



HOW PLANTS MAKE CATS HAPPY

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YOUNG REVIEWERS:



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AGES: 11–12



SHRESTHA

AGE: 11

Catnip—this plant seems to make a lot of cats very happy. But did you know that not all cats like catnip? We wondered if there were other plants that have the same effect on cats that catnip has. Is it possible that some cats who do not like catnip might enjoy those other plants? We let many cats sniff catnip and several other plants to see which plants cats like. It turns out there is hope for cats who do not like catnip but still want to have a good time. But how do these plants make cats so happy? We knew that a chemical compound in catnip called nepetalactone is responsible for the effect catnip has on cats, but we found many more compounds that can do the same! Do cats respond the same way to all these plants and compounds? Read the article to find out.

CATS AND PLANTS

Cats and plants are an interesting combination. Cats need to eat other animals to stay healthy—they do not need to eat their veggies! Some

plants can even be bad for cats if they eat or lick them. Lilies, for example, can kill a cat because something in these plants stops cats' kidneys from working. However, plants are also fun to play with or hide in, and many cats like to eat grass.

Interestingly, there is a special plant that appears to make cats happy. The name of this plant is catnip (Figure 1A). When cats smell catnip, they start rubbing their head against it, they roll around and appear as happy as they could possibly be (Figure 1B). This only happens when cats *smell* catnip, not when they lick or eat it. Sometimes cats who smell catnip also become playful. Unfortunately, some people compare a cat's response to catnip to the effect that some drugs have

Figure 1

(A) A cat enjoying the catnip plant. (B) Things cats do when they smell catnip. The behavior that is observed in response to smelling catnip and some other plants is called the "catnip response".

