

DISSECTING A FISH AND IDENTIFYING ITS INTERNAL BODY PARTS

By Dennis Segura, Aquatic Sport Fishing Education Coordinator

Fishing is a great way to spend a day outdoors with children, but it can also be an opportunity to teach them a little more than just how to catch and clean fish. Cleaning fish is a task we take for granted, but before you dispose of the entrails turn cleaning the fish into a dissection lesson. If you are not familiar with the internal organs of a fish this is a great way to learn along with your kids.

OBJECTIVES: Kids will be able to:

- Learn how to clean a fish and take the entrails out carefully.
- Learn how to identify the major internal organs of the fish.
- Learn what the function of each major organ is.
- Compare and contrast the respiratory, circulatory, nervous and digestive systems of humans and fish.

GRADE LEVEL: 5th grade to 12th grade.

METHOD: Kids will start out by reviewing the vocabulary terms. Next, using the Internal Fish Anatomy Guide kids can study the internal organs of a fish. Then, using Activity # 1, Review the Internal Parts of a Fish Matching Exercise, the kids will draw a line and match each fish organ to its body function. Kids can also do Activity # 2, Review the Internal Parts of a Fish Crossword Puzzle. The kids will then do Activity # 3, Identify the Internal Organs of a Fish by dissecting a fish. Finally, kids will review the similarities between a human's and a fish's vital organs.

MATERIALS: A pencil, a copy of the Internal Anatomy of Fish Guide, a copy of Activity # 1, Review the Internal Parts of a Fish Matching Activity, a copy of Activity # 2, Review the Internal Parts of a Fish Crossword Puzzle, and Activity # 3, Identify the Internal Organs of a Fish through dissection.

OVERVIEW: Kids will begin by reviewing the vocabulary terms. Next, they will use the Internal Anatomy of a Fish Guide to review and study the internal organs of a fish. They will then do Activity # 1, Internal Parts of a Fish Matching Exercise, Activity # 2, Internal Parts of a Fish Crossword Puzzle and Activity # 3, Identify the Internal Organs of a Fish. Activity # 3 will consist of dissecting a fish and carefully removing vital organs for identification. Finally, kids will review the similarities and differences between human and fish organs.

VOCABULARY:

External – Belonging to or part of the outer surface or structure of something.

Sensory – The sensations of seeing, hearing, feeling, tasting and smelling.

Respiration – The action of breathing oxygen.

Oxygen – A colorless, odorless gas that is the life supporting component of air.

Receptors – A body organ that responds to light, heat, cold or other stimulus sent to the brain.

Buoyancy – The ability to float in water.

Digestion – The ability of the digestive system to break down food and absorb nutrients which blood carries to cells throughout the body. The nutrients are then broken down into vitamins, proteins, fats and carbohydrates.

Enzymes – They are vital for life and serve a wide range of important functions in the body, such as aiding in digestion and metabolism. The body uses digestive enzymes to break down food into nutrients so it can absorb healthy things like amino acids, simple sugars, fatty acids and vitamins.

Metabolism – The chemical breakdown of food and its transformation into energy.

Secrete – The process of releasing something or a substance made and released by a living thing, like when your skin sweats or your mouth produces saliva.

Circulatory - the movement of blood in the veins throughout the body. The heart pumps the blood which circulates nutrients and oxygen to vital organs like the brain and removes waste products from all parts of the body.

Respiratory – The respiratory system allows fish and humans to breathe oxygen and expel carbon dioxide.

