

## SHARK DISSECTION INSTRUCTIONS

### Part 1: External Anatomy

The shark has a graceful and streamlined body shape built for fast, long distance swimming. The body is divided into the head, trunk, and tail.

STEP 1: Touch the shark! All members of the lab group should touch the shark. Pick it up, squeeze it, feel it!

STEP 2: Measure the shark! Use your ruler to measure the length of the shark. Remember to measure in centimeters!

The spiny dogfish has a double dorsal fin. The **anterior dorsal fin** is larger than the **posterior dorsal fin**. The spiny dogfish has the presence two **dorsal spines**, one immediately in front of each dorsal fin. The spines carry a poison secreted by glands at their base.

The **caudal fin** is divided into two lobes: a larger dorsal lobe and a smaller ventral lobe. This type of tail is known as a heterocercal tail.

STEP 3: Observe the exterior of the shark.

Along the sides of the body is a light-colored horizontal stripe called the **lateral line**. The line is made up of a series of tiny pores that lead to receptors that are sensitive to the mechanical movement of water and sudden changes of pressure.

### A. Examine the anterior view of the shark.

- The **rostrum** is the pointed snout at the anterior end. This tapered tip at the anterior end helps overcome water resistance in swimming. (*See Figure 1 in An Illustrated Dissection Guide To The Shark, pg 2*).
- The **eyes** are prominent in sharks and are very similar to the eyes of man. A transparent cornea covers and protects the eye. A darkly pigmented iris can be seen below the cornea with the pupil at its center. Upper and lower eyelids protect the eye. Just inside the lower lid is a membrane that extends over the surface of the eye to cover the cornea.
- Large **spiracle** openings are located posterior and dorsal to the eyes. A spiracular valve, permits the opening and closing of the external spiracular pore. The spiracle is an incurrent water passageway leading into the mouth for respiration.
- Most sharks have five external **gill slits** located on three sides behind the mouth and in front of the pectoral fins. Water taken in by the mouth and spiracles is passed over the internal gills and forced out by way of the gill slits.

### B. Examine the mouth of the shark.

- The opening to the **mouth** of sharks is always on the underside. The teeth are sharp and pointed. There are several rows of flattened teeth lying behind the upright set ready to replace them when worn out or lost.

- The nostrils or **external nares** are located on the underside (ventral surface) of the rostrum anterior to the jaws. A nasal flap separates the incurrent from the excurrent opening. Water passes into and out of the olfactory sac, permitting the shark to detect the odors of the water.
- The patches of pores on the head in the areas of the eyes, snout, and nostrils are the openings of the **ampullae of Lorenzini**. These sense organs are sensitive to changes in temperature, water pressure, electrical fields, and salinity.

C. Examine the ventral view of the shark.

- The paired **pectoral fins** act like an airplane's wings to provide the lift needed to keep the shark from sinking.
- The paired **pelvic fins** are located on either side of the cloacal aperture. They are different in males and females.

D. Examine the external reproductive anatomy.

- Males have stout, grooved copulatory organs called **claspers** on the inner side of their pelvic fins. Fertilization in the dogfish shark is internal. During copulation, one of the claspers is inserted into the oviduct orifice of the female. The sperm proceed from the cloaca of the male along the groove on the dorsal surface of the clasper into the female.
- The **cloacal opening** located on the ventral surface between the pelvic fins. It receives the products of the intestine, the urinary and the genital ducts. The name cloaca, meaning sewer, seems quite appropriate.



**Part 2: The Skeletal System**

- Unlike the other 'higher vertebrates' (fish, reptiles, birds, etc.) the shark does not have a bony skeleton but instead has a skeleton composed of cartilage.
- Figure 2 shows a lateral view of the entire shark skeleton. Familiarize yourself with and label the parts outlined within this figure. (See *Figure 2 in An Illustrated Dissection Guide To The Shark*, pg 3).



### Part 3: Muscular Anatomy

- A. On the thickest part of the tail out away one piece of skin. The opening should be no larger than two square inches in size. **\*\*Remember, you are cutting through the skin only.\*\*** Working with a dull probe or the handles of your scissors carefully peel off the skin exposing the underlying muscles.
- B. Examine the **placoid scales** on a piece of the skin. Use a magnifying glass or a microscope to study the scales.
- C. The muscles revealed by skinning the side of the shark are arranged in W-shaped bundles called **myomeres**. The myomeres are separated from one another by connective tissue. Contractions of the myomeres produce the side to side motion of the body that propels the shark forward.
- Flip your shark over onto its back. Make a mid-ventral incision from the cloaca cranially to just below the jaw. **Make your incisions shallow.**
  - Cut around the head, around each fin, around the spiracles, and around the cloaca.
  - From the cloaca cut dorsally around the shark – this will make a circle around the tail. **Remember you are cutting through the skin only.**
  - Using the handles of your scissors or your gloved fingers carefully peel off the skin to expose the muscles.
- D. Compare your specimen with Figure 3 and Figure 4. Try to identify as many of the structures listed as possible. (See Figure 3 and 4 in *An Illustrated Dissection Guide To The Shark*, pgs 5 & 6).



### Part 4: Digestive Anatomy

- A. Place your shark ventral side up on the dissection tray.
- Using scissor make a mid-ventral incision just anterior to the cloacal opening. Cut in an anterior direction slightly to the right of the mid-ventral line. Cut all the way to the pectoral girdle. The inside of the large cavity will be exposed. Fold back the sides of the body wall. (See Figure 5 in *An Illustrated Dissection Guide To The Shark*, pg 7).
  - A smooth, shiny membrane called **peritoneum** can be seen lining the inside of the body wall. The visceral organs are suspended dorsally by a double membrane of peritoneum know as **mesentery**.
  - The **liver** is the largest organ lying within the body cavity. Its two main lobes, the right and left lobes, extend from the pectoral girdle posteriorly most of the length of the cavity. A third lobe much shorter lobe is located medially and contains the green **gall bladder** along its right edge. (See Figure 6 in *An Illustrated Dissection Guide To The Shark*, pg 8).

- The liver is rich in oil which stores energy for the shark. The oil's low specific gravity is also responsible for giving the shark a limited amount of buoyancy.

B. Move the large liver to the shark's right side.

- The **esophagus** is the thick muscular tube extending from the top of the cavity connecting the oral cavity and pharynx with the stomach.
- The esophagus leads into the "J"-shaped **stomach**. The upper portion, the cardiac region, continues as the main body, and ends at the duodenal end.

C. Cut the shark's stomach open along its long axis.

- The stomach will probably contain partially digested remains of fish.
- Remove the remains and wash them down the sink.
- The mucosa is the inner lining of the stomach. The **rugae** are longitudinal folds that help in the churning and mixing the food with digestive juices. A circular muscular valve, the pyloric sphincter, is located at the far end or pyloric end of the stomach. It regulates the passage of partially digested food into the intestines.

D. Move the liver forward.

- The **duodenum** is a short "U"-shaped portion of the small intestine that connects the stomach to the intestine. The bile duct from the gall bladder enters the duodenum.
- The **pancreas** is located on the duodenum and the lower stomach. The secretions of the pancreas enter the duodenum by way of the pancreatic duct.
- The dark, triangular-shaped **spleen** is located near the posterior end of the stomach. Although a part the lymphatic system, the spleen is closely associated with the digestive organs in all vertebrates.
- The **valvular intestine (ileum)** is the second, and much larger, portion of the small intestine. It follows the duodenum and its outer surface is marked by rings.

E. Cut away the outer tissue and slit open the valvular intestine.

- The **spiral valve** is the screw-like, symmetrical shape within the valvular intestine. It adds surface area for digestion and absorption to an otherwise relatively short intestine.

F. Gently move the intestine forward and move the valvular intestine aside to expose the cloaca.

- The **colon** is the narrowed continuation of the valvular intestine. It is located at the posterior end of the body cavity.
- The **rectal gland** is a slender, blind-ended, finger-like structure that leads into the **colon** by means of a duct. It has been shown to excrete salt (NaCl) in concentrations higher than that of the shark's body fluids or sea water. It is thus an organ of osmoregulation, regulating the shark's salt balance. The rectum is the short end portion of the digestive tract between the intestine and the cloaca. The rectum stores solid wastes.

- The **cloaca** is the last portion of the alimentary canal. It collects the products of the colon as well as the urogenital ducts. It is a catch-all basin leading to the outside by means of the cloacal opening.



## **Part 5: Respiratory Anatomy**

### **A. Cut across the gill slits from the pectoral girdle to the corner of the mouth.**

- Cut across the ventral muscular to lay the entire preparation flat. (See *Figure 8 in An Illustrated Dissection Guide To The Shark*, pg 11).
- The gills are the respiratory organs of the shark. They are composed of gill lamellae, blood vessels, and supporting cartilaginous structures are located in a series of pharyngeal pouches.

### **B. Examine the inside of the oral and pharyngeal cavities of the spiny dogfish shark.**

- The oral cavity is the area enclosed by the jaws (mandibular arch) and the cartilage of the throat (hyoid arch).
- The triangular sharp teeth are arranged in several rows beginning at the outer edges of the upper and lower jaws. Behind the functional teeth are additional rows folded downward ready to replace any that are lost.
- The tongue of the shark is practically immovable and without muscles. It is supported anteriorly and posteriorly by cartilage.
- The pharynx is the portion of the alimentary canal posterior to the hyoid arch between the gills. Posteriorly it narrows to form the esophagus.
- The spiracles are openings in the anterior roof of the pharynx. The shark can bring water into its pharynx to the gills by way of the spiracle and mouth.

### **C. Examine the shark's pharynx and heart.**

- The gills are provided with a rich blood supply. Arteries run directly from the nearby heart to the gills bringing deoxygenated blood into the gill lamellae. Oxygen diffuses from the ventilating water current flowing over the gills into the blood.

### **D. Examine the shark's internal gill slits.**

- As you look at the pharynx you will see the internal gill slits. They lead into cavities called gill pouches, which lead to the outside by external gill slits.
- The gill slits are supported by cartilaginous gill arches and guarded by small cartilaginous papillae-like gill rakers which act as strainers to prevent food particles from leaving the pharynx through the gill slits.

### **E. Examine the shark's gill pouch.**

- The partitions between gill pouches are referred as branchial bars.

