1. FERMENTATION BY YEAST

AIM:

To demonstrate the process of fermentation by yeast in the given samples I, II and III.

MATERIALS REQUIRED:

- Glucose solution
- Raw Sugar solution
- Jaggery with salt solution
- Yeast granules
- Beaker
- Lime water
- Test tubes

PRINCIPLE:

Fermentation is an anaerobic metabolic process accompanied with effervescence. During this process, sugar is converted into ethyl alcohol and CO_2. It occurs in yeast and bacteria.

PROCEDURE:

- Take 2ml of the given samples I, II and III in three clean test tubes (labelled as 1,2 and 3) respectively.
- Add few granules of yeast in all the test tubes and plug the tubes with cotton wool.
- Wait while fermentation takes place and note the time taken.
- Appearance of effervescence in the test tube indicates that fermentation has taken place.
- Remove the cotton wool and pass the gas into a test tube containing limewater.
- The lime water turns milky indicating that the gas evolved during fermentation is carbon di oxide.
- The variation in the time taken for fermentation to take place in the different sugar solutions indicates that the simple sugars like glucose are fermented much quicker than the complex sugars.

OBSERVATION:

SL.NO.	SAMPLE	TIME TAKEN	INFERENCE
1			
2			
3			

INFERENCE

Yeast has an enzyme zymase which catalyses the fermentation process. The time taken for fermentation differs in different sugar solutions.

$$C_6H_{12}O_6 \xrightarrow[\text{Yeast}]{\text{Zymase}} 2C_2H_5OH + 2CO_2$$

Glucose   Ethyl alcohol

2
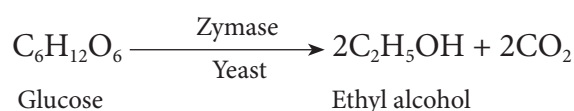
2. DETERMINATIONOF COLOUR AND pH IN THE GIVEN WATER SAMPLES

AIM:

To investigate the colour and pH in the given water samples I, II ,III and thereby determining the quality of water for consumption.

MATERIALS REQUIRED:

- pH paper and colour chart
- Water samples
- Dropper / glass rod
- Test tubes

PRINCIPLE:

The colour of water sample ranges from colourless to green to yellowish brown and grey depending upon the planktonic growth and suspended solids.

The pH (negative logarithm of hydrogen ion concentration) of a solution is a measure of the concentration of hydrogen ions. It decreases with increasing pH and that a difference of one pH unit signifies a tenfold variation in hydrogen ion concentration.The pH value can vary from 0 to 14. Solutions with a pH between 0 and 7 are acidic, while those with a pH between 7 and 14 are basic. pH 7 is considered neutral.

PROCEDURE:

- Observe and tabulate the colour of the water samples I , II and III taken in test tubes against a white background.
- Take the three different water solutions in separate test tubes and label them.
- A piece of pH paper is dipped into the sample and compared with that of the colour on the pH chart.
- The approximate pH value of the samples is thus determined and the results tabulated

OBSERVATION:

SL.NO.	SAMPLE	COLOUR OF THE SAMPLE	pH OF THE SAMPLE
1	I		
2	II		
3	II		

INFERENCE:

- Among the three samples, it is found that, sample _____ is acidic in nature, while sample _____ is found alkaline. Hence it is not suitable for consumption.
- The pH of the sample _____ is found to be _____ since it is closer to the neutral pH, it is fit for consumption.

PRECAUTIONS:

- Use only the standard colour chart supplied with the pH paper for assessing the pH value.
- Keep the pH strips away from chemicals.
- Either use fresh fine dropper or glass rod for each different sample, or wash the dropper or rod well with water every time.

Kaziranga
National Park

Gir National Park
&
Wildlife Sanctuary

Mudumalai Wildlife
Sanctuary
& National Park

Periyar Wildlife
Sanctuary

Point Calimere Wildlife
and bird Sanctuary

4

Mark the given Wildlife Sanctuary and National Park in the given map of India .Write its location and significance.

1. Kaziranga National Park

Location: Golaghat and Nagaon districts of Assam

Significance: Kaziranga National park's 430 square kilometer area sprinkled with elephant-grass meadows, swampy lagoons, and dense forests is home to more than 2200 Indian one-horned rhinoceros, approximately 2/3rd of their total world population. The park is the breeding ground of elephants, wild water buffalo, and swamp deer. Over the time, the tiger population has also increased in Kaziranga, and that's the reason why Kaziranga was declared as Tiger Reserve in 2006.

2. Point Calimere Wildlife and bird Sanctuary

Location: Point Calimere (Kodiakkarai), Nagapattinam (dt)

Significance: It was created for the conservation of near threatened species, Black buck antelope, an endemic mammal species of India.

3. Gir National Park and Wildlife Sanctuary

Location: Talala Gir in Gujarat

Significance: Gir is the only natural habitat of world popular Asiatic Lions. It covers total area of 1412 square kilometers of which 258 Km forms the core area of the National Park. The Sambar is counted largest Indian Deer. The Gir forest is also known for the Chowsingha – the world's only four horned antelope. The Jackal, striped Hyena and Indian Fox are some of the smaller carnivores found in Gir Forest.

4. Periyar Wildlife Sanctuary

Location: Kerala

Significance: Apart from Elephants, the other animals to be seen in the Periyar sanctuary are Gaur, Wild Pigs, Sambar, Barking Deer, Mouse Deer, Dole or Indian Wild Dog and very rarely, a Tiger. There are, now, an estimated 40 tigers here.