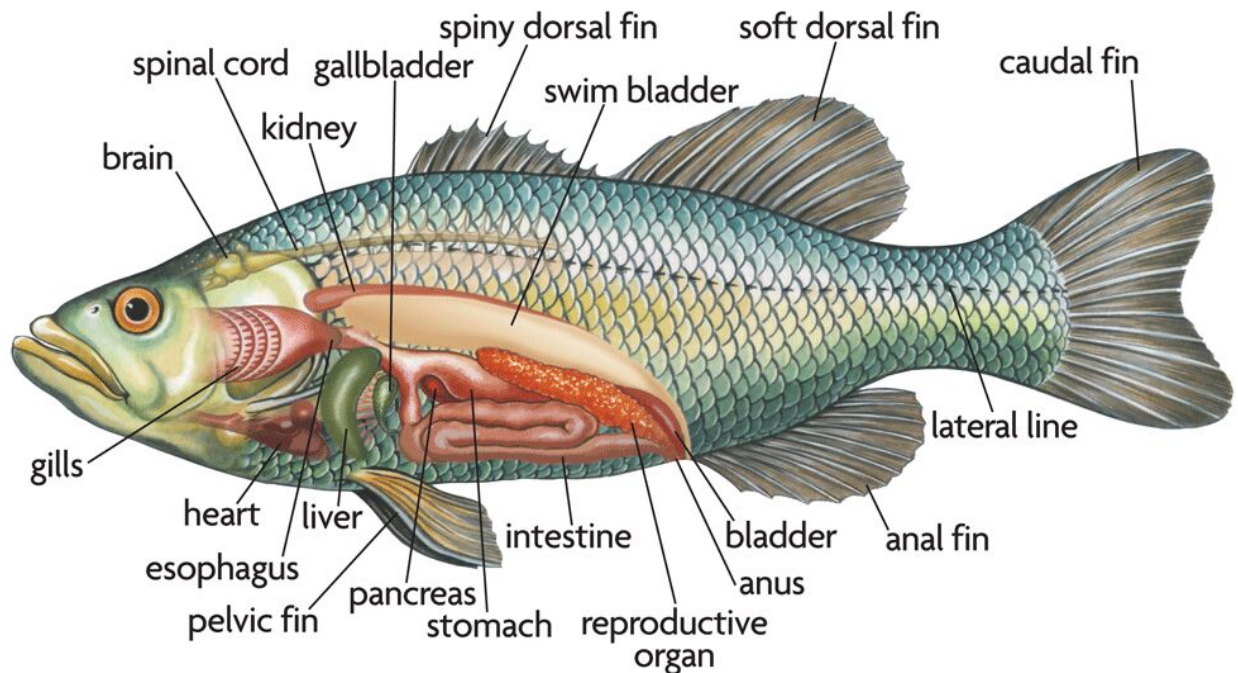
Stimulus – Something that causes a response such as light, sound, heat or cold.

Nervous System – This system is made up of the brain, spinal cord and nerve endings and controls all body functions and allows fish to sense things around them and to react to stimuli such as light, heat or sound for example.

INTERNAL FISH ANATOMY GUIDE:

The illustration below shows a fish's internal anatomy. Fish are cold blooded vertebrates, which means they cannot control their body temperature and have backbones. Most fish species have scales to protect the body and gills to help it breathe in water.

Illustration # 1 – Internal Anatomy with Fins



BRAIN – The control center of the fish where both automatic functions such as respiration (breathing) and higher behaviors occur. All sensory information is processed here.

INNER EAR – Fish hear sound vibrations moving through the water. Fish do not need ear openings because sound travels so well through water. The structure of the inner ear is similar to humans and contains receptors for balance and hearing.

GILLS – Gills are feathery organs full of blood vessels. A fish breathes by taking water into its mouth and forcing it out through the gill passage. As water passes over the thin walls of the gills, dissolved oxygen moves into the blood which circulates and allows fish to breathe.

GILL RAKERS– Pick out debris from the gills and keeps the gills clean.

SPINAL CORD- Connects the brain to the rest of the body and relays sensory information from the body to the brain, as well as from the brain to the rest of the body.

SWIM BLADDER – A hollow gas-filled balance organ that allows fish to conserve energy by maintaining neutral buoyancy (suspension) in the water.

KIDNEY – This organ filters liquid waste from the blood; these wastes are then passed out of the body. The kidney allows fish to exist in salt or fresh water or both.

STOMACH AND INTESTINES – These organs break down food through the process of digestion while absorbing vital nutrients.

PYLORIC CAECA – This organ with fingerlike projections is located near the area of the stomach and intestines and secretes enzymes that aid in digestion.

GALL BLADDER – The purpose of this organ is to store and concentrate bile secreted by the liver.

LIVER – This important organ has a number of functions. It assists in digestion by secreting enzymes that breaks down and stores fats. The liver also helps destroy old blood cells and maintain healthy blood. The liver also helps with waste excretion.

HEART – This organ circulates, or pumps blood throughout the body. Oxygen and digested nutrients are delivered to the cells of various organs through the blood, and the blood transports waste products from the cells to the kidneys and liver for elimination.

SPLEEN – This organ acts as a filter for blood and recycles old red blood cells as well as stores white blood cells.

