

Fish Dissection Background

Introduction

Living things are similar to and different from each other. For example, when we look at the inside of a fish, we learn that the organ systems of fish are similar to those of humans. Moreover, the external anatomy features, or outside body parts of fish can tell us a lot about that species such as where it lives in the water, how it finds food, and how it protects itself from predators.

Internal Anatomy Features

Common internal anatomy features of fish include: heart, liver, pyloric caecae, swim bladder, gonads, kidneys, and stomach.

Heart

In fish, the circulatory system is a single circuit, with blood flowing from the heart to the gills, and then to the rest of the body. The typical fish heart has four chambers. Unlike mammals, blood moves through all four chambers in sequence. The hearts of slow moving fish are small, whereas active swimming species are large.

Liver

The liver has many digestive and storage functions. One of these is the production of bile, a solution which emulsifies or breaks down fats. The liver is also responsible in some species for the storage of fats, blood sugar, and vitamins A and D.

Pyloric Caeca

Pyloric caeca are fingerlike pouches connected to the gut. Not as much is known about the pyloric caeca, but scientists think it may play a principal role in protein digestion.

Swim Bladder

A flexible-walled, gas-filled sac located in the dorsal or top portion of body cavity, the swim bladder controls the fish's buoyancy and is used for hearing in some species. In carp and catfish, the swim bladder is located close to their inner ear and connected to the otolith, (small bones in the inner ear which provide balance, and, in fish, aid in hearingⁱ), by a system of bones called the Weberian ossicles, thus giving them better auditory skills. Fish with reduced swim bladders, such as flat fish, have a lowered hearing ability due to the greater distance between the swim bladder and otoliths. The vibrations in the water cause a pulsing movement in the swim bladder, which can stimulate the otolith, giving fish the ability to hearⁱⁱ. If a fish becomes buoyant, and starts to float upwards, gas diffuses out of the swim bladder into the blood. The gas in the blood is removed from the body at the gills, and expelled into the surrounding water. Conversely, if a fish starts to sink, air enters the swim bladder at a region called the gas gland. Oxygen is the largest percentage of gas in the bladder; nitrogen and carbon dioxide also fill in passively.ⁱⁱⁱ

Gonads

Gonads are sex organs. Males have paired testes that produce sperm, and females usually have paired ovaries that produce eggs. In most cases, fertilization of eggs is performed externally, called spawning. Often these organs are found separate in fish, male and female. However, some fish are hermaphroditic, meaning they carry both types of gonads; ovaries

and testes. Several species that are known for having hermaphroditic sex glands include perches, walleyes, darters, and some of the black basses.^{iv}

Stomach

The stomach is often referred to as the gut; this is where food is stored and digested. When keeping a regulation-size fish, examine the stomach contents. Knowing what a specific fish species eats can help with bait selection.

Kidneys

Kidneys are paired organs located ventral to the spinal column. They are involved in excretion and regulation of water in fish. The kidneys of freshwater fish remove water and re-absorb salts and sugars. They produce large amount of very dilute urine. This helps the fish avoid becoming "waterlogged" from the large amounts of water diffusing into the fish. The kidneys of marine fishes conserve water. Marine fishes drink water and excrete only a small volume of very concentrated urine. In many fish, the gills and gut are largely responsible for the excretion of surplus salts.^v

External Anatomy Features

Common external anatomy features of fish include: dorsal fin, anal fin, caudal fin, pectoral fins, ventral fins, gills, lateral line, nares, mouth, scales, and body shape.

Fins

All fish have external appendages called fins. Like human limbs, fins provide fish with balance, steering, and protection. Fins are either single along the centerline of the fish; the dorsal fin, anal fin, and tail fin, or paired fins; the pectoral fins and ventral fins.^{vi} Pectoral fins help fish balance. The top fin or dorsal fin is also used in balance but its main function is usually protection. The ventral fin and anal fin are located on the bottom or belly of fish and help with steering as well as balance. The tail fin, also called the caudal fin helps propel fish forward.

Gills

Located on either side of a fish, gills provide oxygen to fish from the water. The gills are covered by a flexible bony plate called the operculum. Some fish have spines located on the operculum as a defense mechanism to protect them from predators.^{vii}

Lateral Line

Running down the length of a fish's body is the lateral line. This organ is used to feel low vibrations in the water. The lateral line is made up of a series of microscopic holes located just under the scales of a fish.^{viii}

Nares

All fish possess a sense of smell. Paired holes, or nares, used for detecting odors in the water, are located on a fish's snout. Some fish, such as some shark varieties, catfish or eels, have a heightened sense of smell.

