



Shark Lab Key

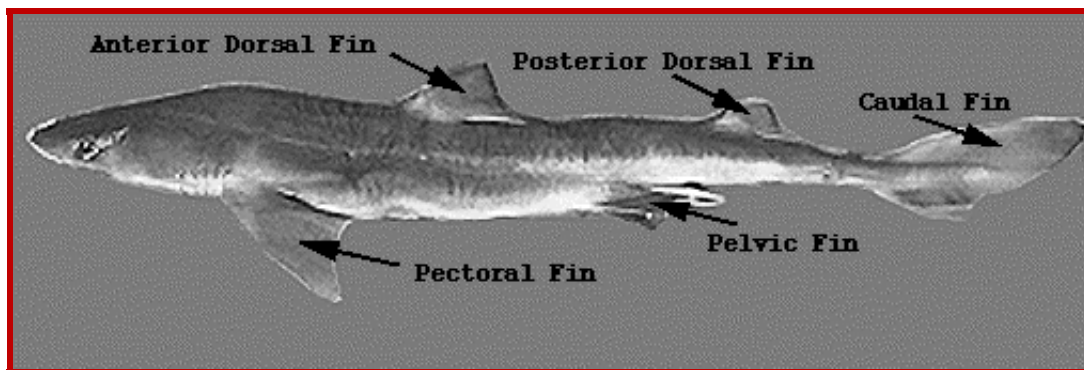
Study this [basic information](#) about the spiny dogfish shark.

Print this [Shark Lab Report Guide](#).

Pre-Lab Research

- Study this [website](#). It provides several useful videos of large shark dissections.
- Study this lab key. Basic instructions for the dissection are noted in **blue**. Key structures of the shark are noted in **red**.

dorsal surface



click on picture for ventral surface

External Anatomy

Examine each of the following items on your shark.

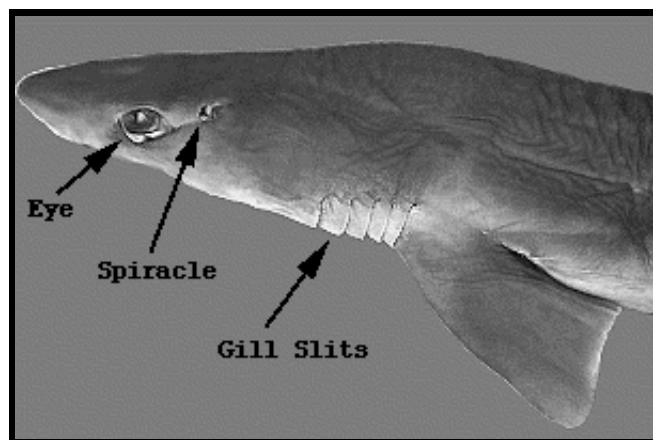
- The streamlined body is divided into the **head**, **trunk**, and **tail**.
- Coloration is dark gray above and almost white below.
- The **lateral line**, made up of a series of tiny pores leading to nerve receptors, is sensitive to vibrations in the water.

The Fins:

- The **anterior dorsal fin** is larger than the **posterior dorsal fin**. A spiny dogfish has two 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*.
- The paired **pectoral fins** act like wings to provide the lift needed to keep the shark from sinking.
- The paired **pelvic fins**, located on either side of the **cloacal opening**, are different in males and females.

The Head:

