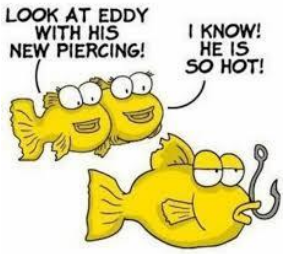
Lab: Biology of Fishes



The Basic Fish:

The essential elements of the fish framework include a skull, a backbone made up of a series of vertebrae, and two pairs of fins- the pectorals and the pelvics. The fish framework also has one or more dorsal fins on the back, and one or more anal fins on the underside. These fins are made of bone or cartilage and are attached to the rest of the skeleton. A caudal or tail fin is firmly attached to the end of the backbone. The bony skeleton provides a rigid framework that allows great variety in movement and provides protection for the internal organs.

1. **In fish with the familiar fish form, such as perch, each type of fin plays a particular and typical role in helping the fish move. Sketch the fish outline below onto your notebook paper. Add to the fish outline all missing fins and other body structures you observe on the fish.**

In fish with a "basic" fish form, the caudal or tail fin provides power. The pectoral and pelvic fins are used to steer and brake. The anal and dorsal fins stabilize the fish. A fish with a missing dorsal fin will be unable to stay upright and will tend to rotate or spin.

In addition to the bony skeleton that all of the true fish have, the bony fish share some other common features. They breathe through gills. Most fish have an outer covering of scales.

Unlike your skin, which is covered by several layers of dead and hardened cells, the fish's skin is alive to the very outermost covering. Because the outer cells of the fish are constantly exposed to water, they do not need the protection from drying that our dead cell layers provide.

The scales grow from pockets in the skin. They overlap like shingles on a roof. It is interesting to note that when the fish first comes out of its egg, it has no scales. A few fish, like the catfish, remain "naked" throughout life. Once the scales begin to form, they grow with the fish. As the fish grows bigger, the scales grow bigger. The number of scales, though, always stays the same. A young fish has the same number of scales as it will have when it is older. As the scales grow, concentric rings form on them. These rings grow closer together in the winter than they do in the summer. This observation is of more than casual interest since by looking at the scale rings, one can determine the age of a fish.

2. **How old was the fish from which this scale was removed?**

Fish skin contains cells that secrete mucus, or slime. The cells are scattered between the skin cells and release mucus as a layer over the surface of the skin. This is what makes a fish slippery. The slime serves several purposes. In the first place, the slime acts as a lubricant that helps the body of the fish slide through the water. The fish can increase its speed while reducing the energy required to move through the water. Secondly, the slime protects the fish from attack by fungus, bacteria, and parasitic protozoa. Damage to the slime layer by

handling exposes living fish to parasites. The slime layer also plays an important role in protecting the fish from injury from abrasions.

3. What are three roles the fish's mucus layer plays?

A.

B.

C.

Fish have a variety and brilliance of color unequaled by any other group in the animal world. Many fish also have the ability to change color. To accomplish these color changes, fish have specialized skin cells called chromatophores (Greek, chromato (color) + phore (bearer) = color bearer). Chromatophores are little sac-like cells, shaped like many armed stars, which are scattered through the skin in great numbers. Each contains colored pigments. Fish can make the pigment practically invisible by withdrawing the coloring into the center of the cell, or it can expose its color in varying degrees by spreading the color into the arms of a star.

4. How would the ability to change colors be of survival value to a fish?

Many fish are countershaded. Countershading is a pattern of coloration in which the dorsal or back side of the fish is darker in color than the ventral or underside. It appears that the shading is a good example of protective coloration. The dark back is almost invisible to an enemy like a fish-hunting bird looking down from above into the dark water. To an enemy looking up from below, the light ventral or underside would be inconspicuous against the light coming from the surface.

5. Some ichthyologists (scientists who study fish) think that the countershading we see in fish is due to the effect of light on the fish's skin. In other words, the top of the fish "gets tan" while the bottom doesn't. Design and briefly describe an experiment that would provide evidence to support or refute this hypothesis.

Fish have evolved into an enormous variety of shapes and body styles. This variety has enabled fish to live successfully in almost all aquatic habitats. Dietary habits of fish also vary greatly. Some fish eat plants, others eat fish, and others eat a great variety of animal life.

