



K.L.E. SOCIETY'S
P. C. JABIN SCIENCE COLLEGE
HUBBALLI
AUTONOMOUS

Semester

I

B.Sc.

✓

B.C.A.

M.Sc.

Answer Booklet No.

39443

Theory Semester End
Examination

April/May 2022

Nov./Dec. 20

Certified that the entries made by the candidate
are found to be correct.

Exam. Reg. No.

1 2 1 C M b 0 0 6

Signature of the Room Supervisor with Date

HRH
16-03-2022

Class :

BSc-Isem

Subject :

Microbiology

Subject Code No.

123 PSC01T

Paper :

12001010

GM



121CMB006

IMPORTANT INSTRUCTIONS TO CANDIDATES

- 1) On the cover page of answer book compulsorily mention your Register Number, Subject, Course Code and required information.
- 2) Don't write your name or mark any signs, such answer scripts shall not be assessed and punished.
- 3) Write your answer from 1st page and don't leave any blank pages and blank space in between.
- 4) Last page is meant for rough work and on completion put cross mark (x)
- 5) The candidates are informed strictly to write their answer only with black ink & write on both sides of the answers sheets.

IMPORTANT INSTRUCTIONS TO CANDIDATES

- 6) Please mention the Question number in the margin. Answer's without Question number & also with wrong question number shall not be valued.
- 7) The students are informed to take compulsorily the signature of the room supervisor with date on the answer book.
- 8) The candidate should be present 20 minutes before the commencement of the examination. After that no students will be allowed in the examination hall.
- 9) Use of any electronic gadgets in the examination hall is strictly prohibited.
- 10) After the last warning bell, no candidate is allowed to leave his/her seat.
- 11) Indulging in different ways and using different means that lead to malpractice is prohibited.
- 12) Don't fold the answers sheets & keep the answer sheets clean.

unit-I

2. a) * Resolving power - is the ability of microscope to distinguish clearly between two closely located organisms.
- * It is the measure of amount of light intensity entering through optical ocular lens of optical microscope is called Numerical Aperture.
- * Numerical Aperture is index to the Resolving power of microscope.
-
2. b) * The five kingdom classification system is proposed by R.H. Whittaker. Earlier classification was mainly based on two domain kingdom.
- * Later Haeckel proposed three kingdom of classification where he segregated protista, plantae and animalia.
- * In which protista included all single cellular organisms and multicellular organisms. He did not segregate between fungi and protozoa.
- * Later, R.H. Whittaker came and based on relative studies made by him on the characteristics of living organisms proposed 5-kingdom domain that includes mainly
- * Monera, Protista, mycota, Plantae and Animalia.
- * On the basis of vegetative characters, mode of reproduction, ability of formation of different modes in structure & function. Based on blood-group, and, observation of cell and physiological and -

- chemical characteristics in the cell ~~and~~ composition of cell, Mode of residing or mode of habitat. By the relative studies he concluded 5 kingdom classification.

(a) Monera

* It includes unicellular prokaryotic organisms in which strictly the bacteria are the sole members of this kingdom.

* Some are Archaeobacteria & Eubacteria.

* Archaeobacteria can thrive in extreme hot and cold temperature.

* Some Archaeobacterias do not possess cell wall. & some are methane gas producing microbes.

Ex: Methanobacterium, Nostoc, etc.

(b) Protista

* It includes unicellular eukaryotic organisms.

* These are ~~divided~~ mainly grouped into, Dinoflagellates, Diatoms, Slime Molds, and Euglenoids.

* Diatoms are of economical importance.

* Dinoflagellates are relatively responsible for the formation of red tides in Ocean.

* Euglena is deprived of cell wall & possess "pellicle" instead of it.

③ Mycota (Fungi)

- This includes heterotrophic organisms which includes fungi
- They are Saprophytes that depend on dead and decaying matter and ~~not~~ these do not possess any chlorophyll pigment
- Ex: Rhizopus, Mucor.

④ Plantae:

- This Kingdom includes all eukaryotic, multicellular green and chlorophyll possessing organisms.
- They prepare own food through photosynthesis
- Includes Monera, Algae, Trees, Angiosperms & Gymnosperms

⑤ Animalia

- This Kingdom involves all multicellular eukaryotic organisms.
- Cell wall is absent, And mode of nutrition is holozoic
- Mode of Reproduction is Sexual and gametes are involved in during reproduction.

2.c) Contribution of

→ i) Louis Pasteur.

- He is regarded as the "Father of Modern Microbiology"
- He is awarded Nobel Prize for the development of the technique "Pasterization"
- He disproved the theory of Spontaneous Generation of Organisms by a series of experiments.

* He took a straight neck flask and boiled the beef broth in the medium for long duration and removed the air from it and sealed and let it - open for some an observation.

* ~~the~~ microbes grew in it. Then he took a goose-necked flask and again boiled the beef-broth in it for a long duration of time. Agt.

* Again he observed ~~for~~ after few days as a result no microbes grew in it. because the s-shaped flask trapped the microbes preventing them from reaching the broth. And the broth was free from contamination.

* He concluded that it was microbes in the air that were responsible for the formation of new organisms in the broth.

* He also discovered the method of microbial fermentation with the use of grape. He made series of experiments in the development of brewing industry for the long life span of good quality wine without spoiling the quality and state of it.

