

86 EXTERNAL ANATOMY OF THE LABORATORY RAT I

The dissection of any vertebrate leads to a better understanding of our own anatomy. Although there is great similarity between the human body and its systems and those of the specimen under dissection, remember that differences do exist. Minor variation can also exist between individual specimens and the specimen and general description provided in the manual.

During the dissection phase of the following three investigations, the best tools available are your hands. The technique of blunt dissection — using your hands and blunt probes to separate tissues and organs along natural divisions — displays tissues and organs most naturally. The greatest results will be achieved by the correct dissection and exploration of the specimen. It is important that you are prepared for the dissection and understand the directions clearly.

Before beginning, each student should review the following terms. Note: When reference to right or left is made, it is the right or left of the specimen that is referred to, and, since the specimen is on its back, these are opposite to the right and left of the person performing the dissection.

OBJECTIVE

- To investigate the external features of the specimen and to identify these on the specimen or facsimile drawing.

TERMS

anterior or cranial	toward the head end
posterior or caudal	toward the tail end
dorsal	toward or near the back
ventral	toward or near the belly
median	in or near the longitudinal plane in the middle of the body
medial	pertaining to the median plane
proximal	lying near the base or site of attachment
distal	lying near the tip or far from the site of attachment

There are three planes of reference commonly used in dissection:

sagittal	parallel to the median longitudinal plane dividing the specimen into right and left sides
frontal	running horizontal to and dividing the specimen into dorsal and ventral sides.
transverse	running at right angles to the longitudinal plane

MATERIALS

preserved rat (intact and doubly injected)

dissection tray

PROCEDURE AND OBSERVATIONS

External Anatomy

After thoroughly rinsing the specimen to remove surface preservative, identify each of the following features on the specimen.

General

1. The body is made up of the head, neck, trunk, and tail. The trunk is divided into the thorax and abdomen at the level of the diaphragm (internal).
2. The forelimb is made up of the upper arm (brachium), forearm (antebracium), palm, wrist, and digits. The hindlimb consists of the thigh, shank, ankle, foot, and digits.
3. The axilla is the area between the thorax and the arm. The inguinal is between the abdomen and the thigh. The perineum is the area around the urogenital and anal openings.

Specific

1. *Eye* These are protected by an upper and lower eyelid.
2. *Pinna* This is the external, soft-tissue portion of the ear. It contains cartilage that provides support for its distinct form.
3. *Vibrissae* These are short, stiff, bristlelike tactile hairs found on the "face."
4. *Claws* These are the hard growths that arise from modification of the *stratum corneum* of the skin at these sites.
5. *Tori* These are the foot pads produced by a thickening of the epidermis of the skin.
6. *Anus* This is the opening located ventrally to the base of the tail and in the midline.

