BIOLOGY FORM FOUR

QUESTIONS AND ANSWERS

CHAPTER ONE

COMMUNICATION AND CO-ORDINATION

THE NERVOUS SYSTEM

1) Define nervous system?

- **Nervous system** is a coordinating system of most multicellular animals; it provides the quickest means of communication in animals.

2) How many types does the human nervous system be divided and what are they?

- The human nervous system can be divided into two types namely: **CNS** and **PNS.**

3) List the main functions of the nervous system.

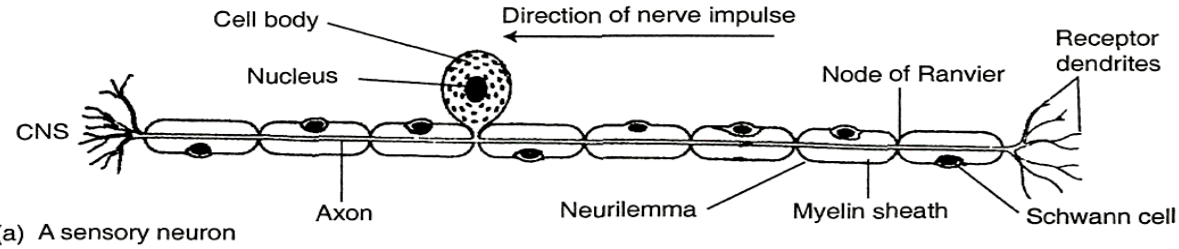
a) It receives information about the environment and other parts of the body.
b) It interprets the information it receives.
c) It makes the body respond to this information.

4) What is neuron or nerve cell? *INSTRUCTOR: NUR MUBARAK*

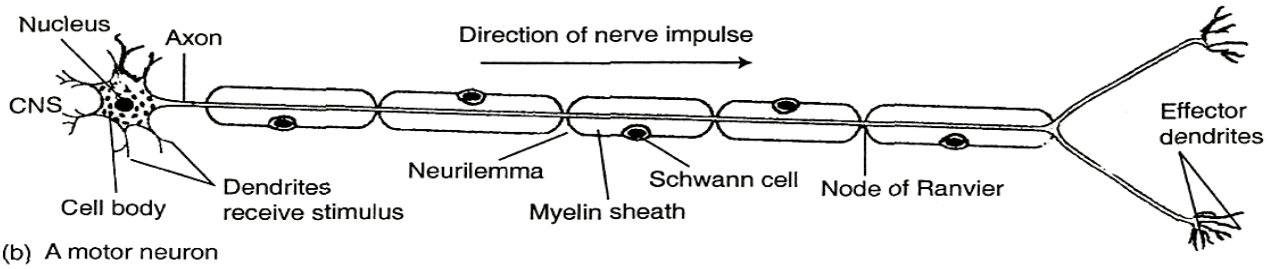
- The **nerve cell** or **neuron** is the basic functional unit of a nervous system.

5) What is the general structure of neuron consists of? With the aid of well labelled diagram.

- The neuron consists of cell body, dendrites and axon.



(a) A sensory neuron



(b) A motor neuron

6) Where does come from the word a) dendrite b) axon originated and state their means?

a) The word dendrite comes from the Greek word (Dendron) means a tree.
b) The word axon comes from the Greek term (axon) means an axis.

7) Define cell body?

- Cell body (centron) is the structure that contains nucleus, mitochondria & other organelles.

8) List the main functions of: a) dendrite b) axon.

a) **Dendrite:**it conduct impulses towards the cell body.
b) **Axon**: it conducts impulses away from the cell body.

9) What is the function of schwann-cell?

- The schwann-cell secretes the myelin sheath.

10) Define myelin sheath?

- Myelin sheath is a fatty insulating layer that covers the axon membrane.

11) What is the membrane that surrounded by myelin sheath?

- The membrane surrounded by the myelin sheath is the neurilemma.

12) The myelin sheath is broken at 1mm intervals by constrictions, what is the name of this distance?

- The myelin sheath is also broken at one-millimetre intervals by constrictions called **nodes of Ranvier.**

13) What is the main function of nodes of nodes of Ranvier?

- The **nodes of Ranvier** help to propagate the nerve impulse and speed up the transmission of an impulse.

14) What is the speed of impulses in M/S? *INSTRUCTOR: NUR MUBARAK*

- The speed of impulses is up to **100m/s.**

15) What is the maximum frequency of impulses?

- The maximum frequency of impulses is about 1500 per second.

16) What are the types neurons according to how many dendrites project from the cell body?

- The neurons are described as **unipolar, bipolar** or **multipolar** according to **how many dendrites** project from the cell body.

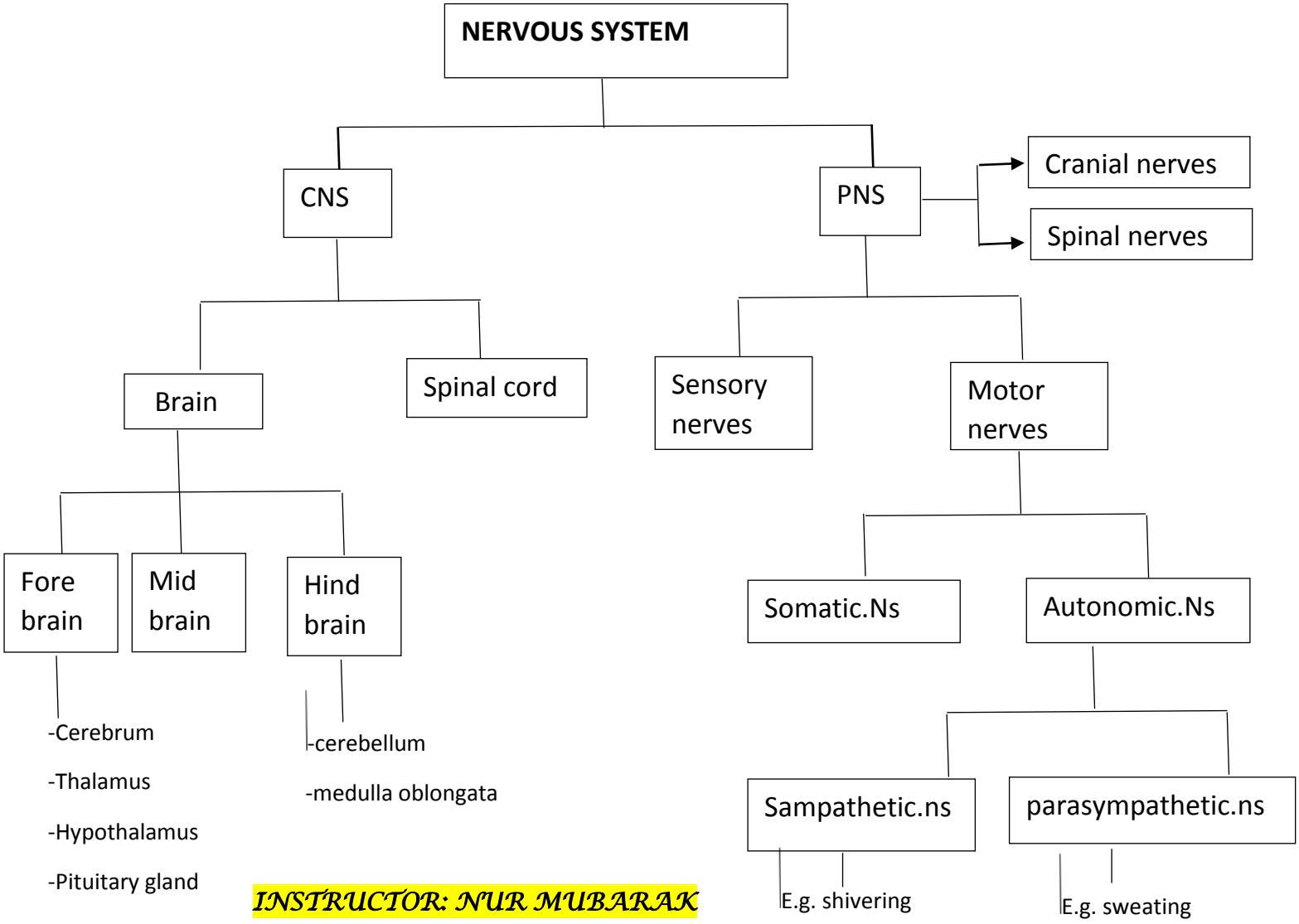
17) List the types of neurons according to the direction of impulse conduction.

- There are **three** types of neurons grouped according to the direction of impulse conduction:
  a) Sensory neuron (afferent neuron)
  b) Motor neuron (efferent)
  c) Relay neurons (conductors, associate or intermediate)

18)List the main functions of each of the following: a) sensory neuron b) motor neuron c) relay neuron.

a) **Sensory neuron**: carry impulse from the sensory organs to CNS.
b) **Motor neuron:** transmit nerve impulses from the CNS to the effectors.
c) **Relay neurons:** is to relay nerve impulses b/w sensory and motor neurons.

19) List the divisions and sub-divisions of nervous system?



INSTRUCTOR: NUR MUBARAK

20) Define brain? And state its weight.

- The **brain** is a delicate nervous organ which is enclosed in bony structure called skull or cranium. And its weigh is 1.3 ----1.4kg.

21) What are the protective membranes enveloped by the brain?

- The protective membranes enveloped by the brain are the meninges.

22) List the types of meninges of the brain.

- The **meninges** consists of Dura **matter, pia matter** and **arachnoid matter.**

23) Define each of the following: a) Dura matter b) pia matter c) arachnoid layer?

a) The **dura matter** is the tough outer membrane covering the brain and spinal cord of vertebrates.
b) The **pia matter** is the innermost membrane covering the brain and spinal cord.
c) **Arachnoid layer** is a narrow space between the dura and pia matter.

24) What is the function of Cerebrospinal fluid?

- It provides nourishment to brain tissue and serves as a shock absorbs from mechanical damage.

25) Define cerebrum?

- Cerebrum is a highly developed part of the brain consisting of left and right hemispheres**.**

26) Name the four regions that each hemisphere of cerebrum is made up of?

- The four regions that each hemisphere is made up of are
  a) The frontal lobe b) The parietal lobe
  b) The occipital lobe d) The temporal lobe

27) List the functions of each of the following;
a) Cerebrum b) thalamus c) hypothalamus d) pituitary gland.

- The functions of each of the following are:
  a) The **main function of the cerebrum** is to control **sensory impulses** such as hearing, vision, and taste. It also controls voluntary body movements such as limbs, lips and neck. Cerebrum also controls learning, memory, intelligence, reasoning, creativity and human individuality.
  b) The **thalamus** contains receptors for pleasure and pain.
  c) The **hypothalamus**, It has receptors for homeostatic functions and It controls appetite and sleep.
  d) **Pituitary gland,** It is the master endocrine gland controlling the rest of the endocrine glands.

INSTRUCTOR: NUR MUBARAK

28) What is the function of mid brain?

- The function of mid brain is, it connects forebrain and hindbrain and it relays impulses between nerves from the spinal cord and the forebrain.

29) List the main functions of: a) cerebellum b) medulla oblongata.

a) The cerebellum's main function is maintenance of body balance and posture.
b) Medulla oblongata controls involuntary activities such as breathing, swallowing, salivation, vomiting. It controls dilation or constriction of blood vessels there by influencing blood pressure.

30) Where do the cranial nerves arise from?

- **Cranial nerves** arise from the brain and form part of the PNS.

31) How many pairs do the cranial nerves of human beings consists of? And where they are confined?

- In human beings there are **12 pairs of cranial nerves** confined to the head and neck.

32) Define spinal cord?

- The **spinal cord** is the posterior extension from the brain to the tail.

33) Where do the spinal nerves arise from?

- **Spinal nerves** arise from the spinal cord and form part of the PNS.

34) How many pairs do the spinal nerves of human beings consists of? And where they are confined?

- There are **31 pairs** of spinal nerve and they are confined below the head.

35) Define reflex action?

- **Reflex action** is a rapid automatic response to a certain stimulus.

36) How many types does the reflex action can be dived and what are they?

- There are **two** types of reflex actions, the simple reflex and conditional reflex action.

37) What is simple reflex action? And give examples?

- **Simple reflex action** is when there is a specific single and automatic response to a particular stimulus.
- **Examples of simple reflex action** include withdrawal of finger from a hot or sharp object, blinking of the eye when an object passes close to it, coughing and sneezing, the knee jerk reflex when the knee is tapped, salivation, secretion of tears when an onion is cut, swallowing, and enlargement of the pupil in different light intensities.

38) Define reflex arc?

- The structural basis of a reflex action is called the **reflex arc**, which is the pathway followed by the nerve impulse.

39) Define conditional reflex action? And give examples?

- Conditional reflex action is an automatic response which can be evoked from an animal by unrelated stimulus.
- Examples of conditioned reflex action are walking, playing, cycling, writing, swimming and driving.

40) List the differences between simple reflex action and conditioned reflex action.

- Differences between simple reflex action and conditioned reflex action

Simple Reflex Action	***Conditioned Reflex Action***
1. Single stimulus to bring about response. 2. Simplest form of behavior and is independent of experience. 3. Sensory and motor components are the same at all times.	1. Repeated stimulus to bring about response. 2. Involves modification of behavior and dependent on experience. 3. Primary sensory component is replaced by a secondary sensory component but the motor component remains unchanged.

41) Define nerve impulse?

- A **nerve impulse** is an electrical signal that is transmitted along a nerve fibre.

42) What are the ions involved in impulse transmission?

- The ions involved in impulse transmission are sodium ions and potassium ions.

43) Define resting potential?

- A non-conducting nerve fiber is described to be **in** a **resting potential.**

44) When does the membrane said to be polarized?

- When there is positive charge outside the axoplasm and negative charge inside the axoplasm so that the membrane is said to be **polarized.**

45) Define action potential?

- **Action potential** is a localized change in electrical potential between the inside and outside of the nerve fiber when stimulated.

46) When does the membrane said to be depolized?

- When there is a negative charges outside the axoplasm and positive charges inside the exoplasm the membrane is said to be **depolarized** or **depolarization.**

47) What is synapse?

- A **synapse** is the junction between dendrites of two adjacent neurons.

48) What is the function of synapse?

- The **function of synapse** is to allow the transmission of nerve impulses from neuron to neuron.

49) What is the transmitter substance that contain in the vesicles of pre-synaptic knop?

- In the pre-synaptic knob there are vesicles which contain a transmitter substance which is usually **acetylcholine.**

50) What are the products of acetylcholine when is used by an enzyme cholinesterase?

- Acetylcholine liberated in the synaptic cleft is destroyed by an enzyme called **cholinesterase** into inactive end 1-1 products namely; choline and acetic acid (ethanoic acid).

THE ENDOCRINE SYSTEM

51) Define gland?

- **Gland** is a modified type of epithelial tissue specialized in production of secretions.

52) List the types of glands.

- Glands are of **three types**, namely: exocrine glands, endocrine glands and mixed glands.

INSTRUCTOR: NUR MUBARAK

53) Define endocrine system?

- The endocrine system is a system that comprises of endocrine glands that are ductless which secrete hormones in to the blood stream.

54) Define hormones?

- **Hormones** are organic compounds which are either **protein** or **steroids** in nature.

55) What are the two main kinds of hormones according to their composition?

a) **Hormones made from amino acids**

These hormones may be modified amino acids, peptides, or proteins. They work by binding to and activating specific receptors on cell membranes. This causes a series of events inside the cell.

Examples: epinephrine, norepinephrine, insulin, melatonin, LH, FSH

b) **Steroid Hormones**

Steroids are lipids made from chloresterol. Steroid hormones enter target cells and attach to the cell's DNA to either start or stop production of a protein (the gene product).

Examples: corticosteroids, oestrogen,testosterone, androgen.

56) List and explain the types of hormones according to their function.

- There are **three types** of hormones and they are:
  a) **Metabolic hormones,** control the metabolism or chemical functioning of the body.
  b) **Regulatory hormone,** control the rate of secretion of other glands.
  c) **Growth hormone,** affect the rate of growth and of the parts of the body.

57) Define target organs?

- The parts of an organism that respond for the hormones are called **target organs.**

58) What are the important rules of hormones in body of an organism?

- Hormones play important roles in regulating growth and development, control of behavior of animals, during breeding and in proper functioning of cells.

59) What is pituitary gland?

- Pituitary gland is a bean-sized structure that dangles on a slender stalk of tissue at the base of the skull.

60) List the main parts that the pituitary gland consists of.

- It consists of **anterior** and **posterior** pituitary gland.

61) Why pituitary gland called master gland?

- The pituitary gland also called master gland because it secretes hormones which regulate many of the other endocrine glands.

62) Where does the thyroid gland found? And which hormone is it secreted?

- The thyroid gland is H-shaped gland located in the neck. The thyroid lies over the top part of the trachea. It produces a hormone called thyroxin.

63) What is the function of the hormone thyroxin?

INSTRUCTOR: NUR MUBARAK

- Thyroxin controls basal metabolic activities.

64) Explain the effects of thyroxin under-secretion (hypothyroidism).

- **Under-secretion** could lead to insufficient iodine in the diet or defective enzymatic reactions concerned with its formation. Hypothyroidism leads to **cretinism** in children and **myxoedema** in adults.

Cretin children have deformed legs, dry leathery skin, large tongue and general body sluggishness. Such children have poor mental development resulting in low intelligence.

Myxoedema in adults is shown by the swelling of the thyroid gland called **goitre.** This is due to overworking of the thyroid gland in an attempt to synthesis enough thyroxine. Due to the low thyroxine concentration, individuals have low metabolic rate as shown by reduced heartbeat and breathing rate and low body temperature. They are mentally and physically sluggish. The low physical activity results into weight gain (obesity), retention of excess fluid (oedema) hence swollen feet and puffy face. **Hypothyroidism can be controlled** by use of balanced diet supplemented by iodized table salt and administration of iodine tablets.

65) Explain the effects of thyroxin over-production (hyperthyroidism).

- **Over-secretion of thyroxine** is often due to presence of plasma proteins that stimulate thyroid activity i.e. defective enzymatic reactions.

Hyperthyroidism leads to increased metabolic rate resulting in increased heartbeat, breathing rate and high temperature. Individuals show nervousness, restlessness and are easily irritable. Extreme hyperthyroidism can lead to heart failure, a condition known as **thyrotoxicosis. Hyperthyroidism can be controlled** by treatment with radioactive iodine. Surgical removal of part of the thyroid gland can also be done.

INSTRUCTOR: NUR MUBARAK

66) Where does the adrenal glands found?

- **Adrenal glands** are attached to the abdominal cavity, one above each kidney.

67) Name the two distinct regions that each adrenal made up of?

- Each is made up of two distinct regions; the outer **adrenal cortex** and an inner one called **adrenal medulla.**

68) Differentiate between adrenal medulla and adrenal cortex?

- **The medulla** receives nerve impulses from the brain and produces the hormone **adrenaline. The cortex** has no nerve supply and produces a number of hormones called **corticosteroids**.

69) What is the function of adrenaline?

- Adrenalin prepares the body for emergency-fight or flight.

70) What would happen when adrenaline functioning?

- The heartbeat increases, increasing the rate of circulation. It increases metabolic rate. The arterioles to the skin and digestive system constrict. In the liver, glycogen is converted to glucose. Skeletal muscles contract and relax which can allow movement. Breathing rate becomes faster and deeper. Fats are converted to fatty acids, which are available in the blood for muscle contraction.

71) Explain the Over-secretion of adrenaline.

- **Over-secretion of adrenaline** can be brought about by the growth of tumour in the medulla of the adrenal glands. Symptoms include high blood pressure, severe headache, racing heart, sweating and faintness. The resultant effect is aging of major body organs such as kidney, heart and liver.

72) What are the similarities of endocrine and nervous systems?

- **The similarities of endocrine and nervous systems are:**

- Both provide means of communication within the body of an organism.
- Both involve transmission of a message triggered by a stimulus and a response.
- The target organs of hormones are like the effector organs.
- Both involve chemical transmission.
- Both bring about survival response.

INSTRUCTOR: NUR MUBARAK

73) What are the Differences between endocrine and nervous systems?

Endocrine system	*Nervous svstem*
(i) Chemical substance to evoke a response, (ii) Chemical transmitted through blood, (iii) Responses slow but affect several partsof the body. (iv) Effects are long-lasting, (v) Response takes place involuntarily.	(i) Nerve impulse to evoke a response. (it) Impulse only through nerve fibre. (iii) Responses quick, specific and localised. (iv) Effects rapid and short-lived. (v)Takes place voluntarily & involuntarily.

74) Define drugs?

- ❖ A **drug** is any chemical substance which when taken into the body has **psychological and physiological effects.**

75) What is drug abuse?

- ❖ Indiscriminate use of drugs with no regard to their side effects is called **drug abuse.**

76) List some of the substances which when introduced into the body also cause psychological and physiological effects that are not curative.

- ❖ Commonly abused drugs include khat,nicotine, *cannabis saliva* and alcohol.

77) List common effects of drug abuse.

- Depressed appetite and poor feeding habits leading to emaciation.
- Interference with absorption of vital vitamins such as vitamin K and vitamin E which may lead to sterility and blindness.
- Lowers nervous co-ordination leading to loss of posture and balance.
- Irritation of the lungs and the respiratory tract leading to frequent coughs and infections.
- May lead to cancer of the lungs, throat and that of the urinary bladder.
- May also cause stomach ulcers.
- Damage to many tissues of the heart and the liver.
- In women, drug abuse may lead to poor foetal development and pregnancy complications.

SENSE ORGANS

78) List the main sense organs in mammals.

- ❖ In mammals the main organs of special sense are: the **eye** for sight, the **ear** for hearing, the **tongue** for taste, the **nose** for smell and the **skin** for pressure, temperature and pain.

INSTRUCTOR: NUR MUBARAK

79) Define eye and state its function?

- ❖ The eye is a complex sense organ, whose **function** is to receive light by which an animal perceives and distinguishes objects in its immediate environment.

80) Where does the eye located?

