How Do You Glow That?

Objectives

The student will define and identify the chemical reaction of bioluminescence. The student will identify terrestrial and marine invertebrates that have luminescent capabilities.

Materials

- ❑ copy of Bioluminescence Funsheet
- ❑ pencils
- ❑ access to Internet, library, or other information resources

Action

1. Divide the class into groups of four and distribute one Bioluminescence Funsheet to each group.
2. Explain that each group will be conducting a bioluminescence scavenger hunt.
3. Bioluminescence is an amazing capability that most marine invertebrates possess as well as a few terrestrial invertebrates. Each task on the scavenger hunt is worth a certain amount of points. Extra points may be awarded if the team provides more examples than asked for on the sheet. The teams will have one week to research and find all items on the scavenger hunt.
4. Allow time for student groups to research items on the scavenger hunt (library, internet, or other resources).
5. Instruct each team to present their scavenger hunt items and research to the class at the end of the week. The team with the most points gathered from their scavenger hunts wins. It is up to the teacher's discretion to determine the prize (extra points on a homework assignment, quiz, etc.)

Bioluminescence Funsheet Answers

1. **Define Bioluminescence.**
   Bioluminescence is the ability of living organisms to produce light through a chemical reaction (living light).

2. **Identify the bioluminescence chemical reaction.**
   Luciferin (protein) + Luciferas (enzyme) (in presence of O 2 + H 2O + ATP) Light occurs at about 25ºC

3. **Identify three or more terrestrial invertebrates that are bioluminescent.**
   Some earthworms, centipedes, fungi, and fireflies.

4. **Identify five or more aquatic invertebrates that are bioluminescent.**
   Dinoflagellates, sea pansies, shrimp, squid, jellyfish,

5. **Identify three or more benefits for an invertebrate to have bioluminescent properties.**
   Serves as a cloaking device, allowing prey to hide from predators. Some animals locate and lure prey with light, attract mates, and confuse predators.

6. **Identify two or more uses that humans have developed for bioluminescent invertebrates.**
   Scientists have learned to use these lights as alternatives to radioactive labels.
   Scientists have used the chemical light from jellyfish to see inside cells. Scientists have studied bioluminescent patterns of how water flows over the surfaces of dolphins as they swim. This allows them to better understand dolphin adaptations for their marine environment and offers information useful to the better design of boats, submarines, and other marine vehicles.

7. **Why is most bioluminescence blue in color?**
   Blue-green light travels the farthest in water. Its wavelength is between 440-479 nm, which is mid-range in the spectrum of colors. Additionally, most organisms are sensitive to only blue light. Many marine invertebrates do not have the visual pigments to absorb the longer or shorter wavelengths.

8. **Where can the most animals be found with bioluminescent capabilities?**
   The ocean. Most animals living between 200 and 2,00 m deep (656 to 6,561 ft.) have some way of producing light.

9. **Some organisms can emit light continuously, but most emit flashes with varying durations from about _____ to _____ seconds.**
   0.1 seconds to 10 seconds. Note: This time interval is an approximations and students' answers may vary slightly.

10. **Identify the factor that determines how bright the bioluminescence is from photosynthetic dinoflagellates.**
    The bioluminescence of photosynthetic dinoflagellates is greatly affected by the intensity of the previous day's sunlight. It is a positive correlation. The brighter the sunlight the previous day, the brighter the luminescence and vice versa.

Bioluminescence Funsheet

Use the Internet, library, or other information resources to answer the following questions about bioluminescence. Each question is worth 5 points and half points will be awarded for additional answers. Use another sheet of paper if necessary. Cite your sources.

1. Define Bioluminescence.

2. Identify the bioluminescence chemical reaction.

3. Identify three or more terrestrial invertebrates that are bioluminescent.

4. Identify five or more aquatic invertebrates that are bioluminescent.

5. Identify three or more benefits for an invertebrate to have bioluminescent properties.

6. Identify two or more uses that humans have developed for bioluminescent invertebrates.

7. Why is most bioluminescence blue in color?

8. Where can the most animals be found with bioluminescent capabilities?

9. Some organisms can emit light continuously, but most emit flashes with varying durations from about _____ to _____ seconds.

10. Identify the factor that determines how bright the bioluminescence is from photosynthetic dinoflagellates.