OVARIES /TESTES – The reproductive organs in fish. Female fish have ovaries that produce eggs while male fish have testes that produce sperm which fertilizes the eggs.

URINARY BLADDER – A distinct bladder for storing waste fluid.

ARTERIES – Blood vessels that deliver oxygen-rich blood from the heart to the tissues of the body.

CAPILARIES - The smallest and most numerous of the body's blood vessels that transfer oxygen and other nutrients from the bloodstream to other tissues in the body; they also collect carbon dioxide waste materials and fluids for return to the veins.

ACTIVITY # 1 – MATCHING EXERCISE. REVIEW THE INTERNAL PARTS OF A FISH.

Instructions: Draw a line and match each fish organ to its body function.

ORGAN

FUNCTION

Brain –

I pump blood throughout the body. Oxygen and nutrients are delivered through the blood to the various organs like the brain.

Inner Ears –

I filter liquid waste material from the blood; this waste is then passed out of the body.

Gills –

I am an inner organ that hears sound in the water and have receptors for balance and hearing.

Gill Rakers –

I break down food through digestion and absorb vital nutrients.

Spinal Cord –

I assist in digestion by breaking down and storing fats. I also destroy old blood cells and maintain healthy cells.

Swim Bladder –

I pick out debris from the gills and keep them clean.

Kidney –

I act as a filter for blood and I recycle old red blood cells as well as store white blood cells.

Stomach & Intestines –

I am a hollow gas-filled balancing organ that allows fish to conserve energy by maintaining natural buoyancy, or suspension in the water.

Liver –

I connect the rest of the brain to the rest of the body and send sensory information such as hearing and seeing from the body to the brain, as well as from the brain to the body.

Heart –

I am the control center of the fish where both automatic functions like breathing and other higher behaviors occur. All sensory information such as sight, taste & smell is processed here.

Spleen -

I allow fish to breathe when it takes water in its mouth and out through the gills. Blood vessels carry dissolved oxygen to vital organs.

Internal Organs of Fish

ACTIVITY # 2 CROSS WORD PUZZLE

The crossword puzzle grid is set against a light gray background. It consists of white squares for letters and gray squares for empty space. The grid is defined by the following structure:

- 1**: A 3-letter horizontal word starting at row 1, column 1.
- 2**: A 3-letter horizontal word starting at row 1, column 3.
- 3**: A 3-letter horizontal word starting at row 1, column 5.
- 4**: A 5-letter horizontal word starting at row 3, column 1.
- 5**: A 2-letter vertical word starting at row 3, column 1.
- 6**: A 10-letter horizontal word starting at row 4, column 1.
- 7**: A 17-letter horizontal word starting at row 5, column 3.
- 8**: A 4-letter vertical word starting at row 5, column 1.
- 9**: A 10-letter horizontal word starting at row 6, column 1.
- 10**: A 5-letter horizontal word starting at row 8, column 1.

Clue positions are marked with numbers in the top-left corner of the starting cell. Some cells in the grid contain three dashes (---) to indicate missing letters.

ACROSS

1. I allow fish to breathe when it takes water into its mouth and out through the gills. Blood vessels carry dissolved oxygen to the vital organs.
4. I act as a filter for blood and I recycle old red blood cells as well as store good white blood cells.
6. I am an inner organ that has receptors for balance and hearing in water.
7. I break down food through the process of digestion and absorb important nutrients.
9. I pick out debris from the gills and keep the gills clean.
10. I pump blood throughout the body. Oxygen and nutrients are delivered through the blood to the various organs.

DOWN

2. I assist in digestion by breaking down and storing fats. I also destroy old blood cells and maintain healthy blood cells.
3. I connect the brain to the rest of the body and send sensory information such as hearing and feeling from the body to the brain, as well as from the brain to the rest of the body.
5. I filter liquid waste material from the blood; this waste is then passed out of the body.
7. I am a hollow gas-filled balancing organ that allows fish to conserve energy by maintaining neutral buoyancy or suspension in the water.
8. I am the control center of the fish where both automatic functions like breathing and higher behaviors such as sight, taste and smell are processed.

ANSWERS:

ACROSS – 1. Gills 4. Spleen 6. Inner Ear 7. Stomach & Intestines 9. Gill Rakers 10. Heart

DOWN - 2. Liver 3. Spinal Cord 5. Kidney 7. Swim Bladder 8. Brain

NOTE (---) indicates a space between words.

