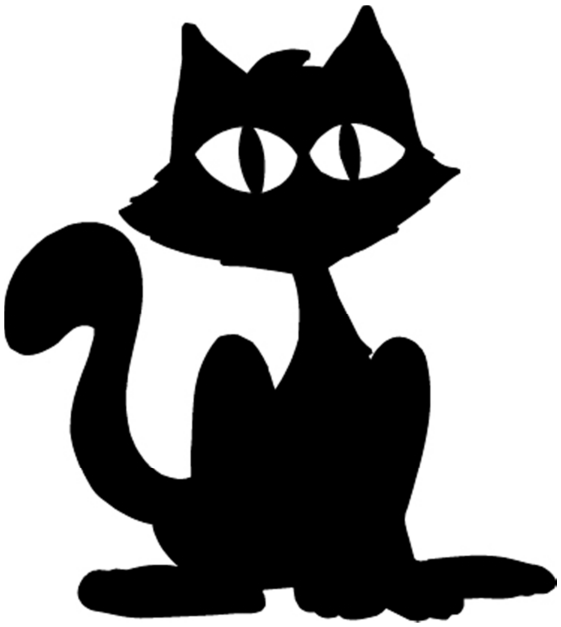
Dissection of the Cat



Introduction

You will be looking at the anatomy of the cat. Believe it or not, the cat is similar in composition to a human. It has the same circulatory system, similar muscles, and a similar skeletal structure.

Psalm 139:13-14 "For you created my inmost being; you knit me together in my mother's womb. I praise you because I am fearfully and wonderfully made; your works are wonderful, I know that full well."

Through the study of creation, we can see the marvelous design that God created. It is my hope that as you study the anatomy of the cat, you will appreciate God's design in your own life.

The classification of the cat (*Rattus norvegicus*)

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Class: Mammalia
Order: Carnivora
Family: Felidae
Genus: *Felis*
Species: *Felis catus*

Step #1 Name Your Cat!

_____

We will be looking at many different parts of the cat. Using the available material, instructions and diagrams, most students will be able to locate many structures for themselves. If after an earnest effort, you cannot find a structure, ask for assistance. Remember, this is a learning experience; it is quite permissible to discuss and observe other students' specimens. Compare you dissection with others, for animals often differ.

The specimen you will receive is a preserved double-injected specimen. Double injected refers to the arteries being filled with a red latex, and the veins being filled with blue latex.

Dissection

Dissecting tools will be used to open the body cavity of the Cat and observe the structures. **Keep in mind that dissecting does not mean "to cut up"; in fact, it means "to expose to view".** Careful dissecting techniques will be needed to observe all the structures and their connections to other structures. You will not need to use a scalpel. Contrary to popular belief, a scalpel is not the best tool for dissection. Scissors are better because the point of the scissors can be pointed upwards to prevent damaging organs underneath. Always raise structures to be cut with your forceps before cutting, so that you can see exactly what is underneath and where the incision should be made. **Never cut more than is absolutely necessary to expose a part.**

Structures to Identify

These are the structures that you are expected to identify.
Check each one off as you identify it. You may proceed at your own pace.

Muscular System

1. **Trunk Muscles**
   - Deltoid
   - Pectoralis major
   - Rectus abdominis
   - External oblique
   - Trapezius
   - Gluteus medius
   - Gluteus maximus
   - Latissimus dorsi
2. **Muscles of the upper limbs**
   - Triceps brachii
   - Biceps brachii
   - Brachialis
   - Brachioradialis
3. **Muscles of the lower limbs**
   - Rectus femoris
   - Vastus lateralis
   - Vastus medialis
   - Gastrocnemius
   - Soleus
   - Sartorius
   - Adductor muscle
   - Gracilis
   - Fibularis longus

Skeletal System

Axial Skeleton

1. **Thoracic Cage**
   - Sternum
   - Ribs
2. **Vertebral Column**
   - Cervical vertebrae
   - Thoracic vertebrae
   - Lumbar vertebrae
   - Sacral vertebrae

Appendicular Skeleton

3. **Bones of the Shoulder Girdle**
   - Clavicle
   - Scapula
4. **Bones of the upper limbs**

   Arm
   - Humerus
   - Radius
   - Ulna
5. **Bones of the lower limbs**

   Leg
   - Patella
   - Femur
   - Tibia
   - Fibula

Digestive System

- Liver
- Esophagus
- Stomach
- Pancreas
- Gall Bladder
- Spleen
- Small intestine
- Large intestine

Excretory/Reproductive System

- Kidneys
- Bladder
- Ovaries (female only)
- Uterus (female only)
- Testes (male only)

Respiratory System:

- Lungs
- Diaphragm
- Trachea

Circulatory System

- Heart
  - Pericardial sack
  - L/R Ventrical
  - L/R Atrium
  - Aorta
  - Vena Cava
- Renal Artery
- Right/Left external jugular
- Right/Left internal jugular vein
- Right/Left subclavian
- Right/Left femoral
- Brachiocephalic
- Brachial
- Common iliac
- Inferior vena cava

Endocrine System

- Adrenal glands
- Thymus gland

Cat Anatomy Checklist

After completing each of the sections below you should have the box initialed by Mr. Sowash to ensure adequate progress.

1. Muscular system: _____

2. Skeletal system: _____

3. Digestive system: _____

4. Excretory system: _____

5. Excretory/Reproductive system: _____

6. Respiratory System: _____

7. Circulatory system: _____

9. Endocrine System: _____

9. Final check: _____

Cat Anatomical Regions

The Cat's body is divided into six anatomical regions:

1. Cranial region – head
2. Cervical region – neck
3. Pectoral region - area where front legs attach
4. Thoracic region - chest area
5. Abdomen – belly
6. Pelvic region - area where the back legs attach

The Muscular System of the Cat

Procedure: Skinning the Cat
You will carefully remove the skin of the Cat to expose the muscles below. This task is best accomplished by making a small incision below the neck with your scalpel and the using your probe to separate the connective tissues that connects the skin to the first layer of muscles. Do not cut into the muscles! You can start at the incision point where the latex was injected and continue toward the tail. Use the lines on the diagram to cut a similar pattern, avoiding the genital area. Gently peel the skin from the muscles, using your fingers or probe to tease away muscles that stick to the skin.

