



Smithsonian

# Color-Changing Cephalopods



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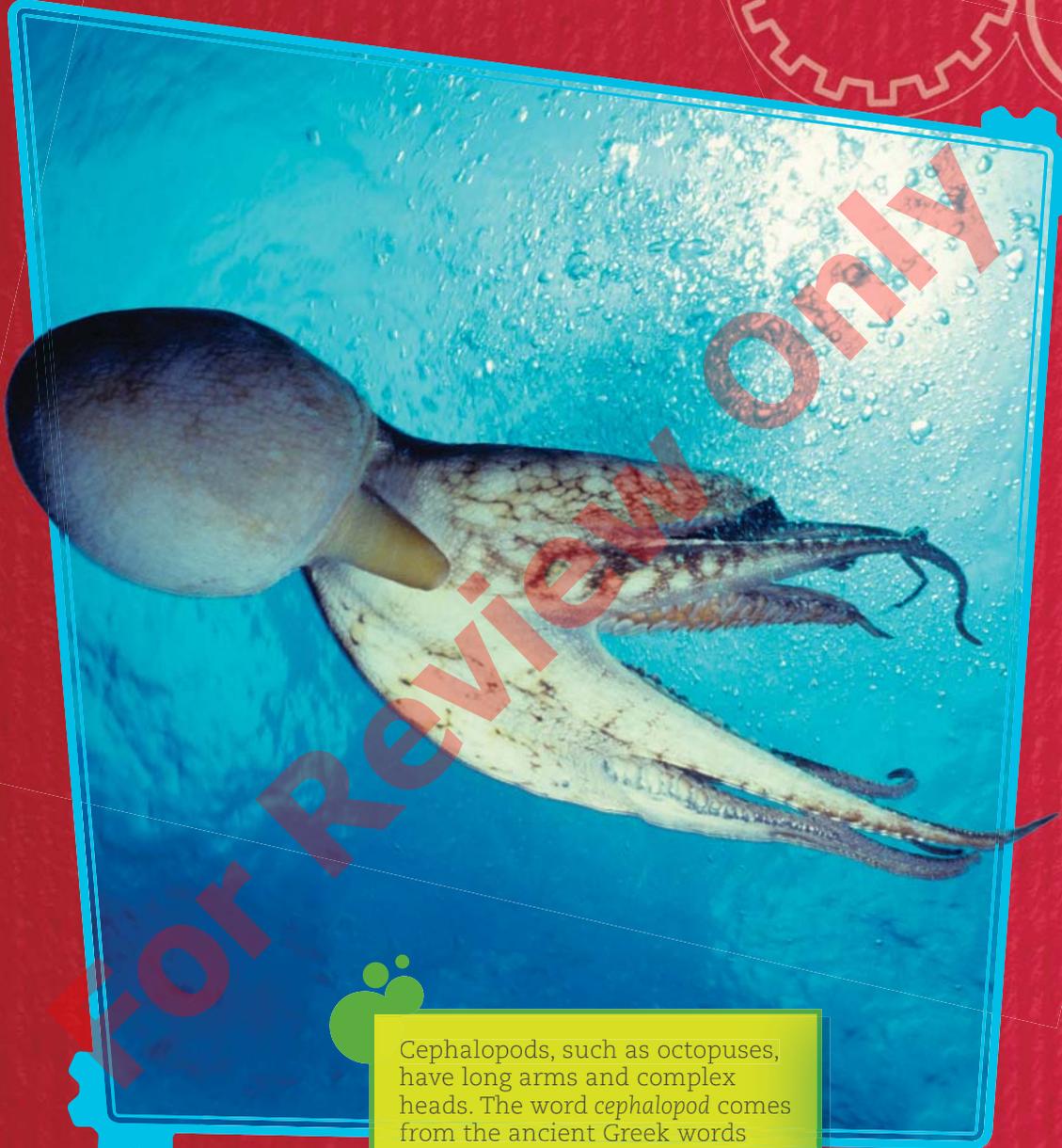
## Vanished!