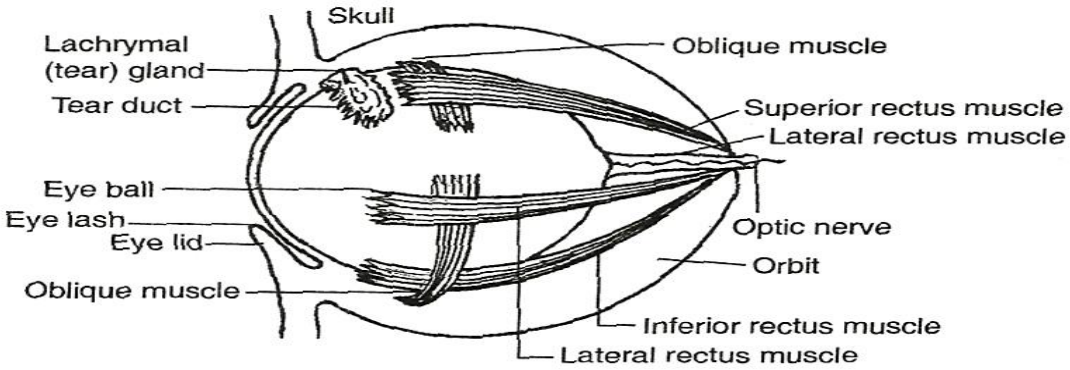
- ❖ The eye is located in a socket in the skull called **orbit**

81) What is the function of orbit?

- ❖ The main function of orbit is to protect the eye against physical damage.

82) In the socket, the eye is suspended by sets of muscles, which move the eye what are they and explain each one, with the aid of well labelled diagram?

- ❖ The **lateral rectus muscles** move the eye left and right. **Superior and inferior rectus muscles** move the eye up and down, while the **oblique muscles** steady the eye in its up and down movement.



83)Where does found the eyelid and state its function?

- ❖ In front of the eyeball, there are two thin folds of skin called the **eyelids**, which protect the eye.

84) Where does the eye lashes found, and state their functions?

- ❖ From the edge of the eyelids are many hairs called **eyelashes** which protect the eye from the entry of small foreign particles.

85) Where does the eyebrows found and state their functions?

- ❖ The **eyebrows** are raised portions of the skin above the eye, thickly covered with hair, **whose function** is to prevent sweat and dust from entering the eye.

86) In land vertebrates there is a lachrymal gland that continuously secretes a watery, saline and antiseptic fluid, what is the name of that fluid?

- ❖ **tears.**

87) What is the function of tears?

- ❖ The tears moisten the cornea and wash foreign particles out of the eye.

88) Where the lachrymal gland of human is found?

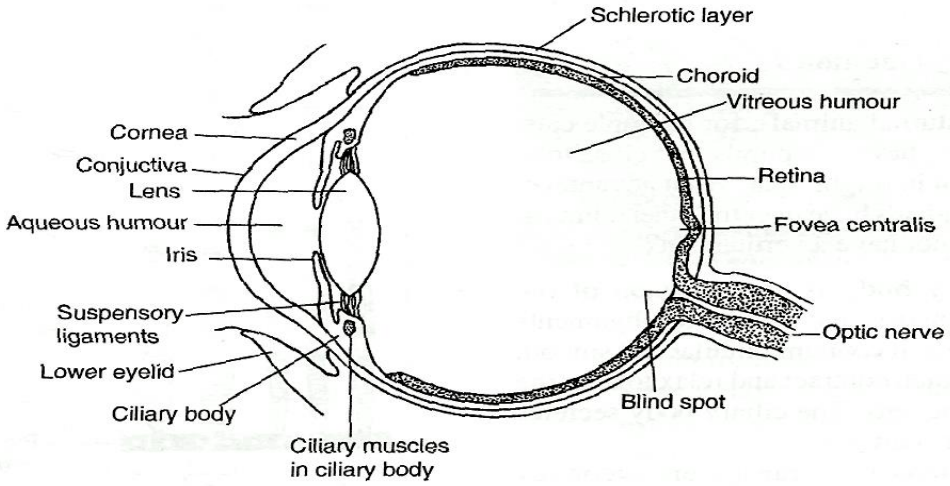
- ❖ The lachrymal gland of human is beneath the upper eyelid

89) How many layers does the human eye wall consists of and what are they with the aid of well labelled diagram?

- ❖ **The walls of human eye consists of three distinct layers**

a) The outer layer or sclera (Sclerotic layer).
b) The middle layer or choroids.
c) The inner layer or retina.

INSTRUCTOR: NUR MUBARAK



90) Define sclera?

- **Sclera** is a white fibrous layer which protects the delicate inner parts of the eyeball and helps in maintaining its shape

91)Define cornea and state its function?

- The **cornea** is a transparent layer which allows light to enter the eye. its function is to refract the light entering to the eye

92)What is conjunctive?

- **Conjunctive** is a protective thin transparent membrane covering the front portion at the cornea

93) Define choroid?

- Choroid is a dark-pigmented, membranous middle layer that contains numerous blood vessels.

94) What is the function of choroid?

- Its functions are to absorb stray light to prevent internal reflection within the eye and to provide nourishment to the eye.

95) At the front of the eye, the choroid extends and forms the ------- and ----------?

- **Ciliary body** and **iris.**

96) Define iris?

- The **iris** is a thin round sheet of muscular tissue.

97) The iris contains two sets of muscles, what are names of these muscles, and what is the function of these muscles?

- The iris contains two sets of muscles namely **Circular** and **radial** which control the diameter of the pupil. It is pigmented giving the eye its color e.g. black, brown or blue.

98) What is pupil?

- The **pupil** is the opening in the iris which allows light to enter the eye.

99) Define ciliary body?

- The **ciliary body** is an extension of the choroids, the iris and suspensory ligaments attached to it.

100) In the ciliary body contain circular and smooth muscles, what is the function of these muscles?

- The function of circular and smooth muscles is to contract and relax to alter the shape of the lens.

101) What is the function of ciliary muscles?

- The ciliary body secretes the aqueous humour.

102) Define lens?

- The **lens** in a transparent biconvex structure located immediately behind thepupil of the vertebrate eye.

103) What is the function of suspensory ligaments?

- The suspensory ligaments held the lens its position, which become taut or loose to alter the shape of the lens

104) The lens divides the eyeball into anterior and posterior chambers. Explain these champers?

- The **anterior chamber** is the part behind the cornea, is filled with a watery fluid the **aqueous humour**while the **posterior chamber** is the part between the lens and the retina is filled with a denser, jelly-like transparent material called the **vitreous humour.**

105) What is function of aqueous and vitreous humour?

- These fluids help maintain the spherical shape of the eyeball, and also to refract incoming light towards the retina.

106) What is retina?

- The **retina** is the light-sensitive layercomposed of three regions.

107) Name and explain the three regions of retina?

- **The three regions of retina are**

1. An **outer** pigmented region in contact with the choroid.
2. A **middleregionof photoreceptors** consisting of rods and cones.
3. An **innermost region of neurons.** These neurons run over the surface of the retina and join to form the optic nerve which transmits nerve impulses from the retina to the brain for interpretation.

108) Differentiate between cones and rods?

- **The deference between cones and rods are:**

	Cones	**Rods**
1	It contains a photochemical pigment called **iodopsin** which perceives light of high intensity	It contains a photochemical pigment called **rhodopsin** which perceives light of low intensity
2	Greater concentration of cones occurs in the fovea centralis or yellow spot which	Rods are in greater concentration round the periphery of the retina and are absent in the fovea centralis.
3	It lacks retinal convergence.	The rods have retinal convergence.
4	They have highVisual acuity	They have lawVisual acuity

109) In higher vertebrates there are three types of cone cells which enable them to differentiate the different colours they perceive the three types of cone cells distinguish light of the colours, name these colours?

- ❖ Blue, green and red.

110) What is blind spot?

- ❖ **Blind spot**is an area in the retina where the optic nerve enters the eyeball.

111) Explain the binocular vision?

- ❖ Binocular vision occurs when the visual fields of both eyes overlap so that the fovea of both eyes are focused on the same object.

112) Define accommodation of the eye?

- ❖ Is the adjustment of the eye structures to bring an image from a near or far object into **sharp focus** on the retina.

113) Explain the accommodation of a close object?

- ❖ The ciliary muscles contract thereby relaxing the tension on suspensory ligaments. The curvature of the lens increases i.e. the close objects are greatly refracted by the lens focusing them on to the retina

114) Explain the accommodation of a distant object?

- ❖ The ciliary muscles relax thereby increasing the tension of the suspensory ligaments. This stretches the lens decreasing its curvature i.e. the lens become thinner. Light rays from a far object are less refracted and hence focused onto the retina.

115) During accommodation, the iris regulates the amount of light entering the eye. Explain in bright and in dim light. With a labeled diagram.

- ❖ In bright light the circular muscles of the iris contract, while the radial muscles relax, and the pupil becomes smaller. This prevents damage of the retina by excessive light.
- ❖ In dim light, the radial muscles of the iris contract, and the circular muscle relax and the pupil enlarges. This allows in enough light to stimulate photoreceptors or the retina.

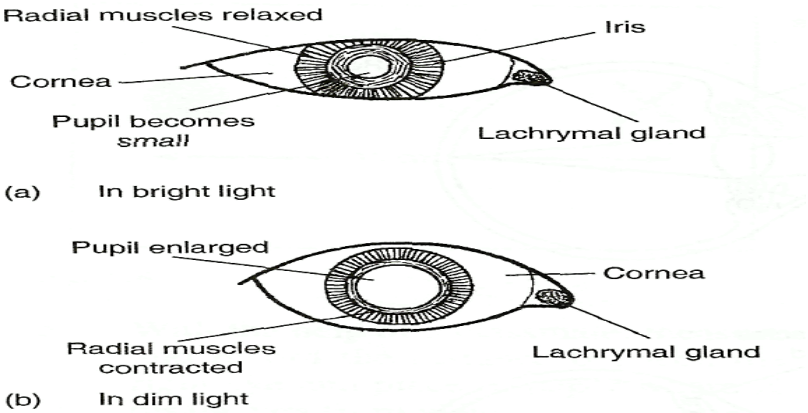


Fig. 3.29: How the iris regulates amount of light entering the eye

INSTRUCTOR: NUR MUBARAK

116) Define Defects of the Eye?

- **Defects of the Eye**are structural changes in the eye which make the focusing mechanism of the eye difficult.

117) List common eye defects?

- Short sightedness (myopia), long sightedness (hypermetropia), astigmatism, squintedness, old sight (presbyopia), colour- blindness, cataracts.

118) Define Short Sightedness (Myopia)? And what causes it? And explain how it can be corrected?

- **Short sightedness** is a condition in which light rays from a distant object are brought to focus in front of the retina while those from a near object are clearly focused on it. **This is caused** by a long eyeball. It may also be due to too much refractive power of the eye lens.

Short sightedness is corrected by wearing concave or diverging lenses. The concave lenses diverges light rays before reaching the eye lens which then focuses the light rays on the retina

119) Define Long Sightedness (Hypermetropia)? And what causes it? And explain how it can be corrected?

- **Long Sightedness (Hypermetropia)**is a condition in which light rays from a near object are not brought to focus by the time they reach the retina, while those from a distant object are sharply focused. **It is caused by** too short an eyeball or a weak lens system. **The disorder can be corrected by** wearing a convex (converging) lens. This lens refracts light rays before reaching the eye lens thereby enhancing refraction in order to focus rays sharply on to the retina.

120) Define Astigmatism? and what causes it? And how it can be corrected?

- **Astigmatism** is a condition in which light rays from an object are brought to focus in different planes. **This is caused by** unequal curvature of the cornea or lens which produces unequal refraction of light entering the eye. **It iscorrected by** wearing a special cylindrical lens in front of the eye, which corrects the focus in the defective planes.

121) Explain Squintedness?

- **Squintedness**is an eye defect in which the extrinsic muscle of the eye that control the turning of the eyeball do not co-ordinate accordingly on stimulation.

122) Define Old Sight (Presbyopia)? And what causes it? And how it can be corrected?

- **Old Sight (Presbyopia)**is a condition in which the light rays from a near object is brought to focus behind the retina, while the rays from the distant object is sharply focussed. **This is caused by** hardening (loss of elasticity) of the lens and weakening of the ciliary muscles due to old age. **The defect is corrected by** wearing a convex or converging lens or one pair of glasses with two different lenses called bifocal lenses.

123) Define Color- blindness?

- **Color-blindness** is a genetic defect in which certain colors cannot be distinguished by human beings and other animals.

124) What is the common type color blindness?

- A common type is red-green colour blindness

125) Explain cataracts according to its causes and its correction?

- This is an eye defect associated with old age. **It may also be caused** by eye injury due to a blow or by complications of diabetes mellitus.

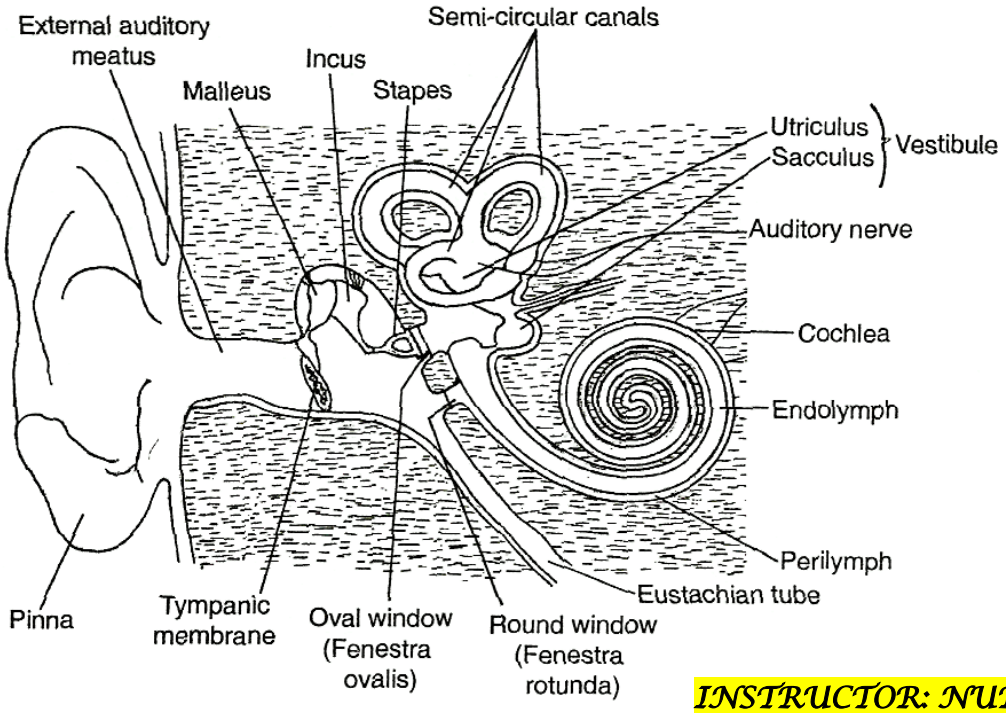
In this condition the eye lens becomes cloudy or opaque hence blocking transmission of light rays. The transparent protein fibres in the lens are denatured and coagulated forming the opaqueness in the lens. **The defect can be corrected** surgically by replacing the defective lens with a good one from a donor or an artificial lens

126) What is ear?

- The ear is a complex sense organ whose functions are to perceive sound and maintain balance.

127) The structure of the ear consists of three parts, name these parts? With iad of well labeled diagram?

- The structure of the ear consists of three parts namely: the outer ear, the middle ear and inner ear.



INSTRUCTOR: NUR MUBARAK

128) State the components of the outer ear?

- **The outer ear** consists of the **pinna** and **external auditory meatus.**

129) What is pinna?

- The **pinna** is a flap of skin and cartilage which partially covers the opening to the external auditory meatus.

130) What is the function of pinna?

- The function of pinna is: It collects and concentrates sound waves into the auditory meatus.

131) Define external auditory meatus?

- **The external auditory meatus** is a tube or passage that directs sound waves to the eardrum (tympanic membrane).

132) The tube (auditory meatus) is lined with hairs, state the function of these hairs?

- The hairs in the tube help to trap solid particles that may enter the ear.

133) The tube (auditory meatus) is lined with lined by wax-secreting cells, what is the function of these wax-sectrating cells?

134) The function wax-secreting cells is to secrete wax that traps dust and prevents entry of solid particles. The wax also maintains the flexibility of the eardrum.

135) Explain the middle ear and list its components?

- **The middle ear** is an air-filled cavity consisting of the tympanic membrane, ear ossicles, and Eustachian tube, oval and round windows.

136) Define tympanic membrane?

- The tympanic membrane is a thin tough membrane that covers the external opening of the middle ear.

137) The ear ossicles are three bones, name each of them?

- The ear ossicles are three bones namely **malleus, incus** and **stapes**.

138) The ossicles are suspended by muscles, state the function of these muscles?

- These muscles also prevent excessive vibrations which could damage the inner delicate membranous labyrinth.

139) Define Eustachian tube and state its function?

- The **Eustachian tube** is a tube connecting the middle ear with the pharynx. **Its function** is to equalize air pressure between the middle ear and the outer ear to prevent distortion of the eardrum.

140) *Note that the Eustachian tube is an important part of the ear, on the other hand it can provide a passage for entry of pathogenic microbes from the pharynx to the middle ear causing ear infection.*

141) Define inner ear?

- **The inner ear** is a fluid-filled cavity connected to the middle ear by the oval window.

142) Name the three cavities of the inner ear?

- The three cavities of the inner ear are the vestibule, the cochlea and the semi-circular canals.

143) Name the fluids that contain the cavities of the inner ear?

- The cavities in the inner ear are filled with fluids called perilymph and endolymph.

144) What are the functions of these fluids?

- The fluids conduct sound vibrations transmitted from the middle ear to the cochlea for hearing. In the vestibule and semi-circular canals the displacement of the fluids leads to restoration of the body balance. The fluids absorb mechanical shock hence protect the delicate sensory structures.

145) What is the function and structure of cochlea?

- The cochlea is the structure responsible for hearing. It is a spirally shaped tube consisting of a system of canals, membranes and sensory cells. The canals are filled with endolymph and perilymph.

146) How do the ears perceive sound?

- Firstly, the pinna concentrates sound waves into the auditory meatus. The sound waves strike the eardrum and cause it to vibrate. The vibrations are transmitted to the ear ossicles in the middle ear.

From the eardrum the vibrations are picked by the first ear ossicle, the malleus, which transmits to the incus up to the stapes. The stapes passes the vibrations to the oval window from where the vibrations are transmitted to the perilymph of the cochlea.

The three ear ossicles are specially arranged to amplify the vibrations as they transmit them to the oval window. In the cochlea the vibrations stimulate the sensory cell hairs to generate nerve impulses which are transmitted to the brain via the auditory nerve for interpretation. The intensity of stimulus transmitted to the brain enables the brain to interpret the impulses as sound of specific pitch and loudness.

147) When does the direction of sound is detected accurately?

- The direction of sound is detected accurately as a result of both ears functioning together.

148) When sound waves come from the front, both ears pick the waves at the same time. What is intensity of the impulses by the auditory nerve?

- The intensity of the impulses by the auditory nerve will be of equal strength.

149) If sound is from the sides, one ear will pick the waves earlier than the other,what is intensity of the impulses by the auditory nerve?

- The intensity of the impulses, transmitted to the brain from one ear will be different from the other one.

INSTRUCTOR: NUR MUBARAK

150) What are the functions of the semi-circular canals and the vestibule?

The function of the semi-circular canals and the vestibule is for balance.

151) Define semi-circular canals?

- Are three tubular cavities containing endolymph. These canals lie mutually at right angles to each other and occupy the three planes of space.

152) What does the vestibule consists of?

- The vestibule consists of utriculus and sacculus which contain the sensory cells.

153) Define deafness?

- **Deafness** is a hearing defect which makes an individual unable to perceive sound.

154) What are the types of deafness?

- There are two categories of deafness i.e. permanent and partial deafness

155) Explain permanent deafness and how it's corrected?

- Permanent deafness is due to damage of the cochlea or auditory nerve. These may be damaged due to prolonged exposure to loud sounds. It may also result when the cochlea is sensitive to certain drugs e.g. some antibiotics, permanent deafness is difficult to correct.

156) Explain partial deafness and how it's corrected?

- Partial deafness is brought about by impairment of the structures that conduct vibrations to the cochlea e.g. the eardrum and ear ossicles. The eardrum can also be damaged by infection or physical blow. It may also be due to the production of too much wax which hardens hence blocking the external auditory meatus. This type of partial deafness can be corrected by surgery or by using a hearing aid.

THE END OF CHAPTER ONE

QUESTIONS AND ANSWERS

NUR IBRAHIM MOHMED (MUBARAK)

BIOLOGY FORM FOUR

QUESTIONS AND ANSWERS

CHAPTER TWO

REPRODUCTION IN ANIMALS AND PLANTS

1) **Define reproduction.**
   - **Reproduction** is the process by which mature individuals produce offspring.
2) **List the types of reproduction.**
   - There are two types of reproduction: **sexual and asexual reproduction.**
3) **Differentiate between sexual and asexual reproduction**.
   - **Sexual reproduction** involves the fusion of the male and female gametes to form a zygote, while **asexual reproduction** does not involve gametes; instead, parts of the mature organisms may develop to new individuals.
4) **List the importance of reproduction.**
   - A) Procreation b) Quality improvement
5) **Where does the cell division start?**
   - The cell division starts with division of the nucleus i.e. the chromosomes and then the cytoplasm.
6) **Define chromosomes.**
   - In the nucleus there are a number of long thread-like structures called **chromosomes.**

INSTRUCTOR: NUR MUBARAK

7) **Define chromatids.**
   - Each chromosome is made of two parallel strands called **chromatids.**
8) **Define centromere.**
   - Each pair of chromatid is connected at one point by a structure called **centromere.**
9) **Where does the chromosomes found?**
   - Chromosomes are present in the nucleus all the time,
10) **Define homologous chromosomes.**
    - In body cells, chromosomes occur in pairs. The member of each pair is called a **homologous chromosome.**
11) **Define genes.**
    - Along the length of the chromosomeis a series of structures called **genes.**Or **gene** is the basic unit of heredity.
12) **List the types of cell division.**
    - There are two types of cell divisions namely **mitosis** and **meiosis**.