Identify the following muscles:

Trunk Muscles

- Deltoid
- Pectoralis major
- Rectus abdominis
- External oblique
- Trapezius
- Gluteus medius
- Gluteus maximus
- Latissimus dorsi

Upper Limbs

- Triceps brachii
- Biceps brachii
- Brachialis
- Brachioradialis

Lower Limbs

- Rectus femoris
- Vastus lateralis
- Vastus medialis
- Gastrocnemius
- Soleus
- Sartorius
- Adductor muscle
- Gracilis
- Fibularis l

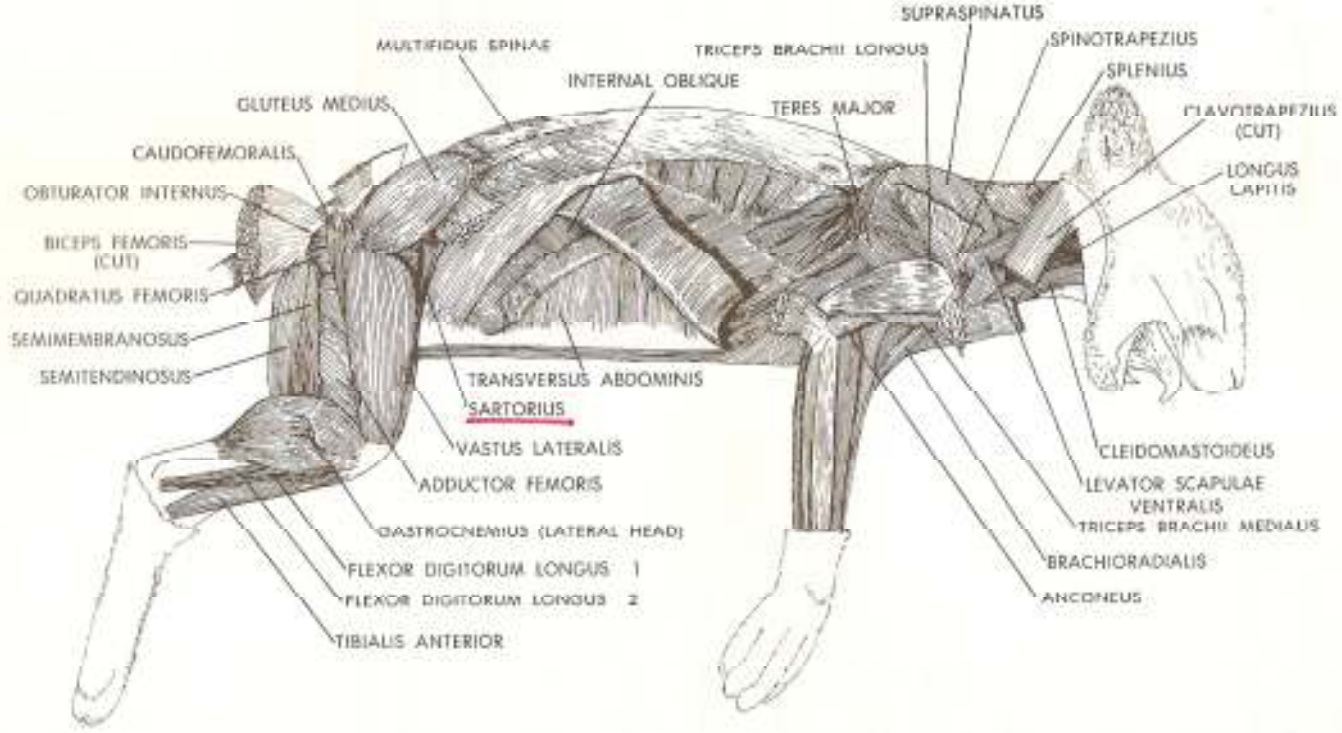


FIGURE 18. Lateral view of deep muscles.

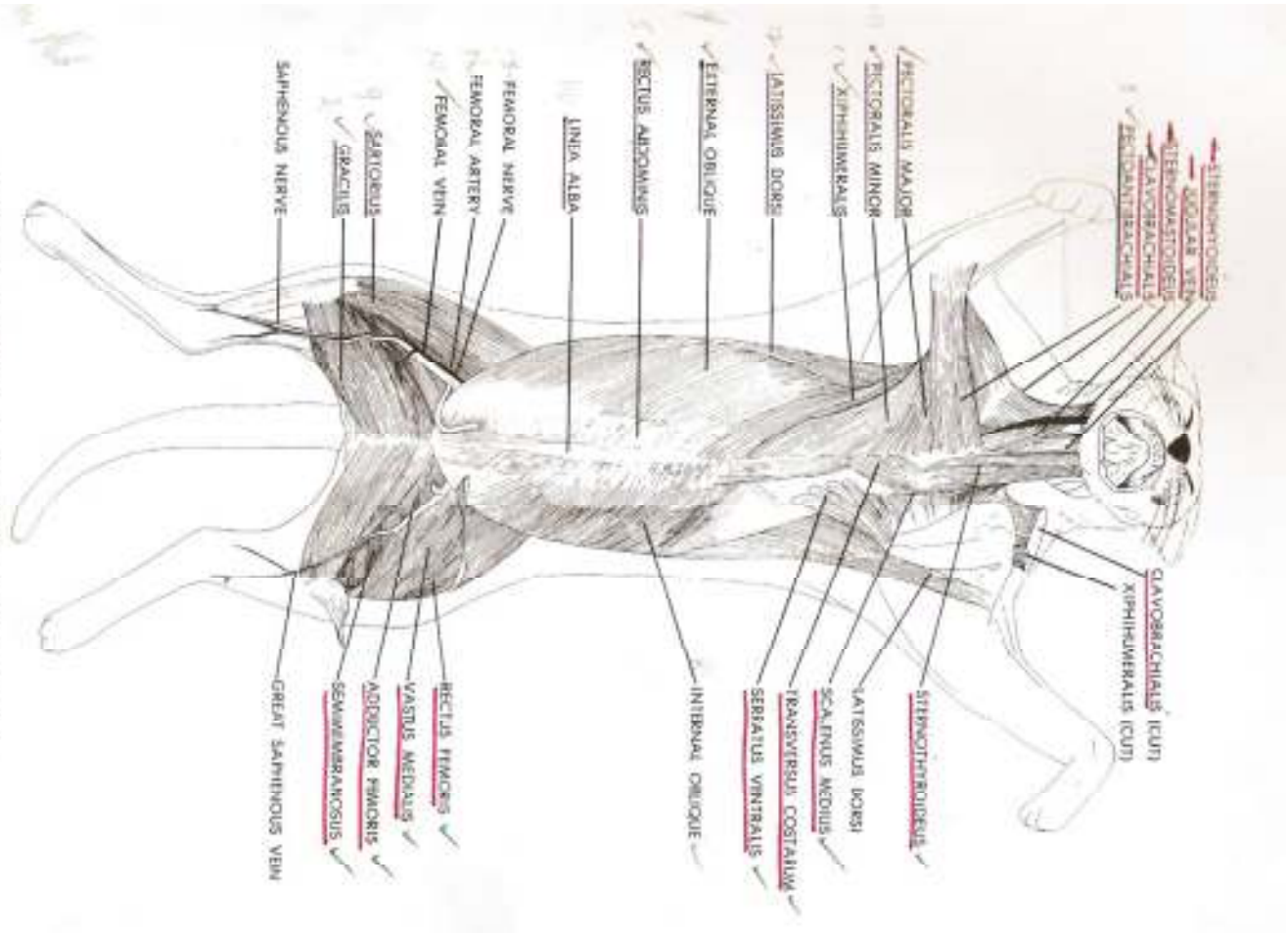


FIGURE 17. Ventral view of superficial and deep musculature.