ACTIVITY # 3 – IDENTIFY THE INTERNAL ORGANS OF A FISH

If you are keeping fish to eat and plan on cooking your fish whole or if you are going to make “fish steaks” you have to keep it fresh after you catch it. Keep the fish on ice in a cooler or on a stringer in the water. If you have a boat with a “live well” keep any fish you catch in the same water you are fishing from. If your fishing location has cleaning stations make sure to use them and clean up after you are done.

TOOLS TO CLEAN / DISECT A FISH:

- Sharp filet knife
- Sharp scissors
- Cutting board
- * Newspaper / Paper towels
- * Bucket for entrails
- * Disposable rubber gloves (optional)
- * Chopsticks to probe
- * Spoon to scrape kidney

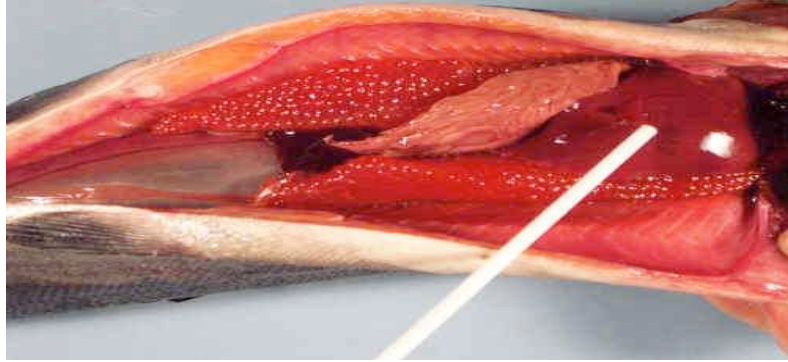
Step # 1 – Rinse the slime off your fish. Remember, fish are slippery and knives are sharp, always use caution when dissecting fish! Disposable rubber gloves work well to help you get a good hold of the fish, especially if the slime has been rinsed off.

Step # 2 - Rest the fish on a table or cutting board. You can place the fish on a newspaper or paper towels to keep the table / board clean. Hold the fish upside down with one hand and Insert the knife tip into the fish's anal opening (vent) and move the blade up along the belly, cutting to the gills. Do not insert the knife blade too deep, keep it shallow so you don't puncture the intestines.



Step # 3 - Spread the body open and take a look at the internal organs while they are still intact. Remove all of the following vital organs carefully and identify them as you dissect the fish.

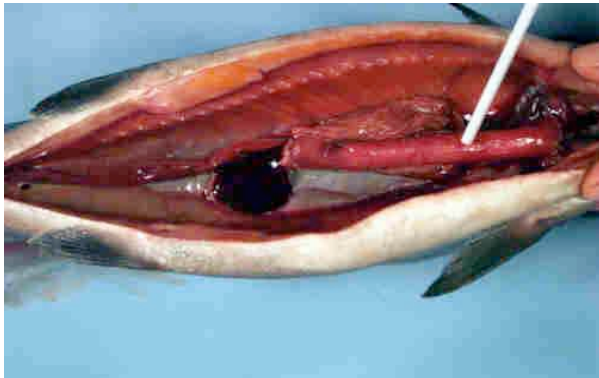
- a. Look into the body cavity and you will see a large dark red organ, this is the **Liver**, the largest organ in a fish's or human's body. Remove it by gently cutting any membrane attached to it. Using your hands pull the liver away from the stomach. You will find the **Gall Bladder** underneath attached to the liver, which helps to digest fats. The liver works to clean blood and stores fats, blood sugar, and vitamins for the fish. The liver is essential in times of low food availability.



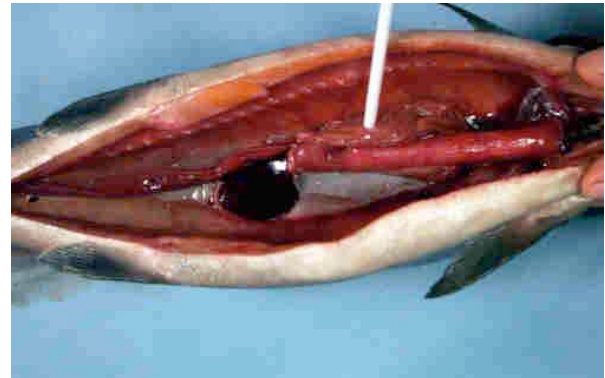
LIVER – Part of the Digestive System

- b.** Track the rest of the digestive system starting from the mouth. Gently push an eight inch probe, a chopstick, into the mouth and into the **Stomach**. Remove the probe and cut the stomach away at the throat and gently pull it out.
- The stomach will be attached to the **Pyloric Caeca** and the dark **Spleen**.
 - Cut the stomach open to see what's inside. Most of the time you will find digested food but once in a while you'll find bait, small fish, insects or terrestrial creatures intact.