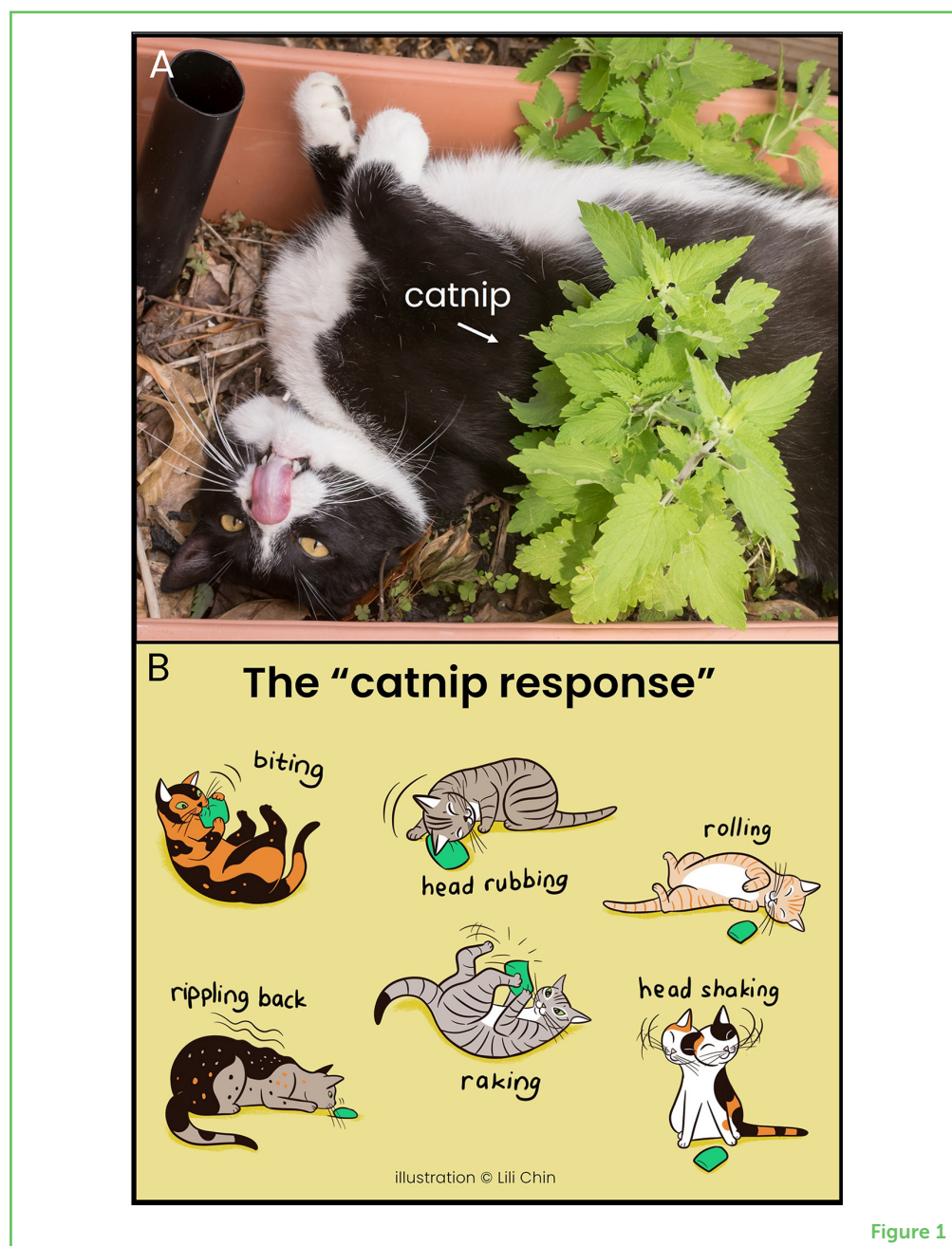


Figure 1

“CATNIP RESPONSE”

Behavior shown by cats in response to smelling cat-attracting plants such as catnip. The behavior typically includes head or cheek rubbing and rolling around.

ANECDOTAL EVIDENCE

Something only seen and described by other people, not tested by scientists. It is not always true.

on humans. It is important to mention that catnip is not addictive or unhealthy for cats. When cats are enjoying catnip, they are not “tripping” or “getting high”. The opposite seems to be true: catnip can help cats, especially cats who are kept inside the house all the time. Giving cats catnip every now and then will make their lives more interesting and exciting—which helps cats stay healthy. Catnip can also help big cats in zoos feel less bored. Yes, not only house cats respond to catnip—big cats such as bobcats and lions do as well!

We still do not know why cats respond to catnip the way they do. We also do not know why the “**catnip response**” is only seen in cats, and not in any other animals.

WHY DID WE STUDY CATS AND PLANTS?

Years ago, we adopted cats from a shelter and we wanted to make them really happy. We bought catnip for them, but, to our surprise, none of the cats liked the smell of this plant. They looked at the catnip, but nothing happened. Our cats not responding to catnip was the reason we started to do research on the “catnip response”. How many cats are there who do not like catnip? More importantly, are there *other* plants that those cats would like instead? We decided to test this, with the help of 100 cats in an animal shelter. We selected several plants we had heard might have an effect similar to catnip. Two of these plants are silver vine (a kiwi plant) and Tatarian honeysuckle ([Figure 2A](#)). No one had ever studied the effects of these plants on cats. There was only **anecdotal evidence**, which is often unreliable.

WHICH OTHER PLANTS DO CATS LOVE?

Similar to results reported by other scientists more than 50 years ago [[1](#), [2](#)], we found that about 30% of the 100 cats we studied did not care for catnip [[3](#)]. When we offered the silver vine and Tatarian honeysuckle plants to the 32 cats who did not like catnip, we noticed that many of them (81%) *did* love at least one of those plants ([Figure 2B](#)). Silver vine was the most popular plant, even more popular than catnip! About 80% of all the cats loved silver vine—smelling this plant made them really happy. Silver vine was also the plant most loved by the cats who did not like catnip. When we gave silver vine to bobcats, they absolutely loved it, too. In addition to silver vine, the cats also loved Tatarian honeysuckle (see [this video](#)). Since this happy, playful behavior was first seen after cats smelled catnip, we call the response to *all* these cat-attracting plants the “catnip response.”