* He also worked on disease silkworm which was responsible for causing huge loss and destruction in the farmers field. by

* He developed the method of vaccination and inoculation. by adoptin which includes the addition of attenuated or weak germs or organisms into the body of an living being which results in the formation of antibodies.

- required to fight against any virus or disease
- * He worked on the diseases of anthrax and Rabies disease, in which the Rabies disease was related to the dogs disease or caused by the bite of dogs. it was also known as water phobia
- By developing a vaccine to both of these disease he has proved to become an successful microbiologist.
- * He developed the method of 'pasteurization' where the heat treatment is given at 62.8°C for the 30 minutes followed by sudden cooling which results in the destruction of pathogenic micro-organisms.
- * This method is mainly applicable for liquid medias for Milk and milk products and it is also used in the brewing industry
- * Also used in the pharmaceutical Industries.
- * Pasteurization method is also one of the method of moist heat sterilization where we kill relatively pathogenic bacteria to make the infusion free from contamination.

ii) Robert Koch:

- He developed the Germ theory hypothesis
- * These postulates which relatively explains that the microbes are causally related for the causing of any disease.
- * Microbes should be present in every instance of the disease.

ii) ~~It is~~ causally

- * The microbe must be isolated from the infected area and should be grown in pure culture
- * The microbes grown in pure culture should be introduced into the body of any organisms under normal physiological conditions
- * The introduced bacterias should produce the same disease as we see in even earlier isolated microorganisms.
- * These were the postulates given by Robert Koch
- * Robert Koch also disproved the theory of Spontaneous Generation
- * He discovered the microbes, he made contribution in discovering, bacillus Anthracis, Vibrio cholera

unit II

3. a) The stains used in Gram's staining is -

- * Crystal violet
- * Gram's Iodine
- * Decolourizer - (Alcohol)
- * Saffranine

3. b) Methods of microbial Preservation.

* There are several methods in the preservation of microbes -

- * Mineral oil overlaying
- * Hot sterile soil culture
- * Lyophilization or free drying.
- * Cryopreservation.

① Mineral oil overlaying

* This is one of the methods of microbial preservation.

* In this method the slant culture are taken in test tube.

* The mineral oil or paraffin is poured on the slant cultures to the depth of 1cm above the culture media.

* This method relatively helps in the preservation of microbes by decreasing their metabolism as well as growth.

* This method reduces the oxygen supply to the cells present in medium which prohibits their cell division and growth of microbes.

* These media are transferred to any other tubes

- by relatively touching the test tubes to the petri dishes first they remove the oil on the media and later a loop of it transferred for the preparation of fresh medium. This is
- * This method is useful for microbes like mycobacterium, ~~Staph~~ Bacillus species.
- * These can be stored to a small low temperature zones of $0-5^{\circ}\text{C}$. & also maintained normally at room temperature.
- * This method can preserve microbes for about 7-10 years or for 8-12 years.

(b) Cryopreservation -

- * This method is the most crucial method for the preservation as the "microbes" to be preserved are subjected to a "liquid Nitrogen" gas for a temperature of (-196°C) in the deep cold state.
- * This is usually carried out in the medium containing lyoprotectants like sucrose or (GMSO) that protects the cells from damaging by the formation ice crystals around the cell.
- * This method is more widely used also to preserve & "semen" of cows or buffaloes in breeding and also to preserve the pollen grains.
- * This method is proved to be viable for the preservation for about 70-80 years.

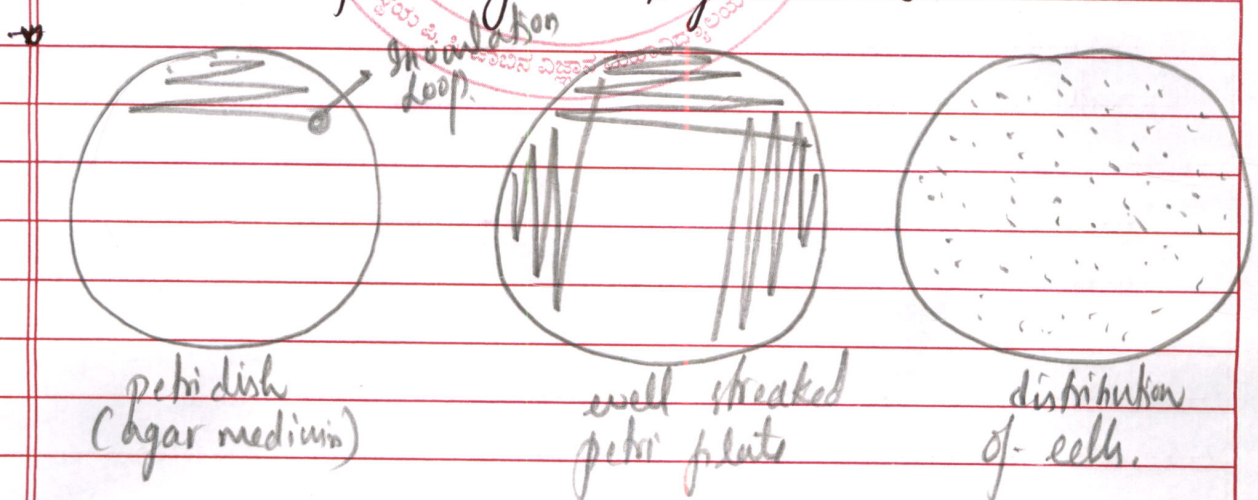
3. c) Planting techniques involved in Isolation of microbes.