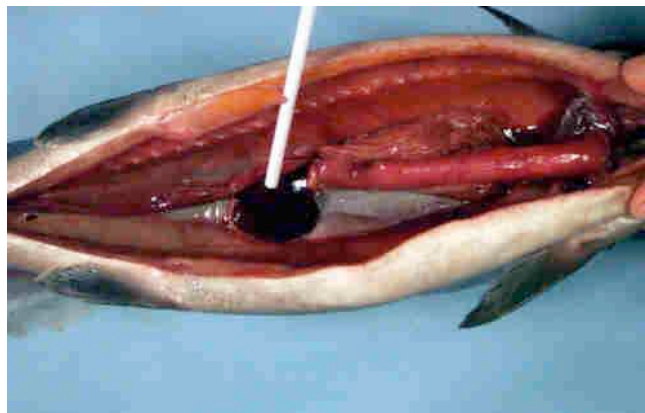
Stomach



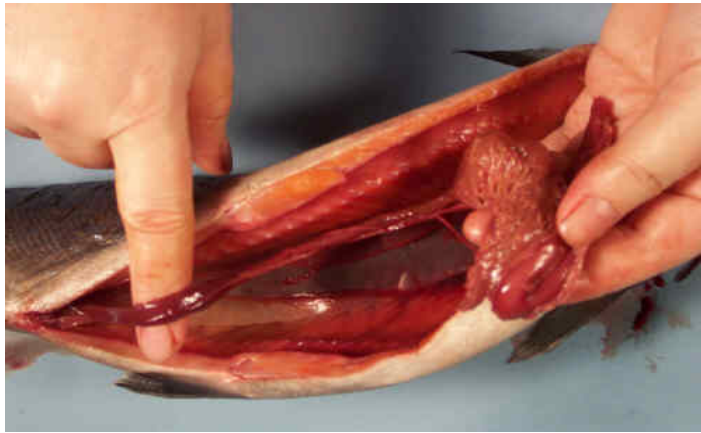
Pyloric Caeca



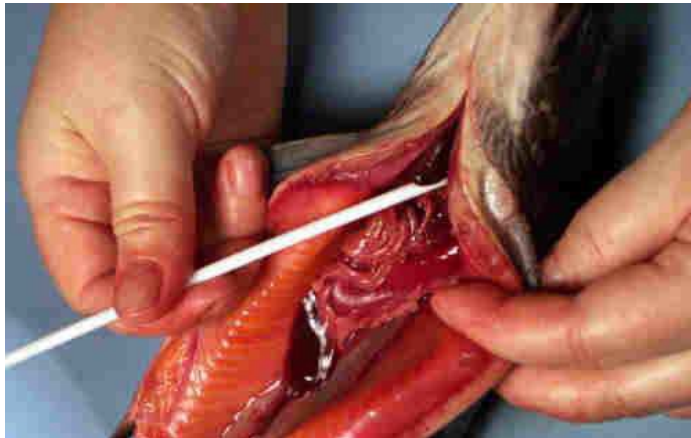
Spleen



c. Next, remove the **Intestines** from the fish. Remove the complete digestive system and intestines which end at the vent.



d. The **Heart** is located near the pectoral fins. The heart is triangular in shape and is often a deep red in coloration. The heart can be found just below the gills and can be cut out at the top near the throat and removed with your fingers.



Heart – Located between Pectoral Gills just below the Operculum.



