



SHARKS

How sharks work

College of Marine Sciences Shanghai Ocean University

2017

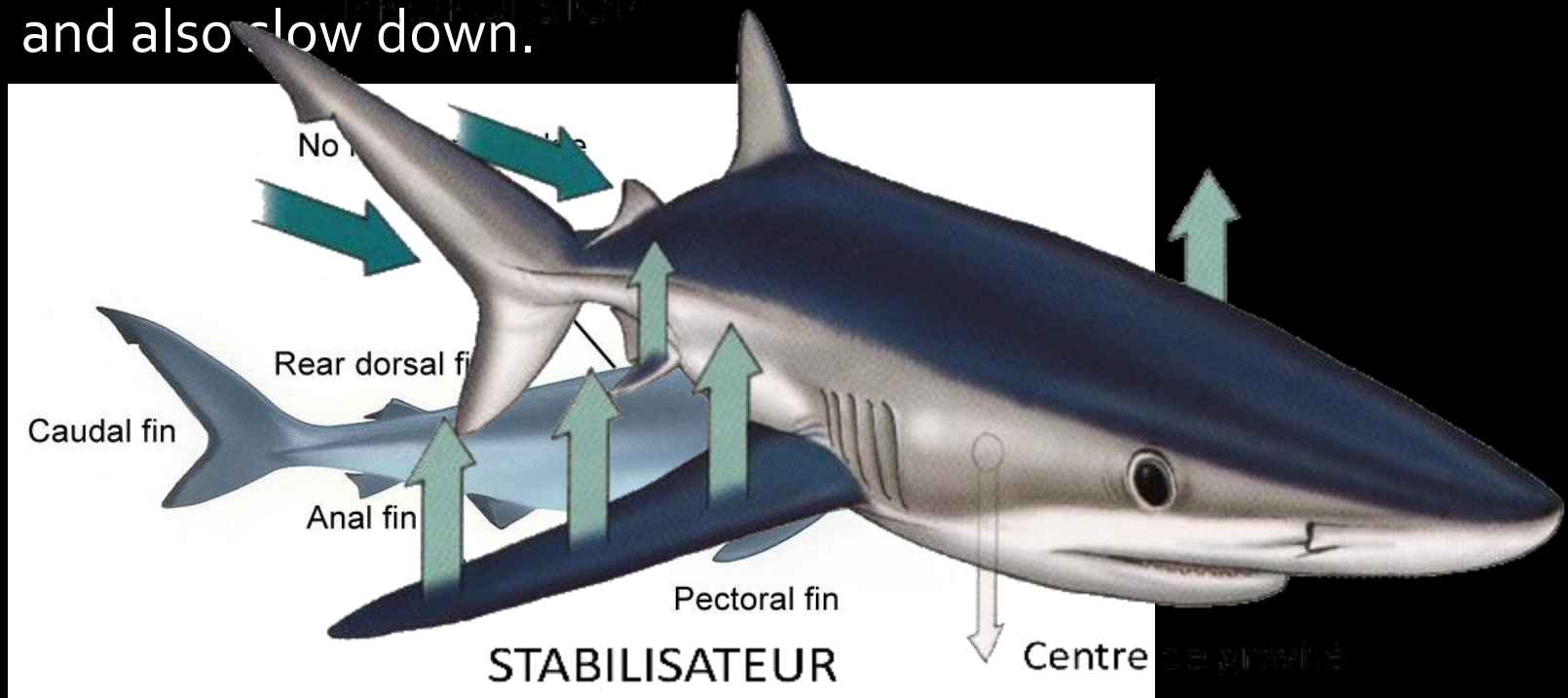
Shark shapes



- All sharks have the same basic body plan- a head with eyes, nostrils and a mouth, and a body with a tail and fins.
- The tip of a sharks' nose is called the snout. Most are pointed, like the tip of a bullet.

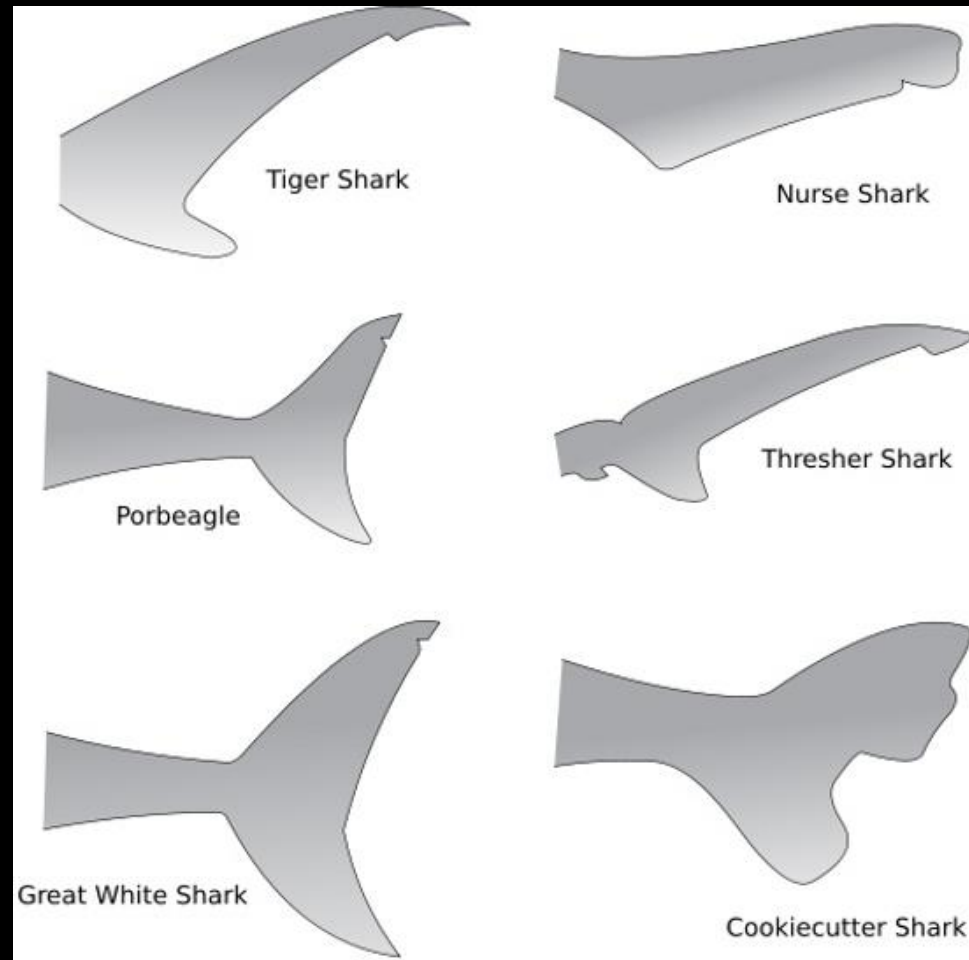
Shark fins

- A typical shark has up to seven fins, not including its tail. A shark's fins help it to balance, change direction in the water and also slow down.



