Unit 10

Gaseous Exchange

Long Answer Questions

Q.1 What do you know about cellular respiration?

Ans. Cellular respiration is the process in which the C-H bonds in food are broken by oxidation reduction reactions and energy is transformed into ATP.

Q.2 What is aerobic respiration?

Ans. In aerobic respiration, oxygen is used and there is complete oxidation of the food material. Carbon dioxide and water are also produced in this process.

Q.3 Define gaseous exchange. Why oxygen is needed?

Ans. Definition

Taking in oxygen and giving out of carbon dioxide is termed as gaseous exchange.

Need of Oxygen

Organisms get the oxygen needed for cellular respiration from their environment and provide it to their cells. The carbon dioxide which produces during cellular respiration is taken out of the cells and ultimately from the body.

Q.4 What is breathing? How is it different from respiration?

Ans. Breathing

The process through which animals take air in their bodies to get oxygen from it and then give out the air for getting rid of carbon dioxide.

Difference between respiration and breathing

RESPIRATION	BREATHING
(i) It involves the mechanical and the bio-chemical processes. (ii) It is of two types and takes place in cells.	(i) It is only the mechanical or physical process of exchanging the gases. (ii) It occurs in two phases and takes place in respiratory system.

Q.5 Describe the process of gaseous exchange in plants.

Ans. Introduction

Plants have no organs or systems for the exchange of gases with the environment. Every cell of a plant exchanges gases with the environment by its own.

Explanation

i) Gaseous exchange in leaves and young stems

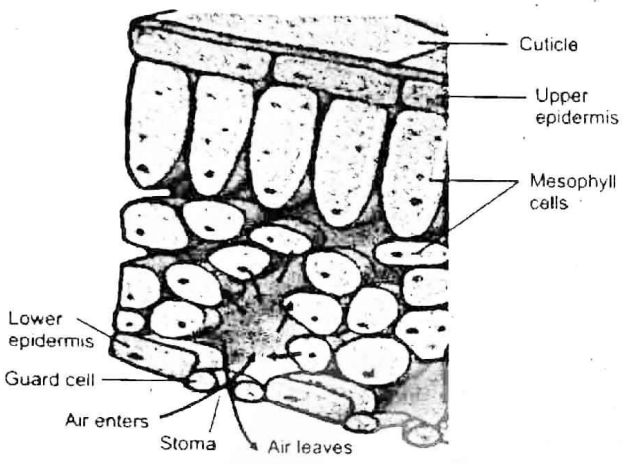
The leaves and young stems have stomata in their epidermis for gaseous exchange.

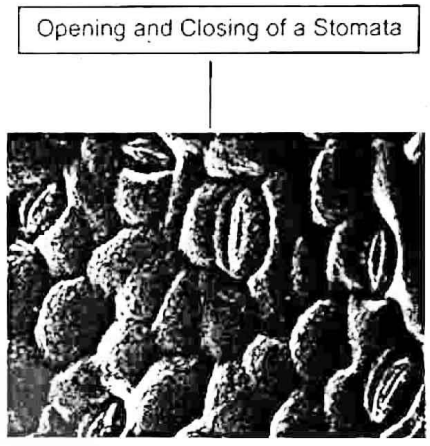
The inner cells of leaves (mesophyll) and stems also have air spaces among them which help in the exchange of gases. In young stems and leaves, some gaseous exchange also occurs through cuticle.

Explanation

During the daytime mesophyll cells of leaves carry out photosynthesis and respiration side by side, the oxygen produces in photosynthesis is utilized in cellular respiration. Similarly the carbon dioxide produces during cellular respiration is utilized in photosynthesis.

However, during night when there is no photosynthesis occurring, the leaf cells get oxygen from the environment and release carbon dioxide through stomata.





ii. Gaseous exchange in woody stems and mature roots

In woody stems and mature roots, the entire surface is covered by bark which is impervious to gases or water. However, there are certain pores in the layer of bark. These are called the lenticels. The lenticels allow air to pass through them.

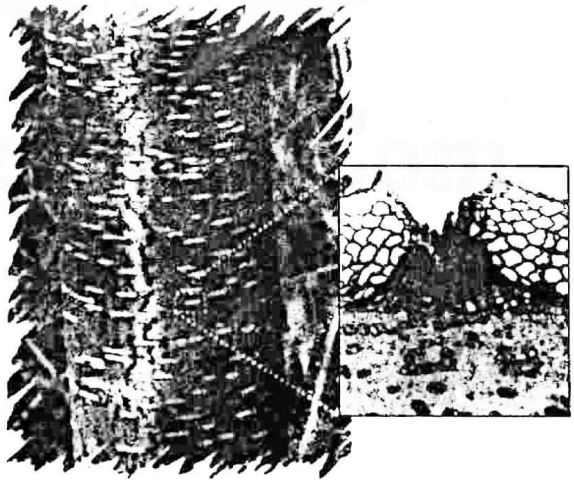


Figure 10.2: Lenticels on a stem and the internal view of a lenticel

iii. Gaseous exchange in young roots

Gases are found in the soil surrounding the roots. These gases diffuse in and out of the general surface of the young roots.

iv. Gaseous exchange in aquatic plants

The aquatic plants get the oxygen dissolved in water and release carbon dioxide in the water.

Q.6 Describe the structure and functions of human respiratory system.

Ans. Introduction

In humans and other higher animals, the exchange of gases is carried out by the respiratory system.

Parts of respiratory system

We can divide respiratory system in two parts i.e.

(1) The air passageway

(2) The lungs

1. Air passageway

Definition

It consists of the parts through which the outside air comes in the lungs and after the exchange of gases it goes out.

Parts of air passageway

This passage of air consists of the following parts:

a) Nasal cavity and nostrils

The nose encloses the nasal cavity. It opens to the outside through the openings called the nostrils.

Structure

The nasal cavity is divided into two portions by a wall. Each portion is lined by fine hairs and mucous.

Function

Fine hairs and mucous filter the dust particles from the air. The mucous also moistens and warms the incoming air and keeps its temperature nearly equal to that of the body.