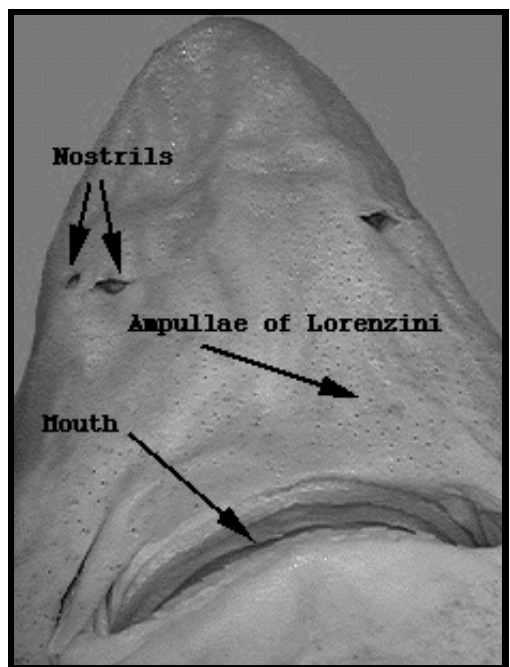
- The **rostrum** is the pointed snout, helping to overcome water resistance in swimming.
- A transparent **cornea** covers the eye. The darkly pigmented **iris** can be seen beneath the cornea with the pupil at its center.
- Upper and lower eyelids protect the eye. Just inside the lower lid is a membrane that extends over the surface of the eye to provide protection without closing the eyes.



- **Spiracle** openings are located above and behind each eye. The spiracle is an incurrent water passageway leading into the mouth.
- Most sharks have five external **gill slits** located behind the mouth and in front of the pectoral fins. Water taken in by the mouth and spiracles is passed over the gills and forced out through the gill slits.

The Mouth:

Using both hands, carefully open the mouth to examine the teeth and tongue.



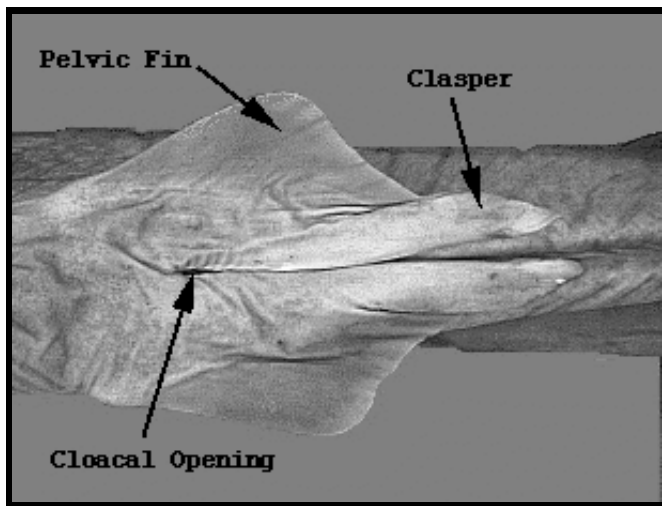
- The triangular **teeth** are arranged in several rows beginning at the outer edges of the upper and lower jaws. Behind the functional first row of teeth are additional rows folded downward ready to replace any that are lost.
- The **tongue** is practically immovable and without muscles. It is supported anteriorly and posteriorly by cartilage.
- The **nares**, external nostrils, are located on the 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 detect very small changes in temperature, water pressure, and electrical fields.

Sexual Dimorphism

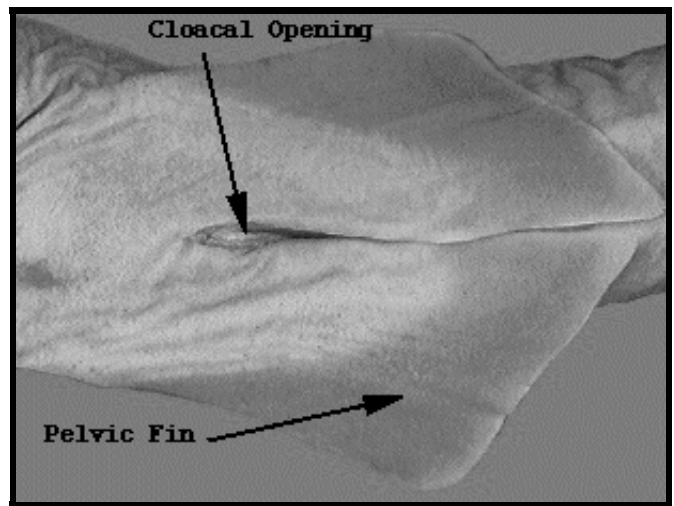
Males have stiff, grooved copulatory organs called **claspers** on the inner side of their pelvic fins. During copulation, these are inserted through the cloaca into the oviduct of the female. Sperm travel from the cloaca of the male along the grooved dorsal surface of the clasper into the female.

