

PHYSIOLOGY OF MICRO ORGANISMS

The background features a grey gradient with abstract, wavy, organic shapes in shades of green and yellow. The shapes are layered and have a slight 3D effect, resembling liquid or biological forms. A small white horizontal line is visible in the bottom right corner.

Introduction

What is PHYSIOLOGY ?

Physiology is the GROWTH, NUTRITION, METABOLISM of the micro-organisms.

Classification of the micro-organisms

Based on Nutrition bacteria are classified

as:

1. Autotrophs - can synthesis all their organic compounds by utilizing the atmospheric CO_2 and N_2 .

No medical importance

2. Heterotrophs - unable to synthesis their own metabolites & depend on preformed organic compounds. **All pathogens**

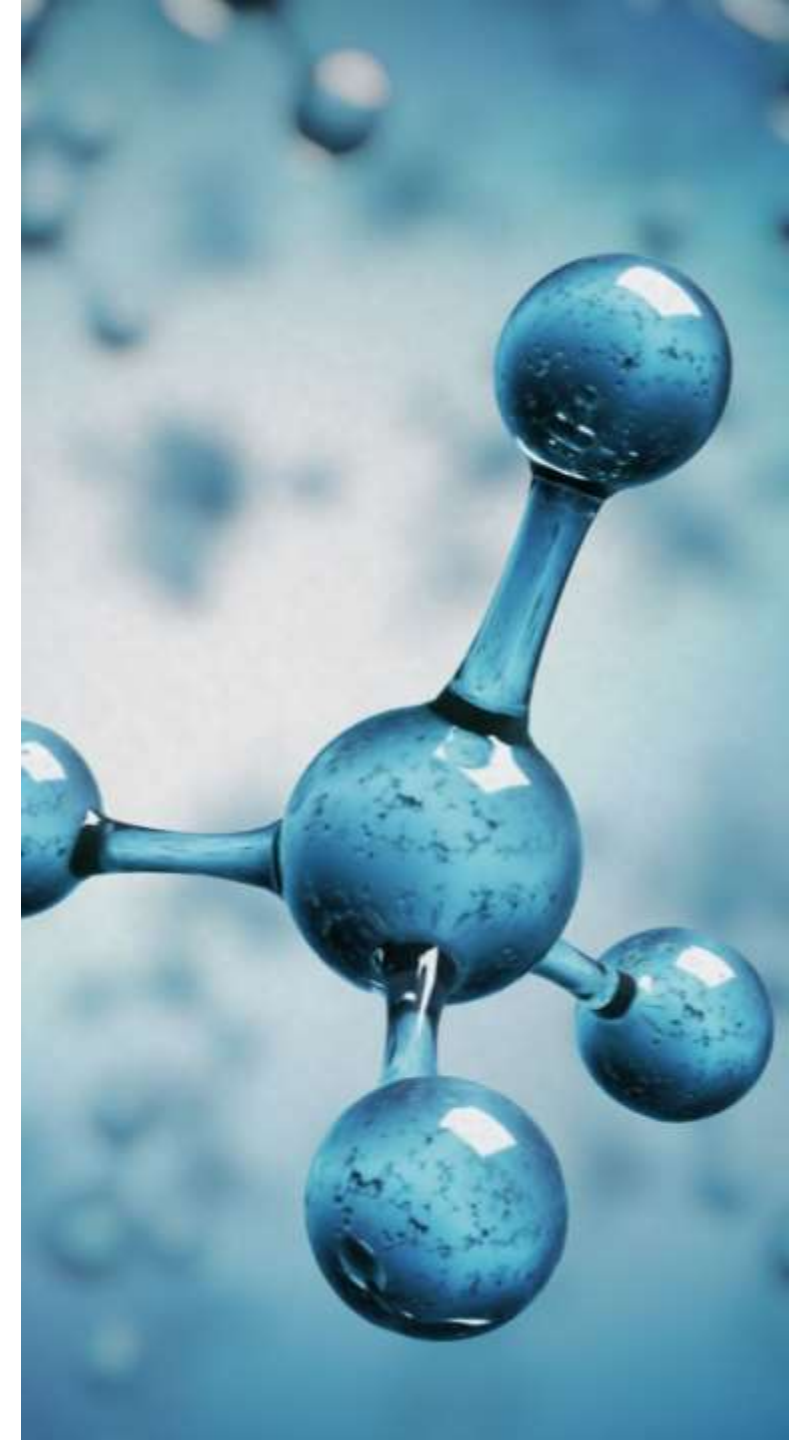


Growth factors

- Some bacteria require some organic compounds in mild quantities - Growth factors or Bacterial Vitamins .
- It can be Essential or Accessory
- **Essential**- when growth does not occur in their absence.
- **Accessory** - when they enhance growth, without being absolutely necessary for it .

Bacterial Nutrition

- Water constitutes 80% of the total weight of bacterial cells.
- Proteins, polysaccharides, lipids, nucleic acids, mucopeptides & low molecular weight compounds make up the remaining 20%.
- For growth & multiplication, the minimum nutritional requirements are water, a source of carbon, a source of nitrogen and some inorganic salts .



