Set II

IRC-I (Zoology)

Full Marks :75 **Time: 3 hrs**

Answer the following question as per instruction mentioned.
Respective marks are given in parentheses on right side.
Candidates are advised to give answer in their own words where group A is compulsory and any four from the group B as far as practicable.

Group A

Short answer type (Compulsory)

1 Answer the following as per instructions (5X1)

a. Explain, why mitochondria energy is called transducer (one sentence answer)

- It converts one form of energy into another or change energy from one source into other source.
- Mitochondria acts as energy transducer as it oxidises glucose and fatty acids to produce the energy currency called ATP.

b. Number of mitotic division required to produce 100 daughter cells

- 99 mitotic division

c. Unique difference between RNA and DNA

- RNA contains the sugar ribose, while DNA contains the slightly different sugar deoxyribose (a type of ribose that lacks one oxygen atom)
- RNA has the nucleobase uracil while DNA contains thymine.

d. Scientific name of honey and lac producing insect

Honey bee- *Apis indica*

Lac insect- *Laccifer lacca*

e. Name one Preservatives for museum specimens

- Formaldehyde (HCHO) in the form of formalin (40% solution of formaldehyde) is used for preserving biological specimens.

2. Differentiae Primary and secondary data (5)

Answer- Data is the outcome of any survey or an experiment which plays a significant part in statistical analysis. It is either collected by the person and is analyse by himself or by other person.. These data are named as primary data and secondary data. The primary data is assembling data or information for the first time, whereas the secondary data is the data that has already beech gathered or collected by others.
The primary data is always original and first-hand, whereas the secondary data is the interpretation and analysis of the primary data.

3. Mention abiotic & biotic factors of a pond ecosystem (5)

Ans –**Biotic factors** are organisms that are alive or were once alive in the ecosystem. Abiotic factors in a pond are all elements other than living, or biotic, factors that are present in or affect the ecosystem of a pond. Temperature, stratification, density, oxygen and carbon dioxide levels, salinity, and calcium and nitrogen levels are only a few of the abiotic elements that differ by pond.

The major **abiotic components** of a typical waste stabilisation pond ecosystem are oxygen, carbon dioxide, water, sunlight, and nutrients, while the biotic components include bacteria, protozoa, and a range of other creatures. Abiotic factors are non-living elements that influence and live in the environment. As a result, abiotic elements such as weather, temperature, and humidity are classified as abiotic, while biotic factors such as predators are classified as biotic.

Plants, animals, and microorganisms, as well as abiotic (nonliving) physical and chemical interactions, make up the ecology of a pond or lake. Lentic habitats are best represented by pond and lake ecosystems. From the Latin lentus, which means slow, lentic refers to motionless or generally calm water.

Group B

4.Differentiate monogenetic & Digenetic parasites. Describe the life cycle and pathogenecity of any one monogenetic parasites . (5+10)

Answer- **Monogenetic** parasites are the parasites that complete their life cycles in one host only.

Example- ***Entamoeba histolytica*** which lives in human large intestine.

Digenetic parasites are those that need more than one host (usually two) to complete their life cycles.

Example- Liver fluke (***Fasciola hepatica***) completes its life cycle in sheep and snail.

Life cycle of *Entamoeba Histolytica*

Structure of *Entamoeba Histolytica*:

The amoeba has three stages in its life cycle, viz. the trophozoite stage, the precystic stage and the cystic stage.

A. The trophozoite amoeba:

This is the growing or feeding stage of the parasite having the following features:

1. The trophozoite is somewhat elongated (Fig. 18.4A); measuring 18 to 40 µm, but the shape is not fixed as the animal constantly changes its contour.

2. The cytoplasm is divisible into a clear translucent ectoplasm and a granular endoplasm.

3. The nucleus is spherical and varies from 4 to 6 µm in size.

a. The nucleus is -surrounded by a delicate nuclear membrane lined with a single layer of chromatin granules.

b. The centre of the nucleus is occupied by a karyosome surrounded by a clear halo.

c. The space between the membrane and the karyosome is traversed by fine threads arranged radially in the form of spokes of a wheel.

4. Ingested blood cells are found in the cytoplasm.

Encystation:

In some cases, the trophozoites are discharged into the lumen from the intestinal wall and are transformed into precystic forms, which produce cystic forms. This phenomenon is known as encystation and leads to the production of a different strain.

B. Precystic amoeba:

1. This is slightly ovoid with a short and blunt pseudopodium projecting from one side (Fig. 18.4B).
2. Size varies from 10 to 20 µm.
3. The motility ceases and ingested particles are extruded.

C. Cystic amoeba:

1. The parasite becomes rounded and surrounds itself by a highly refractile cyst wall (Fig. 18.4C-E).
2. Size varies from 7 to 20 µm.
3. Contains one or more chromatid bodies with round ends.
4. The cyst is uninucleate at the beginning, but undergoes double fission so that four nuclei are produced. The quadrinucleate stage is considered as the mature cyst.

