The Anatomy of a Monarch Butterfly

Introduction to Monarch Anatomy

Monarch butterflies are arguably the most well-recognized of their species. They reside primarily in North America and have been proven to have very interesting anatomy. A monarch's anatomy is made up of many different components, however, they all go hand in hand with each other. The main components consist of the head, the thorax, the abdomen, the forewings and hindwings, and the wing veins.

1:5 magnification

The Head

A monarch butterfly's head generally has four main components: two antennae, two compound eyes, two labial palps, and one proboscis. Each of these components aids the monarch differently, however, they all contribute to the species' sight.

2.5x magnification

The two antennae, present on the top of the monarch's head, help it to perceive chemicals present within the air, like the smells of different flowers or the presence of a possible mate, and help it to maintain balance and detect motion in its surroundings.

The compound eyes, present on each side of the monarch's head, provide the butterfly with vision just under 360 degrees. These eyes are comprised of ommatidia, or smaller eyes, each having its own lens. When information is collected, the monarch's brain can take it and stitch it together, creating a panoramic image.

The labial palps, present on the top of the monarch's head, help to determine what food sources are edible and which ones are not. Finally, the proboscis, or the mouth for the monarch helps it to consume the liquid nutrients it needs to in order to survive.

The thorax of a monarch contains three parts, all fused together, known as the prothorax, mesothorax, and metathorax.

The prothorax is located closest to the head and contains both a pair of legs and a pair of spiracles.

The mesothorax, located in the middle, is the largest part of the thorax. It contains yet another set of legs, another set of spiracles, and the forewings.

The metathorax is located at the bottom of the thorax. It contains the final pair of legs and the hindwings.

1:1 magnification

The Thorax

2.5x magnification

On the outside, it does not appear that there is much to the abdomen of the monarch, however on the inside, some of the most important organs can be found. The abdomen contains the digestive tract, spiracles, and the reproductive organs.

The digestive tract acts very similarly to our digestive tract, in the sense that it helps the monarch process its intaken food and waste. The spiracles, on the other hand, are an interesting part of the monarch's anatomy, given that they aid in the breathing of the species. These spiracles are small holes along the sides of the abdomen, allowing air to travel to the respiratory system so the monarch can breathe. Finally, the reproductive organs are located toward the tip of the abdomen.

The Abdomen

Forewings and Hindwings

Forewings, also known as anterior wings, are located on the middle segment of the thorax. They are essential in the flight of the monarchs and are considered to be one of the most fragile parts of the anatomy.

3.0x magnification

Hindwings, otherwise known as posterior wings, are located on the final part of the thorax. Unlike the forewings, monarchs do not require hindwings to take flight, however they are extremely important in helping in a normal evasive flight pattern.

3.0x magnification

Wing Veins

Most species of butterflies, monarchs included, have veins located on the top pair of their wings. These veins do not serve the normal purpose of transporting blood, but rather give the wings structural support. There is also speculation among some scientists that the more bloated veins, like the one pictured, may help the butterflies hear.