- ① Streak-plate technique.
- Pour-plate technique
- Spread-plate technique
- Serial dilution method

→ Streak-Plate technique: In this method microbes in the culture medium of pure culture, or mixed culture are taken with the help of inoculation loop.

→ Then the inoculation loop is streaked across the solid agar medium on the petri dish or plates in a widely fashion.

→ The main aim of this method is to decrease the number of cultures of microbes and isolate them to form pure single colonies.



this diagram clearly shows how the inoculated medium is streaked across petri plates. And the separated microbes grows pure colonies.

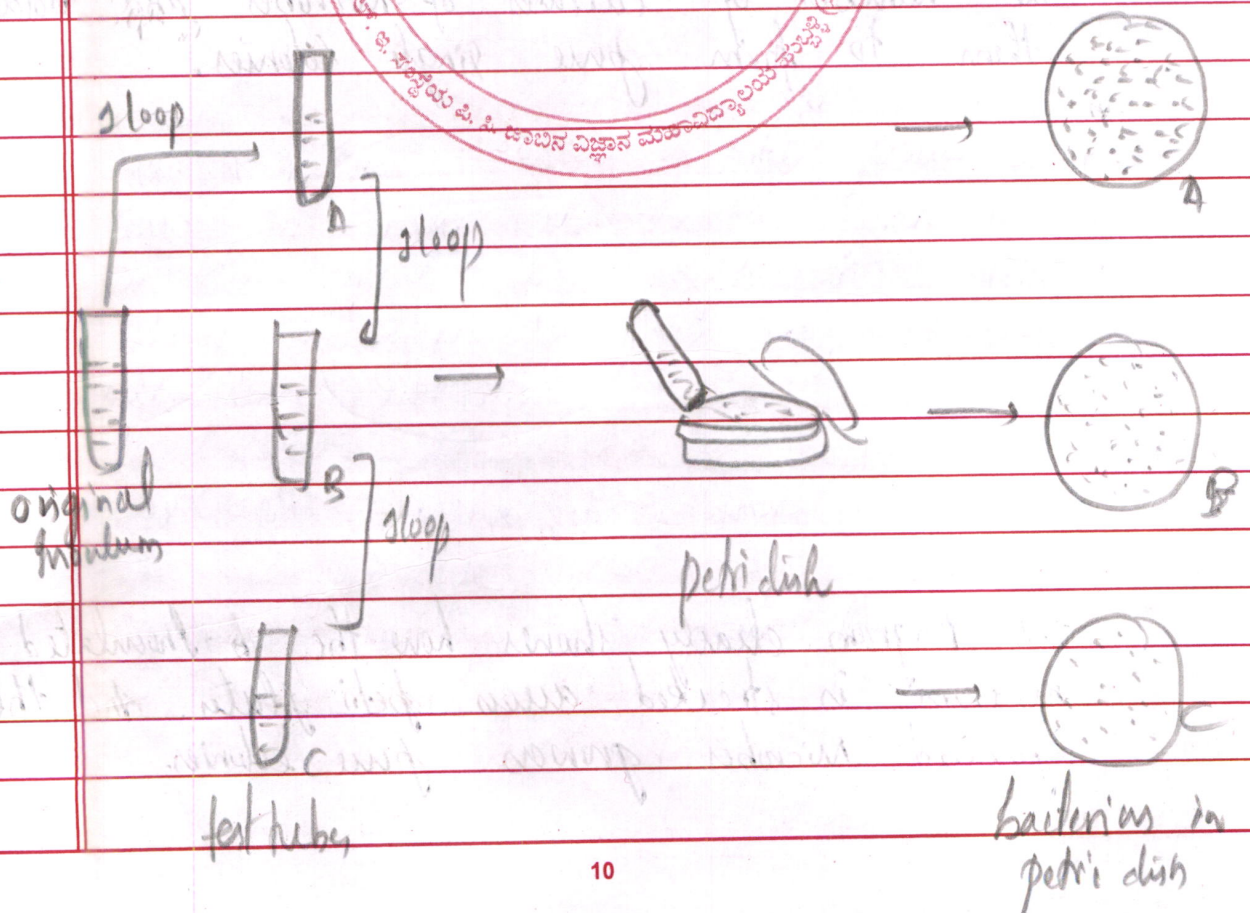
⑤. Pour plate technique

→ In this method, the mixed culture is diluted directly in the test tubes,

* And the 1 loop of diluted medium is poured to the next test tubes and the 2nd loop of medium from second test tube is added to the 3rd test tubes.

