Al- Mustaqbal university college
Department of radiology technologies
1.St stage
Lecture 6

Bacteria

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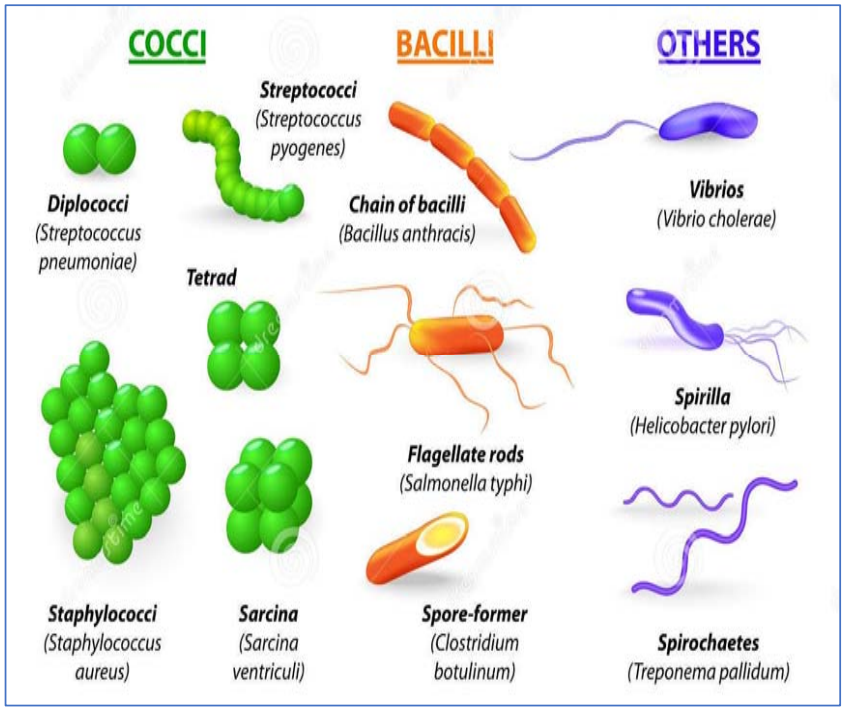
What are bacteria?

- **Bacteria are single-celled organisms that are pretty much everywhere: in the ground, in the ocean, on your hands and in your gut.**
- **While some are harmful, most are not and some are even beneficial to human health.**
- **In many cases, humans live in symbiosis with bacteria, maintaining a mutually beneficial relationship without even knowing it**

Bacterial Shapes

- **Bacteria come in five basic shapes: spherical, cylindrical, comma-shaped, and spiral.**
- **The scientific names for these shapes are cocci (round), bacilli (cylindrical), vibrio's (comma-shaped), spirochaetes (corkscrew) and spirilla (spiral).**
- **The shapes and configurations of bacteria are often reflected in their names. For example, the milk-curdling Lactobacillus acidophilus are bacilli,**

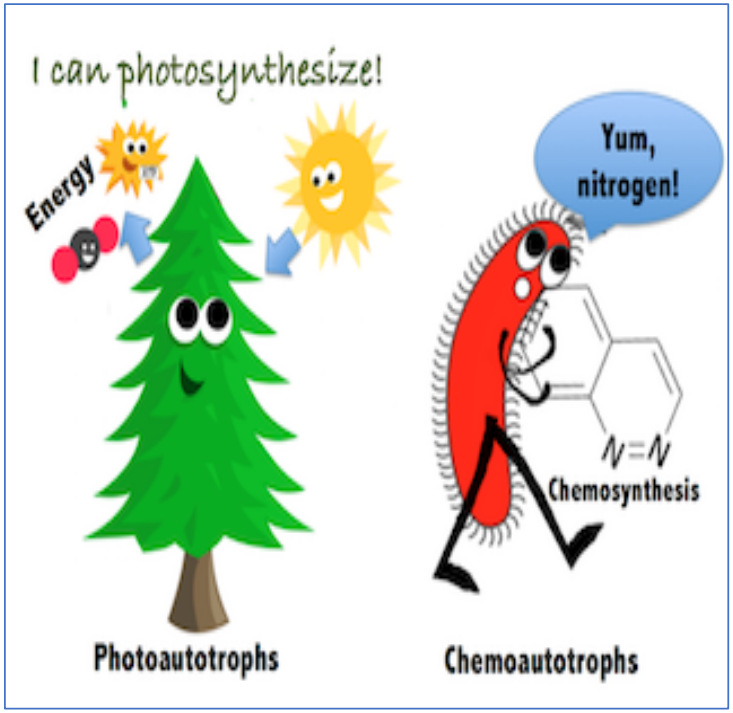


Chemical Growth Requirements

- In order to grow successfully, microorganisms must have a supply of water as well as numerous other substances including mineral elements, growth factors, and gas, such as oxygen.
- Virtually all chemical substances in microorganisms contain carbon in some form, whether they be proteins, fats, carbohydrates, or lipids.
- Carbon can be obtained from organic materials in the environment, or it may be derived from carbon dioxide.
- Both chemoautotrophic and photoautotrophic microorganisms obtain their energy and produce their nutrients from simple inorganic compounds such as carbon dioxide.

