

The *magic* of Morphing

Some creatures
morph—changing
from one form to
another as they
grow up.

By Mary Hoff

CATERPILLARS turn into butterflies. Tadpoles turn into frogs. Maggots turn into flies. Grubs turn into beetles. In fact, many animals start out looking like one kind of creature and end up like something else entirely. To make the change, they go through a shape-shifting process known as *metamorphosis*.

Underwater (left) the green darner nymph feeds on aquatic insects. As an adult (right) the green darner dragonfly swoops and dives at speeds up to 55 miles per hour to capture its primary prey: the mosquito.

GARY MESZAROS, DEMBINSKY PHOTO ASSOCIATES

SKIP MOODY, DEMBINSKY PHOTO ASSOCIATES

Match the Larvae with the adult.



1. Mosquito



2. Green frog



3. June beetle



A



B



C

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4. American toad



5. Spotted salamander



D



E

Write the letter of the larva that matches the adult.

1. Mosquito

2. Green frog

3. June beetle

4. American toad

5. Spotted salamander

What Is Metamorphosis?

Metamorphosis (the *morph* part comes from the Greek word for *form*) is a dramatic change in what an animal looks like and how its body works that takes place as it changes from an immature form (often called a *larva*) into an adult. Animals that undergo metamorphosis include insects, amphibians, mollusks, crustaceans, and some fish.

Why change shape?

Metamorphosis allows young and adults of the same species to occupy different *niches*. A niche is how a living thing fits into the world around it, including what

it eats and the resources it uses. In species that undergo metamorphosis, young and adults don't have to compete for food, space, and other things they need to survive. Tadpoles eat algae, while toads eat insects. Mosquito larvae live in water, while adults live on land.

Think About It. How would you describe your *niche*?

Metamorphosis also lets animals have specialized body parts to use at different times in their lives. Larvae often have strong mouthparts and a powerful diges-

tive tract, so they can eat a lot of food and grow quickly.

Some adult insects don't eat at all. But they have well-developed organs for producing young. Some have wings that allow them to move over long distances in search of a mate. Many also have a keen sense of smell that helps them find mates.

Cues for big changes

As the young of animals that undergo metamorphosis grow, certain cues tell them it's time to make a big change. Inside their cells some bits of DNA wake up, while other bits that had been awake

go to sleep. The newly awakened bits of DNA provide instructions the cells use to make the adult animal.

How do you know when it's time to get up in the morning? Maybe the sun wakes you. Or you hear the sound of an alarm clock. Or perhaps your body listens to the clock inside you and wakes up on its own.

In the same way, young animals receive many cues that can signal when it's time to undergo metamorphosis. Cues include amount of daylight, temperature, humidity, chemicals in their bodies, and chemicals around them.



A green darner nymph clings to an underwater plant and waits to seize a small fish or insect to devour with its clawlike lower jaw.



The wings of the green darner nymph begin to develop. Soon the nymph will swim to shore and emerge from the shell of its aquatic existence.



A freshly emerged green darner begins its terrestrial existence by pumping insect blood, or *hemolymph*, into its wings. Once its soft skin dries and hardens, it is ready to fly.



The green darner is one of the largest and fastest dragonflies in North America. A formidable predator, the green darner has earned the nickname "mosquito hawk."

Green Darner Dragonfly (*Anax junius*)

Without a sound, a young green darner dragonfly, called a *nymph*, crawls from the water and onto a rock at the edge of a lake. The nymph pauses with its back end still in the water. For the past three months, the wingless nymph has been living underwater. After spending its life getting oxygen through gills, as a fish does, the nymph is breathing air for the first time.

Underwater, the nymph had been

capturing insects and fish for food with the huge, clawlike structure that is its lower jaw. But in recent days, the nymph has been changing form inside. Tiny bumps on its back look like they could be wings. Under the nymph's skin, an adult dragonfly is waiting to get out.