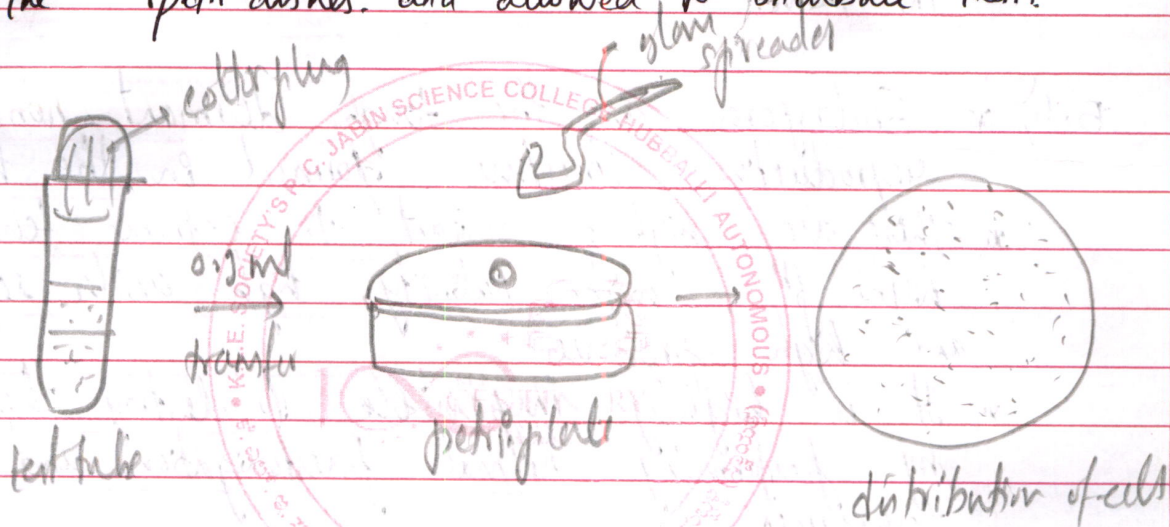
* The test tubes are relatively kept in the room temperature for ~~long~~ about couple of minutes to allow the thorough distribution of cells in the medium.

* Now the test tubes are transferred to petri plates & cultures in them are allowed to solidify and then incubated for their growth.



③ Spread plate technique

→ In this technique the medium is diluted in sterile water or saline. here the 0.1 ml of drop of culture medium is placed on the agar plate and spread it evenly to allow thorough distribution of growth of cells in the petri dishes. and allowed to incubate them.



④ Serial dilution method

→ In this method, a series of 6-7 test tubes are used and the original Gonoculture medium of 1 ml containing the culture is transferred to the next test tube and then next test tube media is transferred to successive test tubes containing agar medium.

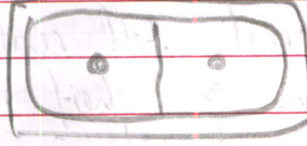
→ The main aim of this method is to decrease the number of concentration of microbes.

→ As microbes concentration decreases they are grown and isolated as well as pure cultures.

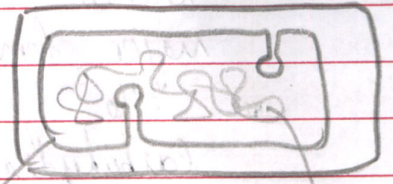
Unit III

5. a) → Viruses are the obligate intracellular parasites which are non-living inert cell structures when present outside the host organism.
- They carry only protein and nucleic acids.
 - They don't have any cell organelles present in them.
-
5. b) → Endospores are the tough, dormant, non-reproductive structures formed in the bacteria.
- These are highly resistant to extreme temperature, high pH, high salinity, high acidic regions and high pressure.
 - It is highly impossible to destroy these spores by performing normal pasteurization and boiling techniques.
 - They can be destroyed by the process of autoclaving, which is the process of prolonged boiling or intermittent heating given to the bacterial spores at a temperature of 121°C for about 20-30 minutes. Sufficiently 3 days to kill these Endospores.
 - The Genus *Bacillus* and *Clostridium* are responsible for the formation of Endospores.
 - The Endospores are formed by cell division & then septum formation takes place that leads to the engulfment of pre-spore formed within cell.
 - As a result cortex formation starts to form outside of cell layer & the coat synthesis starts to take place.

④ formation of Endospore: Division of cell

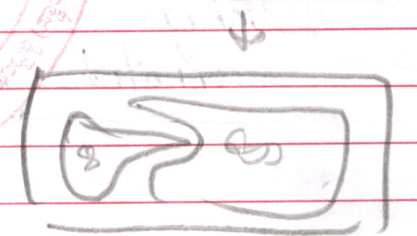
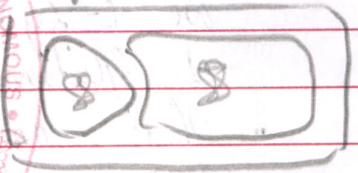


① Axial filament formation

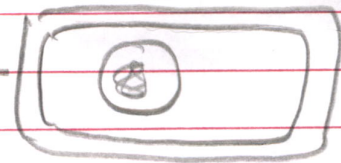


plasma membrane ↓ DNA

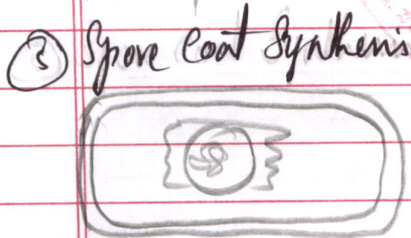
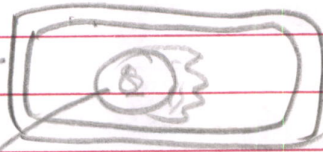
② Septum formation