Part 2: Fitting

A lot can be learned about a fish's way of life by simply looking at the fish. In this activity you will have a chance to "read a fish." As you look at the drawings, keep in mind these three concepts:

1. The shape of the body is an adaptation that helps the fish survive. The body shape often tells us where and how a fish lives.
2. The shape and location of the mouth are adaptations for survival and can give us an insight into the way a fish lives.
3. The color of a fish helps the fish survive. The color we observe can tell us something about the fish's way of life.

Let's take a look at how different body shapes help fish live in different environments.

6. Compare the perch (top), a basic fish, drawn below, with the tuna (bottom), a fish that cruised in the open ocean. How are the fins and body of the tuna different from the fins and body of the perch?

Perch

Tuna

Fish that are able to swim steadily over long distances tend to have a body plan much like the tuna. Note also that the tuna and other open ocean fish tend to be countershaded.

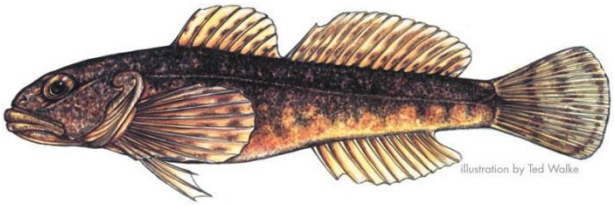
7. This time, compare the perch (bottom) with the butterfly fish (top). How are the butterfly fish's fins and body different from the perch?

Butterfly fish

Perch

Fish shaped like the butterfly fish tend to live around coral reefs or in rocky habitats. They lack the muscle mass and streamlined body of the tuna, so they are not able to cruise the open ocean. Instead, they maneuver very well among the nooks and crannies of reefs. Reef fish tend to have ornate camouflage coloration or vivid colors and patterns that attract mates. Countershading is not very common in these fish.

8. Finally, compare this sculpin (top) with the perch (bottom). How do its fins, body and mouth compare with those of the perch?



Sculpin

Perch

The sculpin is an example of a fish that sit or hover with very little movement and then ambush their prey, lunging with startling swiftness. Since they do not cruise great distances, as tuna do, they do not need to be streamlined. Instead, they benefit from a large mouth and considerable muscle mass to power their sudden acceleration. These fish tend to have camouflage coloration so that they blend in with the sand, rocks or vegetation around them.

Examine the following drawings and note your observations about how the fish's fins and body compare with the basic fish form. Try your hand at inferring whether the fish cruises the open ocean, maneuvers around reefs, or lunges after its prey.

9. Yellowtail jack- Where do you think the jack lives? Is it a cruising, lunging or maneuvering fish? What evidence supports your inferences?

10. Sand sole- Where do you think the sole lives? Is it a cruising, lunging or maneuvering fish? What evidence supports your inferences?

11. Plainfin midshipman- Where do you think the midshipman lives? Is it a cruising, lunging or maneuvering fish? What evidence supports your inferences?

12. Rockfish- Where do you think the rockfish lives? Is it a cruising, lunging or maneuvering fish? What evidence supports your inferences?

13. Sergeant major- Where do you think the sergeant major lives? Is it a cruising, lunging or maneuvering fish? What evidence supports your inferences?

Some fish have bodies and coloration that are so unusual, it is hard to believe they are real. Consider the Bay Pipefish. The pipefish is a pale olive green with narrow horizontal gray lines. It is shown in its most common orientation to the bottom.

14. What do the color and shape tell us about the habitat in which we would most likely find the bay pipefish?

15. What does the size of the mouth tell us about what the pipefish eats?

The anglerfish is dark maroon or black. The projection from the fish's head produces light.

16. What does the color of the anglerfish and the presence of the light producing organ tell us about where the angelfish lives?

17. What do you think the light producing projection might be from?

Name	How they swim	Where they live
Lunate (crescent)	Fast, rapid	Petagic
Forked	Constantly moving	Petagic
Truncate	Strong swimmer, slower	Pelagic
Rounded	Strong swimmer, slower	Pelagic
Leptocercal (long, whip-like)	Wriggling	Usually bottom
Leptocephalli	Weak swimmer, ribbon-like body, wriggling motion	Plankton, pelagic
Small or continuous with body	Weak swimmer, or wriggling on bottom	Pelagic or bottom

Using the chart above, write the tail names. Research and sketch their shape.