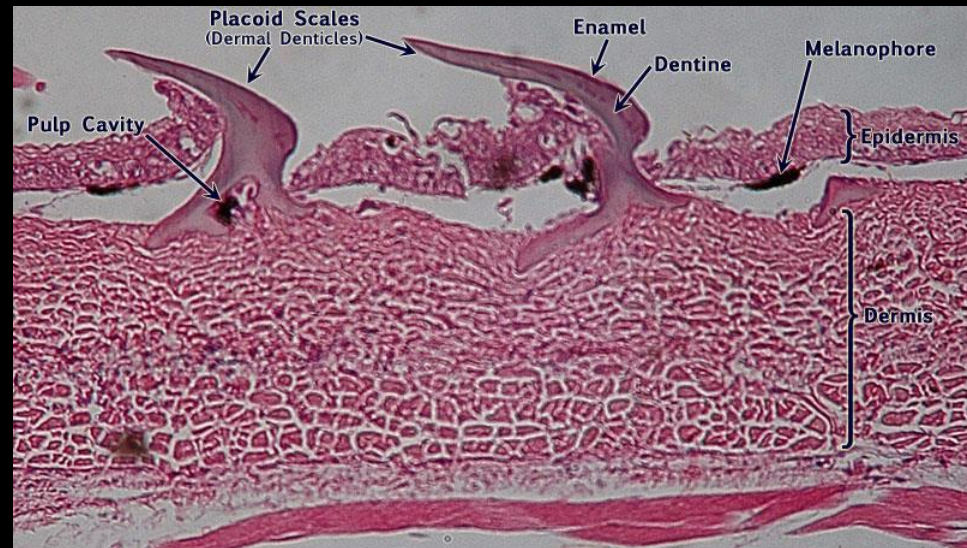
Shark tails

- The shape of a shark's tail usually indicates its swimming speed. High-speed swimmers have equal upper and lower lobes; cruisers have a larger upper lobe; slow sharks have large, flat tails.



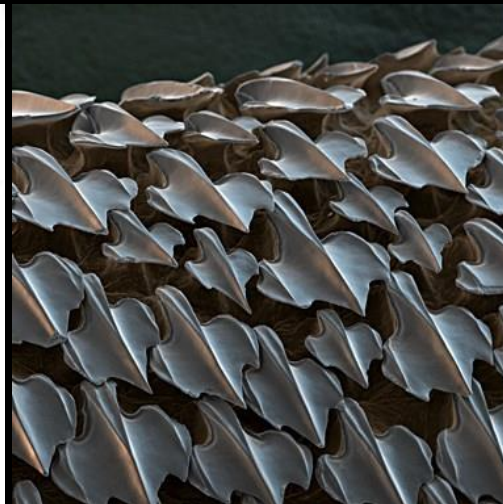
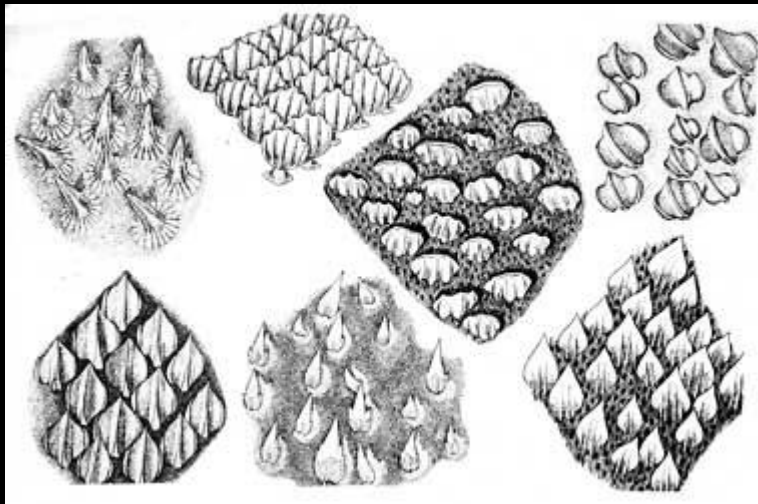
Sandpaper skin

- Unlike other fish, sharks don't have scales. Instead their skin is covered with tiny, hard points called **denticles**, which means 'little tooth'. Denticles give protection from enemies and help sharks slide easily through the water.

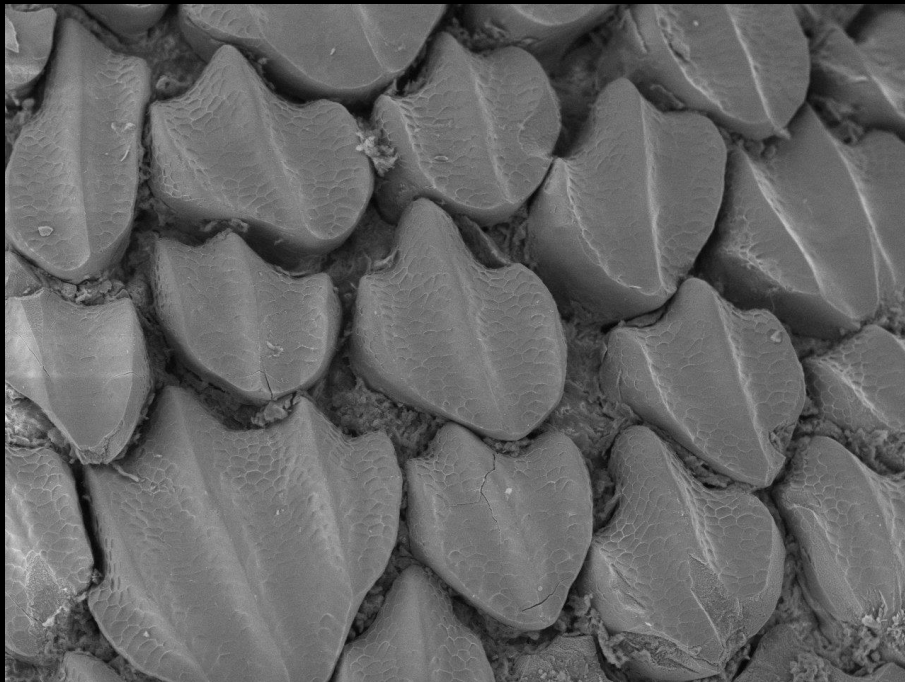


Sandpaper skin

- Many sharks release a slimy substance from their skin to make their bodies move faster through water.
- A shark's denticles eventually fall out and are replaced, just like their teeth.