Scales and Slime

Most fish have scales covering the length of their body. Scales protect fish from injury, much like skin on the human body. On top of these scales is a mucus covering known as the slime

layer. Slime protects fish from bacteria and parasites in the water. Anglers should be careful not to remove the slime layer when handling a fish.^{ix}

Body Shape

A fish's body shape as well as the shape and size of certain external features can tell you a lot about that fish. For example, the body shape of a fish can indicate where that fish lives in the water, and what type of swimmer it is. In addition, tail fin shape also signifies a fish's swimming abilities. For instance, a sharp forked tail like that of a shark implies a fast swimmer, whereas a rounded tail means the fish is good at turning.

Mouth

The mouth parts of a fish will vary in size and may or may not contain teeth, depending on what the fish eats. The location of the mouth on a fish's body can also give us a clue as to what the fish's diet consists of. A superior mouth, a mouth pointing upward, means the fish will eat food located above it; whereas a fish with an inferior mouth, a mouth pointing downward, will eat food located below it.

Compare/Contrast

Even though humans and fish do not look the same we share similar organs and body parts.

<i>Human</i>	=	<i>Fish</i>
Lungs	=	Gills
Large and Small Intestine	=	Pyloric Cacae
Stomach	=	Stomach
Liver	=	Liver
Ovaries/Testes	=	Ovaries/Testes
Kidneys	=	Kidneys
Ears	=	Lateral Line
Skin	=	Slime Layer/Scales
Nose	=	Nares
Arms	=	Pectoral Fins
Legs	=	Caudal Fin

In addition, fish also have analogous organ systems to humans: respiratory, digestive, reproductive, excretory/urinary, circulatory, and nervous/sensory.

Vocabulary

- **Anal Fin**: Last bottom fin on a fish; located near the anal opening; used in balance and steering
- **Caudal/Tail Fin**: Fin on end of fish; used to propel the fish
- **Circulatory System**: Delivery of materials throughout the human body. This includes the heart.
- **Digestive System**: Break down and process proteins, carbohydrates and fats so they can eventually enter body cells. This includes the stomach, liver and pyloric caeca.
- **Dorsal Fin**: Top or backside fin on a fish; used for balance and protection
- **Excretory/Urinary System**: Removal of metabolic wastes, such as carbon dioxide, water, salts and urea from the body. This includes the kidneys.
- **External Anatomy**: The outside body parts
- **Gas Gland**: Fed by arterial blood -gasses enter here.
- **Gills**: Organ a fish uses to obtain oxygen from the water
- **Gill Arches**: The gill arch provides support for the gills.
- **Gill Filaments**: Gill filaments absorb the oxygen from the water, and release carbon dioxide.
- **Gill Rakers**: Gill rakers, which aid in feeding processes, are appendages along the front edge of the gill arch.
- **Homeostasis**: The process of regulation of an organism's internal environment. A disruption to any body system may cause an imbalance in homeostasis.
- **Lateral Line**: Organ a fish uses to “feel” low vibrations; tiny microscopic pores
- **Nares**: Organ a fish uses to smell; similar to nostrils
- **Nervous/Sensory System**: Organs that receive and interpret stimuli. This includes the brain, spinal cord and nerves.
- **Pectoral Fin**: Chest fins on a fish; used for balance
- **Reproductive System**: Organs that help in reproducing offspring. This includes the gonads.
- **Respiratory System**: Breathing and gas exchange. This includes the gills, gill rakers, gill arches and gill filaments.
- **Scales**: Protective cover on a fish; similar to skin
- **Slime**: Covers scales; layer protects from bacteria, parasites, etc.
- **Ventral Fin**: Bottom or belly fins on a fish; used in balance and steering
- **Vertebrate**: Organism with a backbone

ⁱ Office of Marine Programs. Discovery of Sound in the Sea (DOSITS)

“Animals and Sound in the Sea.” 10 October 2008

<<http://omp.gso.uri.edu/dosits/animals/produce/2f.htm>>.

ⁱⁱ “Animals and Sound in the Sea.”

ⁱⁱⁱ “Fish.” Biology Fish Notes. 9 December 2008 <http://ohs-bio.www1.50megs.com/Biology_Notes/Fish.htm#BF%20Senses>.

^{iv} Karl, Lagler, et al. Ichthyology. 2nd ed. New York: John Wiley & Sons, Inc., 1977.

^v “Fish.”

^{vi} “Fish Anatomy.” Florida Fish and Wildlife. 2008. 5 December 2008
<<http://floridafisheries.com/fishes/anatomy.html>>.

^{vii} “Fish Anatomy.”

^{viii} Maryland Department of Natural Resources (MD DNR).
“Fisheries Biology and Management” 10 October 2008
<<http://www.dnr.state.md.us/education/envirothon/FISH%20ANATOMY.pdf>>.

^{ix} “Fish Anatomy.”