**Mid-Term Assignment (Spring-2020) (BS-MLT 2ndSec-A & Sec-B)**

**Course Title: Basic MicrobiologyInstructor: Mr. Fazli Zahir Mian**

**Time: 48 Hours name; AZIZ UR RAHMAN roll no. 16863**

**Q1: Fill in the Blanks.**

1. **Microbes** are living things which individually are too small to be seen withnaked eye.
2. The scientific study of algae is called **agology**.
3. Diseases causing living organisms are known as **pathogens**.
4. **Ribosome** cell organelle is present both in prokaryotic and eukaryotic cell.
5. The power house of cell is known as **Mitochondria**..
6. **Binary fission** is the most common method of asexual reproduction in microbes.
7. Log period of bacterial growth is also known as **exponential**.
8. **Lag** phase of microbial growth is metabolically active and is for industrial purposes.
9. Shrinkage of cell’s plasma membrane caused by osmotic loss of water is called **plasmolysis**
10. For synthesis of cellular material nitrogen and sulfur is needed for protein. synthesis.

**Q2: Write short notes on the following**

**Ans 1 Mitochondria,**

Mitochondria are known as the power houses of the cell. They produce adenosine triphosphase ATP. They are required for cellular respiration. They are present in both animal and plant cells. They are surrounded by two membranes. the inner membrane is folded into finger like projections called cristae.

**Ans 2 nucleous ;**

* Nucleus was first observed by Leeuwenhoek in the RBCs of fishes.
* The term 'Nucleus' was coined by Robert Brown in 1831.
* Nucleus is a double membrane bound dense protoplasmic body.
* It encloses the genetic information of the cell which means that the genetic material (DNA or RNA) is present in it.
* It is absent in prokaryotes and mature RBCs in case of eukaryotes.
* Depending upon the number of nucleus, a cell may be uninucleate, binucleate or multinucleate.
* The shape of nucleus may be discoid, ovoid, spherical, bilobed or multilobed.
* The outermost double layered covering of nucleus is called nuclear membrane or karyotheca or nuclear envelope.
* The nuclear envelop consists of many pores called nuclear pores.
* The nucleus is filled with nucleoplasm which contains chromatin i.e. thread like structures of DNA.
* Within the nucleus is present nucleolus which is a spherical body seen during interphase.

**Ans 3 budding**

**Budding** is a type of [asexual reproduction](https://en.wikipedia.org/wiki/Asexual_reproduction) in which a new organism develops from an outgrowth or bud due to cell division at one particular site. The small bulb-like projection coming out from the yeast cell is called a bud.Since the reproduction is asexual, the newly created organism is a clone and excepting mutations is genetically identical to the parent organism.

Organisms such as [hydra](https://en.wikipedia.org/wiki/Hydra_(genus)) use regenerative cells for reproduction in the process of budding.

In hydra, a bud develops as an outgrowth due to repeated cell division at one specific site. These buds develop into tiny individuals and, when fully mature, detach from the parent body and become new independent individuals.

Internal budding or endodyogeny is a process of asexual reproduction, favored by parasites such as *[Toxoplasma gondii](https://en.wikipedia.org/wiki/Toxoplasma_gondii)*. It involves an unusual process in which two daughter cells are produced inside a mother cell, which is then consumed by the offspring prior to their separation.

**Ans 4 culture media;**

A culture media is a special medium used in microbiological laboratories to grow different kinds of microorganisms. A growth or a culture medium is composed of different nutrients that are essential for microbial growth.

Since there are many types of microorganisms, each having unique properties and requiring specific nutrients for growth, there are many types based on what nutrients they contain and what function they play in the growth of microorganisms.

A culture may be solid or liquid. The solid culture media is composed of a brown jelly like substance known as agar. Different nutrients and chemicals are added to it to allow the growth of different microorganisms.

**Ans 5 growth factor;**

A **growth factor** is a naturally occurring substance capable of stimulating [cellular growth](https://en.wikipedia.org/wiki/Cellular_growth), proliferation, healing, and [cellular differentiation](https://en.wikipedia.org/wiki/Cellular_differentiation). Usually it is a [protein](https://en.wikipedia.org/wiki/Protein) or a [steroid hormone](https://en.wikipedia.org/wiki/Steroid_hormone). Growth factors are important for regulating a variety of cellular processes.

