

## Photo Description



This image shows a gray tree frog clinging to a white wooden surface with its sticky toe pads spread wide. You can see the frog's bumpy skin, large round eyes, and long back legs bent in a climbing position. The frog's coloring helps it blend in with tree bark and wood, which is called camouflage.

## Scientific Phenomena

**Anchoring Phenomenon:** How can a frog stick to smooth surfaces without falling?

This image illustrates adhesive toe pads, a specialized adaptation that allows tree frogs to climb vertical surfaces. Tree frogs have special sticky cells on their toes that create suction and grip surfaces through moisture and tiny hair-like structures. This adaptation evolved because tree frogs need to live and hunt on trees and branches where ground-dwelling animals cannot reach them. The bumpy texture of their skin also helps them blend into their forest habitat, reducing predation risk.

## Core Science Concepts

- \* **Adaptation and Survival:** Frogs have special body parts (toe pads, camouflage coloring, powerful back legs) that help them survive in their specific environment.
- \* **Life Cycle of Amphibians:** Frogs are amphibians that begin life in water as tadpoles and transform into adults that live on land and in water. This process is called metamorphosis.
- \* **Habitats and Ecosystems:** Different animals are suited to different habitats. Tree frogs live in forests and woodlands where they have access to trees, insects, and moisture.
- \* **Animal Classification:** Amphibians are a group of animals with moist skin, legs (or no legs), and a life cycle that includes water and land stages. Frogs are one example of amphibians.

### Pedagogical Tip:

When teaching about frog adaptations, encourage students to physically act out how tree frogs climb by having them pretend their fingers are toe pads—they'll better understand how suction and grip work through kinesthetic learning. This also makes the abstract concept concrete and memorable.

### UDL Suggestions:

To support diverse learners: Provide images of frogs in different habitats (tree frogs, bullfrogs, poison dart frogs) so students can see how adaptation varies. Use both visual and tactile materials—let students touch textured surfaces and smooth surfaces to compare, then relate this to frog skin. Offer vocabulary cards with pictures for English language learners, and allow students to use digital tools to research frog adaptations at their own pace.

## Zoom In / Zoom Out

### Zoom In: Microscopic Level

If we could shrink down and look at a tree frog's toe pad under a microscope, we would see millions of tiny hair-like structures called setae (pronounced SEE-tee). These setae are so small you cannot see them without a microscope! Each seta is thinner than a human hair. When a frog presses its toe pad on a surface, water between the setae creates a weak electrical attraction called van der Waals forces. This invisible force, combined with moisture and the tiny hairs, allows the frog to stick without any glue. Scientists study these toe pads to create new sticky materials for robots and climbing equipment!

### Zoom Out: Forest Ecosystem Level

A tree frog doesn't live alone—it's part of a whole forest ecosystem. The frog climbs trees to hunt insects, hide from predators like snakes and birds, and find mates. The trees provide shelter and hunting grounds. Insects pollinate the flowers and plants that grow in the forest. When the frog dies, it returns nutrients to the soil, feeding the trees. During breeding season, tree frogs return to ponds and streams (their connection to water) where they lay eggs that become tadpoles. This entire interconnected system—trees, insects, water, soil, and frogs—depends on each part working together. If trees disappear, frogs lose their homes and cannot survive.

## Discussion Questions

1. What body parts does this tree frog have that help it climb trees? Why do you think evolution gave it these special toes? (Bloom's: Analyze | DOK: 3)
2. If a frog lived in a dry desert instead of a wet forest, how might its body be different? What would it need to survive? (Bloom's: Evaluate | DOK: 3)
3. How do you think the frog's gray color helps it survive? Where else in nature do you see animals that match their surroundings? (Bloom's: Analyze | DOK: 2)
4. A frog starts as a tiny tadpole in water and becomes an adult frog on land. Why do you think amphibians need both water and land to survive? (Bloom's: Comprehend | DOK: 2)

## Potential Student Misconceptions

Misconception 1: "Frog toe pads work like glue or suction cups."

Clarification: Tree frog toe pads don't stick like tape or glue. Instead, they use a combination of moisture, tiny hair-like structures, and weak forces between molecules to grip surfaces. The frog's toe pad must stay moist to work—if it dries out, the frog loses its grip! This is why tree frogs must live in humid forests, not dry deserts.

Misconception 2: "All frogs have sticky toe pads and can climb trees."

Clarification: Only some frogs have special sticky toe pads designed for climbing. Bullfrogs and leopard frogs have regular feet for hopping on the ground or swimming in water. Different frogs have adapted to different habitats. A bullfrog's flat feet are perfect for life in a pond, but they wouldn't help it climb a tree!

Misconception 3: "Adult frogs don't need water to survive."

Clarification: Even though adult frogs live mostly on land or in trees, they still need moisture. Frogs breathe partly through their moist skin, so they must keep it wet. Tree frogs live in humid, wet forests. All frogs must return to water to lay their eggs. Water is essential to the frog life cycle and survival.