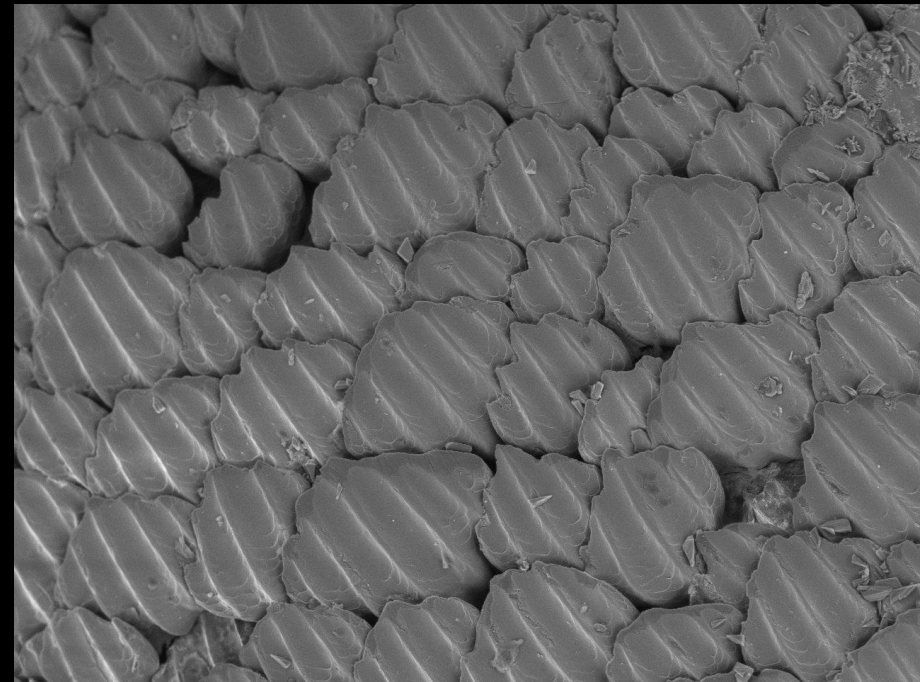


Pelagic shark skin



TM3030Plus0311 NMMD7.6 x200 500 μm

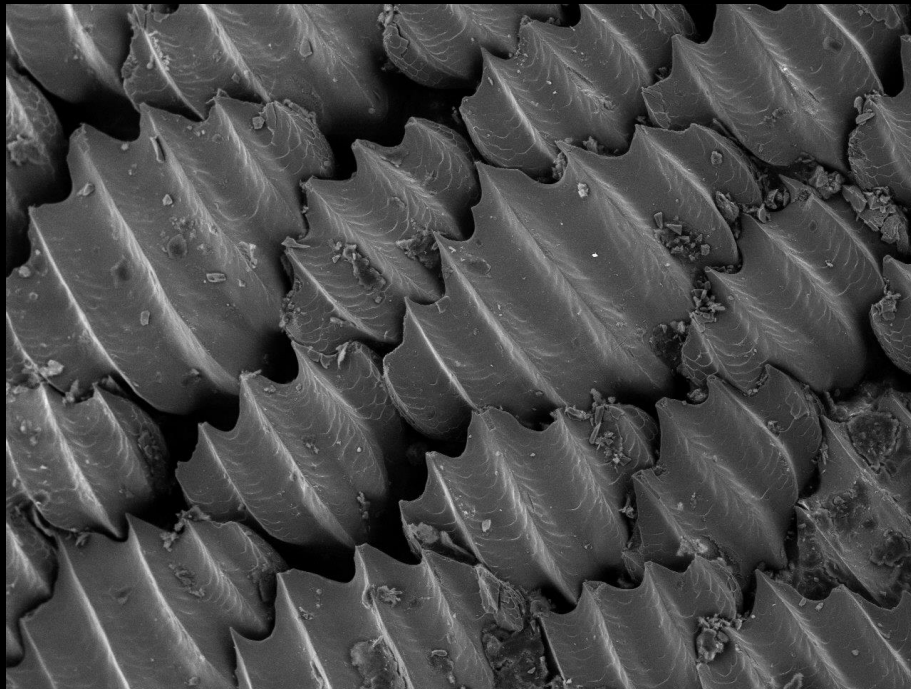
Blue shark



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Silky shark

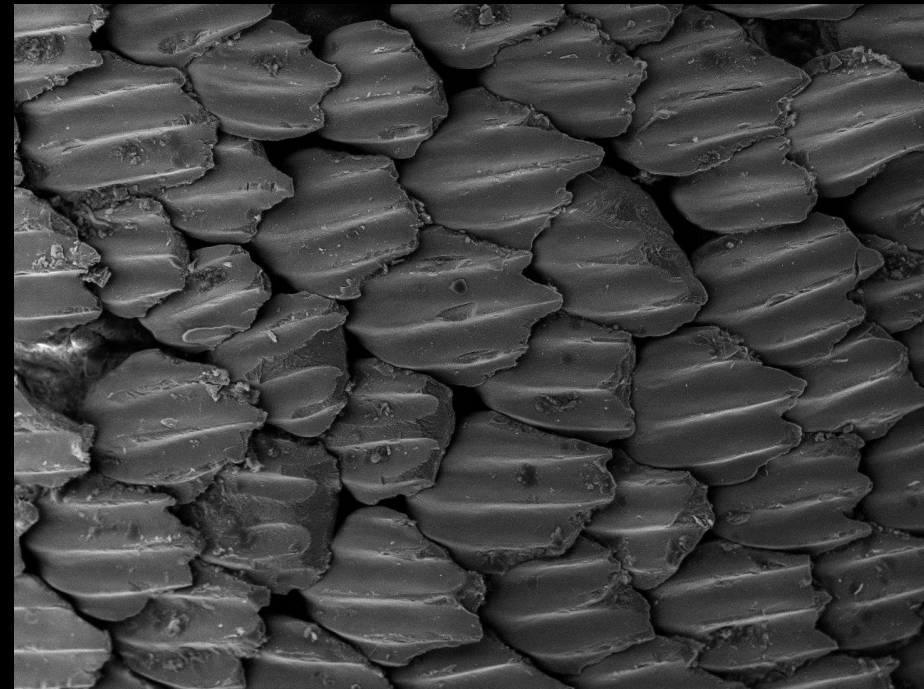
Pelagic shark skin



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Oceanic Whitetip shark

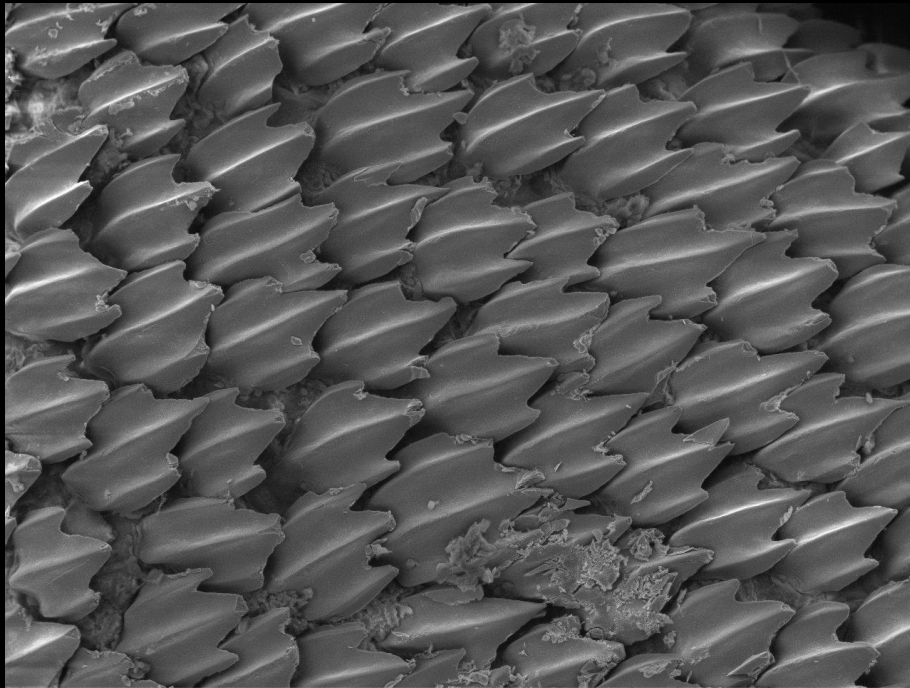


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Shortfin mako shark

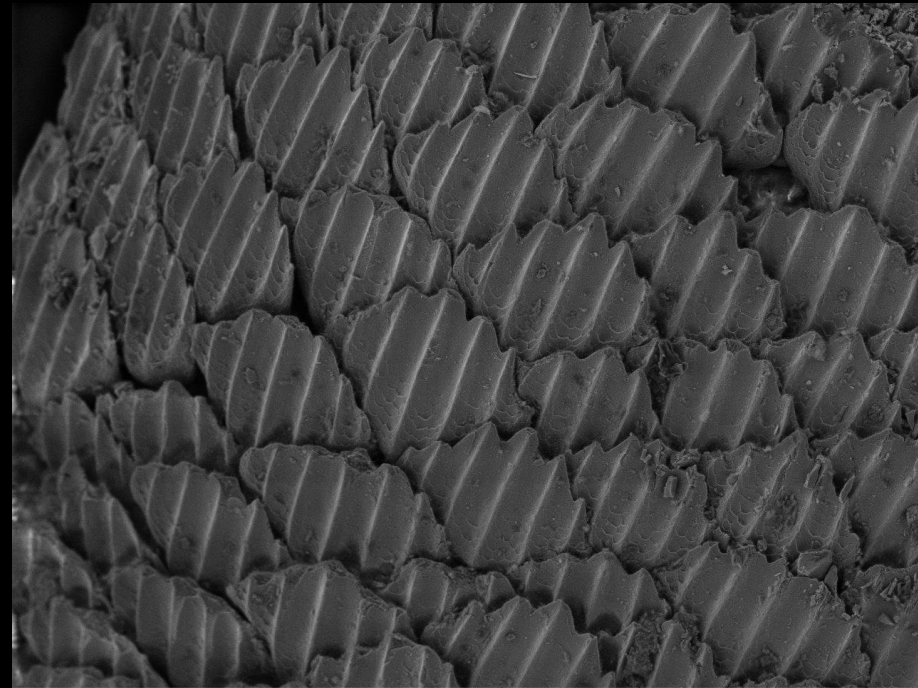
Pelagic shark skin



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Pelagic thresher shark

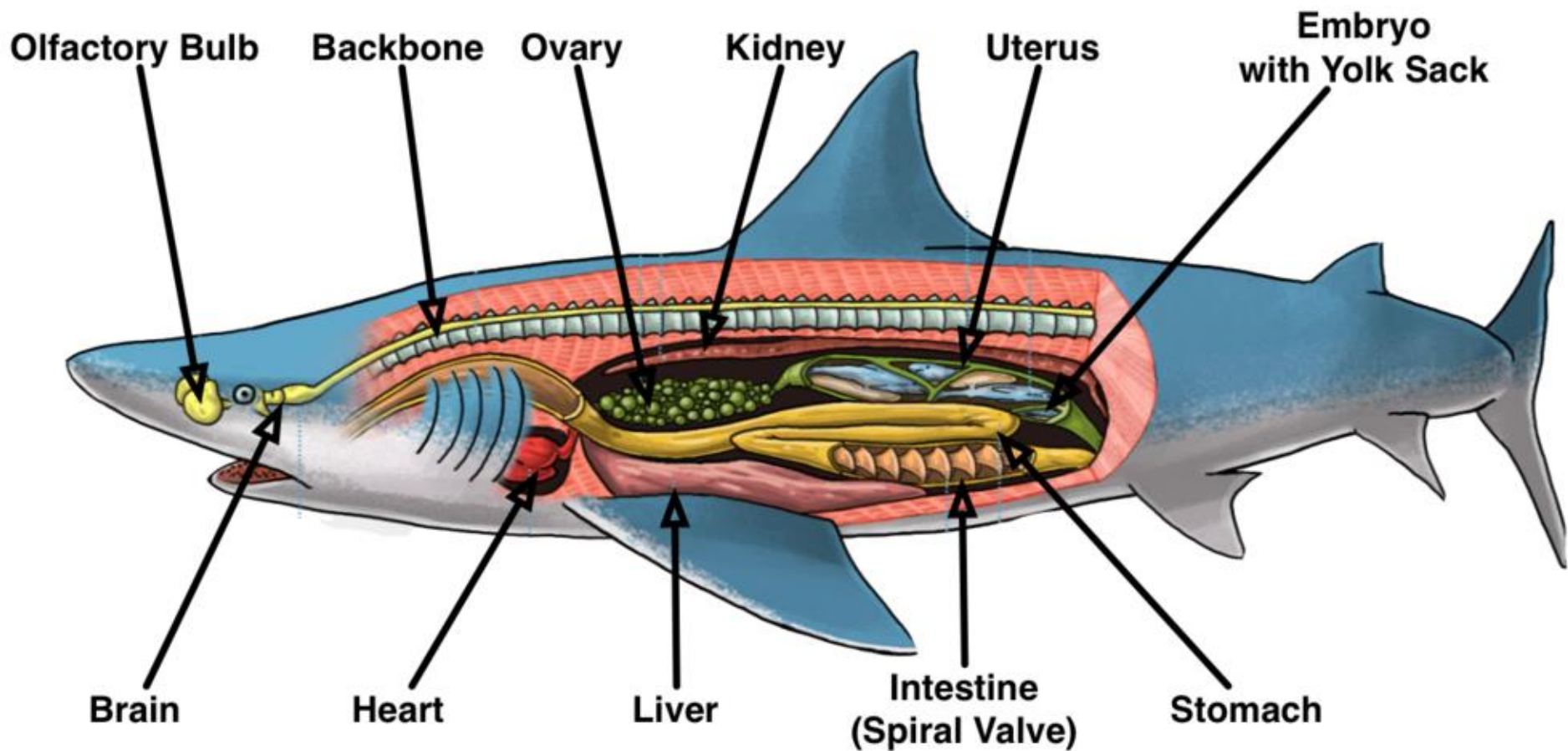


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Scalloped hammerhead shark