The Skeletal System of the Cat

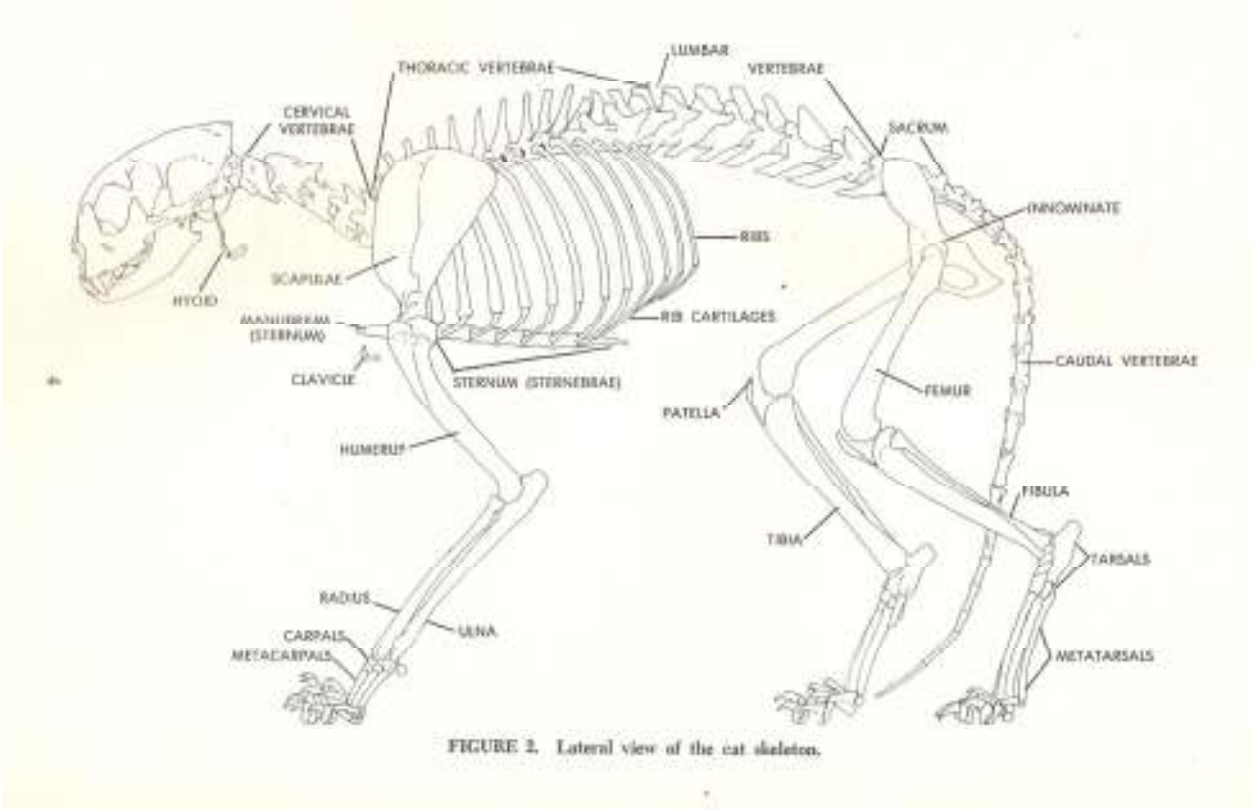


FIGURE 2. Lateral view of the cat skeleton.

Procedure: Exposing the bones of the leg.
Carefully tease away the biceps femoris and gastrocnemius on **one** leg to expose the 3 leg bones: **Tibia**, **Fibula**, and **Femur** and the small **patella** (kneecap). You can also see the **ligaments** around the knee that attach the bones of the lower leg to the femur and the achilles tendon which attaches the gastrocnemius to the ankle. Remove the muscles from **one** arm to reveal the ulna, radius, and humerus. Note the size of the radius. Leave the muscles attached to one arm and one leg for future review. You do not need to expose the bones of the vertebral column, simply identify each of the vertebral regions.

Identify the following bones:

Thoracic Cage
- Sternum
- Ribs

Vertebral Column
- Cervical vertebrae
- Thoracic vertebrae
- Lumbar vertebrae
- Sacral vertebrae

Bones of the Shoulder Girdle
- Clavicle
- Scapula

Upper limbs
- Humerus
- Radius
- Ulna

Lower Limbs
- Patella
- Femur
- Tibia
- Fibula

The Digestive System of the Cat

The Thoracic Organs

Procedure: Use scissors to cut through the abdominal wall of the Cat following the incision marks in the picture on pg. 2. Be careful not to cut too deeply and keep the tip of your scalpel pointed upwards. Do not damage the underlying structures.

1. Locate the **diaphragm**, which is a thin layer of muscle that separates the thoracic cavity from the abdominal cavity. The diaphragm is a helpful directional marker.

2. **DO NOT REMOVE OR CUT THE HEART!** 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.)

The Abdominal Organs

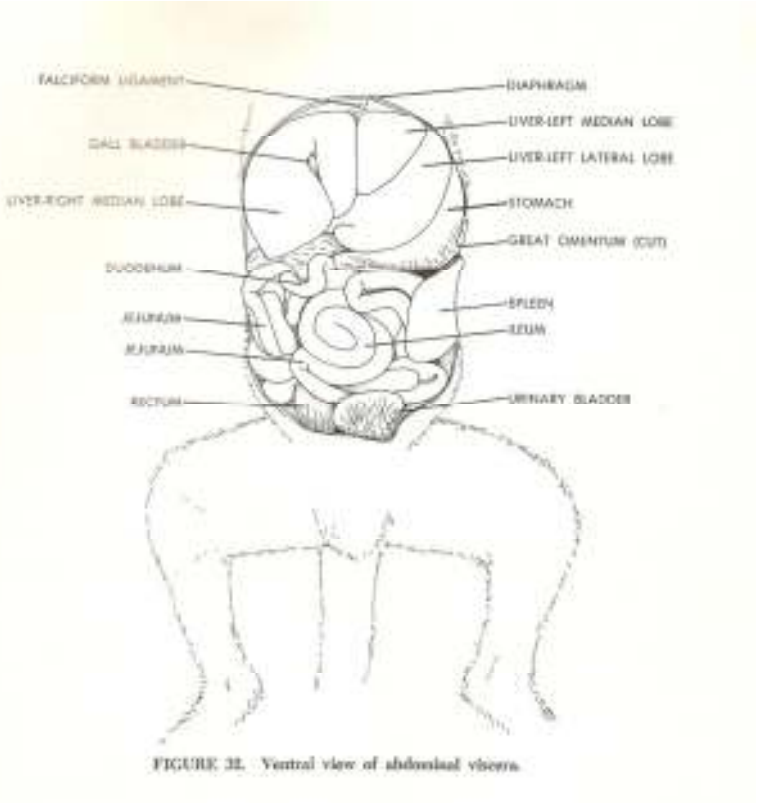


FIGURE 32. Ventral view of abdominal viscera.

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.

2. Locate the **liver**, which is a large, dark colored, multi-lobed 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 stores glycogen and transforms wastes into less harmful substances.

3. The **esophagus** runs through the diaphragm and moves food from the mouth to the stomach. It is distinguished from the trachea by its lack of cartilage rings.