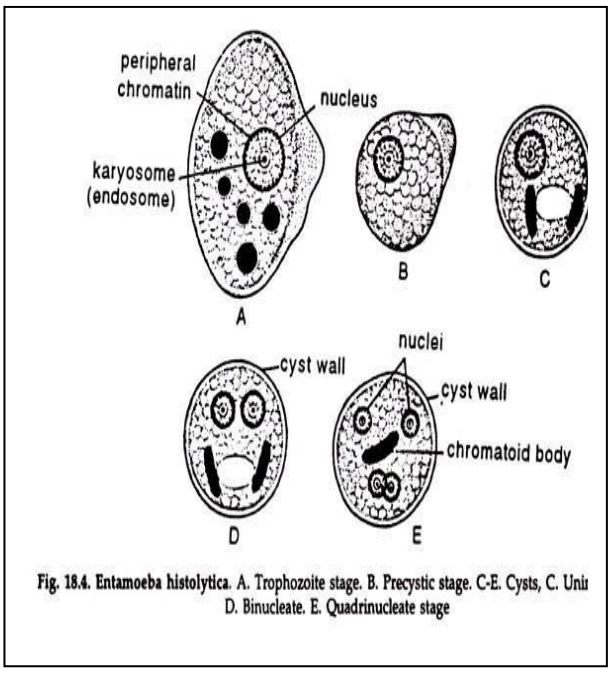


Fig. 18.4. Entamoeba histolytica. A. Trophozoite stage. B. Precystic stage. C-E. Cysts, C. Uni D. Binucleate. E. Quadrinucleate stage

Excystation:

The liberation of the parasite from the cyst is known as excystation. The mature cysts are infective forms. They reach the alimentary canal with contaminated food and drink.

The cyst wall is digested by the action of trypsin in the intestine. When the cyst reaches the iliocaecal junction, particularly the caecum, vigorous amoeboid movement starts in the cytoplasm and a rent appears in the cyst wall. The parasite comes out through the rent.

The four nuclei now divide into eight, the cytoplasm also undergoes division and eight minute amoebulae, also called. metacystic amoebae, are formed. The young amoebae are active and invade the intestinal tissue to reach the mucous and sub mucous layers, their normal habitat.

Reproduction in Entamoeba Histolytica:

Entamoeba reproduces (Fig. 18.5) by binary fission, the rate of multiplication being very high.

1. The nucleus slightly elongate and assumes an ovoid shape.
2. A constriction appears in the middle which grows deeper and the nucleus is divided into two by a modified type of mitosis.
3. The cytoplasmic mass elongates slightly, a constriction appears at the middle which grows deeper and the parasite is divided into two equal halves.
4. Each half receives one daughter nucleus and two individuals are thus produced.

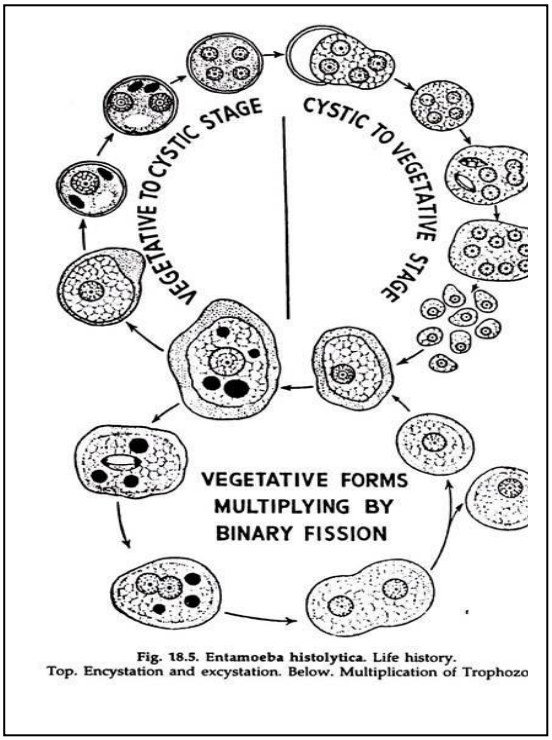


Fig. 18.5. Entamoeba histolytica. Life history. Top. Encystation and excystation. Below. Multiplication of Trophozo

Modes of infection in Entamoeba Histolytica:

The life cycle of Entamoeba histolytica passes only in one host, the man. Transmission from man to man is effected through faecal contamination of drinking water and vegetables directly or through the agency of flies or cockroaches.

The mature quadrinucleate cysts are infective forms. Eating of uncooked vegetables and fruits and drinking of water contaminated with infective forms of parasites lead to the infection of a new host.

Cysts can pass through the intestine of the fly or cockroach in a viable condition, and infest new hosts through contaminated food. Cooks, mess boys and food handlers are important transmitters of infection in tropical countries.

5.What are cabohydrates ? Classify carbohydrates with examples and their clinical importance. (5+10)

Ans- Carbohydrates

The term carbohydrate is itself a combination of the "hydrates of carbon". They are also known as *"Saccharides"* which is a derivation of the Greek word "Sakcharon" meaning sugar. The definition of carbohydrates in chemistry is as follows:

"Optically active polyhydroxy aldehydes or polyhydroxy ketones or substances which give these on hydrolysis are termed as carbohydrates".

Some of the most common carbohydrates that we come across in our daily lives are in form of sugars. These sugars can be in form of Glucose, Sucrose, Fructose, Cellulose, Maltose etc.

Classification of Carbohydrates

The carbohydrates are further classified into simple and complex which is mainly based on their chemical structure and degree of polymerization.

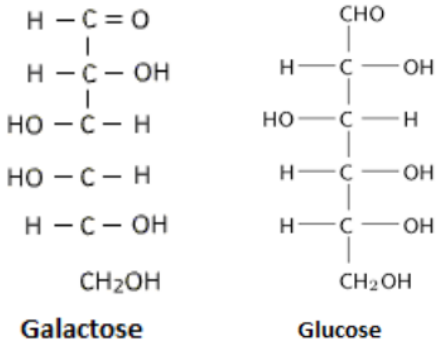
Simple Carbohydrates (Monosaccharides, Disaccharides and Oligosaccharides)

Simple carbohydrates have one or two sugar molecules. In simple carbohydrates, molecules are digested and converted quickly resulting in a rise in the blood sugar levels. They are abundantly found in milk products, beer, fruits, refined sugars, candies, etc. These carbohydrates are called empty calories, as they do not possess fiber, vitamins and minerals.