Growth factors typically act as signaling molecules between cells. Examples are [cytokines](https://en.wikipedia.org/wiki/Cytokine) and [hormones](https://en.wikipedia.org/wiki/Hormone) that bind to specific [receptors](https://en.wikipedia.org/wiki/Receptor_(biochemistry)) on the surface of their target [cells](https://en.wikipedia.org/wiki/Cell_(biology)).

They often promote cell differentiation and maturation, which varies between growth factors. For example, [epidermal growth factor](https://en.wikipedia.org/wiki/Epidermal_growth_factor) (EGF) enhances osteogenic differentiation, [ while [fibroblast growth factors](https://en.wikipedia.org/wiki/Fibroblast_growth_factor) and [vascular endothelial growth factors](https://en.wikipedia.org/wiki/Vascular_endothelial_growth_factor) stimulate blood vessel differentiation ([angiogenesis](https://en.wikipedia.org/wiki/Angiogenesis)).

**Q no. 03 Bacterial growth**

**Bacterial growth** is proliferation of [bacterium](https://en.wikipedia.org/wiki/Bacteria) into two daughter cells, in a process called [binary fission](https://en.wikipedia.org/wiki/Binary_fission). Providing no event occurs, the resulting daughter cells are genetically identical to the original cell. Hence, bacterial growth occurs. Both daughter cells from the division do not necessarily survive. However, if the number surviving exceeds unity on average, the bacterial population undergoes [exponential growth](https://en.wikipedia.org/wiki/Exponential_growth). The measurement of an exponential bacterial growth curve in batch culture was traditionally a part of the training of all microbiologists; the basic means requires bacterial enumeration (cell counting) by direct and individual (microscopic, flow cytometry), direct and bulk (biomass), indirect and individual (colony counting), or indirect and bulk (most probable number, [turbidity](https://en.wikipedia.org/wiki/Turbidity), nutrient uptake) methods. Models reconcile theory with the measurements.

**Differen phases of bacterial growth**

1. **lag phase**, [bacteria](https://en.wikipedia.org/wiki/Bacterium) adapt themselves to growth conditions. It is the period where the individual [bacteria](https://en.wikipedia.org/wiki/Bacterium) are maturing and not yet able to divide. During the lag phase of the bacterial growth cycle, synthesis of RNA, enzymes and other molecules occurs. During the lag phase cells change very little because the cells do not immediately reproduce in a new medium. This period of little to no cell division is called the lag phase and can last for 1 hour to several days. During this phase cells are not dormant.
2. 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. If growth is not limited, doubling will continue at a constant rate so both the number of cells and the rate of population increase doubles with each consecutive time period. For this type of exponential growth, plotting the natural logarithm of cell number against time produces a straight line. The slope of this line is the specific growth rate of the organism, which is a measure of the number of divisions per cell per unit time. The actual rate of this growth (i.e. the slope of the line in the figure) depends upon the growth conditions, which affect the frequency of cell division events and the probability of both daughter cells surviving. Under controlled conditions, [cyanobacteria](https://en.wikipedia.org/wiki/Cyanobacteria) can double their population four times a day and then they can triple their population  Exponential growth cannot continue indefinitely, however, because the medium is soon depleted of nutrients and enriched with wastes.
3. The **stationary phase** 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. The number of new cells created is limited by the growth factor and as a result the rate of cell growth matches the rate of cell death. The result is a “smooth,” horizontal linear part of the curve during the stationary phase. [Mutations](https://en.wikipedia.org/wiki/Mutation) can occur during [stationary phase](https://en.wikipedia.org/wiki/Stationary_phase_(biology)). Bridges et al. (2001) presented evidence that [DNA damage](https://en.wikipedia.org/wiki/DNA_damage_(naturally_occurring)) is responsible for many of the mutations arising in the genomes of stationary phase or starving bacteria. Endogenously generated [reactive oxygen species](https://en.wikipedia.org/wiki/Reactive_oxygen_species) appear to be a major source of such damages.
4. 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.