③ Engulfment of forespore

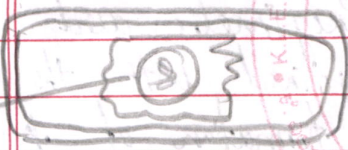


coat ← ④ Cortex formation



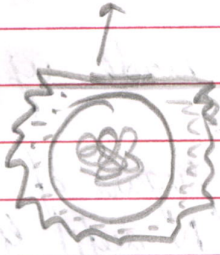
⑤ Spore Coat Synthesis

⑥ Release of spore



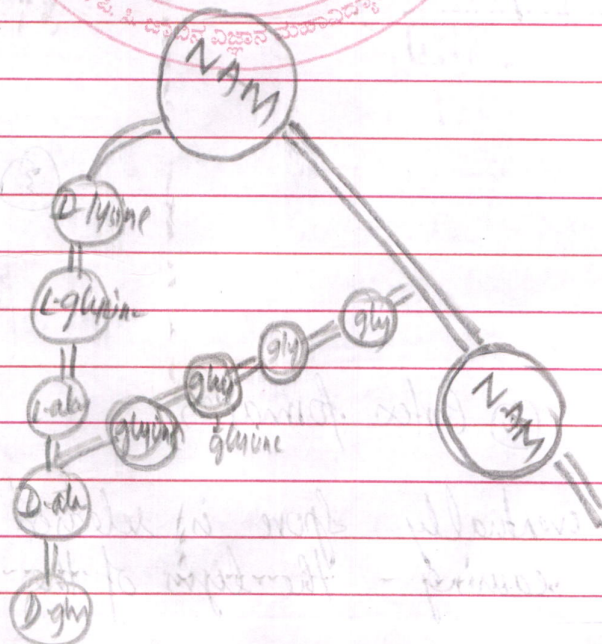
coat ←

⑦ Lysis of the bacterium



* the eventually spore is released out from bacterial cell causing the lysis of the Organism.

- 5.c) The Bacterial cell wall mainly consists of peptidoglycan as chief material.
- In addition to it it also contains teichoic acid, teichoic acid and lipopolysaccharides as the major forms of cell wall.
 - The peptidoglycan in turn is made up of carbohydrates and Nucleic acids.
 - The carbohydrates consists of sugars of NAM (N-acetyl muramic acid) & NAG (N-acetyl glucosamine).
 - There are about 5 Nucleic acids present which are L-Lysine, D-lysine, L-alanine, D-alanine, L-glutamic acid, and diaminopimelic acid.
 - These amino acids are interjoined with the cross linkings of glycine by the formation of β inter-connected peptide bridge.

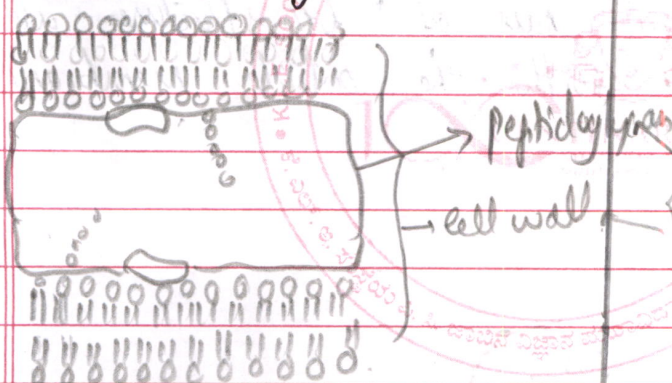


• This is the structure of peptidoglycan subunits bonded diagram.

* Based on composition of cell wall the bacteria are classified into two major classes they are gram positive bacteria and gram negative bacteria

Gram positive bacteria

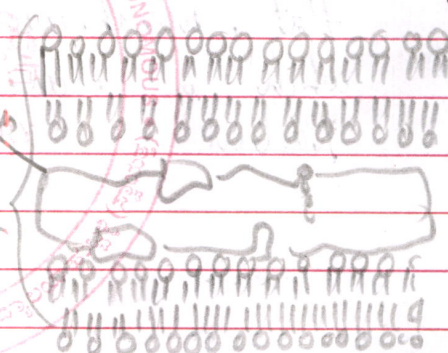
- ① * These contain upto 90% of peptidoglycan
- ② * These contain 1-4% of Lipopolysaccharide
- ③ this cell wall is thick and homogenous



- ④ presence of teichuronic acid
- ⑤ presence of teichoic acid
- ⑥ On the treatment with lysozyme produces protoplast
- ⑦ Absence of outer membrane
- ⑧ presence of L & P ring in flagella

Gram negative bacteria

- * These contain 20-40% of peptidoglycan
- * These contain 40-60% of Lipopolysaccharide
- * gram negative bacterial cell wall is thin and heterogeneous

