

Lesson 7. How Can We Explain How Anoles Evolved Bigger Toe Pads?











Plan Lesson 7

Students are introduced to the case of anoles evolving bigger and stickier toes when urbanization transforms their tropical forest environment into a city. From a video that tells the anole story, students look for evidence to check whether the 6 Key Steps hold for this new case.

In the second part of the lesson, students decide whether 3 statements about natural selection in anoles align with the 6 Key Steps or not. Then, if necessary, they correct the statements.

Learning Targets in this Lesson

- The same process of natural selection applies to present-day animals.

Sequence of Experiences			
1. Introduction		All Class	 5 Minutes
2. Explore Anoles		All Class	 10 Minutes
3. Investigation		Small groups	 10 Minutes
4. Make Meaning		All Class	 15 Minutes
5. Wrap up		All Class	 5 Minutes

Materials

For the class

The anoles video (4:33) <https://youtu.be/52cGcSgQQTo>

Slide deck for this lesson

Agree and disagree signs

A paper 6 Key Steps for the class to complete in the lesson. Keep and post after completion.

For each student

Notebook handout (activity page has been revised and is not the version in the notebook)

After completion, please have students put their initials on the handout and staple/tape it into their notebook on page 15

Preparation

- Locate the 6 Key Steps chart template in the L7 section of your crate with the “Story” column – equivalent to the “Story Strips” column from L4 – left to be filled in during the lesson.
- View the video, noting the questions you will ask students at each of the pauses.
- Review the reference chart at the end of the lesson to familiarize yourself with how the evidence from the anole video aligns with the 6 Key Steps in the chart.
- Review the natural selection statements and ways to correct inaccuracies.

The Lesson

1. Introduction



All Class



5 Minutes

Remind students that in the last class they used the 6 Key Steps chart to consider evidence from a radish plant investigation. They explored how natural selection explained the change in hairiness in a radish population whose habitat was invaded by caterpillars that preferred to eat plants with no or few hairs.

Today, they will see a video about a present-day animal population – small lizards called anoles. They will consider evidence from the video to explore whether the 6 Key Steps can account for changes in the anole population.

Today’s investigation question is:

How can we explain how anoles evolved bigger toe pads?

2. Explore Anoles



All Class



10 Minutes

Explain to students that they are going to see a video that shows scientists at work studying natural selection in anoles. They will be using evidence from the video to fill out a 6 Key Steps chart to explain the way in which anoles evolved stickier toes, just like with the radishes. Point to the blank 6 Key Steps chart and ask students to keep the steps in mind as they watch the video.

If students ask what a toepad is, you can tell them that the video will provide a definition.

Show the video. At the first pause, check for student understanding by asking one or two students to volunteer answers to the following questions:

- *Do you think there is variation in the toepads of the anoles?*
(Trait variant: smaller or larger toepads, more or fewer lamellae)
- *What environmental change did the anoles experience?*
(Environment changes: city has smooth metal objects such as light poles or hard surfaces and not a lot of rough bark to run up)

At the second pause, ask:

- *How do the toepads of city anoles differ from the toepads of forest anoles?*
(Beneficial trait: they have larger toepads, more lamellae and are thus stickier)
- *Why do you think it is beneficial to be able to run on slippery metal surfaces in the city?*
(Students can infer: catch flying insects as food, escape predators, find hiding places)

At the end of the video, ask:

- *Scientists found that city anoles moved faster than forest anoles. What did this tell scientists about their toe pads and lamellae?*
(Speed told them that city anoles had bigger and therefore stickier toe pads)
- *If you looked at the anoles in a city population after 10 generations, which toepad size do you think would be more common?*
(Beneficial trait becomes more common in the population over time)

Return to the blank 6 Key Steps chart. Remind students that their task is to use evidence from the video to explain how anoles evolved bigger toe pads. Get started by writing in the first blank box opposite “Variation in Traits”:

Trait: Toepad size. Variants: larger-smaller

Ask students what evidence there is for this statement (evidence: scientists measured the toepads).

Next, ask a volunteer for an idea to fill out each subsequent box. Also, ask how they know this. What is the evidence?

Explain that the video may not have provided evidence for all the boxes and so there they will infer what evidence they would look for. For example: *The video doesn't tell us why having larger toe pads meant anoles were healthier. Why do you think being able to climb slippery surfaces would result in healthier anoles that could have more offspring? And: How many generations do you think it might take for the anoles to evolve bigger toe pads?*

3. Investigation



Small groups



10 Minutes

Have students move into their small groups and look at the L7 revised activity handout

Three 3rd graders are talking about why anoles that live in the city have **bigger toe pads** than anoles that live in the forest.

Sam: I think city anoles needed bigger toe pads to climb hard surfaces, so they changed because they needed to.

Jeita: I think city anoles with smaller toe pads had offspring that always had bigger toe pads when they grew up.

Lee: I think city anoles with bigger toe pads could climb higher, so they were healthier and had more offspring with bigger toe pads.

Do you agree or disagree with each person's idea?

Sam: I think city anoles needed bigger toe pads to climb hard surfaces, so they changed because they needed to.
___ Agree or ___ Disagree
Tell Sam why you think so: _____

Jeita: I think city anoles with smaller toe pads had offspring that always had bigger toe pads when they grew up.
___ Agree or ___ Disagree
Tell Jeita why you think so: _____

Lee: I think city anoles with bigger toe pads could climb higher, so they were healthier and had more offspring with bigger toe pads.
___ Agree or ___ Disagree
Tell Lee why you think so: _____

Tell them that students in another class wrote the 3 explanations for how anole toe pads changed. Students should discuss all three statements and decide if they agree with them, and why or why not. They should circle whether they agree or disagree then tell Sam, Jeita and Lee why they agree or disagree

Sam: I think city anoles needed bigger toe pads to climb hard surfaces, so they changed because they needed to (preconception: need)

Jeita: I think city anoles with smaller toe pads had offspring that always had bigger toe pads when they grew up (preconception: development/aging)

Lee: I think city anoles with bigger toe pads could climb higher, so they were healthier and had more offspring with bigger toe pads (correct).

4. Make Meaning



All Class



15 Minutes

One option: Call for student attention and point out that there are two signs at opposite ends of the classroom: Agree and Disagree. Explain that you are going to read out, one at a time, the three statements small groups have been discussing. Each time you read out one of the statements, students should move to the “agree” or “disagree” area of the classroom.

After students have moved to one position or the other (or raised hands), ask one or two student volunteers from the “disagree” side to explain why they disagreed and how their group decided to correct the statement. Follow up with a volunteer or two from the “agree” side. Finally, check with the whole class if they have consensus on the three statements.

Second option: Especially if you are pressed for time, have students stay in their small groups. Students should raise hands if they agree or disagree with each statement and a representative of each group can explain their justification. NB: This option might facilitate more reasoning out loud.

Please have students put their initials on the handout and staple/tape it into their notebook on page 15.

5. Wrap Up



All Class



5 Minutes

Ask students what ideas and information they will “take away” from today’s lesson to decide what they should record on the Takeaways Chart.

Listen for these ideas. Use student language as much as possible when you write them on the Takeaways Chart:

- The 6 Key Steps of natural selection can explain how a beneficial trait variant – larger toe pads with more lamellae – became more common in the anole city population over time.
- It is easy to describe the 6 Key Steps of natural selection incompletely.

Our question for next time is:

What evidence explains the evolution of new species over time?

[Save the 6 Key Steps chart you filled in today for future reference]