



ARTHROPOD MOLTING

Why and how it happens

By Kaleigh Jaron

ARTHROPODS

What is it that connects a dragonfly, a crab, and a spider?

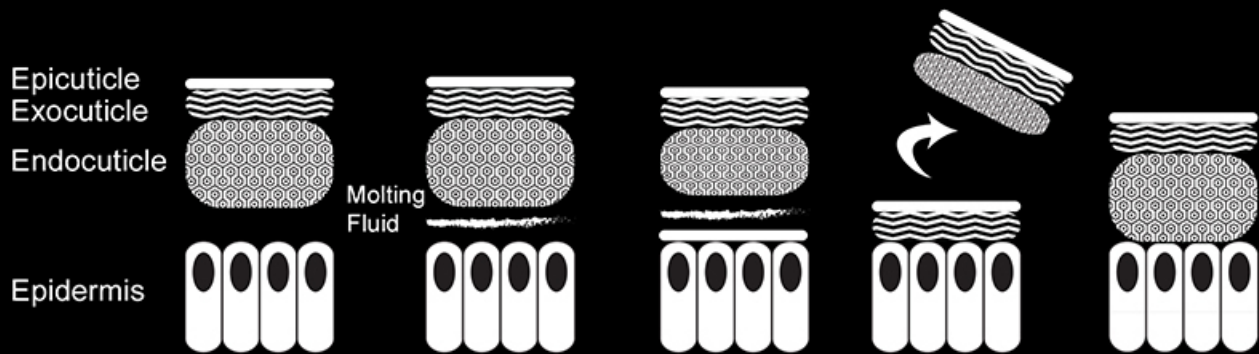
Well, one answer is that over the course of their lives, they will all shed their exoskeleton at least once. This process is known as molting, and occurs for the purpose of growth and metamorphosis. Molting is one of the key criteria for defining an animal as an arthropod, a phylum that consists of insects, spiders, and crustaceans.

What we call an exoskeleton is actually layers of cuticle composed of chitin and waxes. This exoskeleton is often segmented, allowing the arthropod to have joints and movement, with muscles connected to this stiff outer layer. Similar to a human skeleton, the exoskeleton provides both protection and structural support for the body. But unlike humans, this external skeleton is technically dead and cannot grow.



THE MOLTING PROCESS:

An arthropod cannot survive without the support and protection of its exoskeleton. So when it becomes too small for an animal's growing body, hormones are released that inform the arthropod that it is time to molt.



1. Apolysis: The separation of the exoskeleton from the underlying skin cells. During this time, the animal will often become inactive and may hide in order to protect itself during the coming molt.
2. The space produced by apolysis is filled by an inactive molting fluid, which will later digest the bottom layer of the old exoskeleton.
3. A new cuticle layer is produced which will become the top layer of the new exoskeleton. This layer is often larger than the old one in order to allow for growth. Because it is soft when first formed, it is slightly wrinkled until the molting process is complete and the body has filled in the new space.
4. The molting fluid becomes active and digests the bottom layer of the old exoskeleton. This is why the shed molt appears thin.

THE MOLTING PROCESS:

5. The protein components of the digested layer are re-absorbed and used in the process of building the new exoskeleton. The new cuticle layers are built until they are nearly fully formed.
6. Ecdysis: This is the actual process of shedding the exoskeleton. When the new exoskeleton is ready, the animal intakes air or water and contracts it's muscles to swell its body until the old exoskeleton breaks along weak spots, often on the dorsal side. The arthropod then exits the old exoskeleton, leaving its molt behind.
7. The arthropod inflates itself into its new form, smoothing out the wrinkles in it's soft new exoskeleton.
8. Sclerotization: The hardening of the new exoskeleton. Tanning agents are secreted through ducts onto the surface of the newly formed exoskeleton. These tanning agents create a chemical reaction, which cross-link the substances of the top layer of the exoskeleton into the hard shell we recognize.

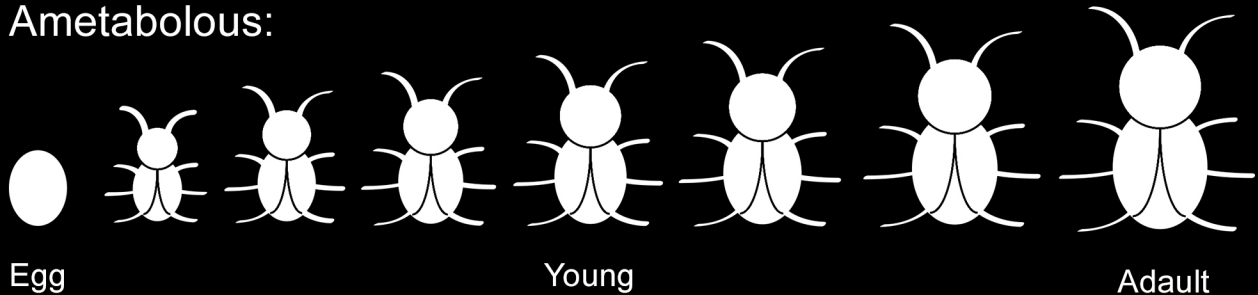


INSECTS:

