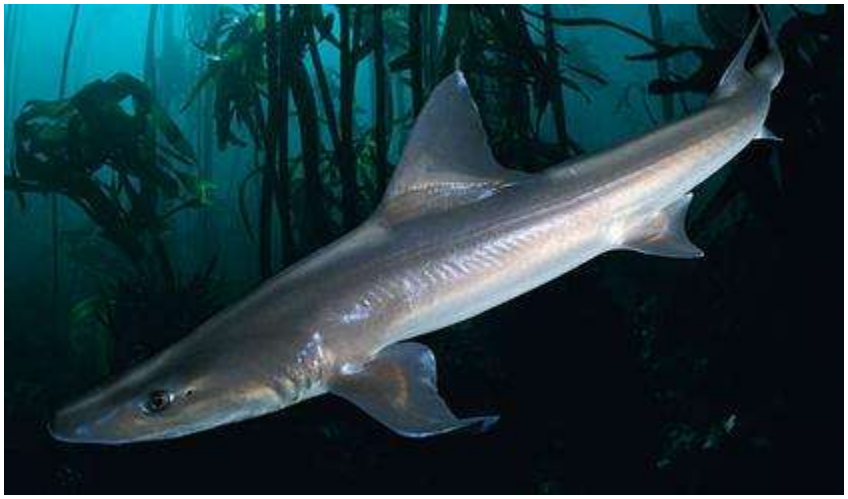
# Dogfish shark



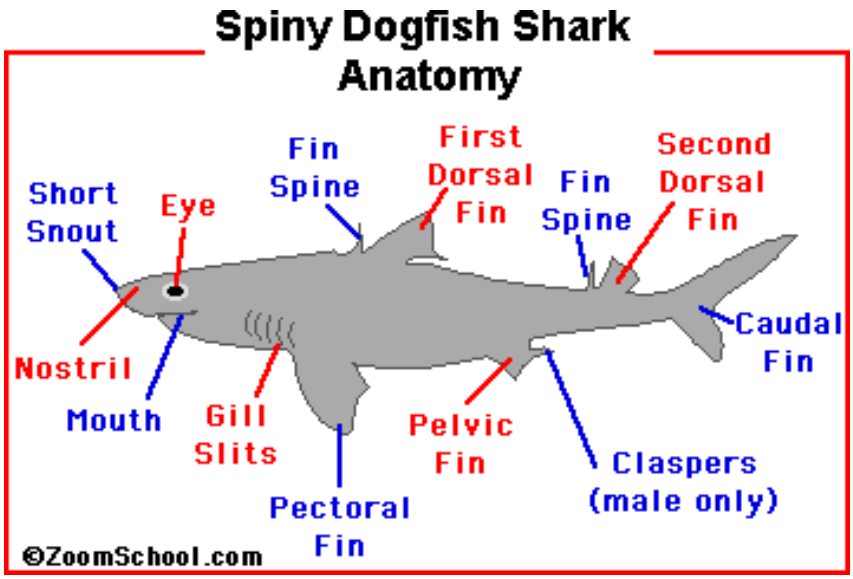


**Classification/Diagnostic characteristics**
**Kingdom:** Animalia (animals)
**Phylum:** Chordata
**Sub-Phylum:** Vertebrata (vertebrates)
**Class:** Chondrichthyes (cartilaginous fish)
**Sub-Class:** Elasmobranchii (sharks and rays)
**Order:** Squaliformes (dogfish sharks)
**Family:** Squalidae
**Genus:** *Squalus*
**Species:** *Squalus acanthias*

- -an anterior skull that contains a large brain and sensory organs
- -an internal skeleton (rigid) that is upheld by the vertebral column
- -internal organs that are held within a large coelom (a body cavity that is enveloped in muscular mesoderm and lined with peritoneum (a mesodermal layer))
- -a relatively complex circulatory system, run by a heart that contracts
- -spine, dorsal fin, caudal fin, anal fin, pelvic fin, heart, and a vertebral column
- -jaws with strong teeth
- -skin that is flexible and has a leathery texture

Dogfish sharks have streamlined bodies that are built for long-distance swimming at high speeds. It's body is dark gray on top and near-white below. It has a double dorsal fin (anterior and posterior), with the anterior fin being larger than the posterior fin. Its caudal fin is divided into two lobes: a large dorsal lobe and small ventral lobe. This is known as a heterocercal tail. Its pectoral fins and pelvic fins are both paired (the pelvic fins are different in males and females). The opening of the dogfish shark's mouth and nostrils lie on its snout, and it possesses prominent eyes similar to those of humans.

