

FIREFLY FINDERS

Background

Fireflies are a familiar group of insects that can produce their own light. This characteristic is called bioluminescence. The "fire" is the result of an oxygen dependent chemical reaction controlled by the insect. In special cells in the firefly's abdomen, chemicals generated in separate glands are mixed in the light chambers that are then flooded with oxygen. The fire dies out as the oxygen is used up by the reaction and the firefly controls the light by opening and closing its spiracles (or breathing holes), controlling the amount of oxygen. That is a lot of detail that can be taught to some students but is understandably over other's heads. It is worth knowing though that the firefly actually turns its light on and off.

The main reason the fireflies light up is to communicate with each other in courtship. The females rarely fly and in some species are wingless! In order to locate mates, male fireflies dip and dive in open meadows flashing their lights in a pattern that is different for each species. Females sit in the grasses or tree trunks and watch for the males flashing their species-specific signal. They respond with a signal the males recognize and are attracted to. As the two insects signal back and forth the speed of their flashing increases and the male flies toward the female's perch. By the time the male is ready to land and mate, the perch area is lit with a constant glow from the female so he can land and mate. (Isn't that romantic?)

It isn't always that simple for the males... Females of some firefly species mimic" the response of a different species and lure in males with whom they will not mate. Instead, when the male lands for courting the female of his choice, she will attack and eat him! The femmes fatale of the insect world -- it's never easy...

Materials

- Black construction paper
- Aluminum foil
- Cards with flash pattern descriptions
- Kids
- Indoors or outdoors

Procedure

To make flash cards, have the students tape a piece of foil to a piece of black construction paper, leaving the top open to make a little pouch. The black side of their card is off, the foil side on.

Explain to the class that many species of fireflies can be flying around the same meadow at the same time. The females need to be able to recognize the pattern of their males in a sea of flashes. The males need to be able to recognize the responses among the grasses. (You can also phrase this exercise in terms of "friends" finding each other – but, it is fun enough that kids should get past juvenile tendencies quickly and just act like kids having fun!)

Practice different flashes with the entire class so everyone is doing it the same way. You should keep it simple, using long (about 2 seconds) and short (about 1/2 second) flashes in various combinations.

long - long - short short - long - short - long

Pass out color-coded cards with "flash" instructions on them. (You can "code" them with markers or crayons.) There should be one for each female firefly that matches one for each male firefly. The gender of the students doesn't matter. You might have them switch after one round and then discuss which firefly gender has the easier job.

Have the students learn the pattern they are looking for and the appropriate response, and slip the card inside the pouch of their flash cards.

This game should be played outside in a large field, but can be adapted for the classroom. Half of the class begins by sitting scattered around the play area. For this round, these are the females. When the game begins, the "males" start to fly toward the "females" flashing their signals. Females try to recognize the correct pattern and flash the response. When two fireflies think they have found each other, they compare their flash-pattern cards to see if they match. If they don't match, the female firefly should start looking around for another male and the male should keep flying looking for a female. If they do match, they should sit down and wait together until the rest of the class is finished and the round is over.

Extensions

You can keep track of the "success rate" of the fireflies by counting how many times a male is attracted to the wrong species of female. These data could be made into a graph and the students can practice using graphs to interpret experimental results. Is this an efficient system based on your class results?

Male fireflies do not just hover in one place while they're flashing. Often, their upward or downward flight is combined with their flash pattern to make the species' pattern more unique. You may add a realistic variation to your class' patterns by including "above your head" and "by your knees" in the instructions - or even "raising" or "lowering" while flashing. The difficulty of the pattern and response should be geared to the ability of the students. (If you want a more challenging game, the flash pattern of the male and the female's response do not have to be the same - it will be easier if they are.)

This game also may be played with penlights or regular flashlights in a dark room if this option is available.

Do you think that fireflies are easily seen and eaten by predators? What predators might eat them? Have the students suggest possible ways they can be protected from predation. (They might taste bad, or fly low enough that bats won't hunt them...)

How do other night-flying insects communicate? (Moths - many species also have wingless females - communicate with chemical signals called pheromones.)