The **cloacal opening** is located on the ventral surface between the pelvic fins. It receives the products of the

intestine, the urinary and the genital ducts.



male



female

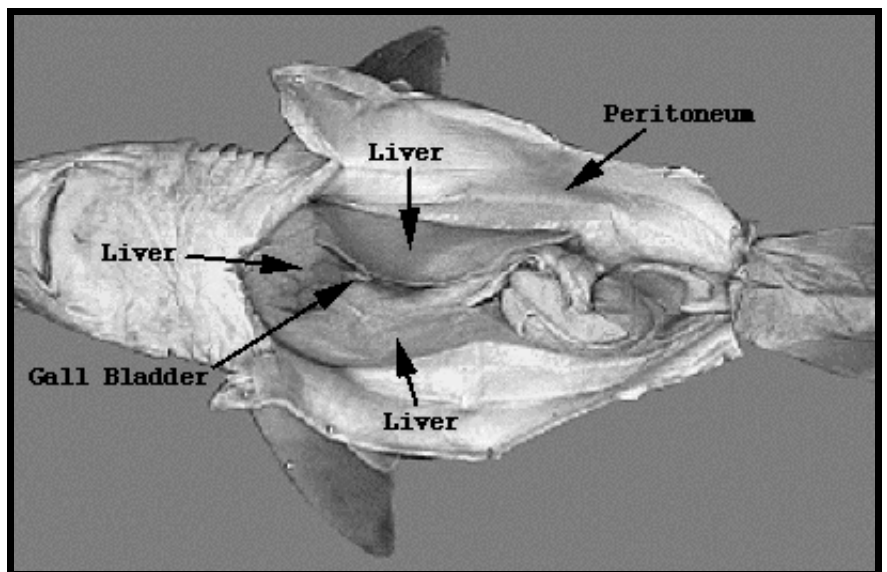
Internal Anatomy

Turn the shark ventral side up and make an incision just in front of the cloacal opening. Extend the cut forward, all the way to the pectoral girdle (between the pectoral fins).

Digestive System:

A shiny membrane, the **peritoneum**, lines the inside of the body wall. The internal organs are supported by a membrane known as the **mesentery**.

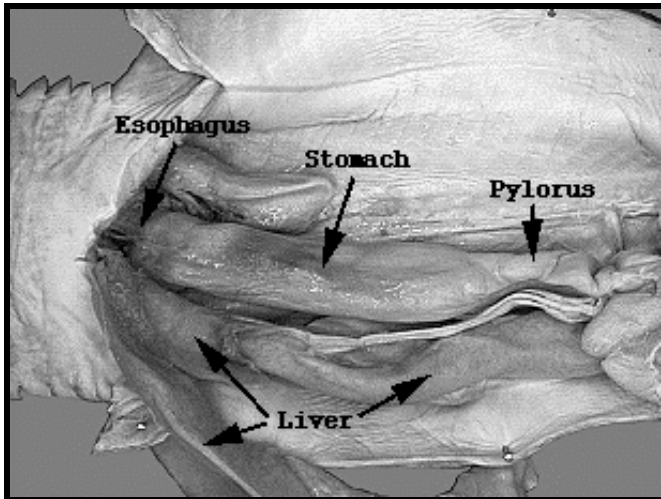
The **liver** is the largest organ in the body. Its two main lobes, right and left, extend from the pectoral girdle backward through most of the body cavity. A third, much shorter lobe (with the green gall bladder attached), is located between the two large lobes.



The liver is rich in oil, which stores energy for the shark and, because of its low specific gravity, provides a limited amount of buoyancy. (Sharks have no swim bladders.)

Remove the two main lobes of the liver to make the other internal organs easier to see.

The **esophagus** is the thick muscular tube connecting the oral cavity and pharynx with the **stomach**.



