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World Languages / English for Academic Purposes

Biomimicry – Using Nature’s Genius to Solve Our Problems

EAP 1586 Reading and Speech Level 5
Time: 3 hours



Goals:

The class will study some of the latest research in the field of biomimicry. Students will then individually explore their favorite nature-inspired technologies and share what they’ve learned with their classmates. The topic is likely to instill awe in the genius of nature and could easily trigger an appreciation for the complexity of the natural world and a strong desire to protect and learn from it.

Instructional Objectives:

Students will practice their listening comprehension skills using a TED talk and two audio recordings from ListenWise after which they’ll be asked to answer questions on the material. They’ll practice their speaking and critical thinking skills while participating in small group think-tanks. Students will incorporate new vocabulary into their spoken and written language after having read a collection of academic texts.

Miami Dade College Learning Outcomes:

- Outcome #1: Communicate effectively using listening, speaking, reading, and writing skills.
- Outcome #3: Solve problems using critical and creative thinking and scientific reasoning.
- Outcome #9: Demonstrate an appreciation for aesthetics and creative activities.
- Outcome #10: Describe how natural systems function and recognize the impact of humans on the environment.

Materials:

TED Talks

Biomimicry in Action by Janine Benyus

https://www.ted.com/talks/janine_benyus_biomimicry_in_action

ListenWise (A collection of stories from NPR gathered specifically for teachers to use in their classroom.)

Design Inspiration from Nature Makes Oyster Glue

<https://listenwise.com/teach/lessons/66-design-inspiration-from-nature-makes-oyster-glue>

Biomimicry and a Desert Beetle

<https://listenwise.com/teach/lessons/78-biomimicry-and-a-desert-beetle>

Handouts

See Appendix

Ask Nature.org

Activities:

Ask students if they have anything with Velcro in their book bags. (Invariably someone has a wallet, a folder, a pair of shoes, or a pocket that incorporates some form of Velcro.) What an ingenious idea! Where did it come from?

The **Velcro** fastener was invented in 1941 by George de Mestral, a Swiss engineer. The idea came to him after he took a close look at the burrs which kept sticking to his clothes and his dog's fur when walking in the Alps.

(You may want to mention that he made 29 million dollars because of that “close look”!)

The concept of incorporating nature’s techniques into our own is nicely incorporated into the TED talk by Janine Benyus – Biomimicry in Action (She has others, too!)

Show the TED talk to the class pausing from time to time to discuss the concepts. Have students take notes knowing that they’ll be discussing their favorites after the talk.

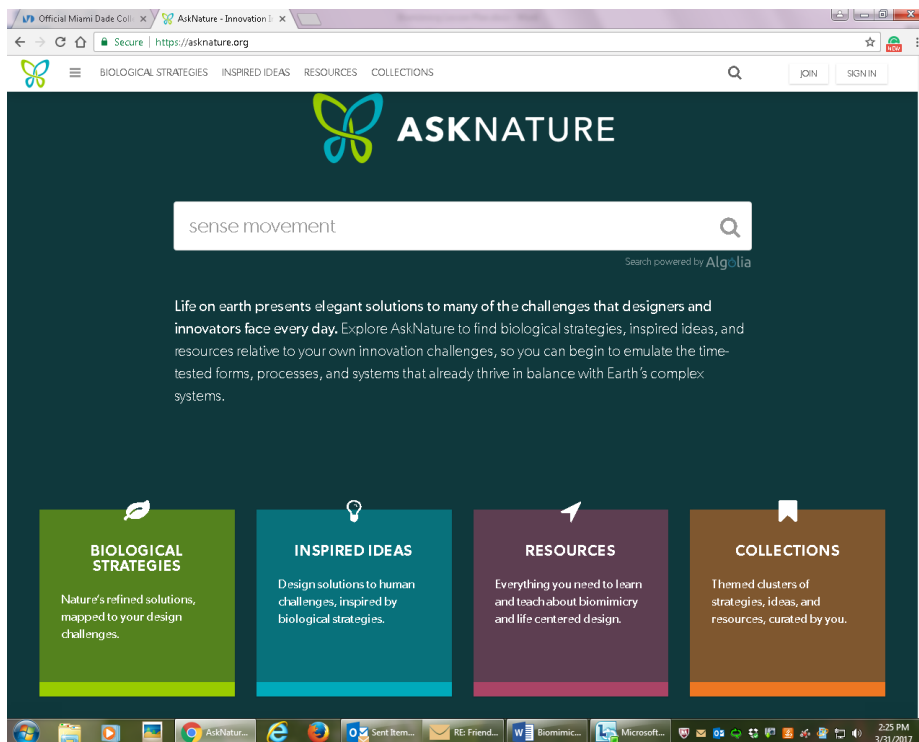
Spend at least 30 minutes in a group discussion.