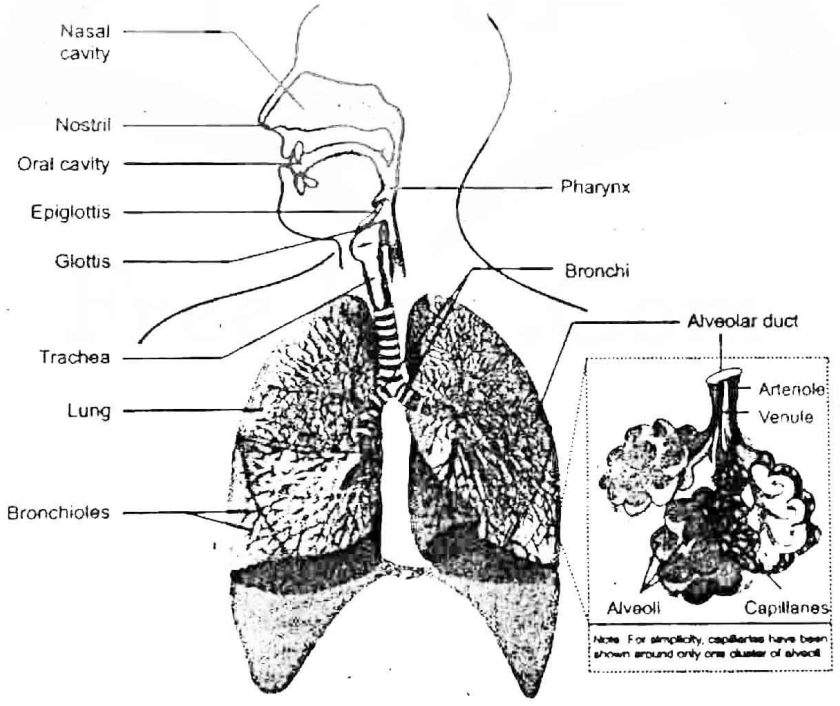


Figure 10.3: The air passageway and the lungs

b) Pharynx

The nasal cavity opens into the pharynx by means of two small openings called internal nostrils. It is a muscular passage and is common to both food and air. It extends to the opening of the oesophagus and the larynx.

c) Glottis and epiglottis

It is a narrow opening at the floor of pharynx which leads into larynx. The air goes from the pharynx into the larynx. The glottis is guarded by a flap of tissue called the epiglottis.

d) Larynx or voice box

The larynx is a box made of cartilage. It is also called the voice box.

Location

It is present between pharynx and trachea.

Vocal cords and sound production

Two pairs of fibrous bands called vocal cords are stretched across the larynx. When the air passes through them, the vocal cords vibrate. This vibration produces sounds. Movements of lips, cheeks, tongue and jaws produce specific sounds which results in speech. Speech is an ability of only humans.

e) Trachea

Larynx continues to the trachea, which is also called the windpipe.

Length and location

It is about 12 cm long tube which lies in front of the oesophagus.

Structure

There are C-shaped cartilagenous rings in the wall of trachea.

Function of cartilage

The cartilages keep the trachea from collapsing even when there is no air in it.

f) Bronchi

On entering the chest cavity, the trachea divides into two smaller tubes called bronchi (singular: bronchus).

Structure

The bronchi also have cartilagenous plates in their walls.

Division of Bronchi

Each bronchus enters into the lung of its side and then divides into smaller branches.

Other functions of trachea and bronchi

Both trachea and the bronchi are also lined with ciliated and glandular cells.

Function of glandular cells

These cells secrete mucous which moistens the air and also traps any fine particles of dust or bacteria that have escaped from the nasal cavity.

Function of cilia

The cilia beat with an upward motion so that the foreign particles along the mucous are sent to the oral cavity from where it may be either swallowed or coughed out.

g) Bronchioles

The bronchi continue dividing in the lungs until they make several fine tubes called bronchioles. The bronchioles progressively lose the cartilages as they become narrower.

h) Alveolar Ducts

The bronchioles end as fine tubules called the alveolar ducts.

i) Alveoli

Each alveolar duct opens into a cluster of pouches called alveoli.

Each alveolus is a sac-like structure lined by a single layer of epithelial cells. It is bound on the outside by a network of capillaries.

j) Pulmonary artery

The pulmonary artery from the heart containing deoxygenated blood enters the lungs and branches into arterioles and then into capillaries which surround the alveoli.

k) Pulmonary vein

Capillaries join together to form the venules which form pulmonary vein. The pulmonary vein carries the oxygenated blood back to the heart.

2) Lungs

All the alveoli on one side constitute a lung. There is a pair of lungs in the thoracic cavity.

Chest wall formation

It is made up of 12 pairs of ribs and the rib muscles called intercoastal muscles.

Diaphragm

A thick muscular structure present below the lungs is called diaphragm.

Lobes of lungs

The left lung is slightly smaller and has two lobes and the right lung is bigger with three lobes. They are spongy and elastic organs.

Blood vessels of lungs

The lungs also have blood vessels that are the branches of the pulmonary arteries and veins.

Pleural membranes

Each lung is enclosed by two membranes called the outer pleural membrane and the inner pleural membrane.

The membranes enclose a fluid which provides lubrication for the free expanding and contracting of the lungs.

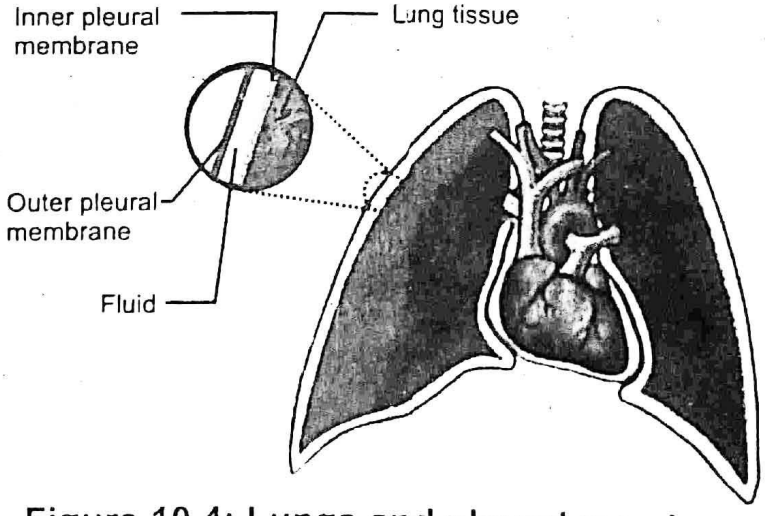


Figure 10.4: Lungs and pleural membranes

Q.7 Describe the mechanism of breathing. (Board 2014)

Ans. Introduction

The physical movements associated with the gaseous exchange are called breathing.