HOW DO CATS RESPOND TO THESE OTHER PLANTS?

We then wanted to know if the way cats behave after they smell silver vine and Tatarian honeysuckle is the same as the way they respond

Figure 2

(A) The cat-attracting plants silver vine (kiwifruit, flowers, and leaves) and Tatarian honeysuckle (wooden stems, leaves, flowers, and berries). (B) Cats who do not like catnip sometimes love other plants such as silver vine or Tatarian honeysuckle.

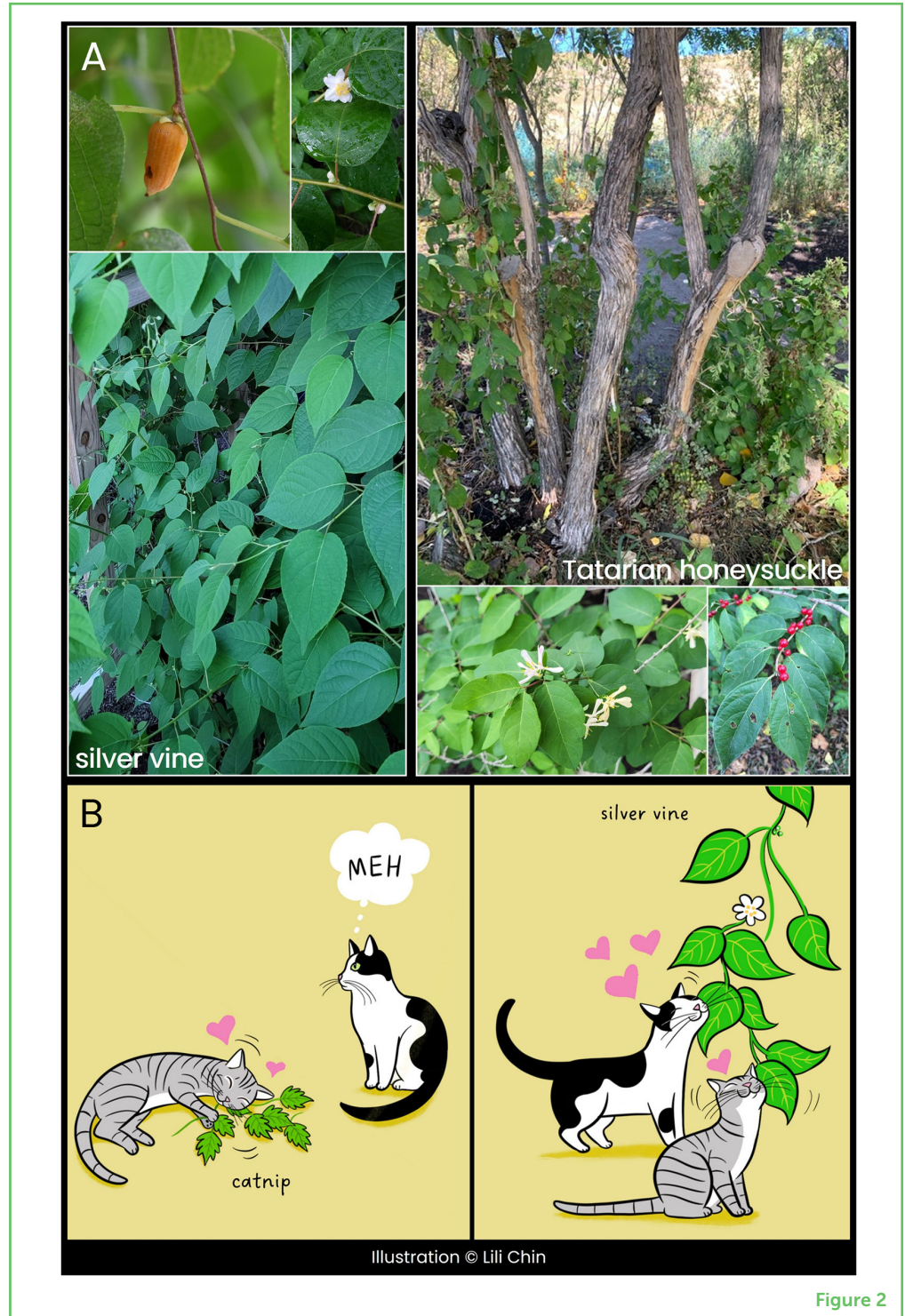


Figure 2

to catnip. We found that the behavior in response to the various cat-attracting plants was very similar. The way a cat behaved after smelling silver vine, for example, was the same way that same cat behaved after smelling catnip. However, we found that the behavior *between* cats differed a lot. For example, cat Fluffy would only sit and rub her head on the plant, whereas cat Mittens would become very playful: biting the plant, bunny kicking it, and rolling on her

NEPETALACTONE

The chemical compound in catnip that makes cats love this plant.



ACTINIDINE

A cat-attracting compound found in many of the plants that cats love.