- The gill lamellae on one side of a branchial bar are called a demibranch, or half gill.
- The demibranchs on the anterior and posterior surface of a single branchial bar are termed a holobranch, or complete gill. Thus, one holobranch belongs to two different gill pouches; the anterior half (demibranch) to the anterior gill pouch, the posterior gill demibranch to the posterior gill pouch.

F. Examine the shark's gill lamellae.

- The gill lamellae are radially folded, highly vascularized tissue attached to the surface of a tough connective tissue, the interbranchial septum.
- Each septum is attached medially to a portion of the cartilaginous gill arch.
- The superficial constrictor muscles act as flap-like valves to open and close the external gill slits.



**Part 6: Circulatory Anatomy**

A. Remove the skin and the ventral musculature from over the pericardial (heart) cavity.

- You may need to remove a membrane to expose the heart and some of its major blood vessels. (See Figure 7 in *An Illustrated Dissection Guide To The Shark*, pg 10).
- The pericardial cavity is the upper portion of the body cavity. It is much smaller than the lower cavity, which contains the digestive organs.
- The pericardial cavity is located anterior to the transverse septum and contains the heart and the major blood vessels leading to and from the heart.
- The pericardium is the membrane lining the inner walls of the pericardial cavity.

B. Examine the shark's heart.

- The ventricle is the thick muscular walled cavity that pumps blood through the **conus arteriosus** to the gills and the body. The conus arteriosus contains a series of semilunar valves that direct the blood flow. (See Figure 7 in *An Illustrated Dissection Guide To The Shark*, pg 10).
- The atrium is thin-walled with two lateral bulging lobes. It pumps blood to the dorsal ventricle.

C. Examine the shark's heart and cardinal sinuses.

- Blood enters the heart through the sinus venosus which drains into the atrium.
- The posterior cardinal sinuses receive blood from the posterior parts of the body and drain through the common cardinal veins into the **sinus venosus** (dorsal to the ventricle, this is a thin walled, non-muscular sac which acts as a collecting place for deoxygenated blood).

D. Examine the shark's ventral aorta.

- Remove the ventral hypobranchial muscles and connective tissues until you reach the lower jaw. Trace the conus arteriosus anteriorly following the major branching blood vessels. (See Figure 9 & 10 in *An Illustrated Dissection Guide To The Shark*, pg 12 & 13).
- The anterior end of the conus arteriosus continues forward as the ventral aorta. It gives off five pairs of afferent branchial arteries which carry deoxygenated blood from the heart to the gills.
- The afferent branchial arteries pass laterally from the medial ventral aorta carrying deoxygenated blood to the gills. These afferent vessels enter the interbranchial bars and serve the holobranchs of the gill arches.

E. Examine the shark's efferent branchial arteries.

- Remove the mucous membrane from the roof of the mouth and pharynx.
- The efferent branchial arteries serve to return oxygenated blood from the gills. This blood is then distributed to all parts of the body. Four pairs of arteries may be seen arising from the gills and uniting in the midline to form the median dorsal aorta.
- The efferent branchial arteries give off many branches. These carry oxygenated blood to the more anterior parts of the shark's body.
- The four pairs of efferent branchial arteries join at the dorsal midline to form the large dorsal aorta. The dorsal aorta passes posteriorly bringing oxygenated blood from the gills to virtually every part of the shark's body.
- Carefully cut away the tissue to reveal the source of each efferent branchial artery in the gill lamellae of the gill pouches.
- The efferent collector loops encircle each of the first four gill pouches.

F. Examine the shark's collector loop.

- Adjacent collector loops are connected to one another by branches which pass through the interbranchial septa.



**Part 6: Urogenital Anatomy**

***\*If your shark is male start here.***

A. Examine the dorsal wall of the body cavity of the male spiny dogfish shark.

- Push aside or remove almost the entire liver, alimentary canal, pancreas, and spleen to reveal the urogenital structures: gonads, kidneys, and associated ducts.
- The urinary and genital systems have distinct and unique functions. The first, the removal of nitrogenous wastes and the maintenance of water balance; the other, the reproduction of

species. However, due to their similar developmental origins and the sharing of common structures, they are usually considered as a single system.

- The shark kidney and its ducts are quite different from those in higher vertebrates. The relationship between the urinary and genital structures is also quite different.
- The kidneys are flattened, ribbon-like, darkly colored structures lying dorsally on either side of the midline, along the entire length of the body cavity. A tough white glistening strip of connective tissue is found between the kidneys in the midline.
- The kidneys of the male are essentially the same as those of the female. The posterior portion is involved in the manufacture and transport of urine. The main difference lies in the anterior portion of the kidney, which in females is degenerate and functionless, but in males is an active part of the reproductive system.

#### B. Examine the anterior view of the male shark.

- Paired testes lie near the anterior end of the body cavity, dorsal to the liver, adjacent to the anterior ends of the kidneys. The sperm pass from the testes to the kidneys within narrow tubules called efferent ductules. (See *Figure 12 in An Illustrated Dissection Guide To The Shark, pg 16*).

#### C. Examine the bottom view of the male shark.

- After passing through the anterior end of the kidney the sperm enter the ductus deferens and pass posteriorly toward the cloaca. In mature male specimens the ductus deferens may be seen on the ventral surface of the kidneys as a pair of highly coiled tubules.
- Note: While in the female this duct carries urine, in the male it transports spermatozoa and seminal fluid. The posterior portion of the ductus deferens widens and straightens to form the paired seminal vesicles.

#### D. Examine the shark's seminal vesicles.

- The paired sperm sacs at the posterior ends of the seminal vesicles receive the seminal secretions. They join to form the urogenital sinuses which exit through the fleshy conical urogenital papilla which extends from the cloaca. The accessory urinary ducts, collect and transport urine from the kidneys. These paired thin tubules may be found along the medial side of the posterior half of the kidney. Small collecting tubules from the kidneys lead into the accessory urinary ducts along their lengths. The cloaca receives the genital and urinary products as well as the rectal wastes.

#### E. Examine the shark's claspers.

- The claspers are modified extensions of the medial portions of the pelvic fins. They are inserted into the female's cloaca during copulation.
- The finger-like claspers each have a dorsal groove, the clasper tube that carries the seminal fluid from the cloaca of the male to the cloaca of the female during mating.

#### F. Find a group with a female shark and then follow the directions below to observe the female anatomy

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## **Part 6: Urogenital Anatomy**

***\*If your shark is female start here.***

### **A. Examine the dorsal wall of the body cavity of the female spiny dogfish shark.**

- Push aside or removed almost the entire liver, alimentary canal, pancreas, and spleen. This should reveal the urogenital structures: gonads, kidneys, and associated ducts. (See *Figure 13 in An Illustrated Dissection Guide To The Shark, pg 17*).
- The ovaries are two cream-colored elongated organs in the anterior part of the body cavity dorsal to the liver on either side of the mid-dorsal line. The shape of the ovaries will vary depending upon the maturity of the specimen. In immature females they will be undifferentiated and glandular in appearance. In mature specimens you may find two to three large eggs, about three centimeters in diameter, in each ovary. When these break the surface of the ovary, upon ovulation, they enter the body cavity and by means of peritoneal cilia are moved into the oviducts.

### **B. Examine the female shark's oviducts.**

- The oviducts are elongated tube-like structures lying dorsolaterally the length of the body cavity, along the sides of the kidneys. In mature specimens they are more prominent. The distal half of the oviduct is enlarged to form the uterus. The shell gland is the anterior end of the oviduct. The eggs are fertilized and receive a light shell-like covering as they pass through the shell gland.

### **C. Examine the female shark's uteri.**

- The posterior half of the oviduct becomes enlarged and is known as the uterus. The fertilized eggs develop into embryos in the uterus. Upon completing their period of gestation (close to two years) the young are ready to be born. The cloaca serves for the elimination of urinary and fecal wastes as well as an aperture through which the young "pups" are born. The two uteri open into the posterodorsal portion of the cloaca just ventral to the urinary papilla.
- Fertilization in the dogfish shark is internal, usually taking place within the shell gland of the oviduct. The fertilized eggs continue to move posteriorly to the uterus. As they grow the pups are attached to the egg, now known as the yolk sac, by means of a stalk. During its period of gestation, which is nearly two years, the yolk is slowly absorbed by the shark "pup." Numerous uterine villi, finger-like projections from the uterine wall, make contact with the surface of the developing embryo and its yolk sac. It is believed that these provide the embryo with water; all other nutrients are supplied by the yolk. At birth the young are about 23 to 29 centimeters long. This type of development, where the young are born as miniature adults but have received hardly any nutrition directly from the mother's uterus, is known as ovoviviparous.

### **F. Find a group with a male shark and then follow the directions above to observe the female anatomy**



## Part 7: Nervous Anatomy

### A. Examine the top view of the spiny dogfish shark with its cranial cavity exposed.

- Remove the skin from the dorsal surface of the head and shaving off thin horizontal chips of cartilagenous cranium until the brain and cranial nerves are exposed. Use your scalpel to shave off one millimeter thick sections so that you don't cut into the brain or nerves. Remove the chips of cartilage with forceps. Remove the chondocranium from the tip of the rostrum back to the gill slits. The delicate vascular protective membrane called the primitive meninx needs to be removed. The nervous system functions in communication between the various parts of an organism and between the organism and its external environment. It consists of the central nervous system; the brain and spinal cord, and the peripheral nervous system; the sense organs, cranial and spinal nerves, and their branches.

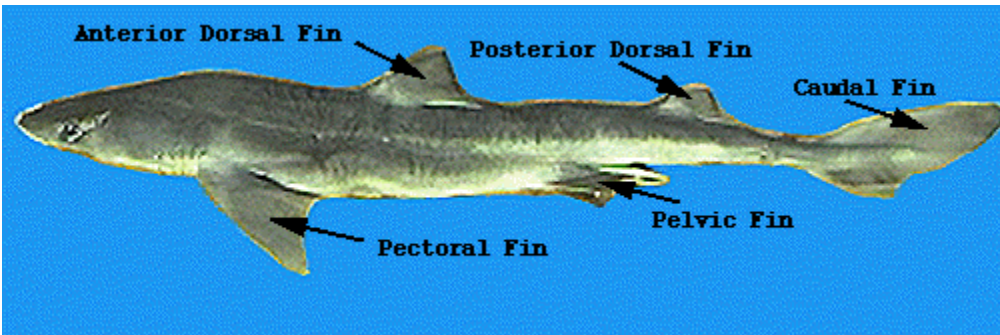
### B. Examine the dorsal view of the shark's brain. You should be able to identify the following organs. (See Figure 14 in An Illustrated Dissection Guide To The Shark, pg 19).

