

ANIMAL BEHAVIOR

Humans have always been interested in animals and how they behave because animals are a source of food and play roles in our rituals and religious beliefs. We are still drawn to animals and we surround ourselves with them. We keep them in our homes, we watch them for entertainment and recreation, we use them to do work, we raise them for food and clothing, we hunt them, we use them to test products, and we use them to answer questions in an attempt to improve the human condition. Some zoologists specialize in the study of what animals do, how they do it, and why they do it. These animal behaviorists use the same principles of biological investigation as other biologists, but focus on four sets of questions. (1) What causes an animal to perform a certain behavior (**causation**)? (2) How does the behavior change as an animal develops from conception through death, but especially during its early life (**development**)? (3) What is the evolutionary history of the behavior (**evolution**)? (4) How does the behavior help the animal to survive and reproduce successfully (**function**)?

Many people assume that animals are just like us and therefore endow animals with human feelings and emotions. They say their dogs act guilty or their cats are jealous; they think of pets as members of the family and wild animals as crafty, or loyal, or cruel, or courageous. Although such interpretations of animal behavior are acceptable and even useful for most people, they also create some problems, especially the assumption that nonhuman animals are “just like us.” Unfortunately, animals are unique—they are not just like us—we must be willing to accept that their thinking is different from our own, and so we must try to “think like them” instead. For example, the apparent guilt evinced by a dog is in reality an expression of the submissive relationship of the dog to its owner. Dogs have evolved a complex dominance hierarchy with specific behavior to signal submissiveness or dominance during interactions with other members of the pack (social group). Thus, when you “scold” a dog, you are asserting your dominance over it, and the dog will in turn perform submissive behavior to inhibit an attack. Many dog owners interpret this submissive behavior as “guilt.”

In this exercise we will study the “agonistic” behavior of the Siamese fighting fish as an example of the study of animal behavior from a biological perspective.

Agonistic Behavior in Siamese Fighting Fish*

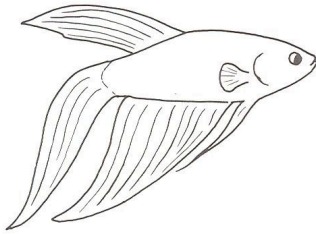
Siamese fighting fish (*Betta splendens*) live in the freshwater tropical streams of Indochina and have been bred for exaggerated fighting (**agonistic**) behavior. The male fish shows by visual **displays** its conflicting and simultaneous urges to attack another male or to flee. You have often seen this flee/attack behavior in the dog, where its intentions are signaled by voice, posture, and the position of its ears and tail. In the wild, one of the male fighting fish eventually will get the upper hand, and bluff its competitor into leaving. When the fish are confined within an aquarium, however, the winner will chase and bite the losing fish.

All of the fighting fish in the lab are male. The presence of another male acts as a **sign stimulus** to release a **fixed action pattern** response. Although the sign stimulus in nature is another male, you can substitute the fish’s own mirror image. Various artificial models can also be used to investigate what features of the invading male’s appearance are the strongest stimuli.

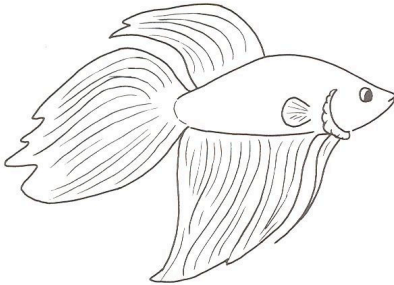
* Adapted from Conflict behavior in Siamese fighting fish, Carolyn Eberhard, Biology Laboratory: a Manual to Accompany Biology. Saunders College Publishing: Philadelphia.

The function of the display is to drive invaders out of the male's territory, and the defending male will have the strongest motivation to display if he is in his own territory (recall your observations of male red-winged blackbirds defending their territories). Thus it is best to experiment with the fish in their home tanks, if possible. The fish's motivation will be higher if he has just displayed to or defeated another male. The best displays also occur between closely matched fish, where neither one is forced to flee.