Phases of Breathing

There are two phases of breathing i.e.

1. Inhalation
2. Exhalation

1. Inhalation or inspiration

a) Contraction of rib muscles and diaphragm

During inspiration the rib muscles contract and ribs are raised. At the same time the dome shaped diaphragm contracts and is lowered.

b) Effect of contraction

These movements increase the area of the thoracic cavity which reduces the pressure on lungs. As a result, the lungs expand and the air pressure within them also decreases. The air from outside rushes into the lungs to equalize the pressure on both sides.

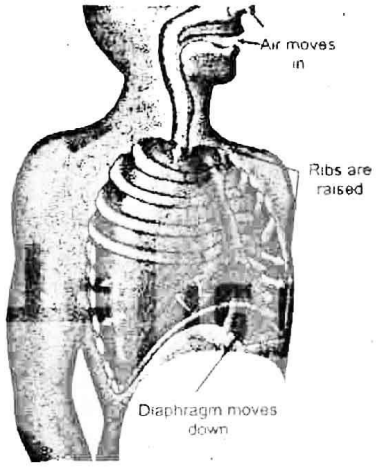


Figure 10.5: Steps of Inhalation

2. Exhalation or expiration

a) Relaxation of rib muscles and diaphragm

After the gaseous exchange in the lungs, the impure air is expelled out in exhalation. The rib muscles relax bringing the ribs back to the original position. The diaphragm muscles also relax and it gets its raised dome shape.

b) Effect of relaxation

This reduces the space in the chest cavity and increases the pressure on lungs. The lungs contract and the air is expelled out of them.

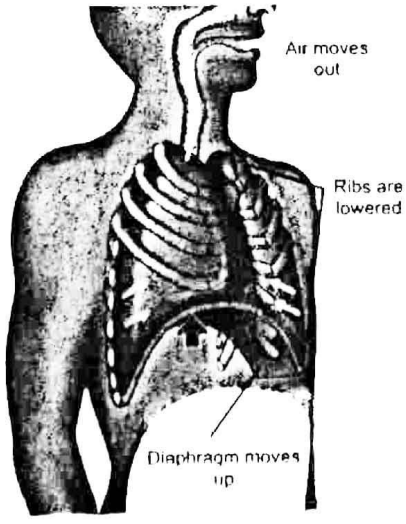


Figure 10.6: Steps of Exhalation

Breathing rate of humans

Humans breathe 16 – 20 times per minute in normal circumstances i.e. at rest.

Control of Breathing rate

The rate of breathing is controlled by the respiratory centre in the brain. The respiratory centre is sensitive to the concentration of carbon dioxide in the blood. When we do exercise or some hard job, our muscle cells carry out cellular respiration at greater rate. It results in the production of more carbon dioxide which is released in the blood. This greater than normal concentration of carbon dioxide stimulates the respiratory centre of brain. The respiratory centre sends messages to the rib muscles and diaphragm to increase the rate of breathing so that the excess carbon dioxide present in blood can be removed out of body.

Breathing rate during exercise

During exercise or other hard physical works the breathing rate may increase up to 30–40 times per minute.

Q.8 Describe the comparison between the inspired and the expired air.

Ans.

Feature	Inspired air	Expired air
Amount of oxygen	21%	16%
Amount of carbon dioxide	0.04%	4%
Amount of nitrogen	79%	79%
Amount of water vapours	Variable	Saturated
Amount of dust particles	Variable	Almost none
Temperature	Variable	Almost equal to body temperature

Q.9 Describe different types of respiratory disorders in man.

Ans. There are a number of respiratory disorders which affect people. The high percentage of respiratory disorders in Pakistan is due to more concentration of air pollutants both in urban and rural atmosphere.

Some of the important respiratory disorders are:

i. Bronchitis

a) Introduction

It is the inflammation of the bronchi or bronchioles.

b) Causes

i) It results in excessive secretion of mucous into the tubes, leading to the swelling of tubular walls and narrowing of tubes.

ii) It is caused by viruses, bacteria or exposure to chemical irritants (e.g. tobacco smoke).

Figure 10.7: Bronchi normal (left) and inflamed (right)

c) Types

There are two major types of bronchitis i.e. acute and chronic.

i) Acute Bronchitis

It usually lasts about two weeks and patient recovers with no permanent damage to bronchi or bronchioles.

ii) Chronic bronchitis

In chronic bronchitis, the bronchi develop chronic inflammation. It usually lasts for three months to two years.

d) Symptoms

Symptoms of bronchitis include:

Cough

Mild wheezing

Fever

Chills

Shortness of breath (especially when doing hard job)

e) Age limit

The majority of people diagnosed with chronic bronchitis are 45 years of age or older.

ii. Emphysema

Introduction

It is the destruction of the walls of the alveoli.

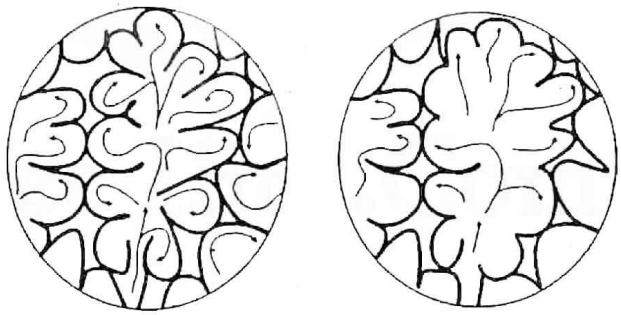


Figure 10.8: The Alveoli, normal (left) and emphysema (right)

Explanation

It results in larger sacs but with less surface area for gaseous exchange. As lung tissue breaks down, the lungs do not come back to their original shape after exhalation so air cannot be pushed out and is trapped in the lungs.

