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Exploring Structures— Butterfly

Is the butterfly really blue?



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Exploring Structures—Butterfly

Try this!

1. Examine the blue and yellow butterflies. Try tilting the case to see the butterflies from different angles. And be sure to look at both the front and back!
2. Shine the light through the butterflies, holding the light underneath the case. Do the butterflies look the same with the light passing through them?

Tip: Squeeze the mini-light to turn it on.

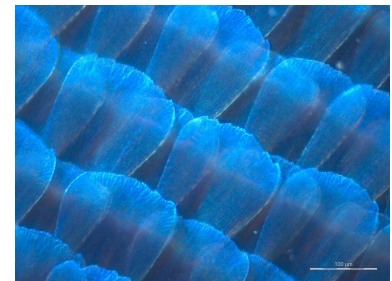


What's going on?

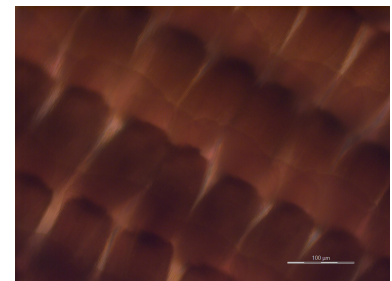
When you turn on the light, the yellow butterfly stays yellow, but the blue butterfly turns brown! That's because the yellow color comes from pigment, but the blue is created by the interference of light bouncing off tiny nanostructures.

The Blue Morpho's wings have very small overlapping scales covered with tiny "ribs." The size and arrangement of these nanostructures makes the wings look blue—but they're actually transparent! There's an air space of a few nanometers between the ribs. Light waves bouncing off the top and bottom surfaces of neighboring ribs interfere with each other. Most light waves are cancelled by the interference and only certain wavelengths—seen as colors—bounce back to your eyes. So when you look at the front of the butterfly, it's a beautiful, iridescent blue.

When the bright light passes through the Blue Morpho's wings, the effect is lost and you see the wings' brown undersides. The back side of the wings is colored by pigment—so the brown side always looks brown.



Light reflecting off the wings



Light passing through the wings

How is this nano?

The way a material behaves on the macroscale is affected by its structure on the nanoscale. Nanotechnology takes advantage of different material properties at the nanoscale to make new materials and tiny devices smaller than 100 nanometers in size. (A nanometer is a billionth of a meter.)



Low-energy display

Nanotechnology allows scientists and engineers to make things like smaller, faster computer chips and new medicines to treat diseases like cancer.

Some nanotechnology and nanomaterials are inspired by nature. Scientists are working on new nanotechnologies that mimic the Blue Morpho's wings. They've already invented low-energy smartphone displays, paints, and fabrics that change color by changing the spacing between materials.