Open ListenWise and create a free account if you don’t already have one.

Pass out a copy of Handout 1 to each student, and play *Design Inspiration from Nature Makes Oyster Glue* two or three times for students. They’ll likely need a few tries to grasp all of the content. Go over the answers together using the document camera in your classroom.

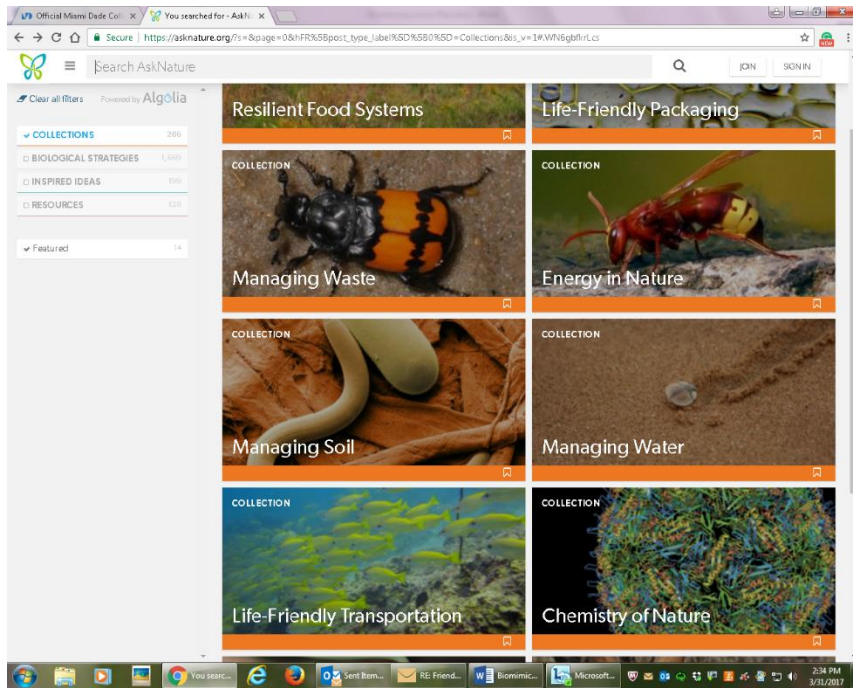
If you have time, pass out a copy of Handout 2 to each student and follow the same procedure with *Biomimicry and a Desert Beetle*. (Alternatively you could use this as an assessment activity.)

Before the end of the class, go to asknature.org.



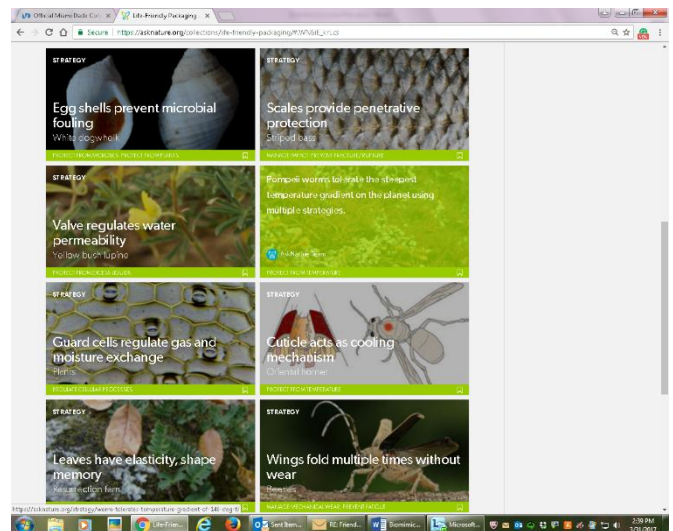
Invite students to explore the entire site on their own, but for the following class, they’ll need to go to the orange box – Collections.

From there they'll click on "Explore all Collections on AskNature.org" and then each student will choose a collection to read about before the following class.



Each collection holds many examples of how nature copes with the problem. For example, Life-Friendly Packaging has these examples:

- egg shells prevent microbial fouling
- valve regulates water permeability
- guard cells regulate gas and moisture exchange
- leaves have elasticity, shape memory
- scales provide penetrative protection
- cuticle acts as cooling mechanism
- wings fold multiple times without wear



Students will read the research related to their chosen collection and come to class the next day with a one-page cheat-sheet to use while explaining what they've learned to a group of three or four others. The paper can (and should) include pictures. (Group students with different collections together.)

After the small group think-tanks, you may want to gather the class together for a large –group discussion of the value of using the genius of nature to solve our everyday problems.

Listening Practice Read these questions about the radio story you are about to hear. Then listen for the answers. You will hear the story twice.

