

Biology Bits

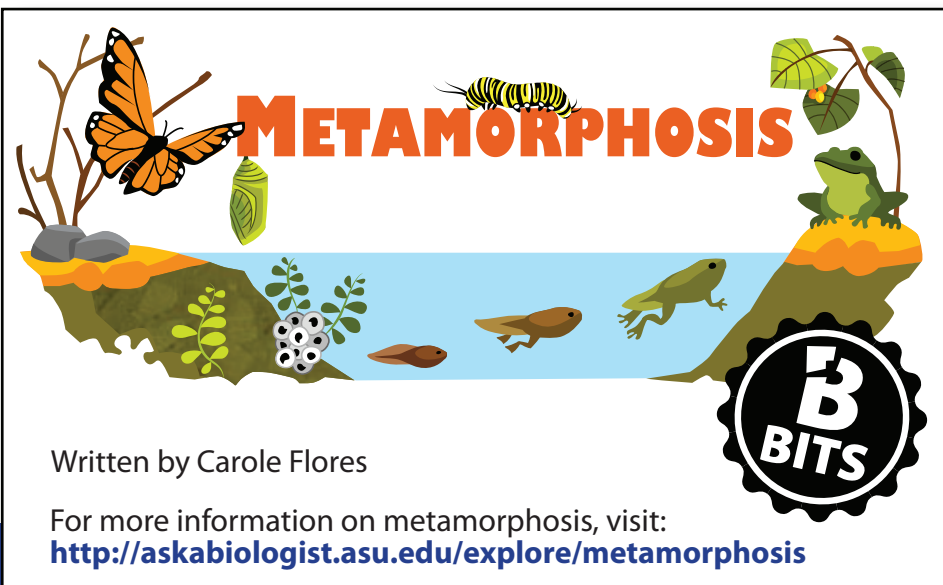
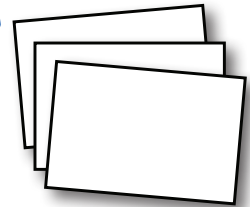
Bite-size Science

Trying new things can be hard. When you play a new sport, you have to learn and remember a whole new set of rules. When you try new food, you may end up not liking it (and you may even wish you could spit it out). The same goes for school. Learning information can be really hard and sometimes scary.

With food, what's the best way to start with something new? Trying a very small piece. You can take a tiny bite...taste it, feel the texture of it, and decide if you want more. Just like with new food, new information can also be easier to learn if you start off with really tiny bites.

Biology Bits stories are a great way for you to learn about biology a little bit at a time. We've broken down information into pieces that are very tiny—bite-sized, we call them. You can try just reading the Biology Bits at first. Cutting out the cards will let you organize them however you want, or use them as flashcards while you read.

Then, when you're ready to move on, use the empty cards to write out what you learned. You can copy what was already written, or try to write it in your own words if you are up for a challenge. Just remember, don't bite off too much at once!



Written by Carole Flores

For more information on metamorphosis, visit:
<http://askbiologist.asu.edu/explore/metamorphosis>

This set of bits will teach you about the set of changes insects and some other animals experience during development:
metamorphosis.

Hungry for more bits? Visit:
<http://askbiologist.asu.edu/activities/biology-bits>



You and a baby have a lot in common. Both of you probably have arms, legs, and skin. But many animals change a lot as they grow. You might not even know they are the same animal. A butterfly starts out looking like a worm. Then it looks like a sack and then it has wings. Many animals go through big changes that we call **metamorphosis**.



A bee hawk larva (top) looks very different than a bee hawk adult (bottom).

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Metamorphosis is a big word. It is easier to understand if we look at the pieces of the word. The first part of the word, **meta-**, means *change*. The middle part, **-morph-**, means *shape*. So now we know it means there is a change in shape. The last part, **-osis**, means *the way a thing happens*. So what is metamorphosis? When you are talking about a living thing, it is *the way it changes shape during its life*.

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Some animals that go through metamorphosis seem to keep the same shape. So how can we tell if an animal goes through this change? Some animals have a hard outer skin. When insects grow, they must get rid of it so they can get bigger. This happens if they fully change shape or not. Animals that get rid of their outer layer go through metamorphosis.



A dragonfly has left behind a hard outer skin.

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Which animals make this change? Ants, butterflies, clams, crabs, and most frogs do it. There are also jellyfish, starfish, and some regular fish that do it.



Frogs and many other animals go through metamorphosis as well.

Some change where they live. Some change how they act as they grow. This keeps the young and adults from fighting over space or food. A good example is a caterpillar. It eats leaves, but a butterfly eats nectar from flowers.

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There are two types of metamorphosis. In one kind, the young insect looks like a mini adult. As it grows, it will only partly change, so this is called **incomplete**. That happens in crickets. In the second kind, the young insect looks very different from the adult. The insect will change entirely as it grows, so this is called **complete**. That happens in caterpillars.