(a) resting or submissive



(b) broadside display



(c) frontal attack



Agonistic Displays of *Betta splendens*. (a) Resting or submissive fish. (b) Broadside display. (c) Dominant fish about to drive a submissive fish away.

The types of conflict displays are shown in the Figure to the left. The normal resting fish shown in (a) is drab in color but if another male appears, the intruder will be challenged with a broadside display shown in (b). The intruder may respond in kind and the mutual broadside display may go on for several minutes. One fish will gradually give up the broadside display and the other may attempt an aggressive frontal attack, tearing and biting to drive him away. The defeated fish will swim away and assume the appeasement appearance of the normal resting fish.

The broadside display of the male is also used during the courtship ritual to attract the female to the male's bubble nest. The male maintains the display during mating, and the female must make herself as inconspicuous as possible to avoid being attacked.

Observe the normal appearance of *Betta splendens* in its tank. These are some of the components of the displays to look for: (1) swimming, (2) swimming away, (3) pectoral fin movement, (4) raising of dorsal fin, (5) lowering of ventral fin, (6) expansion of tail, (7) increased coloring, (8) extension of gill covers, (9) facing the intruder, (10) biting the intruder.

Record your control observations with no stimulus in the Table.

Use a mirror to stimulate the fish by his own appearance. Pay particular attention to the color, fins, gill covers, and the orientation of the fish toward the stimulus. A good rule of thumb is to allow the fish 5 minutes to respond to a stimulus. His resting image is not very threatening, but if he starts to display, the "intruder" will respond likewise and the display will rapidly escalate. Note your observations in the Table.

Use modeling clay or a colored index card to make a model fish and try the effect of moving it alongside (i.e. outside) the tank. You can also try moving a clay model in the tank water. In

the space below the Table, describe what features were present in the model (A). Use the Table to record how your fish responds. Next note the response to other models (B, C) made by other students, or use data from other class members, and if possible draw conclusions about the effect of model shape and color.

Demonstration of Agonistic Behavior

Put two fish, in separate tanks next to each other. If the two are evenly matched, there will be displays for a considerable time. Do not put two fish in the same tank.

If two fish are removed from their tanks and put together in a third tank, they will both be “invaders”; neither one will have the advantage of being on his home territory, and the displays are likely to be evenly matched. If a second fish is introduced into the home tank of a fish, the “resident” will have the advantage of home territory and will be more likely to attack the second fish. The fish are more likely to display if they have recently displayed to and exerted dominance over another fish.

When you are finished with these experiments, it is very important to return all fish to their proper containers as directed by your instructor.

Be sure to turn in your worksheet and self quiz.

Self quiz for: _____

Table. Observations of Agonistic Behavior in *Betta splendens*

Reaction of Fish	Stimulus					Fish
	None/Control	Mirror	Model A	Model B	Model C	
No Response						
Swimming						
Swim Away						
Move Pectoral Fin						
Raise Dorsal Fin						
Lower Ventral Fin						
Expand Tail						
Increase Color						
Extend Gill Covers						
Face Intruder						
Bite Intruder						
Overall Response						
No Response						
Flee						
Broadside Display						
Frontal Attack						

Model A: _____
 Model B: _____
 Model C: _____

You should now be able to answer the following questions.

How did the behavior of fish exposed to agonistic stimuli change from the control situation?

Did model shape strongly affect the response of the fish? If so, in what way did shape matter?

Did model color strongly affect the response? If so, in what way did color matter?

Propose a hypothesis for the agonistic behavior of *Betta splendens*. Recall that a hypothesis is a testable explanation of some phenomenon (agonistic behavior in this case).

Propose a study (observational or experimental) to test your hypothesis. Be sure to provide enough detail to enable someone else to perform the test.