Study suggests blue hue for tarantulas not about attracting a mate

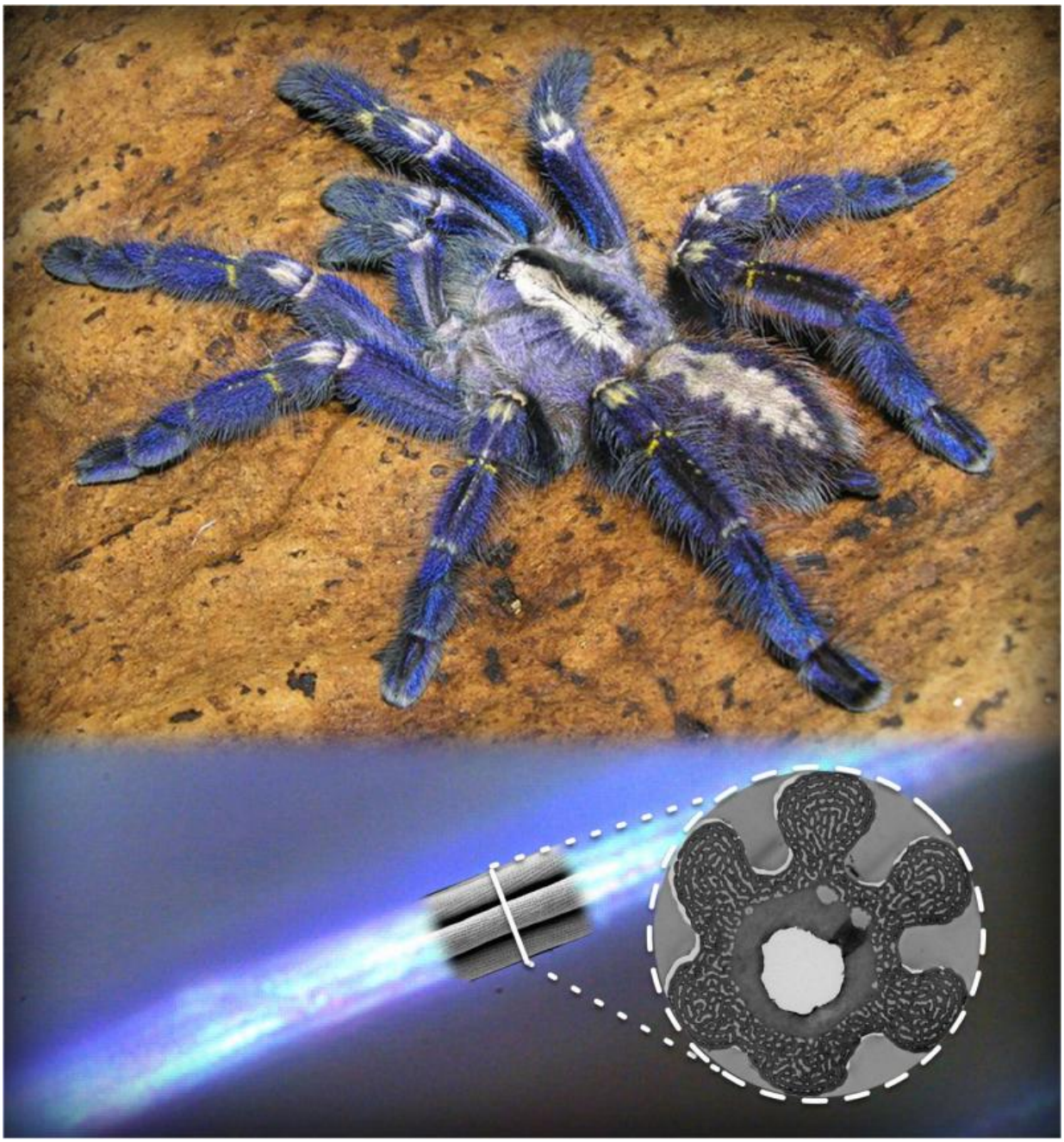
November 30 2015, by Bob Yirka

A greenbottle blue tarantula (C. cyaneopubescens) on a branch. Despite its name, saturated, bright green color rarely occurs in tarantulas. Credit: Michael Kern, thegardensofeden.org

(Phys.org)—A team of researchers affiliated with the University of Akron and the Scripps Institution of Oceanography has found via lab study that the blue color present in many species of tarantula does not appear to be related to attracting a mate. As they report in their paper published in the journal *Science Advances*, both genders have limited eyesight and do not appear able to discern the color blue.