Symptoms

It includes:

i. Shortness of breath

ii. Fatigue

iii. Recurrent respiratory infections.

iv. Weight loss

By the time the symptoms of emphysema appear, the patient has usually lost 50% to 70% of his/her lung tissue.

Effects

The level of oxygen in blood may get so low that it causes serious complications.

iii. Pneumonia

Introduction

It is an infection of lungs.

Double pneumonia

If this infection affects both lungs, it is called double pneumonia.

Causes

The most common cause of pneumonia is a bacterium, *Streptococcus pneumoniae.* Some viral (influenza virus) and fungal infections may also lead to pneumonia.

Explanation

When the causative organisms enter the alveoli, they break the lung tissues and the area is filled with fluid and pus.

Symptoms

It includes a cold that is followed by a high fever, shivering, and a cough with sputum production. Patient may become short of breath.

Effects

The patient's skin colour may change and become dusky or purplish. It is due to poor oxygenation of blood.

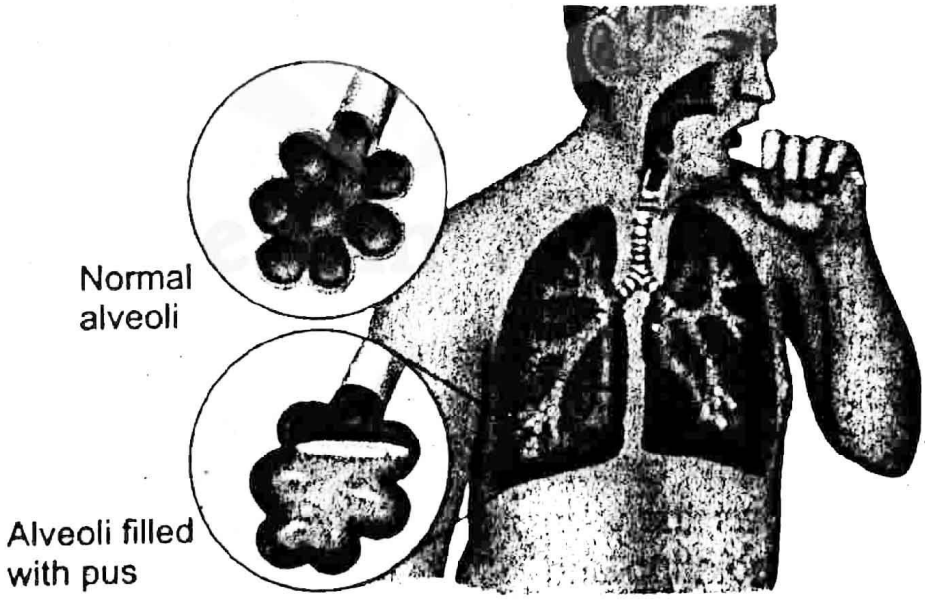


Figure 10.9: Pneumonia

Treatment

i. Vaccines are available to prevent pneumonia caused by *S. pneumoniae.*

ii. Antibiotics are used in the treatment of this disease.

iv. Asthma

Introduction

It is a form of allergy, in which there is inflammation of the bronchi, more mucous production and narrowing of the airways.

Explanation

In asthma patients, the bronchi and bronchioles become sensitive to different allergens (allergy causing factors) e.g. dust, smoke, perfumes, pollens etc. When exposed to any of such allergens, the sensitive airways show immediate and excessive response of constriction. In this condition, the patient feels difficulty in breathing.

Symptoms

It varies from person to person. It includes:

i. Shortness of breath (especially with exertion or at night)
ii. Wheezing (whistling sound when breathing out)
iii. Cough
iv. Chest tightness

Treatment

The medicine in the form of inhalers with ability to dilate the bronchi and bronchioles are used in the treatment of asthma.

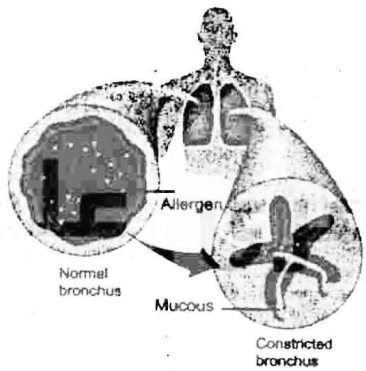


Figure 10.10: Asthma

(v) Lung Cancer / Explain lung cancer and Passive smoking **(Board 2014)**

Introduction

It is a disease of uncontrolled cell divisions in the tissues of the lung.

Explanation

In lung cancer, cells continue to divide without any control and form tumours. The cellular growth may also invade adjacent tissues beyond the lungs.

Symptoms

The most common symptoms are:

i. Shortness of breath
ii. Coughing (including coughing up blood)
iii. Weight loss

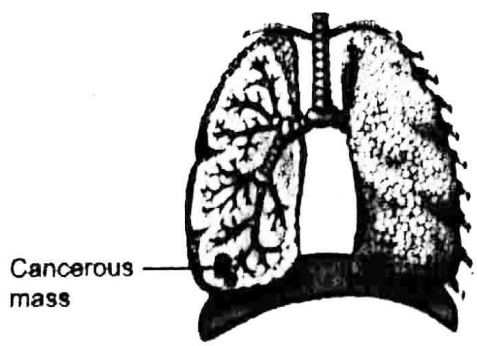


Figure 10.11: Lung Cancer

Causes

(1) Main cause:

Smoking is the main cause of lung cancer.

(2) Other Causes are:

(i) Carcinogens (such as those in cigarette smoke)

(ii) Ionizing radiation

(iii) Viral infection

Known number of carcinogens

Cigarette smoke contains over 50 known carcinogens.

Lung cancer in non- smokers

The risk of lung cancer is significantly lower in non-smokers.

