|  |  |  |
| --- | --- | --- |
| **Learning outcomes: 3.1.1, 3.1.2, 3.1.3 and H.3.1.9,H. 3.1.10**  **At the end of this section you should be able to …** | **Y** | **N** |
| 3.1.1 Know the 5 kingdom system of classification : |  |  |
| 3.1.2 Know the distribution of bacteria and fungi in nature – salt water, fresh water, terrestrial, air-borne |  |  |
| 3.1.3 Draw and describe the basic structure of Bacterial cells  ( including plasmid DNA) |  |  |
| 3.1.3 Know the 3 main types of bacteria |  |  |
| 3.1.3 Describe Reproduction in bacteria |  |  |
| 3.1.3 Describe Nutrition in bacteria |  |  |
| 3.1.3 Describe the factors affecting growth of bacteria |  |  |
| 3.1.3 Explain the term Pathogen |  |  |
| 3.1.3 Define and describe the role of antibiotics |  |  |
| **3.1.3 Contemporary Issue**  Explain the economic importance of bacteria: Give examples of any 2 beneficial and any 2 harmful bacteria |  |  |
| **3.1.3 Explain the potential abuse of antibiotics in medicine** |  |  |
| **H. 3.1.9 Nature of bacteria and fungi**  **Describe prokaryotic nature of bacteria and eukaryotic nature of fungi** |  |  |
| **H.L. Contemporary Issue:**  **H. 3.1.10 Growth curves:**  **Plot a growth curve to include the 5 phases of growth**  **Give an explanation of microbial behaviour at each stage.**  **H. 3.1.10**  **Describe Batch and continuous flow food processing.** |  |  |

**Key Words**

Prokaryotic, Eukaryotic, Endospore, Plasmid, Binary fisson, Autotrophic, Heterotrophic, Photosynthetic, Chemosynthetic, Saprophytic, Parasitic, Pathogen, Antibiotic, Batch food processing, Continuous food processing

**Bacteria (Summary)**

|  |  |
| --- | --- |
| **5 kingdoms** |  |
| **Monera (Bacteria)** | **Prokaryotic** |
| **Protista (Amoeba)**  **Fungi (Mushroom)**  **Plantae (Oak)**  **Anamalia (Tiger)** | **Eukaryotic** |

**Distribution:**

Bacteria and fungi are found everywhere – salt water, fresh water, terrestrial, air-borne.

Ubiquitous: found everywhere.

**Structure of a bacterial cell**

**Labels required:**

* Cell wall
* Cell membrane
* Genomic material including plasmid
* Cytoplasm
* Flagella
* Capsule

Cell wall

Nuclear (genomic) material

flagella

cytoplasm

Cell membrane

Capsule

Plasmid

Cell wall

**3 main types.**

* Cocci e.g. streptococcus
* Spirals e.g. Syphilis.
  + Rods e.g. T.B.

**Reproduction: Binary fisson**

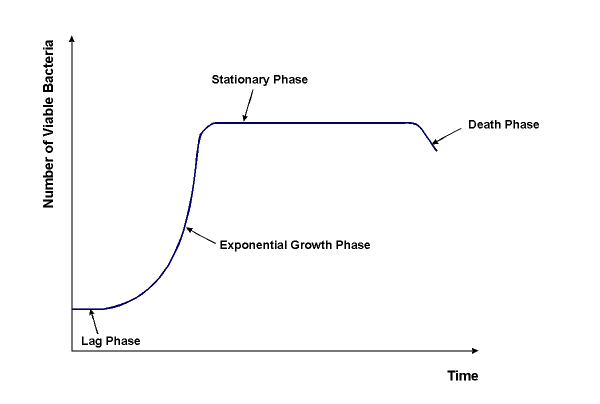
* DNA replicates
* Cell elongates pushing the replicated DNA apart
* Ingrowths of the cell membranes and cell walls occur forming two identical cells or organisms.

Because of their short life cycle and multiple generations, mutations become a very important feature.