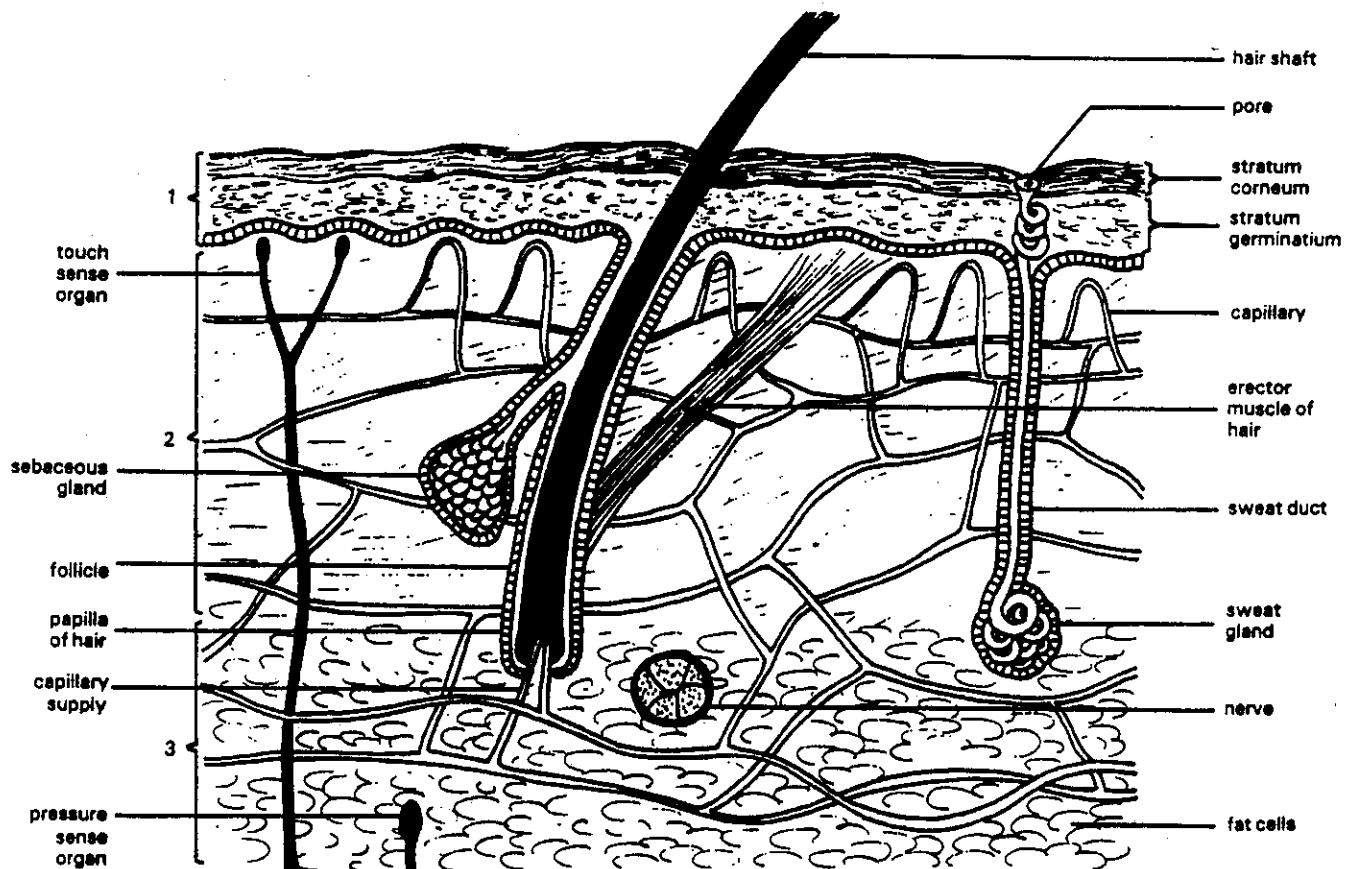


Fig. 1 Cross section of skin.

1. epidermis 2. dermis 3. subcutaneous fat

7. *Urogenital aperture* This is in the female and located anteriorly to the anus.

8. *Prepuce* This is in the male and located anteriorly to the scrotum. The penis is usually retracted and not evident.

9. *Scrotum* This sac present in the male contains

the testes and is located anteriorly to the anus.

10. *Nipples* These are on the ventral side of the body on either side of the midline.

11. *Integument or skin* This covers the body, consists of a number of distinct layers and various glands, and supports the hair follicles.