Passive smoking (the inhalation of smoke from another's smoking) is also a cause of lung cancer. The smoke from the burning end of a cigarette is more dangerous than the smoke from the filter end.

Prevention

(i) Eliminating tobacco smoking is a primary goal in the prevention of lung cancer.

(ii) The World Health Organization has called for governments to stop tobacco advertising to prevent young people from taking up smoking.

(iii) If a person stops smoking the chance to develop cancer decreases as damage to the lungs is repaired and contaminant particles are gradually removed.

Effects

Lung cancer is the most common cause of cancer-related deaths and is responsible for more than 1.3 million deaths worldwide annually.

Q.10 Describe bad effects of smoking. Or Write two bad effects of smoking (Board 2014)

Ans. Introduction

Smoking is harmful due to the chemicals in cigarettes and smoke.

Normal Lungs Smoker's Lungs

Number of chemicals in cigarette smoke

Tobacco smoke contains over 4000 different chemicals, out of which at least 50 are carcinogens and many are poisonous.

Diseases due to smoking

Smoking not only produces lung cancer but also produces a number of life threatening diseases like:

(a) Cancers in

(i) Kidneys

(ii) Oral cavity

(iii) Larynx

(iv) Breast

(v) Bladder

(vi) Pancreas etc.

(b) Emphysema and other respiratory disorders

Many chemicals in tobacco smoke damage the air passageway, which leads to emphysema and other respiratory disorders.

Other effects of smoking

(a) Reduction in the oxygen carrying capacity

It has effects on the circulatory system. The carbon monoxide present in tobacco smoke lessens the oxygen carrying capacity of haemoglobin.

(b) Increase in the production of platelets

Many other chemicals in smoke increase the production of blood platelets. When platelets are more than the normal numbers, they make the blood viscous and it can lead to arteriosclerosis.

(c) Risk of tuberculosis and pneumonia

Smokers are at greater risk of developing infections, particularly in the lungs like risk of tuberculosis increases by two to four times, and of pneumonia by four times.

(d) Weakening and staining the teeth

Smoking is responsible for weakening and staining the teeth. Tooth loss is 2 to 3 times higher in smokers than in non-smokers.

(e) Effect on social life

Smoking also affects the social life of a person. Smokers may face social unacceptance because other people may not want to be exposed to other's smoke.

(f) Increase in the rate of heart diseases and cancer in non- smokers

Non-smokers who are exposed to second-hand smoke at home or work increase their heart disease risk by 25-30 and their lung cancer risk by 20-30%.

Q11. What do you know about Nicotine?

Ans. Nicotine is a powerful poison and was widely used as an insecticide in the past. When inhaled through tobacco smoking, it reaches our circulatory system and not only hardens the walls of the arteries but also damages the brain tissues.

Q12. When the "World No Tobacco Day" is celebrated?

Ans. It is celebrated on the 31st of May every year.

Multiple Choice Questions

1. **The process of gaseous exchange involves:**
   (a) Breakdown of C-H bonds to yield energy
   (b) Physical movements that take air in and out of body
   (c) Getting oxygen from the air and removing carbon dioxide
   (d) Transport of oxygen by the blood to different parts of the body

2. **Most of the gaseous exchange in a leaf occurs through:**
   (a) Stomata (b) General surface
   (c) Cuticle (d) Lenticels

3. **How many bronchi are there in the air passageway?**
   (a) One (b) Two
   (c) Many (d) None

4. **Where does the gaseous exchange occur in humans?**
   (a) Pharynx (b) Trachea
   (c) Bronchi (d) Alveoli

5. **Which structure actively helps in taking the air out of lungs?**
   (a) Nasal cavity (b) Bronchus
   (c) Bronchiole (d) Diaphragm

6. **The primary chemical stimulus for breathing is the concentration of;**
   (a) Carbon dioxide in blood
   (b) Oxygen in blood
   (c) Carbon dioxide in muscles
   (d) Oxygen in muscles

7. **Point out the FALSE statement about respiration.**
   (a) Gases can easily pass through the walls of the alveoli
   (b) Gas exchange in lungs is very efficient because lungs provide large surface area
   (c) In emphysema, the walls of alveoli break and there is more surface area
   (d) Dust particles can damage the lung by irritating the inner alveoli surface

8. **A disease involving the breakdown of air sacs of the lungs is;**
   (a) Pneumonia (b) Bronchitis
   (c) Asthma (d) Emphysema

9. **Which process does not occur in the nasal cavity?**
   (a) Trapping of large dust particles
   (b) Humidification of the inhaled air
   (c) Warming of the inhaled air
   (d) Exchange of gases

10. **What type of blood vessels surrounds the alveoli?**
    (a) Artery (b) Arteriole
    (c) Capillary (d) Vein

11. **In which of the following gaseous exchange occurs through stomata?**
    (a) Leaves and young stems
    (b) Woody stems and mature roots
    (c) Young roots
    (d) Aquatic plants

12. **In humans and other higher animals, the exchange of gases is carried out by:**
    (a) Skin
    (b) Respiratory surface
    (c) Air passageway
    (d) Lungs

13. **The length of trachea is:**
    (a) 10 cm (b) 12 cm
    (c) 22 cm (d) 20 cm

14. **C-shaped cartilagenous rings are present in the wall of;**
    (a) Bronchi (b) Bronchioles
    (c) Alveoli (d) Trachea

15. **How many pairs of ribs are there in humans?**
    (a) 24 (b) 12
    (c) 26 (d) None

16. **How many lobes are present in right lung?**
(a) 2 (b) 3
(c) 4 (d) 5

17. **Which of the following is called voice box?**
(a) Trachea (b) Larynx
(c) Bronchi (d) Alveoli

18. **The normal breathing rate in human being is:**
(a) 10-40 times per minute
(b) 16-20 times per minute
(c) 30-40 times per minute
(d) None of these

19. **During exercise or other hard physical works the breathing rate may increase up to:**
(a) 30 – 40 times per minute
(b) 50 – 60 times per minute
(c) 50 – 55 times per minute
(d) 60 – 70 times per minute

20. **Amount of oxygen in expired air is:**
(a) 21% (b) 16%
(c) 0.04% (d) 4%

21. **Amount of carbon dioxide in inspired air is:**
(a) 16% (b) 0.04%
(c) 4% (d) None

22. **Amount of nitrogen in expired air is:**
(a) 70% (b) 80%
(c) 79% (d) 4%

23. **Cough, mild wheezing, fever, chills and shortness of breath (especially when doing hard job) are symptoms of:**
(a) Emphysema (b) Pneumonia
(c) Bronchitis (d) Asthma

24. **In which of the following disease, the patient has usually lost 50% to 70% of his/ her lung tissue when symptoms appears?**
(a) Pneumonia (b) Asthma
(c) Emphysema (d) Bronchitis

25. **Pneumonia is an infection of:**
(a) Kidneys
(b) Digestive system
(c) Lungs
(d) Blood

26. **Which one is the form of allergy?**
(a) Asthma (b) Bronchitis
(c) Pneumonia (d) Lung cancer

27. **When the "World No Tobacco Day" is celebrated?**
(a) 30 June (b) 31 June
(c) 11 January (d) None

28. **Smoking may also lead to the cancers in:**
(a) Kidneys and pancreas
(b) Oral cavity and larynx
(c) Breast and bladder
(d) All of the above

29. **The destruction of wall of alveoli is called:** **(Board 2013)**
(a) Pneumonia
(b) Emphysema
(c) Asthma
(d) Bronchitis

30. **The inflammation of bronchi or bronchioles is called:** **(Board 2013)**
(a) Bronchitis
(b) Emphysema
(c) Pneumonia
(d) Asthma

31. **Which remains unaffected in expired air?**
(a) O_2 (b) CO_2
(c) N_2 (d) Water vapours

32. **In developing world smoking has:** **10(044)**
(a) Declined (b) Risen by 5.4%
(c) No effect (d) Risen by 3.4%

33. **In young stems and leaves some gaseous exchange occurs through**
(a) Leaf petioles
(b) Cuticle
(c) Leaf petioles and cuticle
(d) Mesophyll

34. **Exchange of gases occurs through lenticels in;**
(a) Woody stems
(b) Mature roots
(c) Woody stems and mature roots
(d) Young stems

35. **Gases diffuse by general surface in:**
(a) All stems (b) Young roots
(c) All leaves (d) Mature roots

36. **Air passageway starts from:**
(a) Nose (b) Pharynx
(c) Trachea (d) Bronchi

37. **A flap of tissue which guards glottis is:**
(a) Larynx (b) Epiglottis
(c) Pharynx (d) Ribs

38. **Temperature of expired air is:**
(a) High (b) Low
(c) Equal to the body temperature
(d) Equal to external environment

39. **Cluster of pouches found in respiratory system:**
(a) Bronchi (b) Alveoli
(c) Bronchioles (d) Trachea

40. **Lungs are organ which are;**
(a) Spongy (b) Elastic
(c) Spongy and elastic (d) Tough

41. **Dusky or purplish skin colour is a symptom of:**
(a) Bronchitis (b) Emphysema
(c) Pneumonia (d) Asthma

42. **Total chemicals in tobacco smoke are:**
(B-2014)
(a) 1000 (b) 2000
(c) 3000 (d) 4000

43. **Tooth loss is _____ times higher in smokers than in non-smokers.**
(a) 2-5 times (b) 1-2 times
(c) 2-3 times (d) 4-5 times

44. **Which of the following lessens the oxygen carrying capacity of haemoglobin?**
(a) Tar
(b) Carbon dioxide
(c) Nicotine
(d) Carbon monoxide

45. **A powerful poison which damages brain is:**
(a) Tar
(b) Nicotine
(c) Carcinogen
(d) Carbon monoxide

46. **Function of pleural membrane is to:**
(a) Hold the lungs in their correct position in cavity
(b) Help to increase the volume of cavity during respiration
(c) Increase volume of chest
(d) Secrete to help the lungs

47. **Which one takes deoxygenated blood towards lungs**
(a) Pulmonary artery
(b) Aorta
(c) Superior Vena cava
(d) Pulmonary vein

48. **Asthma is caused by:**
(a) Perfumes
(b) Vitamin B-12 deficiency
(c) Vitamin C deficiency
(d) Vitamin K deficiency

49. **Some viral (Influenza virus) and fungal infections may also lead to:**
(a) Asthma (b) Pneumonia
(c) Lung cancer (d) Emphysema

50. **A thick muscular structure present below the lungs is called:**
(a) Alveolus (b) Tracheoles
(c) Diaphragm (d) Bronchioles

51. **The main cause of lung cancer is:**
(a) Smoking
(b) Viral infection
(c) Bacterial infection
(d) Both viral and bacterial infection

52. **Passive smoking in non-smokers has increased heart rate by:**
(a) 20- 30% (b) 25-40%
(c) 25-30% (d) 30-40%

53. **Percentage of CO_2 in exhaled air during breathing is:**

(a) 16% (b) 4%

(c) 79% (d) 0.04%

54. **Rate of breathing depends upon concentration of which gas in the blood?** (B-2014)

(a) Oxygen (b) Carbon dioxide

(c) Nitrogen (d) Hydrogen

Answer Key

1	c	**2**	a	**3**	b	**4**	d	**5**	d
6	a	**7**	c	**8**	d	**9**	d	**10**	c
11	a	**12**	d	**13**	b	**14**	d	**15**	b
16	b	**17**	b	**18**	b	**19**	a	**20**	b
21	b	**22**	c	**23**	c	**24**	c	**25**	c
26	a	**27**	d	**28**	d	**29**	b	**30**	a
31	c	**32**	d	**33**	b	**34**	c	**35**	b
36	a	**37**	b	**38**	c	**39**	b	**40**	c
41	c	**42**	d	**43**	c	**44**	d	**45**	b
46	a	**47**	a	**48**	a	**49**	b	**50**	c
51	a	**52**	c	**53**	b	**54**	b		

Short Answer Questions

Q1. Differentiate between breathing and cellular respiration. (Board 2013)

Ans. Breathing

(i) Breathing is used for the process through which animals take air in bodies to get oxygen from it and then give out the air for getting rid of carbon dioxide.

(ii) It is only the mechanical or physical process for exchange of gases.

Cellular respiration (Board 2013)

(i) Cellular respiration is the process in which the C-H bonds in food are broken by oxidation reduction reactions and the energy is transformed into ATP.

(ii) It is a mechanical and biochemical process.

Q2. Trace the path of air from the nasal cavity to the alveoli.

Ans. The following is the path of air:

Nasal cavity ⟶ pharynx ⟶ larynx ⟶ trachea ⟶ bronchus ⟶ bronchioles ⟶ alveolar ducts ⟶ alveoli

Q3. How will you differentiate between stomata and lenticels?

Ans. Stomata

(i) The leaves and young stems have stomata in their epidermis.

(ii) The gaseous exchange occurs through these stomata.

Lenticels

(i) In woody stems and mature roots, there are certain pores in the layer of bark.

(ii) The lenticels allow air to pass through them.

Q4. What are alveolar ducts?

Ans. In the lungs, the bronchioles end as fine tubules called the alveolar ducts.

Q5. Define Alveolus?

Ans. Within the lungs, each alveolar duct opens into a cluster of pouches called alveoli. The alveoli form the respiratory surface in humans.

Q6. What is Asthma? Write its symptoms **(Board 2014)**

Ans. Asthma is a form of allergy, in which there is inflammation of the bronchi, more mucous production and narrowing of the airways. In asthma patients the bronchi and bronchioles become sensitive to different allergens and patient feels difficulty in breathing. The major symptoms are:

(i) Shortness of breath

(ii) Wheezing

(iii) Cough and chest tightness

Q7. Define breathing.

Ans. The term breathing is used for the process through which animals take air in bodies to get oxygen from it and then give out the air for getting rid of carbon dioxide. It is only the mechanical or physical process for exchange of gases.

Q8. What are bronchioles.

Ans. The bronchi continue dividing in the lungs until they make several fine tubes called bronchioles. The bronchioles progressively lose the cartilages as they become narrower.

Q9. What is bronchitis? **(Board 2013-14)**

Ans. Bronchitis is an inflammation of the bronchi or bronchioles. It results in excessive secretion of mucous into the tubes leading to the swelling of tubular walls and narrowing of tubes. It is caused by viruses, bacteria or exposure to chemical irritants e.g. tobacco smoke.

Q10. Define bronchus.

Ans. On entering the chest cavity, the trachea divides into two smaller tubes called bronchus. The bronchi also have cartilagenous plates in their walls.

Q11. Define diaphragm. **(Board 2013-14)**

Ans. A thick muscular structure is present below the lungs is called diaphragm.

Q12. What is emphysema?

Ans. Emphysema is the destruction of the wall of the alveoli. It results in larger sacs but with less surface area for gaseous exchange. As lung tissue breaks down, the lungs do not come back to their original shape after exhalation. So air cannot be pushed out and is trapped in the lungs.

Symptoms

(i) Shortness of breath **(ii)** Fatigue **(iii)** Recurrent respiratory infections **(iv)** Weight loss

Q13. What is exhalation? **(Board 2013-14)**

Ans. It takes place in the following way:

Relaxation of rib muscles and diaphragm

After the gaseous exchange in the lungs, the impure air is expelled out in exhalation. The ribs come back to the original position, the diaphragm muscles also relax and it gets its raised dome

Effect of relaxation

This reduces the space in the chest cavity and increases the pressure on lungs. The lungs contract and the air is expelled out of them.

Q14. What is gaseous exchange?

Ans. Taking in oxygen and giving out of carbon dioxide is termed as gaseous exchange.

Q15. What is inhalation? **(Board 2013-14)**

Ans. It takes place in the following way:

Contraction of Rib muscles and diaphragm

During inhalation the rib muscles contract and ribs are raised. At the same time the dome – shaped diaphragm contracts and is lowered.

Effect of contraction

These movements increase the area of the thoracic cavity, which reduces the pressure on lungs. As a result, the lungs expand and the air pressure within them also decreases. The air from outside rushes into the lungs to equalize the pressure on both sides.

Q16. Define Larynx.

Ans. The larynx is a box made up of cartilage. It is present between pharynx and trachea. It is also called voice box.

Q17. Define lenticels.

Ans. In woody stems and mature roots, there are certain pores in the layer of bark. The lenticels allow air to pass through them.

Q18. What is Nasal cavity?

Ans. The nose encloses the nasal cavity. The nasal cavity is divided into two portions by a wall. Each portion is lined by fine hairs and mucous which filter the dust particles from the air. The mucous also moistens and warms the incoming air and keeps its temperature usually equal to that of the body.

Q19. Define Nostrils.

Ans. Nasal cavity opens to the outside through the openings called the nostrils.

Q20. What is pneumonia?

Ans. It is an infection of lungs.

Double Pneumonia

If this infection affects both lungs it is called double pneumonia.

Cause

The most common cause of pneumonia is bacterium *Streptococcus pneumoniae*. Some viral and fungal infections may also lead to pneumonia.

Q21. What is trachea?

Ans. Larynx continues to the trachea, which is also called the windpipe. It is about 12 cm long tube which lies in front of the oesophagus. There are C-shaped cartilagenous rings in the wall of trachea. The cartilage keep the trachea from collapsing even when there is no air in it.

Q22. Define vocal cord.

Ans. Two pairs of fibrous bands called vocal cords are stretched across the larynx. The vocal cords vibrate when the air passes through them. This vibration produces sounds.

Q23. Define epiglottis. Write its function. **(Board 2014)**

Ans. In the air passageway of man, the glottis is guarded by a flap of tissue is called epiglottis. Epiglottis closes the opening of glottis while swallowing in order to prevent entry of any food particle into it.