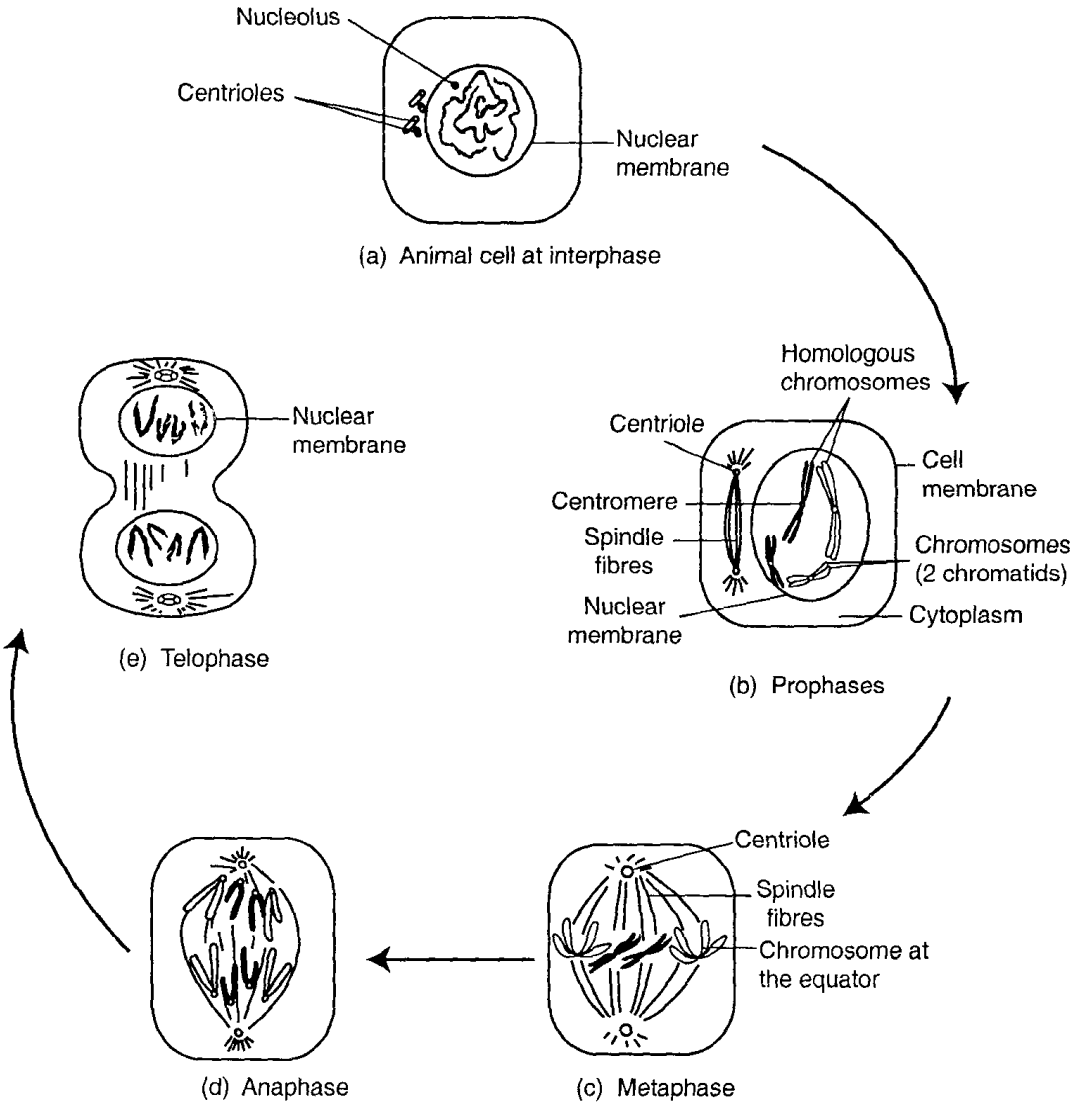
13)Define mitosis.

- **Mitosis**is a type of cell division in which a cell divides into two daughter cells each having the same number of chromosomes as the parent cell.

14)List the stages of mitosis.

- The stages of mitosis are Interphase, prophase, metaphase, anaphase and telophase.

15) Explain how mitosis occur by using a well labelled diagram.



16) Where the mitosis does occur?

- Mitosis occurs in somatic cells during the growth of an organism.

17) Define meiosis.

- Meiosis is a king of cell division

18) How many divisions meiosis does consists of?

- Meiosis consists of **two** successive divisions. The parent cell splits into two (first meiotic division) and the products then divide again (second meiotic division), giving a total of four daughter cells.

19)As in mitosis, meiosis is divided for convenience into a series of stages. These are given the same names as in mitosis but each is followed by I or II, what does these roman numbers indicates?

- These numbers are indicating whether it belongs to the first or second meiotic division.

20)Explain how meiosis I occurs by using a well labelled diagram

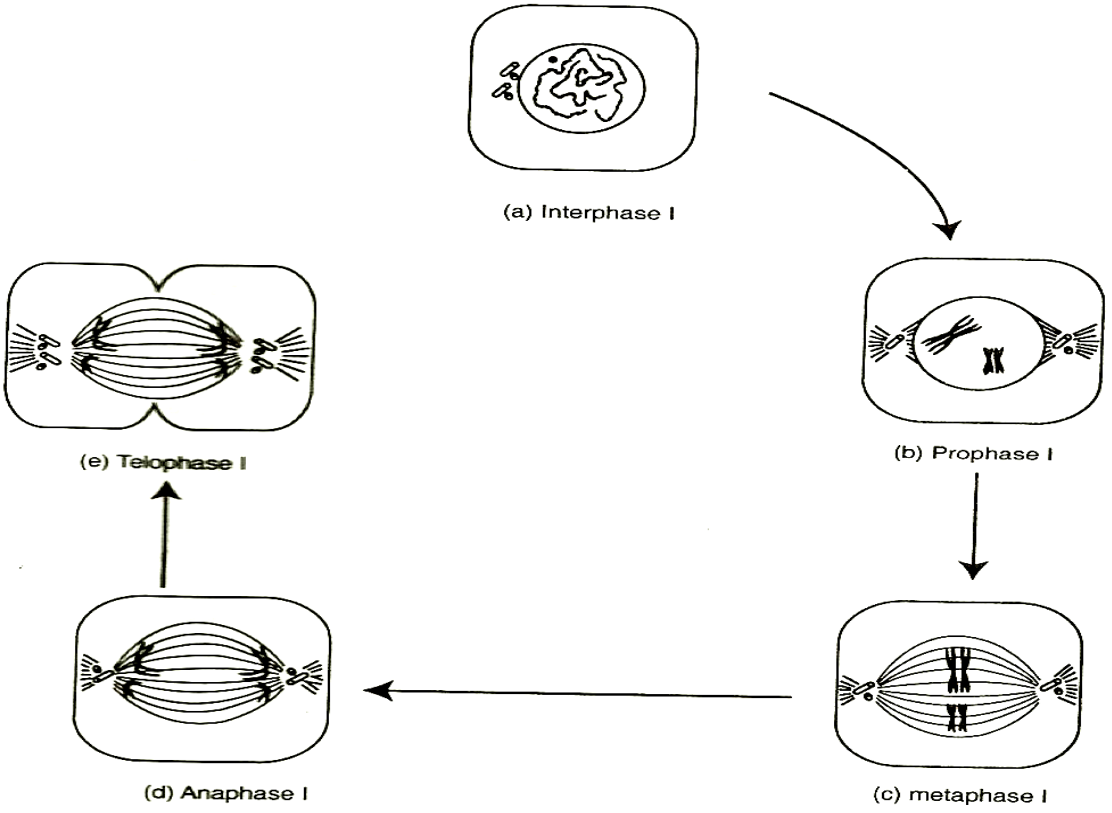


Fig. 3.6: Stages of the first meiotic division

21)What is the function of meiosis I?

- The first meiotic division is responsible for separating the homologous chromosomes and halving the chromosome number. For this reason the first meiotic division is described as **reduction division.**

22) In which phase does the separation of homologous chromosomes occurs?

- During the first anaphase of meiosis **homologous chromosomes separate.**

23) Explain how meiosis I occurs by using a well labeled diagram

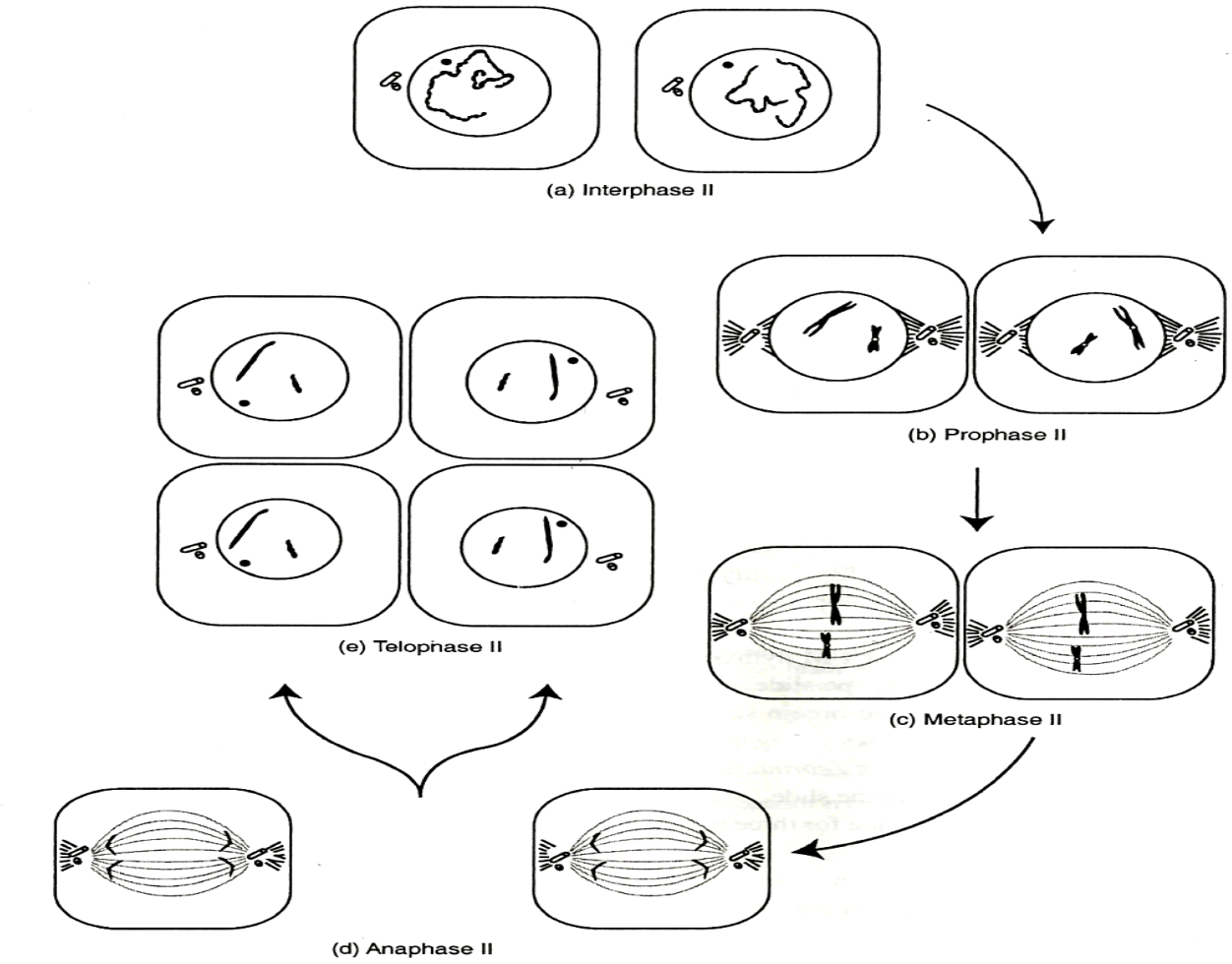


Fig. 3.7: Stages of the second meiotic division

24) What is the function of meiosis II?

- The function of the second meiotic division is to separate the chromatids from each other.

25)In which phase does the separation of sister chromatids occur?

- **During the Anaphase II:** The sister **chromatids separate**

26)Where meiosis does occur?

- Meiosis occurs in reproductive organs leading to formation of gametes.

27) Sate the Similarities between Mitosis and Meiosis.

a) Both take place in plant and animal cells
b) Both involve the division (multiplication) of cells

28) State the differences between Meiosis and Mitosis.

- **Differences between Meiosis and Mitosis**

Meiosis	*Mitosis*
1. Homologous chromosomes associate with one another.	1. Homologous chromosomes do not associate with one another.
2. Takes place in two nuclear divisions each having four stages.	2. Takes place in one nuclear division of four stages.
3. Produces four daughter cells, each haploid.	3. Produces two daughter cells, each diploid.
4. Occurs in reproductive organs leading to formation of gametes.	4. Occurs in somatic cells leading to growth.
5. Chiasma formation takes place and may Lead to crossing-over hence variation.	5. No chiasma formation therefore no crossing-over hence no variation.

Sexual reproduction in Animals

29)Name the gametes that males produce?

- The males produce gametes known as **sperms**

30)Name the gametes that females produce?

- The females produce gametes known as **ova** (singular ovum).

31) Where does the gametes produce?

- The gametes are produced by special organs known as **gonads (reproductive organs).**

32) What is the male gonad and what does it produce?

- The male gonad is the **testes** which produce **sperms**

33) What is the female gonad and what does it produce?

- The female gonads are the **ovaries** which produce **ova.**

34) Define fertilization?

- **Fertilisation** is a process whereby the nucleus of a male gamete fuses with the nucleus of a female gamete to form a zygote.

35) In which animals does external fertilisation occur?

- External fertilisation occurs in animals such as **amphibians and fish.**

36) How external fertilisation occurs?

- It is only possible in water. During this time, the female lays eggs in water and the male sheds sperms over these eggs to fertilise them, resulting in fertilisation outside the body. In this kind of fertilisation many eggs are released to increase the chances of survival, since the fertilised eggs could be attacked by bacteria or eaten by some animals.

During the mating season the males croak, mainly at night to attract females. While mating, the male mounts the female and shed sperms as the female lays the eggs. These activities increase the chances of fertilisation.

Eggs are laid in long strands of slippery jelly-like substance which provides protection to the eggs. At the same time the jelly prevents predators from feeding on the eggs. This substance separates the eggs from each other allowing for good aeration. It also attaches the eggs to the water plants and also makes the eggs to be buoyant.

37) In which animals does internal fertilisation occur?

- Internal fertilisation occurs in **reptiles, birds** and **mammals.**

38) Explain how internal fertilisation occurs?

- Fertilisation occurs within the body of the female. Generally, the number of eggs produced by the females is fewer than those produced by animals where external fertilisation occurs. This is because there are higher chances of fertilisation since the sperms are deposited into the female's body. Furthermore, protection of the gametes and fertilised eggs is higher.

In most mammals, some chameleons and some snakes, the fertilised eggs develop into young ones within the body of the female. After the gestation period the females give birth to young ones.

39) List the three sub-classes of mammals.

- The egg-laying mammals (monotremes), pouch mammals (marsupials), placental mammals.

40) Differentiate between oviparous and viviparous.

- **Oviparous** are mammals that lay eggs, example duck platy pus.
- **Viviparous** are mammals thatgive birth to young ones. Like placental mammals

INSTRUCTOR: NUR MUBARAK

Reproduction in human beings

41) Draw a well labelled diagram of male reproductive system.

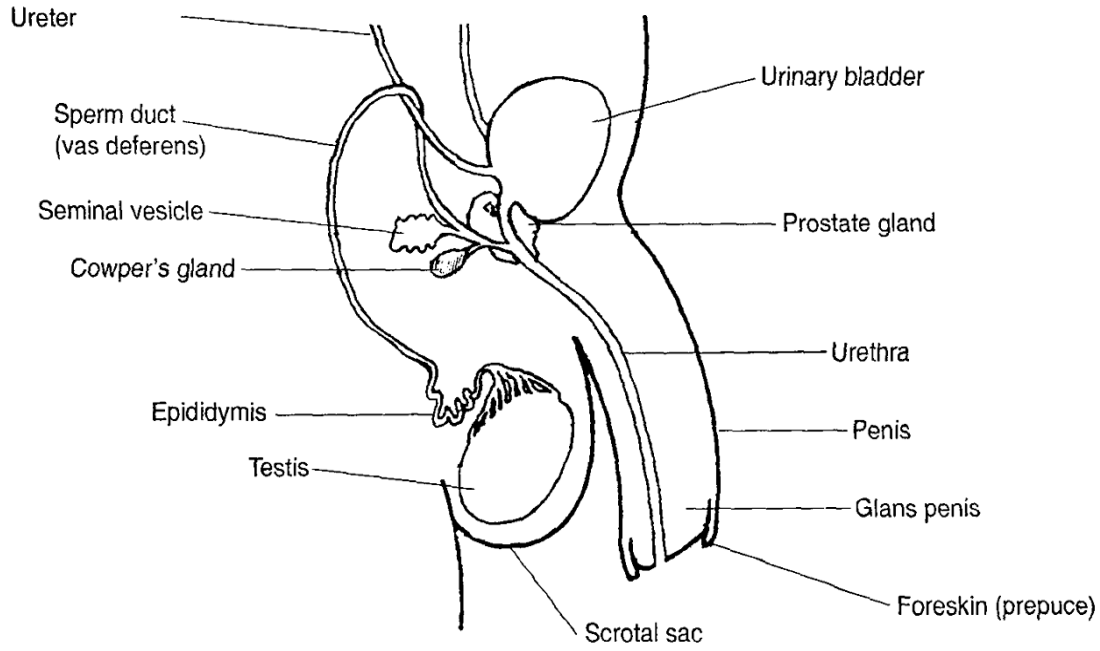


Fig. 3.36(b): Male reproductive system (side view)

42) Where does the testes locate?

- The testes lie outside the abdominal cavity in the **scrotal sac.**

43) What is the physiological significance of having testes outside the body of the human male?

- The position of the testesoutside the body is significant as **it provides a cooler environment for sperm production**. Sperms develop best at a lower temperature than that of the body.

44) Define seminiferous tubules.

- The testis is made up of several highly coiled tubes known as the **seminiferous tubules.**

45) Where does the male hormones(androgens) produce?

- Between the seminiferous tubules are interstitial cells which produce the male hormones called **androgens.**

46)What is epididymis?

- The seminiferous tubules finally unite to form the **epididymis,** a much coiled tube about **6 metres** long when stretched.

47) What is the function of epididymis?

- The function of epididymis is to store the sperms.

48) Define sperm duct?

- **Sperm duct, or vas deferens** is a narrow tube connecting the epididymis to the urethra which is the ejaculatory duct.

49) Define seminal vesicle and state its function?

- **The seminal vesicle**is a blindly ending sac which also opens into the urethra at this region. It provides an alkaline fluid which contains nutrients for the spermatozoa.

50) What is the function of prostate gland?

- **Prostate gland** whose secretion is alkaline to neutralise the vaginal fluids. It also activates the sperms.

51) Where does the Cowper's' gland locate and state its function?

- The Cowper's gland below the prostate gland on either side of the urethra, which secretes an alkaline fluid that neutralises the acidity along the urethra.

52) Define urethra.

- The urethra is a long tube ordinarily used for the expulsion of urine to the exterior.

53) Define penis?

- **Penis** is the male genital organ.

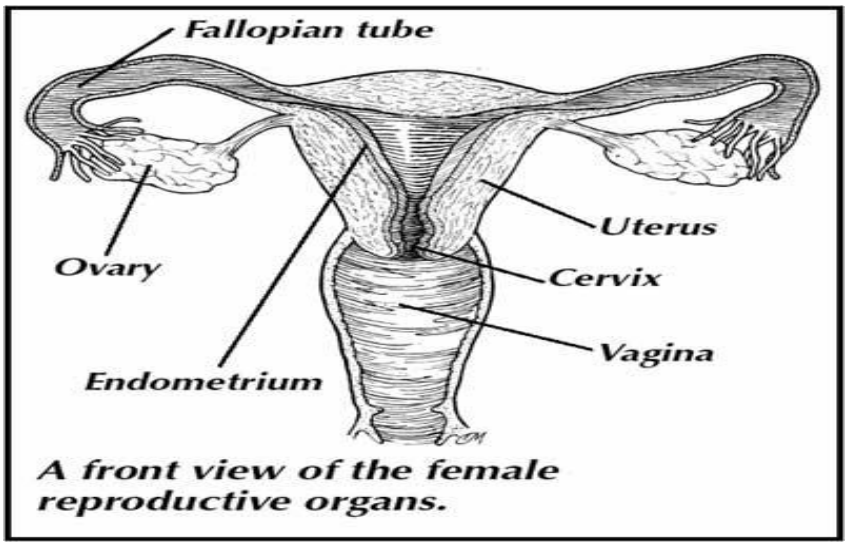
54) What the penis is made up of?

- The **penis** is made up of spongy tissue, muscle and blood vessels.

55) At the time of sexual activity, what is the state of penis?

- At the time of sexual activity, the **penis erects** by having the spaces in its spongy -tissue filled with blood. This enables it to penetrate the vagina during coitus in order to deposit sperms in the female reproductive tract.

56) Draw a well labelled diagram of female reproductive system.



A front view of the female reproductive organs.

INSTRUCTOR: NUR MUBARAK

57) How many ovaries does the human female has?

- There are two **ovaries** which are cream coloured oval bodies measuring 3-4 cm long.

58) Where does the ovaries found?

- ❖ They are found in the **lower part** of the abdomen below the kidneys.

59)Define oviduct.

