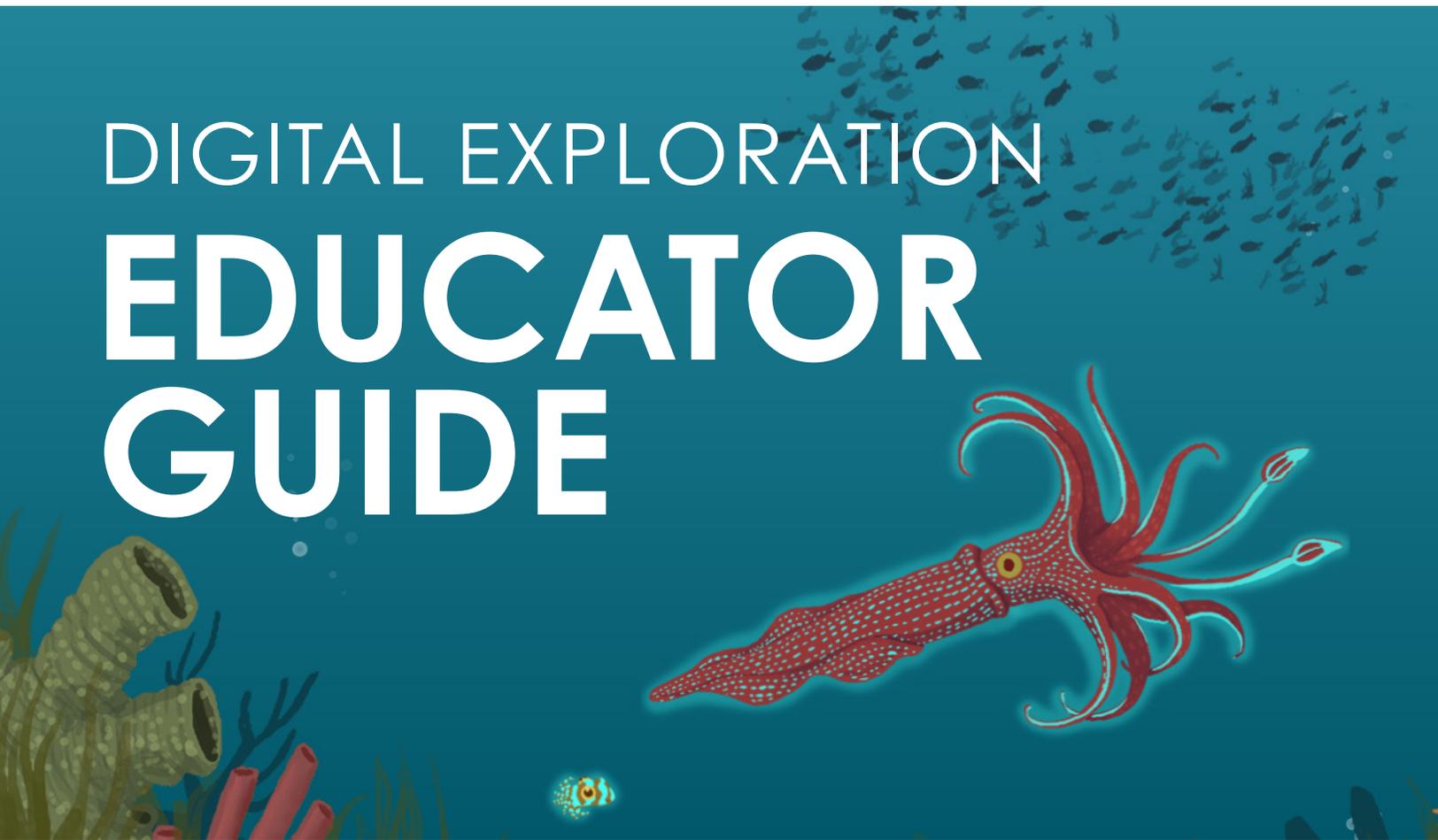


Following Nature's Lead

Exploring Biomimicry and Innovation through Squid Dissection

DIGITAL EXPLORATION EDUCATOR GUIDE



EXPLORING BIOMIMICRY AND INNOVATION THROUGH SQUID DISSECTION

Using this Digital Exploration, students will investigate the anatomy of squid to explore a field of research and design called biomimicry. Through a career lens, students must use their knowledge of external and internal squid structures to help professionals solve different types of problems. The lesson will end with students matching careers that can use biomimicry as a source of inspiration for various designs and innovations.