A look inside



A look inside



- Sharks need oxygen to convert their food into energy. They take in oxygen from the water through their gills and pump it around their body in their blood.
- **Most sharks are cold-blooded**, which means their blood is the same temperature as the water around them.
- **A few species, such as great white, salmon shark and mako shark, are warm-blooded**- they can heat their blood to be warmer than their surroundings. This helps them to swim faster and allows them to move into cooler water to hunt.

Flexible skeleton



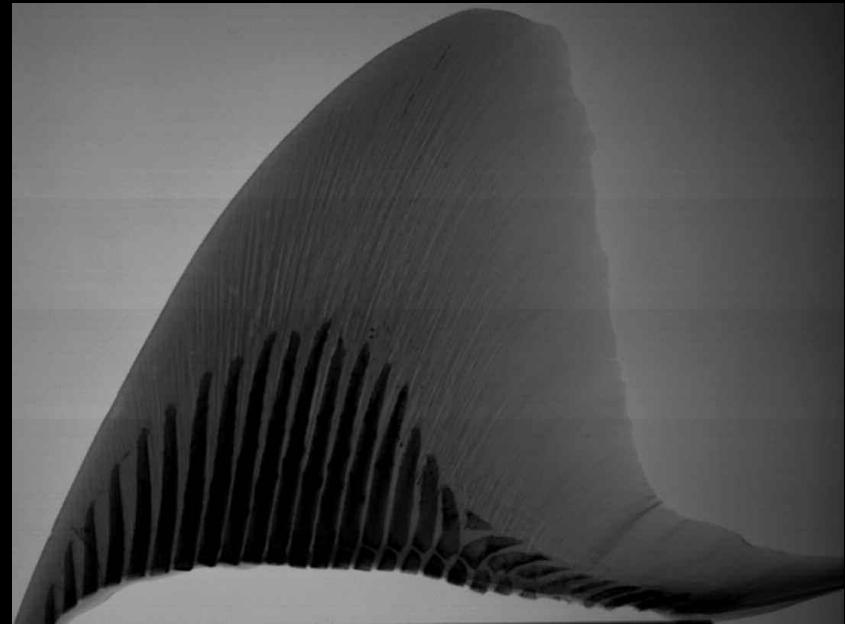
- Sharks have simpler skeletons than bony fish. For instance, a shark's skull is made of only ten pieces of cartilage, whereas a bony fish has over 60 bones in its skull.
- Cartilage is lighter than bone, so sharks' bodies are strong and lightweight. Because cartilage is flexible, sharks can twist and turn easily in the water.



Flexible skeleton



- Shark fins and tails contain hundreds of stiff thin rods of cartilage, which give them their shape.
- The cartilage in a shark's skeleton keeps growing throughout its life.



Teeth and jaw

- A hunting species, such as the great white or the tiger shark, has several rows of teeth.
- Only two front rows of teeth are used for biting. The rest are lining up to replace them.
- In a lifetime, some sharks will get through 30,000 teeth.



