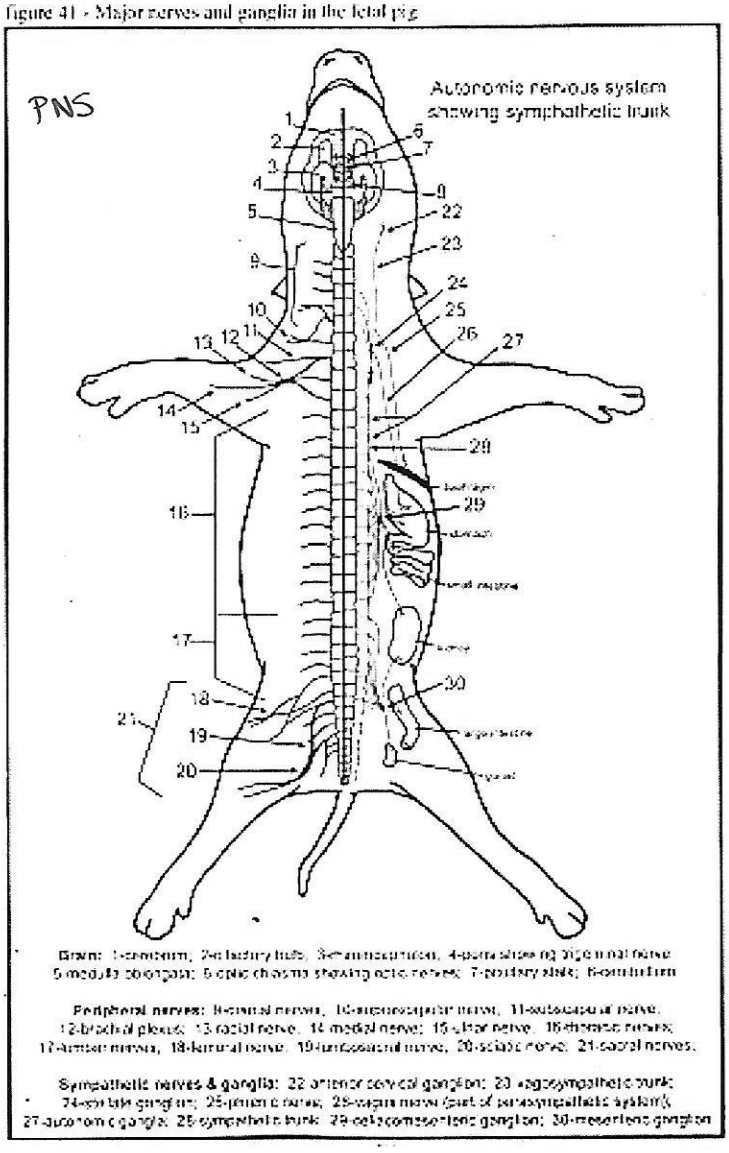
The nervous system is responsible for distributing sensory and motor impulses. A nerve impulse is an electrical signal transmitted along **neurons**. A neuron consists of a **cell body** with a **nucleus**, branching extensions called **dendrites**, and a single extension called an **axon**. Dendrites transmit nerve impulses toward the cell body and the axon carries them away from the cell body to the synaptic terminal. The axon in the vertebrate peripheral nervous system is supported by a series of cells called **Schwann cells** that are protected by the **myelin sheath**. The myelin sheath functions as insulation to the cells. The spaces between the Schwann cells are referred to as the **nodes of Ranvier**. The axon ends in hundreds to thousands of **terminal branches**. At the terminal, the impulse connects with another nerve or an **effector** such as a muscle fiber. This junction is called a **synapse**. An effector is a cell or organ that responds to the nervous system in response to a stimulus. The stimulus is perceived through a **receptor**. Eyes, ears, and nose are considered organ receptors. Neurons are found throughout the body's nervous tissue and in the brain and spinal cord.

The nervous system in mammals and other higher vertebrates consists of the **central nervous system (CNS)** and the **peripheral nervous system (PNS)**. The central nervous system consists of the brain and the nerves along the spinal column (the spinal cord). The peripheral nervous system connects the central nervous system to the organs and other regions of the body. The peripheral nervous system is divided into the **sensory** and **motor pathways**. The motor pathways include the **voluntary nervous system** and the **involuntary nervous system**. The voluntary nervous system is associated with the control of voluntary skeletal muscle. The involuntary nervous system, referred to as the **autonomic nervous system**, is associated with involuntary body processes such as heart rate, blood pressure, breathing, and digestion. Each organ within the autonomic nervous system is controlled by the antagonism of the **sympathetic and parasympathetic nervous systems**. The sympathetic nervous system prepares the body for stress (the "flight or fight response") by increasing heart rate, respiratory rate, and blood pressure. At the same time, it slows down the digestive processes. In contrast, the parasympathetic nervous system lowers heart rate, lowers blood pressure, and increases digestion. The vagus nerve is the major nerve of the parasympathetic system and contains both sensory and motor neurons. In summary, the sympathetic system expends energy while the parasympathetic system conserves it.