Insects can go through one of two kinds of metamorphosis.

Incomplete

- Aphids
- Crickets
- Grasshoppers
- Praying Mantises
- Cockroaches
- Termites
- Dragonflies
- Lice

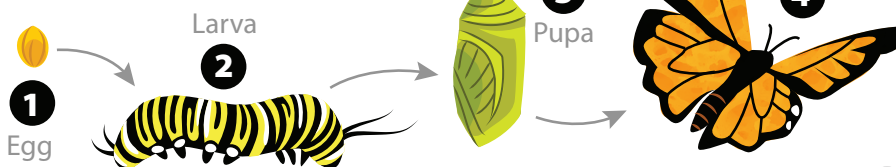
Complete

- Beetles
- Flies
- Ants
- Bees
- Butterflies
- Moths
- Fleas
- Lacewings

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Insects that go through **complete** metamorphosis experience **four** stages of growth. The first stage is called an *egg*. The egg hatches and when the insect comes out, it usually looks like a worm. Then it is in the *larva* stage. The larva eats a lot and grows quickly. Then a hard covering forms around it as it enters the third stage, a *pupa*. The insect goes through more changes as a *pupa* and then squeezes out into the world in its final stage, an *adult*.



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Eggs come from birds. Right? Well, yes... but most animals lay eggs. An egg is a special cell that is made in a female animal's body. It has many of the materials needed to build a new animal. Most animals lay eggs rather than giving birth. Most insects start life inside an **egg** laid in soil, water, or on a plant. These eggs are small and soft. Some other eggs are clear, like those that are laid by fish or frogs.

Eggs from insects (top) and frogs (bottom) look different.

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Many insects hatch out of an egg as a soft, worm-like **larva**. The larva eats a lot of food to grow fast. The word *larva* means *mask*. Larva is a good name because the insect looks different from its parents. It's almost like it is wearing a mask. When the larva is done growing, its outer layer changes into a hard cover.

Larva



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When the larva is protected by a hard cover, it is called a **pupa**. The word *pupa* means *child*. Pupa is a good name because the insect is still young. It has a lot of changing to do, just like a child. The pupa stops eating and moving but it still grows. Lots of changes occur inside its body as it turns into a full-grown insect. When it is done growing, the adult insect squeezes out of the hard cover.

Pupa



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When the insect leaves the pupa stage, it is all grown up. It is an **adult**. A scientific name for an adult insect is *imago*, which means *image*. Imago is a good name because no more changes will occur. The insect is in its final image. The adult usually has wings and can make babies of its own.



Incomplete metamorphosis has **three** stages of growth. These stages are egg, nymph, and adult. An insect starts life as an *egg*. But insects with incomplete metamorphosis don't turn into larva.

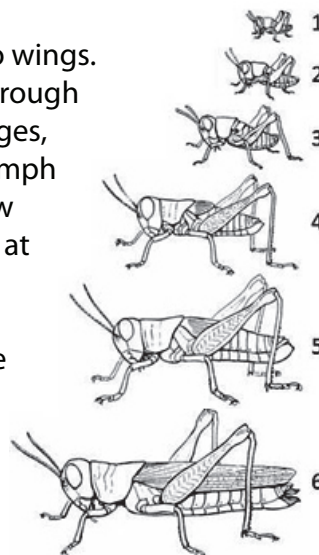


Grasshopper nymph (left) and adult (right). Nymphs look like miniature version of the adults.

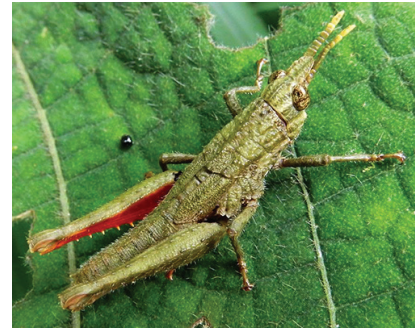
Instead, they turn into nymphs. These look like mini adults. The nymphs will grow to be much larger until it becomes a full adult.



Nymphs look like mini-adults but with no wings. They also cannot lay eggs. Nymphs go through many growth stages. In each of these stages, the nymph's outer cover hardens. The nymph breaks out of the cover so that it can grow larger. This is called molting. Insects molt at the end of each nymph stage. These nymph growth stages are called instars. After a few instars, the insect will squeeze out of its last covering as an *adult*.



You probably know what a skeleton is. Skeletons are frames that support the bodies of many animals. What if we talk about an exoskeleton? **Exo-** means outside. So an exoskeleton is a frame on the outside of the body. This describes the hard outer layer that covers an insect pupa or nymph. This layer is mostly made of a chemical called chitin. At first, it is soft. But then, the chitin hardens to form a hard outer layer. That is why insects must make new exoskeletons as they grow.




A tough exoskeleton protects insects, like the armor of a knight.

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Cicada molting. Hormones in animals' bodies control growth and molting.