Heart of a fish

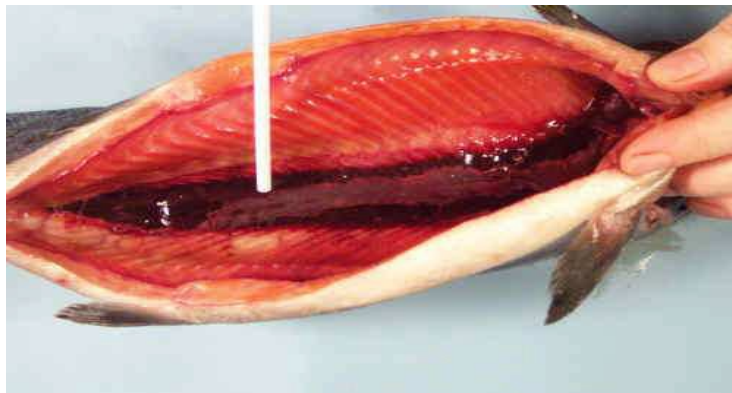
e. Next, remove the **Swim Bladder**. The swim bladder is an elastic membrane sac containing oxygen which provides stability under water enabling the fish to maintain its depth control without floating upward or sinking. To demonstrate how the swim bladder works have a balloon handy. Fill it with air to demonstrate how fish rise in water. Release some air to demonstrate how fish sink in water.



If the swim bladder does not have air in it, cut a small hole in the back near the tail. Insert a straw into the cut and gently blow air into the bladder.

f. Identify the **Kidney**, a paired organ on either side of the backbone. It filters liquid waste material from the blood; these wastes are then passed out of the body. The kidney allows fish to exist in salt or fresh water or both. Remove it by cutting along each side and scraping it out with a spoon.

Kidney



g. Next, examine the **Gills** by using scissors or a knife to cut off the **Operculum**, or gill covers on each side. Remove the gills of the fish to inspect them. You will see they are fan-like feathery organs full of blood vessels.

Lift or cut off the operculum and cut through the bone at the top and bottom where the gills are joined to the head.

Make a cut at the top of the gills.



Make a cut at the bottom of the gills.



Set of removed gills.



Most gills consist of three parts; gill filaments, gill rakers and gill arches.

- **Gill Filaments** function like lungs in people: it's the organ responsible for absorbing oxygen and expelling carbon dioxide.
- **Gill Rakers** are bony projections that serve to strain and trap food particles for fish and keep the gills clean.
- **Gill Arches** offer support for the gills as well as the blood vessels.

h. Observe the fish's **Skeletal System**. Fish have flexible skeletal systems like humans. The backbone is a series of interlocking disks and protects the **Spinal Cord** that runs from the body to the brain. The ribs are light weight, curved bones that protect the vital organs and give the fish its shape.

Backbone and Ribs



- i.** The last step is dissecting the **Brain**. The brain is located in the head at the end of the spinal cord where the nervous system transmits sensory information.

Start by cutting through the fish's head behind the gill cover (operculum).



Hold the head by the nose and place the back of the head down on the cutting board. Remove a very thin slice 1/3 cm. cutting down from the top of the head.



Remove a second slice, again 1/3 cm. and finally a third slice, 1/3 cm. Making three thin slices down will prevent damage to the brain tissue.



Brain after the third slice.

Use the tip of the knife to gently probe and scrape the brain out. Rotate the head as you do this procedure.



The forebrain (front) controls the fish's sense of smell. The midbrain controls vision, learning and response to stimuli. The hindbrain (back) coordinates movement, muscles and balance.



Step # 4 - Clean your fish-cleaning table or area immediately with disinfectant. Collect the guts and head and discard them properly.

COMPARING HUMANS TO FISH:

RESPIRATORY SYSTEM (BREATHING)

FISH – As water enters the mouth it is forced through the gills which absorb oxygen from the water and releases carbon dioxide.

HUMANS – Take in air through the nose and mouth which then moves into the blood vessels that circulate oxygen rich blood to tissues and cells throughout the body.

CIRCULATORY SYSTEM (BLOOD FLOW)

FISH - The circulatory system carries blood throughout the body. Arteries carry blood to the heart which acts like a pump circulating oxygen rich blood throughout the body.

HUMANS - The human circulatory system includes the heart, veins, arteries and capillaries. The blood carries oxygen plus nutrients to the cells and remove waste products. The heart is like a pump which circulates blood throughout the body.

NERVOUS SYSTEM (PROCESSES SENSORY INFORMATION)

The brain and the spinal cord of all vertebrates are similar in structure and in their function. The central nervous system controls all body functions like walking, swimming, thinking, swallowing, breathing etc. The nervous system is made up of the brain, spinal cord and nerves.

DIGESTIVE SYSTEM (FOOD BREAKDOWN)

The digestive system in both humans and fish is similar in function. It breaks down the food you eat into nutrients such as carbohydrates, fats and proteins. They are then absorbed into the bloodstream which is transformed into energy and eliminates waste.