



4th Grade: Insect Communicators

Course description: Insects communicate by using a variety of chemical, visual, and auditory signals. In this set of lessons, students will explore the diversity of strategies that insects use to find each other, share information about their environment, and determine the suitability of potential mates. The final lesson will focus on the remarkable discovery of Karl von Frisch, who was able to describe and subsequently decode the honeybee's "waggle dance" in the 1940's.

Day 1: Insects primarily produce noises to attract potential mates but can also use sound for other purposes such as defense. Students will see examples of the various acoustic structures that have evolved on different insects and learn how insects can manipulate their environment to aid in their production of sounds. We will then play samples of the sounds made by common insects around Philadelphia so that they can learn how to identify them.

Demonstration: Students will make their own insect instruments. Rasps, horns, and percussive membranes will be constructed using various materials. Students will describe where on an insect their instrument could be found and in what circumstances it would be used. Then they will need to devise a song which will be recorded for use in a subsequent lesson.

Day 2: Visible light (400-700 nm) is the portion of the electromagnetic spectrum that humans can see with the naked eye. Insects have a variety of visual receptors and while most of these are also adapted to see within the visible spectrum, they are also frequently able to detect parts of the ultraviolet range (100-400 nm). Students will observe different patterns that insects use to distinguish one another as well as UV markings that flowers often contain to direct pollinators towards their nectar sources. Videos of several ostentatious and bizarre examples of insect mating dances will also be shown.

Demonstration: Students will have a diagram of the electromagnetic spectrum to reference as they learn about the different wavelengths of light. Students will construct their very own insect eyes to understand the difference between how humans and insects view the world around them. On this day, we will bring in a praying mantis that senses depth and movement with its two compound eyes while their three simple eyes (ocelli) on the top of their head are used for perceiving light or dark. Students will then need to make up a dance to the soundtrack of the song they recorded from the previous lesson.

Day 3: One of the most common ways that insects communicate is by releasing chemicals called pheromones. The major types of insect pheromones are aggregation, territorial, trail, and sex pheromones. Students will learn what each of these are used for and how insects are adapted to be able to use them for various purposes.

Demonstration: As it happens, there is an isomer of a common termite trail pheromone found in blue and black Bic pens. Students will get to observe how termites placed on a piece of paper will follow whatever path they draw for them using these pens. Afterwards, students will learn how sensitive moth antennae are by going into a hallway and attempting to detect various perfumes from different distances. Male moths can detect females up to 10 miles away in some cases. If time permits, we will go outside and show the students how the male



moth navigates through a pheromone plume towards a female by using chalk in the parking lot.

Day 4: This class will focus on the famous honeybee waggle dance. Students will learn how bees are able to communicate the distance, direction, quality, and abundance of flowers to other bees in their hive. This mode of communication was initially discovered in the 1940's and students will be able to see how advances in technology (particularly video tracking) have allowed researchers to continue investigating this system with greater sophistication. <https://www.youtube.com/watch?v=bFDGPgXtK-U>

Demonstration: Students will learn to replicate the bee waggle dance in teams. Teams will then need to place objects outside in the parking lot and direct their fellow teammates to pick up the objects using only the waggle dance.