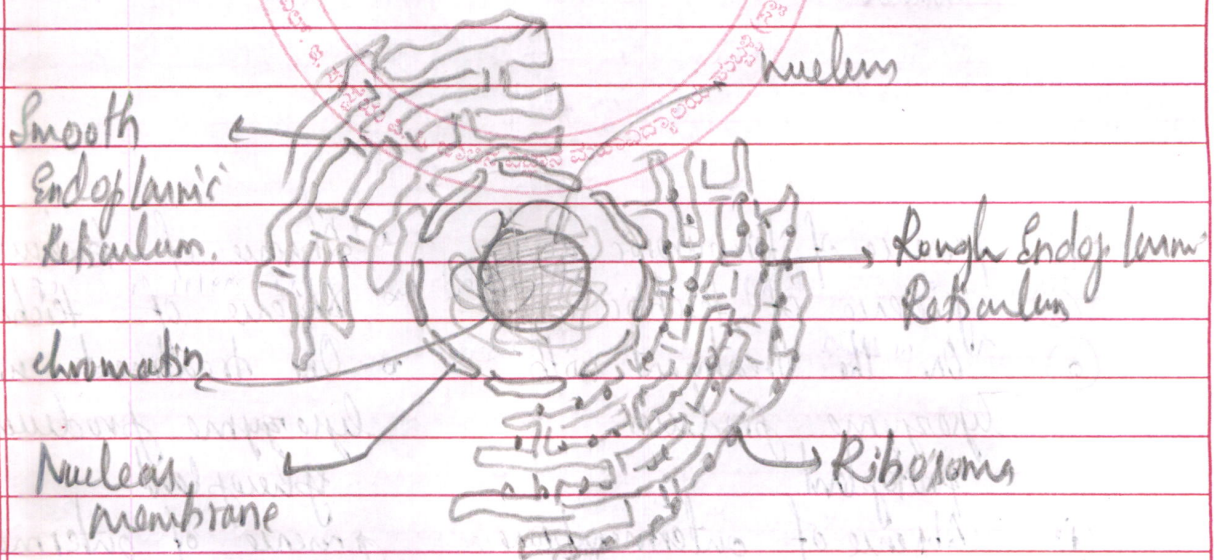


- * Absence of teichuronic acid
- * Absence of teichoic acid
- * On treatment with lysozyme produces spheroplast
- * presence of outer membrane
- * Presence of L & P, S & M ring in flagella

unit IV

- 7.a) * Cilia is the unicellular protein appendages present extracellularly to the cell which aids in the movement of cells.
* Cilia is a hair like outgrowth whose size is small when compared with flagella
Ex: Paramecium.

- 7.b) Endoplasmic Reticulum
This is a thin cellular Organelle, which is thin flat, membranous sacs of like structures are present which is bound with the outside membrane of Nucleus.



- ① Structure of Endoplasmic Reticulum
The Endoplasmic Reticulum consists of 2 structures
① Rough Endoplasmic Reticulum - It is called so because of its appearance. In this the Ribosomes are

- embedded on to the surface of ~~R~~ Endoplasmic Reticulum. It is a sac shaped structure which is highly tubular shaped.

(b) Smooth Endoplasmic Reticulum

this structure do not possess any Ribosomes so it looks smooth in structure and appearance. It is highly tubular in structure.

(c) functions of Rough Endoplasmic Reticulum

- It is majorly involved in the process of protein synthesis on which is the main function of ribosomes.
- It is also involved in the checking of folds of protein formed called as "protein ~~forming~~ - forming".
- It is also involved in the process called "protein sorting".

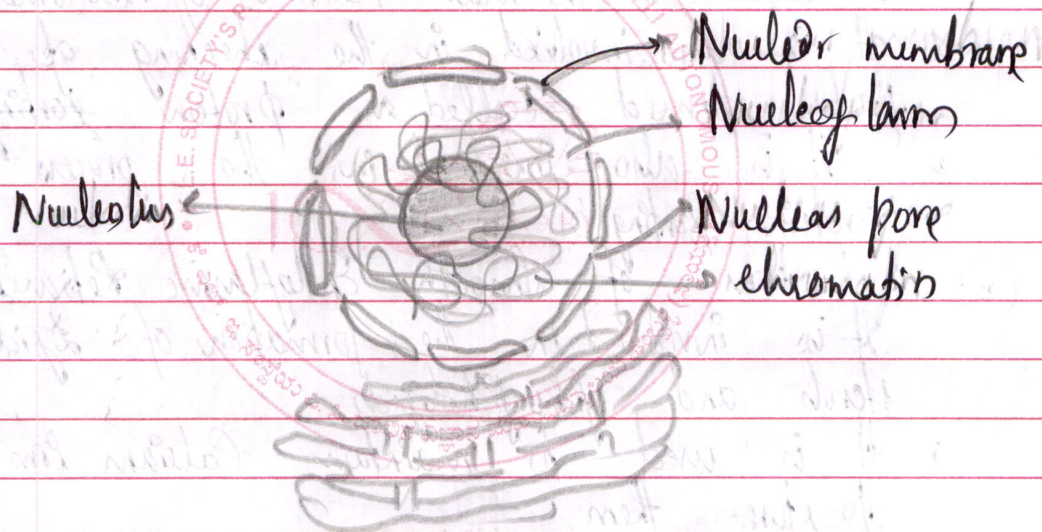
(d) functions of Smooth Endoplasmic Reticulum

- It is involved in the formation of lipid molecules, steroids and phospholipids.
- It is used to maintain Calcium ions & used to store them.
- It is also involved in the synthesis of steroid hormones.

70) ① Nucleus

It is the main head of the cell who controls all the cell functions and metabolic activities of the cells.

- It is involved in the process of transcription and
- It is divided into Nucleoplasm, Nucleolus and ~~also~~ Nuclear Membrane.



- Nucleoplasm is mainly consists in the nucleus
- It is gel like substance that is present around the chromatin and nucleolus
- It helps to maintain the shape of nucleus
- Nuclear membrane is the outer membrane of nucleus which is chemical similar to plasma membrane.
- Nuclear membrane is made up of protein, fats and phospholipids and it consists of Nuclear pores.

- * Nucleo pores helps in the movement of RNAⁱ and nucleic acid materials into and out of the nucleus
- * Nuclear membrane protects the nucleus from mechanical damage and from external stress
- * Nucleus consists of chromatin these are the long strands of DNA. w/ the association of histone proteins.