There are 119 species of dogfish sharks, which come in all shapes, sizes, colors, and live in almost every ocean habitat and depth. They have the smallest shark species (Dwarf lantern shark, which only grows to about 6 inches) and some of the largest (Greenland and Sleeper sharks). Some species have spines attached to their dorsal fins, while others have tall, sail-like dorsal fins. Other species are bioluminescent with greenish bands that can attract and confuse prey or can be used to hide from predators.
Dogfish sharks are one of the most abundant shark species on the planet.




Dogfish Shark Anatomy

**2. Relationship to humans**

Humans, generally speaking, have very negative perceptions of sharks due to their occasional deathly interactions with other species, including us. We use their leathery skin as material for clothing or accessories, and their teeth are sometimes used for necklaces. Sharks are often held in captivity within aquariums, where visitors are entranced by their mystifying dominance. Fishermen are threats to dogfish sharks, because they can be used as food in human dishes.

Dogfish are often caught for their liver oil, which is rich in vitamin A, and are also caught to be used as fertilizer. Dogfish are almost completely harmless to human beings. Being curious creatures, they will often approach divers but will not attack. Divers must be wary, however, because Dogfish sharks have venomous spines that could do accidental damage.

Dogfish shark liver and stomachs contain the compound squalamine, which has the property of inhibiting or reducing the growth of small blood vessels in humans. Squalamine also appears to protect against viruses that attack the liver and blood tissues. Humans hope to harness the dogfish shark's immune system, specifically the compound squalamine, to protect humans against a wide variety of viruses. Sharks skin has been analyzed by numerous companies attempting to recreate the speed of the shark in the water for competitive swim suits and other marine innovations.

**3. Habitat and niche**

Sharks live in the water (mostly in the ocean and rarely but occasionally in lakes and rivers.) Dogfish sharks live in the ocean. Most sharks are predators of other fish and hold high roles within the ocean food chain, while some strain the water in order to consume plankton.
This particular species of shark tends to be a bottom feeder, usually swimming over the muddy or sandy ocean floors worldwide. They prefer to live in temperatures of 7 to 15 degrees Celsius and depths of around 2400 feet, allowing them to live in locations that vary from the chilly Arctic Ocean to the warm waters of the Pacific Ocean. They also can be found in the Mediterranean Sea and the Black Sea. This shark commonly lives in bays and inshore waters, preferring waters less than 18 meters (60 feet) deep. Smooth Dogfish sharks migrate north and south with the seasons.

**4. Predator avoidance**

The dogfish shark’s sharp teeth make it incredibly effective at avoiding predator attacks and sustaining its dominance at the top of the food chain. Its main predators are humans.

The Spiny Dogfish Shark uses a sharp spine in front of each of its dorsal fins defensively to attack enemies. It does this by curling its body to expose the spine then thrusting at the enemy. Now that the enemy is injured the shark is able to swim away safely.

Dogfish Shark Teeth (LC)

**5. Nutrient Acquisition**

Jaws and teeth are key in a shark's acquisition of nutrients. The jaw enables the cartilaginous fish to grasp prey (like other fish) and hold it within its mouth. The teeth enable the organism to grasp the prey as well, but also to break it up into smaller, more easily digestible pieces. In order to extract nutrients from its food, chewing is also crucial. It helps in the process of chemical digestion and makes it easier for the shark to extract the nutrients that it needs. Sharks maximize their nutrient absorption by having large surface areas of their lower region's (ilium) spiral valve, even though their intestines themselves are short. Dogfish sharks are mostly scavengers and opportunistic feeders, but also regularly eat crabs, lobsters and shrimp.

**6. Reproduction and life cycle**

Sharks mate and reproduce to have live young (called pups), not eggs. The females hold eggs within their uterus (womb) during the duration of embryonic development and then give birth to live young after the eggs hatch.

The dogfish shark reproduces **a placental viviparity** which is when the animal hatches from an egg, but the animal (**pup**) then develops inside the female's body. The female does not have a placenta to nourish the pups, so pups have to eat unfertilized eggs or each other to survive. Because there is sibling cannibalism, few pups survive until birth. There are anywhere from 2-11 pups in each litter, and they are 8-12 inches at birth. The gestation period of the dogfish shark is the longest of any vertebrate, it is between 18-24 months, longer than the gestation period for elephants or whales.
The dogfish shark has a total life span from between 25–100 years.