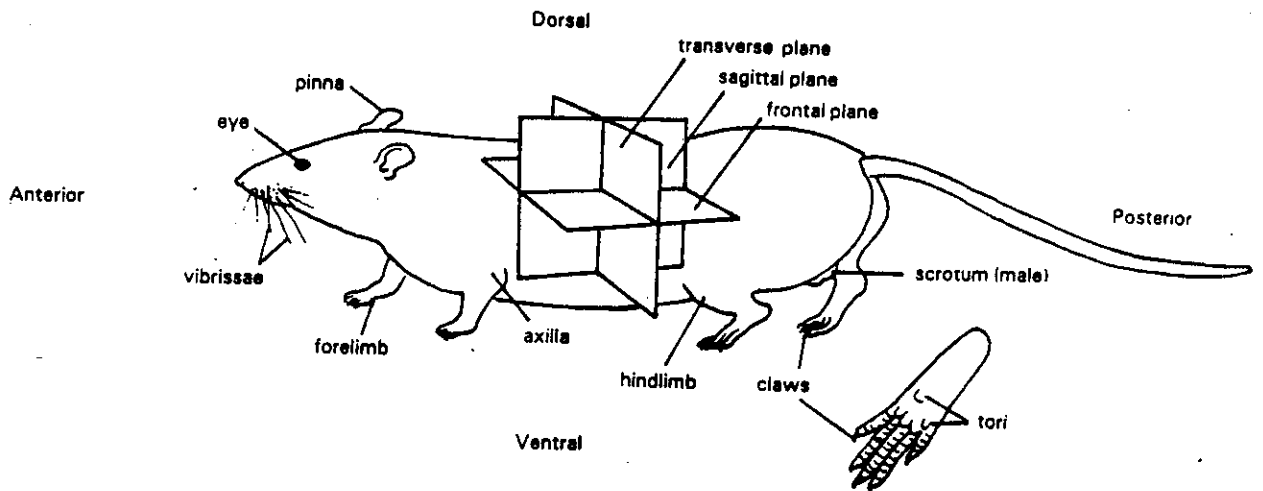


Fig. 2 Side view of rat.

Procedures which ask you to draw a diagram are indicated with a ★ next to them.

You are to carefully draw these diagrams on pages 198-202. Label and draw each diagram carefully and accurately.

87 INTERNAL ANATOMY OF THE LABORATORY RAT II

In this investigation, you will begin to dissect and examine the internal anatomy of a rat. Specifically, you will examine the rat's digestive system, from the mouth to the rectum, and draw a diagram of what you observe.

OBJECTIVES

- To investigate the organization of the digestive system.
- To develop skill in the dissection of specimens according to directions.
- To be able to identify the parts of the digestive system both on the specimen and facsimile diagram.
- To prepare drawings of one's own work.

MATERIALS

preserved rat (intact and doubly injected)	scalpel
dissecting tray	forceps
dissection pins	two blunt probes
bone cutters (one set per class)	scissors

The body cavity or coelom can be divided into two compartments.

Location	Cavity	Divisions
Anteriorly to the diaphragm	Thoracic	Two pleural cavities containing the lungs. Mediastinum, the space between the two pleural cavities, which contains the heart
Posteriorly to the diaphragm	Abdominal	The digestive organs and glands are contained within the peritoneal membrane, while the urogenital organs and glands lie outside dorsally

Care must be taken when dissecting the specimen

to keep intact the membranes of these cavities for observation. Follow the instructions carefully and in sequence so that nothing is removed or damaged before it is examined.

1. Secure the specimen to the dissection tray, placing it on its back and fastening it with dissection pins. The position will require adjustment as the dissection progresses.
2. Examine the diagram (Fig.1.) for the location of the first cuts. Locate the umbilicus and take up a pinch of skin located anteriorly to this point. With the scissors, make a 2 cm cut in the pinch of skin at right angles to the midline. This cut should now permit access under the skin.
3. Make all the other cuts with the scissors. (*Note:* (a) It may be necessary to use bone cutters when cutting through the ribcage. (b) Extra care with the scissors is necessary to avoid cutting the membranes, the heart, and the major blood vessels located in the neck. (c) Cut through the pectoral girdle bones and readjust the position of the forelimbs. (d) It will also be necessary to carefully cut the diaphragm away from the ribs.

4. Observe the peritoneal membranes and the remains of the membranes of the thorax.

5. Carefully raise the peritoneal membrane and cut it away without disturbing the organs beneath. Prepare a clear drawing of the dissection at this stage. *Label as much as you can.*

Digestive System

1. Examine Fig. 2 carefully and identify as many of the organs and glands as possible without moving the dissection.

2. Using a blunt probe, pry open the mouth and identify:

- (a) the tongue — a muscular organ attached posteriorly to the floor of the mouth;
- (b) the teeth — a series of differently shaped objects resembling bone. Identify how many teeth are present and what type;
- (c) the pharynx — the chamber located near the rear of the mouth cavity that is common to both the digestive and the respiratory systems.