- ❖ An **oviduct** is a tube with an expanded funnel shaped opening which conducts ova released by the ovary to the uterus

60)Where does the fertilisation?

- ❖ Fertilisation occurs in the oviducts.

61)Where does the uterus found?

- ❖ The **uterus** is found in the lower abdomen. It is in this structure where the embryo develops.

62)What is the size of original size of uterus?

- ❖ The uterus is capable of expanding as the embryo grows and can return to original size of about **8 cm** in length after birth.

63) Define cervix.

- ❖ Cervix is the neck of the uterus.

64)What is the function of cervix?

- ❖ The cervix has a ring of muscles that separates the uterus from the vagina. It secretes a plug of mucus which prevents entry of pathogens into the uterus during pregnancy.

65)Define vagina.

- ❖ The **vagina** is the copulatory canal. It is also called the birth canal.

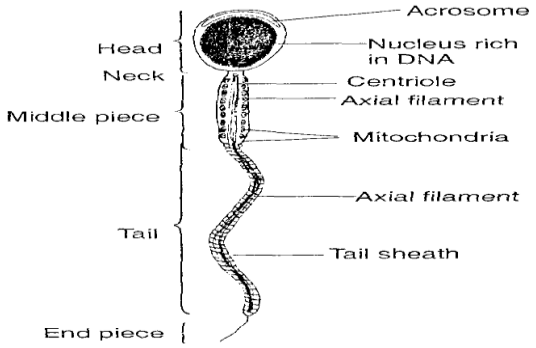
66) State the function of vestibular glands

- ❖ The vestibular glands which release mucus when the female is sexually aroused which helps to lubricate the vagina during intercourse.

67) What the sperm consists of?

- ❖ A sperm consists of an ovoid head, short neck, middle peace and tail.

68) Draw a well labelled diagram for sperm.



69) Where the nucleus of sperm cell does contain?

- ❖ The head contains a large **nucleus.** The nucleus carries genetic material which is haploid in number (n).

70) At the tip of the head is an acrosome which contains lytic enzymes. What is the function of these enzymes?

- These enzymes digest the membrane of the egg for the sperm to penetrate and affect fertilisation.

71) The middle piece is packed with a large number of mitochondria. What would these mitochondria produce?

- These mitochondria produce energy necessary for propulsion of sperm to reach the egg.

72) What is the function of tail of the sperm?

- The tail propels the sperm forward by its side to side lashing action.

73) What would be the journey of sperm along the male reproductive structures?

- Testes → Epididymis → Vas deferens (sperm duct) → urethra.

74) When the process of egg formation does begin?

- The process of egg formation begins in the ovary of the foetus before birth.

75) What would be the path way of sperm after entering the female reproductive organ?

- Vagina → cervix → uterus → oviduct(fallopian tube)

76) When the process of sperm production begin?

- The production of sperms 'in males which only begins at puberty

77) At birth how many potential egg cells are present in the ovaries of the baby girl?

- At birth there are about 70,000 **potential** egg cells in the ovaries of a baby girl.

78) The egg cells are enclosed by a layer of ovary cells known asprimary follicles, what is the function of these primary follicles?

- The primary follicles provide nourishment to the egg cells

79) At birth there are about 70,000 potential egg cells in the ovaries of a baby girl. How many egg cells may develop at puberty?

- Of these about **500** of them may develop into ova during puberty.

80) Draw a mature human ovum?

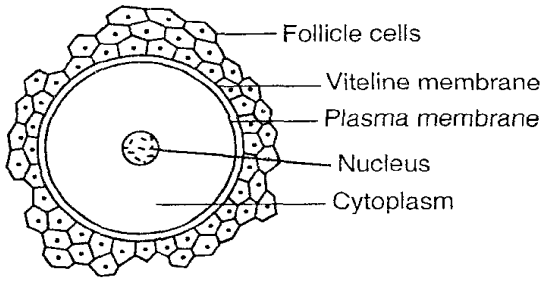


Figure: Mature human ovum

INSTRUCTOR: NUR MUBARAK

81) During puberty the primary follicles undergo growth what would these become?

- ❖ During puberty the primary follicles undergo growth to become the mature **Graafian follicle.** At ovulation the Graafian follicle bursts open to release a mature ovum surrounded by layers of follicle cells

82) Explain the mature human ovum.

- ❖ A mature human ovum is **spherical in shape** with a diameter of about 0.2 mm. It contains a large haploid nucleus surrounded by a nuclear membrane. The nucleus is within the cytoplasm enclosed by a plasma membrane. Another membrane the vitelline membrane surrounds the plasma membrane.

83) Define fertilization and where it occurs?

- ❖ **Fertilisation** is a process whereby the nucleus of a male gamete fuses with the nucleus of a female gamete to form a zygote. This occurs **in the upper part of the oviduct** after copulation.

84) Although a single ejaculation contains millions of sperms, how many sperms will fertilize the ovum?

- ❖ Although a single ejaculation contains millions of sperms, only **one** will fertilise the ovum.

85) What is ovulation?

- ❖ Ovulation is the release of egg from the ovary to the oviduct (fallopian tube)

86) After ovulation how many days does the ovum can remain?

- ❖ After ovulation the ovum can remain viable for 8-24 hrs before it dies.

87) How many days the sperms can remain viable within the female reproductive tract?

- ❖ The sperms can remain viable for 2-3 days within the female reproductive tract

88) Define implantation.

The attachment of the blastocyst to the wall of the uterus by the villi is called **implantation.**

89)Where does the implantation occur?

- ❖ Normally implantation takes place in the uterus

90)How many days it took for implantation to occur?

- ❖ The movement of the zygote from the oviduct to the time it gets implanted last for about **seven days.**

91) What is endometrium?

- ❖ Endometrium is the lining on the inner layer of the uterus.

92) Occasionally the zygote fails to move down the oviduct to the uterus but instead gets implanted into the walls of the oviduct where it develops. What is referred for this condition?

- ❖ This condition is referred to as **ectopic pregnancy** which is fatal if carried to term in most cases.

93)During implantation the blastocyst differentiates into three layers, name these three layers?

- ❖ During implantation the blastocyst differentiates into three layers namely the chorion, amnion and allantois.

94) Draw a well labelled diagram for the embryo membranes.

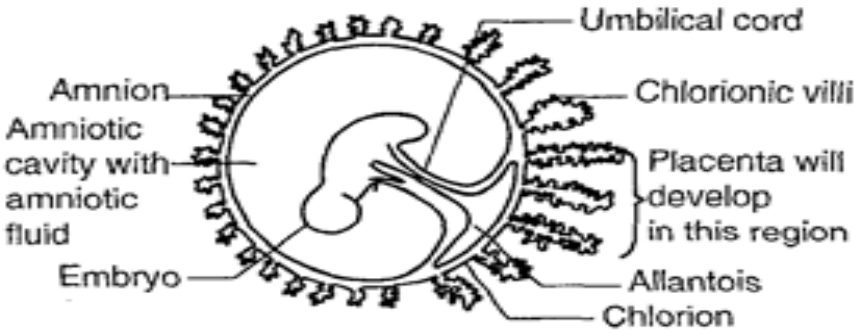


Fig. 3.45: Diagram illustrating relationship between the human embryo and its embryonic membranes

INSTRUCTOR: NUR MUBARAK

95) Define chorion.

- ❖ The chorion, which is the outermost, develops finger-like projections called **chorionic villi**. These villi grow into the endometrium

96) During the early stages of embryo development what are the sites for material exchange between embryo and maternal?

- ❖ During the early stages of embryo development, the **villi** form the sites for material exchange, between the embryo and maternal blood vessels in the uterine wall.

97)Explain the amnion.

- ❖ The amnion surrounds the embryo forming an **amniotic cavity** within which the embryo lies.

98)The amniotic cavity is then filled by a fluid secreted by the amnion called the amniotic fluid, what is the function of this fluid?

- ❖ Amniotic fluid provides a fluid environment which later suspends the foetus providing it with support. It also acts as a shock absorber hence protecting the foetus against mechanical injury.

99)List the layers that the placenta formed.

- ❖ The chorionic villi, allantois together with the endometrium form the placenta.

100) The embryo is attached to the placenta by a tube, name this tube?

- ❖ The embryo is attached to the placenta by a tube called the umbilical cord which increases in length as the embryo develops.

101) When the embryo does become foetus?

- When the placenta is fully formed, the embryo becomes a foetus, this is at about 3 months of pregnancy.

102) List what is allowed to pass through the placenta and what is not allowed to through the placenta.

- The table below shows the placental exchanges

What is allowed to pass through the Placenta	*What is not allowed to pass through the Placenta*
(a) From the mother to the foetus. (i) Oxygen. (ii) Digested food substances like; glucose, amino acids, fatty acids, glycerol. (iii) Vitamins. (iv) Mineral salts. (v) Mineral hormones. (vi) Water. (vii) Antibodies and antigens. (b) From the foetus to mother. (i) Carbon (IV) oxide. (ii) Nitrogenous waste products.	(i) All the blood cells. (ii) Plasma proteins. (iii) Most bacteria.

103) Define placenta.

- The **placenta** is a temporary organ found only in placental mammals and is the only organ in animals composed of cells derived from **two** different organisms, the foetus and the mother.
- The **placenta** is a discrete disc-shaped structure localised in one region of the uterus wall and as it develops it takes over from the trophoblastic villi as the principle site of exchange of materials after **12** weeks.

104) There is no direct connection between the foetal blood system and that of the mother. If the two systems were directly connected, what would happen?

- If the two systems were directly connected, the delicate blood vessels of the foetus would burst due to thehigher blood pressure in the maternal circulatory system.

105) During pregnancy, the placenta takes over the role of producing hormones, oestrogen and progesterone, list the role of these hormones.

- **Table : Summary of major functions of human oestrogen and progesterone during pregnancy**

Oestrogen	*Progesterone*
Growth of mammary glands Inhibits Folical Stimulating Hormone release Inhibits prolactin release Prevents infection in uterus Increases size of uterine muscle cells Increases ATP and creatine phosphate formation Increase sensitivity of myometrium to oxytocin	Growth of mammary glands Inhibits Folical Stimulating Hormone release Inhibits prolactin release Inhibits contraction of myometrium

106) Define gestation period.

- **Gestation period is** the period between conception (implantation) and birth

107) List the gestation period of: man, mice, rabbits, elephant.

- Man it is 9months, mice it is 22 bays, rabbits it is about 30 days and elephant it is about 18 months.

108) What is the first organ formed in the human embryo?

- Heart

109) What is miscarriage?

- If birth occurs before the completion of six months the baby will not survive and this is referred to as **miscarriage.**

110) What isabortion?

- In the case where foetal development is interfered with either chemically or physically such that the foetus is expelled the condition is called **abortion.**

INSTRUCTOR: NUR MUBARAK

111) When does the abortion allowed?

- It is permitted only in circumstances where doctors agree that continuing a pregnancy would endanger a woman's mental or physical health.

112) What is apremature birth?

- If birth occurs after the seven month but before full term, such is referred to as a **premature birth.**

113) Name the hormone that controls the construction of uterus wall during birth(parturition).

- This hormone is called**oxytocin**

114) Define Caesarean Delivery.

- Caesarean delivery is a surgical incision of the abdominal and uterine walls for the delivery of the offspring.

115) Define parental care.

- Parental care is the attention given to the new born by providing food and protection.

116) In which gland does the milk is produced?

- In mammals, the milk is produced by the **mammary glands** under the influence of lactogenic hormones e.g. prolactin.

117) Mother's milk is the best food for the offspring, why?

- Because it contains all the nutrients needed for the growth and development of the body.

118) Define colostrum.

- From the first to the third day the mammary glands produce colostrum, a yellowish fluid which contains proteins and lactose.

119) Define secondary sexual characteristics.

- Secondary sexual characteristics are physiological, structural and mental changes which are associated with femininity and masculinity.

120) What are hormones controlled by the secondary sexual characteristics?

- These are controlled by **oestrogen** in females and **androgens** in males. The period during which these changes occur is referred to as **puberty.**

121) What is The FSH stimulates in males?

- The FSH stimulates the synthesis of sperms.

122) What is the LH stimulates in males?

- The LH also known as Interstitial Cell Stimulating Hormone (ICSH) stimulates interstitial cells to release the male hormones known as **androgens.**

123) What is the main androgen?

- **Testosterone** is the main androgen. It stimulates the development of the secondary sexual characteristics.

124) List the secondary sexual characteristics in males.

- In males these characteristics begin to show up mostly at the **age of fourteen.** These include the deepening of the voice, growth of the hair in pubic region and armpit regions and sometimes on the chin. The body becomes more masculine, the testes enlarge and begin to produce sperms. The production and maturation of sperms is stimulated by FSH.

125) What is the FSH stimulates in females?

- The **FSH** stimulates the ovary to release hormone **oestrogen** and triggers the development of the Graafian follicles in the ovary. As the level of oestrogen increases, it triggers the onset of the secondary sexual characteristics

126) What is the LH stimulates in females?

- The **LH** triggers the mature Graafian follicles to burst open to release a mature ovum (ovulation). After ovulation, hormone progesterone starts being produced. Unlike in males the production of the gonadotrophic hormones is not continuous i.e. it is produced periodically in cycles.

127) List the secondary sexual characteristics in females.

- The characteristics include development of the mammary glands, enlargement of the pelvic girdle and widening of the hip. Also, hair grows in the pubic and armpit regions and the entire body becomes feminine. Internally the ovaries mature and start releasing eggs and the girl begins to menstruate.

128) Define menstrual cycle.

- In females, gamete production is a cyclical activity with a periodicity of approximately **28** days. It is called the **menstrual cycle.**

129) Define menopause.

- Majority of women stop to ovulate at the age of 45. This is described as **menopause.**

130) What is the major cause of male infertility?

- The major cause of male infertility is low sperm count.

131) Define Sexually Transmitted Infections.

- Sexually Transmitted Infections are diseases transmitted through sexual intercourse.

132) List sexually transmitted infections.

- Gonorrhoea, herpes, syphilis, trichomoniasis, hepatitis, candidiasis and Acquired Immune Deficiency Syndrome (HIV/AIDS).

133) DefineGonorrhoea.

- **Gonorrhoea** is a disease of the genital organs caused by a bacterial infection

134) What is the causative agent for Gonorrhoea?

- The infection is caused by gonococcus bacteria called ***Neisseria gonorrhea*** which infect the urethra in males and the vaginal tract in the females.

135) What is the incubation period of Neisseria gonorrhoea?

- Incubation period of *Neisseria gonorrhea* is from 2-14 days.

136) What are the symptoms of this diseases?

- Symptoms manifest in form of **itching of the urethra**, **a yellowish discharge** and **pain when urinating** in males. In females these symptoms are not clear but unusually **vaginal odour** should alert the person of the infection.

137) How does Neisseria gonorrhoea control and treated?

- Control should also involve public education on dangers of indiscriminate sexual contacts and regular screening and treating of people who might be having the disease and are not seeking medical attention. Condoms can be used for prevention.Gonorrhea infection can be treated completely in our health clinics. The drugs used usually are antibiotics which must be administered by a qualified doctor.

138) Define syphilis.

- Syphilis is an acute disease which affects the genital organs of both females and malescaused by a **spiral shaped bacterium** (spirochaetes) called ***Treponema pallidum*.**

139) What is the incubation period of *Treponema pallidum?*

- Incubation period for *Treponema pallidum* is from 7-90 days or usually three weeks.

140) Explain the transmission of treponema pallidum.

- It is a contagious disease spread through sexual intercourse. It could also be transmitted through blood transfusion. Infants may contract the disease during birth or through the placenta if the mother has the disease and has not been treated before the seventh month of pregnancy.

141) What are the symptoms of this disease?

- The acute phase of the disease is called **primary stage** and manifests itself by the presence of a chancre or a solitary painless ulcer on genital or mucous membranes. The **secondary stage** occurs after six months and manifests itself as rashes or mucous patches. Macules (discoloured spots) and papules (pimples on skin) may appear on hands, feet, oral cavity, lips and genital areas. The last stage is the **tertiary phase.** At this stage the disease becomes systemic affecting the whole body. When the meninges are attacked the victims show signs of insanity. The tertiary phase could occur after several years.

142) Explain how the disease control and treatment does.

- It is easier to treat syphilis if the infection is detected in the primary phase. This **treatment** is by use of any broad spectrum antibiotics. Re-examination after every six months to a year is done to confirm total cure. Secondary and tertiary phases are very difficult to treat and need specialised medical care. **Control involves:** avoiding indiscriminate sex. Use of condoms and encouraging positive behaviourial change at individual level may help in steming the spread of the disease.

143) Define trichoniasis.

- Trichomoniasis is a disease that infects genital organs of both males and females caused by a protozoa called ***Trichomonas vaginalis.***

144) How does the Trichomoniasis spread?

- Trichomoniasis is a contagious disease which spreads by sexual intercourse and through contaminated linen.

145) What are the symptoms of the Trichomoniasis?

The infection causes itching of the urethra in males and vaginal itch in females. There is also discharge in the males which is not easily noticeable. In females there is a yellow smelly discharge.

146) What is the incubation period for Trichomoniasis.

- The incubation period for Trichomoniasis is 5 to 28 days

147) Explain the treatment and control of trichomoniasis.

- Trichomoniasis can be treated and cured if the infected couple are properly diagnosed and the correct antibiotics administered. **Control** involves avoiding sharing of linen, avoiding indiscriminate sex and high personal hygiene in the genitals.

148) Define candidiasis.

- **Candidiasis**is an infection caused by yeast-like fungus called *Candida albicans.* It is also known as 'thrush'. It mainly affects genital organs of women and men.

149) What are the symptoms of this disease?

- **Vaginal Candidiasis** causes itching and burning sensation of the genital organs. This may be accompanied by a white discharge from the vagina which does not smell.

150) How does this fungus spread?

- The fungus is usually transmitted through sexual contact.

151) Explain the treatment and control of this disease.

- Treatment is administered by use of anti-fungal drugs. Once infected control includes avoiding use of strongly scented medicated soaps or disinfectants that might alter the pH medium of the birth canal.

152) Define hepatitis.

- **Hepatitis** is a condition that describes the inflammation of the liver. It is caused by a virus which attacks liver cells eventually causing damage in the liver.

153) There are two main types depending on the causative virus, name these?

- There are two main types depending on the causative virus, that is, viral hepatitis type A and type B.

154) List the symptoms of this disease.

- Symptoms include nausea, severe loss of appetite, jaundice and flu-like symptoms, but fever is rare.

155) How does the hepatitis B transmitted?

- This type is highly infectious and is usually transmitted through sexual contacts, blood transfusion, sharing contaminated razors and unsterilised syringes used mainly by drug addicts; kissing and contaminated instruments used by dentists and barbers.

156) Where does Hepatitis B virus found?

- Hepatitis virus type B is present in body fluids such as urine, saliva, semen, milk and even transplacental transmission is possible.

157) What is the incubation period of Hepatitis B virus?

- Incubation period is between 2-6 months.

158) How does this disease control?

- Both the hepatitis types are best controlled by use of vaccines especially in children because once infected the viruses are **not easily** cleared by use of antibiotics. It is also necessary to observe high standards of hygiene, avoiding sexual contacts with infected persons and other causative agents.

INSTRUCTOR: NUR MUBARAK

159) Define Herpes.

- Herpes is a contagious disease which is spread by sexual intercourse caused by a virus called *Herpes simplex.*

160) What are the symptoms of herpes simplex?

- *Herpes simplex* is a disease that manifests itself by lesions on the skin and mucous membrane of buccal cavity, vagina canal and conjuctiva. In males the lesions are found on the head of the penis. These lesions are painless

161) How does herpes spread?

- Herpes is a contagious disease which is spread by sexual intercourse, kissing and contaminated needles and syringes.

162) Explain the treatment and control of herpes.

- There is no known treatment for herpes, but exposure to the disease can stimulate the body immune system to acquire partial resistance to the disease. *Herpes simplex* (being a viral disease) does not respond to antibiotics. Avoid indiscriminate sex and contaminated needles and syringes.

163) What stands for the word AIDS?

- AIDS is an abbreviation for **A**cquired **I**mmune **D**eficiency **S**yndrome.

164) Define AIDS.

- Is a condition caused by a virus known as human immunodeficiency virus (HIV).

165) Where the disease (HIV-AIDS) was first identified?

- The disease was first identified among homosexuals and drug users in the United States of America.

166) Explain the mode of transmission of HIV-AIDS.

- The major way of transmitting HIV/AIDS is through sexual intercourse although it can also be spread through blood transfusion, transplant and by use of contaminated surgical instruments. Infected mothers can transmit HIV/AIDS to babies during birth and through breast milk.

167) What are the signs of HIV-AIDS?

HIV/AIDS manifests itself in adults by major and minor signs. The major signs include chronic diarrhoea for more than one month and eventual loss of more than 10% of the body weight. The minor signs include constant and persistent

cough for more than four weeks, generalised skin infections, herpes zoster and herpes simplex characterised with generalised inflamed lymph nodes.

168) Explain the preventation and cure of HIV-AIDS.

- ❖ HIV/AIDS is a major killer disease with no treatment. So the only way to avoid infection by the HIV/AIDS virus is through positive behaviour change in the following ways:
- ✓ Avoidance of indiscriminate sex.
- ✓ Avoidance of situations that expose you to high risk of infection, such as excessive intake of alcohol, drug addiction, some cultural practices like wife inheritance, female genital mutilation and traditional circumcision.

Other ways of controlling the spread is by avoiding blood transfusion unless the blood has been screened for HIV virus. There should be no sharing of tooth brushes, razors or other implements contaminated with blood and fresh body fluids.
Otherwise there are drugs that can be taken by HIV/AIDS sufferers to alleviate the conditions. These are the **anti-retrovirals.** It should be noted that these are only used to prolong the life of the infected individuals. Anti-retroviral drugs are not a cure for HIV/AIDS.

INSTRUCTOR: NUR MUBARAK

169) List the advantages of Asexual Reproduction.

- ❖ Good qualities, the new plants mature faster, the plant depends on its own activity to reproduce asexually, and they are able to survive temporarily under unsuitable conditions, do not encourage competitors.