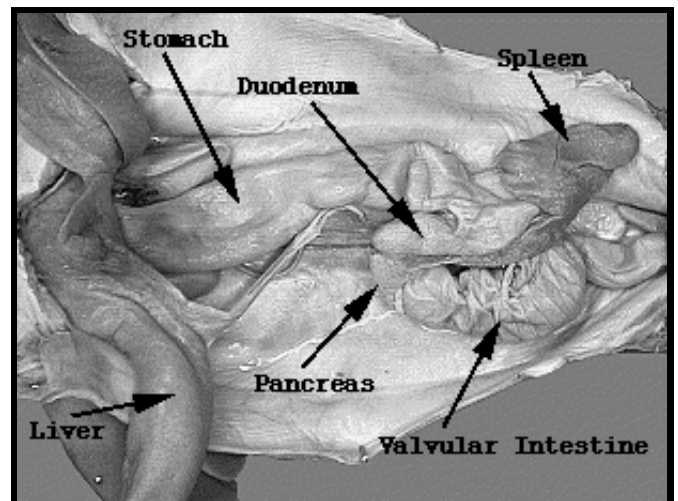
Open the stomach by cutting along its long axis. (There may be partially digested food that must be removed.)

The **mucosa** lines the stomach with longitudinal folds that help churn and mix the food with digestive juices. The back of the stomach narrows to a circular valve, the **pyloric sphincter**, which regulates the passage of partially digested food into the intestines.

Behind the stomach is the **duodenum**, the first section of the **small intestine**. The **bile duct** from the **gall bladder** enters the duodenum.

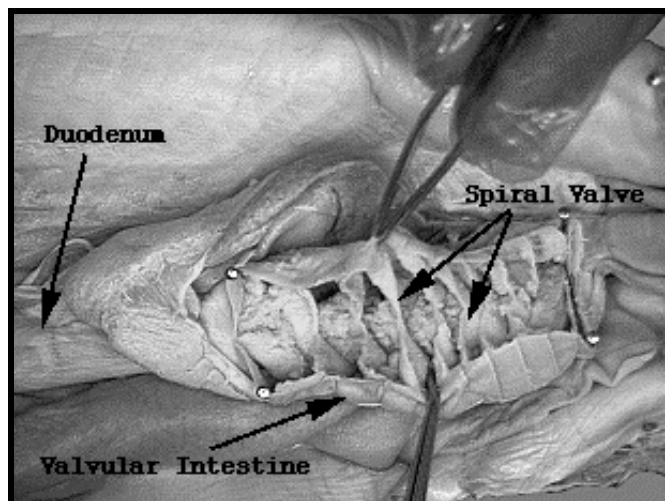
The **pancreas** is located at the connection of the duodenum and the stomach. Secretions from the pancreas enter the duodenum through the **pancreatic duct**.

The dark, triangular-shaped **spleen** is located near the posterior end of the stomach.



The **valvular intestine** is the second, and much larger, section of the small intestine. It is recognized by the rings on its surface.

Open the valvular intestine as you did the stomach.

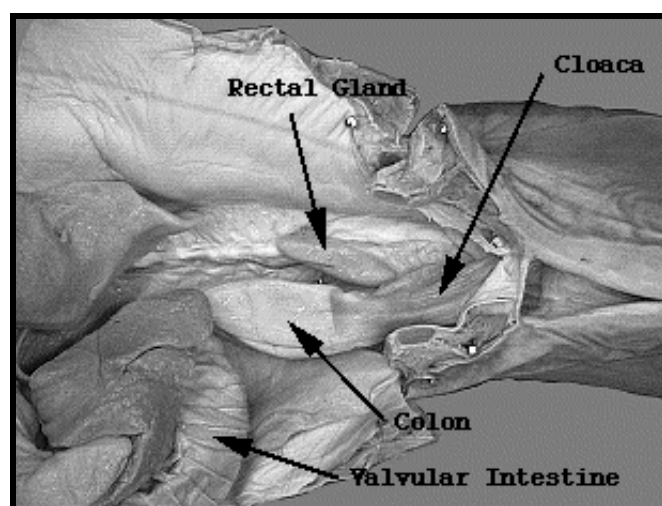


The screw-like structure is the **spiral valve**. It adds surface area for digestion and absorption to an otherwise relatively short intestine.