Rip! In the middle of the night, a split starts to form on the back of the nymph's head, just like the split you might make in a pair of pants that's too tight. With a

wiggle and a stretch, the adult beneath the skin pops its head and front legs out. It arches backward away from the nymph skin and hangs there as its soft skin dries and hardens.

When its legs are stiff, the adult uses them to pull the rest of its body out of the shell. Its wings lie like crinkled lumps on its back. Like pumping air into a beach ball, the green darner inflates its wings to full size by pumping insect blood,

called *hemolymph*, into them. When its wings are dry, it flies off. Leaving its aquatic days behind, the green darner is now a denizen of the sky.

Think About It. A dragonfly larva has gills in its back end. It "breathes" by taking in water through its abdomen, then shooting it back out again. What does this help the larva do, besides get oxygen?

According to folklore, the wider the brown band on the woolly bear caterpillar, the longer winter will be.



GARY MESZAROS, DEMBINSKY PHOTO ASSOCIATES



ALLEN BLAKE SHELDON

After a few weeks in a cocoon, the docile woolly bear caterpillar emerges as an Isabella tiger moth.

Isabella Tiger Moth (*Pyrrharctia isabella*)

The woolly bear caterpillar starts its life as an egg. The egg hatches into a tiny, fuzzy larva, or caterpillar. The caterpillar has one big job in life: to eat. It eats just about any kind of plant it can get its little legs on. When winter comes, it curls up into a ball. In spring, the warm air tells the caterpillar that it's time to become an adult moth.

The caterpillar finds a hidden spot. It starts to make a cocoon for itself out of its own hair, along with silk it releases from *spinnerets* located on its head, near its mouth.

Underneath its caterpillar skin, the woolly bear has been growing another skin, called a *pupal skin*. Then it sheds the caterpillar skin and hardens into a kidney bean-colored lump.

Tucked tightly into its cocoon, the caterpillar begins to dissolve, except for a few cell clusters called *imaginal buds*. At first, it is as mushy as a fruit smoothie. Then those few cells start to grow and multiply. They *differentiate*—form various organs and structures, such as legs, eyes, and a digestive tract.

After a couple of weeks the cocoon opens. An Isabella tiger moth emerges, with wings all shriveled. But soon the moth's wings expand and are ready to fly.

Spring Peeper (*Pseudacris crucifer*)

Like other frogs, spring peepers start their lives as jellylike eggs attached to underwater plants. The eggs hatch into tadpoles, fishlike creatures that live in water and breathe through gills.

As it grows, the tadpole's body starts to make a chemical called *thyroxine*. The thyroxine tells the tadpole's insides that it's time to undergo metamorphosis and become an adult frog.

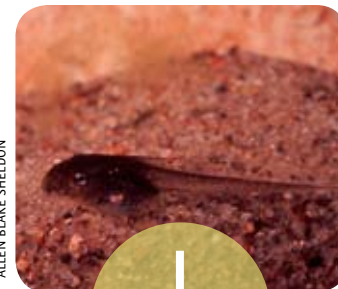
Unlike a caterpillar, a tadpole keeps moving as it undergoes metamorphosis. As it swims around, little legs start to sprout. Its beak disappears, and it grows teeth and a tongue. Its intestines get shorter and more complex in preparation for switching from a diet of algae to a diet of insects and other animals.

The tadpole's gills disappear, and air-breathing lungs grow. The chemicals in its blood change in a way that suits a land-hopping, air-breathing animal instead of a water-swimming one. Its tail shrinks, and the long nerves that control tail movement die.

After about three months, the tadpole has completely transformed into an inch-long frog. With its powerful legs, it hops out of the water and begins a new phase of life on land.

Think About It. If the water in a pond starts to dry up, a tadpole starts to make thyroxine earlier than normal. How does this help the tadpole survive?

This tadpole won't be eaten by a fish. The forest-dwelling spring peeper typically lays its eggs in shallow fish-free wetlands.



ALLEN BLAKE SHELDON



ALLEN BLAKE SHELDON

An adult spring peeper makes a high-pitched noise by forcing air out of its vocal sac. The male frog calls to mark territory and attract a mate.

