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Blue Birds Aren't Blue, and This is How They Fool You

By Josh Bloom — June 30, 2016

I'm a big fan of birds. If you watch them for long enough, you will see more than their colors, sizes and shapes. They also have distinct personalities.

Some of them are also "tricky." They fool you into thinking that they are a beautiful blue color, but this is just an illusion. (More on that later.)

Black-capped chickadees are fearless. They will eat out of your hand if you stand still. Catbirds don't scare easily either, and they are rather inquisitive. If you leave your door open, it is not impossible that you will find a catbird sitting on your kitchen counter. I found this out the hard way. (Getting it out of there was rather challenging.)

Northern Cardinals are both timid and polite. It does not take much more than the sound of a cotton ball falling on a Tempur-Pedic mattress to scare them away. And, if other birds are on the feeder, cardinals will sit calmly nearby and wait for them to finish. Then they hop on and start to feast. New Yorkers should take etiquette lessons from cardinals.

Blue jays are much more like New Yorkers on line at Trader Joe's. They dive bomb the feeder with their huge blue wings fully extended, screaming at the other birds, which promptly get the hell out of the way.

Black-capped chickadee. Fearless and smart.

Male Northern Cardinal. Timid and polite.

Blue jay. Neither timid nor polite. "Color faker"

But there are a couple of differences between blue jays and New Yorkers. New Yorkers can't fly **(1)** , and, with the exception of the guys in Blue Man Group, we are not blue.

But, neither are the blue jays. They obviously look blue, but here is something that you probably don't know: There is no blue pigment in their feathers.

If you grind up the wing of a cardinal, the resulting powder will be red. If you do the same with a blue jay feather, the powder will be brown [1]. You can see the same effect by simply turning

around a blue feather.

Blue jay feathers
Left: Normal view
Right: Backlit

This effect is not unique to blue jays. Blue birds are not really blue. They do not have any blue pigment [2]. Instead they use a very cool trick called light scattering. It is somewhat similar to how a prism works. But nature uses a trick that is much more complex.

How does this work? Blue wings contain tiny pockets made of air and a protein called keratin **(2)**. These pockets are so small that they fall into a group of miniscule structures called nanostructures, which range in size between microscopic and molecular. The tiny pockets are even smaller than the wavelength of visible light, which is exactly why they work (see below).

For perspective, here are examples [3] of some very small entities, measured in nanometers (nm):

Grain of sand- 500,000 nm

Thickness of a human hair- 70,000 nm

Red blood cell- 7,000 nm

Wavelength of visible light- 380-750 nm

Feather nanostructures - Several hundred nm

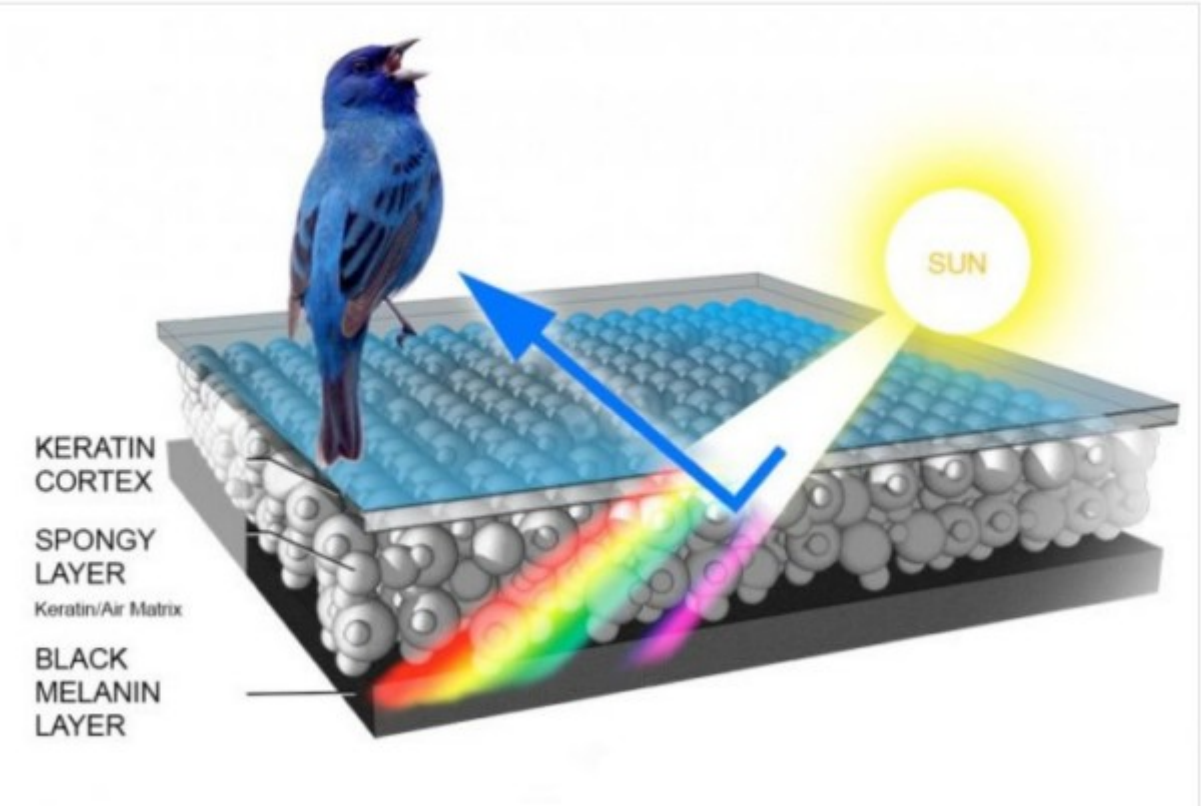
Viruses- approx. 20-250 nm

Gold atom- 0.14 nm

Note that the feather nanostructures are similar (or even smaller) than the wavelength of visible light. This is no coincidence.

The graphic below explains why you see blue in feathers. Visible light strikes the feathers and encounters the keratin-air nanostructures. The size of the nanostructure matches that of the wavelength of blue light. So, while all of the other colors pass through the feather, the blue does not. It is reflected, so you see blue. This is why ground up feathers turn brown. Once the nanostructures are destroyed, you see the bird's true colors. This is also why you do not see blue

when the feather is turned around. The "prism" is now on the wrong side.



Scattering of light by bird feathers. Source: The Cornell Lab Bird Academy [4]

Nature can sure be amazing. Color me impressed.

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Notes:

(1) This is more literal than you might think. One flight in or out of LaGuardia Airport, and you will understand

(2) Keratin is the same protein that makes up hair and fingernails

Since we're talking about birds, just in case you're in a bad mood, watch this: (never fails to crack me up)

https://www.youtube.com/watch?v=9Gc4QTqslN4 [5]

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