5. Mudumalai Wildlife Sanctuary and National Park

Location: Nilgiri hills, Nilgiri District, TamilNadu (Shares boundary with the states of Karnataka and Kerala).

Significance: The protected area is home to several endangered and vulnerable species including Indian elephant, Bengal tiger, Gaur and Indian leopard. There are at least 266 species of birds in the sanctuary, including critically endangered Indian white-rumped vulture and long-billed vulture.

MENDELIAN TRAITS

	DOMINANT		**RECESSIVE**	
Cleft chin		Have cleft		No cleft
Hair curl		Curly		Straight
Tongue rolling		Roller		Non roller
Dimples		Dimple		No dimple
Ear lobes		Free lobe		Attached lobe
Interlocking fingers		Left thumb on top		Right thumb on top
Handedness		Right		Left
Widow's peak		Widow's peak		Straight
Shape of face		Oval		Square
Finger mid digital hair		Hair		No hair

6

4. HUMAN MENDELIAN TRAITS

AIM:

To assess the distribution of various genetic traits in a given population.

MATERIALS REQUIRED :

- List of traits
- Sheet of paper

PROCEDURE:

- The students are divided into groups and the assessment of the various genetic traits are done , first individually and then among themselves.
- The phenotype and the possible genotypes are recorded in the tabular column.
- Based on the occurrence of the traits , the frequency of the dominant and recessive characters were discussed.

TRAIT	POSSIBLE ALLELES	YOUR PHENOTYPE	NO.	%	YOUR GENOTYPE DOMINANT OR RECESSIVE	NO.	%
Cleft chin	Have cleft (C) No Cleft (c)						
Hair curl	Curly (H) Straight (h)						
Tongue rolling	Roller (T) Non roller (t)						
Dimples	Dimple (D) No dimples (d)						
Earlobes	Free lobe (F) Attached (f)						
Interlocking fingers	Left thumb on top (L) Right thumb on top (l)						
Handedness	Right (R) Left (r)						
Widow's peak	Widow's peak (W) Straight (w)						
Shape of the face	Oval (O) Square (o)						
Finger mid-digital hair	Hair (M) No hair (m)						

INFERENCE:

Discuss and answer the following questions :
- Did you have mostly dominant or recessive traits?
- For which trait were most students dominant?
- For which trait were most students recessive?

7

5. ABO BLOOD GROUPS - DEMONSTRATION EXPERIMENT

AIM:

To find out the blood group of a classs / school students.

MATERIAL REQUIRED:

1. Human blood sample
2. Antisera A
3. Antisera B
4. Antisera D
5. Spirit (70% alcohol)
6. , slides. Lancet
7. Cotton
8. Mixing sticks

PRINCIPLE:

The determination of ABO blood group is based on the agglutination reaction. The A, B and Rh antigens present on the surface of the RBC react with the corresponding antibodies (antisera) to form visible agglutination or clumping.

PROCEDURE:

1. Take a clean dry slide / white tile and divide it into three divisions.
2. Wipe the middle finger with cotton moistened with 70% alcohol and allow to dry.
3. Prick disinfected area with sterile lancet.
4. Squeeze the finger and allow a drop of blood to fall on each division of the slide/ white tile.
5. Add one drop of antiserum into the appropriately labeled drop of blood on the slide/ white tile.
6. Mix serum and blood drops with the applicator stick.
7. Observe the mixtures for agglutination and record the blood groups.
8. Record the findings in a tabular form.

OBSERVATION:

Agglutination with….			
Anti A	Anti B	Anti D	Blood Group
(+)-Agglutination		(-)-Non Agglutination	

Group O   Group A   Group B   Group AB
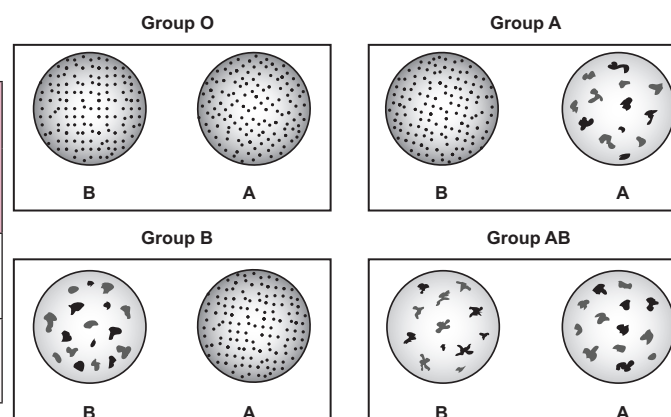
RESULT:

The given blood is found to be_____group

WARNING: A Use only sterilized lancets. void using bell pins or other sharp objects for pricking.

6. PARAMECIUM – CONJUGATION

IDENTIFICATION:

The given slide is identified as Paramecium – Conjugation.

COMMENTS

1. Conjugation is a form of sexual reproduction, wherein two individuals called conjugants mutually exchange nuclear material and then get separated.