170) List the disadvantages of asexual reproduction.

- ❖ Undesired qualities, may not be able to withstand changing environmental conditions, over-crowding and stiff competition.

171) List the advantages of sexual Reproduction.

- ❖ Desirable variations, the variants often show hybrid vigour and also high adaptability to environmental condition,

172) List the disadvantages of sexual reproduction.

- ❖ This becomes difficult in cases where certain organisms are **isolated** from one another. This method may produce individuals exhibiting **undesirable qualities** which may sooner or later become eliminated.

173) List the types of a sexual Reproduction.

- ❖ There are **three types** of asexual reproduction namely:
  a) Binary fission in amoeba.
  b) Spore formation in *Rhizopus.*
  c) Budding in yeast.

174) Define binary fission.

- ❖ This method involves the splitting (fission means splitting) of the original cell into two similar daughter cells.

- Binary fission is a complex process that includes internal re-organisation, division of the nucleus **(karyogamy)** and cytopolasmic division **(cytogamy).** Briefly, the nucleus divides into two, then the cytoplasm divides to form two daughter cells. Binary fission is common in amoeba, plasmodium and bacteria.

175) What is a spore?

- A spore is a small reproductive unit which is usually microscopic and unicellular containing a small amount of cytoplasm and a nucleus. Spores are produced by bacteria, most fungi and some groups of green plants such as mosses and ferns.

176) What is Rhizopus?

- Rhizopus is a saprophytic fungus which grows on substrate like bread, rotting fruits and other decaying organic matter

177) What is mycelium?

- The vegetative body is called **mycelium** which consists of many branched threads called hyphae.

178) Define stolons.

- The horizontal hyphae are called **stolons**

179) What is sporangiophore?

- The hyphae which grow vertically are called the **sporangiophore.**

180) Define budding.

- Budding is a form of asexual reproduction in which a new individual is produced as an outgrowth (bud) of the parent, and is later released as a self-supporting, identical copy of the parent.

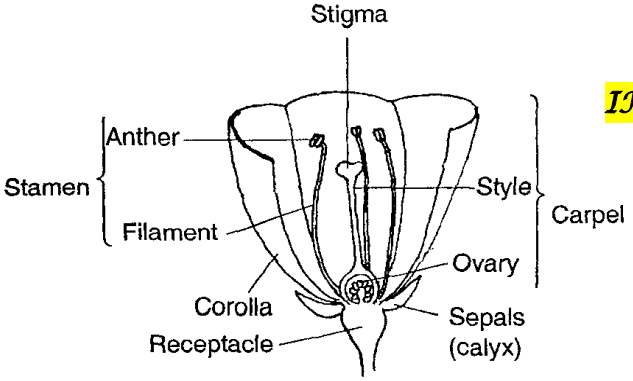
181) What is the reproductive organ of the plant?

- Flower

182) What does the flower is made up of?

- A flower is made up of a flower stalk **(pedicel),** the apex of the flower stalk **(receptacle)** to which are attached the four groups of floral structures, namely the calyx on the outside, corolla (the coloured parts), the male parts **(androecium)** and the female parts (the **gynoecium** or the **pistil).**

183) Draw a well labelled diagram of a flower?



INSTRUCTOR: NUR MUBARAK

184) What is the calyx made up of?

- The calyx is made up of sepals, which are usually green.

185) What is known as for where the sepals are free?

- Where the sepals are free, they form a **polysepalous** calyx

186) What is known as for where the sepals are fused?

- When fused they form a **gamosepalous** calyx.

187) What is the function of calyx?

- The calyx protects the inner parts of the flower especially during bud development.

188) What is corolla is made up of?

- The corolla is made of **petals** which are brightly coloured, large and conspicuous especially in insect pollinated flowers where they attract insects for pollination.

189) Differentiate between gamopetalous and polypetalous.

- If the petals are fused, the corolla is said to be gamopetalous, and if they are free the term **polypetalous**

190) What is androecium?

- **Androecium:** is the male part of the flower and is made up of one or more **stamens.**

191) What are two parts that stamens made up of?

- The stamen consists of two parts, the long stalk-like structure, the **filament,** which bears the **anther** at its tip.

192) What the anther consists of?

- The anther consists of four pollen sacs, which contain pollen grains. These contain the male gametes.

193) Define gynoecium?

- **Gynoecium (pistil):** This consists of carpels that form **the female reproductive organ of the flower.**

194) What is the carpel consists of?

- A carpel consists of the ovary, the style and the stigma.

195) What are the types of gynoecium depending on the number of carpels?

- **Monocarpous** gynoecium has one carpel while **a polycarpous** gynoecium is one with two or more carpels

196) Differentiate between apocarpous and syncarpous?

- The **polycarpous** gynoecium with free carpels is termed as **apocarpous** e.g. in rose and *Bryophylum.* When the carpels are fused together the gynoecium is termed as **syncarpous** e.g. *Hibiscus.*

197) List and define the terms used in describing of a flower.

- **Other Terms Used in Describing a Flower**

a) **Complete flower** - one with all the four floral parts present, namely calyx, corolla, androecium and gynoecium. When one part or more of these are absent, the flower is said to be incomplete.
b) **Unisexual flower** - one with only one of the reproductive parts. It may be either a male or female flower. **Staminate flower** - a male flower. **Pistillate flower** - a female flower.
c) **Monoecius plant** - when both male and female flowers are borne on the same plant, the plant is said to be **monoecius** e.g. maize, oil palm. However, there are cases when plants bear either male or female flowers. These plants are also known as male or female plants and are described as **dioecious** e.g. pawpaw.
d) **Hermaphrodite (bisexual) flower -**has both the male and female reproductive organs e.g. Hibiscus.
e) **The calyx and corolla -** are known as the **non-essential parts** of a flower while androecium and gynoecium are essential parts.
f) **Regular (actinomorphic) flower -**those that can be divided into two similar halves by any vertical section passing through the centre e.g. morning glory. These types of flowers are radially symmetrical.
g) **Irregular (zygomorphic) flower -** can be divided into two equal halves in one particular plane only e.g. crotalaria. Such are bilaterally symmetrical.
h) **Pedicillate flower** - flower with a stalk.
i) **Solitary flower** - those that occur singly while those that grow in clusters make an inflorescence.

198) Define pollination.

- **Pollination is** the transfer of pollen grains from the anther to the stigma

199) Name and differentiate the two types of pollination.

- When the transfer is from the anther of one flower to the stigma of another flower but of the same species it is called **cross-pollination.** If the transfer of the pollen grains is from the anther to the stigma of the same flower, or the same plant it is referred to as **self-pollination.**

200) List the agents of pollination.

- Insects, wind, water, birds, animals.

201) What would the ovules and ovary form?

- The ovule forms the **seed** while the ovary develops into a **fruit.**

202) Name the hormone caused by the increase in size of the fruits?

- **Gibberellins**

203) During fruit formation, what would the wall of the ovary become?

- During fruit formation, the wall of the ovary becomes the **pericarp** or fruit wall

204) The pericarp is usually made up of three layers, name these layers and define each one.

- An outer layer **epicarp**, a middle layer, the **mesocarp** and an inner layer**endocarp.**

205) What is a fruit?

- A fruit is described as a fully grown fertilised ovary containing fully developed seeds.

206) In certain plants such as pineapples and bananas, fruit development takes place without fertilisation. No seed development is therefore noticed. What is known as for these plants?

- parthenocarpy.

207) Differentiate between seed and friut?

- A seed has one scar while a fruit has two scars.

208) If all the seeds and fruits produced by a plant germinated and grew into plants around the parent plant, what this could lead?

- This could lead to competition for light and nutrients

209) List the agents of dispersal of seeds and fruits.

- Animal dispersal, water dispersal and wind dispersal.

210) What did you understand for this chapter?

THE END OF CHAPTER TWO

QUESTIONS AND ANSWERS

INSTRUCTOR: NUR MUBARAK

BIOLOGY FORM FOUR

QUESTIONS AND ANSWERS

CHAPTER THREE

GENETICS

1) **Define genetics.**
   - **Genetics :** is a branch of biology which is the study of **heredity** and **variation.**
2) **What is heredity?**
   - **Heredity** is the passing of characteristics from parents to their offspring.
3) **What is the science genetics attempts?**
   - The science of genetics attempts to explain why organisms differ from one another and at the same time show similarities within the same species
4) **Define variation.**
   - **Variation** is the observable differences among living organisms.
5) **List the types of variation.**
   - The two types of variation are: continuous variation and discontinuous variation.
6) **Define discontinuous variation and give examples.**
   - Discontinuous variations are distinct and clear cut differences of individuals with no intermediate forms.

INSTRUCTOR: NUR MUBARAK

Examples include:

- In human population an individual's is either male or female.
- Ability to roll the tongue, an individual can either roll the tongue or not.
- **Blood groups**: an individual have one of the four blood-groups A, B, AB or O, There are no intermediates.
- **Albinism**: one is either an albino or not.
- Some people have **a free ear lobe** while in others it is attached. Similarly the presence of **long hair** in the **nose** and on the **ear pinna** is also discontinuous variations. Discontinuous variation is also observed in plants. For example, a pawpaw tree is either male or female.

7) **Define continuous variations and give examples.**
   - Continuous variations: The differences b/w the individuals are not clear-cut. There are intermediates or gradations b/w any two extremes.

- **Examples include:** height, mass, skin pigmentation, intelligence as well as many important characteristics in animals and plants cannot be separated into two forms.

8) **Differentiate between continuous variation and discontinuous variation.**

- The table below show the difference between continuous and discontinuous variation:

No	Continuous variations	Discontinuous variations
1	They have intermediate forms	They have no intermediate forms
2	*Characteristics that show continuous variations are controlled by many genes.*	*Characteristics exhibiting discontinuous variations are controlled by one or two major genes.*
3	*The physical expression of these genes is influenced by interaction of the genes and environmental factors.*	*The physical expression of these genes is not influenced by environmental conditions*

9) **List the causes of variation.**

- The causes of variation are: a) gamete formation b) fertilization c) mutation

10) Define chromosomes.

- In the nucleus there are a number of long thread-like structures called **chromosomes.**

11) Define chromatids.

- Each chromosome is made of two parallel strands called **chromatids.**

12) Define centromere.

- Each pair of chromatid is connected at one point by a structure called **centromere.**

13) Where does the chromosomes found?

- Chromosomes are present in the nucleus all the time,

14) Define homologous chromosomes.

- In body cells, chromosomes occur in pairs. The member of each pair is called a **homologous chromosome.**

15) The diploid number of chromosomes of human somatic cell is 46, what its haploid number of chromosomes in gametes?

- 23chromosomes in the gametes.

16) Define genes.

- **Gene** is the basic unit of heredity. Or a **gene** is a section of the DNA on the chromosome made of chains of bases along the DNA strand.

17) Define gene loci.

- **Gene loci** are the definite position of genes on the chromosomes.

18) The gene was in the form of a nucleic acid molecule, name this molecule?

- **Deoxyribonucleic acid** (DNA).

19) Francis Crick and James Watson, worked out the DNA structure. They found that DNA is a complex molecule composed of three different components. List these three components.

- These are; **a five-carbon sugar, a phosphate molecule** and **a nitrogenous base.**

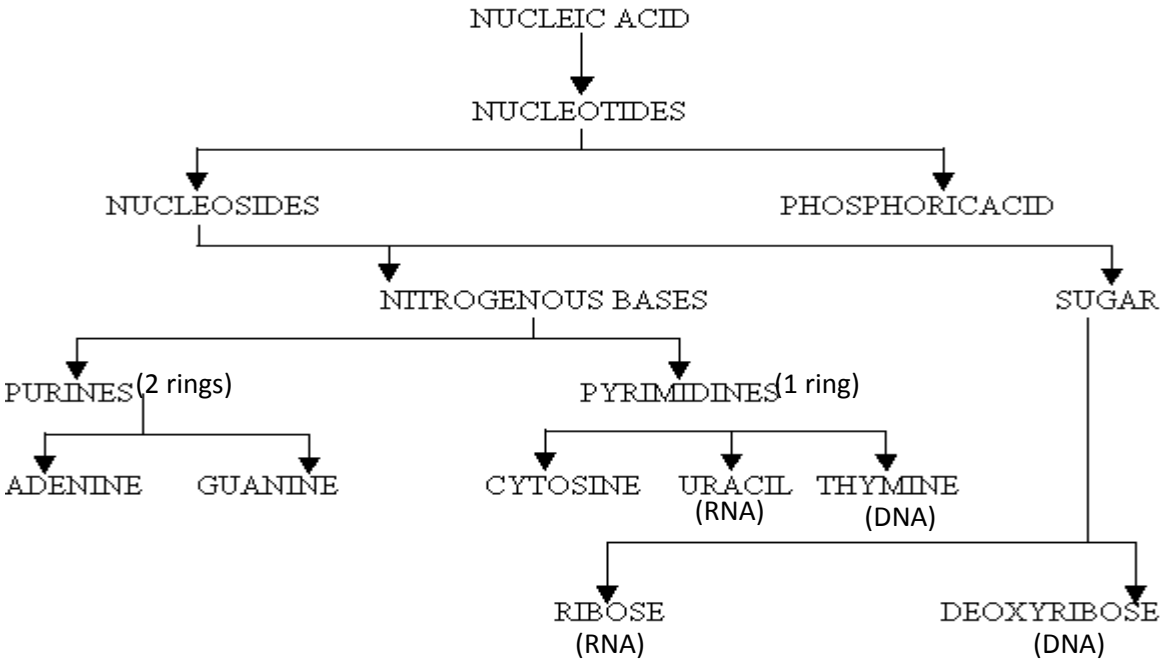
20) Define nucleic acids.

- Nucleic acids: are polymers of nucleotides held by phosphate bridges.

21) Define nucleotide.

- Nucleotide is the combination of **a five-carbon sugar, a phosphate molecule** and **a nitrogenous base.**

22) Draw the types of nucleotides.



23) Draw a short section of the DNA molecule with two strands untwisted to show the positions of the bases, sugars and the phosphate molecules.

- The figure below shows

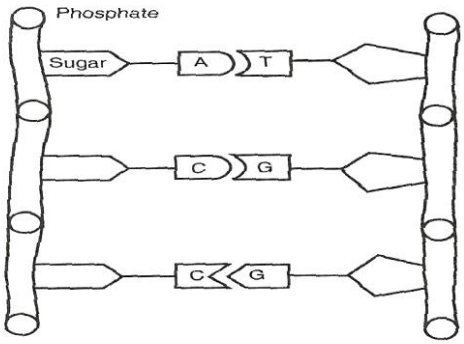


Fig. 1.7(b): The untwisted DNA strand

INSTRUCTOR: NUR MUBARAK

24) What is the role of DNA?

The DNA is an important molecule because it:

- ❖ Stores genetic information in a coded form.
- ❖ Enables transfer of genetic information unchanged to daughter cells through replication.
- ❖ Translates the genetic information into the characteristics of an organism through protein synthesis.

25) Explain the DNA replication.

❖ **DNA Replication**

Hereditary material must be passed on to the next generation.

When DNA is due to replicate:

a) The double helix unwinds and the strand unzips this is due to the weakness of hydrogen bonds.
b) The base pairs separate at the hydrogen bonds.
c) Each of the original strands serves as the template is copied out onto new strand.

26) What is the DNA molecule basically responsible?

❖ The DNA molecule is basically responsible for protein synthesis in the cells.

27) What is the difference between structural protein and functional protein?

❖ **Structural proteinmolecules** determine the structure of the cell and therefore the organism, while **functional proteinmolecules** such as enzymes and hormones control the functioning of the cell.

28) Define codon.

❖ The set of a base triplet is known as **a codon**

29) Where does the protein synthesis occur?

❖ Protein synthesis takes placein **ribosomes** found in the cytoplasm.

30) Since DNA molecules are confined to the cell nucleus, there has to be means of communicating the DNA information to the ribosomes where protein synthesis occurs.The cell has got a special molecule that mediates between the DNA in the nucleus and the cytoplasm. Name this molecule.

❖ This molecule is also a nucleic acid molecule and is known as Ribonucleic acid (RNA).

31) Define transcription.

❖ **Transcription** is the process by which DNA molecule is copied into complementary strand of (mRNA).

32) List the types of RNA.

❖ There are three types of RNA: mRNA, rRNA and tRNA.

33) List the differences between DNA and RNA.

- ❖ Differences between DNA and RNA

DNA	RNA
1) Has deoxyribose sugar	Has ribose sugar
2) Is double stranded	Is single stranded
3) Confined in the nucleus.	Found in nucleus and cytoplasm
4) Has organic bases, cytosine, guanine, adenine and **thymine**	Has organic bases cytosine, guanine, adenine and **uracil**

34) **What is the father of genetics?**

- ♣ An Austrian monk known as **Gregor Mendel** is considered to be the **father of Genetics**

35) Why Mendel is considered to be the father of genetics?

- ★ Because of his pioneering work on inheritance.

36) Mendel carried out various breeding experiments and observed the variations in different characteristics of the garden pea. List these characteristics.

- ★ The characteristics include:

- Height of the sterns - tall or dwarf
- Texture of seed coat - yellow or green
- Colour of seeds - purple or white
- Texture of pods - smooth or wrinkled
- Colour of pods - green or yellow
- Position of flower - axial or terminal

INSTRUCTOR: NUR MUBARAK

37) Name Mendel's first law of heredity?

- ★ The Law of Segregation.

38) What are the factors attributed that the Mendel to success?

✸ Mendel's success can be attributed to the following:

1. He used favourable materials, i.e. the pea plant which is normally self- fertilised. This made it easy for him to employ cross-fertilisation at will.
2. The pea plant he used had several observable contrasting characteristics (traits).
3. His study focused on particular traits while those before him had been attempting to determine wholesome heredity of each organism.
4. He kept accurate data on all his experiments and from the analysis of his data he was able to formulate definite hypotheses.

39) What is the monohybrid inheritance involves?

✸ It involves the transmission of just one pair of contrasting characteristics (traits) such as tallness and dwarfness for height, or smooth and wrinkled for shape of seed coat.

40) Define monohybrid cross.

- ★ **Monohybrid cross**: - is a cross-used to determine one contrasting characteristic.

41) What is the law of segregation states that?

- ♣ **The law of segregation** states that: the characteristics of an organism are determined by internal factors which occur in pairs.

42) Define the following terms: gene, character, trait, alleles, genotype and phenotype.

- **Gene** is the basic unit of heredity.
- **Character** - a structure, function, or attribute determined by a gene or group of genes
  - i.e. the appearance of the seed coat in Mendel's garden pea studies
- **Trait** - the alternate forms of the character
  - i.e "smooth" or "wrinkled" peas
- **Alleles:** - are two separate forms of gene. or different forms of genes
- **Genotype** is the genetic constitution of an organism. Each organism carries two alleles per characteristic, two letters can represent each characteristic, and the two letters make up organism's genotype or set of alleles for a characteristic. Example: - a tall pea plants could have the genotype [TT] and a short pea plant could have a genotype [tt].
- **Phenotype** is the outward appearance of the organism. Example a pea plant with genotype [TT] has a tall phenotype and a pea plant with genotype Tt has also a tall phenotype also a pea plant with genotype [tt] has a short phenotype.

43) Define the following terms: homozygous, homozygote, heterozygous, heterozygote, dominant trait, recessive trait, complete dominance, incomplete dominance, codominace, multiple alleles, and polygenic traits.

- When the allelic genes are identical as in**TT** and **tt,** the condition is known as **homozygous.** An individual with such a condition is referred to as a **homozygote.**
- When allelic genes are not identical as in Tt, the condition is referred to as **heterozygous.** An individual with such a genotypic condition is referred to as a **heterozygote.**
- **Dominant trait** -a trait that shows in a heterozygote. E.g**T** in (Tt)
- **Recessive trait** - a trait that is hidden in a heterozygote. E.g**t** in (Tt)

A dominant gene is that which can express itself in both its homozygous (TT) and heterozygous (Tt) state. While a recessive gene is that which can only express itself in its homozygous state (tt).

The ratio 3 tall: 1 dwarf in the F_2 generation is characteristic of monohybrid inheritance where one gene is completely dominant over the other. This is **complete dominance.**

- **Incomplete Dominance** – One allele is not completely dominant over the other. White flower crosses with a red = **pink flower**.
- **Codominance –** Both alleles contribute to the phenotype. Red cow X White Cow = **Roan Cow.**
- **Multiple Alleles –** More than two alleles control the phenotype. Coat color of rabbits.
- **Polygenic traits** – Several genes control the trait. Skin color in humans.

44) What are the components of genic cross?

✸ The following are components of a genetic cross:

- The parental phenotypes
- The parental genotypes (the crossing x) should be shown here.
- The gametes (conventionally circled).
- The fusion process (fertilisation).
- The filial generation genotypes.

INSTRUCTOR: NUR MUBARAK

45) What is a punnet square?

✸ **A punnet square** is an alternative method of making genetic crosses.

46) A homozygous dwarf pea is self-pollinated what will be the genotype and phenotype of offspring?

Solution

1) Phenotype= Homozygous dwarf pea plant x Homozygous dwarf pea plant.
2) Genotype = tt x tt
3) Gametes= (t)(t) x (t) (t)
4) We use genetic cross

*The offspring genotype are all **tt***
And their phenotypes: all dwarf

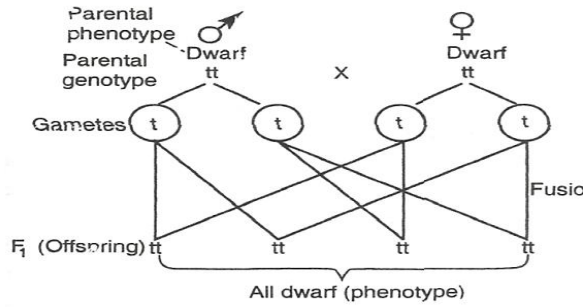


Fig. 1.11 (a): Inheritance of dwarfness trait

47) A homozygous tall pea is self-pollinated what will be the genotype and phenotype of offspring?