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 opening between the esophagus and the stomach is called the cardiac sphincter. The outer margin of the curved stomach is called the **greater curvature**, the inner margin is called the **lesser curvature**.

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. Find the pancreas by looking for a thin, almost membrane looking structure that has the consistency of cottage cheese.

7. The **small intestine** is a slender coiled tube that receives partially digested food from the stomach (via the pyloric sphincter). The term “small” refers to its diameter, not its length. It consists of three sections: **duodenum**, **ileum**, and **jejunum**. The small intestine leads to the large intestine which is much thicker, but shorter.

9. Use your scissors to cut the mesentery (suspends small and large intestines from the body wall) of the small intestine, but do not remove it from its attachment to the stomach and rectum. If you are careful you will be able to stretch it out and untangle it so that you can see the relative lengths of the large and the small intestine.

10. 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**. 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.

12. Locate the **rectum** - the short, terminal section of the colon between the descending colon and the anus. The rectum temporarily stores feces before they are expelled from the body.

Please identify the following digestive organs:

- Liver
- Esophagus
- Stomach
- Pancreas
- Gall Bladder
- Spleen
- Small intestine
- Large intestine

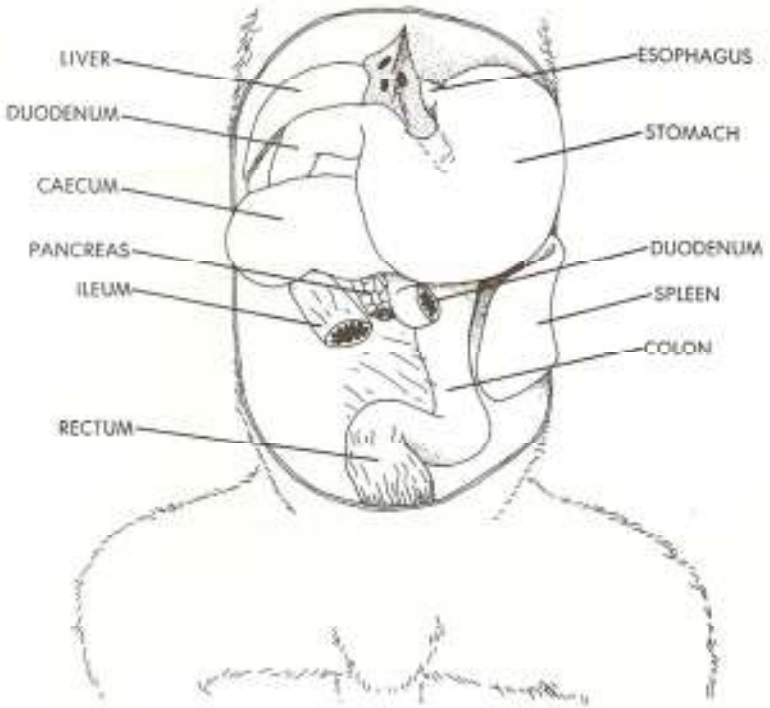


FIGURE 33. Ventral view of abdominal viscera, small intestine and omentum removed.

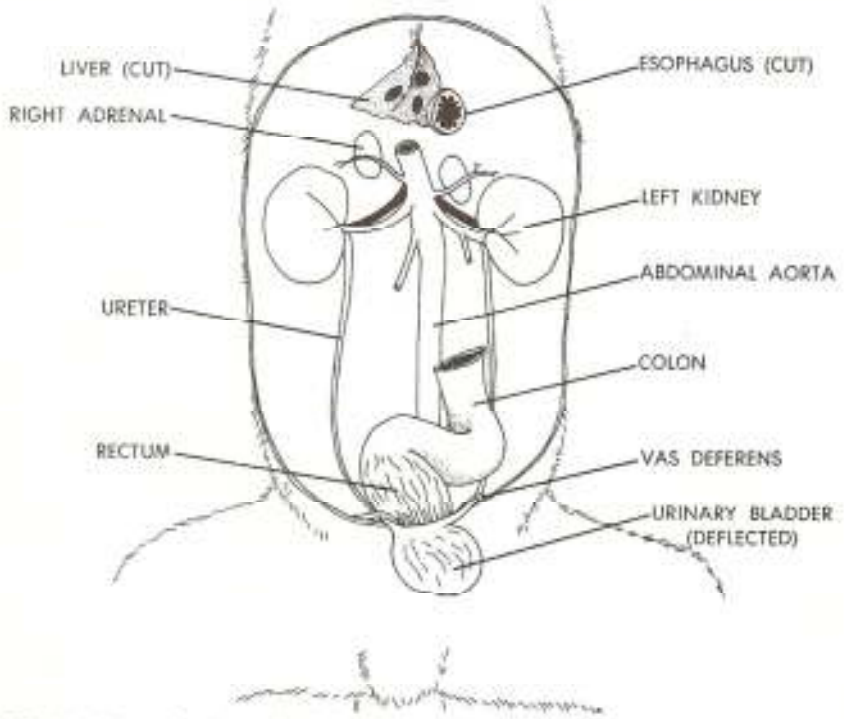
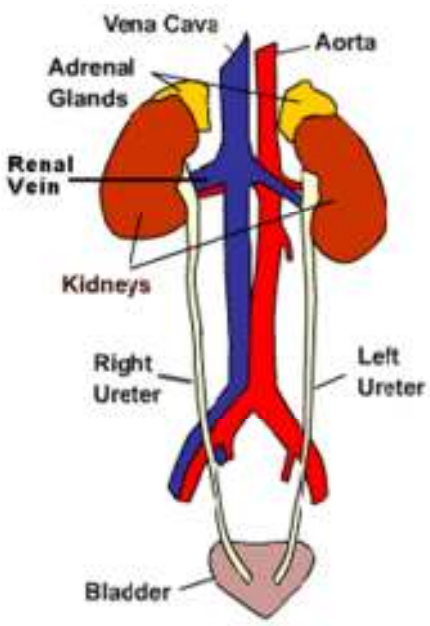


FIGURE 34. Ventral view of abdominal cavity with most of the viscera removed.

The Excretory System of the Cat

The excretory and reproductive systems of vertebrates are closely integrated and are usually studied together as the urogenital system. However, they do have different functions: the excretory system removes wastes and the reproductive system produces gametes (sperm & eggs). The reproductive system also provides an environment for the developing embryo and regulates hormones related to sexual development.



1. The primary organs of the excretory system are the kidneys. These organs are 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 Kidneys. Note the veins and arteries that connect with the kidneys.
3. Remove one of the kidneys and cut it lengthwise. Notice the very fine veins and arteries.
3. The small yellowish glands embedded in the fat atop the kidneys are the **adrenal glands**.

The Circulatory System of the Cat

The general structure of the circulatory system of the Cat is almost identical to that of humans. Pulmonary circulation carries blood through the lungs for oxygenation and then back to the heart. Systemic circulation moves blood through the body after it has left the heart.

Using the diagrams on pg. 11 and 12, trace the flow of blood from the right atrium to the lungs and back to the heart. Now trace the flow of blood in your specimen. You may not be able to locate all these structures due to the placement of the heart and vessels, but you should be able to find a few of them.