2. The pellicle and cytoplasm at the point of contact is broken and a protoplasmic bridge is formed.

3. The large pronucleus acts as female pronucleus and the smaller nucleus acts as male pronucleus.

4. The male pronucleus moves through the protoplasmic bridge and fuses with the female pronucleus to form the diploid nucleus.
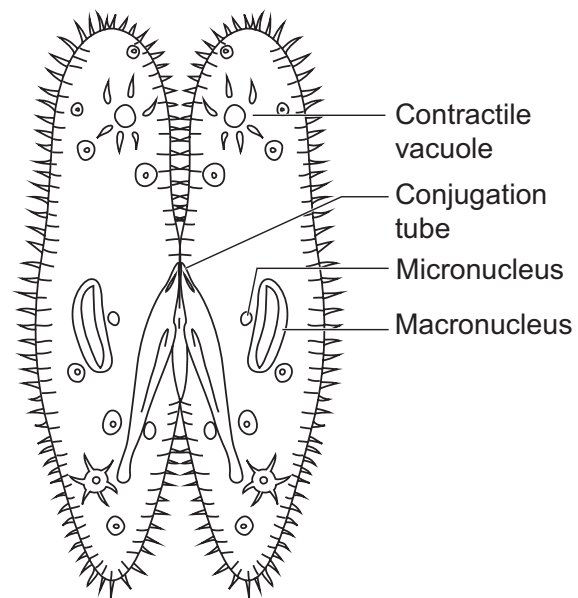

7. HUMAN SPERM

IDENTIFICATION:

The given slide is identified as Human Sperm.

COMMENTS

1. The human sperm is microscopic, flagellated and a motile male gamete.

2. The sperm is composed of a head, neck, middle piece and a tail.

3. The head comprises of acrosome and nucleus.

4. The middle piece possesses mitochondria which produces energy in the form of ATP molecules.

5. The tail is the longest part and is slender and tapering.

9
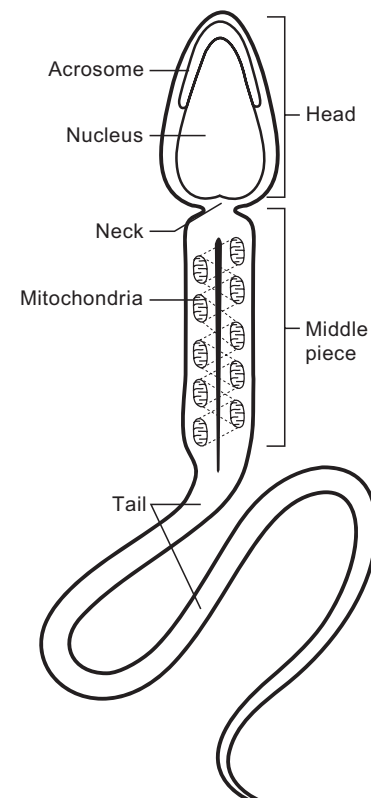
8. HUMAN OVUM

IDENTIFICATION:

The given slide is identified as human ovum.

COMMENTS:

1. Human ovum is microscopic, non-cleidoic and a alecithal female gamete.

2. The ovum is surrounded by three coverings namely vitelline membrane, zona pellucida and corona radiata.

3. The cytoplasm of the egg is called ooplasm and contains a large nucleus called the germinal vesicle.

4. The narrow space between the vitelline membrane and zona pellucida is known as perivitelline space.


Corona radiata
Zona Pellucida
Vitelline membrane
Nucleus
Germinal vesicle
Ooplasm
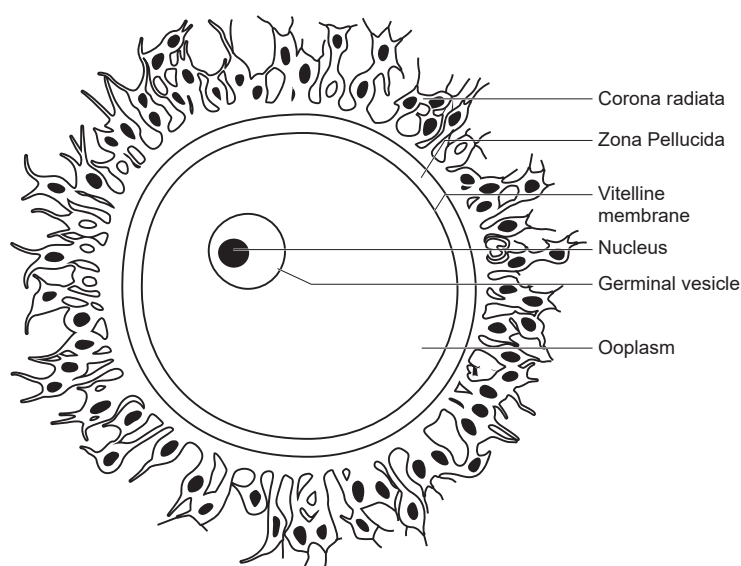
9. *ENTAMOEBA HISTOLYTICA*

IDENTIFICATION:

The given slide is identified as *Entamoeba histolytica.*

COMMENTS

1. Entamoeba is an endoparasitic protozoan which causes amoebiasis or amoebic dysentery.

2. It lives in the lumen of the large intestine and feeds on the epithelial cells.

3. The infective stage of this parasite is the trophozoite.

4. The symptoms of amoebiasis are ulceration, bleeding, abdominal pain and stools with excess mucus.


Plasma membrane
Endoplasm
Ectoplasm
Nucleus

10
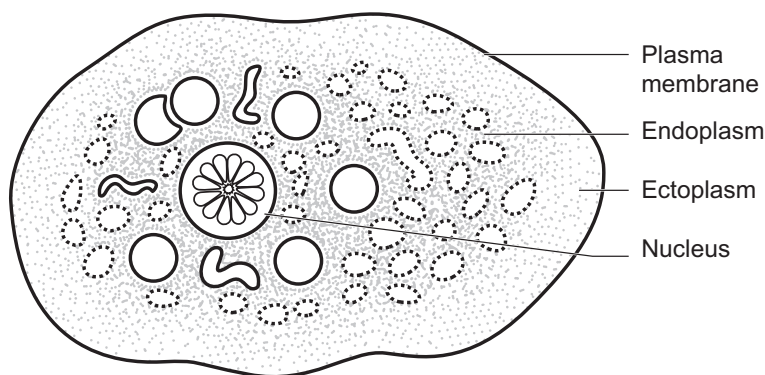
10. THYMUS - T.S

IDENTIFICATION

The given slide is identified as thymus gland – T.S.

