**Chapter 14: Anatomy of the Perch**

**Class Actinopterygii**

 **Subclass Neopterygii**

 **Infraclass Teleostei**

 **Superorder Acanthopterygii**

 **Order Perciformes**

 **Genus *Perca***

 **Species *Perca flavens***

Introduction

The yellow perch is a common fresh-water fish found throughout North America. It is a generalized fish, without a great degree of specialization, and therefore makes a good representative for fish anatomy. By performing the perch gross dissection and examining the perch skeleton, in combination with the guppy histological slides, one can gain an excellent appreciation for how a vertebrate is constructed.

Skeleton

 Fish have a variety of fins that are used for locomotion, balance, display, and defense. In a typical actinopterygiian fish, the fins have bony supports (**fin rays**) in each fin. Two types of fin rays are present in the skeleton of the perch. **Lepidotrichia** are ossified fin rays and are sometimes called fin spines. **Ceratotrichia** are unossified and are therefore called soft fin rays. The **anterior dorsal fin** is composed entirely of lepidotrichia, while only the first two fin rays in the **posterior dorsal fin** are ossified. The remaining supports in this fin are ceratotrichia. The **anal fin** demonstrates an identical construction to the posterior dorsal fin, and the **caudal fin** is completely composed of ceratotrichia.

In the perch, the caudal fin is the main locomotor fin, while the others, including the **pectoral** and **pelvic fins**, control the orientation of the fish in the water. Note the **pelvic girdle** and the **pectoral girdle** that support the two respective fins. Examine the preserved lungfish for a comparison of fin structure seen in a sarcopterygiian (lobe-finned) fish.

 The fin rays in the dorsal, anal, pectoral, and pelvic fins are supported at their bases by a bone, or a series of bones, known as **pterygiophores**. The pterygiophores that support the dorsal fins are simple, ventrally tapering elements. The tips of the dorsal fin pterygiophores extend ventrally into the connective tissue between the two halves of the neural spines. The bony elements supporting the anal fin are similar in construction, but taper dorsally and attach to the hemal spines. However, the anterior few pterygiophores (usually the first two) fuse into a large element that extends dorsally to attach to one or two ventral ribs.

 The caudal (tail) fins of fish vary in their morphology. The perch exhibits a tail with two equal-sized lobes, but its vertebral column extends into the upper lobe. This condition is known as **homocercal**. Compare the perch’s tail to the caudal fin of the shark on display. Shark tails have larger upper lobes and smaller lower lobes. However, like the perch, the shark’s vertebral column extends into the upper lobe, and this construction is known as **heterocerca**l. Finally, compare the perch and shark tails to the caudal fin of the lungfish. Here, the lobes are equal in size, but the vertebral column remains horizontal and does not extend into the upper lobe. Lungfish tails are called **diphycercal**.

Examine the long vertebral column that runs along the length of the perch’s body. There are two main types of vertebrae in fish, the **trunk vertebrae**, which are found anteriorly and the posterior **caudal vertebrae**. Each **vertebra** is composed of three structures, the **centrum**, **neural arch**, and **hemal arch**. The **centrum** almost completely replaces the notochord during development (note it is still a notochord in the guppy slides). The **neural arch** surrounds the spinal cord, and the **hemal arch** surrounds the caudal blood vessels. The trunk and caudal vertebrae can be differentiated by the presence or absence of spines associated with the arches. Both vertebrae types bear **neural spines**, but only the caudal vertebrae have **hemal spines**. Both types of spines are attachment points for muscle tissue. The trunk vertebrae bear **ribs**, *in lieu* of hemal spines, and there are two types in the perch, **dorsal** and **ventral** ribs. The curved ventral ribs are more prominent, while the more delicate dorsal ribs extend laterally.