### Extension Activities

1. Frog Adaptation Investigation: Show students pictures of 5–6 different frog species (tree frog, bulldog, poison dart frog, leopard frog, etc.). Have students create a chart comparing their colors, sizes, and habitats. Ask: "Which adaptations help each frog survive in its home?" Students can present their findings to the class.
2. Sticky Toe Pad Simulation: Create a hands-on experiment using craft materials. Give students small cardboard circles and different adhesive materials (dry, wet, with fabric, etc.) to test which "toe pad" works best to pick up small objects from a smooth surface. Record results and discuss how real frog toe pads work similarly.
3. Life Cycle Sequencing and Drama: Provide students with images of the frog life cycle (egg, tadpole, tadpole with legs, froglet, adult frog). Have students sequence the images, then act out each stage in a short performance for the class. This kinesthetic approach reinforces metamorphosis understanding.

### Cross-Curricular Ideas

#### Math Connection: Measuring and Comparing

Have students measure the length and width of different frog species using a ruler or measuring tape. Create a bar graph comparing frog sizes (tree frog vs. bullfrog vs. poison dart frog). Students can calculate the difference in size between the largest and smallest frog. This reinforces measurement, data organization, and graphing skills while exploring frog diversity.

#### ELA Connection: Narrative Writing and Research

Ask students to write from the perspective of a tree frog: "A Day in My Life as a Tree Frog." Students research what tree frogs eat, where they hide, how they hunt, and when they sleep. This combines creative writing with informational research. Students can also read picture books about frogs and retell the story in their own words, strengthening comprehension and communication skills.

#### Art Connection: Camouflage and Nature Illustration

Have students create a mixed-media artwork showing a tree frog in its natural habitat, emphasizing how its coloring helps it hide. Provide images of different frog species and ask students to illustrate one with accurate colors and patterns. Students can use watercolor, colored pencils, or collage materials. This connects biology to visual arts and helps students observe details in nature.

#### Social Studies Connection: Habitats and Human Impact

Discuss how forests are disappearing due to human activities like logging and building. Ask: "Where would tree frogs go if their forests were cut down?" Students can research a rainforest or wetland habitat and create a poster about protecting frog habitats. This introduces concepts of conservation, environmental responsibility, and human-environment relationships appropriate for Fourth Grade citizenship.

### STEM Career Connection

#### Herpetologist (Reptile and Amphibian Scientist)

A herpetologist is a scientist who studies frogs, snakes, lizards, turtles, and other reptiles and amphibians. They observe frogs in nature, study how they adapt to their environments, and work to protect endangered species. Some herpetologists help save frogs whose habitats are being destroyed by pollution or development. If you love frogs and want to help protect them, this could be your job! Average Salary: \$65,000–\$75,000 per year

#### Biomimicry Engineer

A biomimicry engineer is a scientist or inventor who studies how animals work in nature and then designs new materials or machines based on those ideas. For example, engineers have studied tree frog toe pads and created sticky materials for robots that can climb walls! These engineers combine their love of nature with problem-solving to invent new technologies. Average Salary: \$70,000–\$95,000 per year

#### Wetland Ecologist

A wetland ecologist studies ponds, marshes, swamps, and other wet environments where frogs and other animals live. They monitor the health of these habitats, protect them from pollution, and help restore damaged wetlands so that frogs and fish can thrive. This job takes you outdoors to observe nature and work with communities to keep water sources clean and healthy. Average Salary: \$60,000–\$80,000 per year

### NGSS Connections

#### Performance Expectation:

4-LS1-1: Use evidence to construct an explanation for how the structure of an organism is related to its function. | 4-LS4-2: Make observations that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

#### Disciplinary Core Ideas:

- 4-LS1-A Structure and Function: Every organism has different body structures that serve different functions in growth, survival, and reproduction.
- 4-LS4-C Adaptation: For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. The way in which an organism's structures function to help it survive in its environment is called adaptation.

#### Crosscutting Concepts:

- Structure and Function: The structures of organisms are related to the job those structures perform.
- Adaptation: Organisms have traits that help them survive in their environments.

### Science Vocabulary

- \* Amphibian: An animal with moist skin that lives part of its life in water and part of its life on land (like frogs and salamanders).
- \* Adaptation: A special body part or behavior that helps an animal survive in its environment.
- \* Camouflage: Colors or patterns on an animal's body that help it blend in with its surroundings so predators cannot see it.
- \* Metamorphosis: A big change in how an animal's body looks as it grows from a baby to an adult.
- \* Habitat: The place where an animal or plant lives and finds food, water, and shelter.
- \* Toe Pads: Special sticky parts on a frog's feet that help it grip and climb smooth surfaces.

### External Resources

#### Children's Books:

- From Tadpole to Frog by Wendy Pfeffer (shows life cycle with clear illustrations)
- Leap, Frog by Jane Sutton and John Nez (introduces frog adaptations and survival)
- Tree Frogs by John Crossingham and Bobbie Kalman (detailed look at tree frog adaptations)