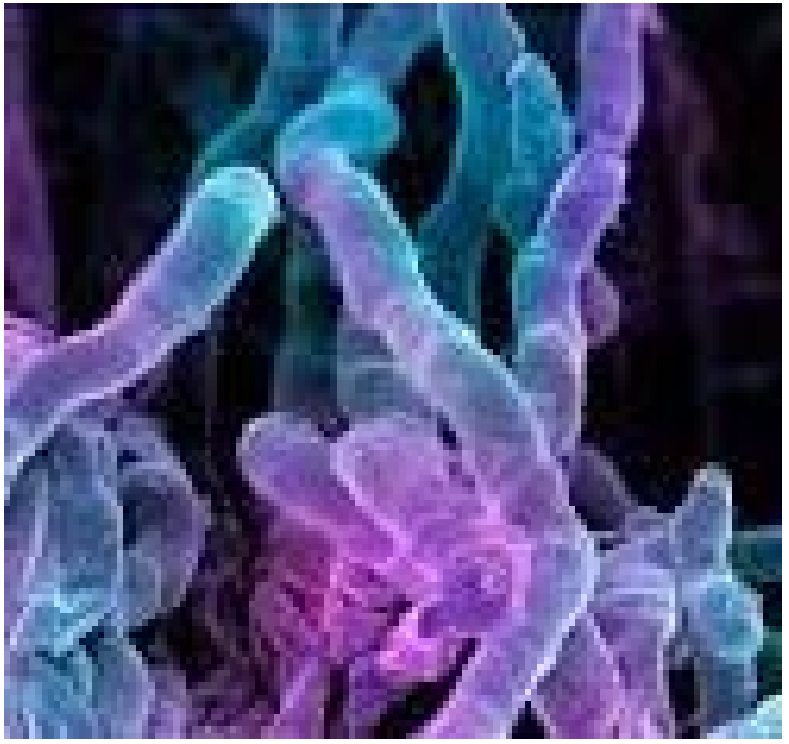
Chemical Growth Requirements

- **Chemoautotrophs do so through chemical reactions, while photoautotrophs use photosynthesis**
- **Among the other elements required by microorganisms are nitrogen and phosphorous.**
- **Nitrogen is: used for the synthesis of proteins, amino acids, DNA, and RNA.**
- **Bacteria that obtain nitrogen directly from the atmosphere are called nitrogen-fixing bacteria. They include species of Rhizobium and Azotobacter, both found in the soil.**
- **Phosphorus is an essential element for nucleic acid synthesis and for the construction of phospholipids.**