CNS = _____

PNS = _____

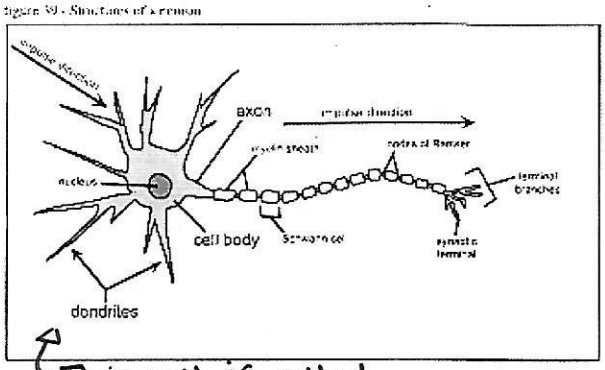
Figure 41 - Major nerves and ganglia in the fetal pig



Brain: 1-cerebrum, 2-olfactory bulb, 3-cerebral cortex, 4-optic stalk, 5-pituitary gland, 6-medulla oblongata, 7-optic chiasma showing optic nerves, 8-pituitary stalk, 9-cerebellum

Peripheral nerves: 9-cranial nerves, 10-musculocutaneous nerve, 11-subscapular nerve, 12-brachial plexus, 13-radial nerve, 14-medial nerve, 15-ulnar nerve, 16-thoracic nerves, 17-lumbar nerves, 18-femoral nerve, 19-iliohypogastric nerve, 20-sciatic nerve, 21-sacral nerves.

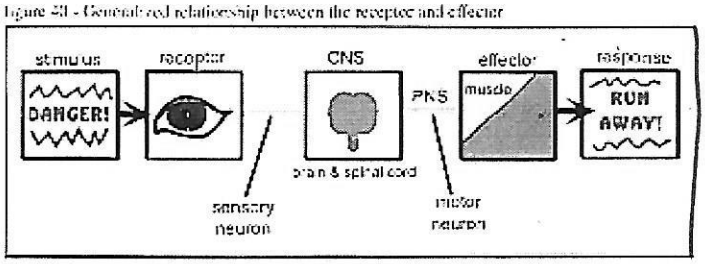
Sympathetic nerves & ganglia: 22-anterior cervical ganglion, 23-vagosympathetic trunk, 24-cervical ganglion, 25-phrenic nerve, 26-vagus nerve (part of parasympathetic system), 27-abdominal ganglia, 28-sympathetic trunk, 29-celiac/mesenteric ganglion, 30-mesenteric ganglion



This cell is called _____

Figure 40 - Structure of a neuron

Figure 40 - General reflex relationship between the receptor and effector

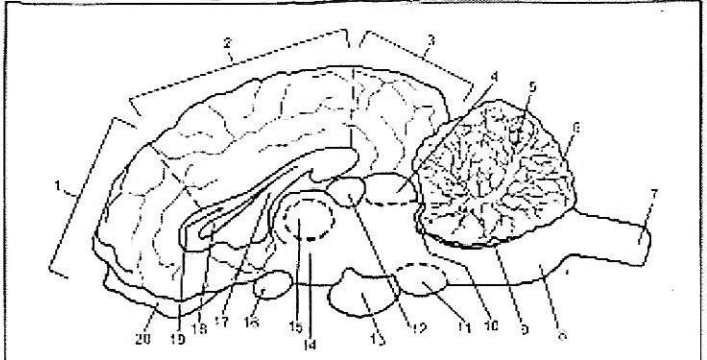


Structures in the Mammalian Brain –

The main organ of the nervous system is the brain. Typically, a sheep's brain is used as an example of a mammalian brain. There is a separate guide that describes the sheep's brain in detail. Both the sheep's brain and the guide, "The Physiology of the Mammalian Brain", are available from the Bio Corporation. This guide includes an illustration of the sheep's brain in the ventral view (to show the cranial nerves) and the sagittal view.

The cerebrum consists of five major lobes: the frontal lobe, the parietal lobe, the temporal lobe, the occipital lobe, and the insular lobe. The temporal lobe, responsible for auditory senses, memory and learning is not shown in the illustration. The insular lobe is located within the cerebrum and is not visible from the surface.

Sagittal view of a mammal brain



1-frontal lobe of the cerebrum, 2-parietal lobe of the cerebrum, 3-occipital lobe of the cerebrum, 4-corpora quadrigemina, 5-pineal body, 6-cerebellum, 7-spinal cord, 8-medulla oblongata, 9-fourth ventricle, 10-aqueduct, 11-cone, 12-pineal body, 13-pituitary gland, 14-hypothalamus, 15-thalamus, 16-optic chiasma, 17-fornix, 18-lateral ventricle, 19-corpus callosum, 20-olfactory bulb

Fetal Pig Dissection: *Nervous System*

Directions:

1. Use the scalpel to scrap the skull until its thin enough to break through to observe the brain.
2. Be careful to not destroy the brain.
3. Try to remove the brain to observe the cerebrum, cerebellum, and possibly the brain stem.
4. Once the brain is removed carefully, separate the two hemispheres to observe the hypothalamus and pituitary gland.

Draw the brain you extracted and write a Summary about your observations when extracting the brain. Even if you failed. what could you have done differently?

Each member needs to create a 3x5 index card for the Lab Practical Final- create it before you turn the packet in. **I will check those.**

STUDY:
Anything from the packet can be on the practical.