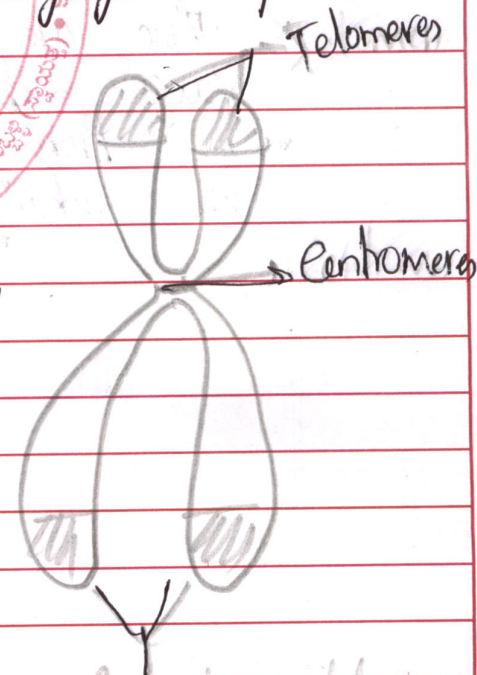
* the chromatin contains genetic material which is responsible for the different characteristics of organism

* these chromatin are classified into 2 types

(a) heterochromatin - It is long densely packed chromatin which is darkly stained

(b) Euchromatin - It is small, loosely packed particle which is lightly stained.

- * The structure next to chromosome is Nucleolus. It is membrane less structure which densely packed & situated at the centre of the nucleus
- * It is also involved in the process of transcription of m-RNA synthesis.



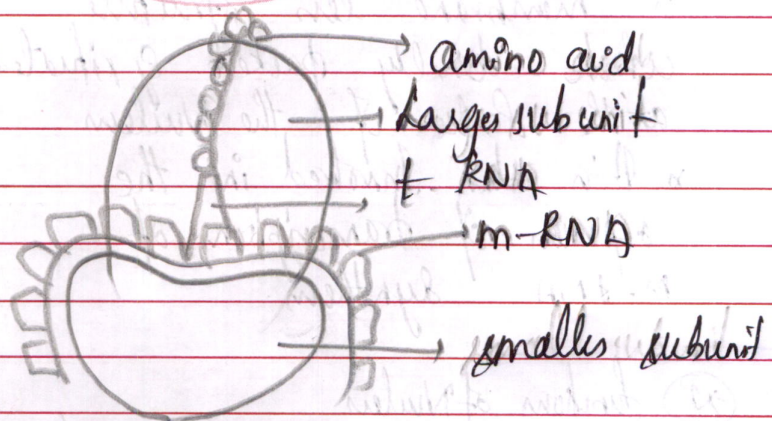
(*) Functions of Nucleus

- * It is involved in the process of transcription
- * It helps in the process of formation of m-RNAⁱ in the cytoplasm.

- * It regulates all the characteristics & governs all the metabolism of the cell.
- * It is also responsible for the hereditary characters of an organism.
- * Nucleus disappears during the formation of cell division it later reappears after the completion of cell division.

* Ribosomes

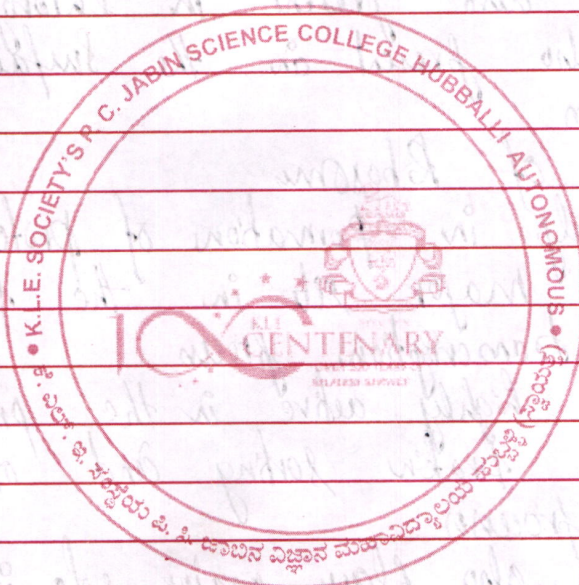
- * These are the membrane-bound smallest organisms called as Protein factories of the cell.
- * They are made up of ribonucleoproteins.
- * They are made up of small subunit and large subunit.
- * In Prokaryotes the ribosomes are of 70's characters.
In Eukaryotes the ribosomes are of 80's characters.



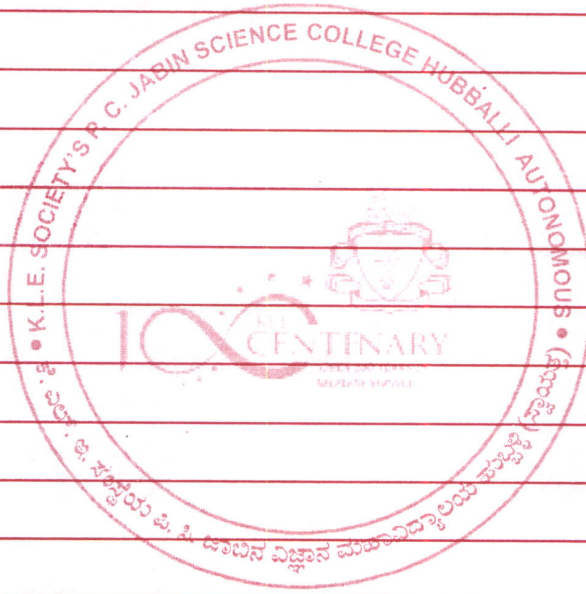
- * The Ribosomes, small subunit is associated with m-RNA.
- * The large subunit is associated with amino acid chains.