Arteries (see diagram page 11-12)

Arteries carry red blood to the muscles and organs that need it. Blood is essential for life. Blood carries nutrients to the body, helps repair cells and tissues, fights against disease, and assists in cleansing toxins. Without blood, we would all be dead.

Veins (see diagram page 12-13)

Your Cat specimen has been double injected with latex to help you identify veins and arteries. **Veins carry used blood (blue) back to the heart and lungs**. The lungs re-oxygenate the blood and the heart pumps it back to the rest of the body. Because the blood that is carried in the veins is used, the arteries are colored blue. In the human body, these veins are not the same bright blue that you see in your Cat. However, if you look at your arm, you can see some bluish veins very close to the skin.

The arteries in your Cat are stained red for easy identification. Look for some of the arteries listed below. You will not be able to find them all, but mark any of the veins that you are able to identify.

Identify the following veins and arteries:

- Renal Artery
- Right/Left external jugular
- Right/Left internal jugular vein
- Right/Left subclavian
- Right/Left femoral
- Brachiocephalic
- Brachial
- Common iliac
- Inferior vena cava

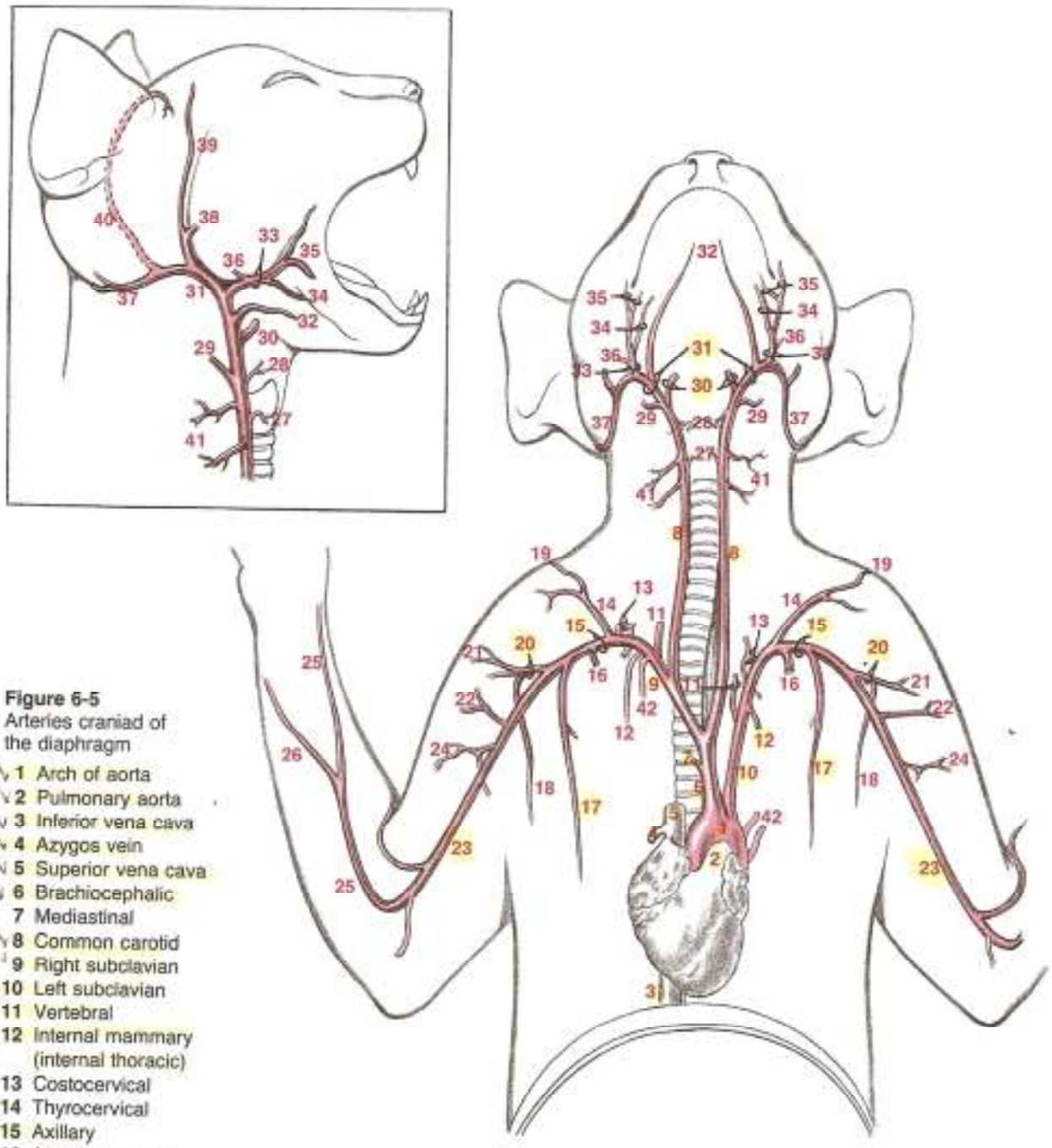


Figure 6-5
Arteries craniad of the diaphragm

1 Arch of aorta
2 Pulmonary aorta
3 Inferior vena cava
4 Azygos vein
5 Superior vena cava
6 Brachiocephalic
7 Mediastinal
8 Common carotid
9 Right subclavian
10 Left subclavian
11 Vertebral
12 Internal mammary (internal thoracic)
13 Costocervical
14 Thyrocervical
15 Axillary
16 Anterior thoracic
17 Long thoracic
18 Thoracodorsal
19 *Transverse scapular*
20 Subscapular
21 Posterior humeral circumflex
22 Anterior humeral circumflex
23 Brachial
24 Deep brachial
25 Radial
26 Ulnar
27 Superior thyroid
28 Laryngeal
29 Occipital
30 *Internal carotid*
31 External carotid
32 Lingual
33 External maxillary
34 Submental
35 Superior and inferior labials
36 Branch to submandibular and sublingual glands
37 Posterior auricular
38 Internal maxillary
39 Superficial temporal
40 Anterior auricular
41 Branches to muscles
42 Superior intercostal

