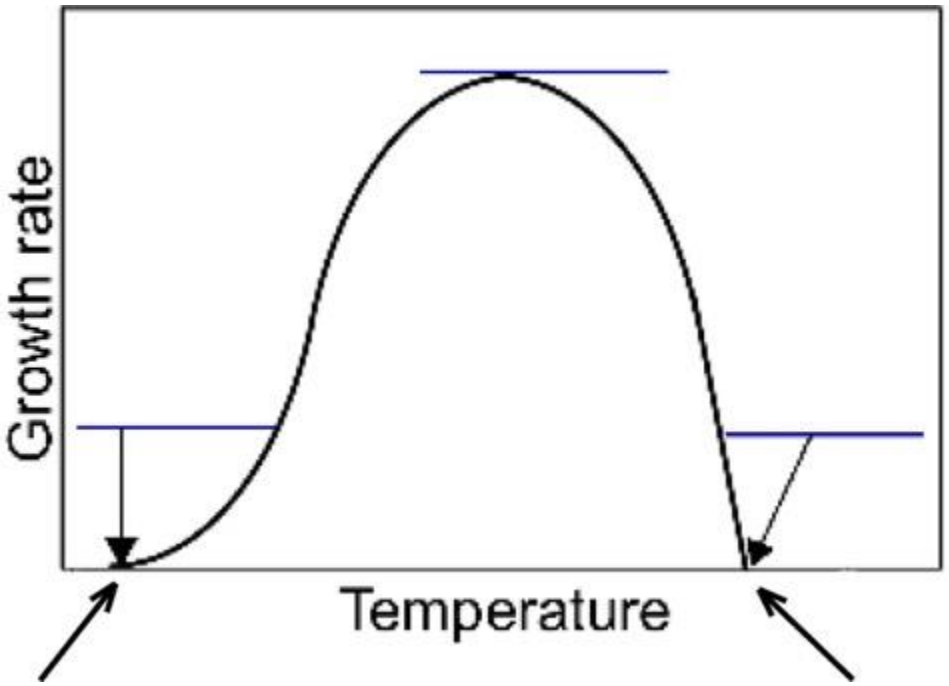
Lecture 5

Most organisms have a range of conditions in which they grow best. We can use this information to help determine appropriate media to use in order to culture specific organisms. We can also use this information to classify bacteria. In this lecture we will discuss a few common environmental influences on bacterial growth.

I. Environmental Influences

A. _____

1. All microorganisms have a temperature range over which they can grow.



Temperature below the minimum can lead to _____ and malfunction of membrane proteins.

Temperature above the maximum can cause _____

_____

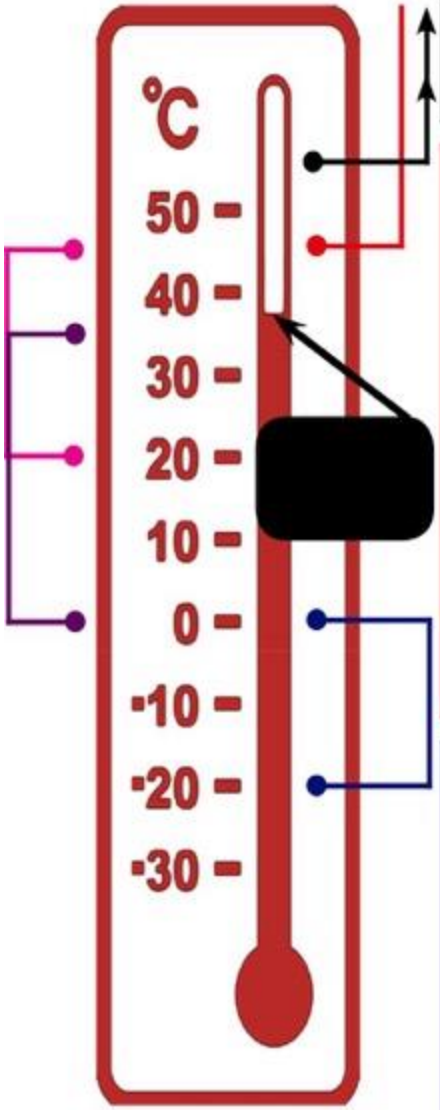
_____

Microbial classification based on temperature

~20°C - ~45°C, with an optimum that is often around body temperature (37°C)

Micrococcus luteus, a normal skin flora with which we commonly work in lab. Photograph by Rachel Watson

0°C - ~35°C with an optimum at room temperature (22-25°C). These microorganisms often spoil refrigerated food.