Under favourable conditions reproduction can occur once every twenty minutes.

Bacterial growth can be represented by a **growth curve**

**Growth curve (5 Phase)**



Log

Survival Phase

**Lag Phase**: Cells adapting to new environment. Cells increase in size but do not divide. No increase in numbers

**Log Phase**: Cell numbers increase at ever increasing rates with time. The more cells that are present the faster the population of cells increases. Optimum conditions for growth.

**Stationary Phase:** No increase in numbers. Rate of cell growth is equal to cell death. At this point bacteria are competing for food, space, moisture and oxygen. There is also a build up of toxic wastes.

**Decline Phase:** Cell death exceeds cell birth. Due to same factors as in stationary phase.

**Survival Phase**: Many bacteria survive by developing endospores in response to unfavourable conditions. Endospores remain dormant until conditions become suitable.

**Endospore Formation:**

Formed in unfavourable environments.

* Cell shrinks
* Rounds up
* Forms a thick wall within the original structure.

When conditions become favourable:

* Spores absorb water
* Break their walls
* Reproduce by binary fisson

**Factors affecting growth**

* Temperature
* Oxygen concentration
* pH
* External solute concentration
* Pressure

**Nutrition in bacteria**

**Autotrophic**: Organisms which have the ability to make their own food from inorganic molecules

2 types of autotrophs

1. **Chemosynthetic:** Organisms which make their own food using energy from chemical reactions
2. **Photosynthetic:** Organisms which make their own food using energy from sunlight

**Heterotrophic:** Organisms which cannot make their own food. Must eat food made by other organisms

2 types of heterotrophs

1. **Saprophytic:** Organisms feed on dead and decaying organic matter
2. **Parasitic:** An organism lives in or on another organism causing it harm.

**Economic importance**

**Beneficial Microorganisms**: Streptococcus in yogurt making. Lactobacillus used to make antibiotics

**Harmful Microorganisms:** Pneumonia caused by Pneumococcus**.** Cholera caused by vibrio

**Pathogenic bacteria**

* Bacteria capable of causing disease

**Definition of Antibiotics**

Compounds produced by microorganisms that stop the growth, or kill other microorganisms.

**Role of antibiotics:**

Used to treat bacterial infection

**Potential abuse due to:**

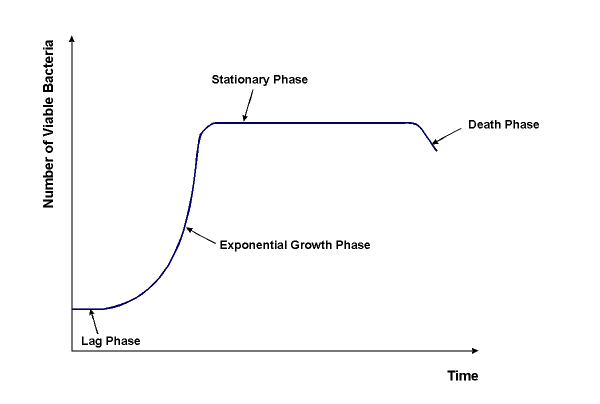
* Over prescription of antibiotics
* Not completing full course of antibiotics
* Taking antibiotics to treat colds and flu (viral infections). Antibiotics only effective against bacterial infections.

**Describe Batch and continuous flow food processing.**

**Batch Culture**

Phases of growth: 5 phases

Lag, Log, Stationary, Decline, Survival



Survival Phase

**Continuous Culture**

Phase of growth: maintained in Exponential

**Batch food processing**

* Cells are grown in a fixed volume of liquid medium in a closed vessel.
* Nothing added or removed during incubation period.
* Products removed at the end. E.g. yoghurt making
* **5 phase growth rate**

**Continuous food processing**

* Nutrients added and products remooved continuously at a rate that maintains the volume at a fixed level
* e.g. Production of single cell protein
* **Continuous growth rate (exponential)**