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*TASC's mission is to rebuild and strengthen the foundation of the Christian faith by increasing awareness of the scientific evidence supporting the literal biblical account of creation and refuting evolution.*



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# Insects: Musings on the Monarch, It's Migration, and Butterfly Metamorphosis

**By Wayne G. Buhler, PhD, C. Gerald Van Dyke, PhD, and Dave Greear, DMin, BSEE**

Insects are amazing! The monarch butterfly, *Danaus plexippus* L., is featured in this article; however, there are thousands of other species with intriguing lifestyles. The European honey bee, *Apis mellifera* L., for example lives in colonies with up to 60,000 nest mates—nearly all are sisters of one mother (the queen). After a young bee completes her duties as a "nurse" bee in caring for the immature "brood," she takes flight in search of nectar-rich flowers as far as three miles from the hive. Upon her return, the location (flight path) and richness of her find is "communicated" to other foraging bees by way of a unique dance on the surface of the honeycomb.

No other singular group of living organisms displays the diversity of life forms, appearance, ecological niches, number of species, and physiological function found in insects. References to these six-legged marvels and their habits pervade literature, including the Bible (e.g., "Go to the ant, thou sluggard; consider her ways, and be wise." Proverbs 6:6 KJV), creative and fine arts, jewelry, textiles, music, engineering, and medicine.[1]

Some insects—particularly those that bite and/or sting, spoil our food, or eat our clothing—incur the dread and disdain of humans. However, only a tiny percentage (less than 1%) of the known species of insects (more than 900,000) are considered pests. In fact, many are necessary for our quality of life as pollinators (one out of every three bites of food in the American diet is dependent on insect pollination), decomposers (the world needs termites), and important sources of food for wildlife (including other insects) and humans (entomophagy—Google it!).

## *First in Flight*

Not lost in these fascinating facts and features is the extensive migratory patterns of some insects. Chief among them, the monarch butterfly, has garnered much acclaim with conservationists, mass media, and the public.

Of the two to three subspecies of monarch butterflies in the western hemisphere, those that make the eastern U.S. their "summer home" are the long-distance "snowbirds" of the butterfly world.

Triggered by changes in temperature, these monarch populations begin moving in a southerly direction in September. Some ascend as high as 11,000 ft., with sustained, wing-flapping-flight for 11 to 12 hours, covering 200 to 400 miles per day! The maximum distance traveled by a single tagged monarch is 2,595 miles from Canada to Mexico. They eventually end up in the forests of the Transverse Neovolcanic Belt of central Mexico. After arriving at their "winter home," the butterflies remain largely quiescent for a period of 4 to 5 months with occasional movement for food and warmth. In spring, the monarchs mate at the colony site, then set out on their return trip, and get as far as southern or mid-tier U.S. states before laying their eggs. Thereafter, it takes multiple generations, aided by strong gulf winds, to recolonize the entire summer breeding range. Come fall, the great-great-great-grand-children of the original northward moving migrants prepare to move south, over a path that they have never followed themselves.

Scientists have yet to fully understand the orientation ability of the monarchs to arrive at a point to which they have never been before (at the end of the fall migration). The best evidence exists for navigation by the sun and magnetism. Coincidentally or providentially, depending on your worldview, the Mexican Transvolcanic Range where the largest overwintering colonies exist contains magnetic anomalies a hundred times stronger than other surrounding terrain due to heavy metallic ore deposits. The presence of magnetic materials in the monarch's head and thorax significantly exceeds the magnetite contained in its non-migratory sister subspecies.[2] Attractive thought, indeed!

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[1] 9News Staff (2022 Nov 04) Maggot therapy spikes in Britain amid increase in antibiotic resistance. https://bit.ly/3VFt7Jl Accessed 2022 Dec 05

[2] Emmel TC, Sourakov A (2008) Monarch butterfly, *Danaus plexippus* L. (Lepidoptera: Danaidae). *Encyclopedia of Entomology*, John Capinera [ed.], Springer.

### *Metamorphosis: Extreme Insect Makeover*

The 3,000-mile trek from northeastern North America to rain forests in Southwestern Mexico by fragile adult butterflies is rivaled only by the profound "journey" it took to develop from a tiny egg to the adult frequent flyer.

In between egg and adult are the larval and pupal stages. Completion of all the stages in the life cycle is considered one generation. Figure 1 illustrates the stages of the life cycle.


Figure 1. Butterfly life cycle. Image by macrovector on Freepik

The following description of butterfly metamorphosis is taken directly from The Butterfly Conservatory exhibition of the American Museum of Natural History.[3]

#### Egg

The butterfly begins its life as an egg about the size of the head of a pin. Adult female butterflies usually lay their eggs on plant leaves or stems. Some place the eggs in protected locations—on the undersides of leaves, for example—where wasps and other predators are less likely to find them.

As the time of hatching nears, a week or two after the egg is laid, the eggshell darkens and becomes almost transparent. At this stage you can see a tiny but fully formed caterpillar moving inside. Finally, the larva chews through the eggshell and emerges into the world.

#### Larva

The butterfly larva, or caterpillar, spends most of its time eating on a specific plant species, digesting its food, and growing.

Caterpillars consume huge quantities of leaves—and they are very specific about which plants they will eat. Most will eat plants from only a single species or genus, called the host plant for that caterpillar; it will die rather than feed on others.

The larva repeatedly outgrows its skin, which splits and is shed. At the end of its growth period, the caterpillar stops eating and finds a good place to molt into the next stage. It spins a small pad of silk and attaches itself to it, hanging upside down, immobile. The larval skin then splits one last time, revealing the pupa.

#### Pupa

Inside the skin of the [butterfly] pupa, or chrysalis, the most dramatic part of the metamorphosis takes place. During this stage of metamorphosis, which usually takes from two weeks to several months, the larval tissues completely break down and reorganize. The outlines of adult features—the wings, eyes, tongue, antennae, and body segments—can be seen on the surface of the pupal skin.

When the [butterfly] is fully formed, the pupal case splits and the butterfly emerges. The butterfly first expels its meconium, metabolic waste products that have accumulated during the pupal stage. It then expands its shriveled wings—by pumping them full of blood [fluid and air]—before flying off.

The following section further describing the butterfly pupal stage, called a chrysalis, is taken from an article by Anthony Bouchard.[4]

#### Chrysalis

The chrysalis is actually part of the caterpillar's body. After the chrysalis forms, the body released [sic] enzymes called caspases that dissolve cells in the insect's muscles and organs, leaving behind only the most vital life-supporting cells. It's from this point that a group of specialized cells called imaginal discs get to work, developing the insect's new body and wings in a short time period.

Now, returning to information from The Butterfly Conservatory exhibition of the American Museum of Natural History:[3]

#### Adult

The primary function of the male butterfly is to find a female. The male butterfly uses vision to locate a female of his own species, then lures her with chemicals called pheromones, produced by his scent glands. Some species also perform elaborate courtship flights.

Once the female has mated, she must lay her fertilized eggs on the appropriate larval host plant. To find the host plant—an amazing feat, given the tremendous diversity of plants in the butterfly's surroundings—

[3] Butterfly metamorphosis. Part of The Butterfly Conservatory exhibition of the American Museum of Natural History. https://www.amnh.org/exhibitions/butterflies/metamorphosis Accessed 2022 Dec 07

[4] Bouchard A (2019 Sep 22) Here's what happens inside a caterpillar's chrysalis. *Labroots*. https://www.labroots.com/trending/plants-and-animals/15714/here-s-happens-inside-caterpillar-s-chrysalis Accessed 2022 Dec 09

the females rely on vision and a highly tuned ability to detect plant chemicals.