**7. Growth and development**

1) In shark reproduction, sharks eggs, unlike most bony fish, are fertilized in the female body by which a male shark's extensions of pelvic fins, claspers transfer the sperm to the female. The gestation period can be up to two years, where the dogfish has the longest period of gestation. Once born, baby sharks, known as pups, are fully independent and are subjected to negative parental care—their mother might eat them. Among shark egg development there are three:

1. Viviparity- Eggs will hatch inside the female, and fetuses will be fed by a placenta via an umbilical cord attached to the fetus in between pectoral fins.
2. Oviparity- Sharks will deposit eggs, with yoke, in the ocean, unguarded by the parents by protected by a leathery membrane.

3. Aplacental Viviparity- Eggs hatch and babies develop inside the female's body, without a placenta. Any unfertilized eggs or weak fetuses will be devoured through sibling cannibalism. There are no morals taught here.

**8. Integument**

Shark skin is typically leathery and flexible, but it can also sometimes have scales that are rough and offer the organism protection from its external environment. The dogfish shark's skin is covered in rough, tooth-like scales called placoid scales or dermal denticles. They are arraged longitudinally and cover the majority of the shark's body. These scales are so rough that they can be used as a sandpaper, offering protection to the shark. In addition, they reduce drag, allowing the shark to swim faster. Dermal denticles are composed of ivory, a tissue that is similar to bone but is much harder.

Placoid (tooth-like scales)

In addition to reducing drag of the swimming shark the denticles of the shark actually create thrust as long as the shark stays moving.

**9. Movement**

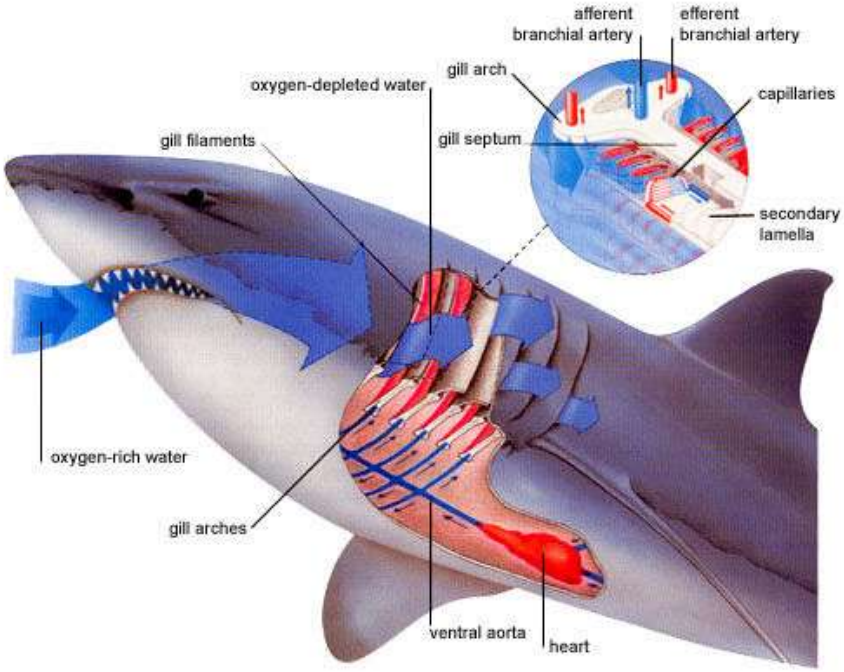
Sharks can propel themselves through the water through lateral undulations (a form of locomotion or movement), which occur within their bodies themselves and within the caudal fin. The dogfish shark's voluntary movements as well as a few involuntary actions (ex. breathing, shivering, etc.) are controlled by skeletal muscle cells, otherwise known as muscle fibers. When muscles contract, actin and myosin contractile proteins slide against one another in opposite directions, enabling the organism to make voluntary movements.

Because of the countercurrent exchange in the gills described in Gas Exchange, some sharks that have lost the ability to pump water in their gills will **asphyxiate** if they stop swimming.