COMMENTS

1. Thymus is a primary lymphoid bilobed organ located behind the sternum and above the heart.
2. It has many lobules separated from each other by connective tissue called septa.
3. Each lobule is differentiated into an outer cortex and inner medulla.
4. Thymus gland is mainly involved in proliferation and maturation of T – cells (thymus dependent cell) and secretion of thymosin hormone.
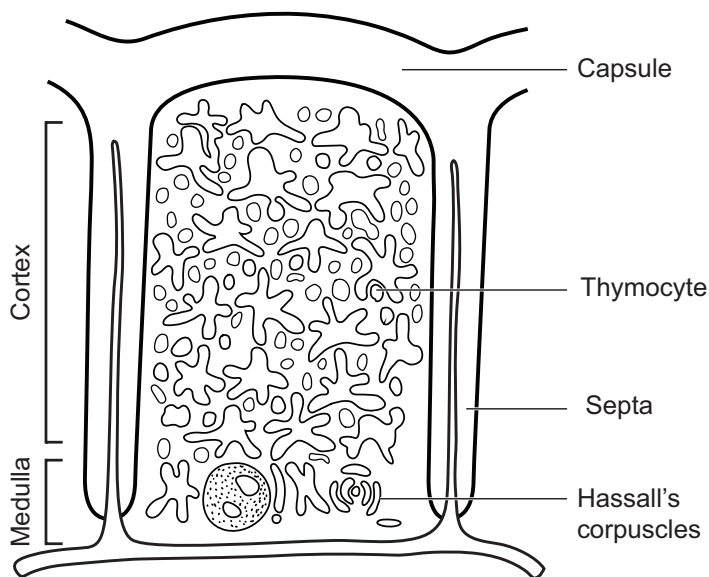

11. LYMPH NODE – T.S

IDENTIFICATION

The given slide is identified as lymph node – T.S.

COMMENTS

1. Lymph node is a small bean shaped structure found along the course of lymphatic duct.
2. Lymph node has three zones: cortex, paracortex and medulla.
3. The cortex contains B lymphocytes, macrophages and follicular dendritic cells.
4. The medulla consists of sparsely populated B-lymphocytes, which secrete antibody molecules.
5. The paracortex zone lies between the cortex and medulla and consists of richly populated T cells and dendritic cell.


11
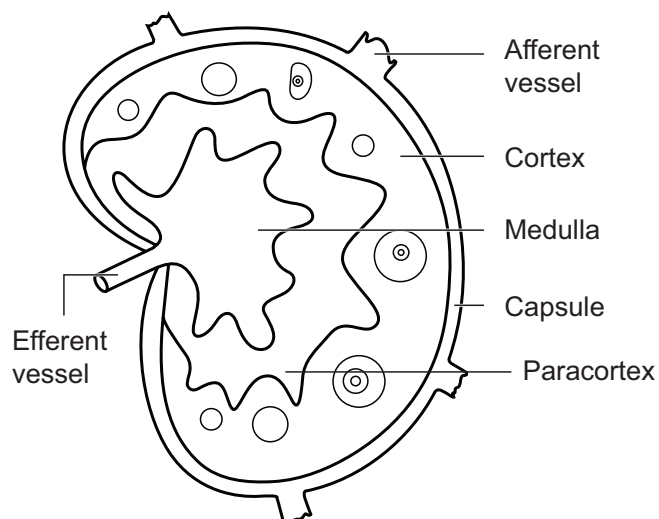
12. MUTUALISM - Sea anemone on hermit crab

IDENTIFICATION

The specimen is identified as Sea anemone on hermit crab.

COMMENTS

1. Mutualism is an association of animals where both species are benefited from the interaction.

2. The hermit crab takes shelter on an empty molluscan shell, while the sea anemone (a sedentary coelenterate) grows on the shell.

3. The crab is protected from its enemies by the stinging cells found in the tentacles of sea anemone, whereas the anemone is transported to procure its food.
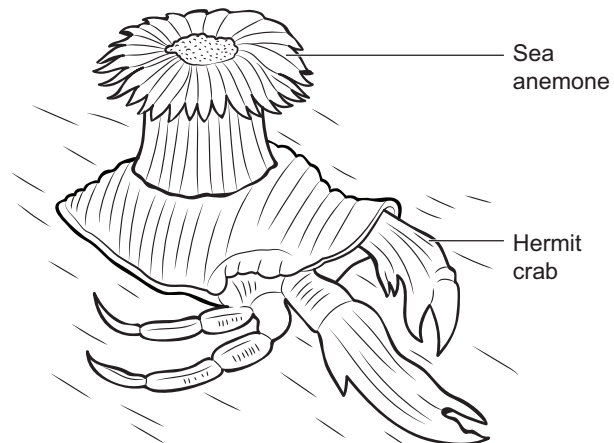

13. COMMENSALISM - Sucker fish (Echeneis) on shark

IDENTIFICATION

The specimen is identified as sucker fish on shark.

COMMENTS

1. Commensalism is an association of two or more species in which one derives benefit, while other is neither benefited nor harmed.

2. The dorsal fin of suckerfish is modified into a sucker – a sticky gripping structure used to attach to the body of a larger fish such as shark.