- **Olfactory Sacs** – Two large bulbous nerve sensors that detect chemicals in the surrounding water.
- **Olfactory Lobes** – Area of the brain that receives nerve signals from the olfactory sacs and processes them.
- **Cerebrum** – The two hemispheres between the olfactory lobes and are associated with sight and smell.
- **Diencephalon** – The region just caudal from the cerebrum and separates the fore and mid-brain. Includes the thalamus and the hypothalamus.
- **Optic Lobe** – Large prominent lobes of the mid-brain that receive nerves from the eyes.
- **Cerebellum** – Just caudal from the optic lobes it controls muscular coordination and position.
- **Auricle of Cerebellum** (Restiform body) – A lateral extension of the cerebellum.
- **Medulla Oblongata** – The base of the brain, a widening of the spinal cord. Controls many of the spinal reflexes.

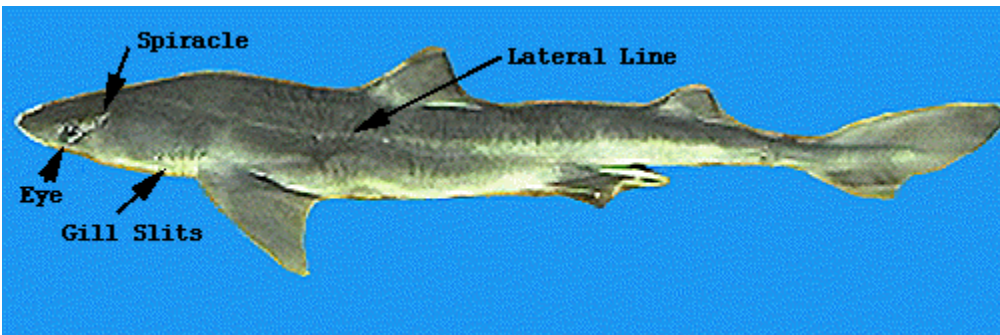
# SHARK DISSECTION PICTURES

## External Anatomy

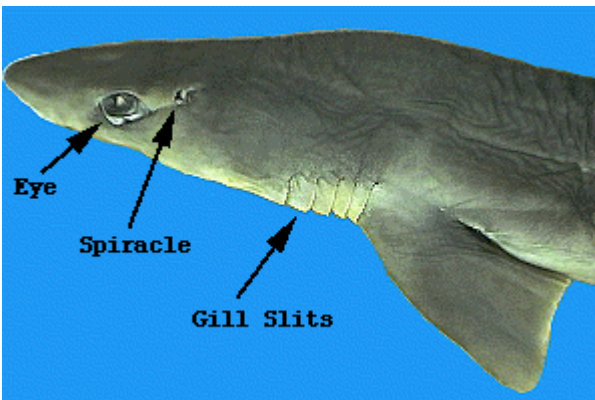
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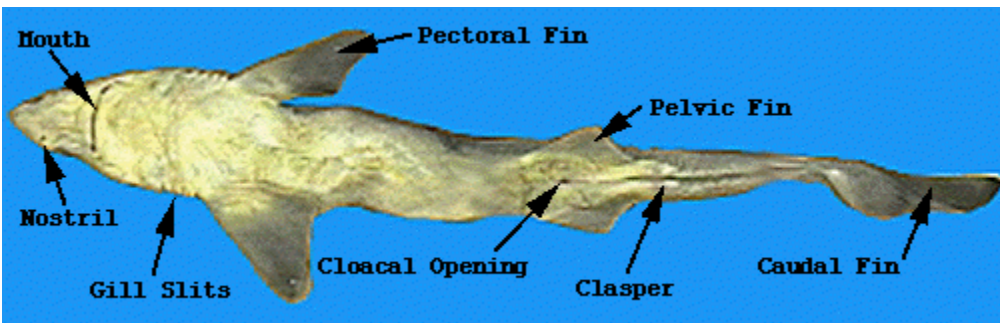
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Labeled Anterior

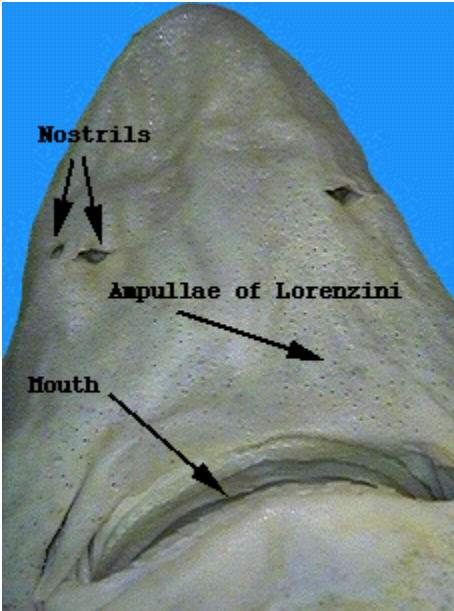


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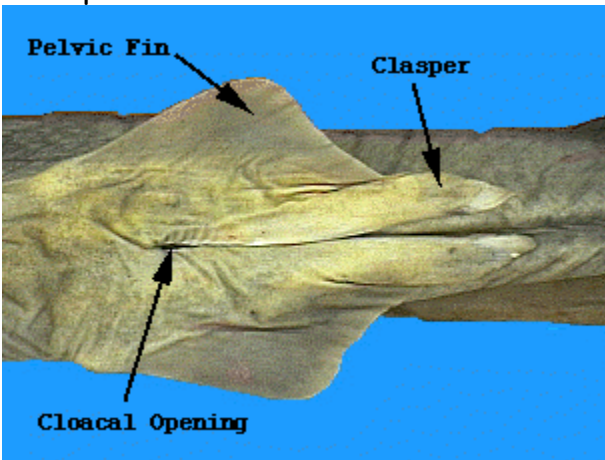


# SHARK DISSECTION PICTURES

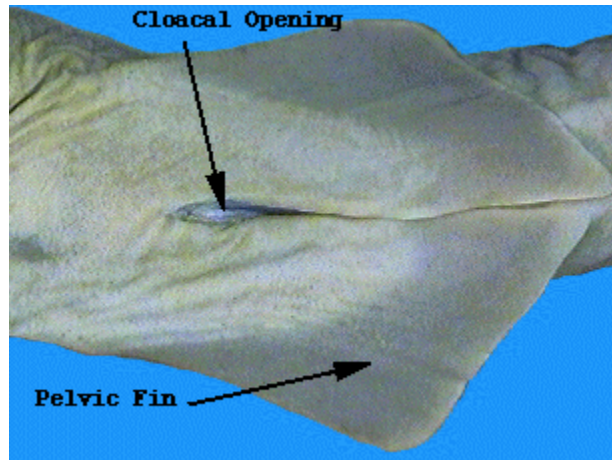
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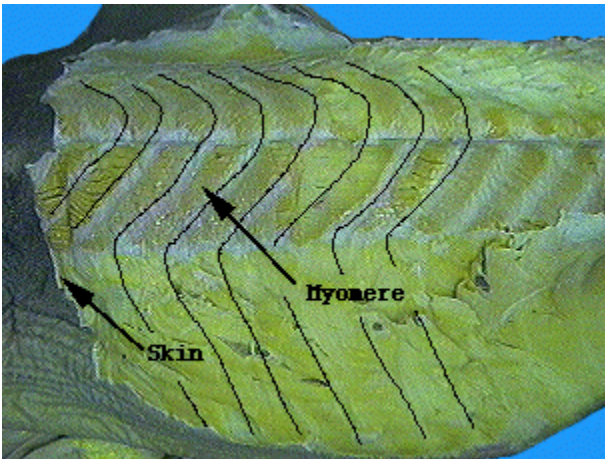
Male pelvis



Female Pelvis



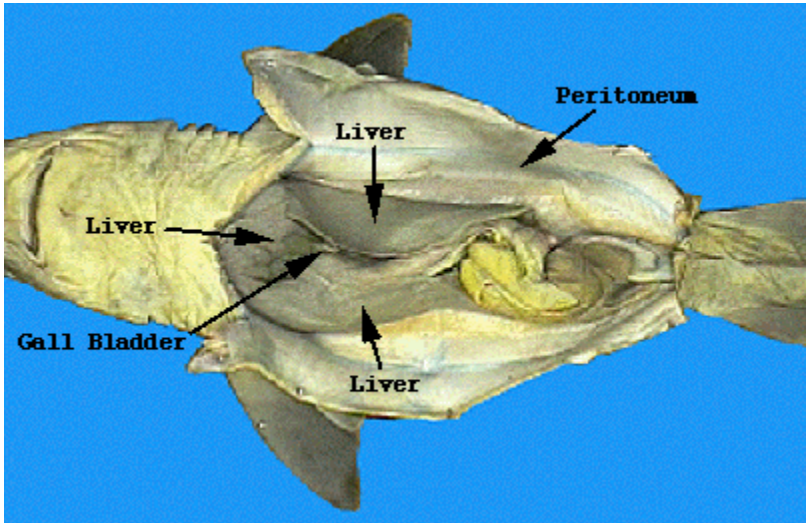
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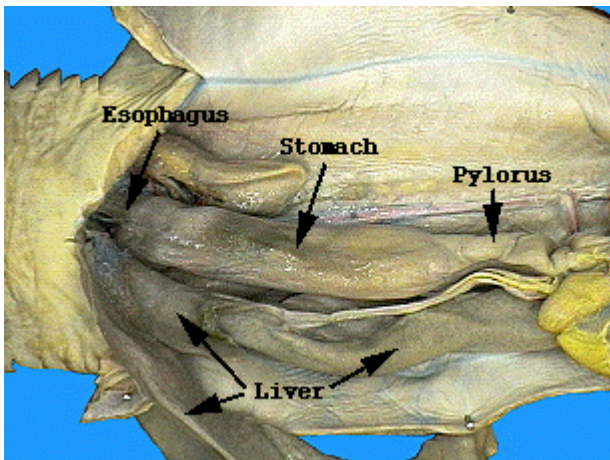
# SHARK DISSECTION PICTURES

