

EXPLORE

IN THIS SECTION
Below Yellowstone
Soggy Mars
Deadly Mates
Obituary for a Lion



ILLUMINATING THE MYSTERIES—AND WONDERS—ALL AROUND US EVERY DAY

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INITIAL LARVAL STAGE
(15-20 DAYS)

MOLTING LARVA
(5-30 MINUTES)

PRE-CHRYSLIS
(3-5 DAYS)

CHRYSLIS
(10-15 DAYS)

EMERGING BUTTERFLY
(0.5-2 HOURS)



1

Activation

A caterpillar eats often and grows quickly. It molts several times, each molt marking a new larval stage, until it reaches maturity. Then its hormones shift, signaling the onset of the chrysalis phase.

Art shows blue morpho (*Morpho menelaus*) at actual size except where noted.



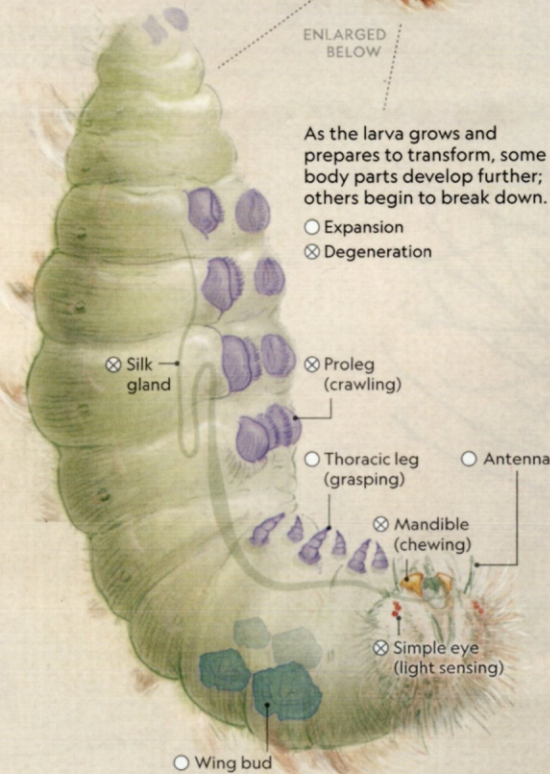
3

Emergence

The butterfly sucks in air until its chrysalis breaks open. It then flaps its wings for several hours to dry them and to circulate blood before flying off in search of a mate.

PROGRAMMED TO CHANGE

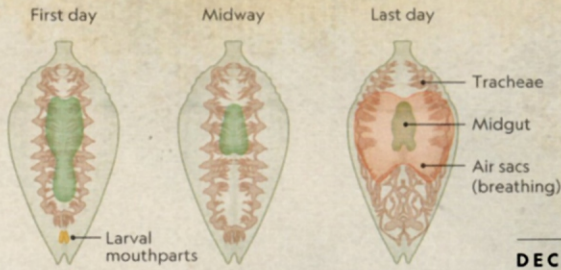
METAMORPHOSIS IS A RADICAL CHANGE in form and function. Frogs and sea urchins metamorphose. Many insects do too, shifting from crawling larva to flying wasp, beetle, or moth. Perhaps the most familiar metamorphosis—the one that's the subject of countless school science projects—is the butterfly's transformation from caterpillar to winged beauty. Yet scientists are only now beginning to grasp what goes on inside a chrysalis. New research suggests that the caterpillar does not dissolve into a "soup," as once thought. Rather, the insect's makeover is a programmed mix of destruction and growth. Certain cells die, and body parts atrophy. Meanwhile, other cells, in place since birth, rapidly expand. In as little as two weeks, the adult emerges entirely remodeled, capable of flight—and bent on finding a mate.



As the larva grows and prepares to transform, some body parts develop further; others begin to break down.

- Expansion
- ⊗ Degeneration

Caterpillars are born with four internal buds that are genetically programmed to grow into wings.