In the deep blue depths of the ocean, two divers explore the shimmering world around them. Through their masks, they look closely at the plants and animals below the surface. Each creature is more interesting than the next. And they have heard stories from other divers that octopuses live in the area. They hope they will be lucky enough to find one.

Just then, one diver spots a rocky outcrop below and signals the other diver to come explore it. Breathing through their scuba equipment, the two divers swim down. As they turn the corner, they see just what they hoped: an octopus! The happy divers turn to each other and grin, high-fiving each other. They quickly turn back to the octopus. But it has vanished! The divers have a wide-open view of the sea around them, and it seems impossible that the octopus just disappeared. Where could it be, and how in the world could they have missed it?



An octopus defends itself by inking as it flees from two scuba divers.



Cephalopods, such as octopuses, have long arms and complex heads. The word *cephalopod* comes from the ancient Greek words *kephale* (keh-PAH-leh), meaning “head,” and *podos*, meaning “foot.”

## Hiding in Plain Sight

It is possible the octopus did not go anywhere at all! If the divers know where and how to look, they will see it right in front of them. The octopus, like other cephalopods, can blend with its environment. It can hide in plain sight. It does this through **crypsis**. This is a set of methods by which animals change themselves to avoid detection. They may change their texture, shape, posture, or color. Through a combination of these means, they can hide from predators or surprise their prey.

A day octopus changes its color and texture to blend into a dead coral reef.





## SCIENCE

### Can You See Me Now?

An octopus can **camouflage** itself by changing its texture. One way it does this is by raising papillae (puh-PIH-lee). Papillae are little bumps that sprout on the surface of the skin. When humans are cold or have a strong emotional reaction, they may grow papillae in the form of goose bumps.

A day octopus changes its color to match a coral reef.



A day octopus changes its texture to match a coral reef.

Fortunately, the divers know a thing or two about crypsis. Looking closely, they see a new blob on the rocky outcrop. It is the octopus blending into its environment. Its color and texture have changed in an instant!

Even knowing that the octopus can do this, the divers are amazed. How can it change in this dramatic way so quickly? Is it a **conscious** choice or an unconscious reaction? And since some animals can do it, what about humans? Is there any way for humans to produce this amazing ability in themselves?

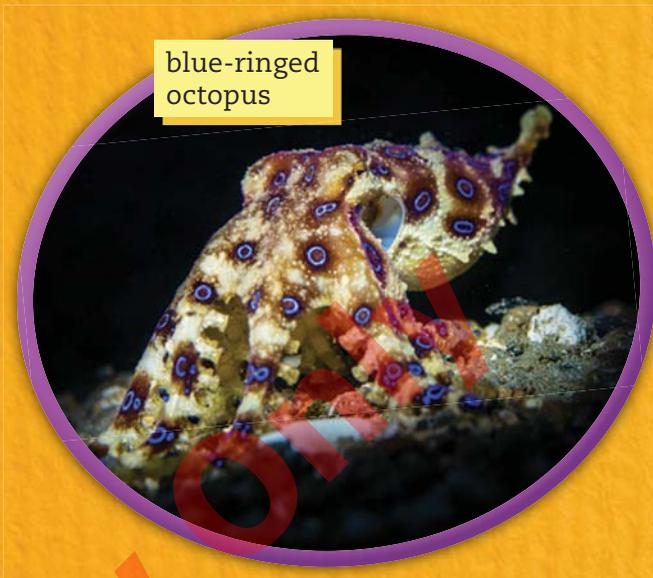
## Are They Magic?

Even if you do not have a chance to see cephalopods in person, a simple online search will bring up videos of them changing. The sight is remarkable every time. Viewers cannot help but wonder how they do it so quickly—or, in fact, how they do it at all. They can shift from one color or shape to another in under a second. For humans, this would be the work of a master magician. For cephalopods, it is simply in their DNA.

