Flight Manual

Basic Interpretive Knowledge for WOF Volunteers

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Flight Manual: Basic Interpretive Knowledge Outline

• This guide will take volunteers through the life cycle of a butterfly, stressing what they will observe within the exhibit.

• The guide’s outline:
  • Adult phase
    • Drive to find a mate and reproduce; behaviors and adaptations associated with reproduction
  • Egg
    • Instinct to search for and lay eggs on host plant; host plant and butterfly coevolution; egg laying strategies
  • Caterpillar
    • Instinct to feed; growth and molting; behaviors and morphology of larval stage; energy flow from sun to insect
  • Pupa
    • Metamorphosis stage; cellular reconstruction; behavior and morphology at pupal stage; adult emergence
  • Adult phase again
    • Adult feeding; behaviors and morphology at this stage

• We did this so that the information has a narrative flow and facts are contextualized within the lifecycle.

• In this guide I use the term “butterfly” in place of lepidoptera. However, the information in the guide applies to both butterflies and moths.
Butterfly Life Stages

• Butterflies go through **complete metamorphosis**, meaning they have four life stages: egg, larva (caterpillar), pupa (cocoon or chrysalis), and adult (butterfly).
  
  • Complete metamorphosis: the young have a completely different body compared to the adults. (grubs vs beetles; caterpillars vs butterflies)

• Many other insects go through complete metamorphosis including beetles, flies, ants, and bees.

• Insects like grasshoppers, cockroaches and stinkbugs go through **incomplete metamorphosis** with only three life stages.
  
  • Incomplete metamorphosis: the young have a very similar body compared to the adults.
Adult Stage: Anatomy

**Proboscis:** Tube-shaped, straw-like mouth used to drink. Rolled up in front of the head when not in use, unrolled when drinking.

**Eyes:** 1 pair; adults have very good eyesight.

**Antennae:** 1 pair, used for sensing chemical and physical signals.

**Head:** First body segment, contains brain, feeding structures, and some sensory structures.

**Forewings:** 1 pair, used for flight and visual communication.

**Hindwings:** 1 pair, used for flight, but not as crucial as the forewings; used for visual communication.

**Legs:** 3 pairs; there are chemoreceptors at the end of each leg.

**Thorax:** Middle body segment where the wings and legs attach.

**Abdomen:** Last body segment, contains most vital organs.
Adult Stage: Reproduction

Adult butterflies are beautiful and biologically complex. The main drive for an adult butterfly is to find a mate and reproduce. Butterflies use wing coloration, chemical cues, and flight patterns to find a potential mate.

- **Wing Coloration**: Butterflies have very good vision and can even see color in the visual and ultra-violet ranges. Butterflies rely on wing coloration as a visual way of assessing mate quality. To a potential mate, a butterfly’s wings can communicate:
  1. If the other butterfly is of the same species (conspecific)
  2. If the other butterfly is healthy and would pass on the best genetic material to their offspring. For example, brighter colors might indicate better genes.

- **Chemical Cues**: Almost all adult butterflies emit pheromones when they’re ready to mate. Pheromones are chemical signals that have evolved for communication within the same species. Structures that sense pheromones and other chemicals are called chemoreceptors. These receptors work like the ones in our noses that pick-up scents. For some butterfly species, females choose males based on the scent of his pheromones.

- **Flight Patterns**: Some butterflies have complex courtship displays that involve specific flight patterns, or dances. Julia Longwings, for example, engage in a courtship dance that can last for hours and includes stages on the ground and in the air. Royal Blue butterflies fly in a spiral formation during courtship. The success of a courtship dance may determine if two butterflies mate. Butterflies can also assess the health of a potential mate by how well they fly and may not reproduce with a poor flyer.
Adult Stage: Wing Scales and Coloration

Wing coloration is the principle form of communication for butterflies. Butterflies can choose their mates based on wing coloration. Some male butterflies flash their brightly-colored wings when fighting with other males. Butterflies also rely on the color of their wings for camouflage and to warn predators.

- Wing scales: Butterfly wings are covered in exoskeleton, which is made of a tough, flexible material called chitin. The wing is a thin chitin membrane supported by thick, exoskeleton-covered veins. Think of a bat’s wing supported by bones. Connected to the thin membrane are millions of scales, also made of chitin.