3. In this association the fish gets free transport and food while the shark is neither benefited nor harmed in the association.


12
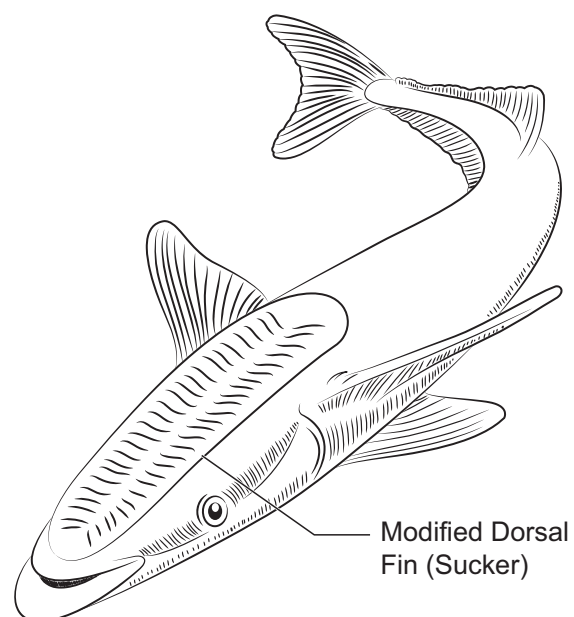
14. tRNA

IDENTIFICATION

The given model is identified as t RNA (transfer RNA).

COMMENTS

1. t RNA was formerly referred to as sRNA (soluble RNA)

2. It is a type of RNA and has a clover leaf structure.

3. It is a small RNA molecule, typically between 70 to 90 nucleotides in length.

4. It is an adapter molecule composed of RNA that serves as the physical link between the mRNA and the amino acid sequence of proteins.

5. It transports activated amino acids from the cellular amino acid pool to the site of protein synthesis.
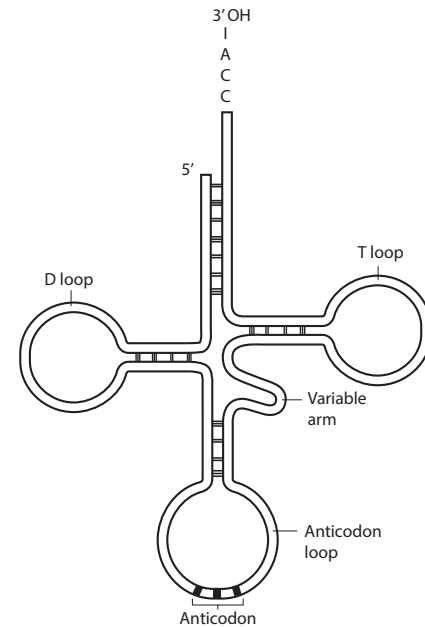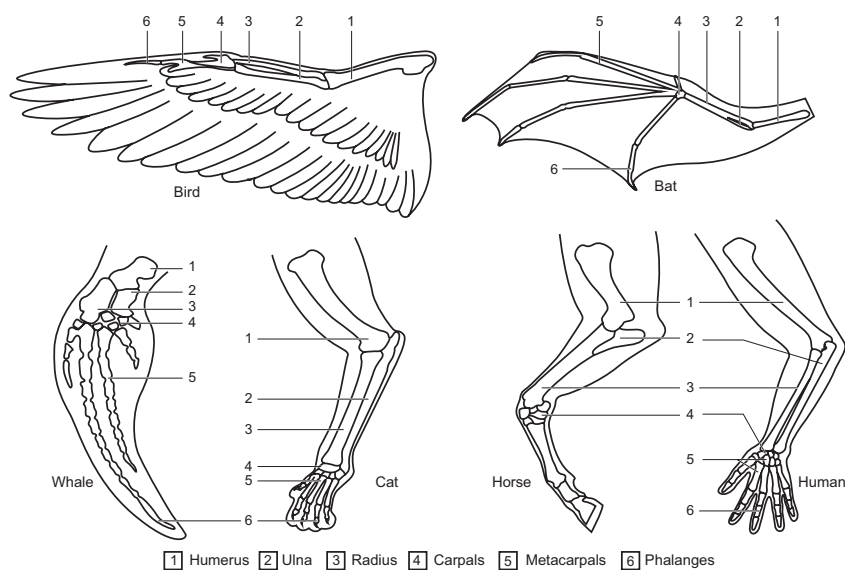

15. HOMOLOGOUS ORGANS

IDENTIFICATION

The given picture is identified as homologous organs.

COMMENTS

1. Structures which are similar in origin but perform different functions are called homologous structure.E.g. Fore limbs of terrestrial vertebrates bird, bat, whale, horse, and human.

2. The forelimbs of these organisms perform different functions, and have similar anatomical structures such as humerus, radius, ulna, carpals, metacarpals and phalanges.

3. In these animals same structures develop along different directions due to adaptations to different needs. This is referred to as divergent evolution.

16.   ANALOGOUS ORGANS

IDENTIFICATION

The given picture is identified as analogous organs.

COMMENTS

1. Organism having different structural patterns but similar function is termed as analogous structure. E.g. Wings of bird and insects (Butterfly, dragon fly).