The **colon** is the narrowed continuation of the valvular intestine.

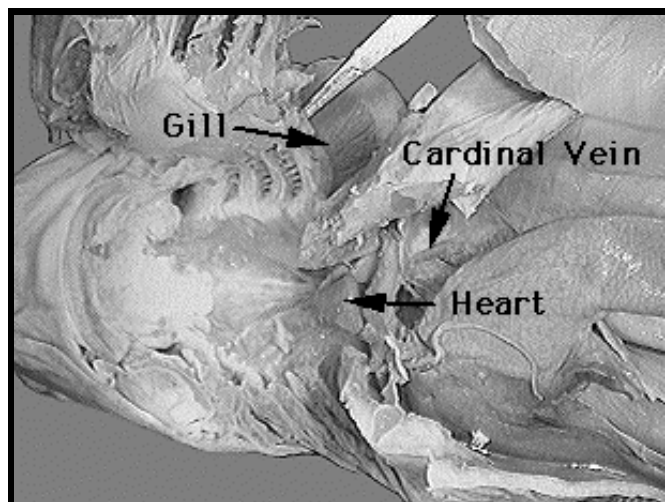
The **rectal gland** is a finger-like structure connected to the colon by a duct. It is an organ of *osmoregulation*, regulating the shark's salt balance. It has been shown to excrete salt in concentrations higher than that of the shark's body fluids or the surrounding sea water.

The **cloaca** is a cavity collecting the products of the alimentary canal and the urogenital ducts. It is a catch-all basin leading to the outside through the cloacal opening.



Respiratory System:

Extend the opening of the ventral muscles all the way to the bottom of the lower jaw. Lay the skin flat to expose the gills and heart.



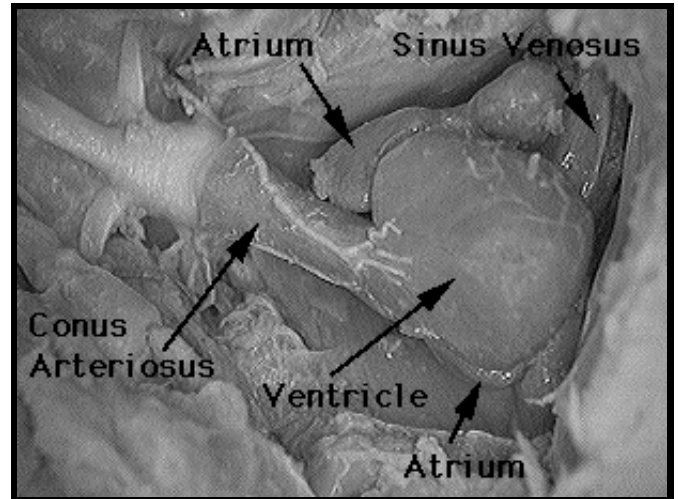
Gills are the respiratory organs of the shark. They are composed of gill, blood vessels, and supporting cartilage structures located in a series of **pharyngeal pouches**.

The five gill slits are supported by cartilage **gill arches** and guarded by small **gill rakers** which act as strainers to prevent food particles from leaving the pharynx through the gill slits.

Circulatory System:

The **pericardial cavity**, lined by the **pericardium**, contains the heart and major blood vessels. The **ventricle** is the thick muscular walled cavity that pumps blood to the gills and the body. The **atrium** is thin-walled with two lateral bulging lobes.