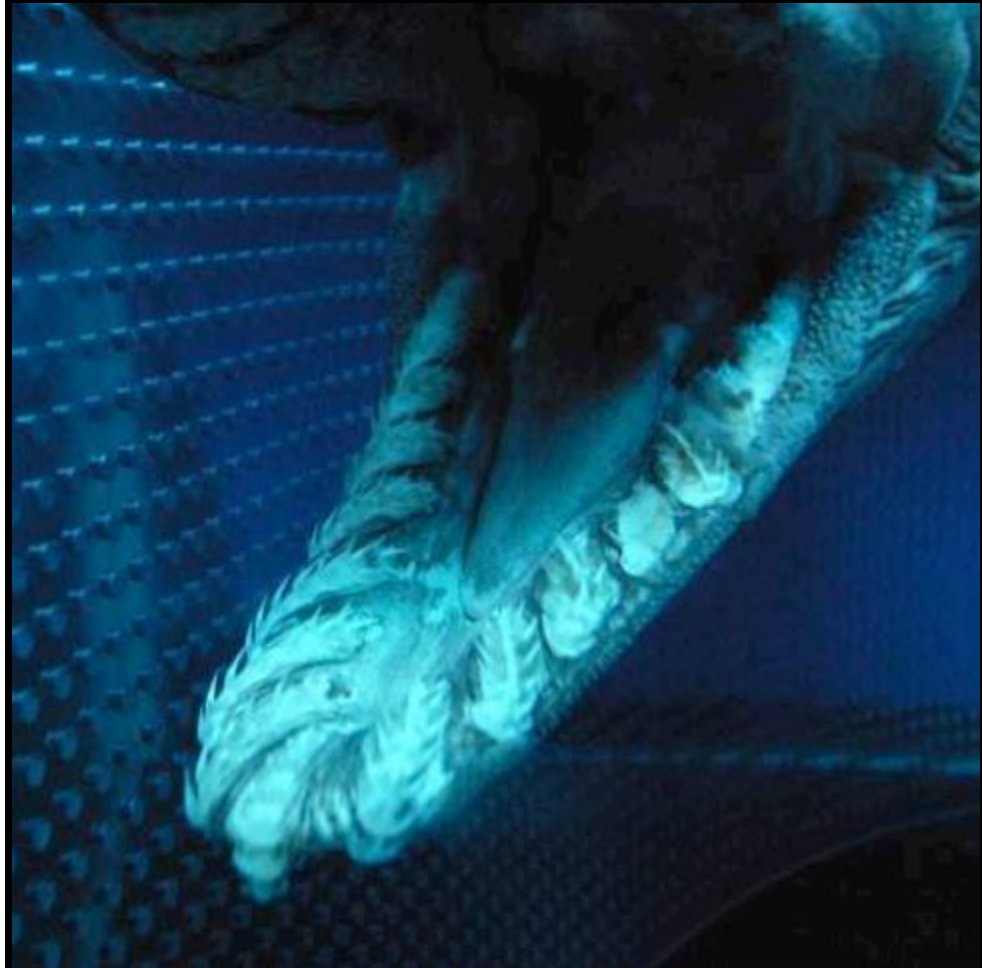
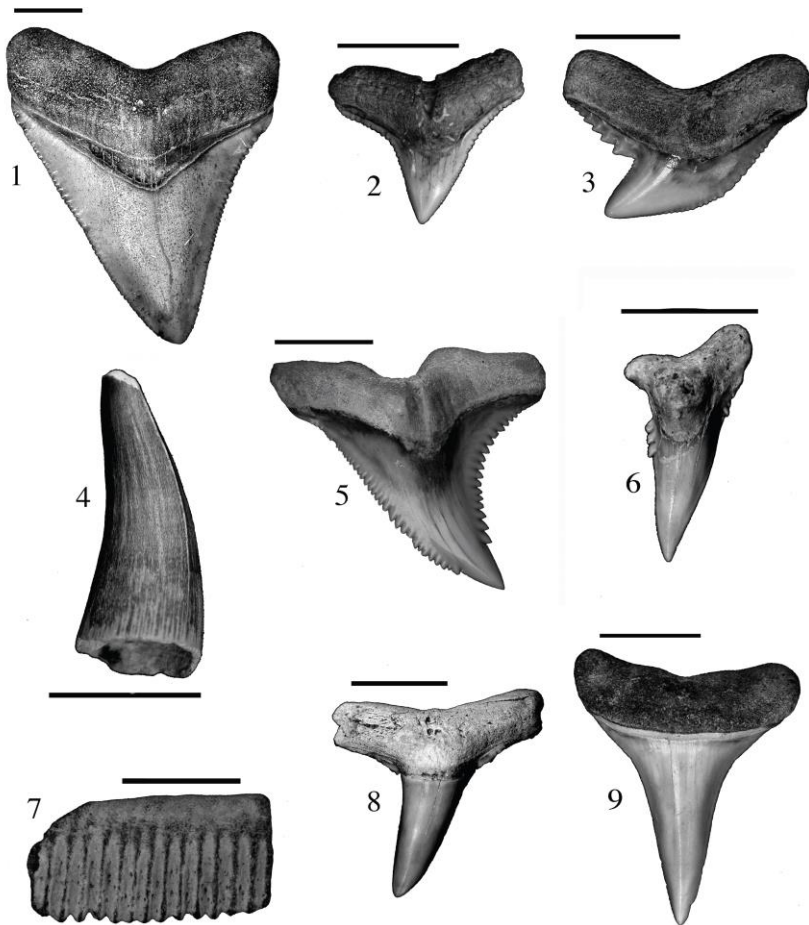


Teeth and jaw



- Port Jackson sharks have small, sharp, pointed teeth at the front of their jaws and large flattened teeth at the back, for crushing sea urchins, starfish and shellfish.

Teeth and jaw



Breathing underwater



- Most sharks have five pairs of gills. Each gill is made up of a set of hair-like filaments full of blood vessels. Each filament is further divided into tiny, leaf-like branches called lamellae. This makes a big surface area for absorbing as much oxygen as possible.
- A few primitive sharks, such as frilled sharks and cow sharks, have six or seven pairs of gills.
- Many shark species have extra breathing holes called spiracles just behind their eyes, which also take in oxygen from the water.

Breathing underwater



- As a shark swims, water flows into its spiracles or mouth and past the gills, where oxygen is absorbed from the water and into the bloodstream.
- Some fast species, such as the mako shark, have to swim continuously so that water keeps flowing over their gills. If they stop swimming they suffocate. Slow-moving species, such as the Port Jackson shark, are able to pump water across their gills using the muscles in their mouth and neck, so they can stop for a rest and still keep breathing.

