Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Period: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Rat Dissection**

**External Anatomy**

1. Pass off with Mrs. Smith the following body parts – BEFORE CUTTING YOUR RAT
	1. Anterior end \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. Posterior \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. Mouth \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	4. Eyes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	5. Dorsal surface \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	6. External nares \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	7. Ventral surface \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	8. Vibrissa \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	9. Mammary papilla \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	10. Anus \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**SEXING YOUR PIG:**

1. Determine the sex of your rat by looking for the urethral orifice. On females, this opening is located near the anus. On males, that rat will have a penis hidden by a fold of skin as well as a scrotal sac. (Refer to the diagrams)
2. Female rats have mammary papilla, find another group that has a male rat and determine if they have nipples also.
	1. What sex is your rat?
	2. Do both male and female rats have nipples?
3. Make sure you are familiar with terms of reference: anterior, posterior, dorsal, ventral. In addition, you'll need to know the following terms.

Medial: toward the midline or middle of the body
Lateral: toward the outside of the body
Proximal: close to a point of reference
Distal: farther from a point of reference

6. Study the rat’s appendages. Count the number of toes.

 a. How many toes does your rat have on its forelimbs?

 b. How many toes does your rat have on its hind limbs?

 c. What order is your rat in?

1. Open the rat’s mouth and locate the incisor teeth, there is a pair on the top jaw and a pair on the bottom jaw.
	1. Does the rat have any other teeth?

1. Remove one of the rat’s eyes. You will examine it later.

**Skinning the Rat**

Refer to the diagram on page 2

**The Anatomy of the Rat (internal)**

In this activity, you will open the abdominal and thoracic cavity of the rat and identify structures. Remember, that to dissect means to "expose to view" - a careful dissection will make it easier for you to find the organs and structures. Be sure to follow all directions.

**The Incision**

(The boxes below are for you to check that you have completed each step, or found each “thing”)

Place your rat in the dissecting pan ventral side up. Use string to "hog-tie" your rat so that the legs are spread eagle and not in your way. Use scissors to cut through the skin and muscles according to the diagram.

## Organs of the Head and Neck

1. Locate the salivary glands, which on the sides of the neck, between muscles. Carefully remove the skin of the neck and face to reveal these glands. Salivary glands are soft spongy tissue that secrete saliva and amylase (an enzyme that helps break down food). There are three salivary glands - the **sublingual**,**submaxillary**, and **parotid**. 

2. Find the **lymph glands** which lie anterior to the salivary glands. Lymph glands are circular and are pressed against the jaw muscles. They are not always visible in the rat. 

3. To locate the **trachea** you will need to carefully remove the **sternohyoid muscles** of the neck. The trachea is identifiable by its ringed cartilage which provides support. The esophagus lies underneath the trachea, though it is easier to locate in the abdominal cavity where it enters the stomach. 

Thoracic Cavity

1.Locate the **diaphragm**, which is a layer of muscle that separates the thoracic from the abdominal cavity. 
2. The **heart** is centrally located in the thoracic cavity. The two dark colored chambers at the top are the **atria**(single: atrium), and the bottom chambers are the **ventricles**. The heart is covered by a thin membrane called the **pericardium**. (We will come back to the heart later.) 
3. Locate the **thymus gland**, which lies directly over the upper part of the heart. The thymus functions in the development of the immune system and is much larger in young rats than it is in older rats. 
4. The **lungs** are spongy organs that lie on either side of the heart and should take up most of the thoracic cavity. 

Abdominal Cavity

1. The **coelom** is the body cavity within which the viscera (internal organs) are located. The cavity is covered by a membrane called the **peritoneum**, which is very thin and web-like, you may need to use forceps to remove some of this membrane to see the organs clearly. 

2. Locate the **liver**, which is a dark colored organ suspended just under the diaphragm. The liver has many functions, one of which is to produce bile, which aids in digesting fat. The liver also transforms wastes into less harmful substances. Rats do not have a gall bladder, which is used for storing bile in other animals. There are four parts to the liver: 

**median or cystic lobe** - located at the top, there is an obvious central cleft
**left lateral lobe** - large and partially covered by the stomach
**right lateral lobe** - partially divided into an anterior and posterior lobule, hidden from view by the median lobe
**caudate lobe** - small and folds around the esophagus and the stomach, seen most easily when stomach is raised

3. The **esophagus** pierces the diaphragm at a spot called the **hiatus** and moves food from the mouth to the stomach.  It is easiest to locate where it enters the stomach. 

4. Locate the **stomach** on the left side just under the diaphragm. The functions of the stomach include food storage, physical breakdown of food, and the digestion of protein. 

The outer margin of the curved stomach is called the **greater curvature**, the inner margin is called the **lesser curvature**. You can make a slit in the stomach and see what is inside it.  Most of the contents should be partly digested rat food. 

At each end of the stomach (on the inside) is muscular valve. The opening between the esophagus and the stomach is called the **cardiac sphincter**. The opening between the stomach and the intestine is called the **pyloric sphincter**. 