## What Are Cephalopods?

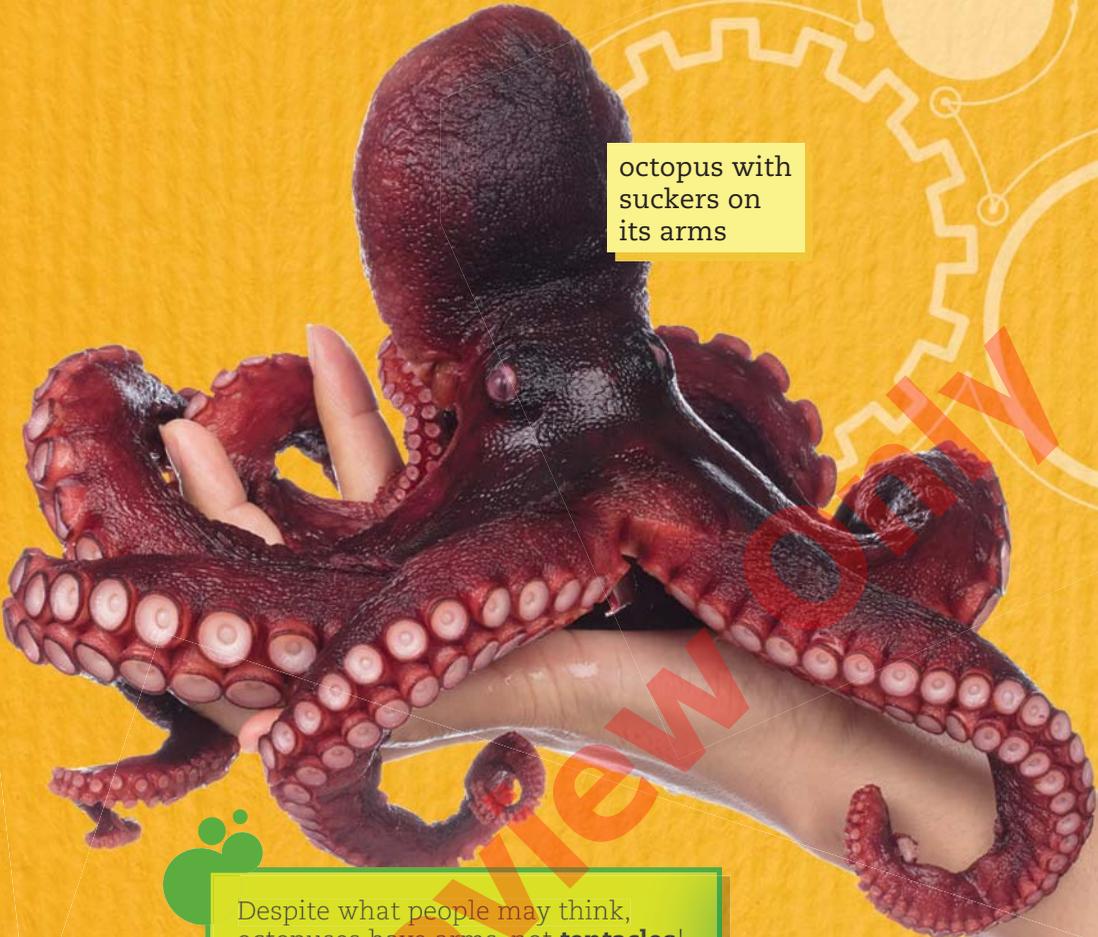
The most common cephalopods are squid, octopods (including octopuses), and cuttlefish. Cephalopods belong to a group known as **mollusks**. Most mollusks, such as clams and snails, have shells. Cuttlefish have internal shells called cuttlebones. But squid and octopuses do not have shells, just soft bodies with lots of muscles. They have large brains and are known for their intelligence. Arms surround their mouths and are used to move and to grab prey. They also have large eyes and good vision, similar to a human's eyesight.

