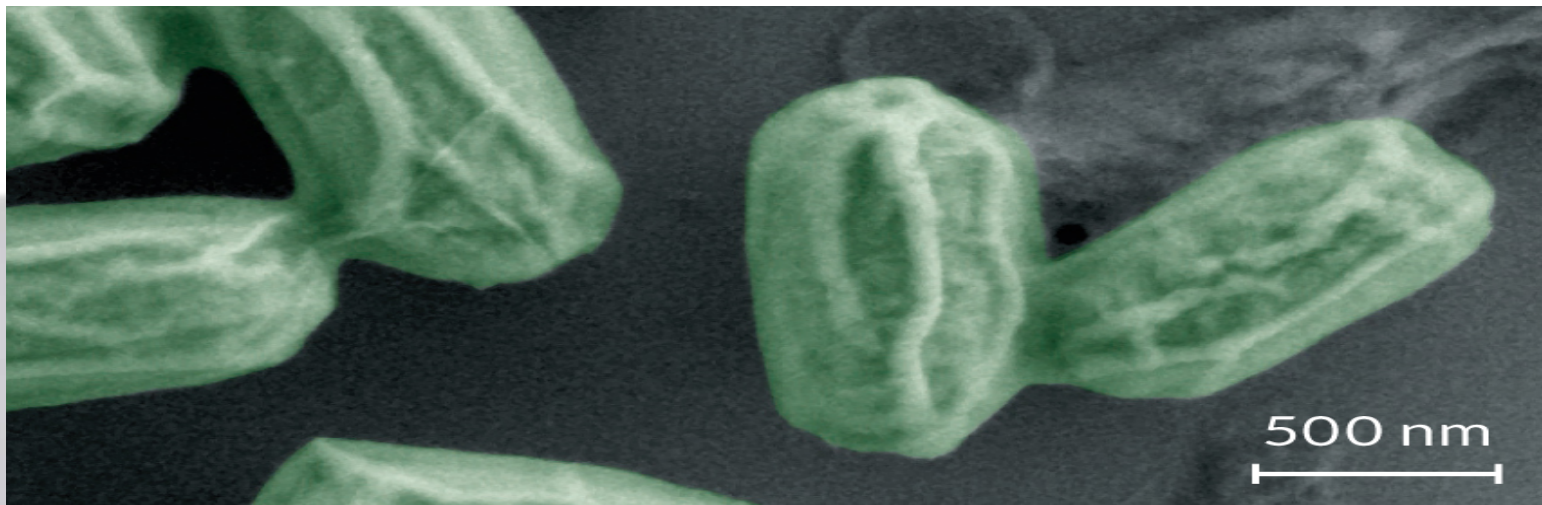
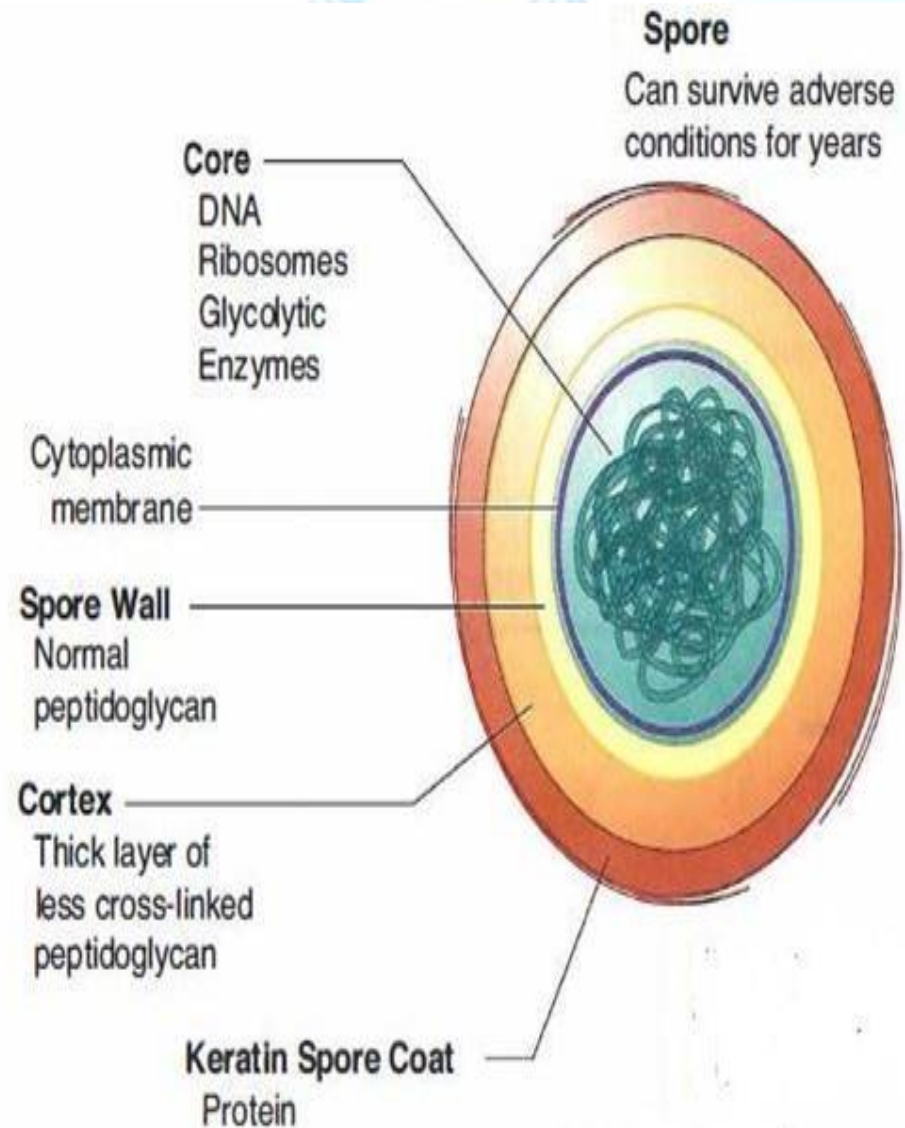