Plants, being producers, synthesize glucose ($C_6H_{12}O_6$) using raw materials like carbon dioxide and water in the presence of sunlight. This process of photosynthesis converts solar energy to chemical energy. Consumers feed on plants and harvest energy stored in the bonds of the compounds synthesized by plants**.**

1. Monosaccharides

Glucose is an example of a carbohydrate monomer or monosaccharide. Other examples of monosaccharides include mannose, galactose, fructose, etc. The structural organization of monosaccharides is as follows:



Monosaccharides may be further classified depending on the number of carbon atoms:

(i)Trioses ($C_3H_6O_3$): These have three carbon atoms per molecule. Example: Glyceraldehyde

(ii)Tetroses ($C_4H_6O_4$): These monosaccharides have four carbon atoms per molecule. Example: Erythrose.

Similarly, we have-

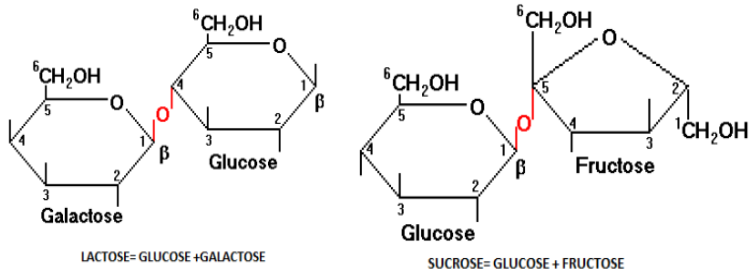
(iii) Pentoses,

(iv) Hexoses, and

(v) Heptoses

2. Disaccharides

Two monosaccharides combine to form a disaccharide. Examples of carbohydrates having two monomers include- Sucrose, Lactose, Maltose, etc.



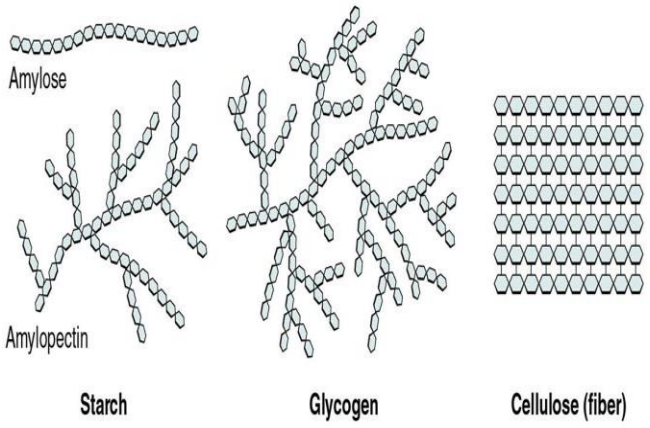
3. Oligosaccharides

Carbohydrates formed by the condensation of 2-9 monomers are called oligosaccharides. By this convention, trioses, pentoses, hexoses are all oligosaccharides.

Complex Carbohydrates (Polysaccharides)

Complex carbohydrates have two or more sugar molecules, hence they are referred to as starchy foods. In complex carbohydrates, molecules are digested and converted slowly compared to simple carbohydrates. They are abundantly found in lentils, beans, peanuts, potatoes, peas, corn, whole-grain bread, cereals, etc.

Polysaccharides are complex carbohydrates formed by the polymerization of a large number of monomers. Examples of polysaccharides include starch, glycogen, cellulose, etc. which exhibit extensive branching and are homopolymers – made up of only glucose units.



1. Starch is composed of two components- amylose and amylopectin. Amylose forms the linear chain and amylopectin is a much-branched chain.
2. Glycogen is called animal starch. It has a structure similar to starch, but has more extensive branching.
3. Cellulose is a structural carbohydrate and is the main structural component of the plant cell wall. It is a fibrous polysaccharide with high tensile strength. In contrast to starch and glycogen, cellulose forms a linear polymer.

Functions of Carbohydrates

The main function of carbohydrates is to provide energy and food to the body and to the nervous system.

Carbohydrates are known as one of the basic components of food, including sugars, starch, and fibre which are abundantly found in grains, fruits and milk products.

Carbohydrates are also known as starch, simple sugars, complex carbohydrates and so on.

It is also involved in fat metabolism and prevents ketosis.

Inhibits the breakdown of proteins for energy as they are the primary source of energy.

An enzyme by name amylase assists in the breakdown of starch into glucose, finally to produce energy for metabolism**.**

Sources of Carbohydrates

1. Simple sugars are found in the form of fructose in many fruits.
2. Galactose is present in all dairy products.
3. Lactose is abundantly found in milk and other dairy products.
4. Maltose is present in cereal, beer, potatoes, processed cheese, pasta, etc.
5. Sucrose is naturally obtained from sugar and honey containing small amounts of vitamins and minerals.

These simple sugars that consist of minerals and vitamins exist commonly in milk, fruits, and vegetables.

Many refined and other processed foods like white flour, white rice, and sugar, lack important nutrients and hence, they are labelled "*enriched*." It is quite healthy to use vitamins, carbohydrates and all other organic nutrients in their normal forms**.**

Carbohydrate Foods

Eating too much sugar results in an abnormal increase in calories, which finally leads to obesity and in turn low calories leads to malnutrition. Therefore, a well-balanced diet needs to be maintained to have a healthy life. That is the reason a balanced diet is stressed so much by dieticians.