## Digestive Anatomy

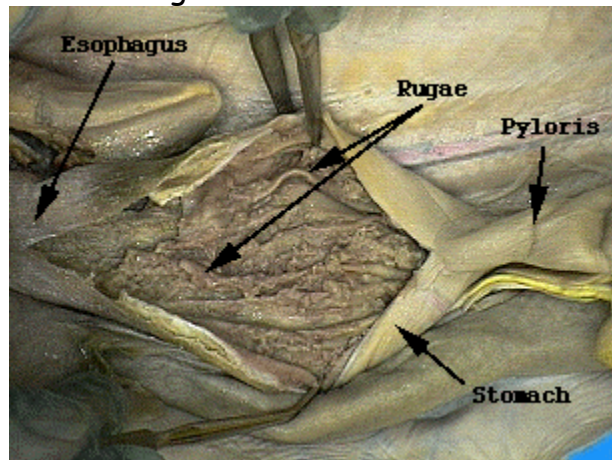
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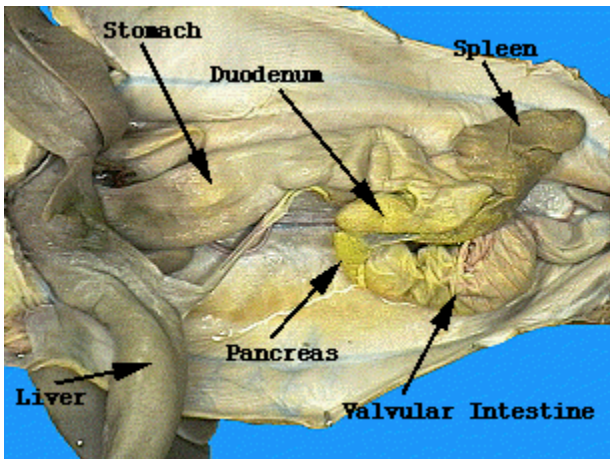
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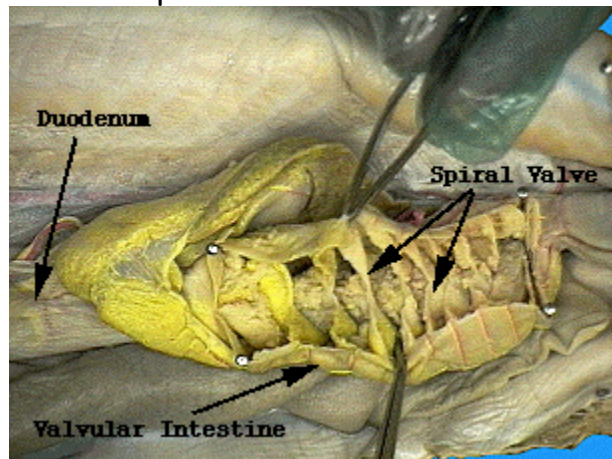
Labeled Rugae



Labeled Intestines

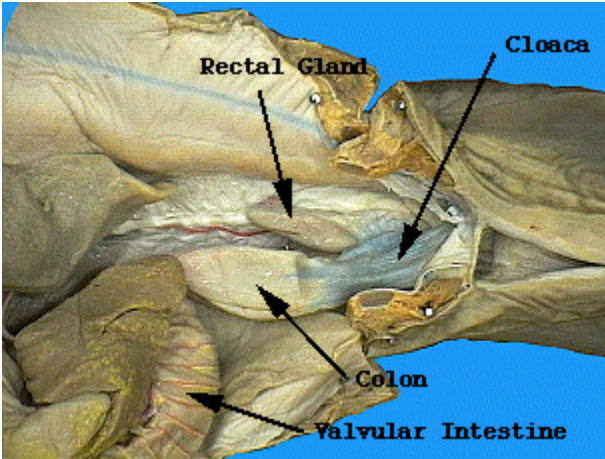


Labeled Spiral Valve



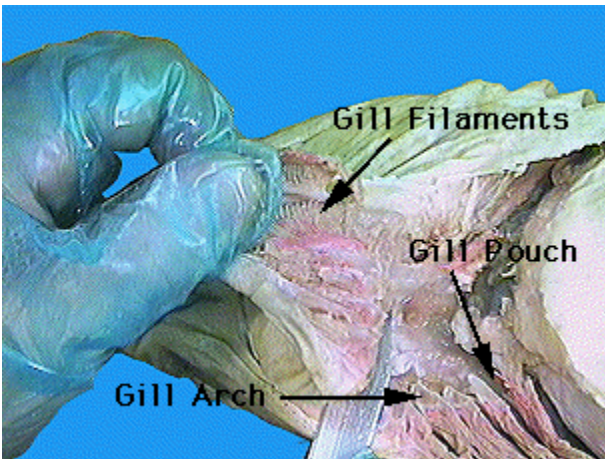
# SHARK DISSECTION PICTURES

## Labeled Cloaca

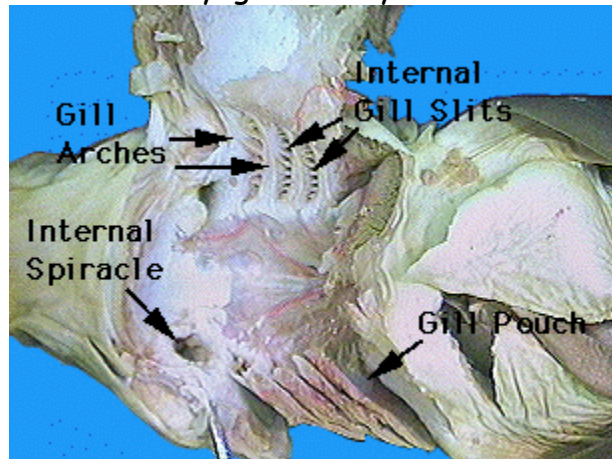


## Respiratory Anatomy

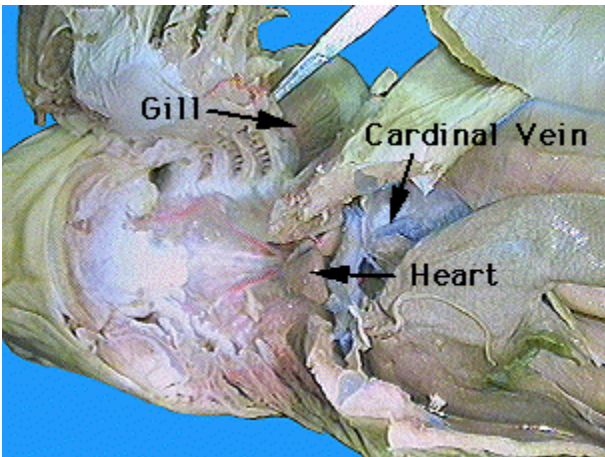
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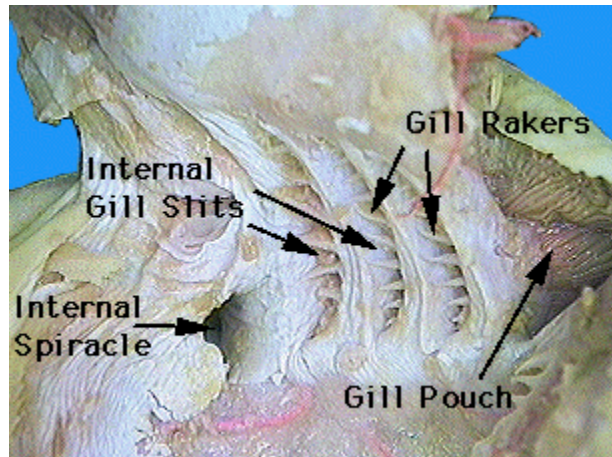
### Labeled Pharyngeal Cavity



### Labeled Heart & Gills

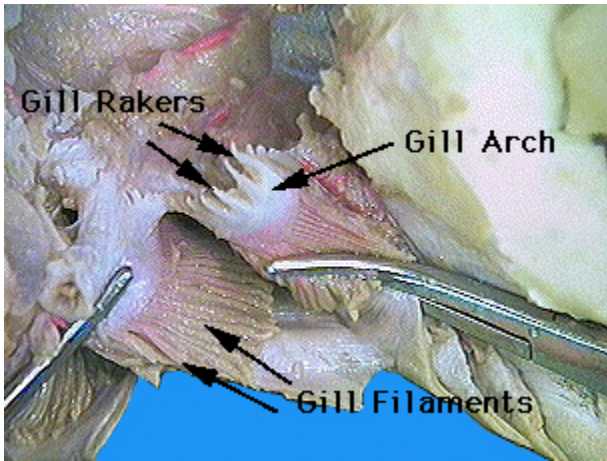


### Labeled Gill Rakers

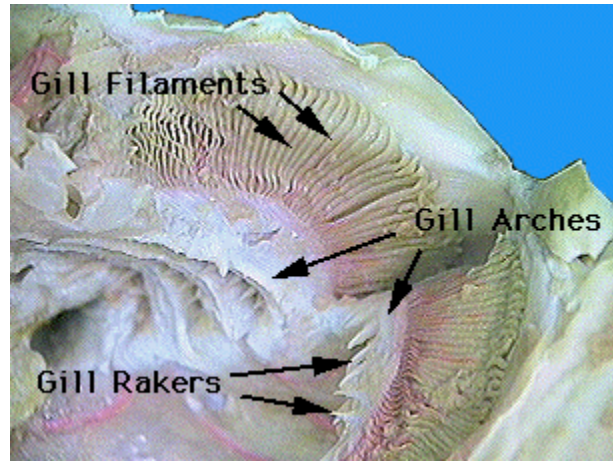


## SHARK DISSECTION PICTURES

Labeled Gill Arches

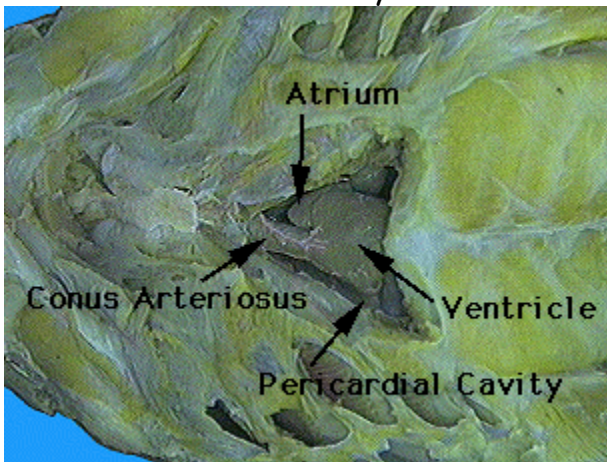


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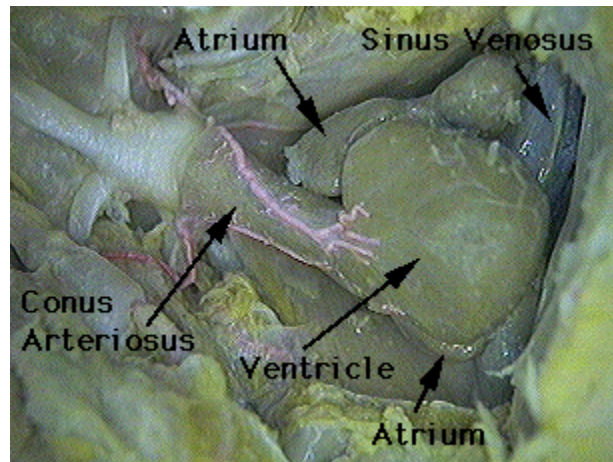