- Pigment vs. Structure: The color of each scale can be produced in two ways, pigment and structure.
  - Pigment is a chemical compound that reflects a certain color. Its something the butterfly produces in its body. In butterflies, red, orange, yellow, brown, black and white scales are generally caused by pigmentation. Think of pigment like a dye or paint that’s infused into the scales.
  - Structural color is produced by the physical layering of chitin within the scale. Wing colors like blue, green and purple are generally caused by structural coloration. Colors at the cooler end of the spectrum (with shorter wavelengths) are more difficult to produce for all plants and animals, so producing them through structure, instead of pigment, requires less energy. You can tell when color is structural because it’s iridescent, meaning the color shimmers or changes slightly depending on how the wing is angled. This occurs because the coloration is caused by the light bouncing off of multiple layers of chitin. When white light hits the scale, all the layers reflect back a certain wavelength, but some wavelengths cancel each other out and others combine and are amplified. For example, in Blue Morpho butterflies, blue wavelengths are amplified and reflected out of the layers, making the scales appear blue. When the wing tilts, the angle of the light changes and bounces off the chitin layers in a different way, thus changing the color you see.
Adult Stage: Vision

Adult butterflies, unlike caterpillars, have very good vision. Butterflies can see all the colors we can and more. We can see light in the visible spectrum, meaning light with wavelengths between 400 and 700 nanometers. The colors of the rainbow are all the colors we can see.

But butterflies can see light with even shorter wavelengths, called ultraviolet light. This means the world looks very different to them than it does to us. Many flowers have special UV pigmentation that attracts butterflies and highlights where the nectar and pollen are in the flower.

Unlike us, butterflies (and other insects) have compound eyes. Compound eyes are made up of thousands of light sensing units. Each unit perceives one color at a time. Thus, insects see the world like a mosaic. (Not the same image duplicated over and over like they show in the movies.)

Mosaic vision may seem worse than ours, but insects can sense movement in their field of vision much better than we can. And because their eyes are so large, they have an almost 360 degree field of vision.
Butterflies with mosaic vision can sense movement better than we can with camera vision. As an object moves across their field of vision, each facet of the compound eye registers the change in color, like a block moving across a grid.
Adult Stage: Searching for a Host Plant

Once a female has mated, her instinct is to find a safe place to lay her fertilized eggs. Nearly all butterflies search for species-specific plants, called host plants, on which to lay their eggs.

Almost all plants produce toxins to repel plant-eating (herbivorous) insects. Butterfly and host plant relationships evolve over long periods of time, so each butterfly species adapts to tolerate and incorporate the toxins produced by their host plant. For example, Pipevine Swallowtails have evolved to feed on highly toxic pipevine plants. The caterpillars not only tolerate the toxins in the pipevine, they are able to sequester and store the toxins in their bodies. Toxins stored by the caterpillars stay in the body through adulthood, making both the caterpillar and the adult butterfly toxic to predators.

Butterflies use vision and chemoreception to find their host-plants. An egg-laying female will fly over vegetation looking for the right leaf shape and color. She will also land on plants and “taste” them with the chemoreceptors at the ends of her legs. She is looking for a specific chemical signature belonging to her species’ host plant.

Once she finds her host plant, the female will lay her eggs. Most species have strategies that dictate how and where they place their eggs. Some species lay eggs singly, some in groups. Some species lay eggs at the tips of leaves, some on the undersides of leaves, and some on the stem. Every strategy is shaped by many years of natural selection and exists to optimize offspring survival.

Because butterflies and host plants coevolve, plants of a certain region are used as host plants by the butterflies of that same region. The relationship between insects and their host plants is a major reason why protecting and growing local plant species is important to ecosystem health.
1. Like beetles, ants, and flies, butterflies have four life stages.
   • Egg, Larva/Caterpillar, Pupa/Chrysalis, Adult/Butterfly

2. Basic butterfly anatomy:
   • 1 head with 1 pair of eyes, 1 pair of antenna, and a straw-like mouth called a proboscis
   • 1 thorax with 2 pairs of wings and 3 pairs of legs
   • 1 abdomen

3. The diving instinct for the adult butterfly is to mate and reproduce. They use vision and
   smell/chemoreception to find a mate and judge their quality. Wing patterns, pheromones, and flight are
   all important in finding a mate.

4. Wing patterns and coloration are possible because butterfly wings are covered in scales. The scales are
   made of exoskeleton. Scales can have color in two ways, through pigment and structure.
   • Pigment is like a dye the butterfly produces in its body.
   • Structural color is produced by the layering of chitin within the scale and is not a chemical made by the butterfly’s body. Iridescent colors are structural.