6. What are the major difference between non chordate and chordate.? Give an account of general characters used in classification of animal kingdom up to phylum with examples. (5+10)

Chordates:

1. A notochord is present at some stage in the life of a chordate.
2. Central nervous system is dorsal and hollow.
3. Gill slits are present in the pharynx either in the embryo or adult.
4. Tail is present at some stage in the life of the chordate.
5. Heart is ventral.
6. If present RBCs contain respiratory pigment (haemoglobin).

Non-chordates:

1. Notochord is not present at any stage in the life of a non-chordate.
2. Central nervous system is ventral and solid.
3. Gill slits are absent.
4. Tail is absent.
5. Heart is dorsal (if present).
6. If haemoglobin or other respiratory pigment is present, it is found in the blood plasma. RBCs are absent.

General characters used in classification of animal kingdom

Scientists have developed a classification scheme that categorizes all members of the animal kingdom, although there are exceptions to most "rules" governing animal classification .Animals are primarily classified according to morphological and developmental characteristics, such as a body plan. One of the most prominent features of the body plan of true animals is that they are morphologically symmetrical. This means that their distribution of body parts is balanced along an axis. Additional characteristics include the number of tissue layers formed during development, the presence or absence of an internal body cavity, and other features of embryological development, such as the origin of the mouth and anus.

Animal Characterization Based on Body Symmetry

At a very basic level of classification, true animals can be largely divided into three groups based on the type of symmetry of their body plan: radially symmetrical, bilaterally symmetrical, and asymmetrical. Asymmetry is a unique feature of Parazoa .Only a few animal groups display radial symmetry. All types of symmetry are well suited to meet the unique demands of a particular animal's lifestyle.

Radial symmetry is the arrangement of body parts around a central axis. This form of symmetry marks the body plans of animals in the phyla Ctenophora and Cnidaria, including jellyfish and adult sea anemones.

Bilateral symmetry involves the division of the animal through a sagittal plane, resulting in two mirror image, right and left halves, such as those of a butterfly ,crab, or human body. Animals with bilateral symmetry have a “head” and “tail” (anterior vs. posterior), front and back (dorsal vs. ventral), and right and left sides.
Animal Characterization Based on Features of Embryological Development

Most animal species undergo a separation of tissues into germ layers during embryonic development. Recall that these germ layers are formed during gastrulation, and that they are predetermined to develop into the animal’s specialized tissues and organs. Animals develop either two or three embryonic germs layers . The animals that display radial symmetry develop two germ layers, an inner layer (endoderm) and an outer layer (ectoderm). These animals are called diploblasts. Diploblasts have a non-living layer between the endoderm and ectoderm. More complex animals (those with bilateral symmetry) develop three tissue layers: an inner layer (endoderm), an outer layer (ectoderm), and a middle layer (mesoderm). Animals with three tissue layers are called triploblasts.

Presence or Absence of a Coelom

Further subdivision of animals with three germ layers (triploblasts) results in the separation of animals that may develop an internal body cavity derived from mesoderm, called a coelom, and those that do not. This epithelial cell-lined coelomic cavity represents a space, usually filled with fluid, which lies between the visceral organs and the body wall

Triploblasts that do not develop a coelom are called acoelomates, and their mesoderm region is completely filled with tissue, although they do still have a gut cavity. Examples of acoelomates include animals in the phylum Platyhelminthes, also known as flatworms. Animals with a true coelom are called eucoelomates (or coelomates) .A true coelom arises entirely within the mesoderm germ layer and is lined by an epithelial membrane. This membrane also lines the organs within the coelom, connecting and holding them in position while allowing them some free motion. Annelids, mollusks, arthropods, echinoderms, and chordates are all eucoelomates. A third group of triploblasts has a slightly different coelom derived partly from mesoderm and partly from endoderm, which is found between the two layers. Although still functional, these are considered false coeloms, and those animals are called pseudocoelomates. The phylum Nematoda (roundworms) is an example of a pseudocoelomate. True coelomates can be further characterized based on certain features of their early embryological development.

Bilaterally symmetrical, tribloblastic eucoelomates can be further divided into two groups based on differences in their early embryonic development. Protostomes include arthropods, mollusks, and annelids. Deuterostomes include more complex animals such as chordates but also some simple animals such as echinoderms. These two groups are separated based on which opening of the digestive cavity develops first:

mouth or anus. The word protostome comes from the Greek word meaning “mouth first,” and deuterostome originates from the word meaning “mouth second” (in this case, the anus develops first). The mouth or anus develops from a structure called the blastopore .The blastopore is the indentation formed during the initial stages of gastrulation. In later stages, a second opening forms, and these two openings will eventually give rise to the mouth and anus .

7.Describe the different karyo-kinetic phases of mitosis with well labelled diagram. How it differs from meiosis?

(10+5)

Mitotic Phase:

The M phase lead to separation of replicated DNA into two daughter nuclei without recombination. Thus, the daughter nuclei have the same chromosome combination as that of parent nucleus. The M phase consists of four stages, viz., 1. prophase, 2. metaphase, 3. anaphase and 4. telophase .

These are briefly described below:

1. Prophase:

Prophase starts immediately after G_2 stage of interphase. Chromosomes look like thin thread and uncoiled in the early prophase .but become shortened, coiled and more distinct during mid-prophase .