Scientists have known for quite some time that many species of tarantula have parts that are colored blue, but have not been able to figure out why that is. In this latest effort, the researchers sought to find that answer by looking at digital image of 53 genera, focusing on the different hues between species and the location of the coloring. They followed that up by obtaining samples of several species and examined them under a normal microscope and then used reflectance spectroscopy and electron microscopy to get a better look.

Their close analysis revealed that the blue hue comes about due to the arrangement of nanocrystals in the hairs that grow on their body, which reflect blue wavelengths of light, though not all the shades in the different species are the same—they are very close. They also found evidence that indicated that the blue color evolved separately at least eight different times in different species, suggesting there must be a strong purpose for it, though they still do not know what it is. They also found that not all species cause blue light to be reflected in the same way, suggesting that it is not related to a different trait such as an ability to repel water.

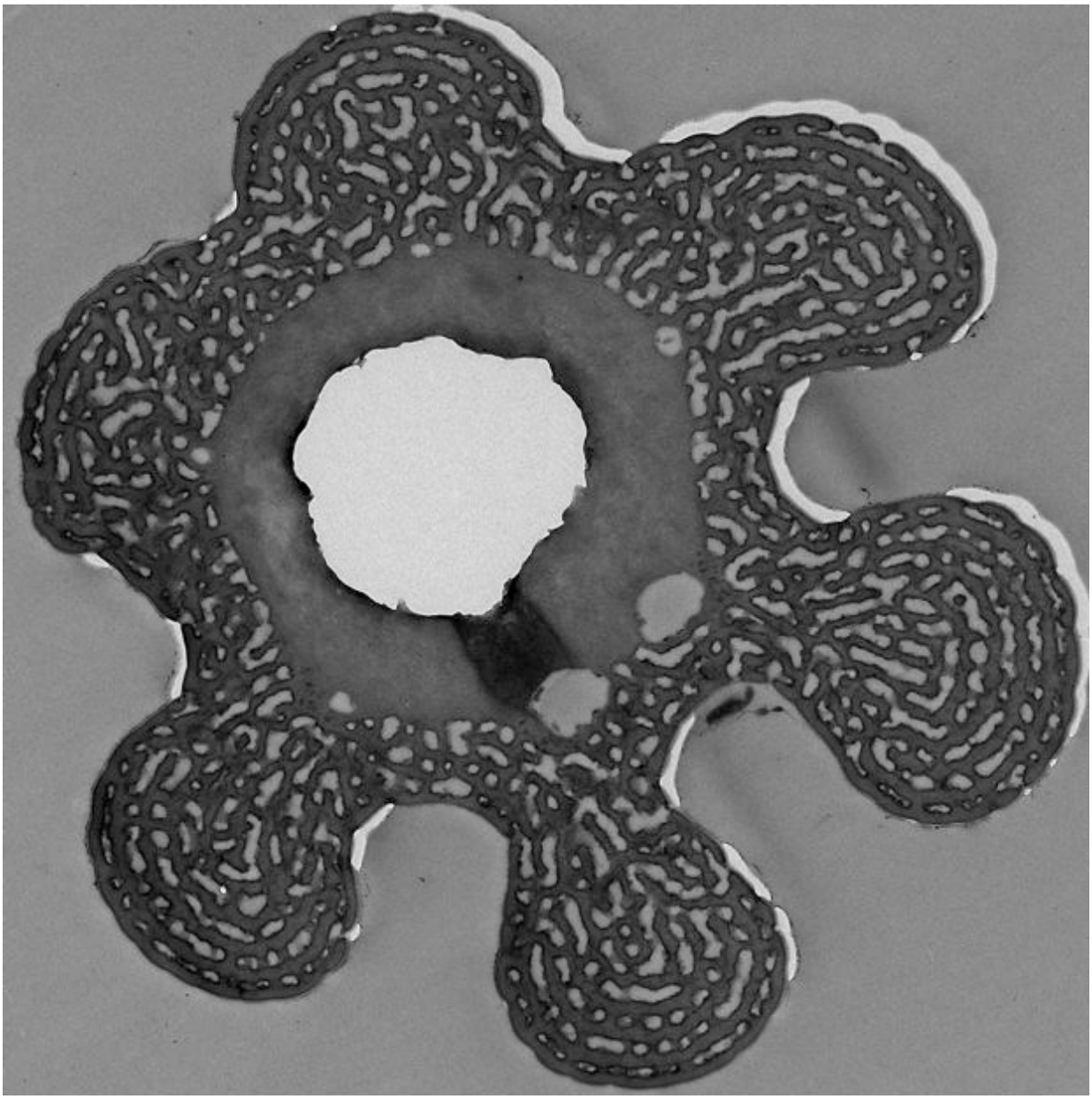


A critically endangered adult female gooty sapphire ornamental tarantula (P. metallica), native to India. A blue hair is observed under an electron microscope. The hair is symmetric with an array of rod-like, tubular foldings projecting longitudinally on its periphery. Organized multilayered nanostructures were observed, which produced the bright blue reflection as seen under the microscope. Credit: Tom Patterson [upper]; B.-K. Hsiung, UAkron [lower]; D. Deheyn. UC San Diego (SIO)

In addition to having poor eyesight, the researchers report that the tarantulas do not appear to try to use their blue color to capture the attention of a mate, suggesting the purpose is likely for signaling, such as to help with evading predators, or fooling prey. How that might work though, remains a mystery especially when noting that tarantulas are nocturnal—they hunt at night. Despite not solving the riddle of the blue hue, the work by the team did show that the colorations though bright, are not very iridescent, a finding that with more study could lead to wide-angle lenses for phones that are less energy intensive.

