

COURSE CODE:

COURSE TITLE:

NUMBER OF UNITS:

COURSE DURATION:

COURSE DETAILS:

Course Coordinator:

Email:

Office Location:

Other Lecturers:

COURSE CONTENT:

COURSE REQUIREMENTS:

READING LIST:

LECTURE NOTES

Nutritional types of different bacteria.

Based on their relation to the following:

- (i) Energy source
- (ii) Hydrogen donors
- (iii) Carbon source

Phototrophs: These are microorganisms that use electromagnetic radiation (light) as their source of energy

Chemotrophs: These are microorganisms that gain energy by oxidation-reduction reactions either by respiration or fermentation.

Autotrophs: These microorganisms obtain cellular carbon by carbon dioxide fixation

Heterotrophs: Microorganisms that obtain cell carbon by assimilation of organic compounds

Photolithotrophs: Microorganisms that use electromagnetic radiation for energy and inorganic compounds as source of carbon.

Chemolithotrophs: Microorganisms that obtain energy by oxidation-reduction and carbon from inorganic compound.

Chemoorganotrophs: Microorganisms that obtain energy by oxidation-reduction and carbon from organic compounds.

The physiology of bacterial growth

Bacterial growth is defined as increase in number of cells or total mass of cells.

Growth rate: measures change in cell number or cell mass per unit time.

Binary fission: The method by which bacteria reproduce. It involves a parent cell doubling in size and then divides into 2 daughter cells which have approximately the same size as the original cell.

Generation time: time required for a doubling of cell numbers.

Doubling time: time required for doubling of cell mass.

Bacterial growth in batch culture

A batch culture is a closed system where no nutrients are added or waste products removed.

Bacterial growth is divided into the following phases

- (i) Lag phase: This is the time interval between inoculation and establishment of the maximum division rate
- (ii) The exponential phase is characterized by a constant minimal division
 - (iii) The stationary phase begins when cells can no longer reproduce due to nutrient depletion
 - (iv) The death phase is due to accumulation of acids as in *Escherichia coli* and lactic acid bacteria and cell lyses due to cellular enzymes

Bacterial growth in continuous culture: Cells grow at a constant exponential rate due to frequent transfer of cell to fresh medium. It is achieved by a chemostat

Determination of bacterial numbers

Bacteria numbers can be total count or viable count.

Total count involves both living and dead or damaged cells while viable count involves only living cells. These can be determined by the following ways

- Bacteria can be enumerated using a microscope directly
- Use of a coulter counter
- Use of a membrane filter
- Use of Koch's method of pour plate technique
- Wet or dry weight determination of growth yield
- Determination of enzymic or metabolic activities
- Nitrogen or protein content determination