A **bacterial spore** is a spore or spore-like structure produced by bacteria. These include endospores , and spores produced by Actinobacteria and *Azotobacter*. Spore formation in bacteria is not a method of reproduction but simply a method of surviving unfavourable conditions. They have a number of features:



1. They can tolerate extreme dryness.
2. Some cannot be killed even at subzero temperatures.
3. Some can spread poisonous chemicals, such as the Cry toxin synthesised by *Bacillus thuringiensis*



There are two types of bacterial spores :

1-Endospores : from inside the bacteria cell .the shape and site of the spore different according to the species of bacteria : (centrally located , terminally located , sub terminally).

The endospores has highly resistance for dry , dyes , radiation , temperature and boiling because :

a-Low content of water .

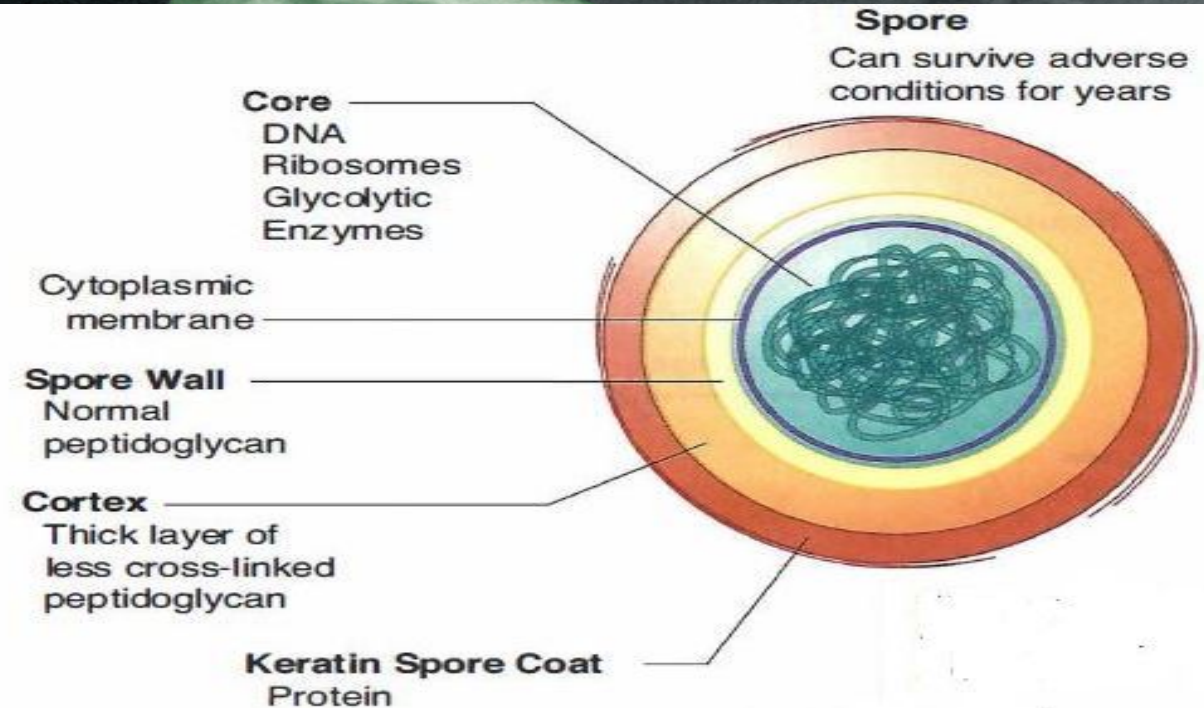
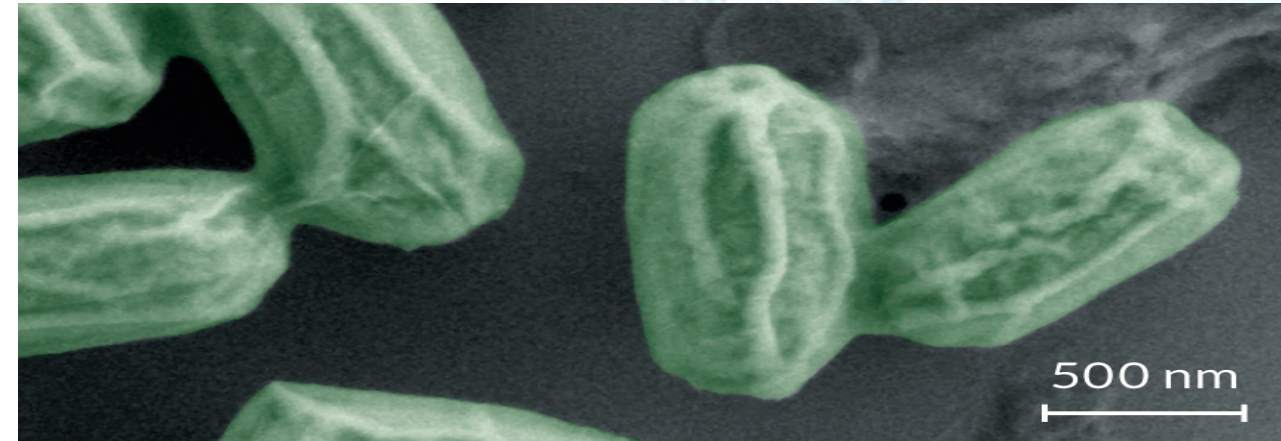
b-High content of dipicolinic acid (DPA).

The last form complex with Ca^{++} ions this complex highly resistance.

2-Exospores : from extracellular , less resistance than endospores due to low content of (DPA).

Requirements for bacterial growth

Most bacteria of medical importance require carbon, nitrogen, water, inorganic salts and a source of energy for growth. They have various gaseous, temperature and pH requirements, and can utilize a range of carbon, nitrogen and energy sources. Some bacteria also require special growth factors, including amino acids and vitamins Growth requirements are important in selectin the various culture media required in diagnostic microbiology and in understanding the tests for identifying bacteria.



Carbon and nitrogen sources

Bacteria are classified into two main groups according to the type of compounds that they can utilise as a carbon source:

- 1 – Autotrophs utilise inorganic carbon from carbon CO_2
- 2– Heterotrophs require organic compounds as their major source of carbon and energy; they include most bacteria of medical importance.



