Nature's Cutest Symbiosis: The Bobtail Squid

hhmi | BioInteractive

Abbreviated Film Guide
Educator Materials

OVERVIEW

Nature's Cutest Symbiosis: The Bobtail Squid is one of 12 videos in the HHMI series "I Contain Multitudes," which explores the fascinating powers of the microbiome: the world of bacteria, fungi, and other microbes that live on and within larger life forms, including ourselves.

In this video, Ed Yong introduces viewers to a master of camouflage: the Hawaiian bobtail squid. It is a small predator native to the coastal waters surrounding the Hawaiian Islands. During the day, to avoid being eaten, it hides by burrowing into the sandy ocean floor, even attaching sand particles to itself. During the night, the bobtail squid leaves its hiding spot and forages in the water column. The squid has evolved to live in a symbiotic relationship with the bioluminescent bacteria species *Vibrio fischeri,* which serves to protect the squid from its predators and prevent it from being seen by its prey. The bacteria are housed in a special structure, called a light organ, located inside the body, and the light shines through the muscles and skin of the ventral side of the squid. At night, the bacteria glow to match the moonlight coming from above, preventing the squid from casting a shadow and camouflaging it well.

Scientists Margaret McFall-Ngai and Edward Ruby at the University of Hawaii have studied the bobtail squid for years. Among the many discoveries they have made, they found that immediately after hatching, the squid collect *Vibrio fischeri* from the ocean water, and that without the symbiotic bacteria, the juvenile precursor to the light organ does not mature into a functioning light organ.

KEY CONCEPTS

A. Symbiosis is a close, long-term interaction between organisms of at least two different species, often comprised of a large host and one or two species of microbe. For the host and/or microbes, one, both, or neither species may benefit from the relationship. When both host and associated microbes benefit, the relationship is called mutualism.
B. Microbes can play an important role in the development of a host organism.
C. The bobtail squid has evolved a number of camouflage strategies through the process of natural selection.
D. Model organisms are used to help scientists understand biological phenomena.

CURRICULUM CONNECTIONS

Standards	Curriculum Connections
NGSS (2013)	LS1.A, LS2.A, LS4.B, LS4.C
AP Biology (2015)	2.C.2, 2.D.1, 2.E.2, 2.E.3, 3.D.1, 3.D.2, 4.A.5, 4.B.3
AP Environmental Science (2013)	II.A
IB Biology (2016)	4.1, C.1
IB Environmental Systems and Societies (2017)	2.1
Vision and Change (2009)	CC2, CC5

PRIOR KNOWLEDGE

Students should

- have a basic understanding of natural selection and evolution;
- be familiar with the concept of food chains and food webs;
- know that bacteria are unicellular organisms, some of which are beneficial and others pathogenic;
- have a basic understanding that during development, cells differentiate to form specialized tissues and organs; and
- be familiar with bioluminescence.

KEY REFERENCE

McFall-Ngai, Margaret. Divining the Essence of Symbiosis: Insights from the Squid-Vibrio Model. 2014 February 4; PLoS Biol 12(2): e1001783. https://doi.org/10.1371/journal.pbio.1001783