Difference Between Mesophiles and Thermophiles

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Key Difference - Mesophiles vs Thermophiles

Bacteria are a group of microorganisms that thrive in all most all environments. They are prokaryotic organisms with very small unicellular structures. Bacteria can be classified based on different factors such as structure, metabolism, and cell components. Bacteria can be classified into five different classes named Psychrophiles, Psychrotrophs, Mesophiles, Thermophiles, and Hyperthermophiles based on the optimum growth temperature. The key difference between mesophiles and thermophiles is that **mesophiles live in moderate temperatures** while **thermophiles live in relatively high temperatures.** Every microorganism has three cardinal temperatures named minimum, optimum and maximum. The optimum temperature of mesophiles is 37 ^{0}C while the optimum temperature of thermophiles is 50 ^{0}C.

What are Mesophiles?

Mesophiles are microorganisms which grow best in moderate temperatures. They cannot live in extreme temperature conditions (excessive coldness or excessive heat). Their temperature range lies between 20 ^{0}C to 45 ^{0}C. The optimum temperature of a mesophile is 37 ^{0}C.

Mesophilic bacteria are considered to be the best decomposers in the soil. They are also involved in food contamination and degradation. Most microorganisms found in the human intestine are mesophiles. Normal human body temperature is 37 ^{0}C, and it is the best temperature for growth of mesophiles. Hence, mesophilic microorganisms are responsible for most human bacterial infections.

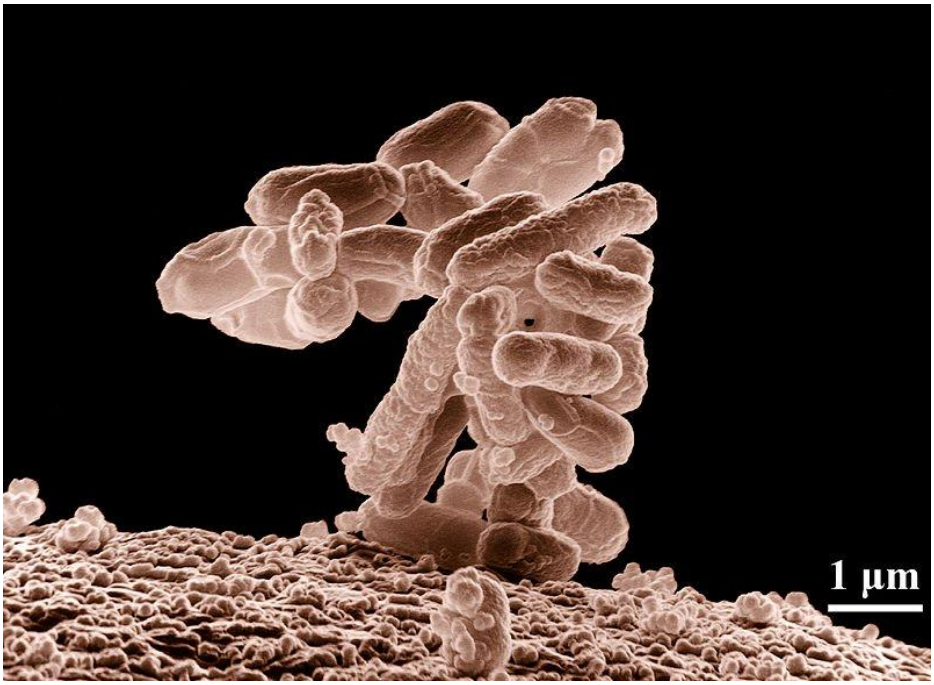

Figure 01: Mesophilic E coli.

What are Thermophiles?

Thermophiles are the organisms which grow best at high temperatures. Hence they are also known as organisms that love heat. They are a type of extremophiles. Thermophiles are found in harsh environments such as soil exposed to direct sunlight, silage, compost heaps, volcanic environments, hot springs, deep sea hydrothermal vents, etc. Thermophiles include archaea and bacteria. Thermophilic bacteria are considered as the earliest bacteria on earth. These organisms possess stable structures which can withstand high heat or temperature. They also possess heat stable enzymes. In general, enzymes can't function at high temperatures since they are heat liable proteins. However, the heat stable enzymes possessed by thermophiles can function at a high temperature. Some of these enzymes are used in molecular biology (eg: Taq polymerase used in PCR) and in washing reagents. Thermophiles have membranes rich in saturated fatty acids. Hence the membrane stability is high compared to mesophiles. DNA of thermophiles also has increased stability. The G-C content is high in thermophiles.

Temperature range of thermophiles ranges between 45 ^{0}C to 80 ^{0}C with an optimum temperature of 50 ^{0}C.

Figure 02: A Hot Spring where Thermophiles Live

What is the difference between Mesophiles and Thermophiles?

Mesophiles vs Thermophiles	
Mesophiles are microorganisms that live in moderate temperatures.	Thermophiles are microorganisms that live and thrive at relatively high temperatures.
Temperature Range	
Mesophiles have a temperature range of 20 ^{0}C to 45 ^{0}C.	Thermophiles have a temperature range of 45 ^{0}C to 80 ^{0}C.
Living Environment	
Mesophiles live in cheese, yogurt, beer, wine, human intestine, etc.	Thermophiles live in soil exposed to direct sunlight, volcanic environments, deep-sea thermal vents, hot springs, etc.
Optimum Temperature	
The optimum temperature of mesophiles is 37 ^{0}C.	The optimum temperature of thermophiles is 50 ^{0}C
Enzymes	
Mesophiles possess enzymes which are heat	Thermophiles possess heat stable

sensitive.	enzymes.
Cell Components	
Cell components of mesophiles are less stable than thermophiles.	Cell components of thermophiles are more stable than mesophiles.
Membrane Stability	
Membrane stability is less compared to thermophiles.	Membranes are rich with saturated fatty acids. Hence membrane stability is high in thermophiles.
Examples	
Examples of mesophiles are *Listeria monocytogenes*, *Staphylococcus aureus*, *Escherichia coli*, *Lactobacillus acidophilus*, etc.	Examples of thermophiles are *Thermus aquaticus*, *Thermococcus litoralis*, *Calothrix*, *Synechococcus*, etc.

Summary - Mesophiles vs Thermophiles

Mesophiles and thermophiles are two groups of microorganisms classified based on the temperature ranges. Mesophiles live in moderate temperatures while. thermophiles live in high temperatures. This is the main difference between mesophiles and thermophiles. The human microbiome is mainly composed of mesophiles since the normal body temperature is the optimum temperature of mesophiles.

References:

1. "Classification of Microorganisms by Growth Temperature - Boundless Open Textbook." Boundless. Boundless, 26 May 2016. Web. Available here. 12 June 2017.
2. "Mesophile." Wikipedia. Wikimedia Foundation, 10 June 2017. Web. Available here. 12 June 2017.

Image Courtesy:

1. "E coli at 10000x, original" By Eric Erbe, digital colorization by Christopher Pooley - released by the Agricultural Research Service (Public Domain) via Commons Wikimedia
2."Grand Prismatic Spring" By Jim Peaco, National Park Service (Public Domain) via Commons Wikimedia

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