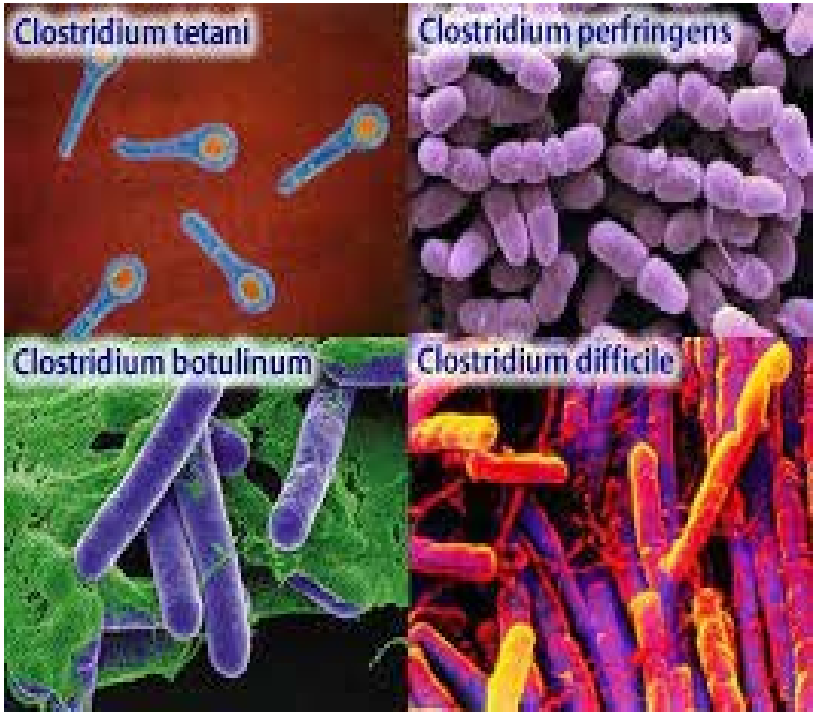
Chemical Growth Requirements

- **Oxygen: is used by aerobic bacteria during the process of cellular respiration as a final electron acceptor.**
- **For aerobic organisms, oxygen is an absolute requirement for their energy-yielding properties.**
- **Certain microorganisms grow in oxygen-free environments and are described as anaerobic. Organisms such as these produce odoriferous gases in their metabolism, including hydrogen sulfide gas and methane.**



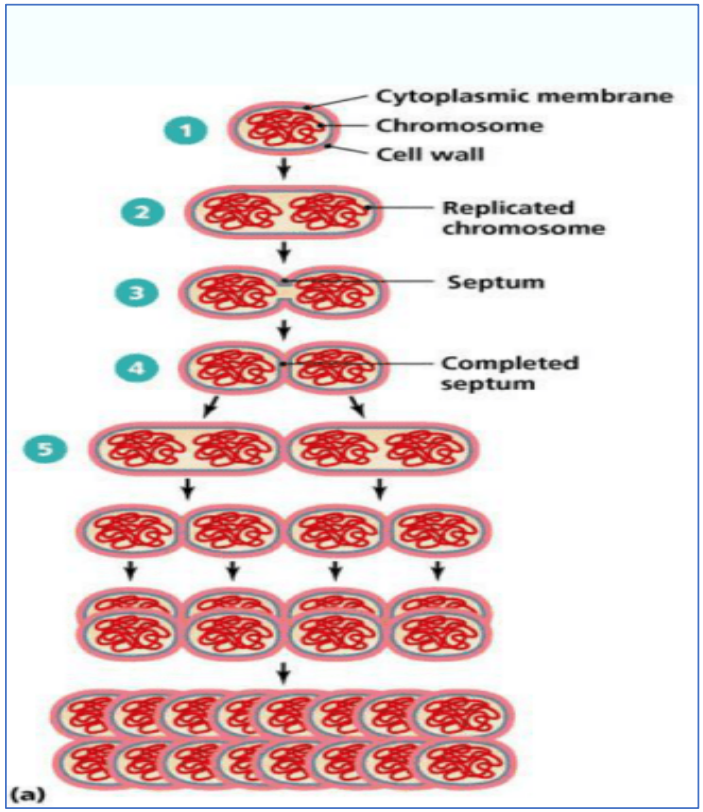
Chemical Growth Requirements

- **Certain pathogenic species, such as Clostridium species, are anaerobic. Certain species of microorganisms are said to be facultative.**
- **These species grow in either the presence or absence of oxygen. Some bacteria species are microaerophilic, meaning that they grow in low concentrations of oxygen.**
- **In some cases, these organisms must have an environment rich in carbon dioxide. Organisms such as these are said to be capnophilic**



Chemical Growth Requirements

- **Other chemical requirements for microbial growth include such trace elements as iron, copper, and zinc.**
- **These elements often are used for the synthesis of enzymes.**
- **Organic growth factors such as vitamins may also be required by certain bacteria.**
- **Amino acids, purines, and pyrimidines should also be available.**



Physical Growth Requirements

- **Certain physical conditions affect the type and amount of microbial growth.**
- **For example, enzyme activity depends on the temperature of the environment, and microorganisms are classified in three groups according to their temperature preferences:**

1. **Psychrophilic organisms (psychrophiles) prefer cold temperatures of about 0°C to 20°C;**
2. **Mesophilic organisms (mesophiles) prefer temperatures at 20°C to 40°c.**
3. **Thermophilic organisms (thermophiles) prefer temperatures higher than 40°C A minimum and a maximum growth temperature range exist for each species.**

- **The temperature at which best growth occurs is the optimum growth temperature.**