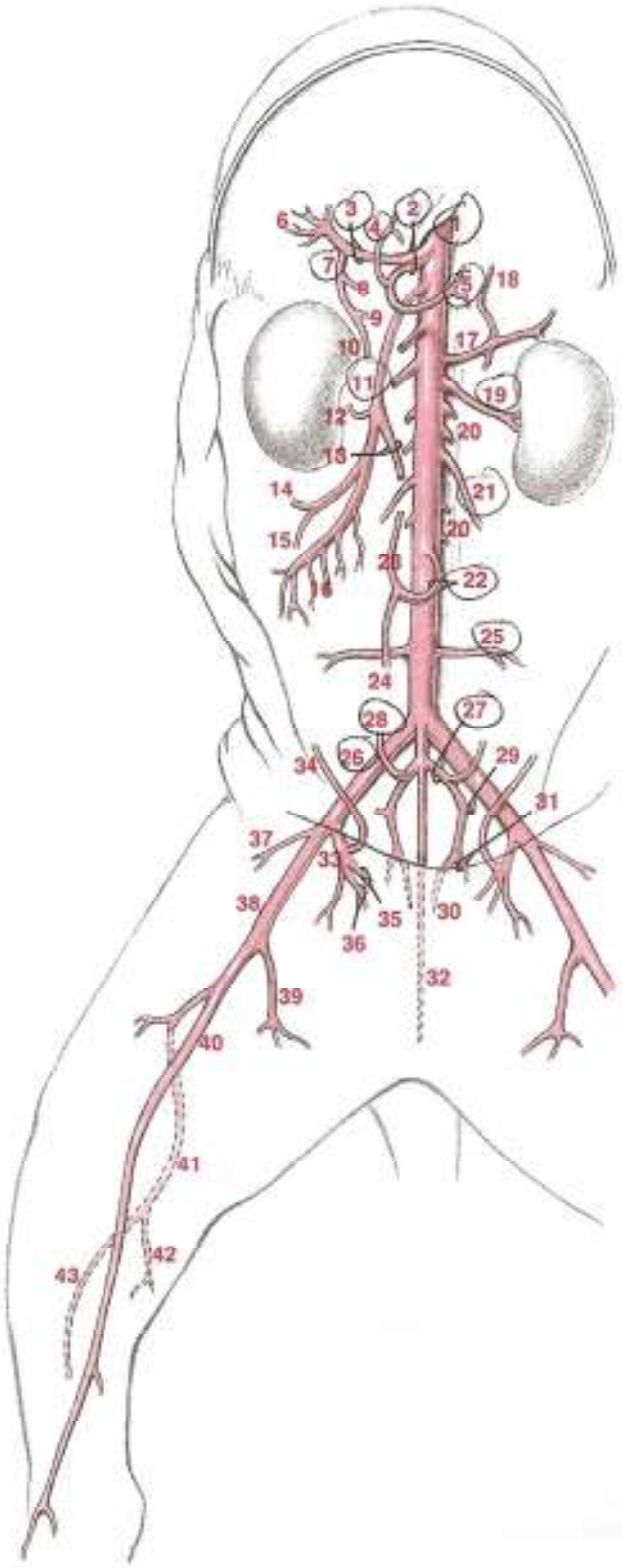


Figure 6-9
Arteries caudad of the diaphragm

1 Aorta (descending)
2 Celiac
3 Hepatic
4 Left gastric
5 Splenic
6 Cystic
7 Gastroduodenal
8 Pyloric
9 Right gastroepiploic
10 Superior pancreaticoduodenal
11 Superior mesenteric
12 Inferior pancreaticoduodenal
13 Middle colic
14 Right colic
15 Ileocolic
16 Intestinals
17 Adrenolumbar
18 Phrenic
19 Renal
20 Lumbars
21 Internal spermatic, or ovarian
22 Inferior mesenteric
23 Left colic
24 Superior hemorrhoidal
25 Iliolumbar
26 External iliac
27 Internal iliac (hypogastric)
28 Umbilical
29 Superior gluteal
30 Middle hemorrhoidal
31 Inferior gluteal
32 Caudal (middle sacral)
33 Deep femoral
34 Inferior epigastric
35 Branch to urinary bladder
36 Branch to external genitalia
37 Lateral femoral circumflex
38 Femoral
39 Branch to muscles
40 Saphenous
41 Popliteal
42 Posterior tibial
43 Anterior tibial