DIHYDROACTINIDIOLIDE

A compound loved by cats that is made by plants and insects, but also by the red fox.



ODORANT

Invisible compounds in the air that can be smelled when they enter the nose. Odorants bind to olfactory receptors.

OLFACTORY RECEPTORS

Proteins in the nose that send a message to the brain when an odorant is bound to it. When the messages arrive in the brain, you smell the odorants.

back every now and then. We also saw that the skin on the back of some cats sometimes rippled, or moved in waves, when they smelled these special plants. This was a response that had never been described before.

WHICH CHEMICAL COMPOUNDS CAUSE THE “CATNIP RESPONSE”?

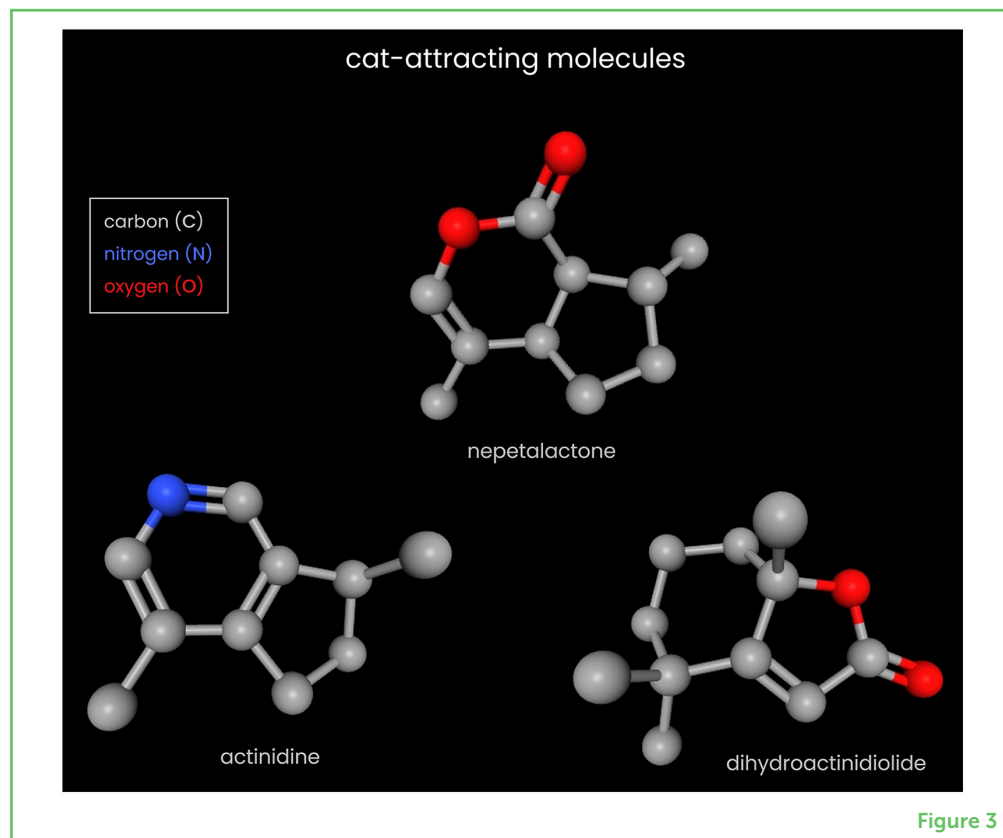
Plants contain hundreds of chemical compounds. We tested which plant chemical compounds the cats were attracted to. We found that cats not only respond to a compound called **nepetalactone**, the known cat-attracting compound in catnip, but also to nine other chemical compounds! Most of these compounds looked like nepetalactone, but **actinidine** and **dihydroactinidiolide** had a different shape (Figure 3).