3. Locate as many of the salivary glands as are obvious:

- (a) parotid — in front of the ear and below the eye;
- (b) submandibular — on the under surface of the lower jaw bone (mandible);
- (c) sciblingual — anteriorly to the submandibular gland.

4. Locate the esophagus and trace its path through the mediastinal region of the thorax through the diaphragm to the stomach. (*Note: Care must be taken since this tube lies dorsally to the other organs of the thoracic region. It may help to pass a blunt probe gently down the esophagus.*)

5. Identify the liver, the large reddish-brown organ that is against the diaphragm, across the width of the cavity, and on the stomach. Note the number of lobes this organ has and then carefully move the right lobe of the liver up and toward the diaphragm.

6. The small intestine starts at the constriction at the posterior end of the stomach. The constriction is produced by a circular group of small muscles called a sphincter. The posterior sphincter is the pyloric, and, if you examine the stomach, there is another sphincter, the cardiac, at the point where the esophagus joins the stomach.

7. The small intestine is divided into three portions. The first is the duodenum, which receives material

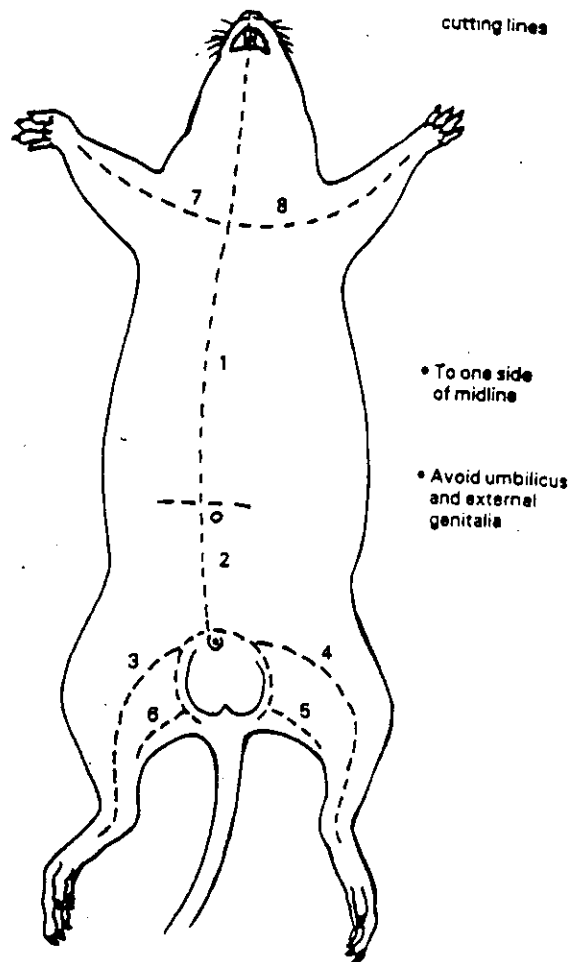


Fig. 1. Dissection of rat

from the stomach, the bile from the liver, and the enzyme solution from the pancreas. Locate the pancreas, a thin pink organ, which lies along the margin of the stomach.

8. The other two portions of the small intestine are, in order, the jejunum and the ileum. Note the fine web of membrane that suspends the intestine from the dorsal wall and carries some of the many blood vessels of the digestive system. Examine this membrane, and then gently pull the small intestine out from the cavity a short distance to the left, and secure it with a pin.

9. Locate the ileocolic sphincter, where the small intestine joins the large intestine. The large intestine proceeds anteriorly from this point as the ascending colon and posteriorly as an extension called the caecum, which terminates in the vermiform appendix.