## Circulatory Anatomy

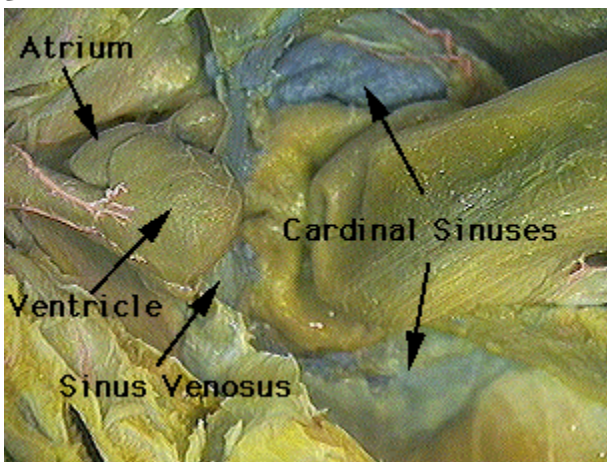
Labeled Pericardial Cavity



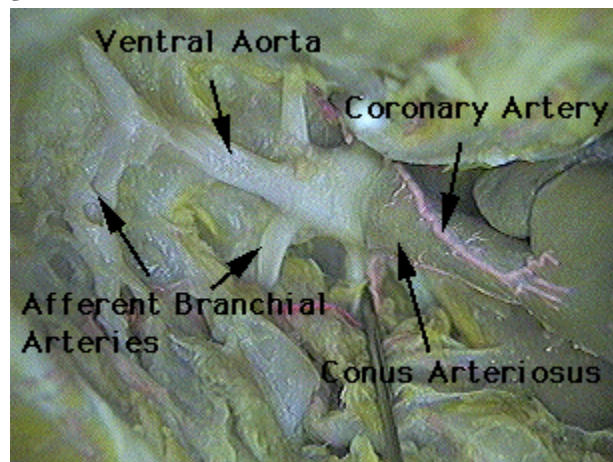
Labeled Heart



Labeled Sinuses

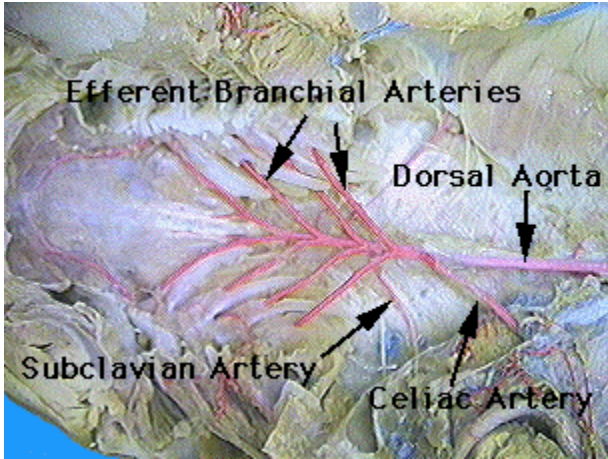


Labeled Ventral Aorta

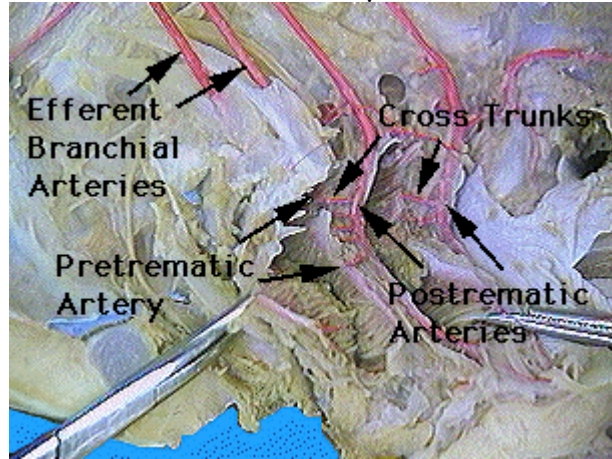


## SHARK DISSECTION PICTURES

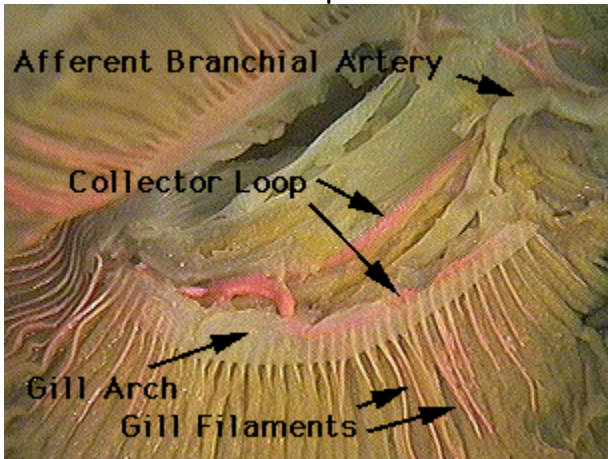
Labeled Dorsal Aorta



Labeled Efferent Artery

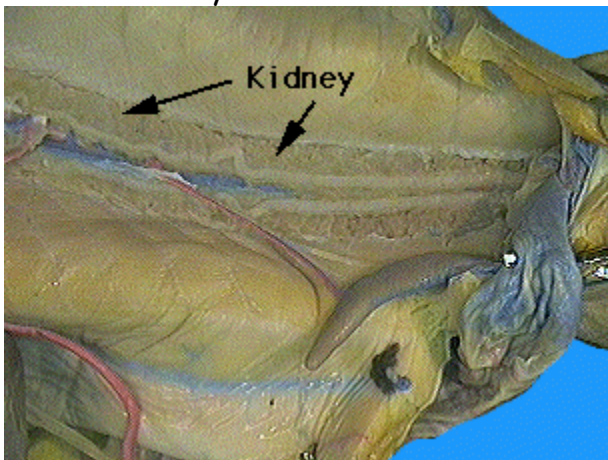


Labeled Collector Loop

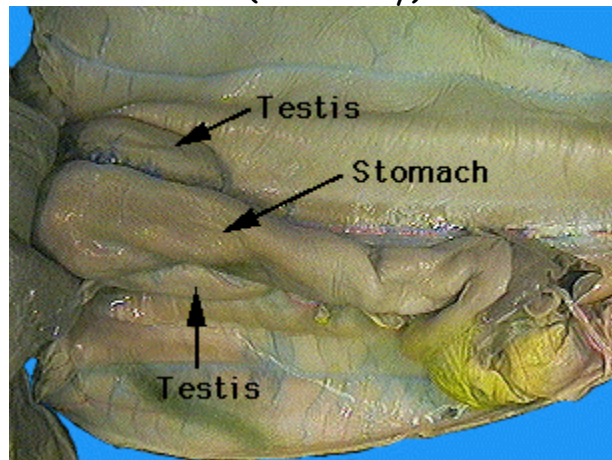


## Urogenital Anatomy

Labeled Kidneys



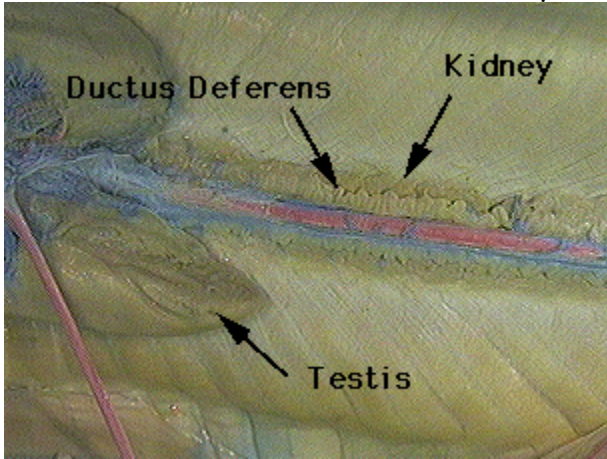
Labeled Testes (males only)



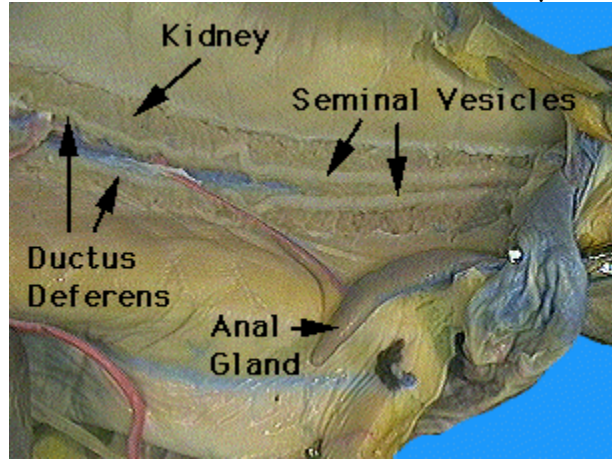


# SHARK DISSECTION PICTURES

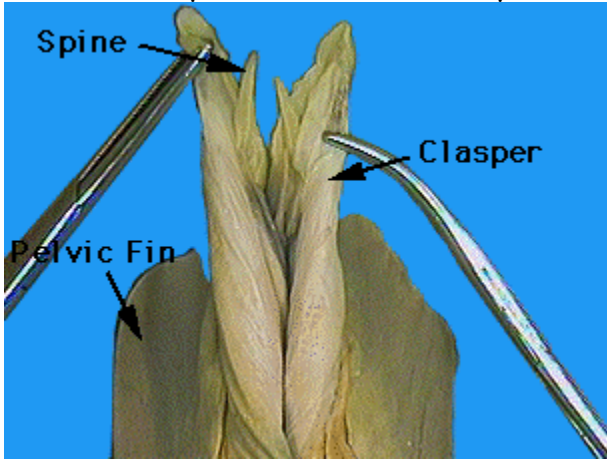
Labeled Ductus Deferens (males only)



