

Complete Metamorphosis (Monarch Butterfly)

Scientific Background

Many insects, including bees, flies, butterflies, and beetles, undergo complete metamorphosis. This means that they have a four-stage life cycle.

The insect starts its life as an *egg*. After it emerges from its egg, the insect is called *larva*. A larva that undergoes complete metamorphosis does not look like the adult form of the insect. There may be several stages of development while the insect is in its larval stage. In the next life cycle stage, the larva changes into a *pupa*. An *adult* insect emerges after it develops during its pupa stage and continues the life cycle by reproducing and laying eggs.

Scientists believe that the differences between adults and larva diminish competition between the life cycle stages for resources and allow the adults to specialize in breeding and dispersing eggs to new sites.

This diagram shows the steps of complete metamorphosis.

Egg » Larva » Pupa » Adult »

Vocabulary

- adult
- egg
- holometabolous
- life cycle
- complete metamorphosis
- generation
- larva
- pupa

*Vocabulary definitions can be found in the **Backyard Bugs** Glossary.*

Thinking Question

What are the similarities and differences between the egg, larva, pupa, and adult stages of an insect that goes through complete metamorphosis?

Exploratory and Extension Activities

Additional Exploratory and Extension activities are available in the Backyard Bugs Teacher’s Guide.

Monarch Butterfly Migration

Using a map of North America and colored pins or dots, plot the migration path of Monarch butterflies. Use data found at Journey North (“Engaging Students in a Global Study of Wildlife Migration”) (www.learner.org/jnorth) or other resources.

Using a world map and colored pins or dots, identify the countries around the world where Monarchs have been sighted. Have students name the country, its capital, and the continent it is found on.

Using Commas

Discuss how to use commas in a series of three similar things. This sentence can be used as an example: Some caterpillars eat pears, apples, and leaves.

On a prepared worksheet, have students circle each comma in a series of six sentences related to a bug: for example, "The stages for the caterpillar's life cycle are an egg, a pupa, a caterpillar, and an adult."

Create two additional sentences that do not have series commas in place. Ask students to add the commas in the correct places. Ask students to complete the lesson by writing their own bug-related sentence that uses series commas.





Name: _____



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Life Cycle Stages of the Monarch Butterfly	Describe what is happening to the Monarch butterfly in each life cycle stage.
	
	
	
	
	
	

Answer Key

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Life Cycle Stages of the Monarch Butterfly	Describe what is happening to the Monarch butterfly in each life cycle stage.
	<p><i>Suggested answers:</i> This is a Monarch butterfly's egg. The egg is cone shaped and ribbed. Female Monarch butterflies lay their eggs on milkweed plants. They can lay up to 500 eggs. The egg is as tiny as a pinhead. It takes a caterpillar 4 to 5 days to grow inside the egg. The egg is ready to go to the next stage of metamorphosis (the larva stage) when you see a black dot at the top of each egg. The black dot is the head of the caterpillar (or larva) inside.</p>
	<p><i>Suggested answers:</i> After hatching, the tiny caterpillar (or larva) begins eating its eggshell. Then it makes small holes in the milkweed leaves. There are 5 separate larval stages, called instars. As the caterpillar grows and its skin tightens, it forms a new bigger one inside the old one. Then the larva breaks and sheds the old skin to become the next instar. During the course of its development, the caterpillar's weight increases nearly 2,800 times, and it eats nearly 9,000 times its own weight in leaves. As the caterpillar changes instars, it develops conspicuous black, yellow, and white stripes and movable tentacles. This advertises to predators that the caterpillar is bitter tasting. Milkweed leaves contain bitter substances that the caterpillar stores and uses to discourage birds and mice from eating it. After about two weeks, the two-inch-long caterpillar stops eating. It is now ready for the next stage of its metamorphosis, the pupa, or chrysalis stage. Now the caterpillar becomes restless and wanders around for a few hours in search of the right spot that will offer it shelter from the scorching sun and rain. Once it finds the right spot, the caterpillar spins a silk button by using a tiny tube on its mouth called a spinneret. Next, the caterpillar turns around and attaches hooks (cremaster) on its hind legs to the silk button. Then the caterpillar lets go with all its other legs. It now hangs upside down, forming the shape of the letter J. It starts to develop its chrysalis.</p>
	<p><i>Suggested answers:</i> This is the Monarch butterfly's pupa stage. Gradually the chrysalis hardens into a beautiful jade-colored, hard, smooth case, decorated with golden dots. Inside this jewel, the old caterpillar tissues gradually transform into an adult butterfly. This process takes about 7 days at normal summer temperatures. You can tell when the butterfly is ready to emerge. About 12 hours before the butterfly will emerge, the chrysalis begins to darken and the pupa's skin becomes clear enough to see the orange and black color of the adult Monarch butterfly's wings inside.</p>
	<p><i>Suggested answers:</i> The Monarch butterfly that is a pupa in its chrysalis is ready to emerge from the chrysalis as an adult Monarch butterfly. You can see the orange and black wings inside. The adult's proboscis lies unfolded along the ventral center; its legs are on either side of it. The antennae lie alongside the legs. The Monarch butterfly's abdomen points backwards towards the cremaster. The seam along the back of the chrysalis cracks and opens just behind the adult's head to let the butterfly tumble out. The adult butterfly clings to the empty case with four of its legs. At first, the wings are like thick flat balloons that will be inflated with blood that is pumped from the abdomen into the veins of the wings. In its adult life cycle stage, the Monarch butterfly can</p>

	<p>reproduce and lay eggs.</p> <p><i>Suggested answers:</i> You can tell the adult male Monarch butterflies from the adult female Monarch butterflies by the black pouch coverings. These pouches contain a perfume that is irresistible to the adult females. This pair of Monarch butterflies is starting to mate. The male carries the female up into a tree or bush, hidden from predators. Over the next few hours the male transfers his sperm into the adult female. Later, the female Monarch butterfly flies away in search of milkweed plants on which to lay her eggs.</p>
	<p><i>Suggested answers:</i> The female Monarch butterflies lay eggs only on milkweed plants. This is because milkweed plants are the only plants the Monarch caterpillars (or larvae) can eat. In North America, Monarch butterflies have a choice of 106 different species of milkweed plants to lay their eggs on. The female Monarch butterfly can lay up to 500 eggs, but usually she lays them one at a time, to assure that predators can't find all of the eggs.</p>