2. The structures of these animals are not anatomically similar though they perform similar functions.

3. The analogous structures are developed due to convergent evolution – different structures evolving for the same function.
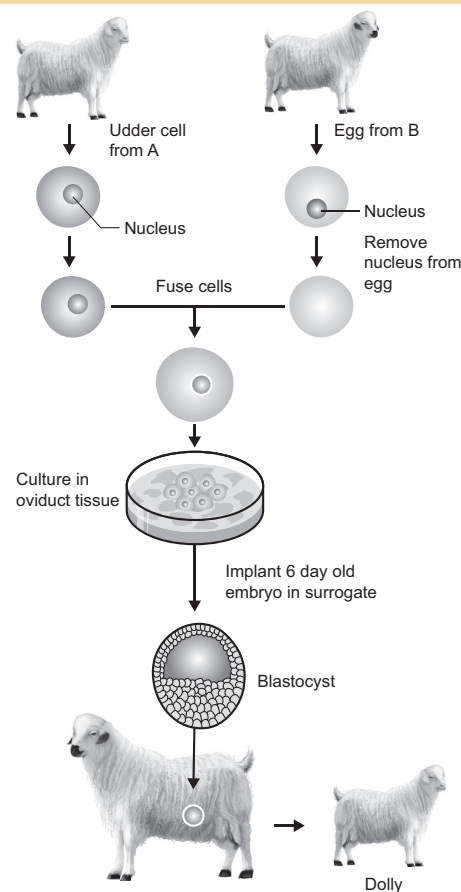

Ulna
Carpals
Radius
Humerus

Forewing

Hindwing
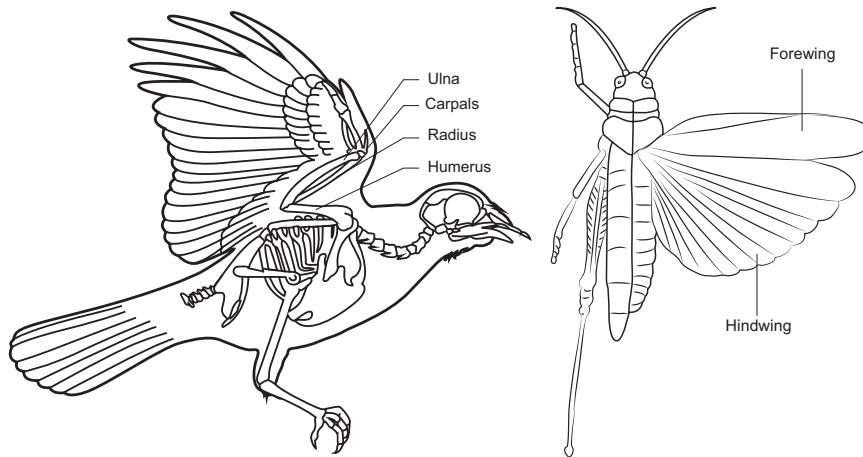
17.   ANIMAL CLONING – DOLLY (SHEEP)

IDENTIFICATION

The given picture is identified as cloning of animal – Dolly (Sheep)

COMMENTS

1. Cloning is the process to produce genetically identical individuals of an organism either naturally or artificially.

2. Dolly was the first mammal (sheep) clone developed by Ian Wilmut and Campbell in 1997.

3. Dolly was cloned from a differentiated somatic cell taken from an adult animal without the process of fertilization.

4. In this process, the udder cells (somatic cells) of mammary gland from a donor sheep were isolated. An ovum (egg cell, germ cell) was taken from the ovary of another sheep and enucleated.

5. The udder cell and enucleated ovum were fused and implanted into a surrogate mother. Five months later, dolly was born.


Udder cell from A

Egg from B

Nucleus

Nucleus

Remove nucleus from egg

Fuse cells

Culture in oviduct tissue

Implant 6 day old embryo in surrogate

Blastocyst

Dolly

14

18. HUMAN INSULIN PRODUCTION- FLOWCHART

IDENTIFICATION:

The given picture is identified as the flow chart of Human Insulin Production.

COMMENTS:

1. Production of insulin by recombinant DNA technology started in the late 1970s.

2. This technique involved the insertion of human insulin gene on the plasmids of E.coli.

3. The inserted gene synthesizes the polypeptide chains A and B segments linked by a third chain(C) as a precursor called Pre-Pro insulin.

4. The linking C chain is excised, leaving, A and B polypeptide chains.

5. Insulin was the first ever pharmaceutical product of rDNA technology, administered to humans.
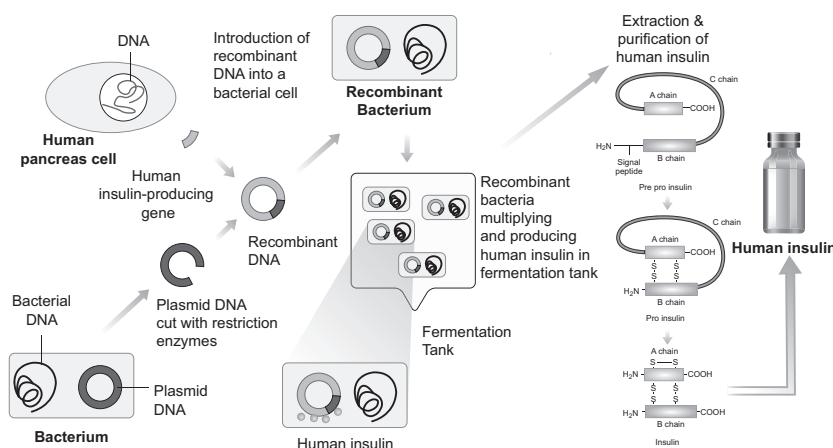
D - GENETICS – KARYOTYPING

19. NORMAL KARYOTYPE

IDENTIFICATION:

The given photograph is identified as normal karyotype of human beings.

COMMENTS:

1. Karyotyping is a technique through which a complete set of chromosomes are separated from a cell and are arranged in pairs.