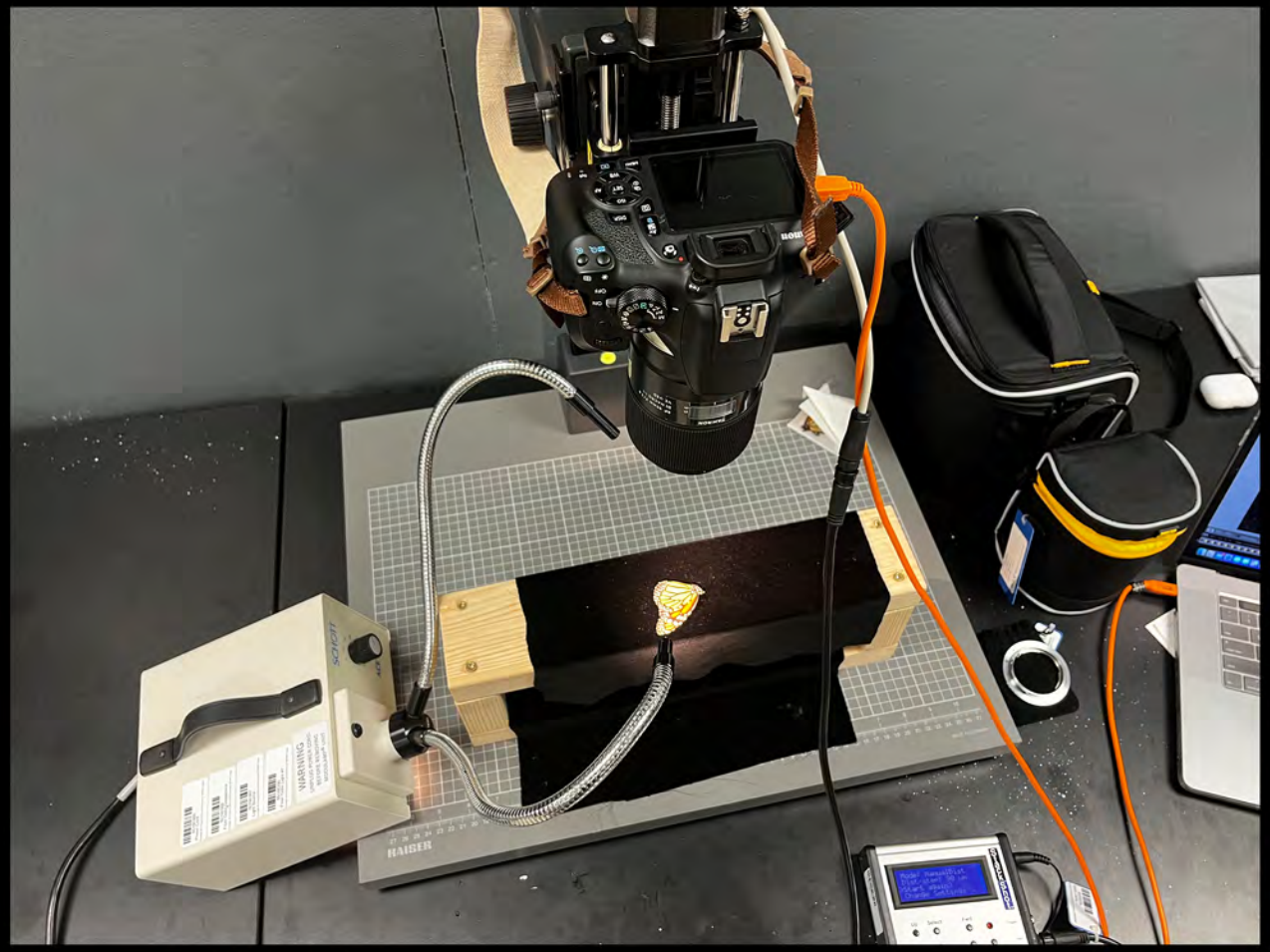
Certain species of butterflies, like monarchs, have stretched-out membranes at the base of their wings that act as an ear. When vibrations hit these membranes, electrical signals within the monarch's nerves are activated, allowing them to hear the things around them.

Since these bloated veins run so close to the ears and there have been speculation that they aid in hearing, a study was conducted where the amount that a butterfly could hear was recorded with the vein intact, and then recorded again when the vein was cut. Through this, it was noticed that the ears became less sensitive, especially to lower-pitched sounds, proving that the wing veins help with hearing sensitivity.

3.0x magnification

Additional Information

All images were shot using a Canon Rebel T6 camera. Both a 25mm f/2.8 Macro for Nikon-F lens and a TamronSP 90mm f/2.8 Di Macro lens were used, depending on the part of the subject being imaged. A copy stand was used to hold the camera and a set of fiber optic lights was used to illuminate the subject. A StackShot Macro Rail was used to focus stack all of the images.



About the Author

Madeline Dowe is a current third-year Photographic Sciences student at the Rochester Institute of Technology in Rochester, New York. Upon graduating in May 2024, she hopes to pursue a career in medical or forensic imaging. For questions or comments about the article, please contact madelinedowephotography@gmail.com

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