Fish

Water Dwelling Animals

Class Agnatha (Jawless fish)

- They are believed to be the most primitive and oldest vertebrates.
- Lamprey and hagfish are the only 2 living members of this class and are placed in the Order Cyclostomata.
- Hagfish live as scavengers (eating dead fish) and lamprey as parasites (attaching themselves to living fish).

Class Agnatha (Jawless fish)

- Have a cartilaginous skull.
- Do not have paired appendages.
- Do not have scales.

http://www.utsc.utoronto.ca/~youson/images/lamprey.jpg

www.ryanphotographic.com/images/JPEGS/Eptatre.

Lamprey

- Live in both fresh water and salt water.
- Adult may grow to 24 inches and weigh up to a pound.
- Soft skin that is slimy and brownish-green color.
- No jaw, limbs, or ribs.

Lamprey

- Nasal opening on top of head leading to olfactory sacs.
- Within these sacs are receptors sensitive to odors.
- Seven gill slits on either side of the head. As water moves in and out of the gill slits, 0_2 dissolved in water is taken in and $C0_2$ is given off.
- Have funnel-like mouths with sharp teeth.

Lamprey

- Attaches itself to other fish by suction.
- Tears a hole in the fish's side with its tongue and injects a chemical to keep the fish's blood from clotting.
- Then sucks out blood and body fluids.
- No stomach

Lamprey

- External fertilization.
- Adults die after gametes are released.
- Atlantic sea lamprey have caused extensive damage to lake trout in the Great Lakes.
- How did they get to the Great Lakes?

Lamprey

- Construction of canals linking the lakes to the Atlantic Ocean permitted sea lampreys to invade the Great Lakes.
- The annual catch went from 12 million pounds to less than a half million pounds.

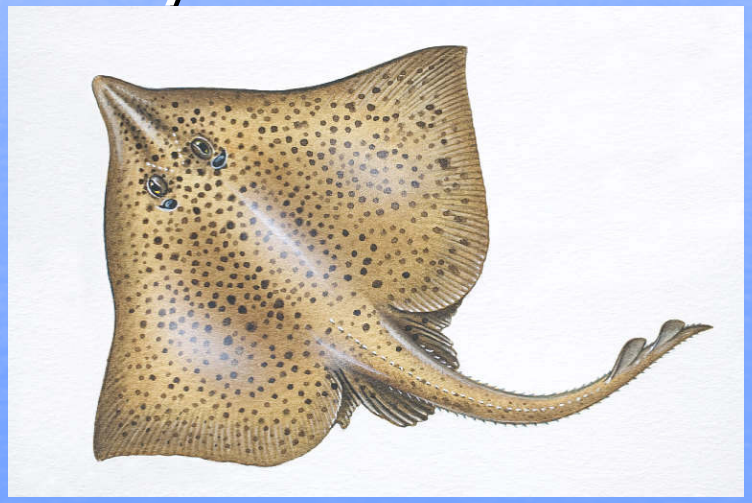
Hagfish

- Produces slime

Class Chondrichthyes
(Cartilage fish)

- Ex. sharks, skates, and rays

www3.sympatico.ca/jcomely/great-white-shark-p...



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Sharks

- The largest living fishes.
- Gray-colored skin is covered by rows of placoid scales.
- Each scale has backward pointing spine covered by enamel.
- This makes the shark's skin feel like sandpaper.
- Scales + teeth are the only bone-like material in the shark's body.
- Body is torpedo-shaped.

Sharks

- Most are predators.
- Water enters the mouth as the shark moves forward. It passes over the gills; gases are exchanged, and exits through the gill slits.
- Have specialized sense organs:
  - Two large eyes to see at close range.
  - Paired nostrils where water enters and is tested for dissolved chemicals
  - This is a shark's sense of smell that guides it to food.
  - They can detect blood up to 1/3 of a mile away

Sharks

- Sharks have a sense organ called the lateral line present on the sides of its body.
- These are sensory cells that can detect underwater vibrations caused by an uneven swimming motion of an injured fish.
- Fertilization occurs internally.