TIME REQUIRED

25–30 minutes

TOPICS

- Structure and Function
- Squid Dissection
- Biomimicry
- Careers in Science, Technology, Engineering and Mathematics

HARDWARE RECOMMENDATION

Following Nature's Lead is accessible on any device. However, for optimal user experience, it is recommended that explorations are accessed via desktop or tablet. This exploration is functional for use on mobile devices (iOS and Android).

TECHNICAL SPECIFICATIONS

While the **Following Nature's Lead** exploration will function in all browsers, including Internet Explorer, Safari, Chrome and Firefox, browser load speeds will vary. For best performance, it is recommended that the most current version of your browser of choice is used when accessing the module. Please note, connection speeds may be impacted by factors such as highly trafficked shared Wi-Fi access, public Wi-Fi and accessing module behind a firewall.

OVERVIEW

This Digital Exploration has four main sections:

INTRODUCTION

The opening page shows images of different organisms, as well as different inventions or designs, inspired by the organisms. Students are invited to match the organism to the correct invention/design as a pre-assessment. Students are then presented with a definition of biomimicry and a snapshot of the diversity of careers that are inspired by biomimicry. Finally, students are introduced to an engineer that noticed a squid's movement. The engineer teams up with a marine biologist to help learn more about this extraordinary species.

INVESTIGATE

Students review a brief introduction about squid, including their classification, habitat, behaviors and unique facts led by the marine biologist. Students are then invited to investigate internal and external squid anatomy by matching squid functions with their structure. This information will help students determine later how squid may be useful for biomimicry research.

ACT

Students are challenged to use their knowledge of squid anatomy by reading statements by different professionals in STEM fields regarding their designs and innovations. They are then invited to choose the correct part of the squid that would help the experts explore their interests.

ANALYZE

To summarize, students will read about other possible uses for designs inspired by the structure and function of squid.

PROCEDURE

This exploration is designed to be flexible to meet the needs of many different learning environments.

ONE-TO-ONE ENVIRONMENT

Students using the exploration for independent, self-paced learning can simply move through the exploration at their own pace.

WORKING IN PAIRS OR AT CENTERS

Students can take turns answering the questions throughout the exploration or they can work together to answer the questions. As students may have different reading levels, you will want to guide them to provide each group member with an opportunity to read and comprehend the information before moving on.

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CLASS ENVIRONMENT

If you are leading a group in a one-to-many environment, you can use a projector and screen or whiteboard to make the exploration the focus of instruction and discussion. Use the questions in this guide and a show of hands during each topic to gauge student comprehension.

CUSTOMIZED INSTRUCTION

You may also choose to use discrete elements from the exploration that fit your timeframe and curriculum.

PATH TO DISCOVERY

1. Explain that the purpose of this Digital Exploration is to examine the anatomy of squid to investigate biomimicry.
2. Read the discussion questions before starting the Digital Exploration.
3. Guide students to respond to the questions, in writing, using evidence from the Digital Exploration.
4. Explain that you will be available to support students as they work.
5. Review student responses to the discussion questions after they have completed the exploration.

DISCUSSION QUESTIONS

- How does the shape of the squid help the squid move around in the water? Use evidence from the Digital Exploration in your response.
- Describe two methods of defense squid use. Use evidence from the Digital Exploration in your response.
- Squid structures are designed to serve particular functions. Describe the relationship between the structure (what it looks like/how it's built) and function (what it does/how it does it) of one external organ and one internal organ.
- Biomimicry requires both knowledge of nature as well as creativity. What is one example you observed in the Digital Exploration that surprised you of how nature has inspired a human innovation.
- Describe why it is important for different careers to collaborate. Use evidence from the Digital Exploration in your response.

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NATIONAL STANDARDS

Next Generation Science Standards

MIDDLE SCHOOL

Science and Engineering Practice

Planning and Carrying Out Investigations

Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation

Engaging in Argument from Evidence

Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

Disciplinary Core Idea

LS1.A: Structure and Function

Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2)

In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS-LS1-3)

Crosscutting Concept

Structure and Function

Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/ systems can be analyzed to determine how they function.

Systems and System Models

Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.

MIDDLE SCHOOL

Science and Engineering Practice

Asking Questions and Defining Problems

Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.

Disciplinary Core Idea

ETS1.B: Developing Possible Solutions

There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3)

Crosscutting Concept

Influence of Science, Engineering, and Technology on Society and the Natural World

The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions.