

RAT DISSECTION

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For this lab you will be examining or dissecting: 1) the skeletal system; 2) some of the muscles; 3) the digestive system; 4) the respiratory system; 5) the uro-genital system; and 6) some of the circulatory system of a rat. You will need to learn the locations of the structures in **bold type** in this dissection guide, and also to learn the functions of those marked with an asterisk (*). You may want to consult your text beforehand for the functions of the starred structures. It is often helpful to work in pairs on this dissection.

Skeleton

On the demonstration table there is a skeleton of a rat. Use it and the drawing to find the bones mentioned below.

All vertebrate skeletons can be divided into two major parts: the **axial skeleton** and the **appendicular skeleton**. The axial skeleton consists of the skull (both the **cranium** and the two **mandibles**), the **vertebral column**, the **sternum** and the **ribs** connecting the sternum to the **vertebrae**.

The appendicular skeleton consists of the **pectoral** (shoulder) **girdle**, the **pelvic** (hip) **girdle** and the **limbs**. In rats the pectoral girdle consists of the **scapula** and **clavicle**. The pelvic girdle is composed of 3 bones that have fused together — the **ilium**, **ischium** and **pubis**. The forelimb consists of the long bones — the **humerus**, **radius**, and **ulna** — and the bones of the wrist and hand. The hindlimb is divided the same way, except that the long bones are called the **femur**, **tibia**, and **fibula**.

As you look at the rat skeleton, try and answer these questions. Some of them are straightforward, others have no one true answer. How does the joint between the cranium and mandibles work? Where does the eye fit on the cranium? Why is there a bony arch (the **zygomatic arch**) on the side of the cranium? Why do the different vertebrae have different shapes? Why do rats have tails? What is the difference between the way the pectoral girdle attaches to the vertebral column and the way the pelvic girdle attaches? Why is there this difference? Why are there holes in the pelvic girdle? What sorts of motions does the joint between the pelvis and the femur allow? What sort is allowed at the knee? At the elbow? Why do forearms have two bones and upper arms only one?

Muscles

Before you begin dissecting your rat, there are some anatomical terms you need to know to understand these dissecting instructions. **Anterior** refers to towards the head end of the rat; **posterior** refers to towards the tail end. **Dorsal** refers to towards the back of an animal; **ventral** towards the front or downwards side; **lateral** towards the sides. **Proximal** means towards the center of the body; **distal** means farther away from the body. All of these terms are relative,

depending on what structures you are referring to. For example, the elbow is proximal to the wrist, but distal to the shoulder.

You will be looking at only a few groups of muscles - those of the trunk and the upper arm. To see these muscles, you need to skin most of your rat. On the ventral side of your rat, pinch tip a small fold of skin in the center of the abdomen and make a small cut. As you proceed, make sure you are only cutting the skin, not the muscles underneath. Begin lengthening your initial cut anteriorly on the abdomen, eventually stopping at the neck. As you go, reach between the skin and the muscles with your fingers or a blunt probe and separate the skin from the muscles. At some points, you may need to use a scalpel to cut muscles or ligaments running to the skin. After you reach the neck, go back to your initial cut and lengthen it posteriorly to about where the legs join the trunk. Then cut laterally on both sides all the way around the dorsal side. Make the same lateral cut around the neck. Then make a cut from the ventral midline out along each arm to about half-way down the forearm. Then cut around the arm. At this point the skin can be pulled free from the body wall and removed entirely. Save the skin to wrap around your rat if you need to stop and begin again at another time.

Now you're ready to find particular muscles. Use the diagram to find the muscles described. Place your rat, ventral side down, on the dissecting tray. The **external oblique** is a thin sheet of muscle reaching from the ventral side around to the center of the back. It is most apparent on the sides of the abdomen. Overlying this are two sets of triangular muscles stretching from the shoulder down to the midline. The larger muscle underneath is the **latissimus dorsi**; the smaller, uppermost muscle is the **spinotrapezius**. Anterior to the spinotrapezius and reaching from the midline towards the shoulder is the **spinodeltoideus**. This covers the beginning of the **biceps brachii** at the proximal part of the humerus. Posterior to the biceps brachii is the **triceps brachii**.

Now place your rat ventral side up. Note the external oblique on this side. Running along the midline in the center of the abdomen is the **rectus abdominis**. Anterior to this are two sets of muscles — the **pectoralis minor** and **pectoralis major**.

A note on muscle function: Each muscle can be divided into three parts - an **origin** that is attached to a fixed structure, a **belly** in the middle, and an **insertion** of the muscle onto a bone that moves when the muscle is contracted. For example, the biceps brachii originates on the scapula and inserts on the radius. When it contracts, the forearm is drawn toward the upper arm. In **opposition** to the biceps brachii is the triceps brachii, which straightens out the forearm.