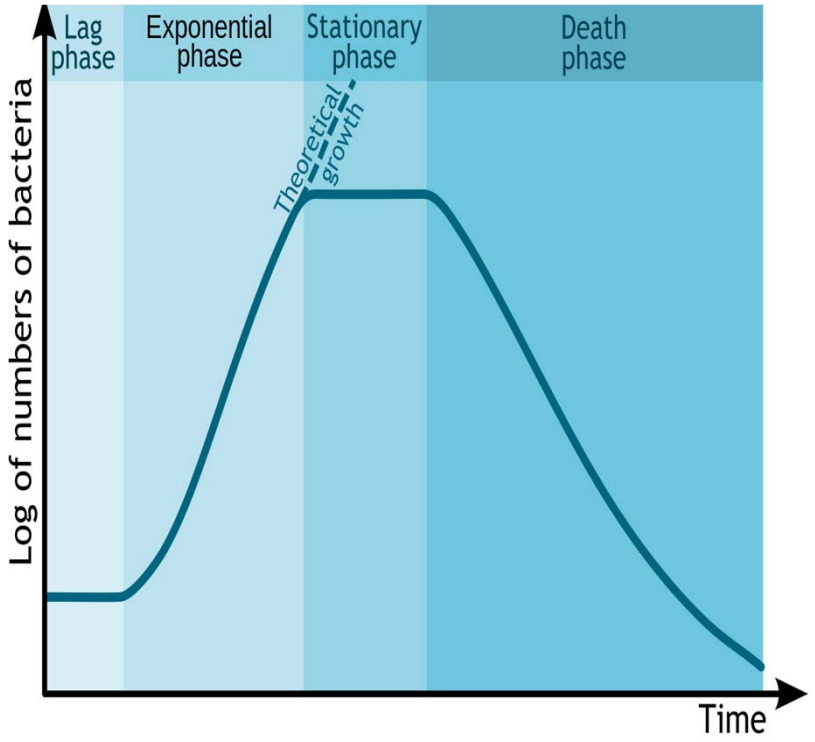
Bacterial growth curve

The bacterial growth curve represents the number of live cells in a bacterial population over a period of time.

There are four distinct phases of the growth curve:

1.Lag: During lag phase, bacteria adapt themselves to growth conditions. It is the period where the individual bacteria are maturing and not yet able to divide.

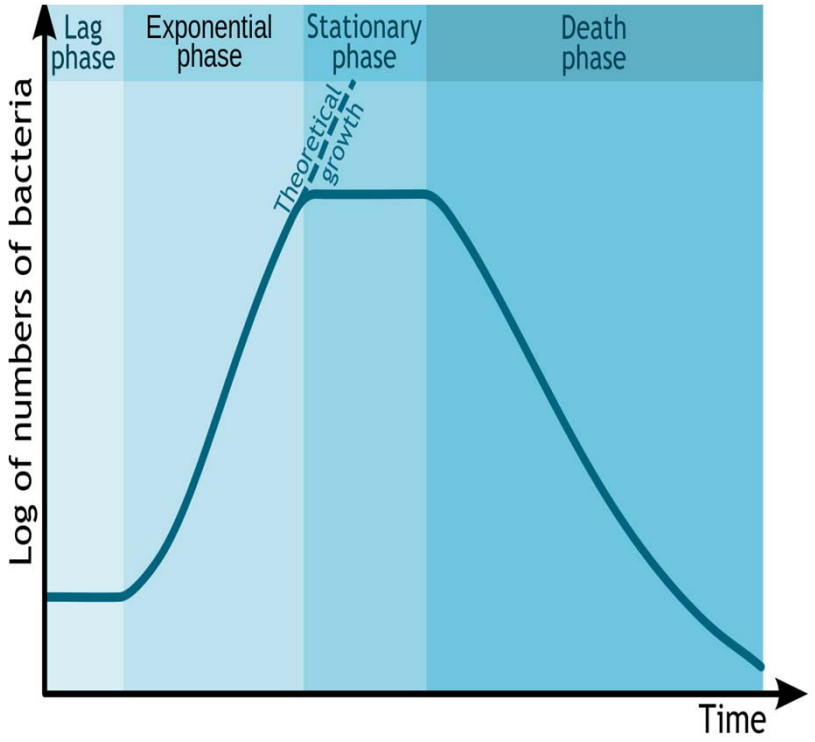
2.Exponential (log):The log phase (sometimes called the logarithmic phase or the exponential phase) is a period characterized by cell doubling. The number of new bacteria appearing per unit time is proportional to the present population.



Bacterial growth curve

3.Stationary :is often due to a growth-limiting factor such as the depletion of an essential nutrient, and/or the formation of an inhibitory product such as an organic acid. Stationary phase results from a situation in which growth rate and death rate are equal

4.Death phase: At death phase (decline phase), bacteria die. This could be caused by lack of nutrients, environmental temperature above or below the tolerance band for the species, or other injurious conditions.



Thank You