Atmospheric conditions

Carbon dioxide

Bacteria require CO₂ for growth; adequate amounts are present in the air or are produced during metabolism by the microorganisms

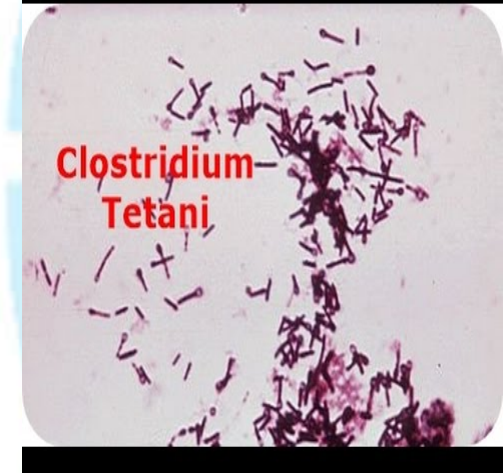
themselves. A few bacteria, however, require additional CO₂ for growth, e.g. *Neisseria meningitidis*, *Campylobacter jejuni*.



Oxygen

Bacteria may be classified into four groups according to their O₂ requirements:

- 1- Obligate (strict) aerobes: grow only in the presence of oxygen, e.g. Pseudomonas aeruginosa.
- 2- Microaerophilic bacteria: grow best in low oxygen concentrations, e.g. Campylobacter jejuni.
- 3- Obligate (strict) anaerobes: grow only in the absence of free oxygen, e.g. Clostridium tetani.
- 4- Facultative anaerobes: grow in the presence or absence of oxygen, e.g. Escherichia coli.



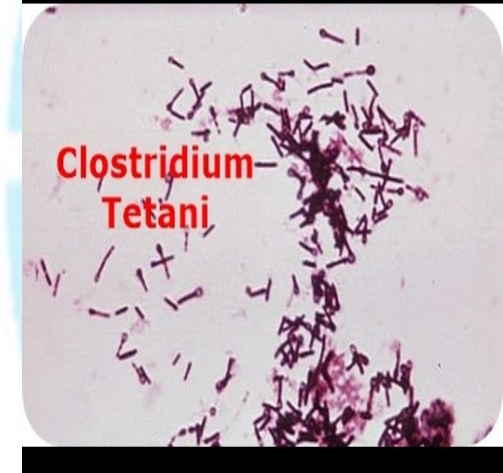
Temperature

Most pathogenic bacteria grow best at 37 C°. Bacteria may be classified into four groups according to their temperature requirements :

1-Mesophiles : 15-45 C°

2-Psychrophiles : less than 20 C°

3-Thermophiles : more than 60 C°



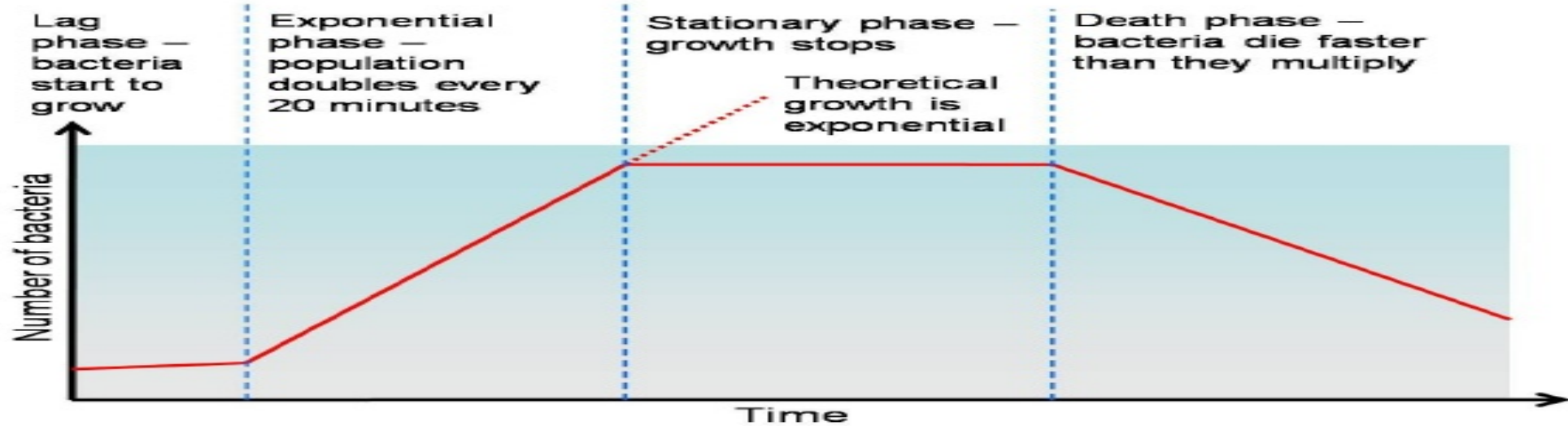
pH

Most pathogenic bacteria grow best at a slightly alkaline pH (pH 7.2–7.6).



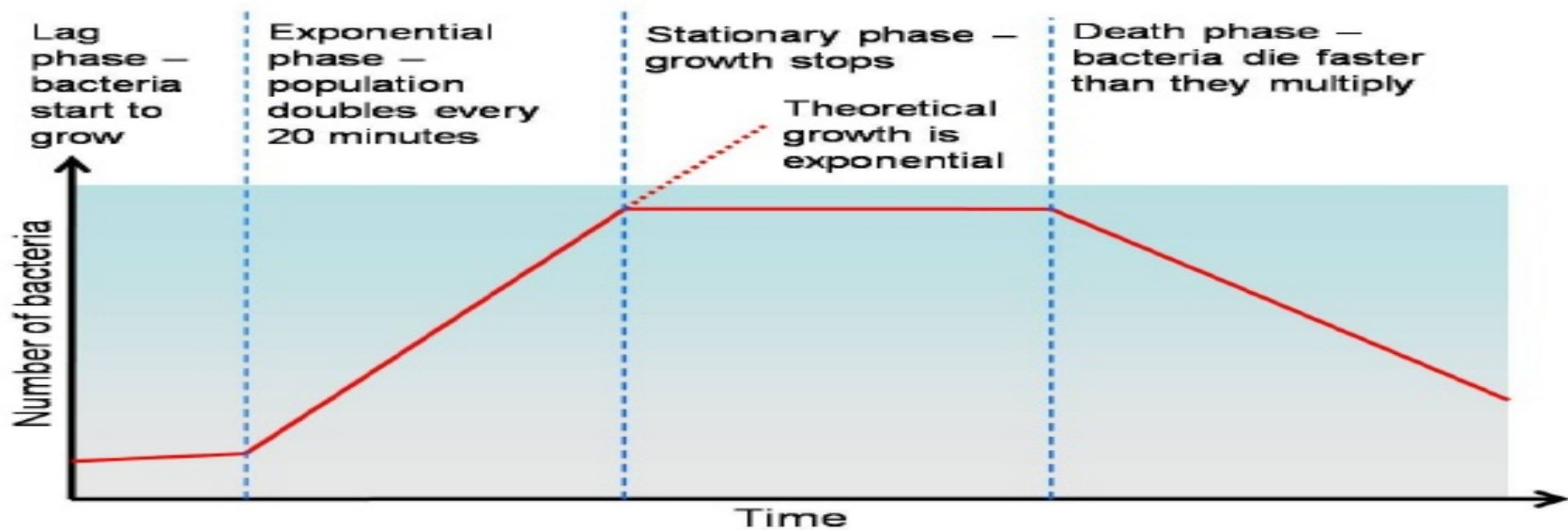
Stage of bacterial growth

1 -Lag phase (A): the interval between inoculation of a fresh growth medium with bacteria and the commencement of growth;