Optimum between 85° C and 115°C. These do not grow below 55° C

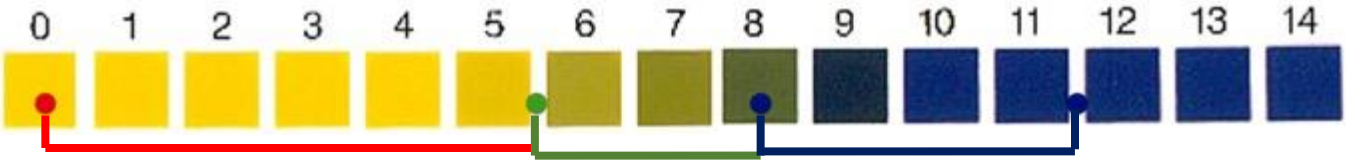
~45°C - ~85°C, with an optimum that is often between 55-65°C

Hot springs run-off channel shows a "V"-shaped growth pattern. In the white area (the hottest area), only non-photosynthetic bacteria grow. As the water cools on the edges, other photosynthetic microorganisms can grow and thus the colors deepen. Photo by Rachel Watson,

Temperature range of < 0°C - ~20°C, with an optimum of 15°C

"Bleeding footprints" or "watermelon snow" caused by red snow algae near Rainbow Lake at the base of Mt. Massive, CO. Photograph by Rachel Watson

B. Hydrogen ion concentration (pH)



(acid lovers) pH between 0-5.5

Cyanodinum is an acidophilic algae. It grows at pH values as low at 0. Photo by Rachel Watson, taken in Yellowstone's Lemonade Springs

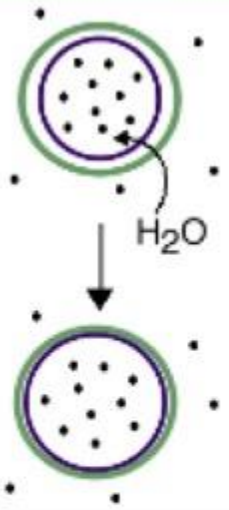
pH between 5.5-8.0

(Base lovers) pH between 8.0-11.5

C. Osmotic pressure and _____

1. Osmotic pressure is the force that _____ exerts on the plasma membrane of an organism. Water moves across the membrane in response to an _____ in the environment.

Water Diffusion = _____



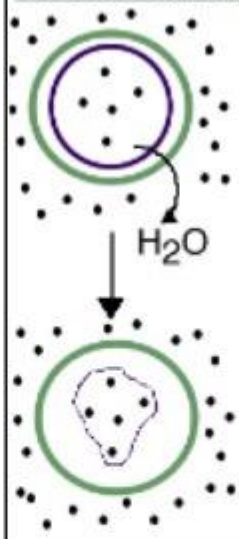
The concentration of salts and other molecules (solute) inside the cell is _____ than the solute concentration outside the cell = a _____ environment.

The cytoplasmic membrane is _____ _____.

If the influx of water continues, the cell may _____.

The rigid cell wall in most bacteria, algae and fungi allow them to _____ _____ a somewhat hypotonic environment. Many microorganisms _____ _____ _____ to keep their membrane _____ against the cell wall.

Water Diffusion = _____



The concentration of salts and other molecules (solute) inside the cell is _____ than the solute concentration outside the cell = a _____ environment.

The cytoplasmic membrane _____ _____ _____

_____ = water is present in a hypertonic environment but it is not available because it is tied up in solute interactions.

_____ = Some procaryotes can tolerate a hypertonic environment. How is this possible? How does this relate to halotolerance?

_____ = Procaryotes that require a high concentration of NaCl in order to live.

D. Microbial classification based on O_2 requirements

_____

Require O_2 for growth. In a Blood Heart Infusion (BHI) agar deep, the growth occurs in a thing band at the top of the tube.

_____

Do not require O_2 for growth but grow better when it is present. In a BHI agar deep, the growth is thickest at the top, but continues throughout the tube.

_____

Require low concentrations of O_2 (2-10%). In a BHI agar deep, growth is in a thin band just sub-surface.

_____

Indifferent to O_2. Will grow evenly throughout a BHI agar deep

_____

Generally killed by the presence of O_2. In a BHI agar deep, growth is mainly in the bottom half of the tube.