Breathing underwater



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Digesting food

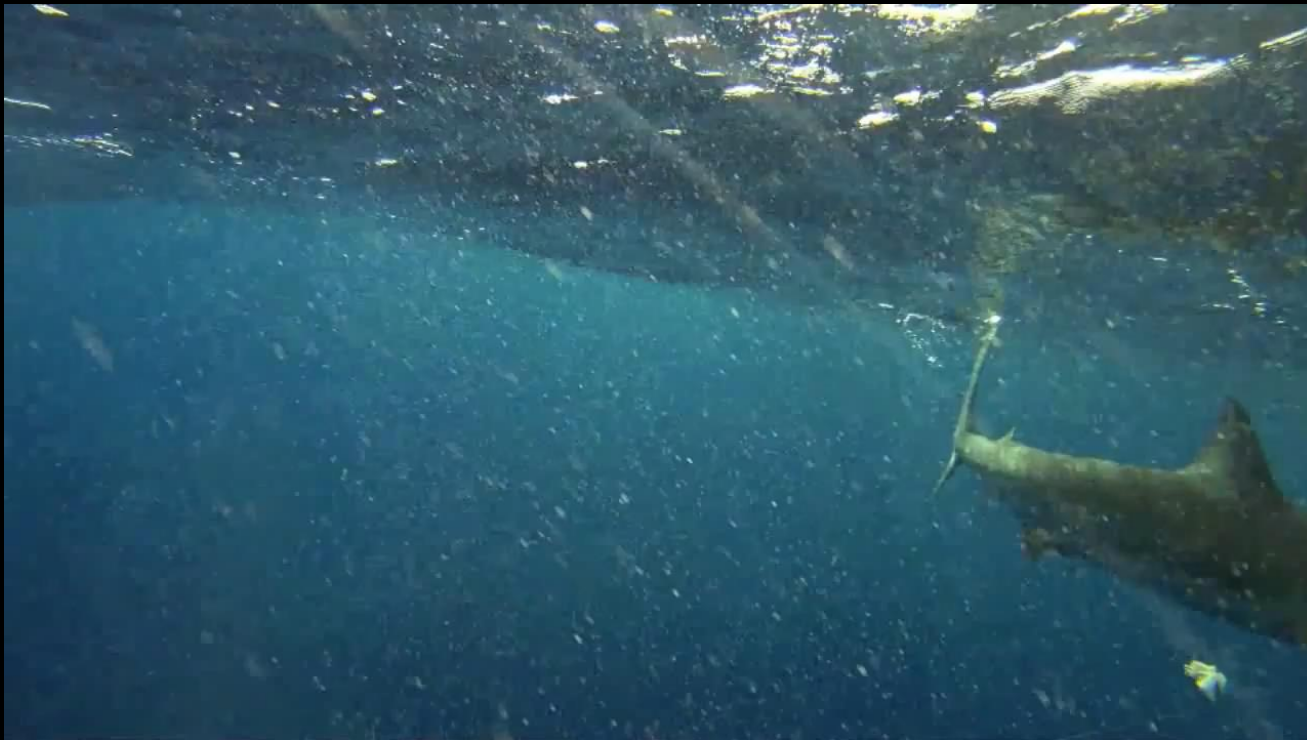


- A shark's digestive system consists of a long tube, with the mouth at one end and an exit hole, called the cloaca, at the other.
- Digesting a meal takes a long time in most sharks. Sandbar sharks and blue sharks take about three days to digest a meal.
- Warm blooded sharks, such as the great white and mako shark, digest a meal more quickly, in about one or two days.
- Sharks may cough up inedible items. Many sharks such as lemon, mako and tiger sharks, can even turn their stomach inside out and push it out of their mouths to rinse out unwanted contents.

Digesting food



- A shark can shoot its stomach out of its mouth and swallow it back inside its body again in just a few seconds.



Digesting food



Eyes and vision

- Some species have a special eyelid called **nictitating membrane**. This closes over the eye when the shark is about to bite, to protect it from damage.



Nictitating membrane of a tiger shark



Eyes and vision

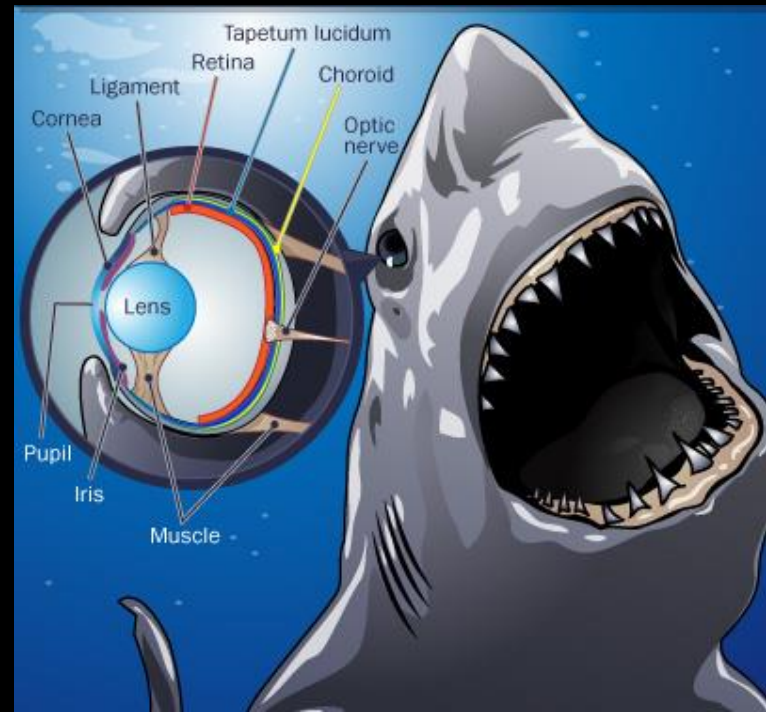


- White sharks and whale sharks don't have nictitating membranes. Instead, they swivel their eyes back into their eye sockets too protect them. This means they can't see their prey as they bite.



Eyes and vision

- Many sharks have a layer of shiny plates called the *tapetum lucidum* at the back of their eyes. It collects and reflects light, helping them to see, even in the gloomy darkness, which makes shark eyes appear to glow in the dark.



Eyes and vision



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Sensing smells



- A shark uses its nostrils purely for detecting scents in the water. About two thirds of a shark's brain processes all the information about smells in its surrounding environment.
- Swimmers have been known to attract sharks just by having a tiny scratch on their skin.
- Some sharks can detect smells in the air. Oceanic whitetip sharks sometimes point their noses up through the water surface to see if there is any smelly food nearby, such as a rotting whale carcass.

Sensing smells



- A shark homes in on a scent by zigzagging its snout from side to side and then moving towards the side where the smell is strongest.
- Great white sharks can smell tiny amounts of blood in water up to 5km away.