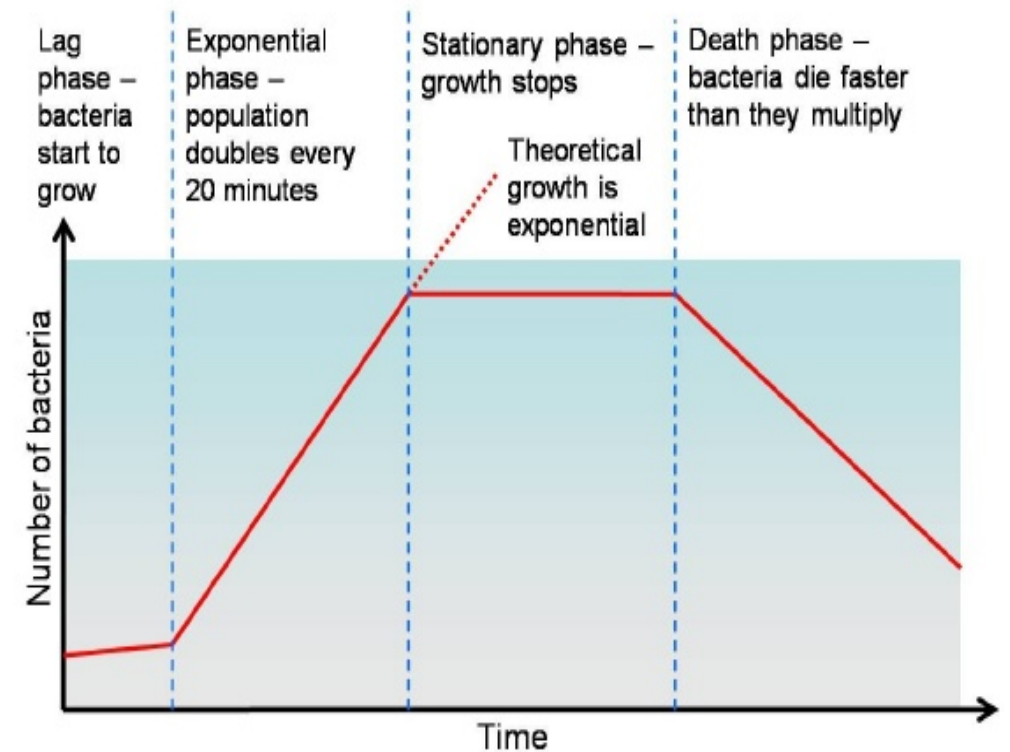
Graphical Representation of a Bacterial Growth Curve

2 -Log phase (B): the phase of exponential growth; the growth medium becomes visibly turbid at approximately 1×10^6 cells/ml;