The following is an explanation of the origin of butterflies from an evolutionary perspective taken from The Butterfly Conservatory exhibition of the American Museum of Natural History: [5]

> Our understanding of butterfly origins is based on the study of living Lepidopteran species. We can often learn about evolution from the fossil record, but there are relatively few butterfly fossils. Those that do exist, like the 40-million-year-old *Prodryas persophone* [sic], are remarkably similar to modern-day forms—so the fossil record sheds little light on the origin of today's butterflies.
>
> Many scientists think that the specialized association between today's butterflies and flowering plants suggests that butterflies developed during the Cretaceous Period, often called the "Age of Flowering Plants," 65 million to 135 million years ago—a time when dinosaurs also roamed the earth.
>
> *Evolutionary relationships among major Lepidopteran groups are not well understood* [emphasis added]. What we do know is that, despite the attention they receive from scientists and the public alike, butterflies are not the pinnacle of Lepidoptera evolution. One recent theory is that an obscure moth family, the Hedylidae, represents the closest living relatives of the butterflies. Essentially, this theory suggests that butterflies are just a group of brightly colored moths.

Of all the amazing feats and features of insects, the life cycle of a common, yet extraordinary, butterfly is compelling evidence for a Master Designer.

### *Christian and Insect Metamorphosis Compared*

The change (metamorphosis) that occurs in the life of a Christian is analogous to the change (metamorphosis) that occurs in the butterfly. But within the culmination of the work of the Spirit in that future day of Jesus Christ, the change will include the outward also. The metamorphosis actually cannot be completed apart from this culminating, outward change. The Spirit of God "…who has begun a good work in you will complete it until the day of Jesus Christ." (Philippians 1:6, NKJV).

Theologically, what happens takes place in three steps:

1. Justification is one point in time (past tense) and saves us from the penalty of sin.
2. Sanctification is a present process that progressively is saving us from the power of sin; the metamorphosis is turning us into something new from the inside out.
3. Glorification is the future one point in time act that saves us from the presence of sin.

Below are a few scriptures explaining the spiritual change.

> And do not be conformed to this world [age], but be transformed [μεταμορφοω, *metamorphoo* in the Greek] by the renewing of your mind, that you may prove what is that good and acceptable and perfect will of God. (Romans 12:2, KJV)
>
> Therefore if any man be in Christ, he is a new creature: old things are passed away; behold, all things are become new. (2 Corinthians 5:17, KJV)

Colossians 3:10 (KJV) reveals how the renewing of the mind is accomplished:

> …and have put on the new man who is renewed [literally, "is being renewed"] in knowledge after the image of Him who created him…
>
> You were taught, with regard to your former way of life, to put off your old self, which is being corrupted by its deceitful desires; to be made new in the attitude of your minds; and to put on the new self, created to be like God in true righteousness and holiness. (Ephesians 4:22–24, NIV)

That which occurred on the mount, when Jesus was transfigured, is a foretelling of things that are yet to occur. The same Greek word (*metamorphoo*) translated "transformed" in Romans 12:2 is translated "transfigured" in Matthew 17:2. As Peter, James, and John appeared with Jesus on the mount, Jesus was transfigured before them, and Moses and Elijah appeared and stood in His presence.

The disciples got a brief glimpse of his preincarnate glory. Again, this was not just an external makeover, but what He was truly and internally briefly became visible externally.

> And we all, who with unveiled faces contemplate the Lord's glory, are being transformed (*metamorphoo)* into his image with ever-increasing glory, which comes from the Lord, who is the Spirit. (2 Corinthians 3:18, NIV)

Therefore, as we "see" (through the eye of faith) the "glory" of Christ in the Word, and meditate on that, our minds are renewed, and we begin to resemble more closely the very glory we are seeing in an incremental step by step process! We are being metamorphosed! ☙

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[5] Evolution. Part of The Butterfly Conservatory exhibition of the American Museum of Natural History. https://www.amnh.org/exhibitions/butterflies/evolution Accessed 2022 Nov 29

## COMING EVENTS

**TASC Zoom Meeting, January 12, 7:00 pm EST**

This meeting will present many amazing aspects of insects, including their diversity, appearances, ecological niches, and impact on the earth, plants, other animals, and humans. Details of the monarch butterfly's metamorphosis and migration will be emphasized and a comparison to spiritual metamorphosis in the life of a Christian.

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