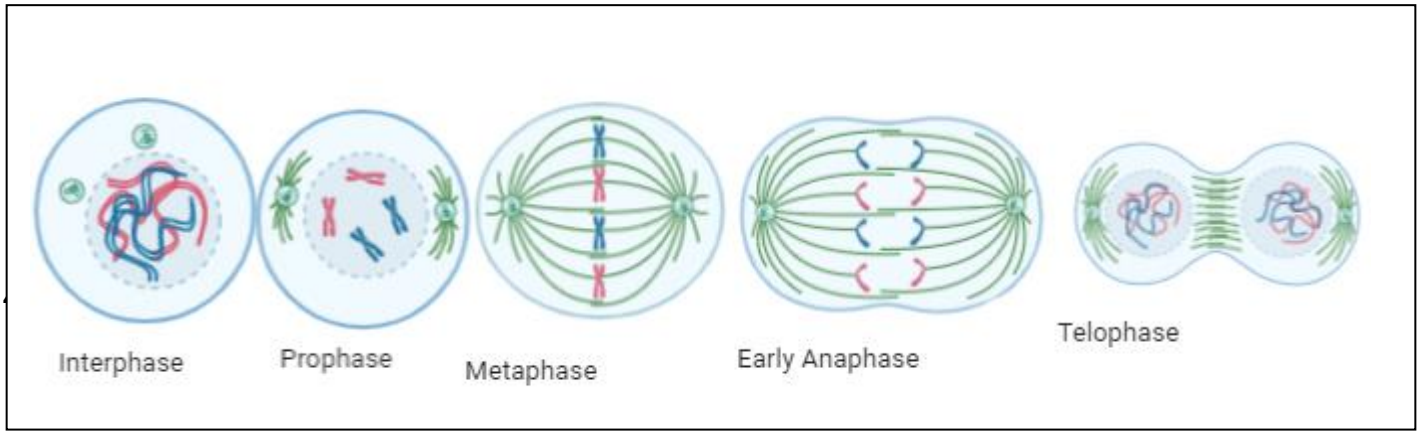
In the late prophase, chromosomes appear more conspicuous, short and thick and longitudinally double .The two chromatids of each chromosome held at centromere are visible under light microscope. The nucleolus becomes smaller in size. The nuclear membrane and nucleolus disappear at the end of prophase.

2. Metaphase:

This phase begins after prophase. The spindle tubes are formed and chromosomes are oriented in the centre at equatorial plate. Chromosomes are attached to the spindle tubes at the centromere. Chromosomes are clearly visible at metaphase. Sister chromatids of each chromosome are joined together at the point of centromere, but their arms are free .

3. Anaphase:

This is the phase when chromatids separate at the centromere and move towards opposite sides or poles. Chromatids of each chromosome become free at the centromere, but each chromatid is attached to spindle tube. These chromatids suddenly move apart, one goes to one pole and the other towards the other pole. After separation each chromatid becomes a chromosome .



When chromosomes reach the pole, the last stage, telophase begins. The spindle tubes disintegrate, a new nuclear membrane is formed at each pole covering the chromosomes. The nucleoli also reappear at each pole. Chromosomes again become thinner and longer by uncoiling and unfolding and look like a single thread under light microscope . Then the nucleus enters interphase. Among all the four phases of mitosis, prophase takes longest duration

DIFFERENCE BETWEEN MITOSIS AND MEIOSIS

	Mitosis		Meiosis
1	Occurs in somatic cells	1	Occurs in reproductive cells.
2	Each DNA or chromosome replication is followed by one nuclear division, thereby maintaining the amount of DNA and the number of chromosomes per cell remains constant from generation to generation.	2	Each DNA or chromosome replication is followed by two successive divisions of the nucleus. Thus, each of the daughter cells contains half as many chromosomes and half as much DNA as its parent cell.
3	All chromosomes behave independently of each other.	3	Homologous chromosomes get paired together.
4	The chromosomes at the metaphase are arranged in such a way that the centromeres lie at the metaphase plate and the arms of chromosomes are free.	4	The chromosomes at the metaphase are arranged in such a way that the centromeres of homologous chromosomes lie on either side of the metaphase plate, pointing towards the opposite poles.
5	There is no crossing-over or exchange of parts of chromatids between homologous chromosomes.	5	Crossing-over or exchange of parts of chromatids between homologous chromosomes is a rule, than exception.
6	Two daughter nuclei are produced from a single parental nucleus.	6	Four daughter nuclei are produced from a single parental nucleus.
7	Centromeres divide thereby separating the two chromatids.	7	Centromeres do not divide during the metaphase-I Homologous chromosomes rather than chromatids separate. Centromeres divide during the metaphase II.

8. Name two species exploited in sericulture and describe the techniques and its economic importance. **15**

ANS-

MULBESSRY SILK-Bombyx mori AND TASAR SILK- Antheraea mylitta

For the production of mulberry silk, the sericulture process follows three primary steps.

- Moriculture – the cultivation of mulberry leaves.
- Silkworm rearing – promoting the growth of the silkworm.
- Silk reeling – the extraction of silk filaments from the silkworm cocoons.

Finally, the silk filaments are woven together to form a thread. These threads are often plied together to form a yarn.

Moriculture

Moriculture refers to the cultivation of mulberry plants, whose leaves are used as silkworm feed. These plants can be grown via three different methods:

- Cultivation from seeds
- Root-grafting
- Stem grafting

The stem grafting method is the most commonly used method for mulberry plantation. Here, cuttings that are approximately 22 centimetres in length, containing at least 3 buds, are extracted from the stem of a mature mulberry plant. These cuttings may be directly planted or first kept in nurseries and then transplanted.

The mulberry leaves can be harvested from the plants via the following methods:

Leaf picking – the removal of individual leaves by hand.

- Branch cutting – removal of the entire branch.
- Top shoot harvesting – removal of the mulberry shoot tops.