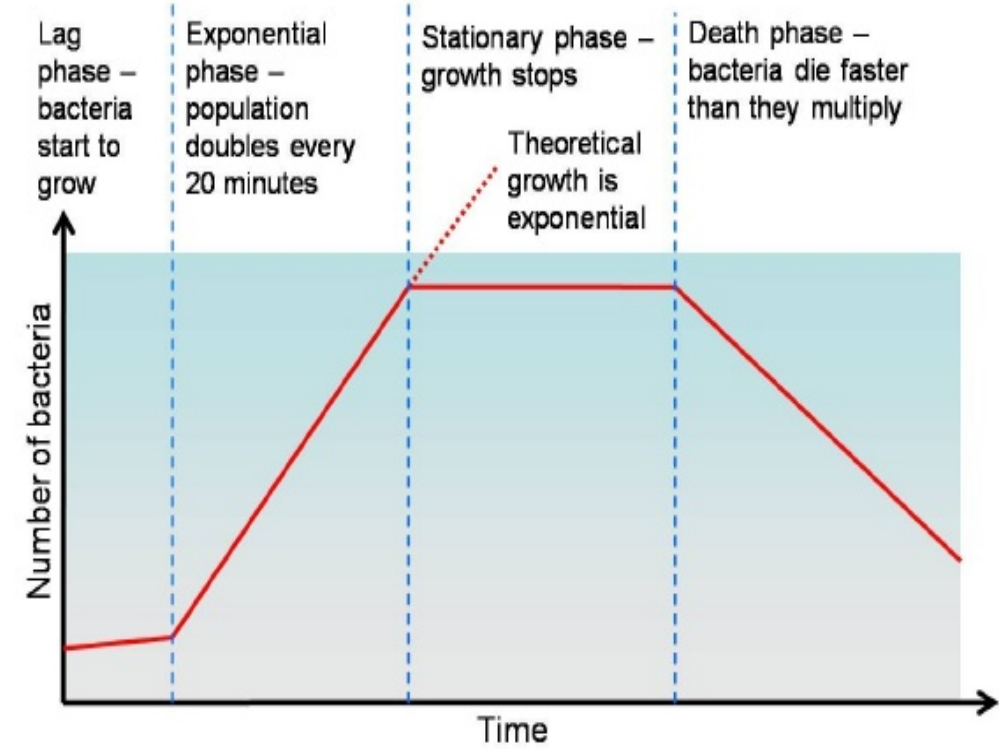
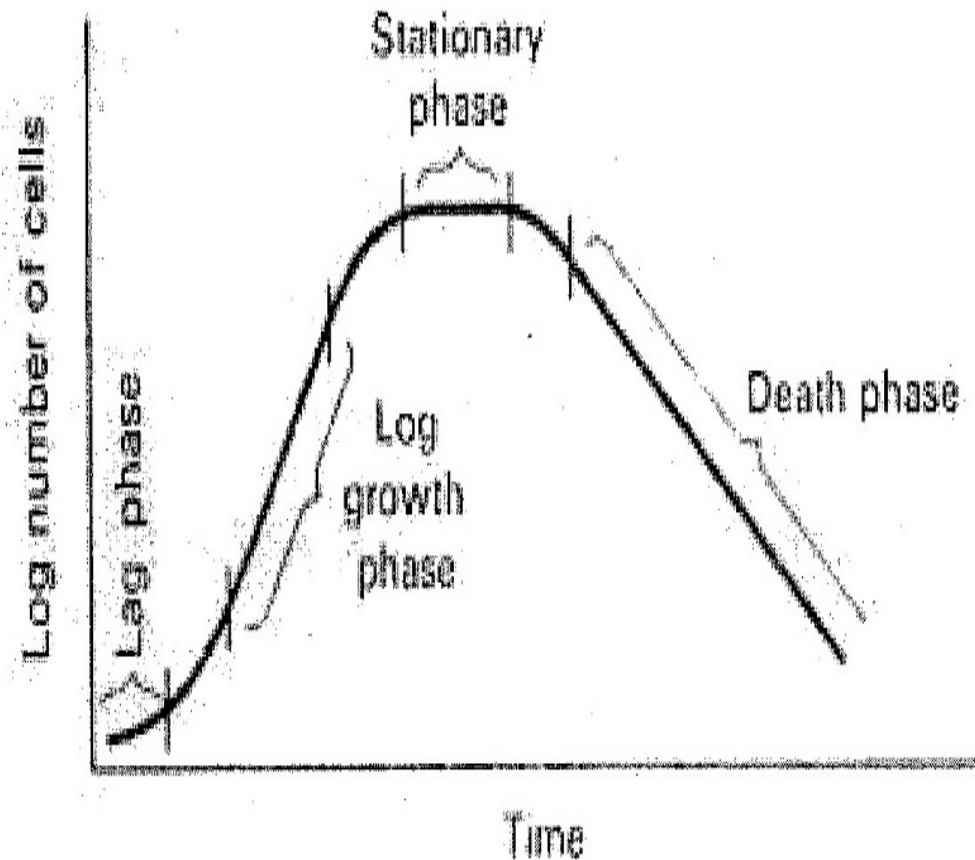
Graphical Representation of a Bacterial Growth Curve

3- Stationary phase (C): the growth rate slows as nutrients become exhausted, waste products accumulate, and the rate of cell division equals the rate of death; the total viable count remains relatively constant;



Graphical Representation of a Bacterial Growth Curve

4 -Decline phase (D): the rate of bacterial division is slower than the rate of death, resulting in a decline in the total viable count.



Graphical Representation of a Bacterial Growth Curve

Thank You

Questions?

Comments and opinions would be appreciated.