5. Butterflies have very good vision. This helps them find food and mates. Unlike humans, they can see UV
   wavelengths and they have mosaic vision.

6. Most butterflies lay their eggs on specific plants called host-plants.
   • Host plants are the preferred and usually only food the caterpillars will be able to eat.
   • Almost all plants produce toxins to avoid getting eaten by insects.
   • The caterpillars that specialize on a host-plant have evolved to tolerate those toxins and incorporate them into their bodies. The toxins stay in their bodies when they change into butterflies.
   • The relationship between butterflies and host plants show why native plants are so important to an ecosystem.
Egg stage: Cellular Division and Growth
In the eggs stage, the insect’s cells are multiplying and organizing. The length of the egg stage varies species to species. For most of the butterfly eggs you'll see in the caterpillar house, the egg stage lasts from 1 – 2 weeks. Some butterflies from temperate climates will overwinter in this stage and spend months as eggs.

Larval Stage: Feeding and Growth
Once the caterpillar forms inside the egg, it will chew its way out. Most caterpillars eat the egg case for a boost of protein as they start the larval stage. The larval stage is the second stage in the butterfly’s lifecycle. The driving instinct for the caterpillar is to eat as much plant material as possible before pupating.

Feeding is also the means by which caterpillars gain their toxic chemical defenses. Caterpillars incorporate the toxins produced by the host plant into their bodies. These toxins make them unpalatable (taste bad) and sometimes dangerous to predators.

A caterpillar’s body is specialized for consumption of plant material. Unlike adult butterflies, caterpillars have chewing mouthparts called mandibles. Also unlike the adults, caterpillars have small eyes, called ocelli, and poor eyesight. They use touch and the chemoreceptors on their legs and small antenna to sense the world around them and to know if they’re eating the right plant.

As the caterpillar grows it must shed its exoskeleton, or molt. Butterflies, like all other insects, are arthropods and thus have their skeleton on the outside of their bodies. Insect skeletons are made of chitin, a tough but flexible material. Right before a caterpillar molts, it grows a new exoskeleton under the old one. As a caterpillar molts it will flex its body to crack the old exoskeleton along preexisting lines of weakness called sutures. Once the old exoskeleton is loose, the caterpillar will shrug it off and crawl out. New exoskeleton is soft and pliant after molting and needs time to harden. The periods between molts are called instars, and a caterpillar typically has 5 instars before pupating. For many species, different instars have different coloration and behaviors. In the Spicebush Swallowtail, early instars are camouflaged as bird droppings, but later instars mimic snakes. In the Pipevine Swallowtail, early instars stick together in a group, but later instars are usually alone.

Once a caterpillar has stored enough energy through feeding, its body is triggered by hormones to begin pupation. Like the other molts, the new pupal exoskeleton, or chrysalis, forms underneath the caterpillar’s old exoskeleton. While the pupa is still flexible, before the chrysalis hardens, it will wiggle out of the last caterpillar exoskeleton.
Larval Stage: Defenses

- **Fake eyes and Antenna:** Many caterpillars have fake eye-spots and fake antenna, sometimes called “tentacles”. Spicebush Swallowtails have large fake eye spots that look like snake eyes. Monarchs and Pipevine Swallowtails have prominent fake antenna. A caterpillar’s eyes and antenna are actually very small and close to the caterpillar’s mouthparts. By having fake eyes and antenna, caterpillars can confuse predators and trick them into attacking less essential body parts. Caterpillar can also use them to mimic other animals (like snakes), or seem larger and more dangerous.

- **Aposematism:** Aposematism is when animals have warning colors that tell predators that the animal is toxic or venomous. Monarchs have bright stripes to warn predators that they’re toxic. Predators like birds quickly learn that eating a monarch will result in an upset stomach and a terrible taste.

- **Camouflage:** Caterpillars can also use coloration to blend into their surroundings as opposed to stand out. Many caterpillars have evolved to look like sticks, stems, or parts of leaves.

- **Leaf Rolls and Hiding:** Similar to spiders, caterpillars can make silk. Silk is usually used in the pupation process to anchor a chrysalis or spin a cocoon. Some caterpillars will use the silk to glue leaves into rolls or pockets that they can hide in. Caterpillars will leave their hiding place to feed and return to hide from predators. Some caterpillars do not make leaf rolls, but stay on the undersides of leaves to hide.