5. The **spleen** is about the same color as the liver and is attached to the greater curvature of the stomach. It is associated with the circulatory system and functions in the destruction of blood cells and blood storage. A person can live without a spleen, but they're more likely to get sick as it helps the immune system function. 

6. The **pancreas** is a brownish, flattened gland found in the tissue between the stomach and small intestine. The pancreas produces digestive enzymes that are sent to the intestine via small ducts (the pancreatic duct). The pancreas also secretes insulin, which is important in the regulation of glucose metabolism. 

7. The **small intestine** is a slender coiled tube that receives partially digested food from the stomach (via the pyloric sphincter). The coils of the small intestine are held together by a membrand called the mesentery. 

The small intestine has three sections: **duodenum**, **jejunum** and  **ileum**, (Listed in order from the stomach to the large intestine.)  The duodenum is recognizable as the first stretch of the intestine leading from the stomach, it is mostly straight.  The jejunum and ileum are both curly parts of the intestine, with the ileum being the last section before the small intestine becomes the large intestine. 

8. Locate the **colon**, which is the large greenish tube that extends from the small intestine and leads to the anus. The colon is also known as the **large intestine**. Food entering the colon from the small intestine is controlled by the ileocecal valve. The colon is where the finals stages of digestion and water absorption occurs and it contains a variety of bacteria to aid in digestion. The colon consists of five sections: 

**cecum** - large sac where the small and large intestine meet (the ileocecal valve regulates passage of materials)
**ascending colon** – food travels upward.
**transverse colon** – a short section that is parallel to the diaphragm
**descending colon** – the section of the large intestine that travels back down toward the rectum.
**rectum** - the short, terminal section of the colon that leads to the anus. The rectum temporarily stores feces before they are expelled from the body.

**Label the blank lines on the diagram on this page.**

**Test Your Knowledge**

1. Lies under the stomach and secretes insulin \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. The section of large intestine between the ascending and descending colon: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Connects the mouth to the stomach: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Thin membrane that covers the heart: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Muscle that separates the abdominal cavity from the thoracic cavity: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Destroys old blood cells and lies within the folds of the small intestine: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. The lobe of the liver that has an obvious central cleft: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Another name for the large intestine: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. Organs of the respiratory system that lie on either side of the heart: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. Large organ of the thoracic cavity that lies just under (posterior) to the diaphragm: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
11. The last section of the colon, storage of feces: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
12. The pouch of the colon that is found just where the small intestine joins it: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
13. Valve that regulates the passage of food from the stomach to the small intestine: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
14. Thin membrane that covers the organs of the abdominal cavity: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
15. The first section of the small intestine: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
16. The section of large intestine that is parallel to the diaphragm: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
17. Structure related to the immune system, lies at the top of the heart: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
18. Valve the regulates passage of materials from the small to the large intestine: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
19. The opening in the diaphragm where the esophagus passes through: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
20. Section of small intestine that comes after the duodenum: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Urinary and Reproductive Systems**

1. The primary organs of the excretory system are the **kidneys**. Locate these large bean shaped structures located toward the back of the abdominal cavity on either side of the spine. **Renal arteries and veins** supply the kidneys with blood. 

2. Locate the delicate **ureters** that attach to the kidney and lead to the bladder. Wiggle the kidneys to help locate these tiny tubes. 

3. Procedure: Remove a single kidney (without damaging the other organs) and dissect it by cutting it longitudinally. Locate the **cortex** (the outer area) and the **medulla** (the inner area). 

4. The **urethra** carries urine from the bladder to the **urethral orifice** (this orifice is found in different areas depending on whether you have a male or female rat).

5. The small yellowish glands embedded in the fat atop the kidneys are the **adrenal glands**. 

\*\*You are responsible for knowing the structures of both sexes. Locate the structures in your own rat and then observe the structures of the opposite sex from another group's rat.

**The Reproductive Organs of the Male Rat**

**Label the structures on the diagrams below**

1. The major reproductive organs of the male rat are the **testes** (singular: testis) which are located in the **scrotal sac**. Cut through the sac carefully to reveal the testis. On the surface of the testis is a coiled tube called the **epididymus**, which collects and stores sperm cells. The tubular **vas deferens** moves sperm from the epididymus to the **urethra**, which carries sperm though the penis and out the body. 

2. The lumpy brown glands located to the left and right of the urinary bladder are the **seminal vesicles**. The gland below the bladder is the **prostate gland** and it is partially wrapped around the penis. The seminal vesicles and the prostate gland secrete materials that form the seminal fluid (semen). 



**The Reproductive Organs of the Female Rat**

1. The short gray tube lying dorsal to the urinary bladder is the **vagina**. The vagina divides into two **uterine horns** that extend toward the kidneys. This duplex uterus is common in some animals and will accommodate multiple embryos (a litter). In contrast, a simple uterus, like the kind found in humans has a single chamber for the development of a single embryo. 

2. At the tips of the uterine horns are small lumpy glands called **ovaries**, which are connected to the uterine horns via **oviducts**. Oviducts are extremely tiny and may be difficult to find without a dissecting scope. 



**Taxonomy for Rats**

1. Domain
2. Kingdom
3. Phylum
4. Subphylum
5. Class
6. Order