10. Trace the path of the large intestine, or colon.

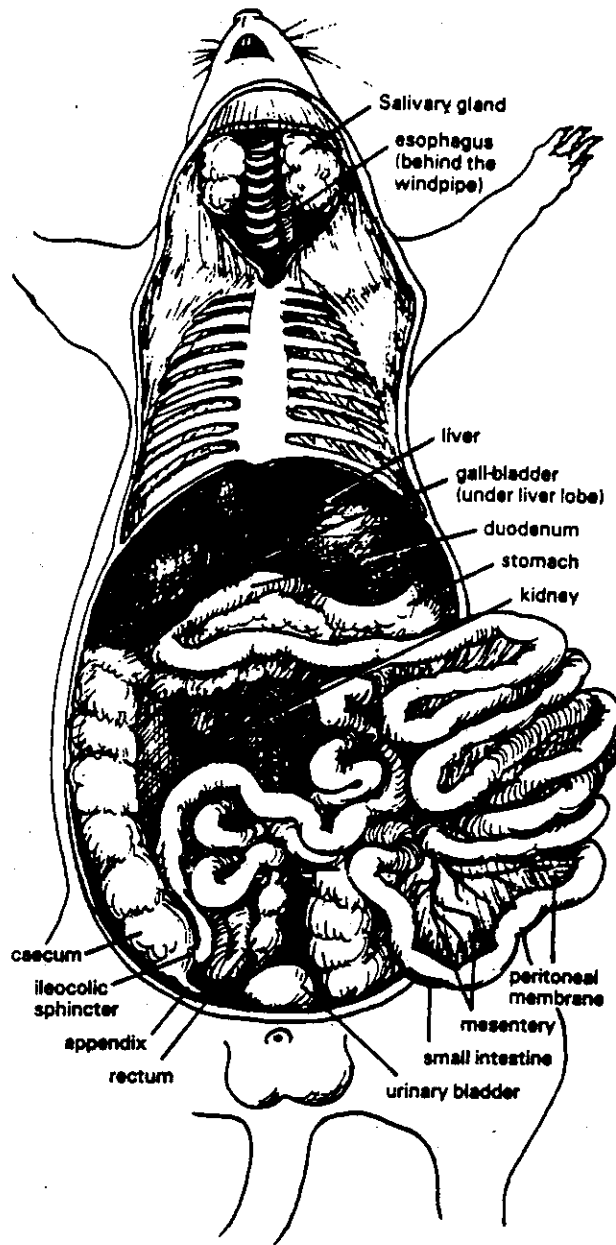


Fig. 2. Organs of the rat

11. Identify the expansion of the colon, which is anterior to the anus. This portion is the rectum.



12. Prepare a drawing of the dissection as it now appears. *Label as much as you can.*



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This portion of the dissection deals with those systems that are not immediately obvious. The respiratory system is mainly confined to the thorax, as is the core of the circulatory system, while the urogenital system is located against the dorsal wall of the abdominal cavity. *Note:* Carefully remove the digestive system by cutting at the cardiac sphincter and at the ileocolic sphincter for the present. Now locate the small organ suspended in the mesentery, as it will likely be removed as well. This is the spleen; it is an accessory organ to the circulatory system.

OBJECTIVES

- To dissect the thoracic cavity, and identify both the circulatory and respiratory organs.
- To complete the dissection of the abdominal cavity and identify the urogenital system.

MATERIALS

preserved rat
(doubly injected)
dissecting tray
dissection pins
bone cutters
(one set per class)


scalpel
forceps
two blunt probes
scissors
storage facility

Part 1 Thoracic cavity (use the diagrams on p. 196 A)