A. _____

B. _____

C. _____

D. _____

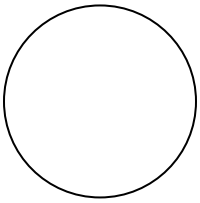
E. _____

F. _____

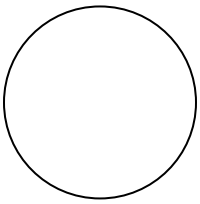
G. _____

19. Fish scales: Using the compound light microscopes, view the scale types below.

Draw Ctenoid and Cycloid Scales here:

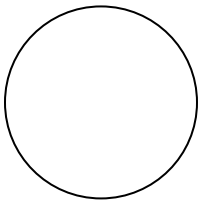


Ctenoid Scales



Cycloid Scales

Draw a Shark Placoid scale here:

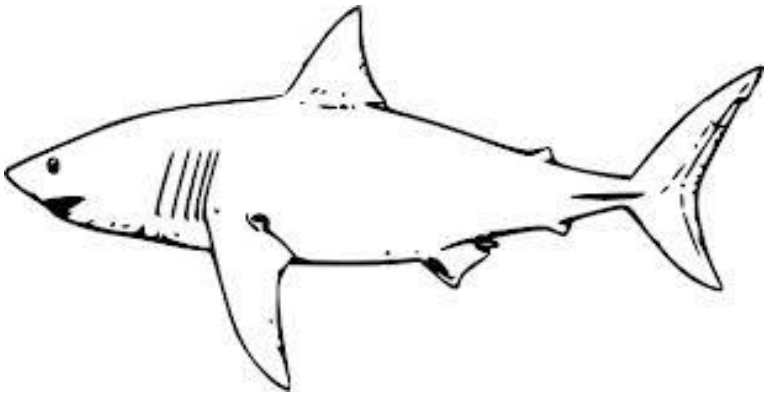


Shark Placoid Scales

20. Shark Anatomy:

Label the Shark External Anatomy:

A. _____
B. _____
C. _____
D. _____
E. _____
F. _____
G. _____
H. _____
I. _____
J. _____



21. Shark Taxonomy

Key:

1.	A.	Body kitelike (if viewed from the top)	Go to 12
	B.	Body not kitelike (if viewed from the top)	Go to 2
2.	A.	Pelvic fin absent and nose sawlike	Family Pristiophoridae
	B.	Pelvic fin present	Go to 3
3.	A.	Six gill slits present	Family Hexanchidae
	B.	Five gill slits present	Go to 4
4.	A.	Only one dorsal fin	Family Scyliorhinidae
	B.	Two dorsal fins	Go to 5
5.	A.	Mouth at front of snout rather than on underside of head	Family Rhinocudontidae
	B.	Mouth on underside of head	Go to 6
6.	A.	Head expanded on side with eyes at end of expansion	Family Sphyrnidae
	B.	Head not expanded	Go to 7
7.	A.	Top half of caudal fin exactly same size and shape as bottom half	Family Isuridae
	B.	Top half of caudal fin different in size and shape than bottom half	Go to 8
8.	A.	First dorsal fin very long, almost half total length of body	Family Pseudotriakidae
	B.	First dorsal fin regular length	Go to 9
9.	A.	Caudal fin very long, almost as long as entire body	Family Alopiidae
	B.	Caudal fin regular length	Go to 10
10.	A.	A long needlelike point on end of nose	Family Scapanorhynchidae
	B.	Nose without long point	Go to 11
11.	A.	Anal fin present	Family Squalidae
	B.	Anal fin absent	Family Carcharhinidae
12.	A.	Small dorsal fin present near tip of tail	Family Rajidae
	B.	No dorsal fin present near tip of tail	Go to 13
13.	A.	Front of animal with two hornlike appendages	Family Mobulidae
	B.	No hornlike appendages	Family Dasyatidae

Name Date Class

Lab

How Can a Key Be Used to Identify Organisms? 17-1

Figure 2