A look at the critically endangered gooty sapphire ornamental tarantula (P. metallica) from the underside. Metallic blue color can be seen on the femurs. Credit: Michael Kern, thegardensofeden.org

A front view shot of a critically endangered gooty sapphire ornamental tarantula (P. metallica) and its reflection. Credit: Michael Kern, thegardensofeden.org



A microscopic image of a multilayer nanostructure inside a tarantula's hair that is responsible for its vibrant blue color. Credit: Scripps Institution of Oceanography, UC San Diego

More information: B.-K. Hsiung et al. Blue reflectance in tarantulas is

evolutionarily conserved despite nanostructural diversity, *Science Advances* (2015). DOI: 10.1126/sciadv.1500709

Abstract
Slight shifts in arrangement within biological photonic nanostructures can produce large color differences, and sexual selection often leads to high color diversity in clades with structural colors. We use phylogenetic reconstruction, electron microscopy, spectrophotometry, and optical modeling to show an opposing pattern of nanostructural diversification accompanied by unusual conservation of blue color in tarantulas (Araneae: Theraphosidae). In contrast to other clades, blue coloration in phylogenetically distant tarantulas peaks within a narrow 20-nm region around 450 nm. Both quasi-ordered and multilayer nanostructures found in different tarantulas produce this blue color. Thus, even within monophyletic lineages, tarantulas have evolved strikingly similar blue coloration through divergent mechanisms. The poor color perception and lack of conspicuous display during courtship of tarantulas argue that these colors are not sexually selected. Therefore, our data contrast with sexual selection that typically produces a diverse array of colors with a single structural mechanism by showing that natural selection on structural color in tarantulas resulted in convergence on similar color through diverse structural mechanisms.

Press release