2. A diagrammatic representation of chromosomes is called an idiogram.

3. There are 22 pairs of autosomes and a pair of allosomes (XX- female, XY – male) arranged based on their size, shape, banding pattern and position of centromere.

4. It helps in gender identification and to detect genetic diseases.

15
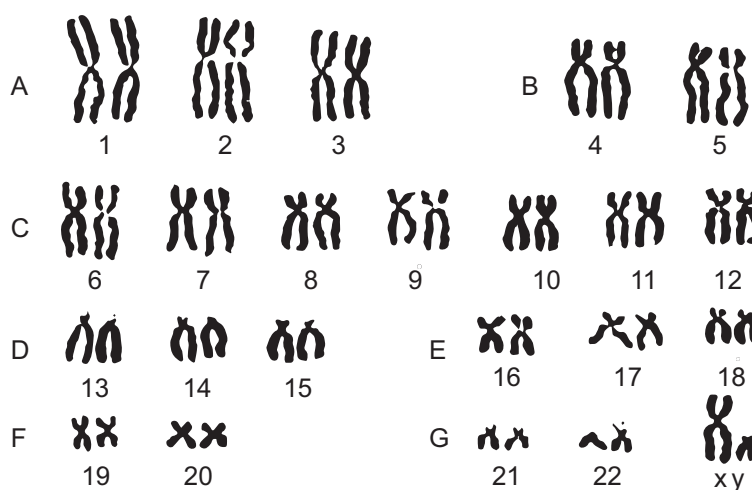
20. PATAU'S SYNDROME

IDENTIFICATION:

The given photograph is identified as Patau's Syndrome.

COMMENTS:

1. It is one of the autosomal aneuploids formed due to trisomic condition of chromosome 13.

2. It is caused by meiotic non-disjunction of chromosomes.

3. The symptoms are multiple and severe body malformation with profound mental deficiency.

4. The individuals have small head with small eyes, cleft palate and malformation of brain.
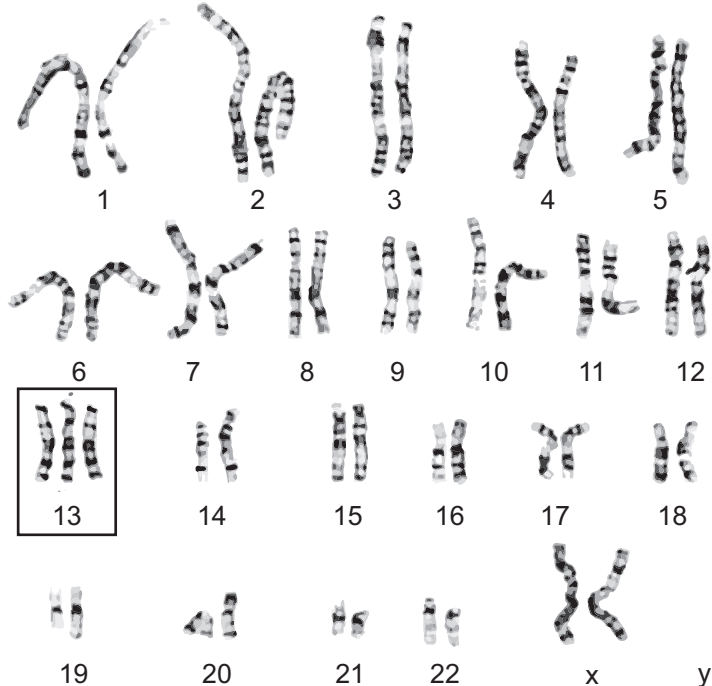

21. TURNER'S SYNDROME

IDENTIFICATION:

The given photograph is identified as Turner's syndrome.

COMMENTS:

1. This genetic disorder is due to the loss of an X chromosome resulting in a karyotype of 44A+XO = 45.

2. It is caused due to meiotic non-disjunction of allosomes.

3. These individuals are sterile female with short stature and webbed neck.

4. They also have under developed breasts and gonads with lack of menstrual cycle during puberty.


16
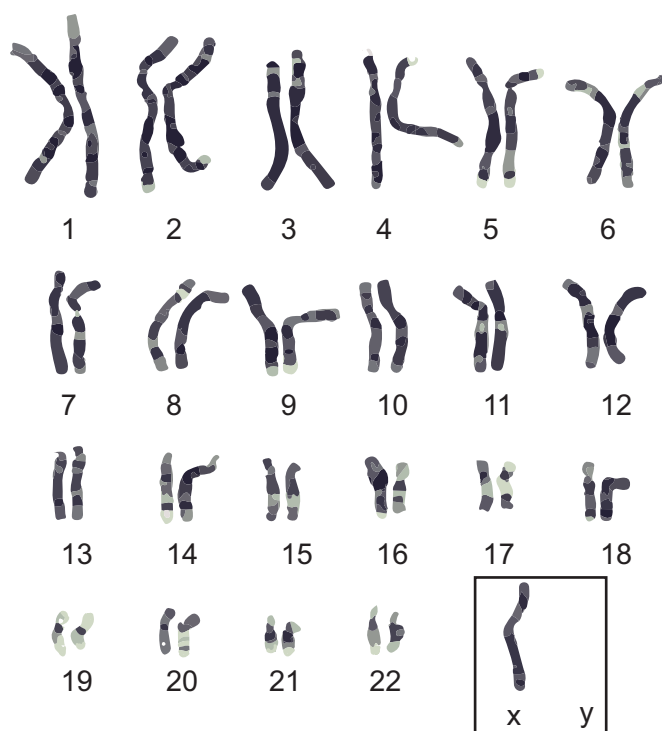
22.   HAEMOPHILIA (BLEEDER'S DISEASE)

IDENTIFICATION

The given pedigree chart is identified as the genetic disease Haemophilia.