Skates and Rays

- Have flattened bodies with whip-like tails.
- Rays have diamond or disk-shaped bodies and skates are usually more triangular.
- Much slower than sharks.
- Most are bottom dwellers and feed on mollusks and crustaceans.
- Have ventral mouth with strong jaws

Skates and Rays

- Water enters through 2 openings on top of their heads called spiracles.
- It passes over their gills and exits through ventral gill slits.
- They hide themselves by lying on the ocean bottom buried in sand or mud.
- Stingrays have a tail with a venomous barbed spine and use it for protection.

Class Osteichthyes (Bony fish)

- **Body Shape and Structure**
  - Fish bodies are divided into a head, trunk, and tail section.
  - Have a streamlined body and strong muscles making them very fast swimmers.
  - On each side of the head is a crescent-shaped slit where the gills are located.
  - They are protected by a hard plate called the operculum.

Class Osteichthyes (Bony fish)

- Fish scales are thin, flat disks of bone that grow from pockets in the skin.
- They overlap like shingles on a roof.
- They grow larger as the fish gets bigger.
- As the fish grows, new rings form on its scales (much like growth rings on a tree).
- Darker lines show where growth has stopped for that year.

Class Osteichthyes (Bony fish)

- Fish feel slimy because their scales are lubricated by a mucus secreted from glands behind the scales.
  - This helps them glide smoothly through water and helps protect them from parasites.
- Many fish have a color pattern known as counter shading camouflage.
  - Their ventral surface is lighter colored than the dorsal surface.
  - Others can change colors to match their environment.

Fins

- Paired fins
  - Pectoral fins are nearest the head and correspond to the arms of higher vertebrates.
  - Pelvic fins are posterior to and below the pectoral fins and correspond to hindlegs of higher vertebrates.
  - Pectoral + pelvic fins are used mainly for steering and keeping balance when resting.

Fins

- Single fins
  - Caudal fin grows from the tail.
    - It helps to push the fish forward.
  - Dorsal fins (anterior and posterior) help the fish to stay in an upright position while swimming.
  - Anal fin grows along the midline on the ventral surface and helps the fish maintain stability while moving

Organ Systems

- Digestive System
  - Most fishes have large mouths with many sharp teeth.
    - These teeth slant backwards making it hard for prey to escape once it is in the mouth.
  - Taste buds lining the tongue and mouth help it to detect chemicals in the water.
  - The pharynx (throat cavity) leads to a short esophagus which joins the upper end of the stomach.
  - From the stomach, food passes to a short intestine where digestion and absorption of food by the blood takes place.

Organ Systems

- Circulatory System
  - Fish blood contains both red + white blood cells.
  - Have a 2-chambered heart.
    - Pumping chamber is called the ventricle.
  - Ventricle pumps the blood from the heart to the capillaries of the gills where the blood picks up dissolved 0_2 gas from the water and gives off $C0_2$.
  - As the oxygenated blood leaves the gills, it is carried to all parts of the body passing through the capillaries of various organs.
  - Eventually, the blood leaves the capillaries and enters the veins which lead it back to the heart into the atrium.
  - The atrium pumps blood back into the ventricle.

Organ Systems

- Respiration
  - Organs of respiration are the gills.
  - A gill consists of an arch of bone or cartilage (gill arch) fringed with a "double row of projections called gill filaments.
  - These filaments have many capillaries which brings the blood in close contact with water to exchange gases.

Organ Systems

- Air Bladder
  - The air bladder acts as a float helping the fish to move to different levels in the water.
    - Ex. Fish live at different depths at different times of the year.
  - It is filled with 0_2 N_2, and $C0_2$ that pass into it from the blood and they can adjust the amount of gas inside it.