Listen to It! Visit www.mndnr.gov/ volunteer to hear the call of the male spring peeper. Find it under Online Extras.

Glass eels hide among rocks as they undergo metamorphosis and wait to move upstream into freshwater.



TIM WATTS



DOUG STAMM

Adult eels swimming in freshwater near the Florida panhandle. Their long, tubelike bodies allow them to hide and hunt among the rocks.

American Eel (*Anguilla rostrata*)

An adult American eel is a long, tube-shaped fish. But when eels first hatch from their eggs in the Atlantic Ocean, they look more like see-through willow leaves. The name of the larva at this stage, *leptocephalus*, means “thin head.”

Leptocephali feed on small aquatic organisms as they float along with ocean currents. After about six months of swimming and drifting, the leptocephalus approaches North America.

When the leptocephalus is almost to the continental shelf, chemicals inside its body tell it to start undergoing metamorphosis, and it becomes what is called a *glass eel*. It looks like a translucent mini-eel as its intestines, gills, and other internal organs start to change to their adult form. It gets shorter, and it fattens into a snakelike shape.

When a young eel enters freshwater it is called an *elver*. As it becomes an adult, its skin will turn to a dark blue-gray color. Adult eels that live in Minnesota were once leptocephali drifting in the ocean! They swam 2,000 miles up the Mississippi River to get here.

Think About It. How does being transparent (see-through) help a leptocephalus survive?

A NOTE TO TEACHERS

Find teachers guides to this and other Young Naturalists stories online at www.dnr.state.mn.us/young_naturalists.

Plain Pocketbook Mussel (*Lampsilis cardium*)

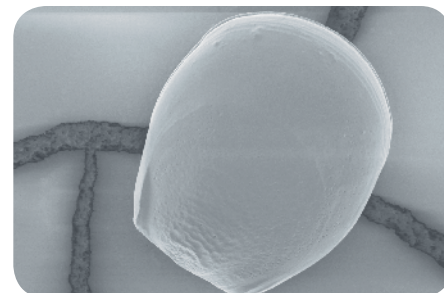
On a gravelly bed of the St. Croix River, a female plain pocketbook mussel relaxes the muscle that holds the two halves of her shell together. Her mantle flaps—soft, slimy pieces of tissue—stick out into the water. One end is long and loose and waves in the current like the tail of a swimming fish. The other end has a dark spot, like a fish’s eye. She rhythmically pulses her mantle flaps to simulate a swimming minnow. Before long a hungry bass comes by. The bass tries to eat what it thinks is a minnow. As it does, the mother mussel releases thousands of larvae into the water. Some of the mussel larvae, called *glochidia*, get sucked up into the fish’s mouth. When they get to the fish’s gills, they attach and tissue grows over them.

The glochidia develop a strong foot, the beginnings of gills, and digestive organs. After two to six weeks, the glochidia have metamorphosed into juveniles and move out of the fish’s tissue. The juveniles are easy prey for insects, crustaceans, worms, and fish. Scientists think some may temporarily burrow into the riverbed to stay safe. Eventually they rise to the river bottom and begin filtering water for food. Unless an animal moves them or they get washed away by currents, this is where they will spend the rest of their days—until they too lure a fish and the cycle begins again. V

Identify It! Learn how to tell Minnesota’s mussels apart. Check out *Field Guide to Freshwater Mussels of Minnesota*.



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A plain pocketbook mussel (top) in the St. Croix River tries to lure a fish by displaying its mantle flaps that look like minnows. When a fish strikes, the mussel’s gills break open and release thousands of minute larval mussels or *glochidia*. An electron microscope shows a magnified image of a larva (bottom), which would be barely visible to the naked eye.

Watch It! Visit www.mndnr.gov/volunteer to watch a video of the pocketbook mussel’s mantle display. Find it under Online Extras.

Answers from pages 52-53.

1. Mosquito: C
2. Green frog: B
3. June beetle: A
4. American toad: E
5. Spotted salamander: D