It is interesting to note that 1 kilogram of mulberry leaves can feed approximately 50 silkworms (from the egg stage to the cocoon stage).

Silkworm Rearing

In sericulture, the silkworm rearing process begins with the laying of eggs by the female silk moth. Typically, 300-500 eggs are obtained from one female silk moth. These eggs (laid on a paper/cardboard sheet) are then disinfected with the help of a 2% formalin solution.

A feeding bed is prepared on a rearing tray by sprinkling chopped mulberry leaves onto it. The hatched larvae are transferred into this tray via a process known as brushing. In order to maintain humidity, foam strips are soaked in water and placed on the tray.

The silkworm larvae initially have a good appetite. As they grow, their appetite slowly diminishes until their active stage. At this stage, the silkworm eats enthusiastically until its final feeding stage.

After reaching maturity, the larvae begin searching for hospitable places to begin their pupation. At this stage, the body of the silkworm shrinks and becomes translucent. These mature larvae now wrap themselves in a cocoon by secreting saliva from the two salivary glands on their heads. This saliva solidifies and becomes silk when it comes in contact with air.

Generally, the cocoon is spun in 2-3 days. However, some varieties of silkworms can take up to 4 days to spin their cocoons.

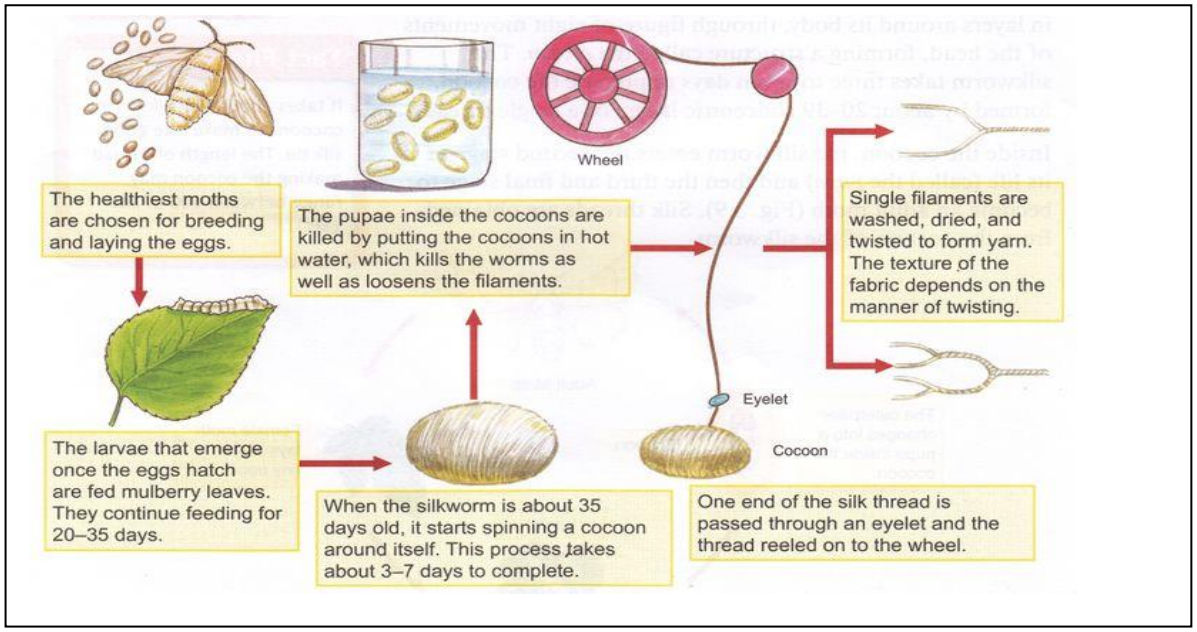
Silk Reeling

Inside the cocoons, the larvae undergo metamorphosis and turn into pupae. The harvesting of silk from these cocoons is the final stage of sericulture. First, the pupae inside the cocoon are killed by boiling the cocoon and exposing it to steam and dry heat. This process is called stifling.

Now, the silk filaments are removed from the dead cocoon via a process called reeling. When the cocoons are placed in boiling water for approximately 15 minutes, the adhesion of the silk threads reduces, enabling the separation of individual filaments. These filaments are twisted into a thread with the help of a series of guides and pulleys. This silk is then re-boiled in order to improve its lustre.

One thread of silk contains approximately 50 silk filaments. However, over 900 meters of filament can be obtained from a single cocoon. Thus, raw silk is obtained from the silkworm and the sericulture process is completed

- The boiling of silkworm cocoons in the sericulture process has come under severe criticism from several individuals and organizations.
- Mahatma Gandhi actively promoted the use of Ahimsa silk (or peace silk). This method of producing silk did not involve the boiling of silkworm pupae and, therefore, did not violate the Ahimsa philosophy.
- Campaigns have been formed to protest against the inhumane treatment of silkworms by the People for the Ethical Treatment of Animals (PETA).



Economic importance of silk

i. As the silk fibers can retain some moisture, the clothes made of silk can be used in both the winter and summer seasons.

ii. The silk is non-conductor of electricity, and therefore can be used as an insulator covering of electric wires.

iii. The silk thread is used in surgical works.

iv. Large amount of foreign currency can be earned by exporting clothes made of silk.

v. The silken clothes manufactured in Bangladesh play a vital role in solving problems of clothing.

vi. Many people are employed in silk producing factories and mills and the problem of unemployment is solved to some extent.

vii. The housewives can earn money in the house in return of less labour and less capital through the culture of silk worm.

viii. The oil secreted from the body of pupae and their remains are useful as poultry feed. The dead pupae are also used as manure.