Digestive and Respiratory Systems

To see these and the other systems, you must dissect your rat further. Start by cutting with your scissors from the corners of the mouth back to the ears. Pry the jaws apart and complete the cut so that the mouth can be opened and the pharynx exposed. Note the **soft palate** and the ridged **hard palate** anterior to it. At the base of the tongue is an opening, the **glottis**, into the **larynx**. The **epiglottis** is the tiny triangular flap that guards the glottis. The **trachea*** extends from the larynx to the point of branching just before the lungs. To see the trachea and the **esophagus***

just dorsal to the trachea, you may need to cut through the throat muscles on the ventral side.

To see the organs of the **thoracic** and **abdominal cavities**, begin cutting through the body wall muscles just anterior to the genital opening and continue anteriorly just to one side of the midline on the ventral side. Cut through the ribs in the thoracic cavity and continue up to the throat region. There find the **diaphragm*** and cut it away from the body wall. At the posterior end of the abdominal cavity, cut laterally through the external oblique until you can pin back the ventral side muscles and expose the organs underneath. If necessary, make another pair of lateral cuts toward the anterior end, but be sure not to cut through any organs.

In the thoracic cavity note the **heart*** and **lungs***. In some rats there may be a **thymus gland** covering the anterior half of the heart, but in older rats this gland disappears. Trace the trachea as it divides and goes into the lungs.

In the abdominal cavity, pick up the esophagus as it comes through the diaphragm and note where the esophagus enters the **stomach***. At the posterior end of the stomach there is a muscular valve called the **pyloric sphincter**; this leads into the **small intestine***. Over the stomach and quite conspicuous is the **liver***. Most mammals have a gall bladder near the liver; rats do not. The **spleen*** is the flattened, reddish organ lying just to the left and posterior to the stomach. The intestines and other organs are attached to the dorsal wall of the body cavity by sheets of membranes. These are the **mesenteries**. In the mesentery that stretches along the stomach, spleen and small intestine, there is a diffuse, glandular organ called the **pancreas***. Now follow the small intestine all the way along until it becomes the **large intestine***. At the junction between the small and large intestines, there is a blind pouch called the **caecum**. Be careful not to tear the mesenteries as you examine the intestines. At the end of the large intestine there is an expanded portion called the **rectum**, which opens to the exterior through the **anus**.

Uro-genital System

If you move the intestines to one side, you will see one of the two **kidneys*** imbedded in the dorsal body wall. From these, **ureters** lead to the **urinary bladder***. The ureters are small white tubes and are often difficult to find. The urinary bladder empties to the outside through the **urethra**. Be sure you can locate the urethral opening on both male and female rats.

The reproductive system of female rats is relatively simple. You should know both male and female systems. In the female the prominent **uterine horns*** pass dorsally to the bladder and ureters. Where the horns join dorsal to the urethra, is the **vagina*** which opens to the exterior through the **vaginal opening**. On the exterior, the anus is just ventral to the tail, the vaginal opening is ventral to the anus, and the urethral opening is ventral to the vagina. At the anterior end of each uterine horn there is a short, convoluted oviduct which opens into a transparent pocket around the small, round **ovary**. Often the ovary is hard to find. Try feeling in the fat at the end of the uterus for a small, hard, round body. Some female rats may be pregnant and have small embryos in the uterine horns. If yours is pregnant, cut longitudinally along the horns and observe the embryos.

The male reproductive system is more complicated than the female's. Locate the male's **scrotum** and cut longitudinally through just the skin to locate the **testes***. Separate the skin from the testes and continue the cut up to the abdominal cavity. Notice the **epididymis** lying around each testis. Find the **vas deferens*** that leads from each testis to the urethra. You will probably have to cut through some muscles in the pelvis area to locate some of these structures. Be careful as you do so. To either side of the bladder are two sets of glands. The smaller, round, more posterior ones are the **prostate glands**. The larger pair of glands are the **seminal vesicles**, which are actually two different glands — the **vesicular glands** and the **coagulating glands**. Follow the urethra as it goes through the **penis***. In males the bladder and the testes both empty to the outside through the urethra.

Circulatory System

Go back to the heart in the thoracic cavity. (Right and left in this description refers to the rat's right and left). Find the **right** and **left atria**. Note that the **left ventricle** occupies the larger half of the heart; the **right ventricle** is much smaller. Depending on your rat, you may or may not be able to see the other blood vessels described here. Use the demonstration rat to help find these. The **posterior** and **anterior venae cavae** return blood from the posterior and anterior parts of the body to the right atrium. From there the venous blood moves to the right ventricle, from which it is pumped to the lungs via the **pulmonary trunk**. The pulmonary trunk splits into two pulmonary arteries, one leading to each lung. Oxygenated blood returns from the lungs through the pulmonary veins, which are difficult to see, to the left atrium. From there it moves to the left ventricle and then is pumped to the body via the **ascending aorta**.