- **Toxins and Venom:** Most caterpillars incorporate toxins from their host plants into their bodies, making them toxic to predators. Toxic caterpillars usually have a bad taste or cause intestinal distress, but are rarely deadly. By not killing the predator, the caterpillars allow the predators to learn to avoid them in the future. A few caterpillars produce venom, like a scorpion or spider. The Saddleback, for example, has venom glands at the base of its spines that can cause severe skin irritation.

- **Spines and Bristles:** Caterpillars can have hard spines that could hurt a predators mouth. Caterpillars can also have fuzzy hairs or bristles that make eating it complicated and unpleasant. As mentioned above, some caterpillars have stinging hairs and spines that are attached to venom glands and cause painful irritation.

- **Osmeterium:** Many swallowtails have an organ called an osmeterium in their head. When they are confronted by a threat they will puff out their osmeterium, which has a strong foul order that can disgust predators and make the caterpillar seem unappetizing.

The larval stage is an extremely vulnerable stage for the butterfly. Many animals use caterpillars as a food source and this pressure has lead to the evolution of all the defenses listed above. Adult butterflies spend so much energy on reproduction because most of their offspring will be eaten. Butterflies have evolved to have high numbers of offspring so that even after predation at every life stage there will still be enough adults to replenish the species.
Larval Stage: Preparing to Pupate

- **Leaving the Host Plant:** When the caterpillar has consumed enough food, it’s signaled by hormones to start pupation, the third life stage for a butterfly. Most caterpillars have the instinct to leave their host plant before they pupate. In the caterpillar house you’ll see Monarchs and Spicebush Swallowtails crawl off their host plant and search for places to pupate in the Caterpillar House. Caterpillars do this because the host plant has lots of evidence of feeding that can attract predators. Predators search for caterpillar waste (frass) and holes in the leaves to find caterpillars. Because the pupa stage is so vulnerable, caterpillars look for a safer place to form their chrysalids.

- **Finding a Safe Place:** To avoid getting eaten caterpillars search for a place that is covered, hidden, and/or far away from their host plant. You may notice monarch chrysalids under the eaves of the sheds by the caterpillar house in the summer.

- **Spinning Silk:** Once the caterpillar has found a safe place to pupate, it will glue itself to stable surface using silk. Silk is produced as a liquid by a special gland called a silk gland. The caterpillar excretes the liquid silk through a structure by its mouth called a spinneret. Once the silk hits the air it becomes a very strong, flexible, solid fiber. Unlike butterflies, moths spin a thick covering of silk, called a cocoon, around themselves before they pupate.

- **Shedding the Last Caterpillar Exoskeleton:** Once the caterpillar is anchored with silk, the chrysalis will form underneath the caterpillar’s exoskeleton. Once the chrysalis has formed, the pupa wiggles out of its last caterpillar exoskeleton. The chrysalis will harden over the next few hours.
Egg and Larva Stage: Basic Takeaway Information

1. During the egg stage, the insect’s cells are multiplying and organizing. This stage lasts about 1-2 weeks for the species you’ll see in the caterpillar house, but varies across species.

2. The main drive for a larva/caterpillar is to eat and grow before becoming an adult.
   - Caterpillars have specialized mouthparts for chewing called mandibles.
   - Caterpillars feed on species-specific host plants.
   - Caterpillars incorporate the toxins in host plants into their own bodies. They are able to do this because the butterfly species has evolved over a long period of time to be able to feed on the host plant.
   - The caterpillar stage lasts about 2-3 weeks for most of the species you’ll see in the caterpillar house, but varies across species.

3. Caterpillars have small simple eyes, small antenna and have limited senses.

4. Insects have a skeleton on the outside of their bodies called an exoskeleton.
   - In order to grow insects must shed their exoskeleton (molt).
   - A new exoskeleton grows under the existing one.
   - Most caterpillars molt 5 times, the 5th molt is when the chrysalis is formed and the last caterpillar exoskeleton is shed.

5. Caterpillars are an important food source for predators and therefore need to defend themselves.
   - Caterpillars have many defenses including camouflage, toxins, warning colors, spines, and hiding.

6. When caterpillars are ready to pupate, they leave their host plant and try to find a safe place, away from predators.
   - Caterpillars secure themselves to a stable structure using silk.
   - Once they are secure, the chrysalis forms under the caterpillar’s exoskeleton. Once the chrysalis has formed, the last caterpillar exoskeleton is shed.
   - In a few hours, the chrysalis hardens.
During the pupa stage the butterfly’s entire body changes in a process called metamorphosis. Metamorphosis is the transformation from the larva form to the adult form in insects.