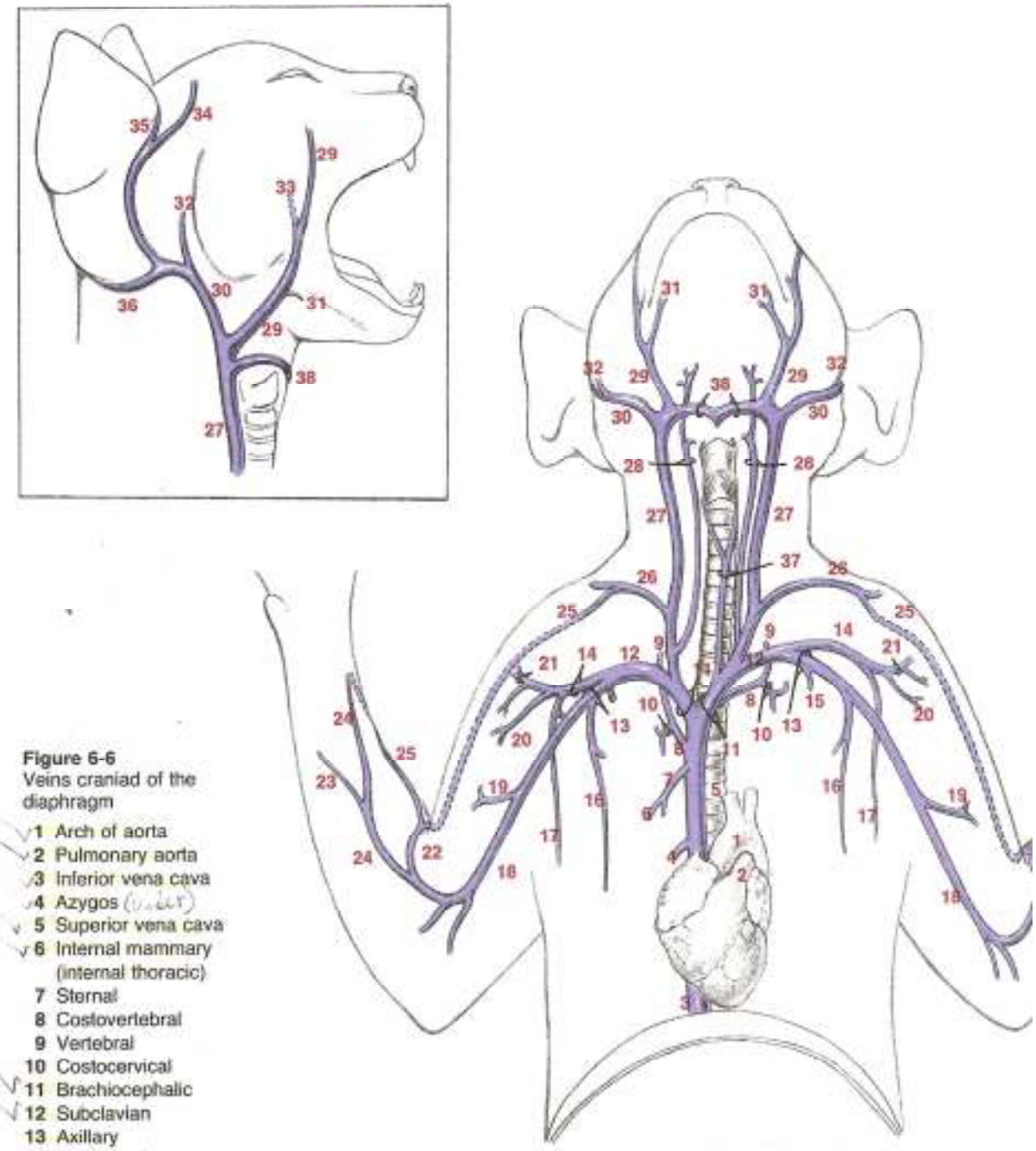


Figure 6-6
Veins craniad of the diaphragm

1 Arch of aorta
2 Pulmonary aorta
3 Inferior vena cava
4 Azygos
5 Superior vena cava
6 Internal mammary (internal thoracic)
7 Sternal
8 Costovertebral
9 Vertebral
10 Costocervical
11 Brachiocephalic
12 Subclavian
13 Axillary
14 Subscapular
15 Anterior thoracic
16 *Long thoracic*
17 Thoracodorsal
18 Brachial
19 Deep brachial
20 Anterior humeral circumflex
21 Posterior humeral circumflex
22 Median cubital
23 Ulnar
24 *Radial*
25 Cephalic
26 Transverse scapular
27 External jugular
28 Internal jugular
29 Anterior facial
30 Posterior facial
31 Submental
32 *Internal maxillary*
33 Deep facial
34 Superficial temporal
35 Anterior auricular
36 Posterior auricular
37 Inferior thyroid
38 Transverse

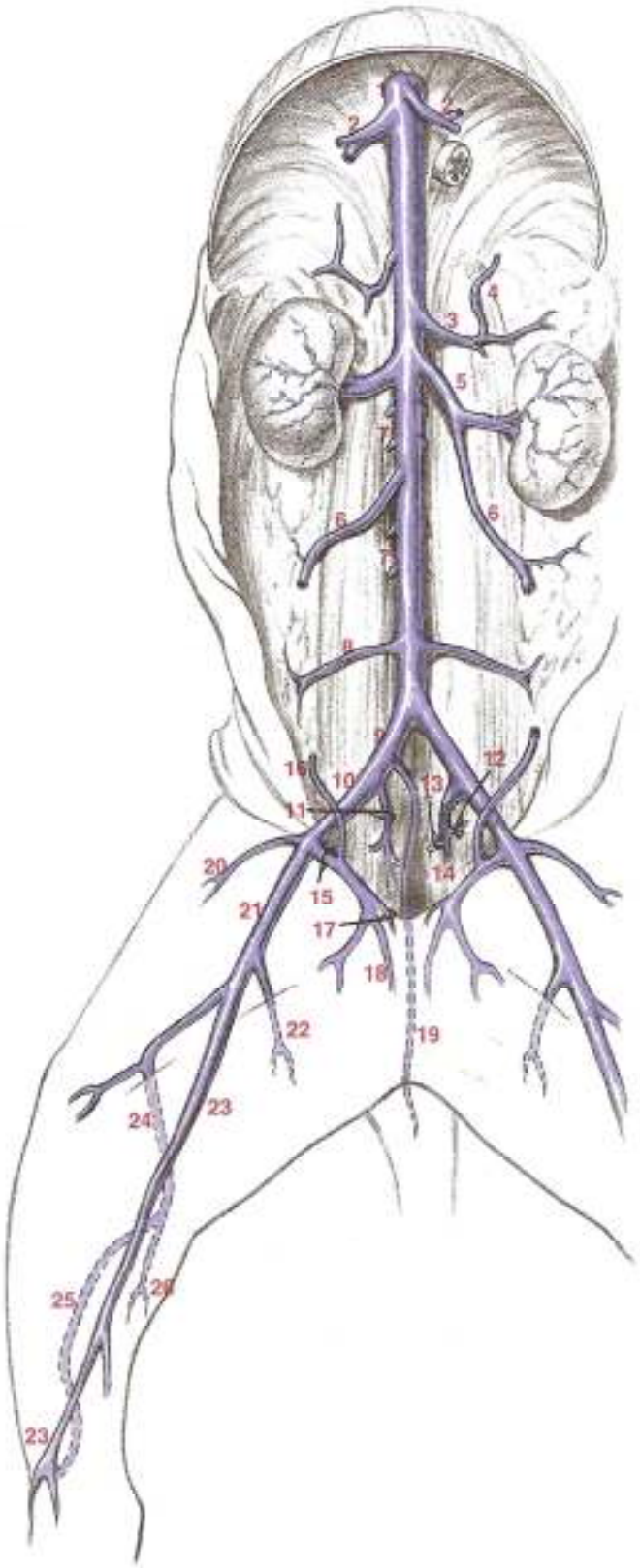
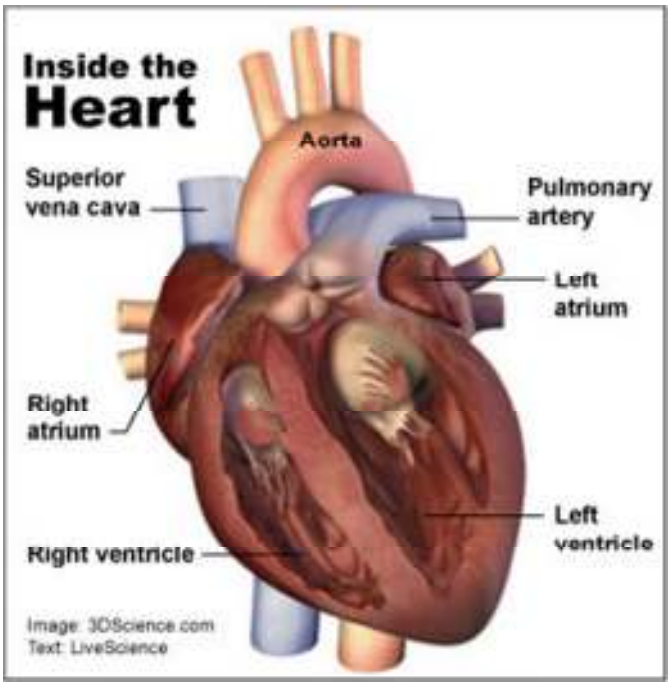


Figure 6-10
Veins caudad of the diaphragm

1 Inferior vena cava
2 Hepatic
3 Adrenolumbar
4 Phrenic
5 Renal
6 Internal spermatic, or ovarian
7 Lumbars
8 Iliolumbar
9 Common iliac
10 External iliac
11 Internal iliac (hypogastric)
12 Superior gluteal
13 Middle hemorrhoidal
14 Inferior gluteal
15 Deep femoral
16 Inferior epigastric
17 Tributary from urinary bladder
18 Tributary from external genitalia
19 Caudal (middle sacral)
20 Lateral femoral circumflex
21 Femoral
22 Tributary from muscles
23 Greater saphenous
24 Popliteal
25 Anterior tibial
26 Posterior tibial

Heart

After completing the procedures above dealing with veins and arteries, remove the heart from the pericardial sack. You will need to sever the arteries and veins connecting the heart to the circulatory system. **Do this slowly and carefully so that you do not cut more than is necessary.** Leave as much of the veins and arteries attached to the heart as possible.



Identify the aorta, left and right atrium, and left and right ventricle. Carefully insert your probe into these opening and work it into the center of the heart.