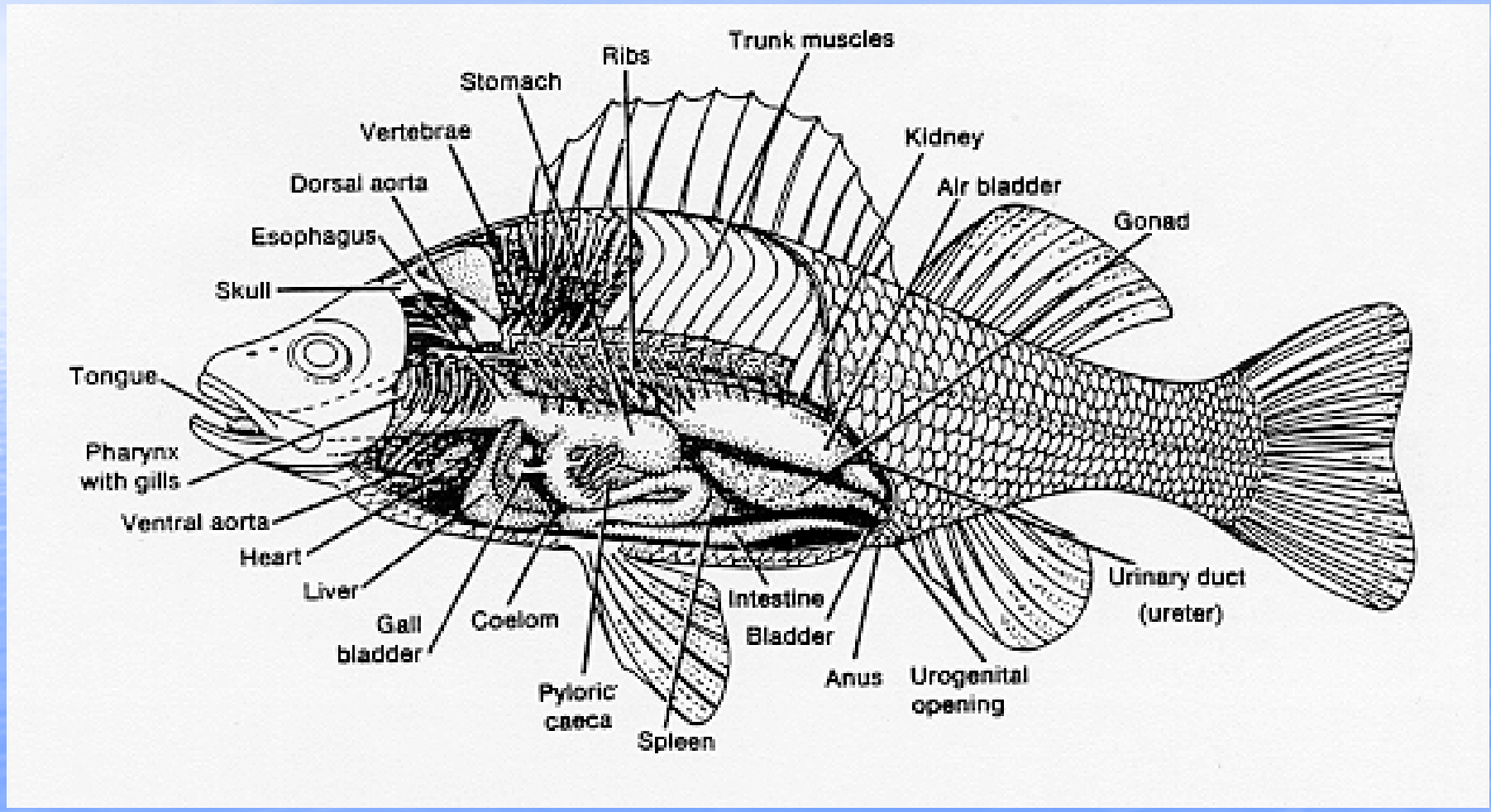
Organ Systems

- Senses in Fish
- Olfactory (smell) sense is the keenest sense.
  - They probably use this sense to locate food.
- They detect sound vibrations through skull bones.
- Lateral line is also associated with hearing.
  - It is formed by a single row of pitted scales running along each side of the fish containing sensory cells.
  - These help to detect low frequency vibrations in the water.
- Fish have large eyes, but can only see clearly up to about a yard away.
  - Beyond this, they can detect movement, but not see clearly.

Organ Systems

- Reproduction
  - Gonads (sex organs) lie above the intestines.
  - Most bony fish have external fertilization.
  - Ex. Female lays her eggs (spawns) and male swims over and discharges his sperm (milt) onto the eggs.

