

Fish Biology

Objective

To explore the basic biology of a bony fish and compare organ function to that of the human body.

Experiences and Outcomes

SCN 3-12a

I have explored the structure of organs and organ systems and can relate this to the basic biological processes required to sustain life.

Background Information

There are estimated to be over 23,000 species of fish in the world, most of which are marine species. This large group of animals is hugely diverse and includes the world's tiniest fish, a species of carp less than 1 centimeter, to the largest fish, the whale shark, growing up to 12 metres in length.

Fish fall into three main groups; jawless fish, cartilaginous fish and bony fish, the latter of which make up over 97% of all fish. All fish are vertebrates, so have a backbone and a central nervous system. They also have gills for breathing, fins for locomotion and scales for protection.

Individual species vary in body size, shape, colour and anatomy and their bodies are adapted to survive in specific habitats, for hunting and eating and for finding mates.

The shape of a fish's body reflects the environment that it lives in. The round, flat shape of a plaice is perfectly adapted to the sea floor, the elongated eel is shaped for hiding in rocky crevices and the streamlined body of a mackerel is suited to fast swimming in the open ocean.

The fins on a fish are used for locomotion. The tail fin is primarily used to propel the fish forward through water; the dorsal fin and anal fins are used as a rudder to control direction while the pectoral fins are used for balance.

A lateral line runs from the head to the tail and contains pressure sensitive nerves that pick up information from the water around the fish. These nerves can detect vibrations in the water created by movement or sound and allow fish to detect predators and prey in the water around them.

Jawless fish are primitive, jawless parasites and scavengers which includes the lampreys and hagfish. As their name suggests they have no jaws and feed by attaching onto other animals using their sucker mouth and chomping through the animals flesh. They have no scales and very few fins.

Cartilaginous fish include sharks, skates and rays, of which there are over 30 species living in the Moray Firth from the small dogfish, reaching 50cm in length, to the basking shark reaching lengths of 10 metres. The skeleton of these fish consists of cartilage, which is light and flexible compared to bone. This gives sharks the advantage of moving fast and agile in the water, making them formidable hunters. Sharks have other features that distinguish them from bony fish, they have scales called denticles. They possess a large oily liver which helps them to float instead of a swim bladder like bony fish. Sharks also invest more energy in reproduction, ensuring a higher chance of survival. Some produce eggs that mature within a hard egg case while others keep the young within their bodies until they are ready to hatch, producing live young.

Bony Fish

The skeleton of a bony fish is primarily bone, unlike sharks and rays whose skeleton is formed of cartilage. The skeleton is made up of the skull, the backbone, ribs and fin bones.

→ Fish biology

All animals require oxygen in order to survive and grow. Land animals such as birds and mammals have lungs and breathe in air to extract oxygen. In the aquatic environment oxygen is dissolved within the water and fish use gills to extract the oxygen. Gills are made up of very thin tissue and are filled with blood; as the fish swims through the water, oxygen passes over the gills and directly into the blood.

A fish's brain is very small relative to the size of its body. The brain sends messages through nerves to and from the other parts of the fish's body. It controls the heart, picks up senses and regulates chemicals in the fish's body. The primary function of the fish's brain is to process senses such as vision, hearing and vibrations. The secondary function of the brain controls muscle movement. This differs from the human brain which is much larger and more complex and includes areas that control emotion, creativity and memory.

There are several organs within the fish's body that assist with digestion including stomach, intestines and liver and kidneys. The stomach and intestine are where food is broken down. The liver breaks down oils and the kidneys clean the blood and control the salinity in the fish's body.

The swim bladder is an organ filled with air and a fish can adjust the amount of air in the bladder. More air, the fish will raise to the surface, less air and the fish will sink downwards.

Bony fish release vast amounts of sperm and eggs into the water and species such as cod can produce up to 9 million eggs which develop in the gonads. The tiny eggs become part of the plankton and most will never reach adulthood. Although most bony fish reproduce by spawning there are exceptions such as seahorses, lumpsuckers and viviparous blenny that invest much more energy in caring for their young and therefore enhance the chances of their young reaching adulthood.

Activity

Use the 'Biology of a Fish' Activity Worksheet. Ask the pupils to label the body parts of the fish.

Discussion Points and Follow-on Activities

Label the body parts. Compare the function of the fish's internal organs with that of humans. Compare organ function such as kidneys and salt regulation, brain and heart size. Compare lungs and gills used for oxygen intake.