

## Photo Description



A green chrysalis hangs from a wooden beam, suspended by a thin stem. The chrysalis has a smooth, jade-colored shell with small yellow markings and black spots. This protective casing shows the amazing transformation happening inside as a caterpillar changes into a butterfly.

## Scientific Phenomena

This image captures the metamorphosis phenomenon, specifically the pupal stage of a butterfly's life cycle. Inside this chrysalis, the caterpillar's body is completely breaking down and rebuilding into a butterfly through a process called histolysis and histogenesis. Special groups of cells called imaginal discs, which were dormant during the caterpillar stage, are now rapidly dividing and forming adult butterfly structures like wings, antennae, and reproductive organs. This complete transformation typically takes 1-2 weeks depending on the species and environmental conditions.

## Core Science Concepts

1. Complete Metamorphosis: Butterflies undergo four distinct life stages - egg, larva (caterpillar), pupa (chrysalis), and adult butterfly, with dramatic changes between each stage.
2. Structural Adaptations: The chrysalis provides protection during the vulnerable transformation period, with its hard outer shell and camouflaged coloring helping it survive predators.
3. Life Cycles in Nature: This represents how living organisms grow, develop, and reproduce in predictable patterns that ensure species survival.
4. Energy and Matter Transfer: The caterpillar stored energy and nutrients that are now being reorganized to build the butterfly's body structures.

### Pedagogical Tip:

Use this image to help students understand that growth isn't always gradual - sometimes organisms undergo dramatic changes. Connect this to students' own growth spurts or losing baby teeth as examples of significant developmental changes.

### UDL Suggestions:

Provide multiple representations of metamorphosis including time-lapse videos, physical models, and hands-on activities like raising painted lady butterflies in the classroom to support different learning preferences and provide concrete experiences.

### Zoom In / Zoom Out

**Zoom In:** At the cellular level, enzymes are breaking down caterpillar tissues while stem-like cells rapidly divide and differentiate to form completely new organs. DNA is switching on different genes to create butterfly characteristics that were never expressed during the caterpillar stage.

**Zoom Out:** This metamorphosis is part of larger ecological relationships where adult butterflies will pollinate flowers, helping plants reproduce, while also serving as food sources for birds, spiders, and other predators in the food web.

### Discussion Questions

1. What advantages might this complete transformation give butterflies compared to animals that look similar throughout their lives? (Bloom's: Evaluate | DOK: 3)
2. How does the chrysalis structure protect the developing butterfly inside? (Bloom's: Analyze | DOK: 2)
3. What would happen to butterfly populations if something disrupted the chrysalis stage? (Bloom's: Predict | DOK: 3)
4. How is a butterfly's metamorphosis similar to and different from how humans grow and change? (Bloom's: Compare | DOK: 2)

### Potential Student Misconceptions

1. Misconception: The caterpillar just grows wings and becomes a butterfly.  
Reality: The caterpillar's body completely dissolves and rebuilds into an entirely different form with new organs and structures.
2. Misconception: The chrysalis is like a cocoon that moths make.  
Reality: Butterflies form chrysalides (hard cases), while moths typically spin cocoons (silky wrappings).
3. Misconception: The transformation happens quickly, like in cartoons.  
Reality: Metamorphosis takes 1-2 weeks of complex biological processes occurring inside the protective casing.

### Cross-Curricular Ideas

1. Math Connection - Measuring Time and Growth: Have students create a timeline showing the butterfly life cycle with estimated durations for each stage. Students can use a number line or calendar to calculate how many days a chrysalis stage lasts, then compare it to other animal development periods. This connects to measurement and data skills.
2. ELA Connection - Narrative Writing: Ask students to write from the perspective of a caterpillar entering the chrysalis, describing what they imagine happening inside during the transformation. This creative writing activity helps students practice descriptive language while deepening their understanding of metamorphosis as a dramatic change.
3. Art Connection - Life Cycle Illustration: Have students create a four-panel comic strip or illustrated poster showing the complete butterfly life cycle, using the chrysalis as one key panel. Students can research and draw their chosen butterfly species, reinforcing both scientific accuracy and artistic skills.
4. Social Studies Connection - Migration and Geography: Connect butterfly metamorphosis to monarch butterfly migration patterns. Students can research where monarchs travel, map their routes, and discuss how the complete life cycle is essential for their survival across different environments and seasons.

## STEM Career Connection

1. Entomologist (Bug Scientist): An entomologist is a scientist who studies insects like butterflies, moths, beetles, and ants. They observe how insects grow, what they eat, and how they help our environment. Some entomologists work in labs raising butterflies to understand metamorphosis better, while others study insects in nature to protect endangered species. Average Salary: \$65,000
2. Botanist/Plant Scientist: Botanists study plants and how they grow. Many botanists work closely with butterflies because adult butterflies help flowers by spreading pollen. These scientists might study which plants butterflies visit and how to grow gardens that attract and support healthy butterfly populations. Average Salary: \$63,000
3. Environmental Educator: Environmental educators teach people of all ages about nature and wildlife, including butterfly life cycles. They might work at nature centers, zoos, or schools, leading programs where people can observe chrysalides and watch butterflies emerge. They help communities understand why protecting habitats is important for insects and other animals. Average Salary: \$45,000

## NGSS Connections

- Performance Expectation: 3-LS1-1: Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.
- Disciplinary Core Ideas: 3-LS1.B Growth and Development of Organisms
- Crosscutting Concepts: Patterns and Systems and System Models
- Science and Engineering Practice: Developing and Using Models

## Science Vocabulary

- \* Metamorphosis: The process of complete change from one life stage to another in certain animals.
- \* Chrysalis: The hard protective casing that surrounds a developing butterfly during its transformation.
- \* Pupa: The life stage between larva and adult when metamorphosis occurs.
- \* Life cycle: The series of changes an organism goes through as it grows and develops.
- \* Adaptation: A special feature that helps an organism survive in its environment.

## External Resources

Children's Books:

- From Caterpillar to Butterfly by Deborah Heiligman
- The Very Hungry Caterpillar by Eric Carle
- Waiting for Wings by Lois Ehlert