**10. Sensing the environment**

Sharks have very strong senses of smell, which enable them to detect blood or other scents within their environments. Their senses of smell can be used to track their prey, or to stay clear of predators. Sharks' nervous systems rely on the pulse of electrical current (called action potential) down the axons of their neurons. This action potential occurs through the depolarization of the plasma membrane, with the use of ion channels opening and closing. Action potentials are all-or-nothing signals. When they reach threshold, they fire, and then undergo a refractory period in which electrical signals cannot be generated through its axon. The neurotransmitters bind to receptor sites on the postsynaptic cell, triggering the opening and closing of ion channels (leads to depolarization of its membrane), triggering another action potential in the postsynaptic cell. This is the process by which chemical signals are transmitted from one neuron to another. Sharks, like other vertebrates, have spinal cords and brains, which together are called the central nervous system (CNS), which plays a crucial role in the process of sensing their environment. Sensory signals/cells transmit signals to the central nervous system, which are then sent to the peripheral nervous system (PNS) (other neurons and supporting cells that lie outside of the brain or spinal cord). The sympathetic and parasympathetic branches of the autonomic nervous system (ANS) (involved in controlling involuntary functions in the body) are very important in sharks' ability to sense their environment. These divisions are involved in the flight-or-flight response and can therefore enable the organism to react to its environment in the necessary physiological ways.

11. **Gas exchange**




Gas Exchange in a Shark

Similar to other fishes, sharks possess gills that aid in gas exchange. The gills themselves support countercurrent exchange, which is an efficient way of extracting oxygen from an organism’s external environment, based on the natural concentration gradient. The blood flows in the opposite direction of the water, as it passes through and over the lamellae. Water flows over the shark’s gills, which contain many filaments, which are covered with lamellae (the gas exchange surfaces themselves), made of thin tissues. This contact induces countercurrent exchange, supplying the shark’s blood with oxygen. The

oxygenated blood can provide the rest of the body with the oxygen that it needs to carry out its other metabolic functions. Some sharks swim nearly constantly in order to force water over their gills, to maximize gas exchange. If they open and close the cavities that house the gills, water will also be forced over the gill surfaces.

**12. Waste removal**

Sharks dispose of nitrogenous wastes by converting them to urea and trimethylamine oxide, which is then stored within the body's fluids. NaCl that is not needed by the shark will be excreted with its feces (a rectal gland within the organism secretes Na+, and Cl- follows.)

The dogfish shark's excretory system arises from a series of tubules, archinephros, where there is one pair in every segment between the heart and the tail. Internally, each tubule opens to the body cavity.

**13. Environmental physiology (temperature, water and salt regulation)**

Sharks have evolved to tolerate relatively high concentrations of urea in their bodies. Because of this, they have osmolarites similar to that of their external environment and therefore lose less water to their environment. Their excretory systems can create dilute urine to excrete unneeded wastes while conserving the right amount of water. Sharks, as vertebrates, also have kidneys, which are used to control the amount of water that the body needs by excreting excess. Sharks tend to be ectotherms, which means that their body temperatures often come to match those of their external environments. Also, sharks, like all other organisms, maintain homeostasis (a stable internal environment) by the cooperation of all of its cells, tissues, and organs. Organ systems allow their internal environment to exchange materials (like salt, glucose, etc.) with their external environments, based on the molecules that they need or the wastes that they don't.

**14. Internal circulation**

Vertebrates, including dogfish sharks, have closed circulatory systems, meaning that the blood (circulating fluid) stays separate from the interstitial fluid (surrounding the cells), through the employment of blood vessels. The blood is made up of blood plasma and blood cells. Vertebrates also have multi-chambered hearts, which pump blood arteries, which then pump the blood away from the heart. Arteries branch into smaller components/vessels called arterioles, which transport blood into the capillary beds (strings of capillaries in which materials are transported between the blood and the interstitial fluid). Venules are attached to capillaries, which join together to form veins, which transport the blood back to the heart. Blood flows through the gas exchange organs and the rest of the body, in order to transport nutrients and oxygen that the body needs in order to perform metabolism or other special functions. The blood circulates through the body due to heart beats. Sharks have two-chambered hearts, which consists of an atrium and a ventricle. The atrium receives blood from the body, which then pumps the blood to the ventricle, which then pumps the blood to the gills to be oxygenated. The oxygenated blood is then carried through the joining of efferent arterioles (leaving the gills), to carry oxygen to other capillaries and body tissue.