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Hormones are chemicals made in all plants and animals. They control growth and other changes in our bodies. They control how animals act and how their bodies work. In insects, a hormone is released when it is time to molt. A different hormone can cause growth to start. Another can stop growth.




Animals can change a lot as they grow. Caterpillars turn into butterflies. Tadpoles turn into frogs. Worm-like grubs become beetles. What happens to the tissues in a larva when it changes into an adult? Many are broken down and the parts are used to build the adult body. But some cells, especially those in the brain, are kept. This means that if the larva learns something, the adult might be able to remember it!




Ladybug larva (left) and adult (right). Though they look very different on the outside, some cells in the brain may still be the same.

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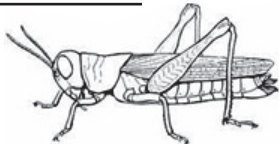
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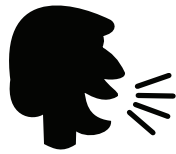


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How do
you say?

Caterpillar – [cat-uh-pill-er]

Exoskeleton – [ek-sow-skell-eh-ton]

Hormone – [hohr-moan]

Imago – [ee-mah-goh]

Larva – [lahr-vuh]

Metamorphosis – [met-uh-mohr-foe-sis]

Molt – [mohlt]

Nectar – [neck-ter]

Nymph – [nimff]

Pupa – [pew-puh]

Tissue – [tish-ew]

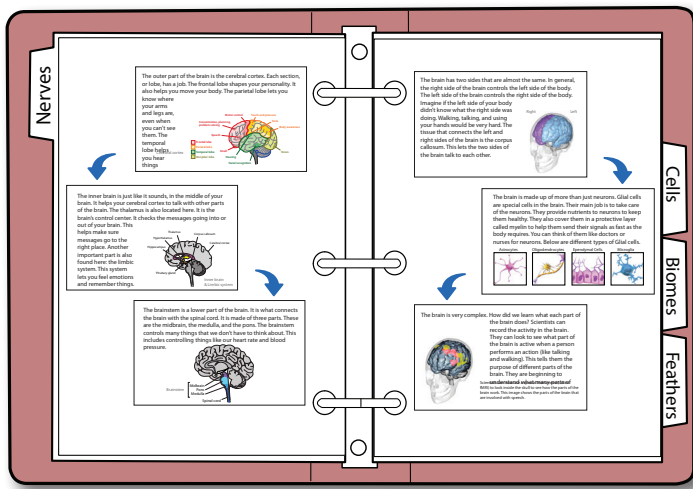
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Instructions

Ready to begin? You can use these bits in many ways. You can print the pages and place them in a notebook for review. You can also cut each card out to re-organize them any way you want.

The empty cards can be used to write out what you learned in your own words, or to copy what's already written. Also included is a pronunciation guide, to help you learn how to say the more complicated words.

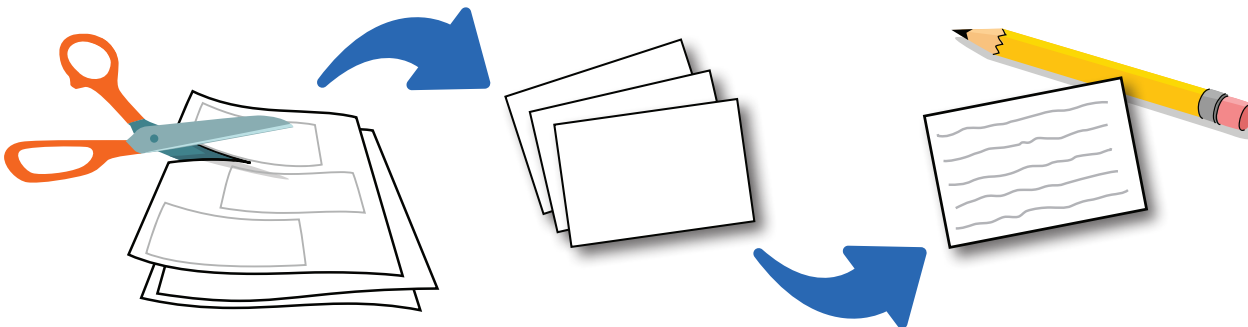


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- Insect eggs

Brian1442 - via *Wikimedia*

- Cicada molting

Derrickchapman - via *Wikimedia*

- Grasshopper adult

Harald Süpfle - via *Wikimedia*

- Bee hawk larva

Jacopo Werther - via *Wikimedia*

- Grasshopper nymph

Magnus Manske- via *Wikimedia*

- Tadpole eggs

MathKnight- via *Wikimedia*

- Ladybug adult

Pengo - via *Wikimedia*

- Grasshopper nymph stages

Pierre Deviche

- Dragonfly exoskeleton

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- Green grasshopper, illustrations

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- Ladybug larva

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- Bee hawk adult