Inside the chrysalis, the transformation is complex. First, most of the caterpillar’s body is digested by the same enzymes the caterpillar used to digest its food. The digested cells become a nutrient rich liquid within the chrysalis. Not all of the body parts are digested. The respiratory system, made of tubes called trachea, remains intact and actually expands. The gut also remains, but unlike the respiratory system the gut shrinks as the adult body is formed. There is evidence in some species that parts of the nervous system remain as well.

Cells called imaginal cells play a key role in metamorphosis. These are cells that are genetically predestined to form the adult structures like eyes, wings, legs, and mouthparts. Imaginal cells are formed very early in a butterfly’s life, while the insect is still inside the egg. The cells form clumps called “discs”, and each disc is fated to become a specific adult body part. For example, there is an imaginal disc that will become the right forewing, one that will become the left antenna, etcetera. Within the chrysalis, the imaginal cells move to the proper locations and multiply. A butterfly’s antenna, for example, may start as 50 cells, but could increase to 50,000 cells by end of metamorphosis. The nutrients gained by digesting the old caterpillar body fuel the imaginal cell movement and division.

To read more about this fascinating process check out these resources:
- Article in Scientific American
- Ask an Entomologist

The process of metamorphosis can take from 1-3 weeks for most butterflies, but can take longer for larger species.

Many butterflies in temperate climates will overwinter as pupa and delay completing metamorphosis until spring, spending months in their pupal stage.
Pupa Stage: Defenses

- **Spikes:** many pupa have hard spikes that could hurt a predator’s mouth

- **Coloration:** pupa can have colors that can mimic bird droppings or camouflage with the surroundings. Chrysalids often have metallic spots or can be entirely metallic. The word chrysalis comes from the Greek word for gold. It’s not completely clear why chrysalids have metallic coloration. The reflective surface may provide camouflage, mirroring the surroundings, or make the chrysalis look like a drop of water. Metallic coloration may also confuse predators, making them think the chrysalis is an inedible object.

- **Movement:** many pupa will wiggle if they perceive a threat through changes in light or physical sensations. The wiggling could throw off smaller predators and startle larger ones.

- **Toxins:** The chrysalis retains the toxins gained through the caterpillar’s feeding. Predators learn to avoid the bad taste and discomfort associated with toxic chrysalids.

- **Hiding:** Most caterpillars find a hidden or covered location before they pupate to avoid catching a predator’s eye.
Pupa Stage: Emergence

• Once the adult butterfly has fully formed inside the chrysalis it will molt one last time, shedding its pupal exoskeleton.

• When a butterfly sheds its chrysalis it is called eclosing, or emerging. (This is not when a butterfly is “born”.)

• Emergence takes about 5 minutes or less. First the butterfly flexes its muscles to pull air into the chrysalis and crack it along preexisting lines of weakness called sutures.

• The butterfly slips out of the chrysalis and excretes the leftover liquid from metamorphosis. This first waste is called meconium.

• After emergence the wings are crumpled and soft. The butterfly must pump a fluid called hemolymph (similar to blood) into the veins of the wings to expand them. Once the wings are expanded, the butterfly must wait for them to stiffen before it can fly away.

• While the butterfly waits, it will zip together the two tubes that make up its proboscis and clean its antenna using its forelegs.

• After emerging, the adult butterfly will not grow and/or molt again. (A smaller butterfly, or a newly emerged butterfly, is not a “baby” butterfly).
Pupa Stage: Basic Takeaway Information

1. The process of changing from larva to adult is called metamorphosis.
2. Metamorphosis is complex and occurs within the pupal exoskeleton, called the chrysalis.
   - Within the chrysalis most of the caterpillar’s body is digested.
   - The respiratory system and gut remain intact.
   - Cells that are predestined to become the adult body parts use the energy from the digested caterpillar parts to move and multiply.
   - Metamorphosis can take from 1-3 weeks for most butterflies, but can take longer for larger species.
   - Many temperate species overwinter as pupa, delaying metamorphosis until spring.
   - Once the adult butterfly forms, it will shed its chrysalis in a process called emergence.
     - After emerging, the butterfly’s wings are soft and crumpled. The butterfly expands its wings by pumping fluid into the wing veins.
     - After the wings are expanded, they need to stiffen or “dry” (remember they are covered in exoskeleton, which is soft after molting). This takes about an hour.
     - Once the wings are stiff, the butterfly will fly away in search of food and a potential mate.
     - Adult butterflies do not grow or molt after emerging from their chrysalids.
Adult Stage: Feeding

