


A MONARCH METAMORPH

BY JESSICA CANCELLIERE | PHOTOS BY ELIZABETH MARSHALL


The iconic monarch butterfly (*Danaus plexippus*) is one of the most familiar and beloved insects in North America, famous for its spectacular annual migrations and bright colors that send a warning signal to predators. For many, our deep appreciation for monarchs stems from our fond childhood memories of observing them in the classroom. Educators have long realized the value of bringing these charismatic creatures into the classroom to let children witness, firsthand, the stunning transformation from caterpillar to butterfly. Observing monarchs up close, as children, creates a strong and lasting connection with the butterfly, and brings science into our lives in a personal way.

The fantastic, abrupt change in form from larva to pupa to adult, known as complete metamorphosis, occurs in many insects, including flies, wasps, beetles, moths, caddisflies, and others. The monarch, however, perfectly embodies this transformation, and continuously fascinates and mystifies even those prone to stomping on, cursing at, swatting at, or ignoring insects altogether.

In May, we begin to see the Mexican monarch migrants return to the North. By early June, the females have deposited their eggs individually on milkweed leaves, and by midsummer, the striking yellow-black-and-white banded caterpillars adorn most milkweed plants. Eventually, the mature caterpillars attach themselves to the milkweed plant with silk threads, then transform into a remarkable green-and-gold chrysalis. About six weeks after the egg was laid, an adult butterfly emerges from the chrysalis. It will soon be part of a new generation that will begin the species' long journey back to Central Mexico for the winter.



As the chrysalis cracks open, the monarch slowly emerges with tiny, crumpled, wet wings.



From the outside, few changes are apparent until the final day, when the black, orange, and white wing patterns of the adults are visible through the chrysalis.

THE PROCESS OF METAMORPHOSIS

The transformation from pupa to adult takes about 9 to 15 days. Most of the physiological and morphological changes that produce an adult monarch actually begin in the larva (caterpillar). The wings and other adult organs develop from tiny clusters of cells already present in the larva, and by the time it pupates, the monarch has already begun the major

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About an hour after emerging from its chrysalis, the monarch's wings are full-sized, dry, and ready for flying.

The butterfly clings to the empty chrysalis shell as its heart pumps hemolymph through the body cavities, and the insect visibly begins to grow.

The body and wings begin to enlarge as hemolymph (insect blood) begins to pump through.



changes to attain its adult form. As it forms the pupa, the antennae, proboscis, wings, and legs move to the surface, just inside the exoskeleton. Inside the chrysalis, the monarch's mouth parts are reconstructed from the leaf-chewing mouth parts of the caterpillar to the nectar-sucking proboscis of the adult butterfly. The emerging butterfly will have six legs instead of the eight it had as a caterpillar, and its eyes will grow larger to provide better vision for finding flowers to feed from. Flight muscles will reorganize in the thorax, and reproductive organs will also form.

The transformation from a caterpillar into a majestic monarch is truly amazing, yet, ironically, the butterfly's lifespan is short, generally only about two to six weeks. However, the last generation of the year (typically born in late summer) do survive longer and often overwinter in California or Mexico. The main function of a female monarch is reproduction, and during its brief life, it will lay up to 300 eggs. Soon after, the eggs hatch and a new metamorphosis will begin, leading to the next generation of these beloved butterflies.