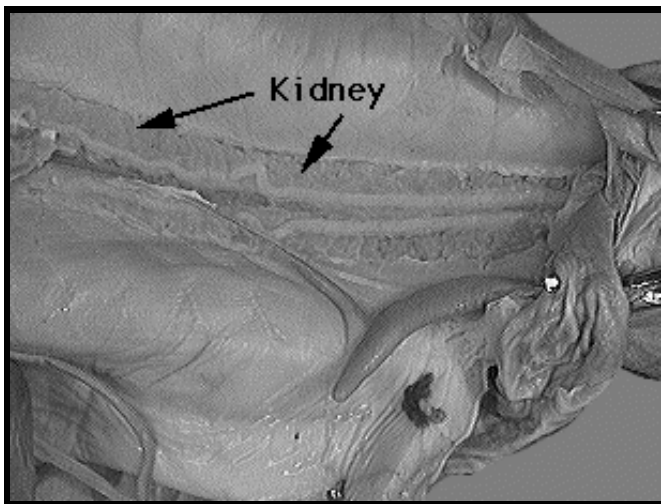
- Blood enters the heart through the **sinus venosus** which drains into the atrium.
- The front of the **conus arteriosus** branches into five pairs of arteries which carry deoxygenated blood from the heart to the gills.
- Another set of vessels return oxygenated blood from the gills to the heart to be distributed to all parts of the body.



Urogenital System:

Carefully remove the stomach, intestines, spleen and remaining lobe of the liver to expose the gonads, kidneys, and associated ducts.

The **urinary system** is responsible for the removal of nitrogenous wastes and the maintenance of water balance. The **genital system** is responsible for the reproduction of species. However, since they share some common structures in the shark, they are usually considered as a single system.



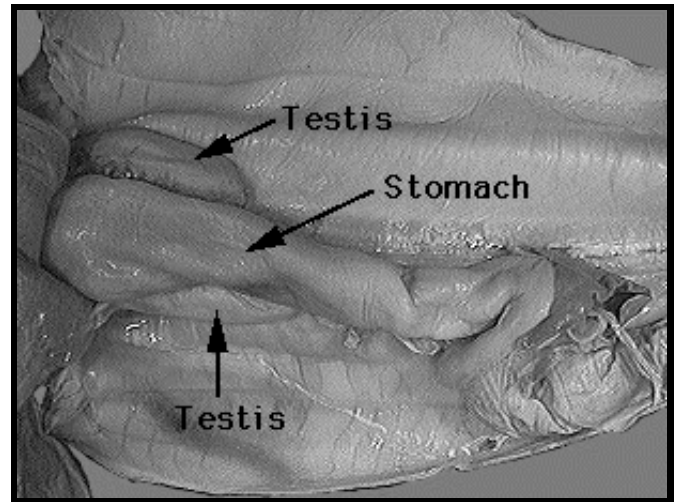
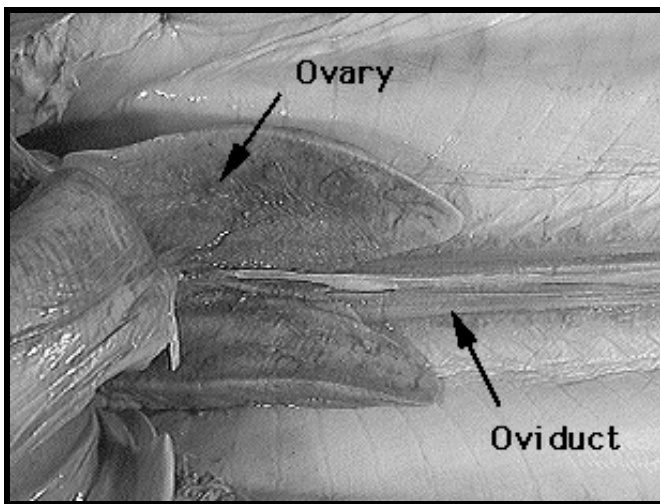
The **kidneys** are flattened, ribbon-like structures lying dorsally on either side of the midline, along the entire length of the body cavity.

The kidneys of the male and female are slightly different. The posterior portion is involved in the manufacture and transport of urine in both sexes. The main difference lies in the front portion of the kidney, which in females is under-developed and functionless, but in males is an active part of the reproductive system.

Male:

Paired **testes** lie near the front of the kidneys. **Sperm** pass from the testes through small tubules to the kidneys.

After passing through the front of the kidney, sperm enter the **ductus deferens** and pass to the cloaca. In mature males this duct may be seen on the ventral surface of the kidneys as a pair of highly coiled tubules.

