

## Photo Description



A large cicada with golden-brown coloring sits on a tree branch surrounded by colorful autumn leaves. The insect has clear, veined wings and large eyes that help it see predators. You can observe the cicada's strong legs that help it grip onto tree bark and branches.

## Scientific Phenomena

This image captures the Anchoring Phenomenon of cicada emergence and survival behavior. Cicadas spend most of their lives underground as nymphs, feeding on tree root fluids for 13 or 17 years depending on the species. When soil temperatures reach exactly 64°F, they emerge simultaneously in massive numbers, molt into adults, and climb trees to mate and lay eggs. This synchronized emergence is a survival strategy called "predator satiation" - by appearing in huge numbers all at once, most cicadas survive even though predators eat many of them.

## Core Science Concepts

1. Life Cycles and Metamorphosis: Cicadas undergo incomplete metamorphosis with three stages - egg, nymph, and adult - spending most of their lives in the underground nymph stage.
2. Behavioral Adaptations: Synchronized emergence in massive numbers overwhelms predators, ensuring species survival through a strategy called predator satiation.
3. Physical Adaptations: Large compound eyes for detecting movement, strong claws for gripping surfaces, and specialized wing structures for producing loud mating calls.
4. Ecosystem Interactions: Cicadas serve as both herbivores (feeding on plant roots) and prey species, transferring nutrients from underground root systems to above-ground food webs.

### Pedagogical Tip:

Use the "Think-Pair-Share" strategy when introducing cicada life cycles. Have students first think individually about what they know about insects that live underground, then pair up to discuss their ideas, and finally share with the whole class. This builds on prior knowledge while introducing new concepts.

### UDL Suggestions:

Provide multiple ways for students to represent their understanding of cicada adaptations - they can draw and label diagrams, create clay models, act out behaviors, or write descriptive paragraphs. This supports different learning preferences and abilities.

### Zoom In / Zoom Out

1. **Zoom In:** At the cellular level, specialized cells in cicada wing muscles contract rapidly to create vibrations that produce their characteristic loud calls. These muscle cells can contract up to 400 times per second, making cicadas some of the loudest insects on Earth.
2. **Zoom Out:** Cicada emergences affect entire forest ecosystems by providing massive amounts of protein to birds, mammals, reptiles, and other insects. Their tunneling activities also aerate soil and their decomposing bodies add nitrogen and other nutrients to forest soils.

### Discussion Questions

1. "How do you think spending 17 years underground helps cicadas survive as a species?" (Bloom's: Analyze | DOK: 3)
2. "What patterns do you notice in when and how cicadas emerge from the ground?" (Bloom's: Analyze | DOK: 2)
3. "If climate change causes soil to warm up earlier each year, how might this affect cicada populations?" (Bloom's: Evaluate | DOK: 4)
4. "What evidence from the photo shows how this cicada is adapted to live in trees?" (Bloom's: Apply | DOK: 2)

### Potential Student Misconceptions

1. Misconception: "Cicadas are the same as locusts and will eat all the plants."  
Clarification: Cicadas are not locusts and do not eat leaves or crops. Adult cicadas barely eat at all, only sipping small amounts of tree sap.
2. Misconception: "Cicadas come out every summer like other bugs."  
Clarification: Most cicada species have 13 or 17-year life cycles and emerge only during specific years, not annually.
3. Misconception: "The loud buzzing sound means cicadas are angry or dangerous."  
Clarification: Male cicadas make loud calls to attract mates for reproduction, not as a warning or threat. Cicadas cannot bite or sting humans.

### Cross-Curricular Ideas

1. Math - Data Analysis: Create a bar graph showing the number of years different cicada species spend underground (13 years vs. 17 years). Students can calculate how many days that equals and compare it to their own age. They could also estimate how many cicadas emerge in a given area based on sample counts.
2. ELA - Informative Writing: Have students write an explanatory paragraph from the perspective of a cicada nymph describing what happens during its 17 years underground. They should use sensory details and sequence words to describe the journey from egg to emergence. This builds narrative writing skills while reinforcing scientific understanding.
3. Art - Nature Illustration: Students create detailed colored-pencil or watercolor drawings of cicadas in their natural habitat, paying close attention to the wing vein patterns, body segments, and colors visible in the photo. Display finished artwork alongside labeled diagrams of cicada anatomy, combining scientific accuracy with artistic expression.
4. Social Studies - Patterns and Cultural Impact: Research how cicada emergences are celebrated or documented in different communities and cultures. Students can create a map showing where major cicada emergences occur in the United States and discuss how communities prepare for or respond to these natural events.

## STEM Career Connection

1. Entomologist (Insect Scientist): Entomologists study insects like cicadas to understand how they live, grow, and interact with their environments. They observe insects in nature, conduct experiments in laboratories, and help protect forests and crops. Some entomologists even travel to different countries to discover new insect species! Average Salary: \$65,000 per year
2. Ecologist (Ecosystem Scientist): Ecologists study how animals like cicadas fit into their ecosystems and affect other living things. They research questions like "What happens to birds when cicadas emerge?" and "How do cicadas help forests stay healthy?" Their work helps us understand and protect nature. Average Salary: \$68,000 per year
3. Sound Engineer/Bioacoustics Specialist: These scientists study the sounds that animals make, including the loud calls male cicadas produce to attract mates. They use special equipment to record and analyze insect sounds, and their research helps us understand animal communication and behavior. Average Salary: \$62,000 per year

## NGSS Connections

- Performance Expectation: 5-LS2-1 - Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment
- Disciplinary Core Ideas: 5-LS1.A - Structure and Function, 5-LS2.A - Interdependent Relationships in Ecosystems
- Crosscutting Concepts: Patterns, Structure and Function, Systems and System Models

## Science Vocabulary

- \* Emergence: When cicadas come out of the ground all at the same time after many years underground.
- \* Nymph: The young form of a cicada that lives underground and looks different from the adult.
- \* Adaptation: A special body part or behavior that helps an animal survive in its environment.
- \* Predator satiation: A survival strategy where so many animals appear at once that predators cannot eat them all.
- \* Synchronous: Happening at exactly the same time across a large area.
- \* Compound eyes: Eyes made of many small parts that help insects see movement and light.

## External Resources

Children's Books:

- Cicadas! Strange and Wonderful by Laurence Pringle
- Billions of Cicadas by Rebecca Hirsch
- The Year of the Cicadas by Rebecca Hirsch