Solution

1) Phenotype= Homozygous tall pea plant x Homozygous tall pea plant.
2) Genotype = TT x TT
3) Gametes= (T)(T) x (T) (T)
4) We use genetic cross

*The offspring genotype are all **TT***
And their phenotypes: all tall

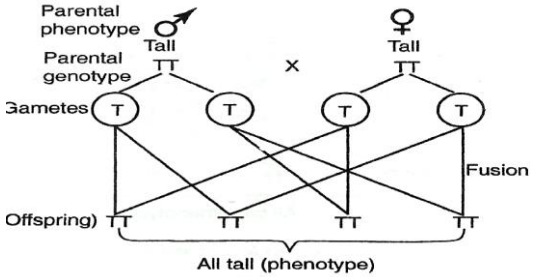


Fig. 1.11 (b): Inheritance of tallness trait

48) A homozygous tall pea plant is crossed with a homozygous dwarf pea plant, what will the genotype and phenotype of all the possible offspring in f2-generation?

Solution

1) Phenotype= Homozygous tall pea plant x Homozygous short pea plant.
2) Genotype = TT x tt
3) Gametes= (T)(T) x (t) (t)

We use genetic cross

INSTRUCTOR: NUR MUBARAK

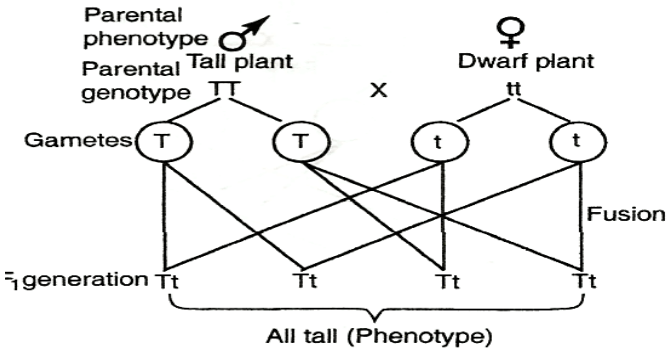


Fig. 1.12 (a): Cross between pure breeds

F_1 generation

1. Offspring genotype = all Tt.
2. Offspring phenotype = all tall hybrid.

A cross b/w tall hybrid offspring

1. Phenotype = Heterozygous tall plant x Heterozygous tall plant.
2. Genotype = Tt x Tt
3. Gametes = (T) (t) x (T) (t)

We use genetic cross

Instructor: Mubarak

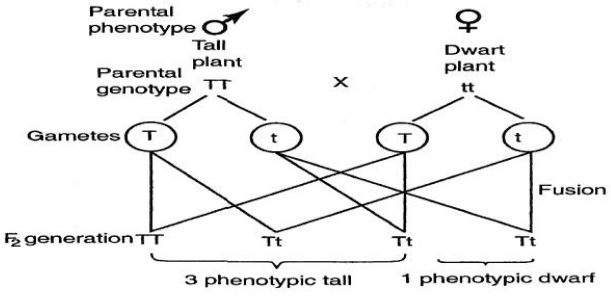


Fig. 1.12 (c): Results of F_1 selfing cross

2) Offspring F_2 phenotype =1 Homozygous tall, 2 Heterozygous tall and 1Homozygous short. Or simply **1:2:1.** Therefore, the probable ratio of tall offspring to short offspring is **3:1**, which is ¾ tall and ¼ short.

49) What is the scientific name of fruit fly?

- *Drosophila melanogaster*

50) Why Drosophila isconsidered a suitable organism for use in genetic experiments?

- The fruit fly is a suitable organism for genetic study due to the following reasons:

1. The female lays many eggs resulting in a large number of offspring. This increases the sample size for study. The larger the sample the more reliable the result.
2. Have many observable characteristics that are distinct and contrasting.
3. It is easily bred in the laboratory with minimum requirements.
4. It has a short generation time, that is, 10 -14 days. Therefore many generations can be studied in a short period.
5. Offspring can be crossed with their parents at will (backcrossing).
6. The flies are safe to handle because they do not transmit any known human diseases.

INSTRUCTOR: NUR MUBARAK

51) Solve the following monohybrid crosses:

- *A yellow color in peas is dominant to green peas, a homozygous yellow pea plant is crossed with a homozygous green pea plant, what will the genotype and phenotype of all the possible offspring in f2-generation? Dominant color = YY. Recessive color = yy*
- *In fruit flies long wings [L] are dominant to short wings [l] two heterozygous long winged fruit flies both [Ll] are crossed, what are the genotypes and phenotypes of their offspring?*
- *A black dominant horse matted (BB) with white horse (bb), state the genotype and phenotype of their offspring in f2-generation? ?*
- *Homozygous brown eyed Rabbit (BB) is crossed homozygous blue eyed Rabbit (bb) what is the possible genotype and phenotype of their offspring in f2-generation? ?*
- *A dominant black cat (BB) is crossed with a recessive white Cat (bb); state the phenotypic ratio of their offspring in f2-generation? ?*
- *A homozygous dominant green Pod (GG) is crossed with homozygous yellow Pod (gg), what is the possible genotype and phenotype of their offspring in f2-generation?*

52) What is the genotype and antigen of each of blood group?

Table: Human blood groups and their genotypes

Blood group (phenotype)	*Genotype*	*Antigens*
A	AA, AO	A
B	BB, BO	B
AB	AB	A and B
O	00	0 (Zero)

Note: Gene A and gene B have equal degrees of dominance, that is they are **co-dominant,** and will both express themselves when present together as in the AB blood group. Gene O is recessive and will only express itself in the homozygous condition.

53) A marriage between a man of blood group A **and a woman of blood group** B **will produce children of all four blood groups, draw genetic diagram to show this.**

Solution

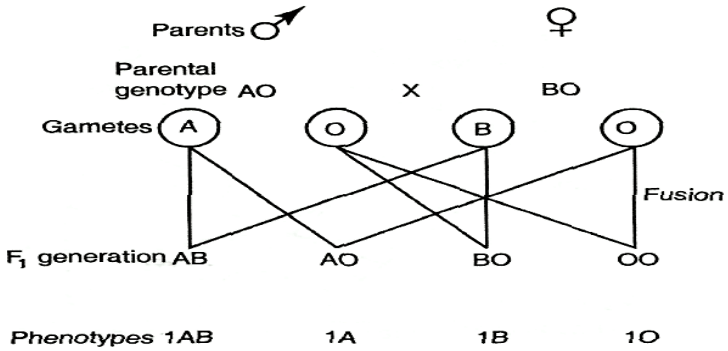
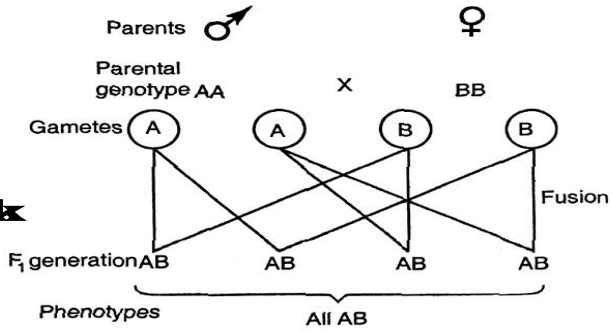


Fig. 1.19(a): Inheritance of groups in the ABO system

54) A man who is homozygous for blood group A married to a woman who is homozygous for blood group B would produce children who would only be AB, draw a genetic diagram to prove this.

Solution



Instructor: Mubarak

55) Solve the following:

- A marriage between a man of blood group **A** and a woman of the same blood group cannot produce children of blood group B.
- A man of blood group B and a woman of the same blood group cannot produce children of blood group A.
- Parents who belong to blood group O cannot produce children with blood group A or B.

56) Explain the inheritance Rhesus factor?

- In human beings, possession of Rhesus antigen makes one Rh+ (Rhesus positive) while absence of Rhesus antigen makes one Rh- (Rhesus negative). The presence of Rh antigen is due to a dominant gene which is dominant over the gene for its absence.If one of the parents is Rh+ then all the children will be Rh+. Rh- children will only result if both parents are Rh-

57) If blood from a Rhesus positive (Rh+) person is transfused into a person without the Rhesus factor, what will be the blood of the recipient?

- The recipient produces antibodies against the Rhesus factor of the donor. This causes agglutination of red blood cells of the recipient.

58) If a woman who is Rhesus negative is married to a Rhesus positive man, what would happen at that time?

- If a woman who is Rhesus negative is married to a Rhesus positive man, when she becomes pregnant the child will be Rhesus positive. Rhesus antigen can cross the placenta into the mother's bloodstream prompting the mother's immune system to produce Rhesus antibodies. When antibodies get into the foetal circulation, an antigen-antibody reaction takes place and the red blood cells of the foetus are destroyed (haemolysed). In the second pregnancy the amount of antibodies are more and cause a lot of damage to the foetal red blood cells resulting in death. This is called Haemolytic**disease** of the new born *(Erythroblastosisfoetalis).*

59) Define test cross.

- A cross between an individual of unknown genotype with an individual of recessive genotype is known as **a test cross**.

60) What is back cross?

- A test cross where an offspring is crossed with one of its parents is known as **back cross**.

61) Where do the genes that determine whether a child becomes a male or female are located?

- The genes that determine whether a child becomes a male or female are located on the specific pair of chromosomes called **sex chromosomes** which are of two types, X and Y chromosomes (named after their shape). The remaining 22 pairs of chromosomes are called **autosomes** and are responsible for other inheritable characteristics. A male human being carries the XY (heterogametic) while a female carries XX (homogametic) combination.

62) The sex of a child is a matter of chance and depends only on whether a spermatozoon that fertilises the ovum carries X or Y chromosome. During fertilisation there are four possible genotypic combinations. Two out of these four combinations (XX) result in a girl while the other two combinations (XY) result in a boy. There is therefore a 50% chance that fertilisation can result in either XX (girl) of XY (boy). Draw this a genetic diagram.

Solution

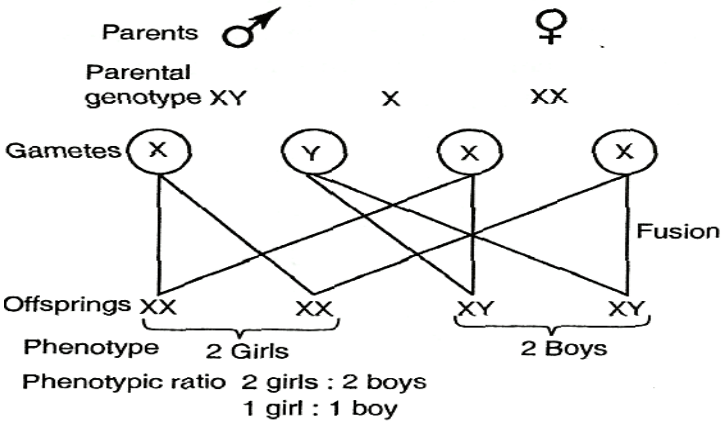


Fig. 1.21: Sex determination in man

INSTRUCTOR: NUR MUBARAK

63) Define linkage genes.

✸ The genes found on the same chromosome are called **linked genes.**

64) Define sex-linked genes.

✸ All genes located on the sex chromosomes are said to be **sex-linked genes.**

65) In humans there are *a few genes located on the Y chromosome which control the characteristics that are exclusively male. List these characteristics.*

✸ *These are **premature baldness** and **tuft of hair in the ear pinna and in the nose***

66) **What are the Characteristics controlled by genes located on the X chromosome**?

✸ These include **colour blindness** and**haemophilia.** These characteristics can arise in either males or females

67) Explain colour blindness.

✸ Red-green colour-blindness is the inability to distinguish red and green colours by some people. This trait is linked to the X chromosome. The gene that determines normal colour vision is dominant over that for colour-blindness.

68) A marriage between a colour-blind man and a woman homozygous for normal colour vision results in their daughters being carriers but with normal colour vision.he daughters are described as carriers because they are heterozygous and colour blindness is suppressed by the dominant gene for normal colour vision. All the sons of the two parents however, are normal. **Draw this a genetic diagram.**

Solution

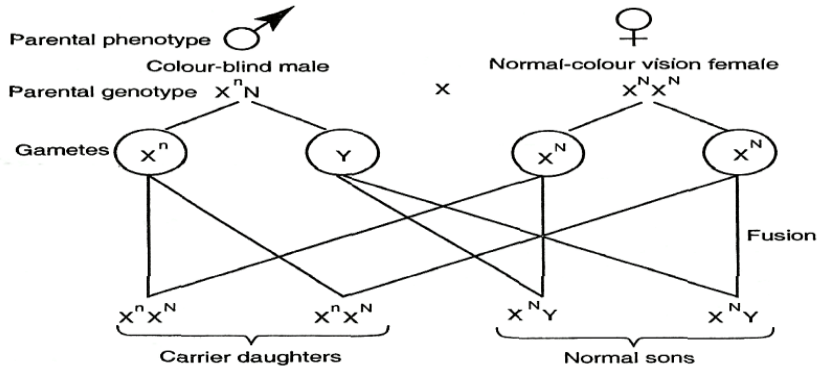
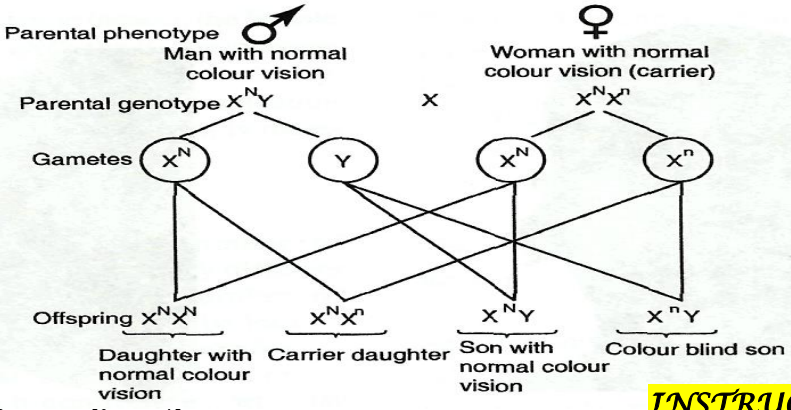


Fig. 1.23(a): Inheritance of colour blindness



INSTRUCTOR: NUR MUBARAK

69) What is a pedigree?

✸ **A pedigree** is a record, in table form showing the distribution of one or more traits in different generations of related individuals.

70) Draw the inheritance of colour-blindness through two generations by a pedigree.

Solution

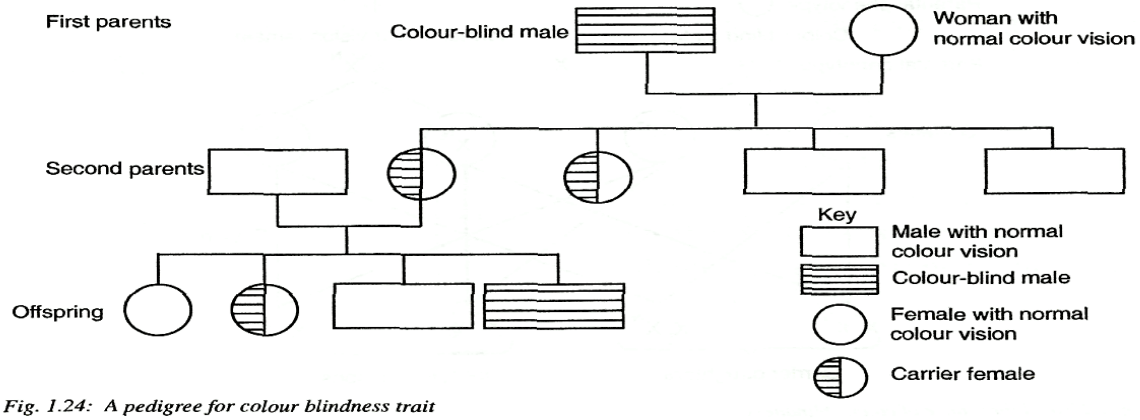


Fig. 1.24: A pedigree for colour blindness trait

71) Explain hemophilia.

✸ This is another sex-linked trait where the blood of the sufferer takes an abnormally long time to clot.

72) If a normal man is married to a carrier woman for haemophilia, there is a probability of that if their child is a boy he will be a haemophiliac and if a daughter, she will be a carrier. Draw this a genetic diagram.

Solution

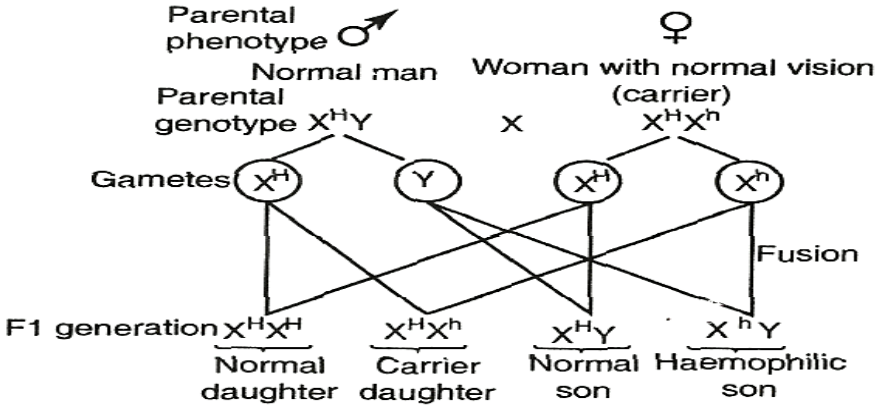


Fig. 1:25: Inheritance of haemophilia in man

73) Define mutation.

✸ **Mutation** is a change in the genetic makeup of an organism.

74) Define mutagens.

✸ The substance that can increase the rate of the mutation is called **Mutagen**.

75) What is mutant?

✸ The unusual characteristics of individual is called **mutant.**

76) List the types of mutation.

✸ There are **two types** of mutations 1) Chromosomal mutations and 2) Gene mutation

77) Define chromosomal mutation and list its types?

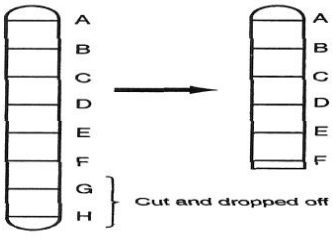
✸ Chromosomal mutations(chromosome aberrations) involve changes in the structure or number of the chromosomes. There are **five types** of chromosome mutations:deletion, duplication, inversion, translocation and non-disjunction.

78) Explain each of the following with the aid of diagram: deletion, duplication, inversion, translocation and non-disjunction.

Deletion- some sections of the chromatids break off and fail to reconnect to any of the chromatids. as seen in figure 3.26(a).

Duplication- a section of a chromatid replicates and adds an extra length to itself and in so doing sets off genes is repeated as shown in figure 3:26 (b)

Inversion - a chromatid breaks at two places. When rejoining, the middle piece rotates and rejoins in an inverted position.



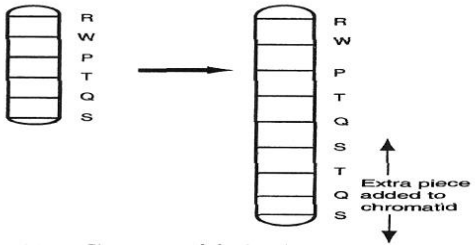


Fig. 3.26(a): Chromosomal deletionFig. 3:26(b): Chromosomal duplication

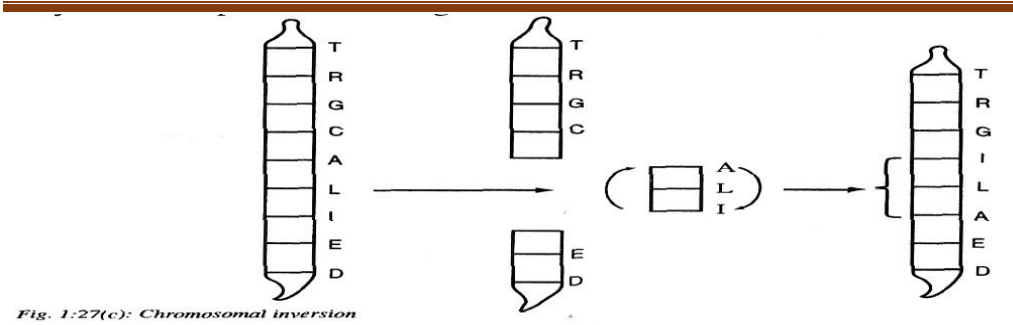


Fig. 1:27(c): Chromosomal inversion

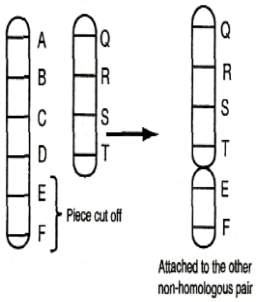


Fig. 1:27(d): Chromosomal translocation

Translocation- a section of one chromatid breaks off and becomes attached to another chromatid but of the non-homologous pair. See figure 3.26(d).

Non-disjunction- failure of homologous chromosomes to segregate during meiosis. It leads addition or loss of one or more whole chromosomes.