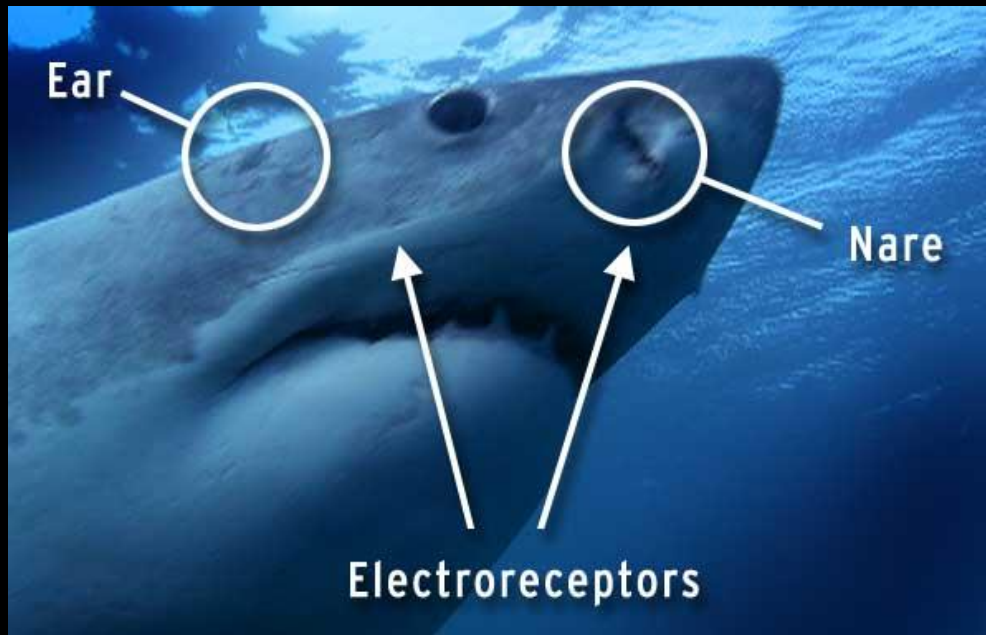
Sensing smells



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Hearing sounds

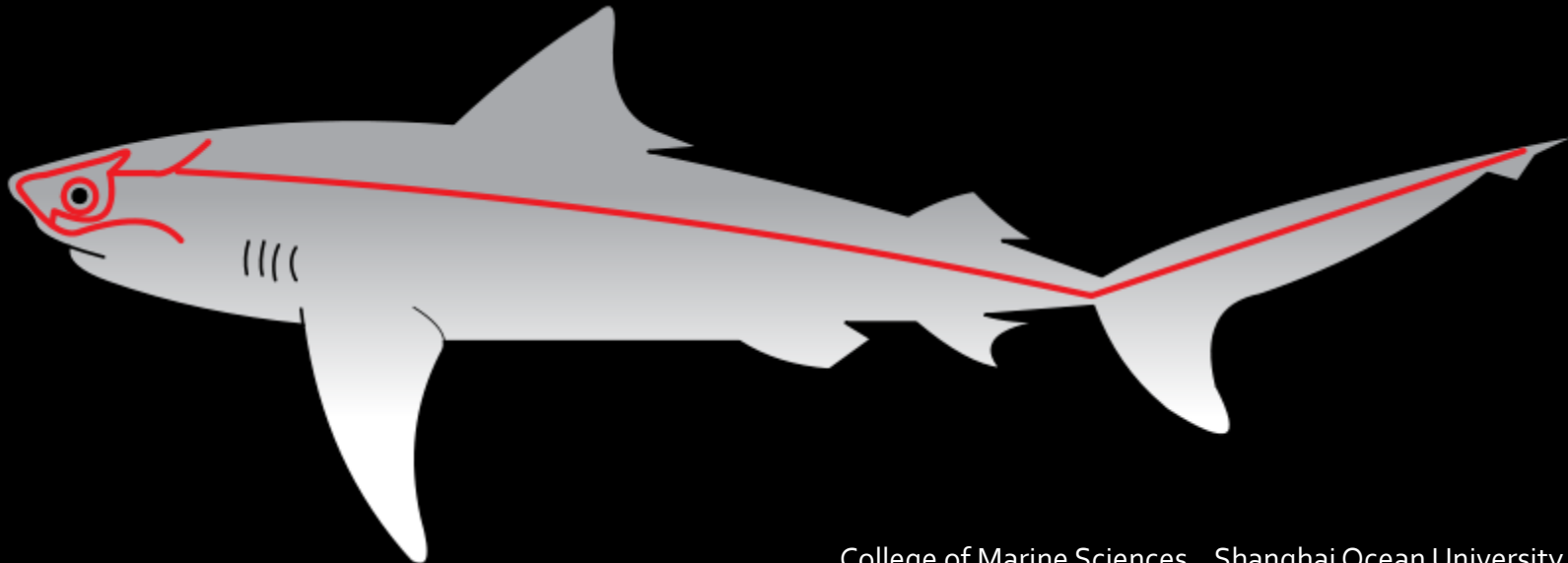
- Sharks have ears. The openings are tiny holes, just behind the eyes. Sharks hear by sensing the vibrations.



- Sharks hear low sounds best, such as the noise made by an injured animal underwater.

Touch and taste

- Lateral line is a long tube running down each side of a shark's body, under its skin. As it is most effective for picking up vibrations close to the shark's body, the lateral line helps sharks to find their way in murky or dark water, when their other senses are not much use.



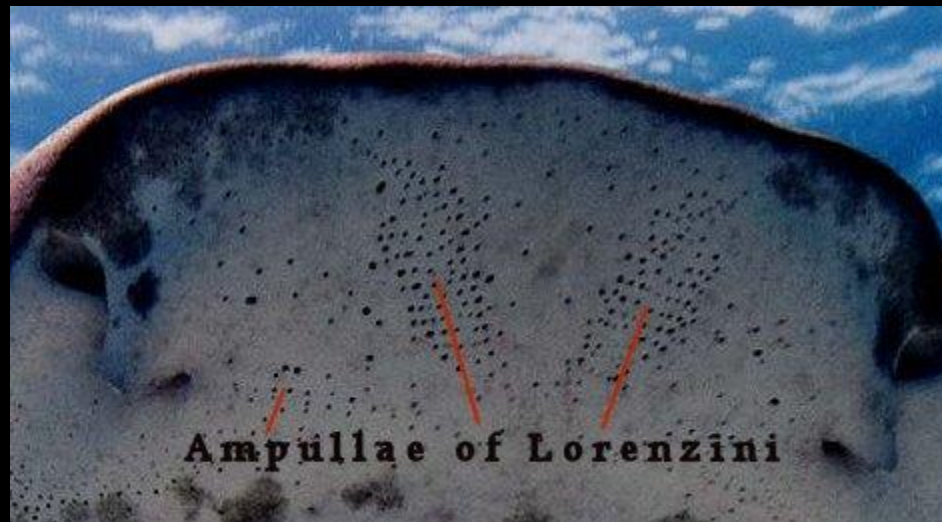
Touch and taste



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The sixth sense

- To detect electricity, a shark has tiny holes in the skin around its head and snout. They are called ampullae of Lorenzini.



The sixth sense



- All animals give off tiny amounts of electricity when their muscles move. Electricity doesn't travel well through air, but it does through water.
- The ampullae of Lorenzini can sense animals within a range of about one meter.
- Tiger shark has up to 1500 ampullae of Lorenzini. Slow-moving sharks that live on the sea bed have only a few hundred ones.

The Electrosensory system



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Hammerhead vs. Stingray