blue-ringed octopus



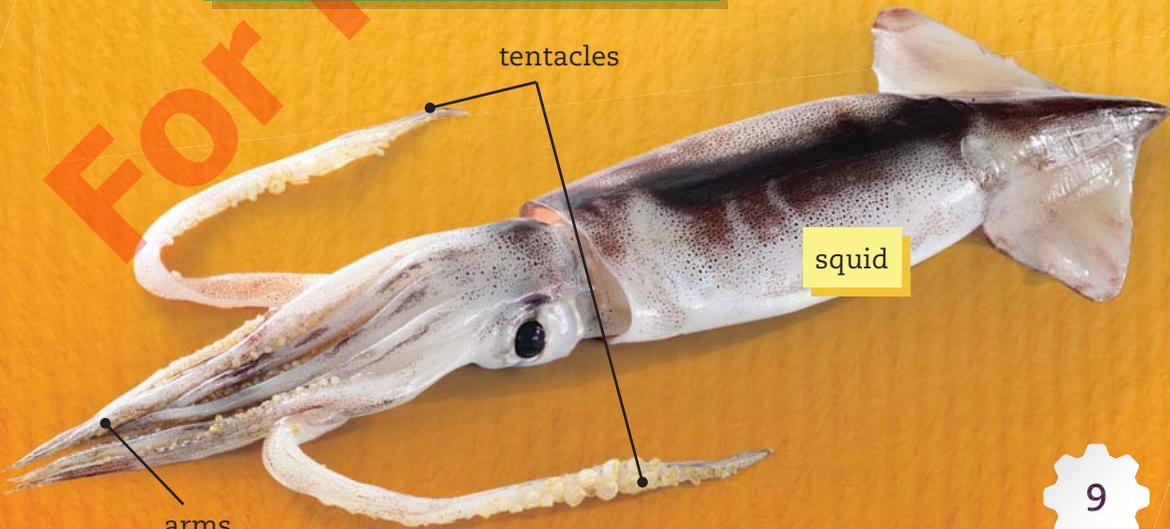
pharaoh cuttlefish





octopus with suckers on its arms

Despite what people may think, octopuses have **arms**, not **tentacles**! Arms have suckers all along them, but squid and cuttlefish tentacles have suckers just at the ends.



tentacles

squid

arms

# STEAM CHALLENGE

## Define the Problem

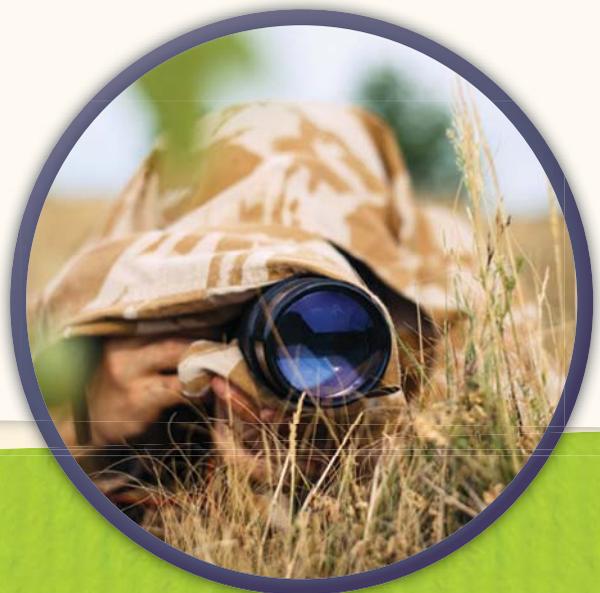
Wildlife photographers need to hide to get good pictures of animals. A company has asked you to design clothing to help photographers blend in with two different habitats. Use what you know about camouflage to make an item of clothing the company can sell.



**Constraints:** Your design must use both color and texture to camouflage a person.



**Criteria:** A successful piece of clothing will adjust to blend in with two different habitats (rainforest, desert, etc.).





## Research and Brainstorm

What are some of the different ways that cephalopods can camouflage themselves? What type of clothing would be most helpful to hide a person? How can you make your clothing change to camouflage a person in different habitats?



## Design and Build

Find images in books or online of two habitats for your clothing. Sketch your design. What purpose will each part serve? Will you have any detachable parts? Build the piece of clothing.



## Test and Improve

Have a friend wear the piece of clothing. Explain your design to them and describe how it functions to camouflage a person in two different habitats. Did it work? Did it use both color and texture? How can you improve it? Modify your design and try again.



## Reflect and Share

Would your item be easy for a photographer to wear and move around in? Would it work in different weather conditions? How would you modify your design to be weather resistant?