

DATA *Nugget*

Sexy Smells

Featured scientist: Danielle Whittaker from Michigan State University

Research Background:

Animals collect information about each other and the rest of the world using multiple senses, including sight, sound, and smell. They use this information to decide what to eat, where to live, and who to pick as a mate. Choosing a mate is an important decision that requires a lot of information, such as how healthy a potential partner is, and whether they have good genes. The quality of a mate can affect how many offspring an animal has and if their genes will get passed on to the next generation.



Figure 1: Danielle holding a male dark-eyed junco. Notice the white feathers in his tail.

Many male birds have brightly colored feathers that are attractive to females. For example, the peacock has bright and elaborate tail feathers, called ornaments, which are thought to communicate a male's quality. Besides using their sense of sight to see ornaments, female birds may use their other senses to gather information about potential mates as well. Danielle, a biologist, wanted to figure out if birds use vision and their other senses, such as smell, to determine the quality of potential mates!

scientific
question
(purple)

Danielle decided to research how dark-eyed juncos communicate through their sense of sight and smell. Dark-eyed juncos, a type of sparrow, are not colorful birds like peacocks, but they have bright white feathers in their tails. Male dark-eyed juncos have more tail-white than females. Females may use the amount of white in a male's tail to determine whether he is a high quality mate. Danielle was also interested in several chemical compounds found in junco preen oil, which birds spread on their feathers. This preen oil contains compounds that give birds their odor. Danielle found that males and females have different odors! Just as males have more white in their tail feathers, they also produce more of a chemical called 2-pentadecanone. Danielle wanted to test whether this chemical might be a signal of mate quality.

two
alternative
hypotheses
stated twice
each (blue)

Danielle captured male juncos at Mountain Lake Biological Station in Virginia. She measured their tail-white by estimating the proportion of each tail feather that was white, and adding up the values from each feather. She also took preen oil samples and measured the percent of each sample that was made up of 2-pentadecanone. She followed these birds for one breeding season to find out how many offspring they had. If females pick mates based on visual ornaments, then she predicted males with more tail-white would have more offspring. If females pick mates based on smell, then she predicted males with more 2-pentadecanone would have more offspring.

predictions
(pink)

DATA *Nugget*

Shooting the Poop

Featured scientist: Martha Weiss from Georgetown University

Research Background:

Imagine walking through a forest in the middle of summer. You might see many species of caterpillars eating plants and hiding from predators. Some caterpillars might camouflage themselves or build shelters built from leaves, to avoid being seen. Others are brightly colored to warn predators that they have chemicals that make them taste awful. You can hear birds chirping, a slight breeze rustling the leaves, and a faint pinging noise like rain. However, what you hear is not rain – it is the sound of millions of forest insects pooping!

For forest insects, poop could alert predators to their presence and that a tasty meal is around. Usually insects keep moving and leave their frass (poop) behind, but some insects build shelters and aren't able to keep moving because they invested in building a shelter.

The silver-spotted skipper is an insect that lives in the forest. They have a variety of defense strategies against enemies, including building leaf shelters for protection. Martha is a behavioral biologist who studies these insects. While raising silver-spotted skipper caterpillars in the lab, Martha noticed that they were making a pinging noise in their containers. Upon further observation, she discovered that they “shoot their poop”, sometimes launching their frass over 1.5m! Martha wanted to figure out why these caterpillars might have this very strange behavior. Perhaps flinging their poop is a way to avoid being found by predators.



Scientific
question
(purple)

hypothesis
(blue)
stated twice

prediction
(pink)

To evaluate whether the smell of frass helps predators find and locate a caterpillar, Martha conducted an experiment with a wasp that eats silver spotted skippers. She allowed two silver-spotted skipper larvae to build shelters on a leaf and then carefully removed the larvae. She then inserted 6 frass pellets into one of the shelters, and 6 beads designed to look like frass but with no smell (control treatment) into the other shelter. She placed the leaf in a cage containing an actively foraging wasp colony (n = 10 wasps), and recorded how many times the wasps visited each shelter (control beads or frass), and how much time the wasps spent exploring each shelter. She expected wasps would spend more time exploring the shelters with the frass than they would exploring the control shelters.