Media Relations

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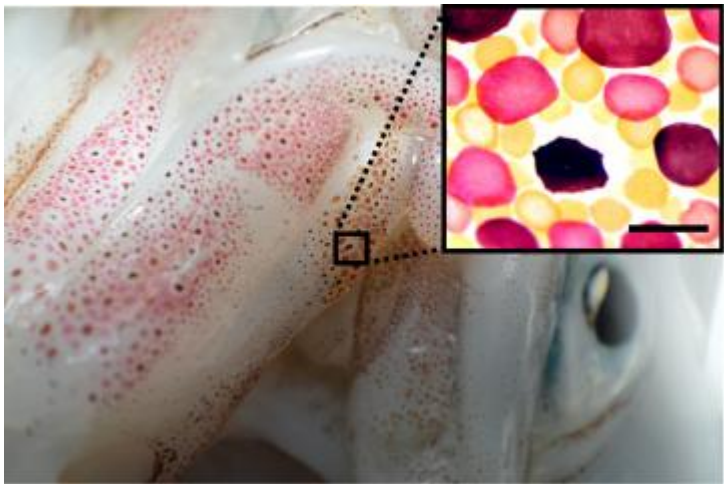
UNH Researchers Take Steps to Unlock Camouflaging Mystery of Squid



Red, yellow, and brown Chromatophores (inset) are isolated from squid Doryteuthis pealei. Photo Credit: University of New Hampshire

DURHAM, N.H. – Researchers at the University of New Hampshire have identified the pigments that contribute to the broad range of colors displayed on the skin of cephalopods, which include squid, cuttlefish, and octopi, allowing them to camouflage their appearance in response to different environmental cues.

The research was conducted by Leila Deravi, an assistant professor of chemistry and materials science. Deravi and her team set out to identify the molecular mechanism that triggers cephalopods to alter their presence in the hopes of duplicating this process for future use in textiles, like camouflage, paints, cosmetics and other products used to disguise appearance.

“This is a really exciting finding. It allows us to better understand just how sophisticated and intricately wired these animals are, even on the molecular level,” said Deravi. “One of the most basic components of coloration is the pigment, but we learned that even the pigment itself can aggregate into different forms to give a broad range of color.”

“The holy grail is of course to be able to design systems that can behave how cephalopods do - to sense different environmental conditions and adapt to them either by blending in or by standing out,” continues Deravi. “Now that we know the composition of the pigments they use, we can begin to think about integrating them into materials that are capable of these tasks.”

The study was published in the journal *Langmuir* and can be viewed here: http://pubs.acs.org/doi/abs/10.1021/acs.langmuir.6b00243

Cephalopods are complex animals that use multiple optical organs to sense and respond to the surrounding environment and quickly change their skin to match, or stand-out in, the background around them. This so-called camouflaging process can help with signaling, communication, or protection within their natural habitat. Thousands of color-changing organs, called chromatophores, are located in the skin and are filled with a network of nanostructured pigmented granules that are anchored by muscle fibers. When the muscle fibers contract they cause the chromatophores to

expand and distribute the pigmented granules. This process happens over multiple chromatophores and changes the entire color of the animal. The idea that these pigments contribute to the color change in cephalopods had been suggested before, but not analytically verified until now.

The research team focused on the squid *Doryteuthis pealeii* because it is readily available off the coast of New England. Squid are also considered a simpler model in studying adaptive coloration, compared to cuttlefish and octopus, because they have a fewer number of chromatophores per square inch on their skin. Their chromatophores are also larger than those in octopi and cuttlefish, making them easier to identify during dissection.

Now that the researchers have identified what the pigments are, their next steps will be to understand what their purpose is and why they are localized specifically within the nanostructured granules in the chromatophore. In order to match the speed and dynamic range of the color-changing abilities of the cephalopods, researchers have to understand how these animals work and what the molecules are that help them do so effectively. The team's results are the first steps.

The University of New Hampshire, founded in 1866, is a world-class public research university with the feel of a New England liberal arts college. A land, sea, and space-grant university, UNH is the state's flagship public institution, enrolling 13,000 undergraduate and 2,500 graduate students**.**

PHOTOS AVAILABLE FOR DOWNLOAD

http://www.unh.edu/news/releases/2016/04/images/img-8FigureA.jpg
Red, yellow, and brown Chromatophores (inset) are isolated from squid *Doryteuthis pealei*.
Photo Credit: University of New Hampshire

http://www.unh.edu/news/releases/2016/04/images/img-8FigureB.jpg
Nanospherical pigment granules are extracted and purified from *D. pealei* chromatophores (left). Soluble pigments are extracted from the granules using acidified methanol, leaving behind spherical nanostructures with reduced diameters (right)
Photo Credit: University of New Hampshire

Video of identified pigment is available upon request.

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