Surprisingly, scientists still do not really know how the sense of smell works. We do not know where and how most **odorants** bind in the nose, and we also do not know how the shape of these smelly compounds determines what they smell like. One super exciting thing that we learned was that only few cats respond to actinidine, but those cats who do like actinidine, love it more than any of the other compounds. This is the first clue that there may be not just one, but multiple **olfactory receptors** in the nose these cat-attracting compounds bind to!

Discovering that cats love the smell of dihydroactinidiolide was extremely exciting too—and here is why. All other chemical compounds that cats like are, as far as we know, only made by plants or insects. Insects produce these compounds to warn other insects in the group when there is danger. Plants make the same compounds to protect themselves against bugs. Insects that might want to eat the plants smell these compounds and think there is danger, so they avoid eating the plant. Pretty amazing, right? But it turns out that dihydroactinidiolide is also produced by a mammal. This cat-attracting compound was found in the fur of the tail, close to the butt, and in the urine of the red fox. We believe foxes may use dihydroactinidiolide to communicate with each other *via* smell. Learning that foxes make a compound that cats love made us wonder if cats maybe respond to all these compounds because they already produce some of these compounds themselves. Perhaps cats also use tiny amounts of these compounds to communicate with other cats, and the joyful response only happens when they smell the compounds in large amounts in plants.

Figure 3

Different plants contain different compounds that make cats happy. Nepetalactone is only found in catnip. Silver vine contains lots of actinidine. Tatarian honeysuckle wood contains the fewest cat-attracting compounds, but cats still really love it. The shapes of actinidine and dihydroactinidiolide are different from nepetalactone and other cat-attracting compounds. Compared to nepetalactone, actinidine misses the oxygen atoms and has a nitrogen atom instead. Dihydroactinidiolide has oxygen atoms on the ring that contains five carbon atoms, not on the ring with six carbon atoms.



HOW IS SILVER VINE DIFFERENT FROM CATNIP?

We learned that cats who do not enjoy catnip may love other plants such as Tatarian honeysuckle (especially the wood) and silver vine. We now also know which chemical compounds in these plants are responsible for the “catnip response”. We then quantified all the cat-attracting compounds in catnip, silver vine, and Tatarian honeysuckle. This helped us understand how much of each cat-attracting compound is made by these plants. As we expected, nepetalactone was only found in catnip. Interestingly, we also found that several cat-attracting compounds in silver vine were not present in catnip, and that silver vine contained a lot more actinidine than catnip. This may explain why many of the cats who do not like catnip, love silver vine.