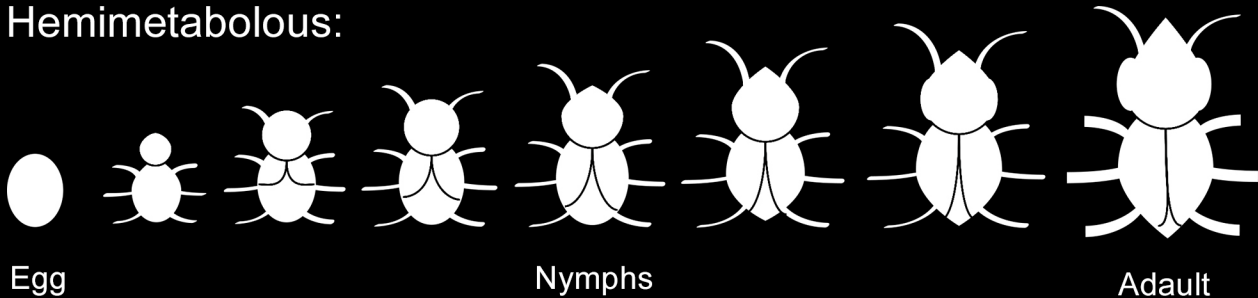
Insects in general do not molt in their adult form. Rather, they put all their energy into mating and producing offspring. It is only in their adolescent forms that they focus on growing. And unlike arachnids and crustaceans, insects also go through the process of metamorphosis while molting.

There are three types of metamorphosis that can take place in insects:

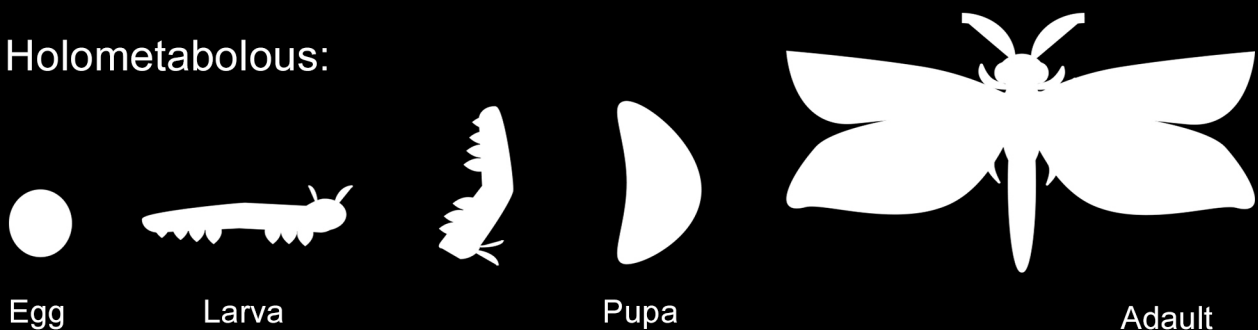
Ametabolous:



Hemimetabolous:



Holometabolous:



Crustaceans:

Crustaceans molt their entire lives as they continue to grow, molting less often with age. Very large crustaceans may have to wait months for their exoskeleton to harden after molting. This is because a soft new exoskeleton cannot support the weight of a heavy crustacean. In fact, they may resemble a water balloon until they have fully undergone the process of Sclerotization.



Arachnids:

Arachnids typically molt for the first time while they are still inside their egg sack. By the time they emerge, they look like a miniature of their adult form. Generally, a spider will molt between five and nine times before reaching full maturity depending on their gender and species.

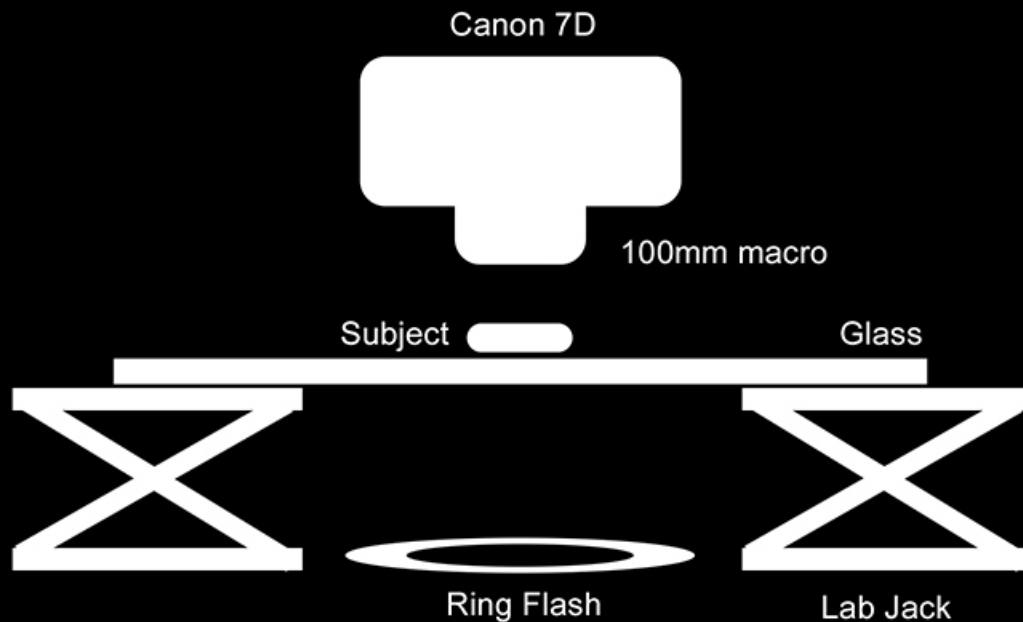


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Lesser Brown Scorpion
Isometrus maculatus



Amano Shrimp
Caridina multidentata



Giant Hawaiian Dragonfly
Anax strenuus



Liomera crab



Cane Spider
Heteropoda venatoria