- * The larger subunit & smaller subunit together are joined by the amino acid reaction with mRNA's linkages
- * these are responsible for the formation of protein synthesis.
- * these are mostly present in all cell types and it is highly specific in binding nature
- * It is also present in chloroplast, mitochondria
- * It is also present in the surface of Endoplasmic Reticulum.
- ⑤ Functions of Ribosome
 - * It helps in formation of protein synthesis
 - * It is major site in the formation of m-RNA's during transcription process
 - * It is highly active in the process like protein folding, protein sorting and other metabolic energy processes
 - * It also play major role in the process of cell division, cell differentiation
 - * The t-RNA also called as adaptor RNA which play major role in the formation of transcription process
 - * Ribosomes are the protein factories of cell which perform the major tasks of metabolism taking place in the body

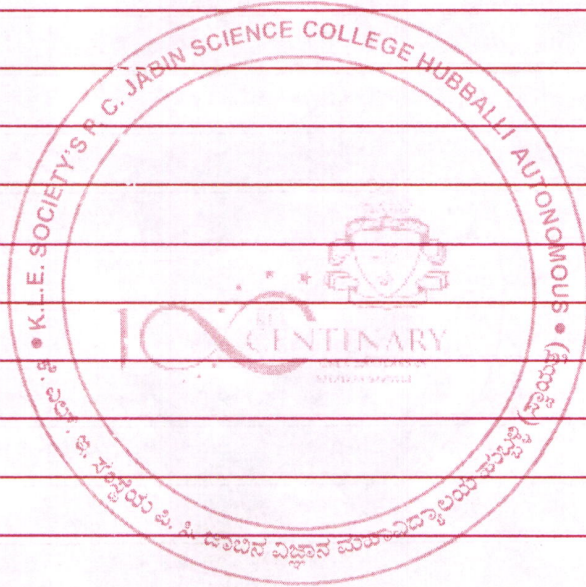
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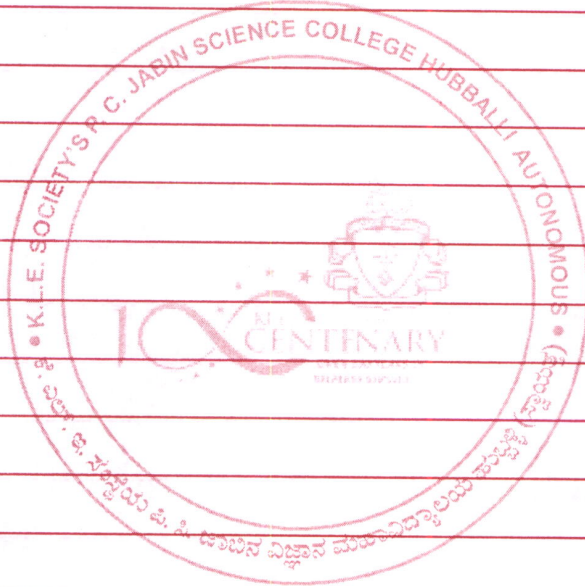
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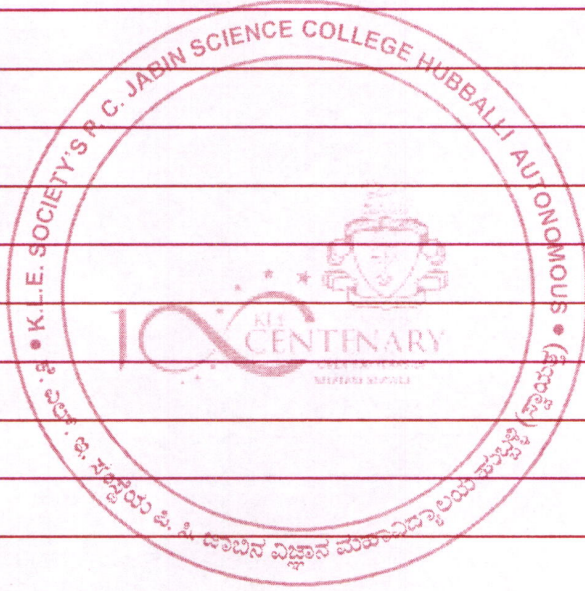
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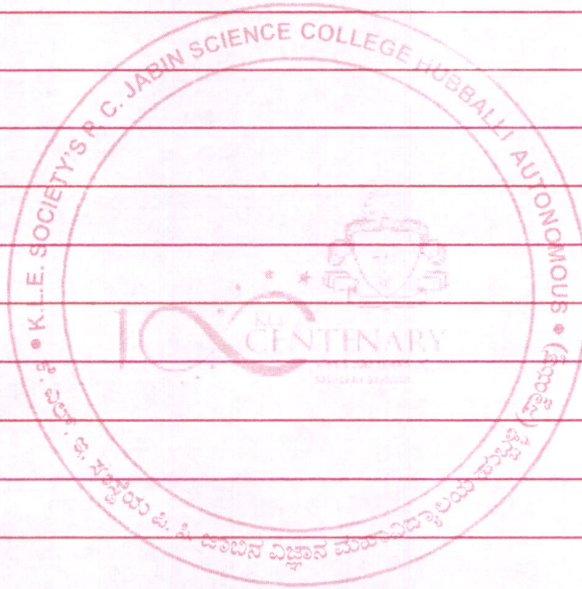
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