 The skull anatomy of fish is very complex and will not be covered completely in this class. However, there are a few important bones you will need to know. The **premaxilla** and **maxilla** form the upper jaw and are free from the skull. This condition is unlike that found in many other animals, such as mammals, where both bones are fused to the skull and are immobile. The most posterior portion of the upper jaw is composed of the **quadrate**. The lower jaw is formed by the **dentary** and the **articular**, and it articulates with the skull through the **hyomandibula** and the **symplectic** bones. This type of jaw attachment is known as modified **hyostyly**.

 The **gills** are the main respiratory and osmoregulatory organs of the fish. The **operculum** is the covering that protects the fragile gills from physical injury. Note the **opercular** bone.

Gross Anatomy

 Examine the entire fish before dissection. Please note the **various fins** that you identified in the skeleton. The **lateral line** runs from just posterior to the **operculum** to the caudal fin. It is sensitive to water pressure and is used to sense the environment around the fish, especially in murky waters where visibility is reduced. **Branchiostegal rays** can be seen under the operculum.

The **mouth** is terminal in the perch, and **two nostrils** are present on either side of the head, anterior to the eyes. The opercular bone (operculum) covers the gills, and the gill slit or opercular opening is found at its posterior margin. The **anus** is positioned anteriorly to the anal fin and the **urogenital opening** (cloaca) is found posterior to the anus.

 One of the most distinctive external features of most fish are scales. The scales of fish develop within the dermis of their skin and, therefore, are known as dermal scales. Actinopterygiian fish can exhibit three types of scales, **ganoid**, **cycloid**, and **ctenoid**. **Ganoid** scales have an outer layer of enamel that is laid down on top of lamellar bone. This type of scale is found on gars. **Cycloid** and **ctenoid** scales are both composed of lamellar bone. Perch exhibit ctenoid scales. Compare the morphology of these three scale types to each other and to that of **placoid scales** (class Chondrichthyes) by looking at the available prepared slides.

 Carefully cut away the operculum to expose the gills. Note the **pharynx**, which is the space the between the mouth and esophagus. On each **gill**, there are numerous **gill filaments** where gas and ion exchange occur. The gills are supported by **branchial (pharyngeal) arches**, of which there are four. The most anterior arch, and the gill it supports, should be plainly visible. To see the other three arches, pull the first arch laterally and separate the individual arches. **Gill rakers**, projections that extend inward across the pharyngeal slits, should be visible on the first arch. These structures help in feeding by preventing prey (and debris) from passing through the pharyngeal openings and escaping.

 With a scalpel, make a shallow cut from the anus anteriorly between the pelvic fins to the point where the gills join together. Next, cut from the anus dorsally and anteriorly until the body wall covering the abdominal cavity is removed.

 Often the gonads are very large in the perch. Please note the **ovary** (single) or **testes** (paired) that should be easily visible in the posterior portion of the **pleuroperitoneal** cavity. Please remove the gonad(s). The large organ lining the dorsal side of the body cavity is the **swim bladder**.

The digestive system is the most obvious system visible. Follow it anterior to posterior and identify the **pharynx**, **esophagus**, **stomach**, **duodenum**, **pyloric ceca**, **small intestine**, and **rectum**. Just ventral to the stomach and anterior to the duodenum note the **liver** and **gall bladder**. A thin strip of dark tissue located dorsal to the swim bladder is the **kidney**

 The **transverse septum** separates the pleuroperitoneal cavity from the **pericardial cavity** where the heart is located. Please identify the **sinus venosus**, **atrium**, **ventricle**, **bulbus arteriosus**, and **ventral aorta**.

 There are several miscellaneous structures to be aware. Note that the **muscle tissue** in fish is segmented and forms a “zig-zag” like pattern. Each “zig-zag” is called a **myomere**, and myomeres are separated from each other by sheets of connective tissue known as **myosepta**. This construction is an ancestral vertebrate trait that disappears in the adults of terrestrial vertebrates, but is still visible in their embryos.

In the most anterior-dorsal portion of the body cavity is the **head kidney,** which is the main producer of red blood cells in fish. In other vertebrates, this function is performed by the bone marrow. Just ventral and posterior to the stomach is the **spleen** where white blood cells mature.