<https://listenwise.com/teach/lessons/66-design-inspiration-from-nature-makes-oyster-glue>

1. Joe Palca is an NPR correspondent who wants to learn more about some research concerning oysters. Where does he travel for this story? A. South Carolina B. California C. Indiana

2. What year does this story take place? a. 1999 b. 2013 c. 2016

3. He's talking to a man named Jonathan Wilker, who speaks very quickly! What is Jonathan focusing his research on?

- a. how to raise oysters in a place that's far from the ocean
- b. the chemical method oysters use to create strong glue
- c. how the strong (but sharp) shells of oysters can be used for industrial purposes

4. How many tanks does Jonathan Wilker have in his lab? a. 1 b. 3 c. 7

5. Jonathan Wilker is particularly excited about something he and his colleagues have created. What is it?

- a. a very strong adhesive that can work under water
- b. a tank that can hold 300 gallons of salt water and thousands of oysters
- c. a building material that is much harder than cement and twice as strong

6. What would be useful about this research?

- a. it could help surgeons with their work
- b. it could prevent buildings from collapsing during earthquakes
- c. it could provide food for people who are starving

7. How did Jonathan Wilker get interested in studying oysters?

- a. at a restaurant
- b. in the ocean
- c. during a class at Purdue University

8. Right now Wilker is putting special tiles in the oyster tanks. Why?

- a. he wants to see if the oysters prefer tiles to glass and can grow faster that way
- b. he wants to find a material that oysters cannot attach to
- c. he wants to know if the oysters will bond to the tiles and make an even stronger material

9. Who might benefit from the research with tiles and oysters?

- a. fishermen and ship owners (and the environment)
- b. engineers and construction workers (and the environment)
- c. people in the developing world who don't have enough to eat (and the environment)

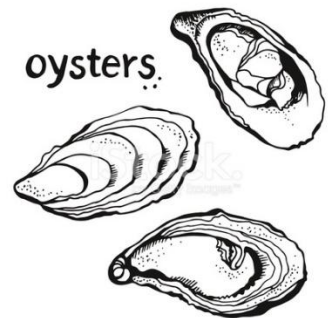
10. Jonathan Wilker says that his kind of research takes a long time, but some people have already called him showing that they're interested in his research. What field were these people in?

- a. managers of hardware stores that sell things like hammers and nails
- b. government officials and humanitarian organizations
- c. cosmetologists – people in the beauty industry

11. Where do the oysters in this story come from? _____

12. There are other animals in the tanks in this story. What are they? _____

13. What does Jonathan Wilker keep in a drawer in his lab? _____



Read the following questions. Then listen to the radio story to hear the answers.

You will hear the story twice. <https://listenwise.com/teach/lessons/78-biomimicry-and-a-desert-beetle>

1. Our story is about a researcher who is studying a certain beetle. Which desert is the beetle named after?
a. Atacama Desert b. Namib Desert c. Sahara Desert
2. This desert beetle has the ability to pull water out of the air. How much water can it pull from air?
a. 12% of its weight b. 12 grams c. 12% of the water that it needs
3. How does the beetle pull water from the air?
a. It uses its back. b. It uses its feet. c. It uses the hairs on its head.
4. Researcher Deckard Sorenson says that the beetle has super-hydrophobic regions and super-hydrophilic regions.
Which word means “water loving”? a. super-hydrophobic b. super-hydrophilic
5. Deckard Sorenson says that the sky is a huge reservoir of water. How many gallons of water are in the earth’s atmosphere?
a. 3.9 billion b. 3.9 trillion c. 3.9 quadrillion
6. Deckard Sorenson is using nanotechnology to create a surface coating with similar characteristics of the beetle. The surface coating by itself will not gather water. What else do you need?
a. a drill to dig deep into the desert sand
b. a fan to pass air over the surface coating
c. a heating device to keep the surface coating in liquid form
7. Deckard Sorenson’s end goal is to create something that will be useful (and profitable). What is it?
a. a water bottle that fills itself
b. a well that can easily pull up water from deep within the earth
c. a device that pulls carbon dioxide out of the atmosphere to prevent global warming
8. The story mentions other places that his invention could be used. What are those places?
a. hospitals and schools
b. government offices and law firms
c. greenhouses and fields
9. How much energy do you need to keep Deckard Sorenson’s invention going?
a. A lot! Almost the same amount as you need to power a car or boat engine
b. Very little. Some solar panels and a rechargeable battery would be sufficient.
c. None. This device works with absolutely no energy!
10. Sorenson’s device can gather a lot of water.
What is his response when the interviewer asks, “How much water”?
a. “3 liters per square meter per hour at a temperature of 70 degrees Fahrenheit and with 75% humidity”
b. “over 65,000 gallons a day with additional non-potable water available for washing clothes or cleaning tools”
c. “an endless supply of clean water that will never run out and could save millions of lives”