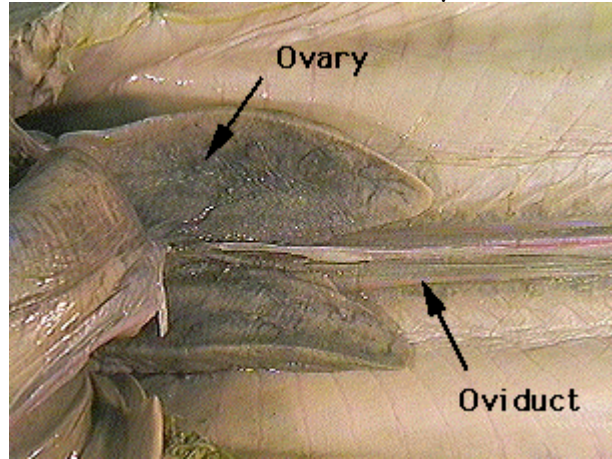
Labeled Seminal Vesicles (males only)



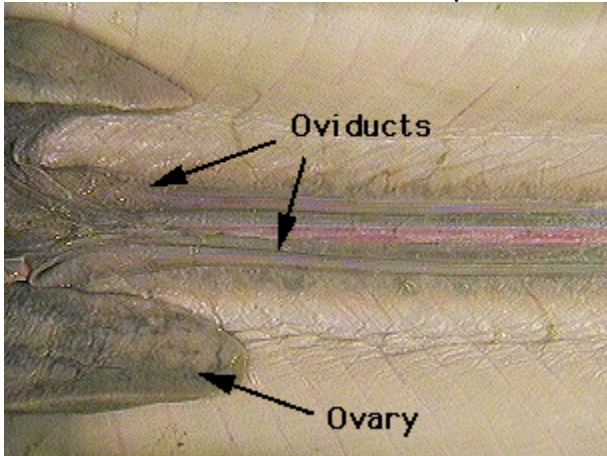
Labeled Clasper Tubes (males only)



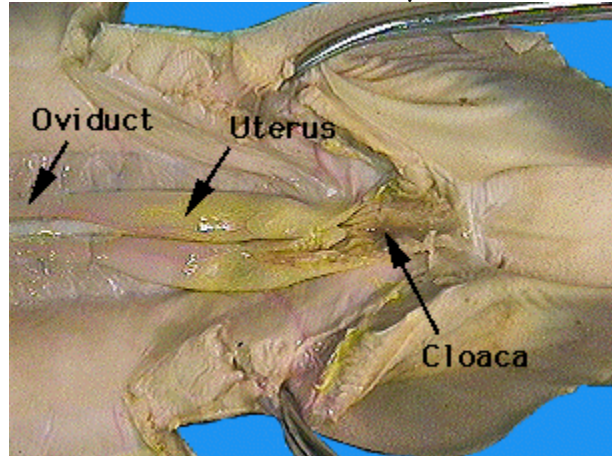
Labeled Ovaries (females only)



Labeled Oviducts (females only)



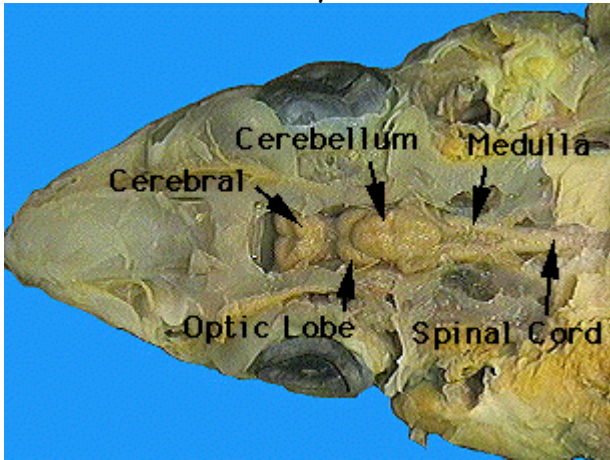
Labeled Uteri (females only)



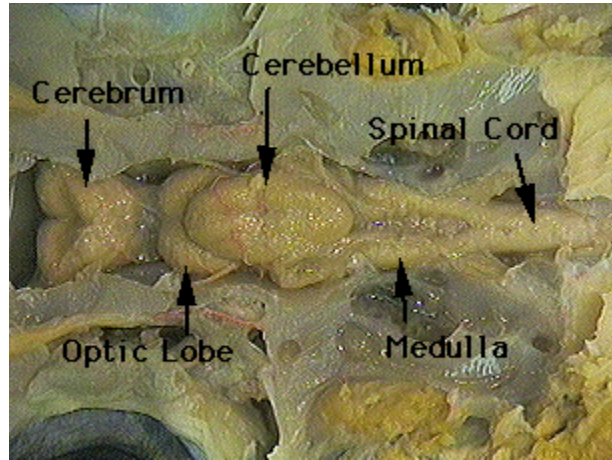
# SHARK DISSECTION PICTURES

## Nervous Anatomy

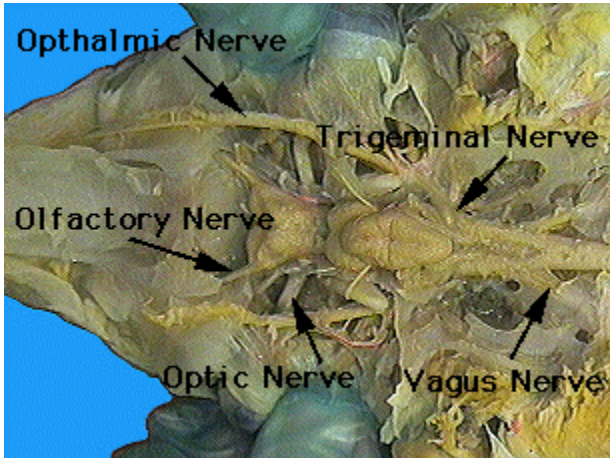
Labeled Cranial Cavity



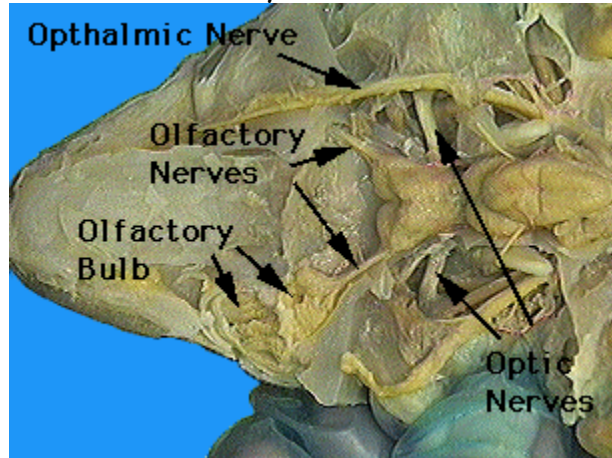
Labeled Brain



Labeled Cranial Nerves



Labeled Olfactory Sac

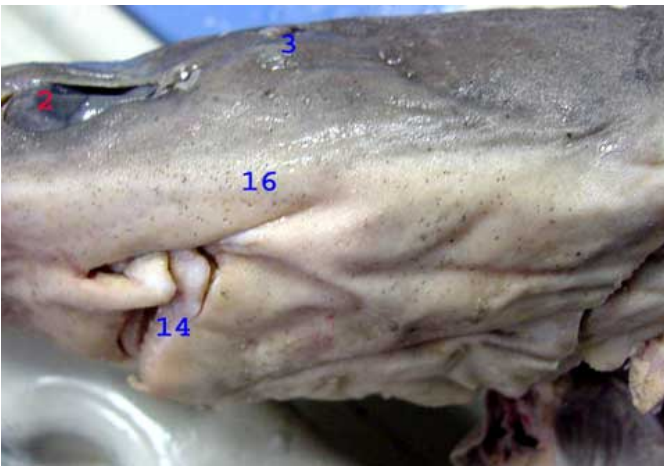
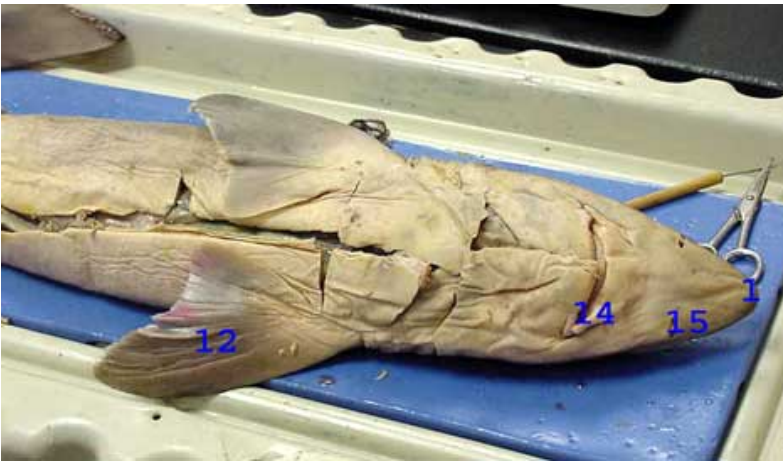
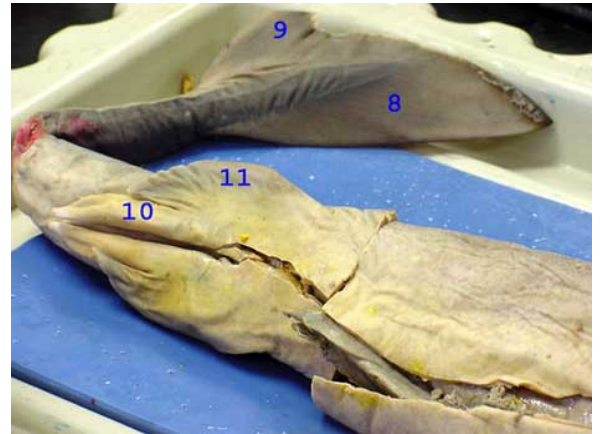
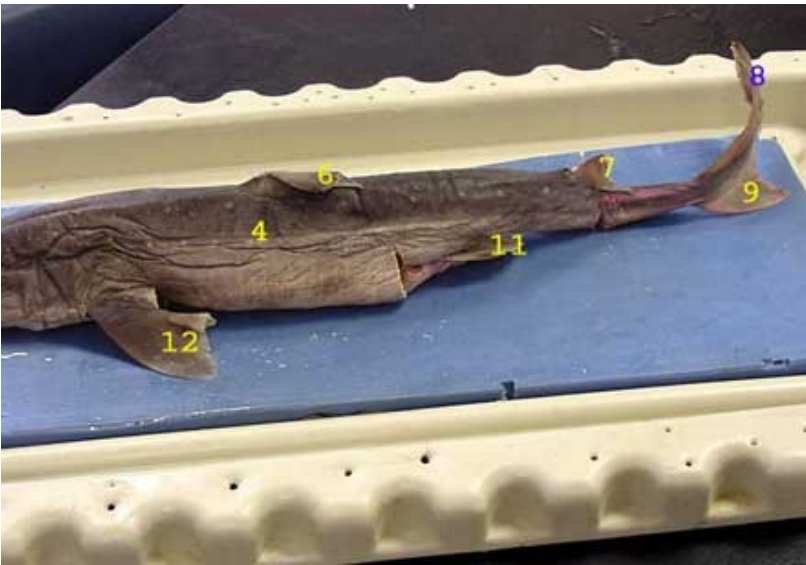


## SHARK DISSECTION PICTURES

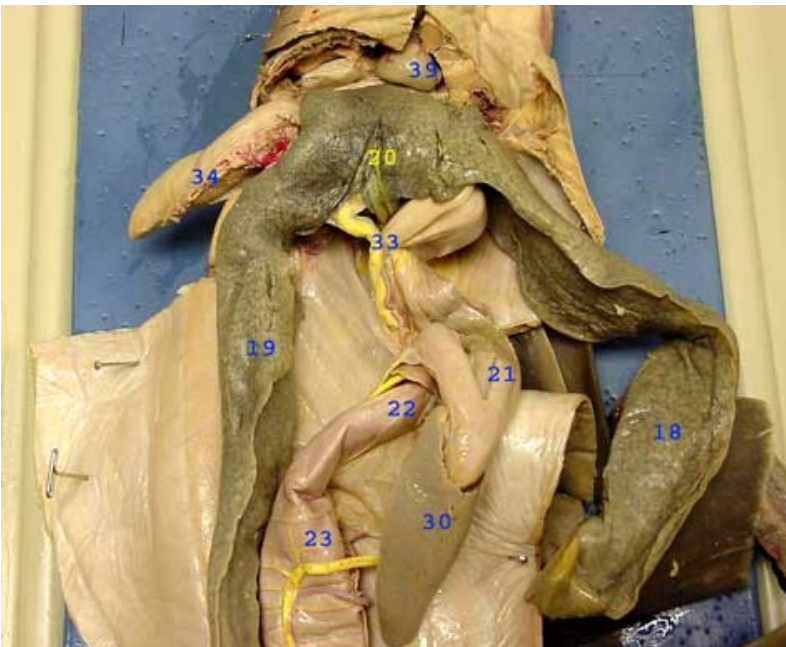
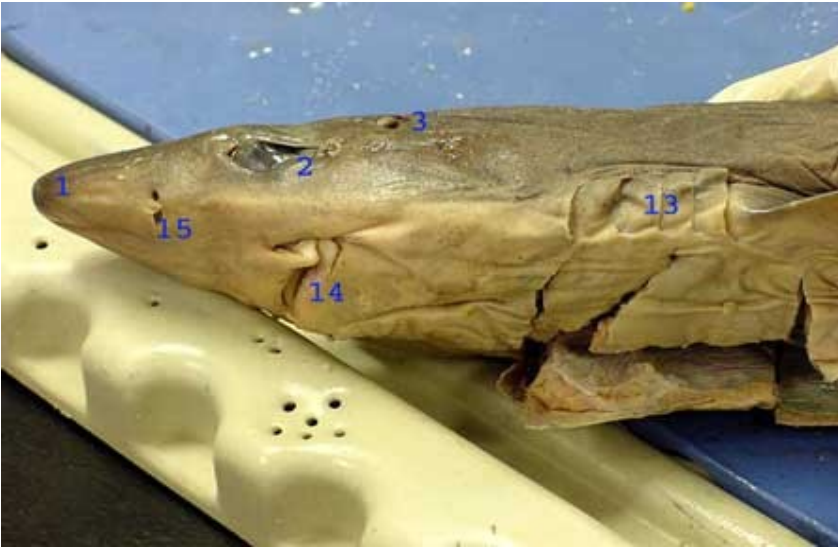
Shark Structures - Numbers will match to pictures below.

1. Rostrum	19. Right Lobe of Liver	37. Sperm Sac
2. Eye	20. Gallbladder	38. Rugae in Stomach
3. Spiracle	21. Stomach	39. Ventricle
4. Lateral Line	22. Duodenum	40. Atrium
5. Fin Spine	23. Ilium	41. Conus Arteriosus
6. Anterior Dorsal Fin	24. Spiral Valve	42. Gills
7. Posterior Dorsal Fin	25. Colon	43. Transverse Septum
8. Dorsal Lobe of Caudal Fin	26. Cloaca	44. Ductus Deferens ( Sperm Duct)
9. Ventral Lobe of Caudal Fin	27. Urogenital Papilla	45. Dorsal Aorta
10. Clasper	28. Ventral Lobe of Pancreas	46. Ovary
11. Pelvic Fin	29. Dorsal Lobe of Pancreas	47. Efferent Branchial Arteries
12. Pectoral Fin	30. Spleen	48. Celiac Artery
13. External Gill Slits	31. Kidney	49. Internal Carotid Artery
14. Mouth	32. Rectal Gland	50. Anterior Mesenteric Artery
15. Nostril	33. Bile Duct	51. Lienogastric Artery
16. Ampulla of Lorenzini	34. Right Testis	52. Posterior Mesenteric Artery
17. Medial Lobe of Liver	35. Left Testis	53. Iliac Artery
18. Left Lobe of Liver	36. Sinus Venosus	

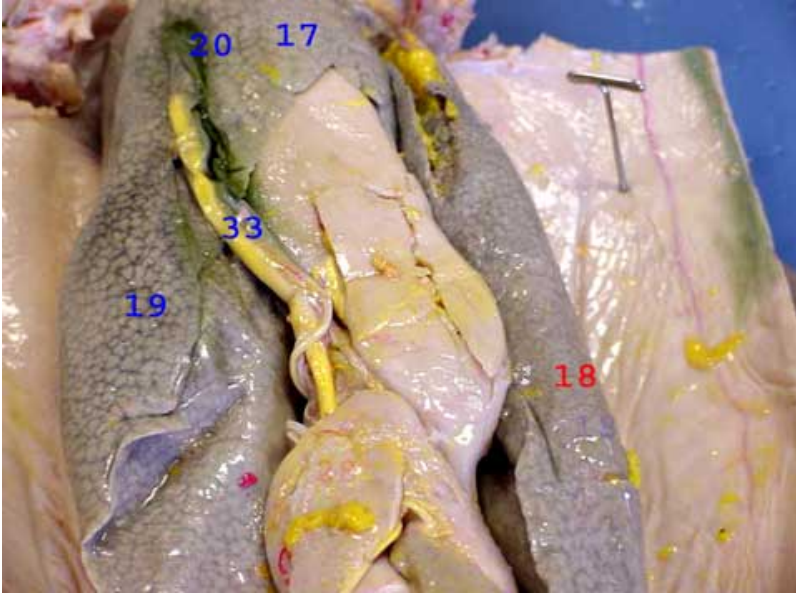
# SHARK DISSECTION PICTURES



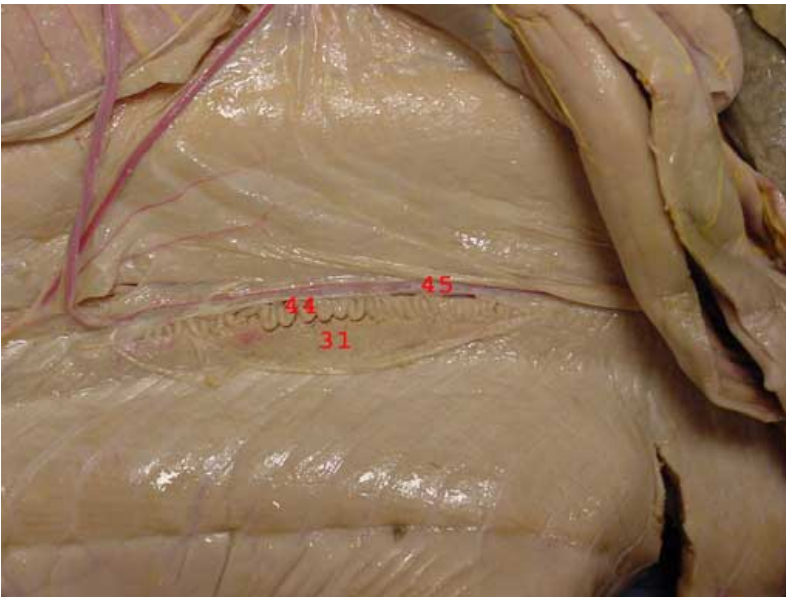
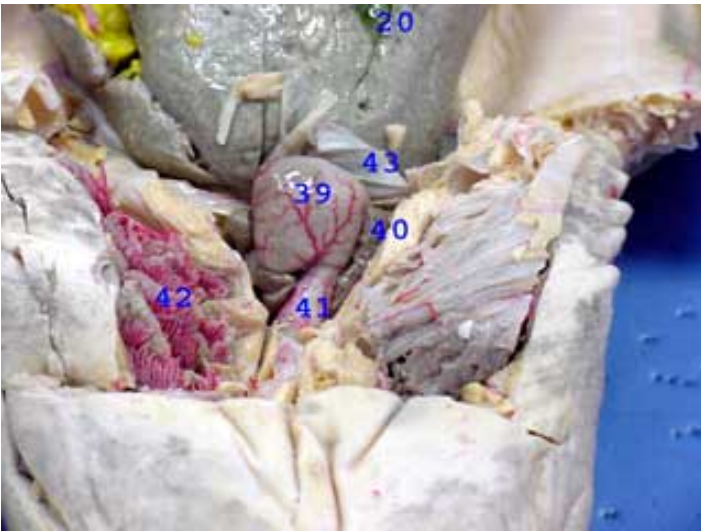
# SHARK DISSECTION PICTURES



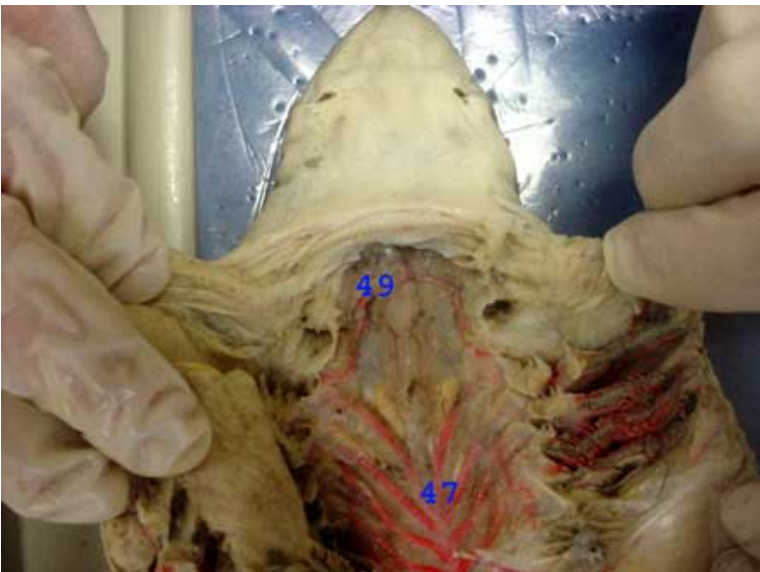
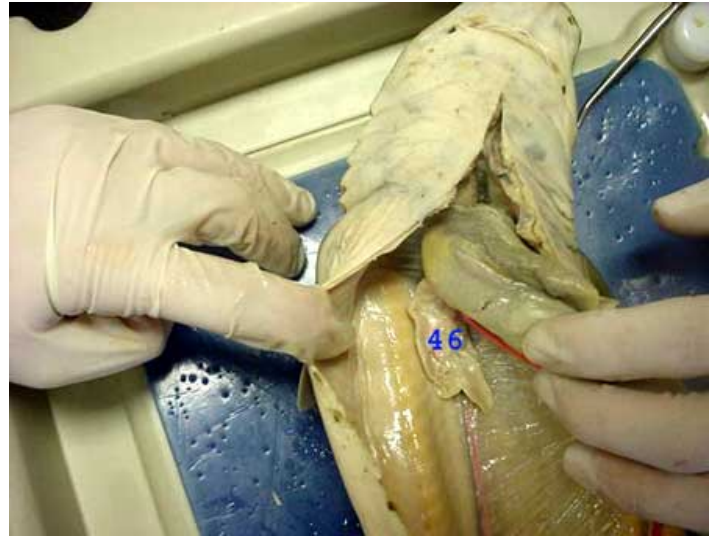
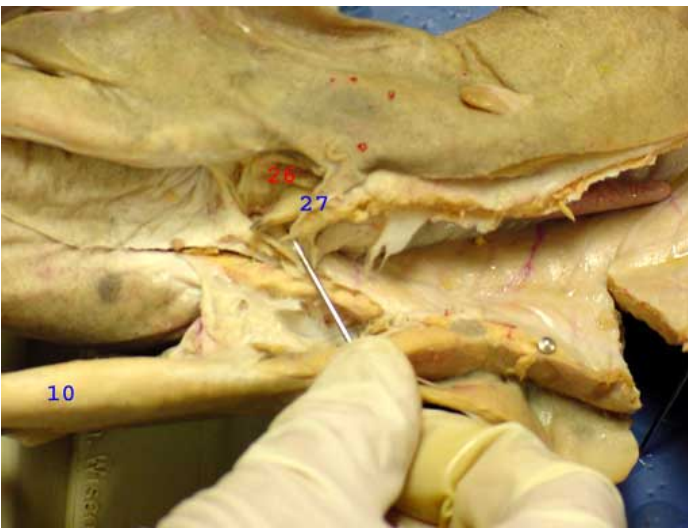
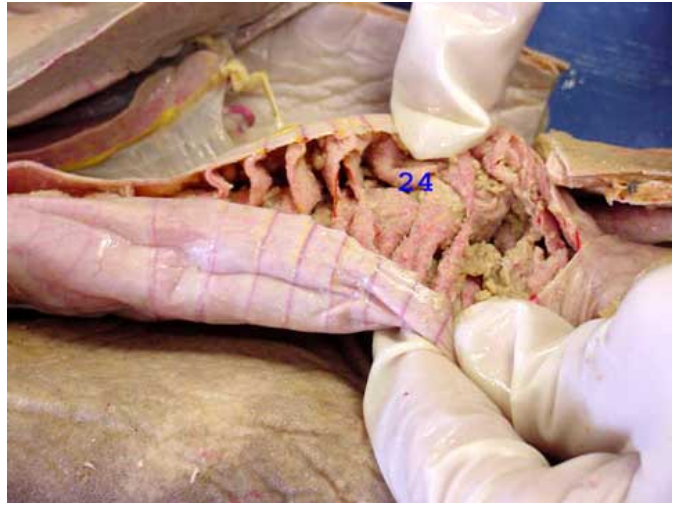
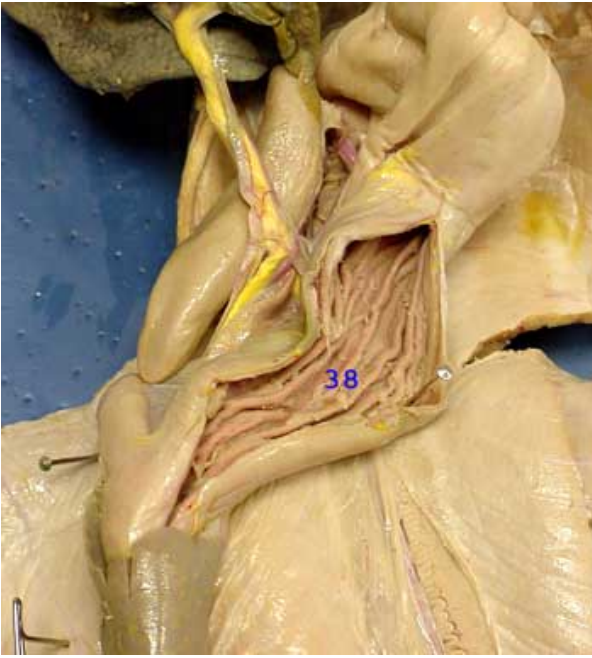
# SHARK DISSECTION PICTURES



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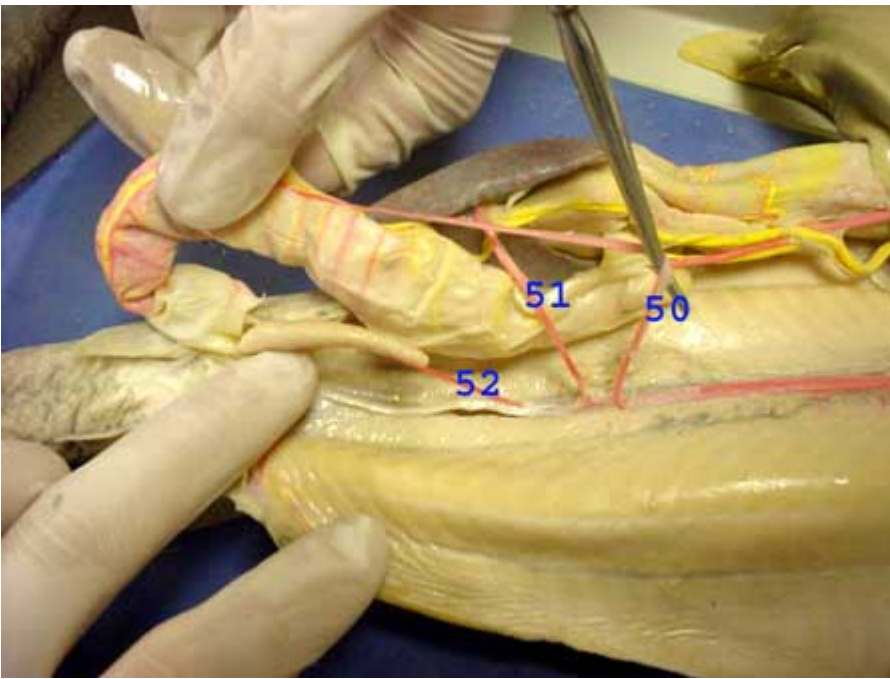
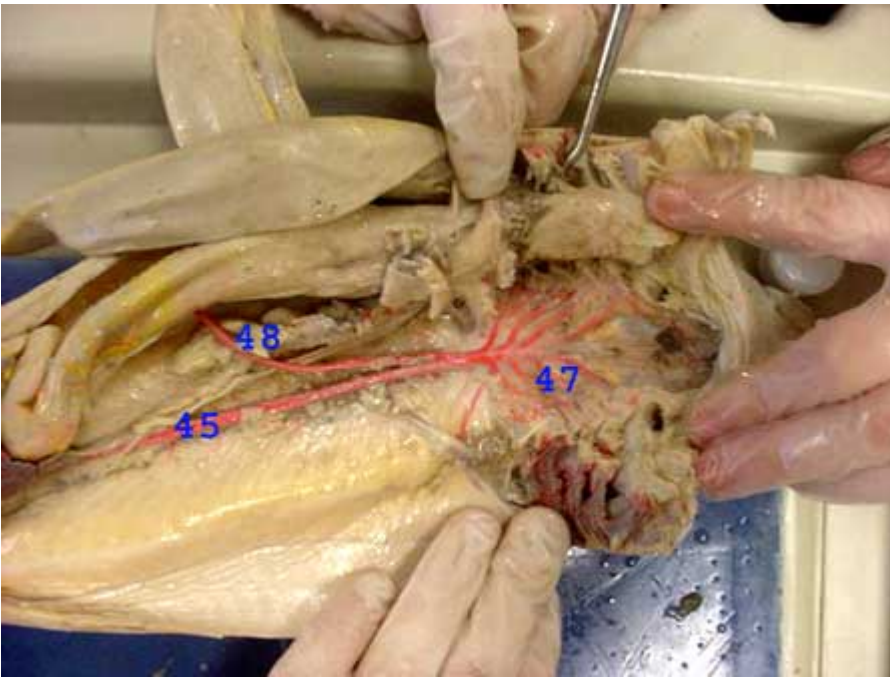


# SHARK DISSECTION PICTURES





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