Finally, make an incision between the left and right ventricles with your scalpel. Try to locate the bicuspid and semilunar valves which open and close the ventricles.

Identify the following parts of the heart:

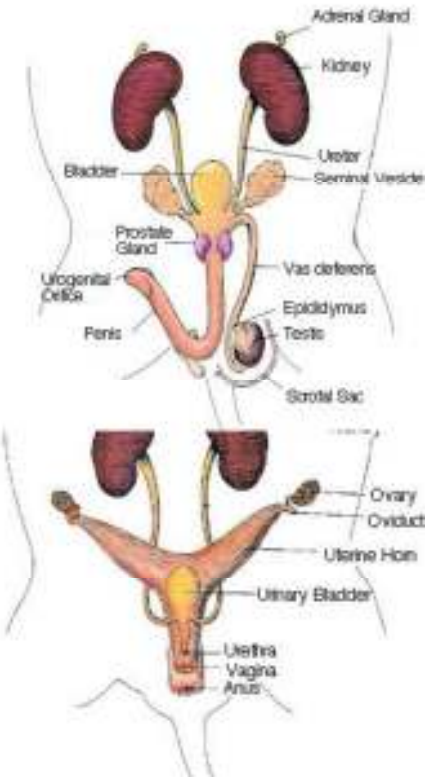
- Pericardial sack
- L/R Ventrical
- L/R Atrium
- Aorta
- Vena Cava

The Excretory and Reproductive System of the Cat

Male Reproductive Organs

1. The major reproductive organs of the male Cat 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).



Female Reproductive Organs

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.

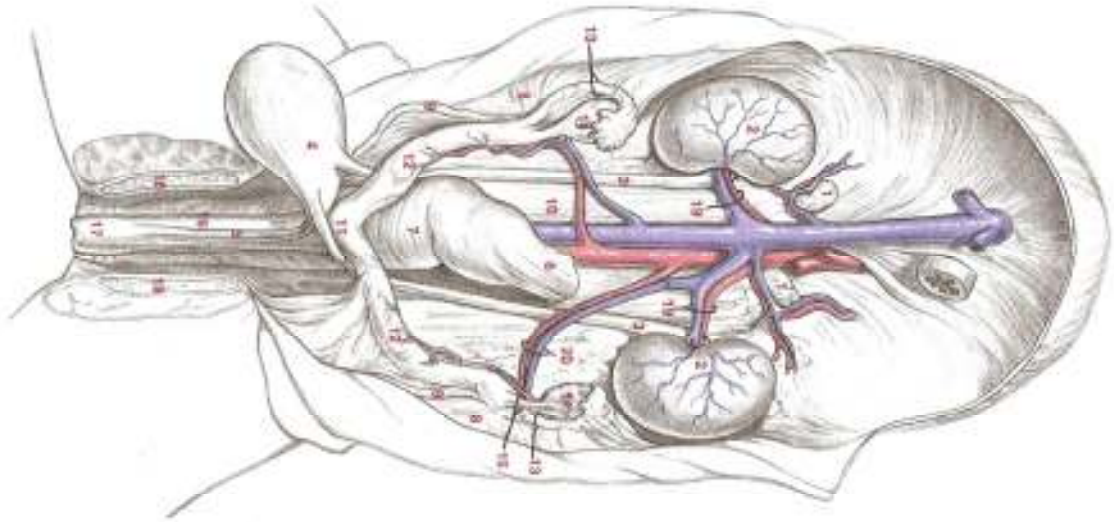


Figure 5-2
Female urogenital system

1 Adrenal gland
2 Kidney
3 Ureter
4 Urinary bladder
5 Urethra
6 Descending colon
7 Rectum
8 Broad ligament
9 Round ligament
10 Psoas muscles
11 Body of uterus
12 Horn of uterus
13 Uterine tube
14 Ovary
15 Ovarian ligament
16 Vagina
17 Urogenital vestibule
18 Pubic bone
19 Renal blood vessels
20 Ovarian blood vessels

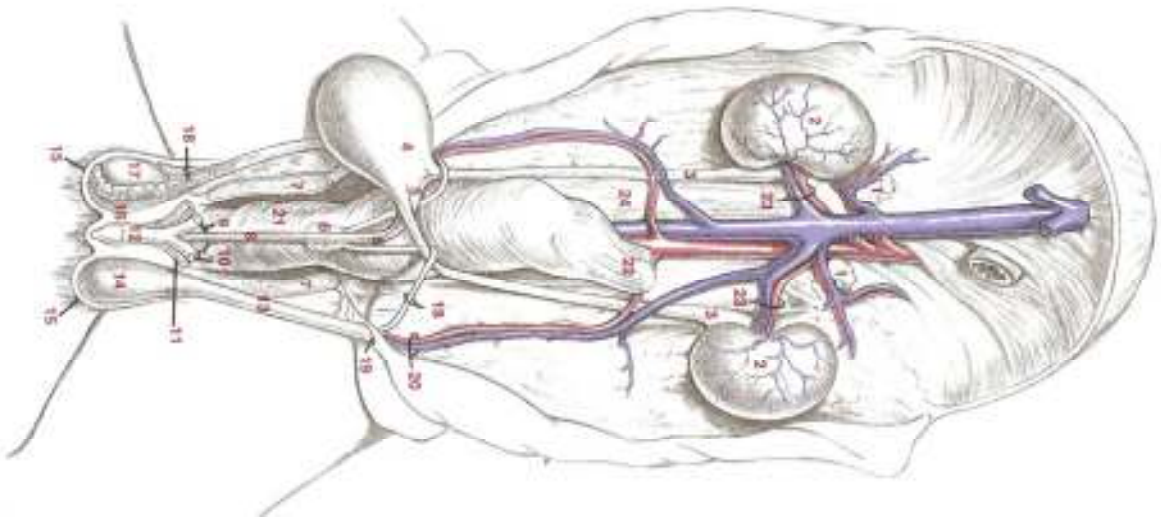


Figure 5-4
Male urogenital system

1 Adrenal gland
2 Kidney
3 Ureter
4 Urinary bladder
5 Neck of bladder
6 Prostate gland
7 Pubic bone
8 Urethra
9 Bulbourethral gland
10 Crus of penis
11 Ischiocavernosus muscle
12 Penis
13 Spermatic cord with fascial covering
14 Testis and epididymis with fascial covering
15 Scrotal integument
16 Epididymis*
17 Testis
18 Ductus deferens*
19 Location of inguinal canal
20 Internal spermatic blood vessels
21 Rectum
22 Descending colon
23 Renal blood vessels
24 Psoas muscles

* The right testis has been rotated so that the ductus deferens appears ventrally. The ductus is on the medial side of the testis, and the epididymis is dorsal in position.

Final Check

Can you confidently identify all of the structures listed on pg. 2? These are the structures that you will be tested on. As there are many variations amongst living organisms, **it is strongly suggested that you spend some time looking at the cats of other groups**. Try to identify the same parts. Colors, locations, and size will vary from one Cat to another. You will look at many cats during the lab test.

Once you feel confident in your ability to identify the parts on pg. 2, ask Mr. Sowash complete the final check point.