MYSTERIOUS CAT-ATTRACTING COMPOUNDS IN TATARIAN HONEYSUCKLE

Finally, there was a bit of a puzzle in our research. We let five cats smell catnip for a long time. After 10 days, they got bored with it. We expected that cats who were bored with catnip would also be bored with other plants that contained the same (or fewer) cat-attracting molecules as catnip. However, when cats were bored with catnip and we gave them Tatarian honeysuckle, one of the cats became extremely

happy—even happier than when he smelled catnip for the first time. We do not know why this happened, because all the cat-attracting compounds that we found in Tatarian honeysuckle are also found in catnip—sometimes in even higher amounts. This could mean that Tatarian honeysuckle contains *other* chemical compounds that some cats love, which have not been identified yet. This may explain why some cats who do not like catnip love Tatarian honeysuckle.

As you see, we still do not understand exactly *why* plants make cats happy and how the compounds that we found in catnip and other plants make cats behave the way they do. We are continuing our research to find the answers to these questions. We also hope that more people will start using catnip, silver vine and Tatarian honeysuckle to help their cats live happier and healthier lives.

ACKNOWLEDGMENTS

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ORIGINAL SOURCE ARTICLE

Bol, S., Scaffidi, A., Bunnik, E., and Flematti, G. 2022. Behavioral differences among domestic cats in the response to cat-attracting plants and their volatile compounds reveal a potential distinct mechanism of action for actinidine. *BMC Biol.* 20:192. doi: 10.1186/s12915-022-01369-1

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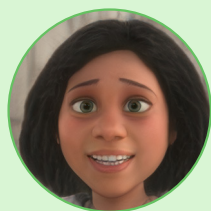
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YOUNG REVIEWERS

KENNEDY MIDDLE SCHOOL, AGES: 11–12

We are 6th graders in Mrs. Boczanowski's science classes on Team Independence at Kennedy Middle School. Our school is located in Natick, Massachusetts, which is a large town 20 min outside of Boston. Natick is known for being the home to former NFL player, Doug Flutie. Our school mascot is the cougar and we work everyday to R.O.A.R which means show Respect, take Ownership, accept Others, and be Responsible. We are focusing on life science topics this year including cells, human body systems, and ecosystems. We found the article about the effect of catnip very interesting!



SHRESTHA, AGE: 11

I am very much interested in Science and Mathematics. I love to observe the natural world. I also love dancing and traveling. Painting is one of my favorite hobbies.

AUTHORS

SEBASTIAAN BOL

Sebastian works as a scientist at Cowboy Cat Ranch. He studied molecular biology at Wageningen University and the University of Amsterdam in the Netherlands, where he was born and raised. He founded Cowboy Cat Ranch in 2016 after he, his wife Evelien, and their cats moved to a rural area close to San Antonio in Texas. In his free time, he enjoys remodeling the house to make it a cat paradise and working on their land to make it a good place for the local wildlife to live. He also loves smelling lots of different perfumes. *bol@cowboycatranch.org



JENNIFER FUENTES

Jennifer is a middle school science teacher in San Antonio, Texas. She was born in Uvalde, Texas and studied environmental science at Baylor University in Waco, Texas.



She began her teaching career in 2018 in a small rural Texas town called Gonzales. During her free time, she enjoys hiking, rock climbing, and cuddling her two dogs Gretchen and Charlie.

**ROLANDO GARZA**

Rolando is an M.D./Ph.D. student at the University of Texas Health Science Center in San Antonio. This means that when he is done with this 8-year program, he will be both a medical doctor and a scientist. He was born and raised in rural Texas and went to college at the University of Texas San Antonio. In addition to being very smart, he is super friendly and fun to be around. Rolando loves SpongeBob, dinosaurs, rock climbing, and playing one of his many guitars.

**EVELIEN M. BUNNIK**

Evelien started her own research laboratory at the University of Texas Health Science Center in San Antonio, Texas in 2016, where she studies the malaria parasite and how the human body defends itself against it. She was born in the Netherlands and studied at the Universities of Leiden and Amsterdam. Before she moved to Texas, she and Sebastiaan lived in beautiful California for 5 years. She enjoys cuddling the cats, running, cycling, and solving puzzles.