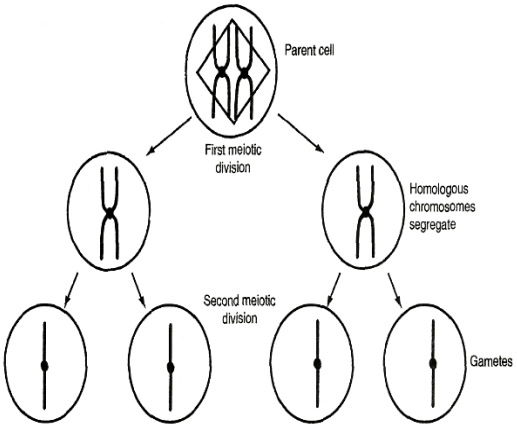


Fig. 1:28(a): Normal meiosis

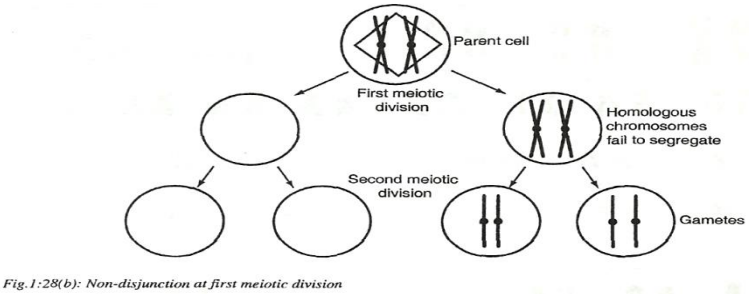
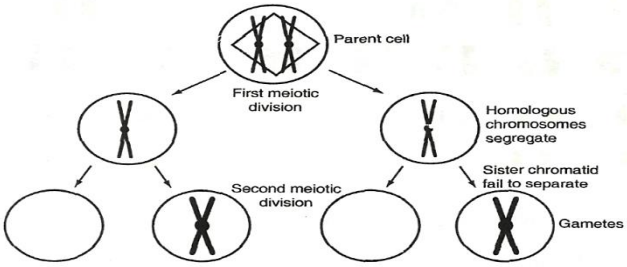


Fig. 1:28(b): Non-disjunction at first meiotic division



79) Explain Down syndrome.

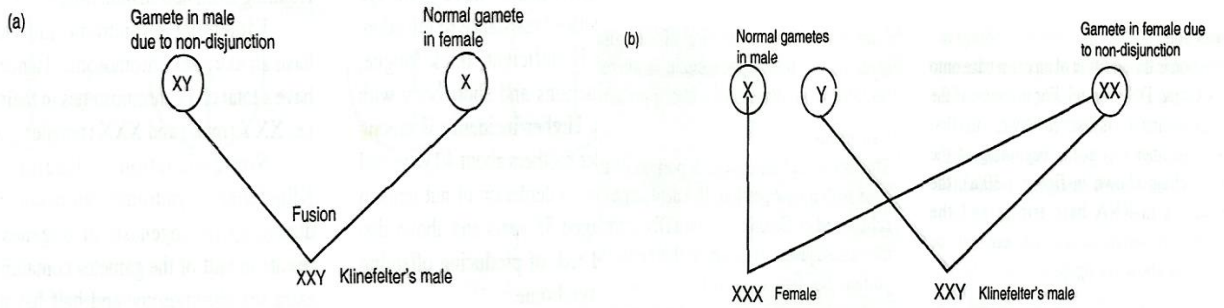
- Non-disjunction causes **Downs's syndrome** where there is an extra somatic chromosome number 21. . Higher incidence is among children of older mothers about 40 years old and may be due to depletion of nutrients in eggs. Fathers aged 55 years and above also have increased risk of producing offspring with Downs's syndrome.

80) List the symptoms of Down syndrome.

- Slit-eye appearance, reduced resistance to infection, always mentally deficient, thick tongue, cardiac malfunctions and short body with stubby fingers.

81) Explain klinefelter's syndrome.

- Klinefelter's syndrome individuals have an extra sex chromosome. Hence they have a total of 47 chromosomes in their cells i.e. XXY (male) and XXX (female). Non-disjunction leading to Klinefelter's syndrome can occur either during spermatogenesis or oogenesis.



82) List the symptoms of klinefelter's syndrome.

- Symptoms of Klinefelter's syndrome in males include infertility due to lack of sperm production, underdeveloped testes and reduced facial hair. They are also usually taller than average with signs of obesity. Persons with XXX constitution are females who appear relatively normal in most characteristics.

83) Explain tuner's syndrome.

- Turner's syndrome is where an individual lacks one sex chromosome, hence there are only 45 chromosomes (XO or YO) in the cells instead of the normal 46 chromosomes. YO zygotes do not develop due to the absence of many vital genes. Individuals with this syndrome are females

84) List the symptoms of tuner's symptoms.

- They are infertile due to lack of ovaries and small uterus, no breast development and are short in stature.

85) Define polyploidy.

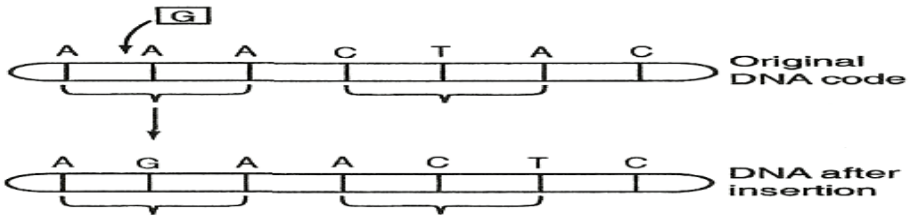
- Polyploidy – describes a nucleus that contains more than two sets of chromosomes. it is rare in animals, but common in plants. It results from non-disjunction.

86) Define gene mutation and list its types.

- **A gene mutation** involves a change in the structure of a gene. Gene mutations are also referred to as point mutations. There are **four main types** of gene mutations namely insertion, substitution, inversion and deletion.

87) Define each of the following with the aid of diagram: insertion, substitution, inversion and deletion.

Insertion is the addition of an extra base onto an existing DNA strand.



Deletion is the removal of a gene portion.

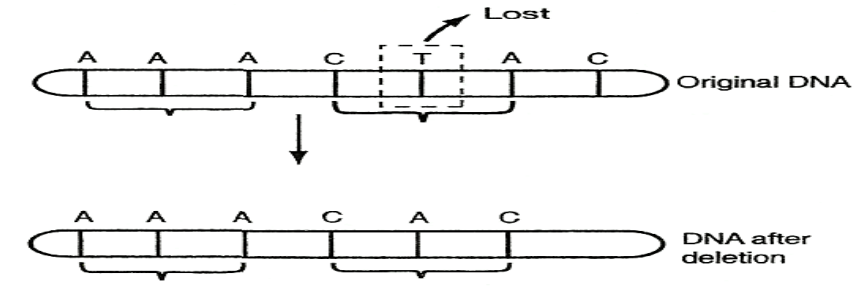
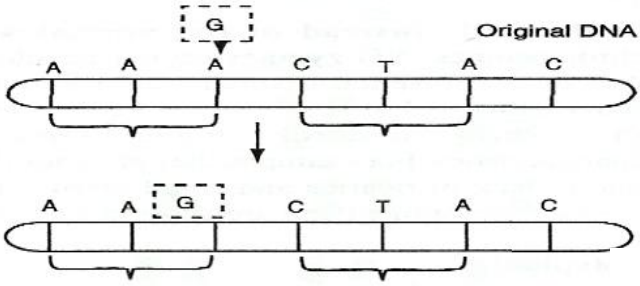


Fig. 1.30 (b): Deletion

Substitution is the replacement of a portion of the gene with a new portion.



Instructor: Mubarak

Inversion- If a portion of the DNA strand carrying AC rotates through 180°, that portion is said to be inverted, see figure

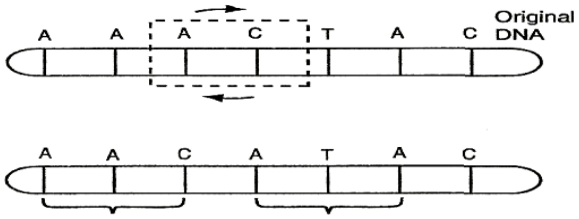


Fig. 1.30 (d): Inversion

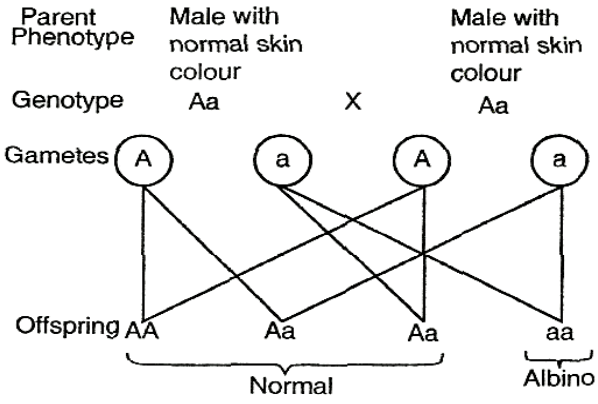
88) List the disorders due to gene mutation.

- The disorders include albinism, sickle-cell anaemia, haemophilia, colour-blindness.

89) Define albinism.

- **Albinism** is a condition where the synthesis of the skin pigment, melanin, fails and ischaracterised by a light skin, white hair and pink eyes.

90) In a family an albino child can be bom if both parents are carriers of the recessive gene. Draw this a genetic diagram.



INSTRUCTOR: NUR MUBARAK

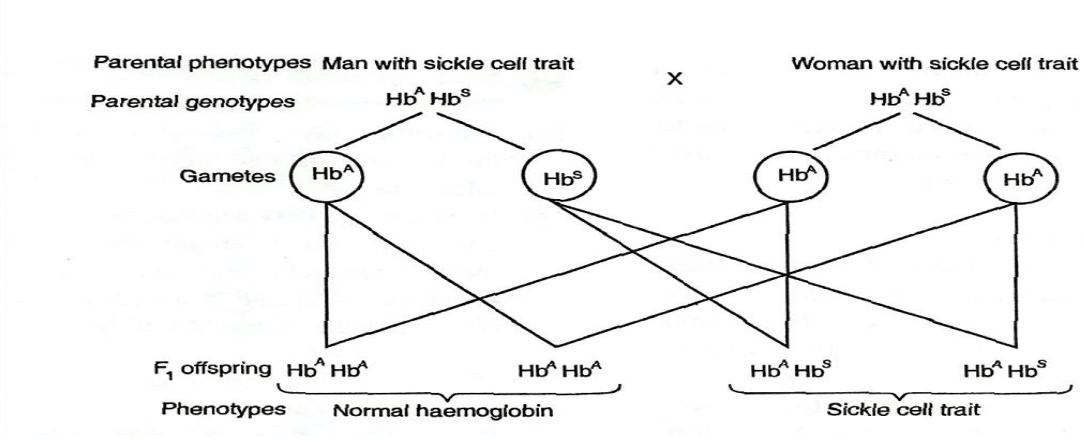
91) Explain sickle cell anemia.

- Normal haemoglobin type A consists of two polypeptide chains. In the sickle-cell condition one amino acid, glutamic acid, is replaced by another acid valine, in each of the two polypeptide chains of the haemoglobin molecule. The resulting haemoglobin, known as haemoglobin type S.

92) List the symptoms of sickle cell anemia.

- Most of the individual's **red blood cells are therefore sickle-shaped** and the person frequently experiences **oxygen shortage** to the body tissues. The sickle-shaped cells are not able to squeeze through capillaries. Severe pain in the joints, arms, legs, and the stomach.

93) If a man with sickle-cell trait (carrier) marries a normal woman, the probability that any of the offspring will carry the sickle-cell trait is 1/2.draw this a genetic diagram.



94) Compare between normal hemoglobin and defective hemoglobin.

Table: Comparison between Normal Hemoglobin and HemoglobinHbS

Normal Haemoglobin (Hb A)	*Defective Haemoglobin (Hb S)*
I. A position in each polypeptide chain is occupied by glutamic acid.	1. The same position in each polypeptide is occupied by valine.
2, Does not easily crystalise in low oxygen concentration such as in the capillaries.	2. Easily crystalises in low oxygen concentration.
3. The haemoglobin is efficient in oxygen loading and transportation.	3. Is not efficient in oxygen loading and transportation.
4. The red blood cells carrying them have the normal biconcave shape.	4. The red blood cells carrying them are crescent or sickle-shaped.

95) List the Practical Applications of Genetics

- Knowledge of genetics has been put to practical use in areas ranging from plants and animal breeding, blood transfusion, genetic counselling.

96) Define in breeding.

- **Inbreeding-**breeding closely related individuals to increase chances of desired qualities being exhibited.

97) What is cross breeding?

- **Crossbreeding-** cross between two genetically dissimilar lines to reduce chances of harmful recessive alleles.

98) Define transgenic.

- **Transgenic-** An organism that contain a foreign gene.

99) List the advantages of breeding.

Advantages of breeding

INSTRUCTOR: NUR MUBARAK

1) Early maturity in both animals and plants.
2) Resistance to disease
3) Increased length of productive season.
4) Adaptations to local conditions such as amount of rainfall, soil type and temperature.
5) Higher yields in terms of meat, milk, egg and fruit production.
6) Ease of harvesting as in case of coffee, mango and banana.

100) Define genetic counselling.

- **Genetic counselling** is the provision of information and advice on genetically inherited disorders, their risks and outcomes.

101) Define genetic engineering.

- **Genetic engineering** - identification of a desirable gene, altering, isolating and transferring it from one living organism to another.

102) What are the fields applied for genetic engineering.

- Genetic engineering has been applied in the following fields: 1) **Farming 2) Medicine:** a) production of insulin b) medicinal proteins c) production of vaccines

103) What is gene therapy?

- **Gene therapy** is the replacement of faulty genes with normal ones aimed at correcting genetic disorders.

104) Define cloning.

- **Cloning**: is a type of reproduction where a group of cells arise from a single individual cell without fertilization. The offspring are called clones and are genetically identical.

105) What is genome?

- **Genome** is the total genetic content of any cell in an organism. It comprises of all genes on all the chromosomes

106) Define gene mapping.

- **Gene Mapping**: is identifying specific positions occupied by specific genes on a chromosome.

107) What are the importance of human genome project?

(i) Identification of defective genes, hence facilitating their correction.

(ii) Identification of genes that are susceptible to certain diseases so that individuals can take preventive measures.

(iii) Predicting the protein that a gene produces.

108) What did you understand for this chapter?

THE END OF THE QUESTIONS AND ANSWERS OF GENETICS

BIOLOGY FORM FOUR

QUESTIONS AND ANSWERS

CHAPTER FOUR

ECOLOGY

1) **Define Ecology.**
   - **Ecology** is the study of the interrelationships of organisms to each other and to their environment.
2) **What is the environment constitute?**
   - **The environment** constitutes the surroundings of an organism both living **(biotic)** and non-living (**abiotic** or physical).
3) **What is the difference between Autecology and Synecology?**
   - If the study involves a single species it is referred to as **Autecology** while the study of many species is called **Synecology.**
4) **The knowledge gained from ecology is applied in many spheres of life, list these spheres.**
   - ✓ Sustainable food production.
   - ✓ Conservation of natural resources, pollution control
   - ✓ Control of diseases and pests.
   - ✓ Prediction of adverse weather patterns.
   - ✓ Population control.
   - ✓ Ecotourism.

INSTRUCTOR: NUR MUBARAK

5) ***Define biosphere***.
   - **Biosphere** is the part of earth and atmosphere inhabited by living organisms.
6) **What is habitat?**
   - **The habitat is a specific locality with a particular set of conditions where an organism lives.**
7) **List the types of habitat.**
   - **Habitats are categorized into two**: terrestrial (land) habitats and aquatic (water) habitats.
8) **Define ecological niche.**
   - An **ecological niche** is the position that an organism occupies in a habitat.
9) **Define community.**
   - **A community** refers to all organisms belonging to different species that interact in the same habitat.
10) **Define ecosystem and give examples.**
   - **An ecosystem** is a natural unit composed of abiotic and biotic factors whose interactions lead to a **self-sustaining** system e.g. a small pond or a large ecosystem such as a tropical forest.
11) **Define Biomass and give examples.**

- **Biomass** is the total dry weight of living organisms at a particular trophic level (feeding level) or per unit area e.g. total weight of a maize crop per hectare or weight of zebras in a park.

12) Define carrying cappacity and give example

- **carrying capacity** is the maximum number of organisms an area can comfortably support without depletion of the available resources e.g. the maximum number of cattle a paddock can hold without overgrazing.

13) Factors in an ecosystem are divided into two groups name each one?

- Factors in an ecosystem are divided into **two groups** namely **abiotic and biotic** factors.

14) Define abiotic factors and give examples.

- **Abiotic factors** are the non-living environmental factors which affect the distribution of organisms like light, temperature, atmospheric pressure, salinity, humidity, soil texture, pH and wind.

15) What is the main source of energy for all life on earth?

- The sun is the main source of energy for all life on earth.

16) What is used for A photographic light meter and Seechi disc?

- **A photographic light meter** is used to measure light intensity while the **Seechi disc** measures light penetration in water.

17) What is Energy?

- **Energy** is the ability to do work.

INSTRUCTOR: NUR MUBARAK

18) Define temperature.

- **Temperature** is the degree of hotness or coldness of a substance.

19) What is thermometer?

- **Thermometer** is an instrument used for measurement of a temperature.

20) What is a barometer?

- **Barometer** is an instrument for measuring atmospheric pressure.

21) Define humidity.

- **Humidity** is the amount of water vapour in the atmosphere.

22) What is the instrument used to measure humidity?

- The instrument used to measure humidity is the **wet and dry bulb hygrometer.**

23) What is wind?

- Wind is moving air.

24) What is used for a wind vane or a windsock?

- **A wind vane or a windsock** is used to determine direction of prevailing wind.

25) What is measured by the speed of wind?

- The speed of wind is measured by **anemometer.**

26) What is PH?

- **PH (hydrogen ion concentration)** pH is the measure of how acidic or alkaline water is in aquatic habitat or soil solution.

27) Explain composition?

- ♣ If two different species require a common resource whose availability is limited, they are said to be in **competition** for it.

28) Differentiate between intraspecific composition and interspecific composition.

- ♣ Competition between individuals of the same species is known as **intraspecific** while that between individuals of different species is known as **interspecific competition.**

29) Define predation.

- ✸ **Predation** is the food relationship in which one organism kills another for food and feeds on it either wholly or in part.

30) What is the difference between predator and prey?

- ✸ The organism which kills another for food is referred to as the **predator** while the one killed is the **prey.**

31) Define parasitism.

- ♣ **Parasitism** is the relationship in which an organism obtains nutrients from another live organism without killing it.

32) What is parasite?

- ✸ The organism which lives on or in another live organism is called a **parasite**

33) Differentiate between ectoparisite and endoparasite.

- ✸ The parasites that lives on the host surface are known as **ectoparasites** e.g ticks while those found inside the body of the host are known as **endoparasites** e.g. plasmodium.

34) Define Saprophytism.

- ♣ **Saprophytism** is a type of nutrition where organisms obtain nutrients from dead organic matter hence causing decomposition.

35) Define saprophytes.

- ♣ **Saprophytes** are organisms which feed on died and decaying matters. And include fungi and bacteria.

36) What is nitrogen cycle?

- ♣ **Nitrogen cycle** is the cycling of nitrogen and its compounds in nature.

37) Define nitrogen fixation.

- ♣ **Nitrogen fixation** is the process by which the free atmospheric nitrogen is converted into a form that can be utilised by plants.

38) How the Biological nitrogen fixation does achieve?

- ♣ Biological nitrogen fixation is done by **nitrogen-fixing micro-organisms**. These include symbiotic bacteria like ***Rhizobhim*** of the root nodules of legumes. They convert nitrogen gas into ammonia which is then utilised by the plants to make proteins. Biological fixation is also done by **free-living bacteria** *e.g* ***Azotobacter*** and ***Clostridium,*** and some **algae** e.g *Anabaena,* ***Chlorella*** **and** ***Nostoc***. These organisms fix nitrogen into ammonia which is then converted to nitrates.

39)How the Non-Biological nitrogen fixation does achieve?

- ♣ Non-biological nitrogen fixation is achieved by lightning. During thunderstorms, the lightning energy combines atmospheric nitrogen with oxygen to form nitrous acid and nitric acid. These are then chemically converted into nitrates.

40) What is the natural source of energy?

- ♣ The sun is the natural source of energy.

41) Define producers.

- ✸ **Producers:** are the green plants.

42) Define the following terms: herbivorous, carnivorous and omnivorous.

- ♣ **Herbivorous** are animals that eat for plants.
- ♣ **Carnivorous** are animals that feed on flesh of another animal.
- ♣ **Omnivorous** are animals that feed on both flesh of animals and plants.

43) Define the following terms: scavengers, producers, primary consumers, secondary consumers, tertiary consumers and quaternary consumers.

- ♣ **Scavengers:** are those which feed on died bodies of both herbivores and carnivores.
- ♣ **Producers:** are the green plants.
- ♣ **Primary consumer:** is the herbivore which feed on directly on the plants.
- ♣ **Secondary consumer:** is the carnivore which feed on directly on herbivore.
- ♣ **Tertiary consumer:** is the scavenger which feed on the secondary consumer.
- ♣ **Quaternary consumer:** is the one which feeds on the tertiary consumer.

44) What is trophic level (feeding level)?

- ♣ The feeding levels of producers and consumers are referred to as **trophic level (feeding level).**

45) What is a food chain?

- ✸ The linear flow of energy from a producer to a consumer is known as **food chain**.

46) Give two examples about food chain.

- ✸ Grass → Grasshopper → Bird
- ✸ Napier grass → Goat ⟶ Human

47) What shows the arrow in the food chain and food web?

- ✸ The arrow is a food chain and food web always shows the direction of energy flow.

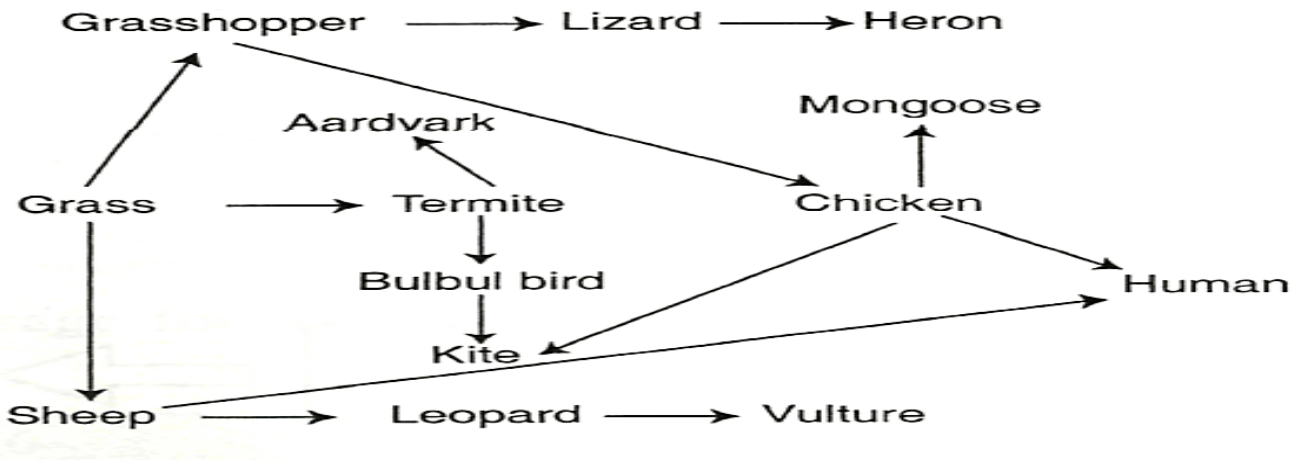
48) Define food web?