Based on Nutritional Requirement

- Phototrophs - Bacteria which derive their energy from sunlight.

Chemotrophs - Bacteria which derive energy from chemical reactions.

Organotrophs: require organic sources of hydrogen

Lithotrophs : require inorganic sources of hydrogen like NH_3 , H_2S

OTHER GROWTH FACTORS

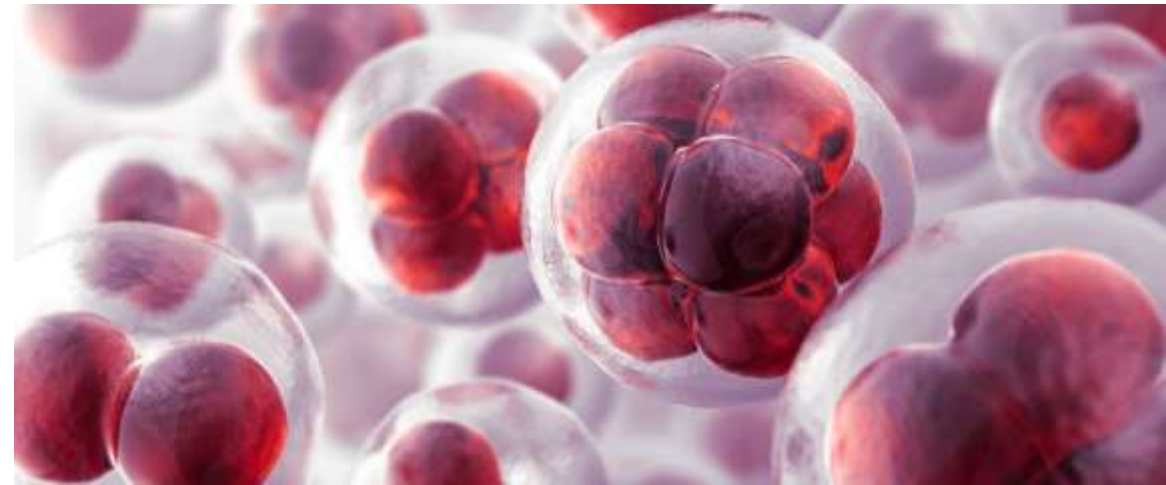
- Identical with mammalian nutrition

Vitamin B complex -

- thiamine
- riboflavine
- nicotinic acid
- pyridoxine
- folic acid &
- Vit. B 12

Growth

- It is an increase in all the cell components ,which ends in multiplication of cells leading to an increase in population .
- It involves an increase in the size of the cell ,and an increase in the number of individual cells .
- Bacteria divide by Binary fission .



Binary fission

1 Cell elongates and

- DNA is replicated.
- Plasma membrane
- DNA (nucleoid)

2 Cell wall and plasma membrane begin to constrict.

3 Cross-wall forms, completely separating the two DNA copies.

4 Cells separate.

Generation time

- Interval of time between two cell divisions
- The time required for a bacterium to give rise to 2 daughter cells in optimum conditions
- Also called as population doubling time .

Some other factors affecting the growth of the organisms are here by listed as

1 Temperature

2 Atmospheric oxygen and carbon dioxide

3 Moisture and dryness

4 H⁻ion concentration

5 Radiation

6 Mechanical and sonic strength .

Bacterial growth curve

- When a bacterium is added to a suitable liquid medium & incubated, its growth follows a definite course
- If bacterial counts are made at intervals after inoculation & plotted in relation to time, a growth curve is obtained
- Shows 4 phases:
 - Lag phase
 - Log phase/exponential phase
 - Stationary phase
 - Phase of decline

Phase of growth

1 Lag phase :

- No increase in number but there may be an increase in the size of the cell

2 Log or Exponential phase :

Cells start dividing and their number increases exponentially .

3 Stationary phase :

Cells stop dividing due to depletion of nutrients and accumulation of toxic substances .

Equilibrium exists between the dying cells and the newly forming cells ,so viable count remains stationary .

- 4 Phase of decline :

- Population decreases due to the death of the cells – autolytic enzymes .

Morphological and Physiological alterations during growth

Lag phase –maximum cells size towards the end of the phase

Log phase – smaller cell, stain uniformly

Stationary phase –irregular , staining ,sporulation and production of exotoxins

Phase of decline –involution forms

Bacterial count

- . Growth in numbers can be studied by bacterial counts.
- 2 methods - Total cell count
- Viable cell count

Total count

Total number of cells in the sample - living + dead.

Can be obtained by :

- Direct counting under microscope using counting chambers.
- Counting in an electronic device - Coulter counter

— Viable cell count

- Measures the number of visible cells
- Methods – surface colony count
- 1 Dilution method
- 2 Plating method
- Number of colonies that develop after incubation gives an estimate of the viable count .

Metabolism

- Absorption to elimination of substances in cell
- Oxidation –Aerobes
- Fermentation –Anaerobes
- Oxidation –reduction –potential =electrons to accept or to part with