A NEW WAY TO SEE INSIDE
Until recently, the only way to study a chrysalis's development was to cut it open or x-ray it—with fatal results. Now 3D models from harmless micro-CT scanning reveal details: The trachea expands to allow increased oxygen intake, and the gut shrinks to adjust to a diet that switches from plants to nectar.

DECODER BY DAISY CHUNG

2

Transformation

Once it's big enough, a caterpillar finds a safe spot and often attaches itself to it with silk. A final molt reveals a shell called a chrysalis; inside, the insect changes dramatically in preparation for adult life.

Leg upgrade

Stubby prolegs that help a caterpillar move degenerate; thoracic legs grow to adult size.

Wing expansion

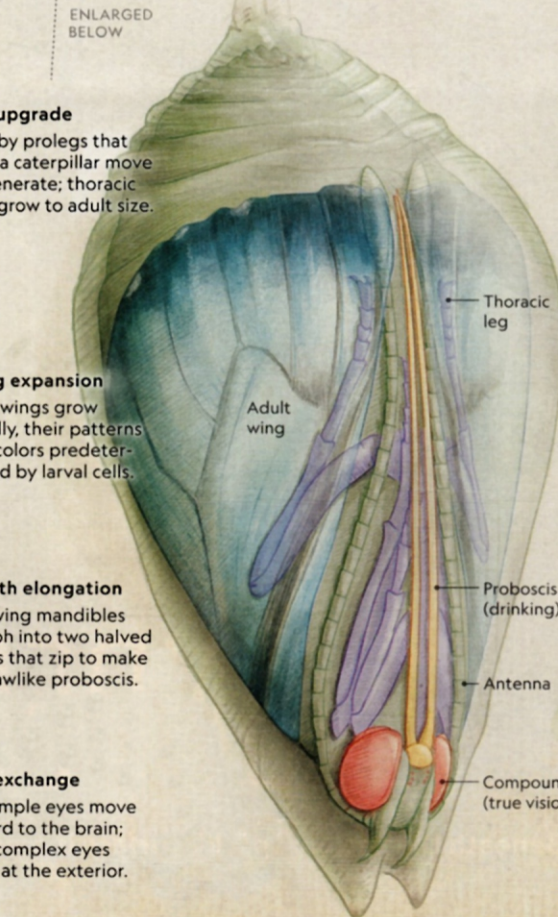
Four wings grow rapidly, their patterns and colors predetermined by larval cells.

Mouth elongation

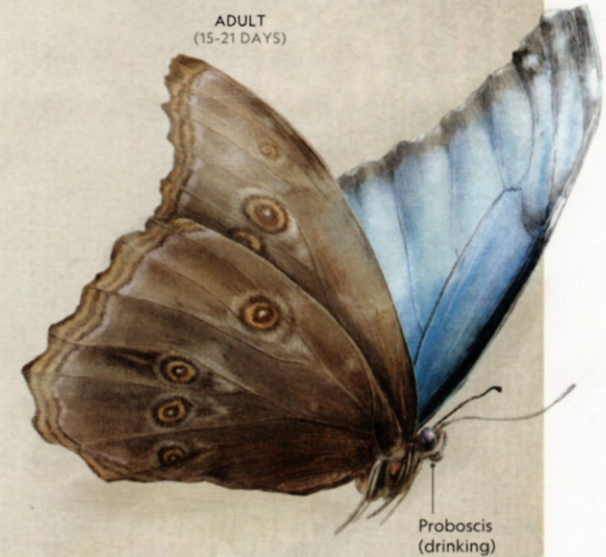
Chewing mandibles morph into two halved pipes that zip to make a strawlike proboscis.

Eye exchange

Six simple eyes move inward to the brain; two complex eyes form at the exterior.



ADULT
(15-21 DAYS)



Butterfly brains are almost completely rewired to meet the flying insect's new needs, but they may retain some olfactory memories from the larval stage.

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