1. The pharynx was identified in Investigation 87. From this common chamber, the other tube that accompanies the esophagus is the trachea.
2. Using the blunt probe, explore the entrance to the trachea. It is easily identified on the ventral side and possesses a series of rings. These rings are cartilage and support the tube to prevent its collapse due to the pressure of exhalation.
3. Locate the point at which the trachea branches. Each of the branches is a bronchus (pl. bronchi), and they terminate at the lungs.
4. Once the two spongy lungs have been identified, attempt to locate the membrane that lines the thoracic cavity and the lungs. This is the pleural membrane; the cavities the lungs occupy are the pleural cavities.
5. Identify the number of lobes that comprise each lung.
6. Carefully clear away the tissue that covers the trachea in the neck region. (Try to preserve any major blood vessels.)
7. Identify the region of cartilage located in the trachea. This is the larynx. Note the large gland around the larynx. This is the thyroid.
8. Locate the heart. It is the large organ that fills the

mediastinal region between the pleural cavities. The space it occupies is the pericardial cavity, and it is enclosed by a strong membrane called the pericardium. As with the pleural and peritoneal membranes, the pericardium has two portions, one that lines the cavity, the other that covers the organ. Here, it is the heart.

9. Overlying the heart is a dark tissue, which is the thymus gland. There may also be a quantity of yellow fat. Carefully remove this tissue and then slit open the pericardium in the midline, exposing the surface of the heart.

10. Prepare a drawing of the heart, identifying its orientation and the orientation of the major blood vessels. *Label as much as you can.* 

11. Locate the anterior chambers of the heart. These are the atria (sing. atrium), which receive blood coming to the heart. Directly below the atria, identify the larger ventricles in the posterior end of the heart and find the coronary vessels on their surface. These vessels supply blood to the heart muscle itself.

12. Carefully raise the heart and locate the vena cavae. The superior and inferior vena cavae enter the right atrium on the dorsal side. The left atrium receives blood returning from the lungs via the pulmonary veins. These should also be located.

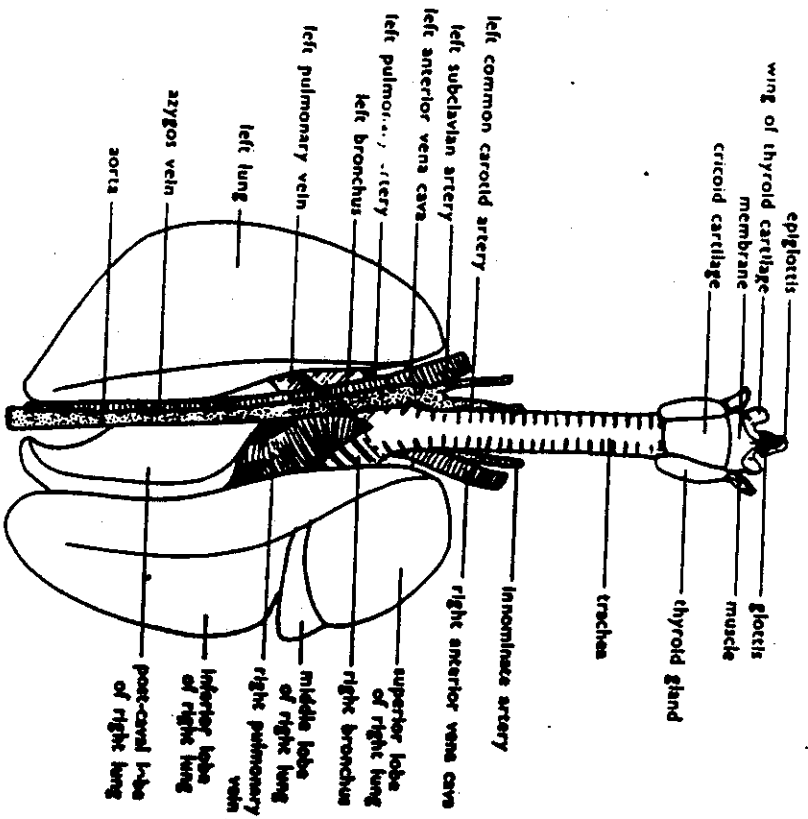


Fig. 38
Clear any fat from the bronchi and blood-vessels.
Identify the parts shown.

