

Extremophiles

Have you ever seen pictures of the hot pots at Yellowstone National Park and wondered if any living things can survive in that environment? Well, the answer is yes, they can. Organisms adapted to extreme temperatures live and thrive there. These organisms belong to the Domain **Archaea**. All members of this domain have **prokaryotic** cells which are characterized by the lack of a nucleus; instead, DNA is located in a nucleoid region.

Archaea are unique among prokaryotes in their ability to live in the most extreme of environments. Archaea have a cell wall that lacks the **peptidoglycan** found in other prokaryotes. They are classified into three categories:

- methanogens
- extreme halophiles
- extreme thermophiles.

Methanogens have the unique ability to obtain energy by using carbon dioxide to oxidize hydrogen gas, making methane gas as a waste product. Methanogens are strictly **anaerobic**. This means that they cannot live in the presence of oxygen which is poisonous to them. They live in swamps or marshes where other organisms have consumed all of the oxygen. Methanogens do have practical uses for humans. They are important decomposers in sewage treatment. They have also been used experimentally by farmers to convert garbage and dung into methane gas.

Halo means salt. Extreme **halophiles** live in incredibly salty environments like the Great Salt Lake or the Dead Sea. Some halogens must live in an environment that is ten times as salty as the ocean in order to survive.

The extreme **thermophiles** thrive in very hot environments. Most of these bacteria do best around 60-80°C. (Human body temperature is 37°C. Water boils at 100°C.) The hot sulfur springs of Yellowstone National Park are inhabited by *Sulfolobus*. Archaea that live near deep-sea hydrothermal vents live in water over 100°C.

Name _____

Date _____

Not all Archaea live in extreme environments. Scientists have found large numbers of marine archaea living in moderate areas of the ocean. As a group, however, Archaea are known for their extreme living conditions.

Name _____

Date _____

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Questions

1. True or False: There are organisms that live in the hot pots of Yellowstone.
2. Extremophiles all belong to the Domain _____.
3. Prokaryotic cells are defined by their lack of what intracellular structure?
 - a. ribosomes
 - b. nucleus
 - c. DNA
 - d. Cell membrane
4. Methanogens give off _____ gas as a byproduct of their metabolism.
5. True or False: Methanogens can live in the presence of oxygen.
6. How are methanogens useful to humans?
7. In what type of environment would you find an extreme halophile?
8. True or False: Extreme thermophiles thrive at temperatures significantly above human body temperature.
9. Thermophiles that live near deep-sea hydrothermal vents can withstand temperatures greater than _____.
10. Do all Archaea live in extreme environments?

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Answer Key

1. **True** or False: There are organisms that live in the hot pots of Yellowstone.
2. Extremophiles all belong to the Domain **Archaea**.
3. Prokaryotic cells are defined by their lack of what intracellular structure?
 - a. ribosomes
 - b. nucleus**
 - c. DNA
 - d. Cell membrane
4. Methanogens give off **methane** gas as a byproduct of their metabolism.
5. True or **False**: Methanogens can live in the presence of oxygen.
6. How are methanogens useful to humans?
Decomposers for sewage treatment.
7. In what type of environment would you find an extreme halophile?
Very salty.
8. **True** or False: Extreme thermophiles thrive at temperatures significantly above human body temperature.
9. Thermophiles that live near deep-sea hydrothermal vents can withstand temperatures greater than **100°C**.
10. Do all Archaea live in extreme environments?
No.