- ✸ **Food web:** is the feeding relation between the organisms and ecosystem.

It is usually made up made up of several interrelated food chains.

INSTRUCTOR: NUR MUBARAK

49) By looking at the food web below, name the producer? And how many primary consumers are there in this food web?



- **Grass** is the producer, and there are **three primary consumers** in this food web.

50) Define Ecological pyramid?

- **Ecological pyramid** is graphical representation of trophic structure of ecosystems.

51) List the types of ecological pyramids.

- There are **three types** of ecological pyramids namely **pyramid of numbers**, **pyramid of biomass** and **pyramid of energy.**

52) Define pyramid of numbers.

- **Pyramid of Numbers-** the graphic representation of numbers of individuals at various tropic levels.

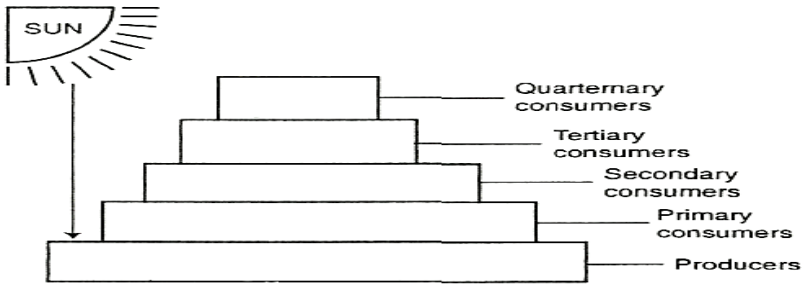
53) Define pyramid of biomass.

- **Pyramid of Biomass-** the graphical representation of the relationship between the amounts of biomass at different trophic levels. **Biomass** – the total mass of all the living organisms in a given area.

54) Define pyramid of energy.

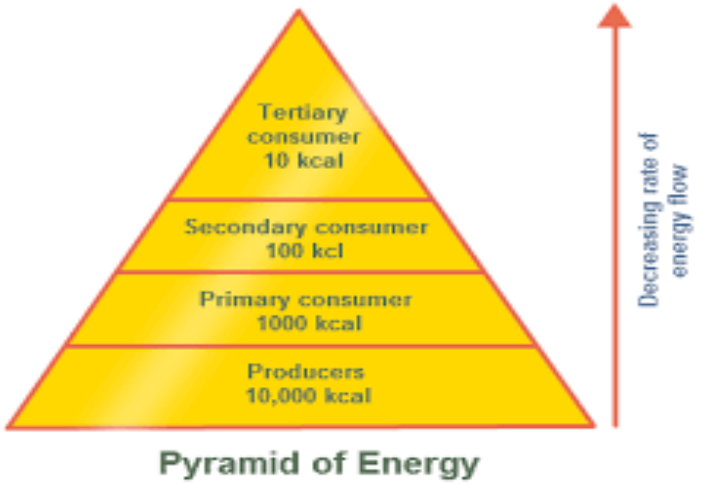
- **Pyramid of energy-** a graphic representation that shows the amount of energy that is available at each trophic level.

55) By looking at the figure below what is the natural source of energy?



- The sun

56) By looking at the figure below, what is the energy that the producers have?



Pyramid of Energy

- The producers have 10,000 Kcal

57) Define population.

- A population is a group of organisms belonging to the same species in a particular habitat.

58) List the characteristics of population.

- Density, dispersion and population growth

59) Define each of the following terms: Density, dispersion and population growth.

- ✓ **Density:** is the number of individuals per unit area.
- ✓ **Dispersion:** is the spread or distribution of organisms in a habitat.
- ✓ **Population growth:** is the rate of increase in numbers.

60) What is a sample?

- A **sample** is a small number of individuals taken from a habitat that is representative of the whole population.

61) What are the methods used when sampling can be carried out?

- Quadrat method, Line transect, Belt transect, Capture - recapture method.

62) What is a quadrat?

- A quadrat is a square frame of known area made of wood or metal.

63) What is used for line transect method?

- A line transect method may be used to find out the distribution of species of plants in an area.

64) What is belt transect?

- A belt transect is taken by running two ropes parallel to each other and about one metre apart along the length of a plot.

65) Explain capture-recupture method.

- It is possible to estimate the total number of individuals in a population by repeated sampling. After selecting the study area determine its size and choose the organism to be studied.

INSTRUCTOR: NUR MUBARAK

66) What is adaptation?

- ♥ An **adaptation** is a change in an organism that increases its chances of survival in a specific environment.

67) Plants possess different adaptations based on their habitats, hence there are four main groups of plants name each of them.

- ✸ Xerophytes, mesophytes, halophytes and hydrophytes.

68) Define xerophytes.

- ♥ **Xerophytes:** are plants adapted to withstand a dry habitat.

69) What are characteristics of habitats of xerophytes.

- ♥ These habitats are characterised by the following conditions:

a. Unpredictable and poorly distributed rainfall which is usually less than 250 mm but hardly exceeds 350 mm per year.
b. Very high day temperatures but very low night temperatures which result in high diurnal temperature ranges.
c. They are windy.
d. Low humidity.

70) What are the adaptations of xerophytes to their habitats.

- ♥ **Adaptation of Xerophytes to their Habitats**

a) Leaves are **reduced in size,**This reduces the surface area over which transpiration occurs.
b) Shedding of leaves during drought to reduce surface exposed to transpiration.
c) Leaves have **thick waxy cuticle to** minimise the rate of cuticular transpiration.
d) Some leaves are **folded** to reduce rate of transpiration by not exposing stomata to environmental factors.
e) Some have **sunken stomata** which accumulate moisture in substomatal air spaces leading to low diffusion gradient thus reducing transpiration rate.
f) Most Xerophytes show **reduced number of stomata** that lowers the rate of transpiration.
g) Some xerophytes experience **reversed stomatal rhythm** (opening the stomata at night and closing them by day) to prevent excessive loss of water by transpiration.
h) Some plants have **deep roots** to absorb water from deep in the soil e.g. Acacia tree.
i) Other plants have **superficial roots** which grow horizontally close to the soil surface to absorb water after a short or light shower of rain.
j) Some plants store water in large parenchyma cells contained in **succulent** stems and leaves e.g. cactus which has a swollen stem.
k) Some xerophytes **have a very short life cycle** to evade drought, hence some survive as seeds or as underground penetrating organs e.g. corns and bulbs.

71) Define mesophytes.

- ♥ **Mesophytes:** A plant living under normal conditions of water supply or in well-watered soils.

72) What are characteristics of habitats of mesophytes?

The habitats of mesophytes have the following general characteristics:

- ♥ Adequate rainfall ranging from 950 mm-1800 mm that is distributed throughout the year.
- ♥ Humidity is relatively high.
- ♥ Thick clouds are common.
- ♥ Moderate to high temperatures, with low diurnal range.
- ♥ Less windy.
- ♥ Shallow water table.

73) What are the adaptations of mesophytes to their habitats?

- ♥ **Adaptations of Mesophytes to their Habitats**

a) for reduction of water loss while others are for increase of water loss.
b) They are also adapted to light conditions.
c) Trees grow tall due to competition for light.
d) Majority of mesophytes show leaf mosaic that minimise overlapping and overshadowing of leaves so that all leaves are exposed to light for photosynthesis.
e) Some mesophytes have waxy and glossy surfaces to reflect the strong light rays and drip off rain water. Examples of mesophytes are majority of the common terrestrial plants.

74) Define hydrophytes.

- ♥ **Hydrophytes**: Plants which normally grow wholly or partly in fresh water.

75) What are characteristics of habitats of hydrophytes?

- ♥ Their habitats are characterised by the following conditions:

1. They have low concentration of dissolved gases such as oxygen and the water medium is of low density.
2. Waves and currents are usually common.
3. Light is less abundant under water.

76) What are the adaptations of hydrophytes to their habitats?

Adaptations of Hydrophytes to their Habitats

1. Most emergent and floating types have broad leaves with maximum number of stomata on the upper surface. This provides a large surface area for gaseous exchange. The exposed stomata allow for quick loss of excess water through transpiration.
2. Their leaves have numerous and sensitive chloroplasts that photosynthesise under low light intensities.
3. Hydrophytes have large air-filled tissues (aerenchyma). The air in the aerenchyma reduces the density giving buoyancy to the plants and also assist in gaseous exchange.

4. They have poorly developed roots that lack root hairs to reduce absorption of water.
5. Flowers are raised above the water t o allow for pollination.

77) Define Halophytes. INSTRUCTOR: NUR MUBARAK

- ♥ **Halophytes:** plants which are able to tolerate very salty conditions in soil and marine water

78) What are characteristics of habitats of Halophytes?

- ♥ The habitats are characterised by the following conditions:

1. They have high concentration of mineral salts.
2. They have low concentration of dissolved gases especially in marine water.
3. Light intensity is low in marine water.
4. Currents and waves are common in seas. Note:Temperatures in marine environment are generally stable.

79) What are the adaptations of halophytes to their habitats?

Adaptation of halophytes to their habitats

a) Halophytes are faced with a problem of absorbing water from a medium which has a very high salt concentration. The water is thus not easily available to the plant, making the plant experience a physiological drought.
b) They overcome this problem in several ways.
c) They have root cells which concentrate a lot of salts in them and this enables them to take in water by osmosis in the normal way.
d) Some plants have salt glands that secrete excess salts. Also many of them have water storage tissues.
e) Most of the submerged halophytes are found close to the surface where there is sufficient light energy for photosynthesis. Those in deeper waters are capable of photosynthesising in low light intensities.
f) The reproductive adaptations include floating fruits.

80) Define adaptation.

- ♥ **Pollution** is the release of substances or forms of energy into the environment by human activities.

81) What is a pollutant?

- ♥ A **pollutant** is a substance mainly waste that contaminates air, water or soil.

82) List the three types of pollution.

- ♥ There are **three** main categories of pollution namely **air, water** and **soil** pollution.

83) What are the causes of Air pollution?

Causes of Air pollution include: INSTRUCTOR: NUR MUBARAK

(a) Sulphur based chemicals e.g. sulphur (IV) oxide (SO_2) and Hydrogen Sulphide (H_2S).
(b) Oxides of Nitrogen e.g. nitrogen (II) oxide (NO) and nitrogen (IV) oxide ($N0_2$)
(c) Smoke and Fumes. D) Dust d) Lead (Pb) f) Aerosols g) Noise

84) Explain Control of Air Pollution

INSTRUCTOR: NUR MUBARAK

1. Legislation

Governments need to enforce the relevant legislative acts on environmental pollution.
Automobiles should be fitted with filters and catalytic converters in their exhaust pipes to reduce emission of oxides of nitrogen, sulphur and carbon.
Industries manufacturing sulphuric and nitric acids should have long chimneys fitted with scrubbers to remove the acid gases.

1. Encourage the use of lead free fuels in motor vehicles.
2. Develop and encourage use of **renewable energy sources** e.g. solar and wind energy.
3. Use CFC free aerosols and appliances.
4. Use of biological control methods to control pests, diseases and weeds. This reduces reliance on non-biodegradable chemicals.
5. Encourage use of public means of transport as much as possible other than private cars. This minimises consumption of fossil fuels and emission of gas pollutants.
6. Smoking in public should be banned.
7. Ear muffs should be used in factories and *'jua kali'* workshops that generate loud noises.
8. The masses should be educated on the need for sustainable environmental management.
9. The government should be a signatory to global treaties on environmental conservation.

85) List the causes of water pollution

- **Sources of Water Pollution**

(a) Domestic Effluents (b) Industrial Effluents (c) Heat (d) Oil Spillage (e) Agro-chemicals (f) Lead (g) Mercury (h) Soil Erosion

86) Explain the control of water of pollution.

Control of Water Pollution

1. Legislation: The relevant legislation should be enforced and provide for heavy penalties. In addition, international treaties on environmental conservation should be adhered to.
2. Industries should control or treat the industrial effluents before discharge into water bodies.
3. Proper treatment and disposal of sewage: There should be separate systems for disposal of sewage and drinking water.
4. Encourage the use of unleaded petrol.
5. The public should be educated on correct amounts of inorganic fertilisers and pesticides to be used. They should be encouraged to use organic farming and biological control of pests.
6. Appropriate soil erosion control methods to be put in place such as building of gabions, terraces, mulching and growing of soil cover crops.

87) List the sources of soil pollution.

Sources of Soil Pollution

(a) Oxides of sulphur (b) Aerosols (c) Petroleum products (c) Petroleum products (d) Inorganic fertilisers (e) Solid Waste

88) Explain the control of soil pollution.

INSTRUCTOR: NUR MUBARAK

Control of Soil Pollution

All solid wastes should be sorted out according to manufacturer specifications, then appropriate disposal methods applied.

1. Recycle solid wastes
2. Household wastes that are biodegradable can be disposed in a compost pit to form compost manure for organic farming.
3. Combustible solid wastes e.g. old clothes, sanitary towels, hair should be burned in incinerators.
4. Discourage excessive use of agro-chemicals.
5. Biological control of pests and diseases to be encouraged.
6. Encourage pipeline transportation of petrol and petroleum products to minimise risk of spillage.

89) N.B Nuclear emissions can also cause soil, air and water pollution.

90) What nuclear energy is used for?

- ♥ Nuclear energy is used in the generation of electricity and propelling of nuclear war planes, nuclear propelled ocean vessels, space ships and submarines.

91) What are the Effects of Radioactive Emissions?

1. Increased mutation rates with increased abnormalities some of which are inheritable.
2. It causes cancer such as bone tumours and leukaemia.
3. Excess doses of radioactive emissions cause so much damage leading to death.

92) Explain the control of Radioactive Emissions.

- ♥ Due to potential dangers of nuclear waste disposal and energy management, the control is only by dialogue between nations with the nuclear technology.

93) What is a disease?

- ♥ **A disease** is a disordered state of a tissue, organ, system or organism, during which its functions are not carried out normally.

94) List the causative agent, mode of transmission, symptoms and Prevention and treatment of the disease cholera.

- ♥ **Cholera** is a disease by a bacterium known as *Vibrio cholerae.* The bacteria are normally found in contaminated water and are passed on by flies to food, thereby contaminating the **food.**

Symptoms

- ♣ Violent diarrhoea and vomiting.
- ♣ Severe abdominal pains.
- ♣ General body dehydration due to the high frequency of defection.
- ♣ Loss of appetite.

Prevention and treatment

- ♥ Sanitary disposal of faeces.
- ♥ Personal hygiene should be maintained.
- ♥ Domestic water should be boiled or chlorinated.
- ♥ Oral rehydration salts should be administered treatment.
- ♥ Administering of antibiotic drugs in order to kill the bacteria.

95) List the causative agent, mode of transmission, symptoms and Prevention and treatment of the disease typhoid.

- ♥ **Typhoid** is a disease caused by a bacterium called **salmonella typhi.** The bacteria are passed out in either urine or faeces.

Symptoms

- ✸ Fever and headaches.
- ✸ Abdominal pain and vomiting.
- ✸ Severe diarrhoea.
- ✸ Dry cough and dehydration.

INSTRUCTOR: NUR MUBARAK

Prevention and treatment

- ♥ Proper disposal of faeces and urine.
- ♥ Domestic water should be boiled or chlorinated.
- ♥ Hands should be washed clean before eating.
- ♥ Fruits should be washed with clean water before being eaten.
- ♥ Administering antibiotics.

96) List the causative agent, mode of transmission, symptoms and Prevention and treatment of the disease Entamoeba histolytica.

- ♥ Amoebic dysentery is caused by **Entamoeba histolytica.**

Symptoms

- ✓ Formation of ulcers on the colon wallleading to diarrhoea.
- ✓ Faeces that contain blood.
- ✓ Dehydration and fever.
- ✓ Abdominal pains.

Prevention and treatment

- ★ Avoiding contaminated food or water with cysts.
- ★ Boiling drinking water.
- ★ Proper food shortage.
- ★ Proper faecal disposal.
- ★ Administering of amoebicides

97) List the causative agent, mode of transmission, symptoms and Prevention and treatment of the disease Malaria.

- ♥ **Malaria** is a disease caused by a protozoan parasite called **Plasmodium.**

There are four different species of plasmodium namely *P. vivax, P. ovale, P. falcipamm* and *P. malariae.*

The *Plasmodium* is transmitted from an infected person to a healthy person by a female *Anopheles* mosquito (vector). When the mosquito bites an infected person it sucks blood containing the parasites. Inside the mosquito, the plasmodia develop into infective stages. When the same mosquito next bites a healthy person it passes on the infective plasmodia from its salivary glands into the blood system of the healthy person.The parasites invade the liver cells where they multiply. They are then released into the bloodstream where they now attack and destroy the red blood cells.

Symptoms

- ♣ High regular fever and profuse sweating.
- ♣ Chills and shivering.
- ♣ Headache, muscle and joint pains.
- ♣ Lack of appetite and vomiting.

INSTRUCTOR: NUR MUBARAK

- ♣ Enlargement of liver and spleen.
- ♣ Anaemia due to destruction of red blood cells.

Prevention

- ➢ Use of nets to prevent mosquito bites.
- ➢ Insecticides are sprayed in dwelling places.
- ➢ Drainage of stagnant water and clearance of vegetation around houses destroys the breeding sites of mosquitoes.
- ➢ Use of oil on stagnant water.
- ➢ Use of fish in ponds to feed on the mosquito larvae (biological control).

98) List the causative agent, mode of transmission, symptoms and Prevention and treatment of the disease *Ascaris lumbricoides.*

- ♥ ***Ascaris lumbricoides*** is a parasitic roundworm which belongs to the **phylum Nematoda.** Ascaris lumbricoides infect small intestine of pigs and human beings.

The adult female lays eggs in the small intestine of the host. The eggs are passed out with the faeces and may be swallowed by a new host through contaminated food and water. Contaminated vegetables or fruits which are not washed well before being eaten are also a source of infection. There is also direct infection from faeces to mouth by hands especially in children.

Effects of the Parasite on the Host

- ♣ Irritation in the trachea that lead to lung damage.
- ♣ Malnutrition since a lot of digested food is consumed by the parasite.
- ♣ Intestinal blockage.

Adaptative Characteristics of Ascaris lumbricoides to its Parasitic Mode of Life

1. *Ascaris lumbricoides* has two hosts, human beings and pigs.
2. It lays many eggs to increase the chances of survival even when some are destroyed.
3. The eggs have a protective shell to survive harsh environmental conditions.
4. Tolerant to law oxygen concentration.

Prevention and Treatment

- ♣ Proper sanitary disposal faeces and proper use of toilet facilities.
- ♣ High standards of personal hygiene.
- ♣ Hygienic handling and cleaning of fruits and vegetables.
- ♣ Drinking water should be boiled.
- ♣ Use of drugs to kill the worms or inactivate the eggs.

99) List the causative agent, mode of transmission, symptoms and Prevention and treatment of the disease Schistosomiasis (Bilharzia)

- ♥ **Schistosomiasis (Bilharzia)**

Bilharzia is caused by a flatworm of the genus ***Schistosoma***. There are **three** different species of schistosoma that infect human beings. These include *Schistosoma mansoni, Schistosoma haematobium* and *Schistosoma japonicum.*

The parasite spreads through drinking contaminated water with larval form cercariae. The parasite can also penetrate the skin. Once in the body, they get into the blood stream and migrate to the liver where they mature into adults.

Effects of Parasite on its Host

- ♥ Itching – penetration site.
- ♥ Fever
- ♥ Damage to blood vessels causes blood to appear in urine or stool.
- ♥ Abdominal pains and diarrhoea.
- ♥ If untreated the disease can result in death.

Adaptation of *Schistosoma*

- ♥ Suckers for attachment so that they are not dislodged.
- ♥ The parasite has two hosts: human and snails.
- ♥ Some larval forms can remain dormant and viable until they come into contact with a human being.
- ♥ The adult worm in blood produces chemical substances which protect it against the host's defence mechanism.

Prevention and Treatment

- ♥ Proper sanitary disposal of both faeces and urine.
- ♥ All drinking water should be chemically treated or boiled in order to kill the eggs.
- ♥ People should not bathe or swim in water infested with snails.
- ♥ Avoid walking bare feet in swampy areas.
- ♥ The snails should be killed by spraying the water with molluscicides.
- ♥ Infected persons should receive proper medical treatment.

100) An investigation was carried out between 1994 and 2003 to study the changes of fish population in a certain small lake. Four species offish, A, B, C and D were found to live in this lake.
In 1995, a factory was built near the lake raising the average temperature from 25°C to 30°C. In 1997, sewage and industrial waste from a nearby town was diverted into the lake. 1999, discharge of hot water, sewage and industrial waste into the lake was stopped.

The fish population during the period of investigation are shown in the table below.

Fish Species	1994	1996	1998	2000	2001	2002	2003
A	6 102	223	20	106	660	4 071	7 512
B	208	30	11	22	63	311	405
C	36	100	0	0	0	0	0
D	4 521	272	23	27	29	400	617

(a) **In which year was the fish population lowest?**

- ♥ Year 1998 had the lowest fish populations.

INSTRUCTOR: NUR MUBARAK
BIOLOGY FORM FOUR QUESTIONS AND ANSWERS