STANDARD 3

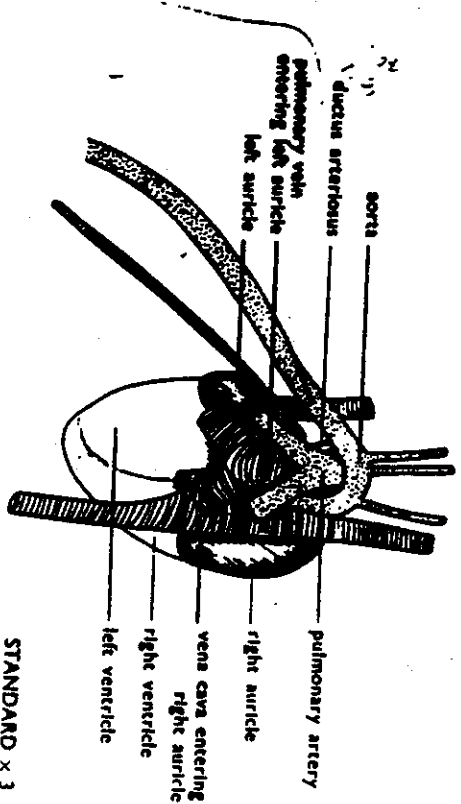


Fig. 39
Separate the bronchi from the pulmonary arteries.
Cut through each pulmonary vein, bronchus and pulmonary artery as indicated to remove the lungs, but leave as much as possible of the blood-vessels.

Fig. 40
Lay aside the aorta and azygos vein.
Study the dorsal view of the heart and the relation of the blood-vessels to it.

STANDARD x 3

13. Blood leaves the heart in two ways. From the right ventricle it travels through the pulmonary artery to the lungs. Locate this artery and trace its path as far as possible. (It bifurcates very close to the heart.)

14. The large vessel leaving the left ventricle and arching from the heart is the aorta. Attempt to locate and trace the dorsal aorta (to the abdomen and posterior portion of the body) and the carotid arteries (to the head).

15. Remove the heart and carefully cut it open in the frontal plane to separate its front and back. Identify the various chambers and structures in the heart.

Part 2 Abdominal Cavity

1. First locate the urinary bladder. This is located near the pelvic girdle ventrally to the rectum. This bladder may be collapsed like a deflated balloon. When you have successfully identified this structure, carefully cut through the large intestine near the rectum and remove it entirely from the cavity.

2. Carefully cut through the pelvic girdle (bone cutters may be necessary). Be sure to avoid cutting any other tissues. Readjust the legs. This should expose the tissues that pass through the pelvic girdle.

3. Locate the kidneys behind the peritoneum on the dorsal wall of the cavity. Carefully remove the peritoneum to expose these bean-shaped organs fully.

4. Carefully examine the anterior surface of each kidney for the presence of the adrenal gland. The yellow fat deposits can be removed using a probe.

5. Identify the renal arteries, which branch from the dorsal aorta, bringing blood to the kidney for processing. Beneath these note the renal veins, which carry the blood out to the vena cavae and to the liver.

6. Locate and trace the path of the tube that runs from the medial wall of the kidney down the centre of the body. This is the ureter, which terminates at the urinary bladder.

7. Identify the single urethra as it exits the bladder and leads to the exterior. This is the exit route for urine. The length of this structure will depend upon the sex of the specimen.

8. If the specimen is male, observe the sac or scrotum that contains the testes. Carefully cut open the sac and locate the sperm duct on the surface of the testis. Trace this duct to its junction with the urethra. Locate the penis, which is posterior to the bladder.

If the specimen is female, locate the ovaries, which are posterior to and smaller than the kidneys. There is a small tube leading from the area of the ovaries to the uterus. This is the oviduct or Fallopian tube, but it is hard to find in the connective tissue, and care is needed. Identify the posterior constriction of the uterus. This is the cervix. Behind it is the vagina, which leads to the external opening.

9. Prepare a diagram for your specimen displaying the relationship and organs of the urogenital systems. *Draw both the male + female.*

10. *View a specimen of each sex.*

If you have a male rat, look around the lab for a female rat.