Internal Anatomy of Fish



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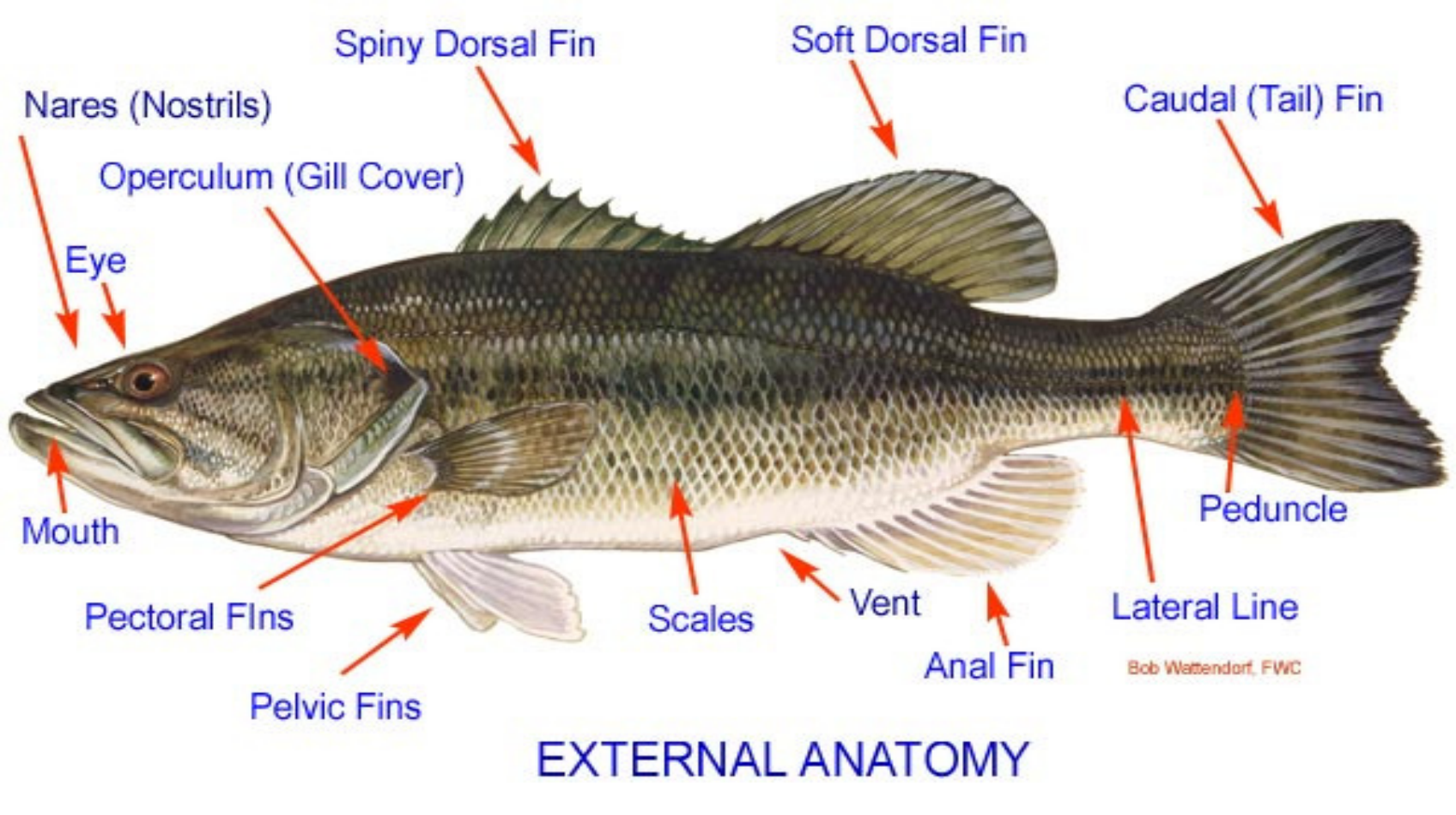
External Anatomy of Fish



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