9. Describe the principle, construction, working and importance of colorimeter. (15)

What is Colorimeter?

Colorimeters are used to detect colour and determine a solution's concentration. When a wavelength is passed through a sample, some of the light gets absorbed and some passes through. The passing wavelengths of light get detected.

Principle of Colorimeter

The principle of Colorimeter is based on the photometric technique that states when an incident light of intensity **(I_0)** passes through a solution, then

- Part of the incident light is reflected (I_r)
- Part of the incident light is transmitted (I_t)
- Part of the incident light is absorbed (I_a)

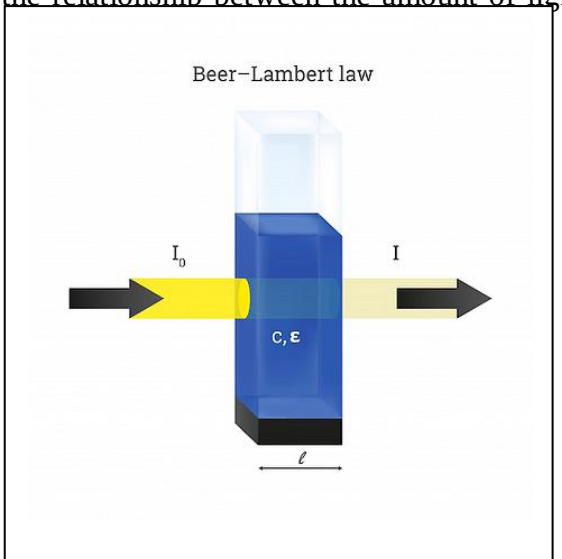
Therefore,

$$\mathbf{I_0 = I_r + I_t + I_a}$$

Here, the value of **reflected light** (I_r) is eliminated as I_0 and I_t values are enough to calculate I_a. Values for the amount of light absorbed and transmitted are measured by keeping I_r constant. The principle of colorimeter is based on two fundamental laws of **photometry** that establish the relationship between the amount of light absorbed and the concentration of the substance.

Beer-Lambert's Law

Beer's Law states that the amount of light absorbed is directly proportional to the concentration of the **solute** in the solution.



$$\mathbf{Log_{10}\ I_0/\ I_t = a_s c}$$

Where,

- $\mathbf{a_s}$ → Absorbency Index
- **c** → Concentration of solution

Lambert's Law states that the amount of light absorbed is directly proportional to the length and thickness of the solution under analysis.

$$\mathbf{A = log_{10}\ I_0/I_t = a_s b}$$

Where,

- **A** → Test of Absorbance
- $\mathbf{a_s}$ → Absorbance of standard solution
- **b** → length or thickness of the solution

Where Absorption index is given by:

$$\mathbf{a_s = A/cl}$$

In the combined mathematical expression of Beer-Lambert's Law,

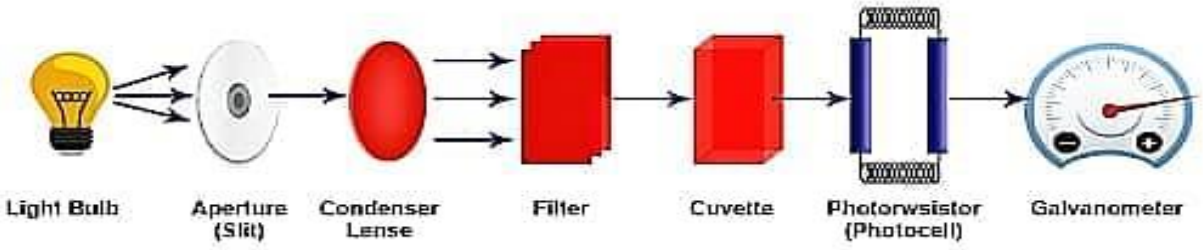
- **A → Absorbance or optical density of the solution**
- **c → Concentration of the absorbing material (gm/lit)**
- **l → distance travelled by light in solution (cm)**

In simple terms, the combined principle of Beer-Lambert's law states that the amount of light absorbed by a colour solution is directly proportional to the **concentration** of the solution and the **length of the light path** through the solution, $\mathbf{A \propto cl}$.

Components of Colorimeter

The main parts that make up the colorimeter are:

- **Source of Light:** Tungsten filament is commonly used as a light source in colorimeters.
- **Monochromator:** It is used to split the light into different wavelengths and select the particular wavelength under observation.
- **Sample Holder:** This is where the cuvettes or test tube containing the colour sample solution is placed. These are made of glass at visible wavelengths.
- **Photo Detector System:** This system produces an electric signal when light falls into it which is in turn reflected as a reading in the **galvanometer**.
- **Measuring Device:** The galvanometer is used as the measuring device where it converts the electrical signals into readings that correspond to the intensity of light.



Components of Colorimeter

Uses of Colorimeter

The uses of a Colorimeter are as follows:

- Colorimeter is widely used in the medical industry to estimate biochemical samples such as blood, urine, cerebral spinal fluid, plasma, serum, etc.
- They are used to analyse the colour contrast and brightness in mobile, computer and television screens to provide users with the best viewing experience.
- It also finds its application in the paints and textile industries.
- Colorimeter is used in the food and food processing industry.
- It is used in the printing industry to measure the quality of print paper and printing ink.
- They are also used to test the water quality and screen for the identification of chemical substances such as chlorine, fluorine, cyanide, **iron**, molybdenum, etc.
- They are used in jewellery to measure diamond quality.
- Colorimeter is used to measure the concentration of haemoglobin in **blood** samples.
- It helps to monitor the nutrient concentration in the **soil** for plant growth.
- Colorimeter is also used in the pharmaceutical industry to identify substandard products and drugs.