Adult butterflies use their proboscis to feed. The proboscis works like a straw by sucking up liquids. Butterflies have multiple ways of sensing their food. Their excellent eyesight allows them to search for food visually. Many flowers have UV coloration that specifically attracts pollinating insects. Butterflies can also “taste” their food using the chemo receptors on the tips of their legs.

Butterflies have a variety of food and nutrient sources, including:

• **Flower Nectar**: Flowers have evolved to have a sweet liquid called nectar that functions to attract pollinators like bees and butterflies. The nectar is produced by special glands within the flower called nectaries. Butterflies stick their proboscis into the flower to suck up the nectar, almost like drinking from a cup with a straw.

• **Fruit Juice**: Many tropical butterflies feed on the juice of overripe or rotting fruit that has dropped from the plant. Fruit-feeders are attracted to the alcohols present in fermenting fruit and can smell them from far away. Not many temperate butterflies have evolved a preference for fruit juice because it isn’t steadily available in colder climates. Fruits fall from trees all year in tropical zones so many tropical butterflies specialize on fruit juice.

• **Dead Animals, Dung, and Brine**: Butterflies seek out these seemingly odd foods because they’re looking for salts and minerals. Salts and minerals are scarce in their natural diet. Plant cells have no salts, but animal cells use salt to regulate water balance. Butterflies in the Flight House may land on visitors to drink their sweat. The salts and minerals collected at these sources are incorporated into the eggs and thus very important to butterfly reproduction.

• **Water**: Butterflies can also drink water if they don’t get enough from their food. Sometimes water sitting on rocks or the shores of rivers or ponds have minerals as well.
Adult Stage: Surviving Predators

In order to reproduce, butterflies must survive long enough to find a mate. Butterflies have multiple strategies to avoid being eaten, including:

- **Camouflage**: Butterfly wings can have coloration and shape that allows them to blend in with their surroundings. Butterflies use their excellent vision to find places where their wings will blend in. For example, you might see green Malachites hiding under green leaves. Some butterflies look exactly like dead leaves when their wings are closed.

- **Aposematism (warning colors)**: Butterfly can be brightly colored to communicate to predators that they’re toxic. The bright orange and black markings on a monarch wings are warning colors. Some non-toxic butterflies mimic the warning colors of toxic ones.

- **Mimicry**: Some butterflies have patterns than mimic other animals. The Owl butterfly has large spots on its hindwings that look like owl eyes. The Owl also has patterning that looks like a snake head on its forewing. Mimicry tricks predators into think the butterfly is larger and more dangerous than in reality.

- **Toxins**: Butterflies retain the toxins acquired as caterpillars. Caterpillar become toxic by feeding on toxic host plants and incorporating the toxins into their body.

- **Flight**: Flying one way for butterflies to avoid predators. Because their eyes are so good at sensing motion, they can easily see an approaching predator.

- **Hiding/Roosting**: When butterflies rest they usually go to a hidden or covered place and fold up their wings. The outside of the wings can have camouflage coloration to further protect them while they roost.
1. In order to reproduce, butterflies must survive long enough to find a mate. To survive, butterflies must eat and avoid being eaten.

2. Butterflies eat using their proboscis, a long tube-shaped mouth that works like a straw.
   - Butterflies can eat flower nectar, fruit juices, and liquids with salts and minerals (animal waste, brine, sweat, etcetera). Different species specialize on different foods depending on the environment in which they evolved.

3. Butterflies have many strategies to avoid being eaten including camouflage, toxicity, mimicry and hiding.
Top Questions Asked by Visitors

• What is the difference between a pupa, chrysalis, and a cocoon? (https://www.floridamuseum.ufl.edu/discover-butterflies/faq/) essentially chrysalis ⇔ pupa, cocoon is silk covering
• Why does this butterfly only have four legs?
• How long do butterflies live?
• How long are they in the egg stage? Caterpillar stage? Pupa stage?
• Do the butterflies fight?
• Why aren’t there caterpillars all over the plants?
• Why can’t the butterflies leave the exhibit?
• How does monarch migration work?