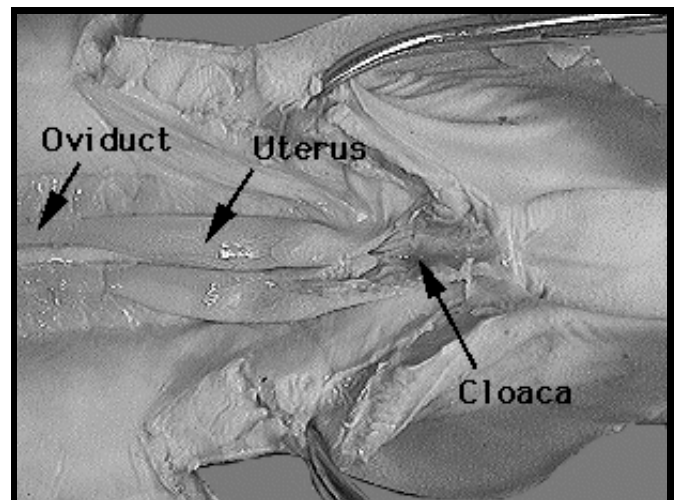
**Female:**

The **ovaries** of females are two cream-colored, elongated organs in the front of the body cavity above the liver.

In immature females they will be small and glandular in appearance. In mature specimens two to three large eggs, about three centimeters in diameter, may be visible in each ovary.

During ovulation, eggs enter the body cavity and, by means of **peritoneal cilia**, are moved into the oviducts.

The **oviducts** are tube-like structures running along the sides of the kidneys. Eggs are fertilized and receive a light shell-like covering as they pass through the **shell gland** in the first half of the oviduct. The last half of the oviduct is enlarged to form the **uterus**.



As they grow in the uterus, the embryos are attached to the egg, now known as the **yolk sac**. During its **period of gestation**, which is *nearly two years*, the yolk is slowly absorbed by the embryo.

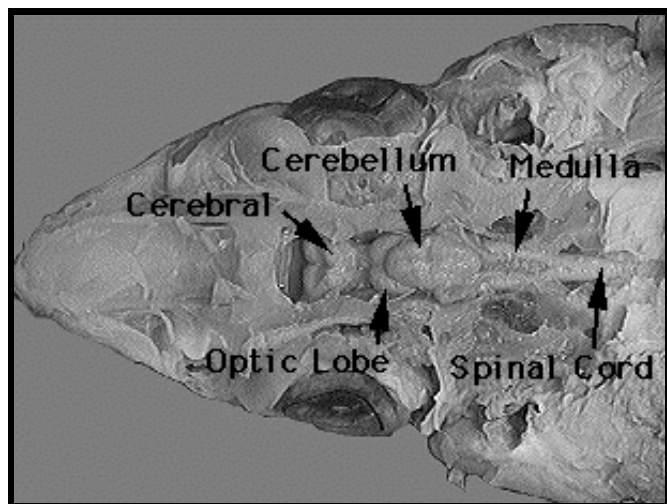
Numerous **uterine villi**, finger-like projections from the

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.

The **cloaca** serves as the aperture through which the 23 to 29 centimeter long shark "pups" are born.

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*.

Nervous System:



Remove the skin from the dorsal surface of the head and shave off thin layers of the cartilage cranium until the brain and cranial nerves are exposed.

There are two main parts of the nervous system:

- *central nervous system* - the brain and spinal cord
- *peripheral nervous system* - the sense organs, cranial and spinal nerves, and their branches.

Parts of the shark brain:

- **Forebrain:**
 - The two cerebral hemispheres are rounded lobes at the front of the brain. The first portion of the cerebrum is known as the olfactory lobes, responsible for the sense of smell.
 - The second portion of the forebrain consists of the epithalamus, pineal body, thalamus, hypothalamus and pituitary body.
- **Midbrain:** The optic lobes are prominent bulges of the brain responsible for sight.
- **Hindbrain:**
 - The cerebellum is an oval-shaped portion that partly overlaps the optic lobes.
 - The medulla oblongata is the elongated region at the back of the brain that narrows into the spinal cord.