COMMENTS

1. Haemophilia or bleeder's disease (Royal disease) is the most notorious of all sex-linked diseases. The person suffering from this disease bleeds for a long period (30 minutes to 24 hours) during injury due to the failure of blood coagulation.

2. It is caused by a recessive X – linked gene more common in men than women.

3. The females are carriers of the disease and would transmit the disease to 50% of their sons even if the male parent is normal.

4. It follows criss – cross or zig – zag pattern of inheritance (i.e., grandfather transmits his X linked character to his grandson through carrier daughter).

◯ Normal	▨ Affected	◨ Carrier
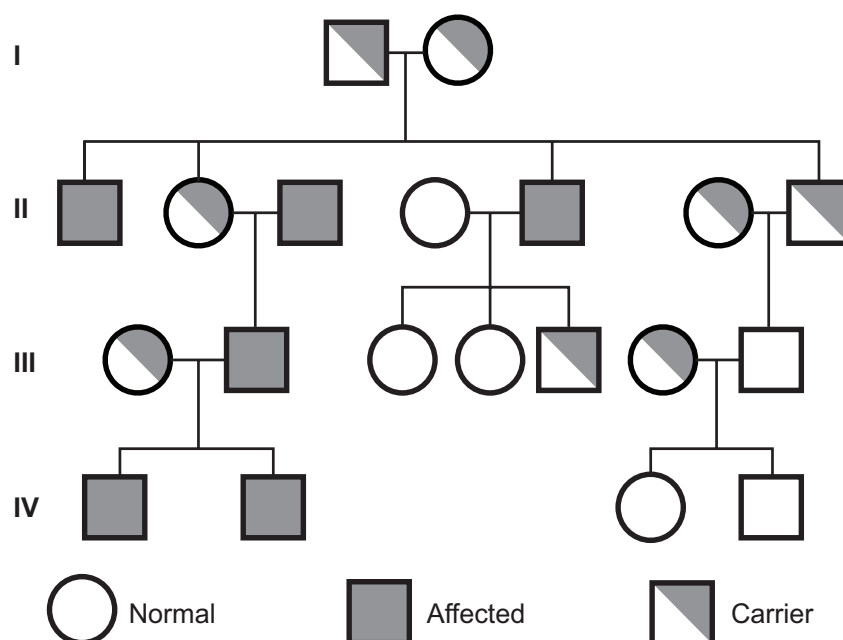
DISCUSSION QUESTIONS:

1. Observe the given pedigree chart and identify the affected individuals and carriers in the II generation.

2. Why are men affected often in X linked inheritance?

3. What is the pattern of inheritance in the given pedigree chart?

4. Why are women said to be carriers in X linked inheritance?

IDENTIFICATION

The given pedigree chart is identified as the genetic disease sickle cell anaemia,.

COMMENTS:

1. It is an autosome linked recessive trait that can be transmitted from parents to the offspring, if both the parents are carriers for the gene (heterozygous).

2. The disease is controlled by a single pair of allele Hb^A and Hb^S. The genotype of $Hb^S Hb^S$ shows the diseased phenotype for sickle cell anemia.

3. The heterozygous $Hb^A Hb^S$ individuals appear apparently unaffected but they are carrier of the disease.

4. The defect is caused by the substitution of Glutamic acid by valine at the sixth position of the beta globin chain of the haemoglobin molecules.

DISCUSSION QUESTIONS:
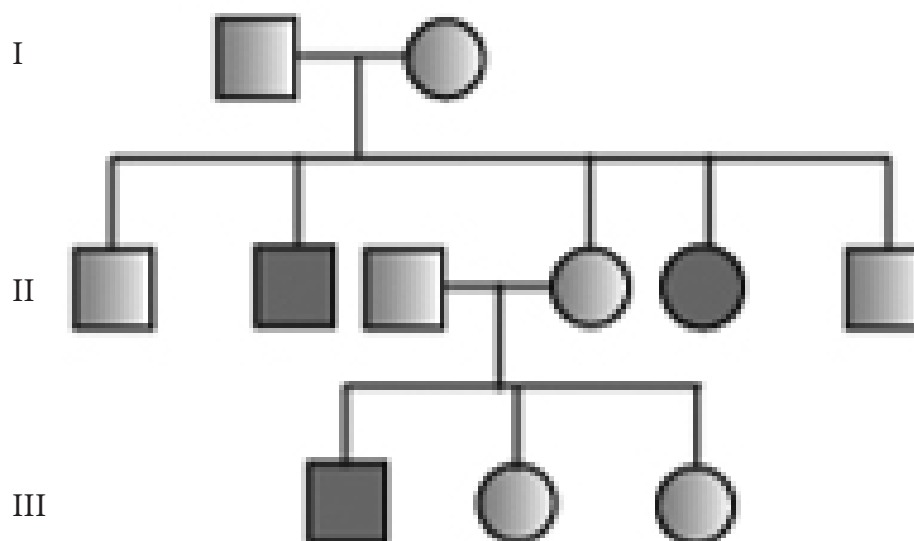
1. Observe the given pedigree chart and give reasons for the occurrence of the disease in the first generation.

2. Will males and females be equally affected in this type of inheritance? Give reasons.

3. How does the disease appear in the II generation when the parents are normal?

4. How is Sickle cell anemia disease caused?