9. write short notes on any two (7.5X2)

a.Measures of central tendency

ans-

Central Tendency

Measures of central tendency are summary statistics that represent the center point or typical value of a dataset. Examples of these measures include the mean, median, and mode. These statistics indicate where most values in a distribution fall and are also referred to as the central location of a distribution. You can think of central tendency as the propensity for data points to cluster around a middle value.

Mean

The mean is the arithmetic average, and it is probably the measure of central tendency that you are most familiar. Calculating the mean is very simple. You just add up all of the values and divide by the number of observations in your dataset.

Median

The median is the middle value. It is the value that splits the dataset in half, making it a natural measure of central tendency.

To find the median, order your data from smallest to largest, and then find the data point that has an equal number of values above it and below it. The method for locating the median varies slightly depending on whether your dataset has an even or odd number of values.

Mode

The mode is the value that occurs the most frequently in your data set, making it a different type of measure of central tendency than the mean or median.

To find the mode, sort the values in your dataset by numeric values or by categories. Then identify the value that occurs most often.

B.TISSUE PROCESSING

Introduction

After the removal of a tissue sample from the patient, a series of physical and chemical processes must take place to ensure that the final microscopic slides produced are of a diagnostic quality. Tissues are exposed to a series of reagents that fix, dehydrate, clear, and infiltrate the tissue. The tissue is finally embedded in a medium that provides support for microtomy. The quality of the structural preservation of tissue components is determined by the choice of exposure times to the reagents during processing. Every step in tissue processing is important; from selection of the sample, determining the appropriate protocols and reagents to use, to staining and final diagnosis. Producing quality slides for diagnosis requires skills that are developed through continued practice and experience. As new technology and instrumentation develops, the role of the histology laboratory in patient care will continue to evolve, providing standardization of processes, increased productivity, and better utilization of the resources available. This chapter will provide an overview of the steps in the process and the reagents needed to prepare tissue for microscopic evaluation.

Principles of tissue processing

Tissue processing is designed to remove all extractable water from the tissue, replacing it with a support medium that provides sufficient rigidity to enable sectioning of the tissue without parenchymal damage or distortion.

Stages of tissue processing

• Fixation – stabilizes and hardens tissue with minimal distortion of cells.

• Dehydration – removal of water and fixative from the tissue.

• Clearing – removal of dehydrating solutions, making the tissue components receptive to the infiltrating medium.

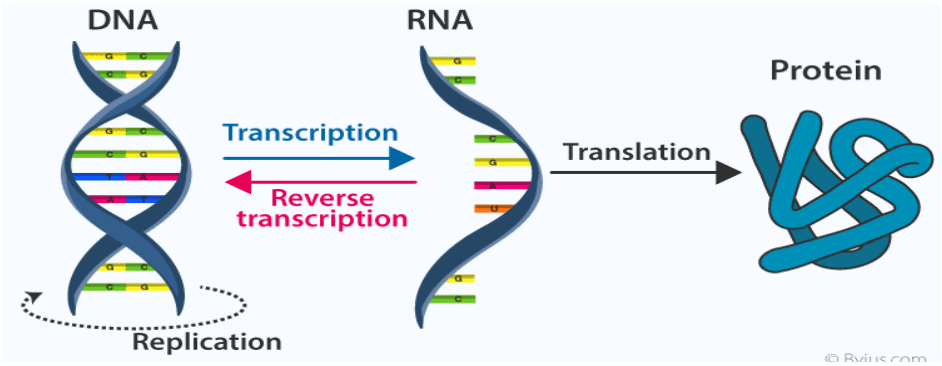
• Infiltrating – permeating the tissue with a support medium.

• Embedding – orienting the tissue sample in a support medium and allowing it to solidify.

C. Central Dogma of Molecular Biology

DNA, or deoxyribonucleic acid, contains the genes which give instructions for all the proteins of an organisms . **Proteins**, in turn, determine the structure and function of cells . Thus instructions for making proteins with the correct sequence of amino acids are encoded in DNA. The flow of genetic information from DNA to protein via RNA is called central dogma of molecular biology in all organisms. The central dogma of molecular biology is thus an explanation of the flow of genetic information within a biological system. Francis Crick is regarded as father of Central dogma of molecular biology It illustrates interlinking of four molecular process

1. Replication – Syntheis of DNA from DNA or RNA from RNA
2. Transcription – synthesis of RNA from DNA
3. Reverse Transcription Synthesis of DNA from RNA , in case of Retrovirus
4. Translation - -Synthesis of protein on mRNA



D.Mendel's contribution

Geroge Mendel Is regarded as father of genetics. He **deduced the fundamental laws of inheritance through his research on pea plantsi. Pisum sativum ..** He deduced that genes are inherited in pairs and as separate units, one from each parent. Mendel studied the segregation of parental genes and their presentation as dominant or recessive traits in the offspring. Based on this he formulated three laws

Law of Dominant - In a monohybrid cross, dominant allele is always expressive in heterozygous condition

For example Tt -the plant will be tall due to expression of T(dominant allele) ove t (recessive allele in Tt Condition) Plant will be dwarf only in homozygous tt condition.

Law of segregation/Law of purity of gametes – The allele of an heterozygotes separate at the time of gamete formation and is always remain pure and do not blend with each other.

Law of Independent assortment – In a dihybrid cross. appearance of two characters are independent to each other .

For example - offspring of a cross RrYy and RrYy will produce a ratio of 9:3:3:1 so. Shape round & wrinkled and colour of seed yellow & green are independent