Q24. What are the symptoms of Bronchitis? **(Board 2014)**

Ans. Symptoms of Bronchitis includes:

(a) Cough
(b) Mild wheezing
(c) Fever
(d) Chills
(e) Shortness of breath (Especially when doing hard job)

Q25. What is Larynx? Write its function. **(Board 2014)**

Ans. Definition

The larynx is a box made of cartilage. It is also called the voice box. It is present between pharynx and trachea.

Function

Two pairs of fibrous bands called vocal cords are stretched across the larynx. When the air passes through them, the vocal cords vibrate. This vibration produces sounds. Movements of lips, cheeks, tongue and jaws produce specific sounds which results in speech. Speech is an ability of only humans.

Unit 11

Homoeostasis

Long Answer Questions

Q.1 Define homeostasis. Why body of an organism needs this? Which processes help in its occurrence?

Ans. Homeostasis may be defined as the maintenance of the internal conditions of body at equilibrium, despite changes in the external environment.

Examples:

1. The core temperature of human body remains at about 37°C despite fluctuations in the surrounding temperature.
2. The blood glucose level remains about 1g per liter despite eating a meal rich in carbohydrates.

Need of homeostasis:

An organism's body needs homeostasis because:

1. Body cells need the internal environment in which conditions do not change much.
2. Stable internal conditions are important for the efficient functioning of enzymes.

Processes helping in homeostasis

1. Osmoregulation

Definition

It is maintenance of the amounts of water and salts in body fluids (i.e. blood and tissue fluids).

Effect of osmoregulation

Relative amount of water and salts in body fluids and inside cells control the processes of diffusion and osmosis, which are essential for the functioning of cells.

2. Thermoregulation

Definition

The maintenance of internal body temperature is called thermoregulation.

Effect of thermoregulation

The enzymes of body work best at particular temperatures (optimum temperature). Any change in body temperature may affect the functioning of enzymes.

3. Excretion

Definition

Excretion is also a process of homeostasis. In this process, the metabolic wastes are eliminated from body to maintain the internal conditions at equilibrium.

Metabolic wastes

Metabolic waste means any material that is produced during body metabolism and that may harm the body.

Q.2 Describe homeostasis in plants. What different mechanisms are adopted for homeostasis in plants? OR How plants remove metabolic wastes? (Board 2014)

Ans. Homeostasis in plants

Plants respond to environmental changes and keep their internal conditions constant i.e. homeostasis. They apply different mechanisms for the homeostasis of water and other chemicals (oxygen, carbon dioxide, nitrogenous materials etc).

Removal of extra Carbon dioxide

In daytime, the carbon dioxide produced during cellular respiration is utilized in photosynthesis and hence it is not a waste product. At night, it is surplus because there is no utilization of carbon dioxide. It is removed from the tissue cells by diffusion. In leaves and young stems, carbon dioxide escapes out through stomata. In young roots, carbon dioxide diffuses through the general root surface, especially through root hairs.

Removal of extra oxygen

Oxygen is produced in mesophyll cells only during daytime, as a by-product of photosynthesis. After its utilization in cellular respiration the mesophyll cells remove the extra amount of oxygen through stomata.

Removal of extra water

1. Transpiration

(a)Definition

Transpiration is the loss of water from plants surface in the form of vapours e.g; conifers and most of plants.

(b) Explanation

Plants obtain water from soil and it is also produced in the body during cellular respiration. Plants store large amount of water in their cells for turgidity. Extra water is removed from plant body by transpiration.

At night, transpiration usually does not occur because most plants have their stomata closed. If there is a high water content in soil, water enters the roots and is accumulated in xylem vessels.

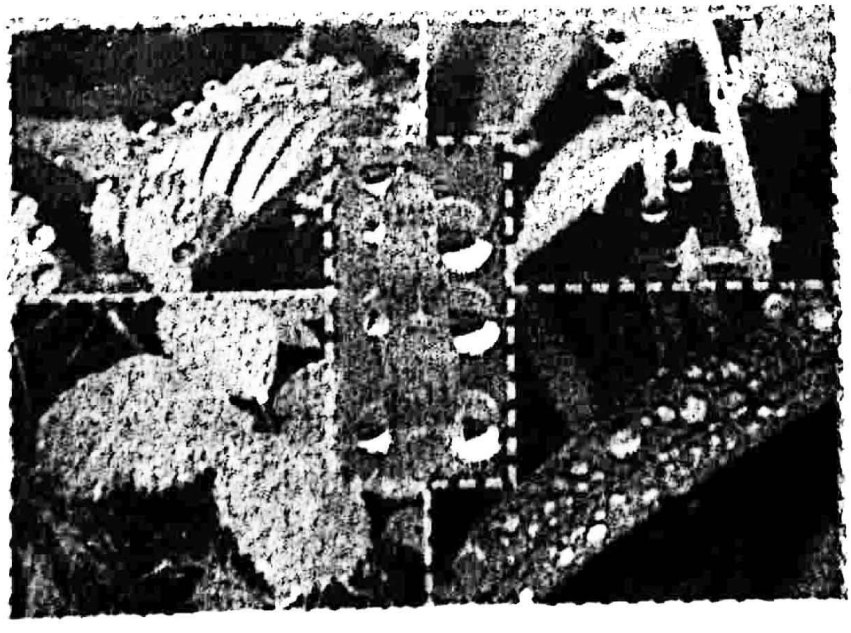


Figure 11.1: Guttation in different plants

2. Guttation

(a)Definition

The appearance of drops of water on the tips or edges of leaves is called guttation. Guttation is not to be confused with dew, which condenses from the atmosphere on to the plant surface.

(b) Explanation

Some plants such as grasses and strawberry force this water through special pores, present at leaf tips or edges, and form drops.

Removal of Other Metabolic Wastes

Plants deposit many metabolic wastes in their bodies as harmless insoluble materials.

Example

1. Calcium oxalate crystals

Calcium oxalate is deposited in the form of crystals in the leaves and stems of many plants e.g. in tomato.

Figure11.2: Calcium oxalate needles in a leaf cell

2. Shedding of leaves

In trees, which shed their leaves yearly, the excretory products are removed from body during leaf fall.

3. Resins

Resins are removed by coniferous trees.

4. Gums

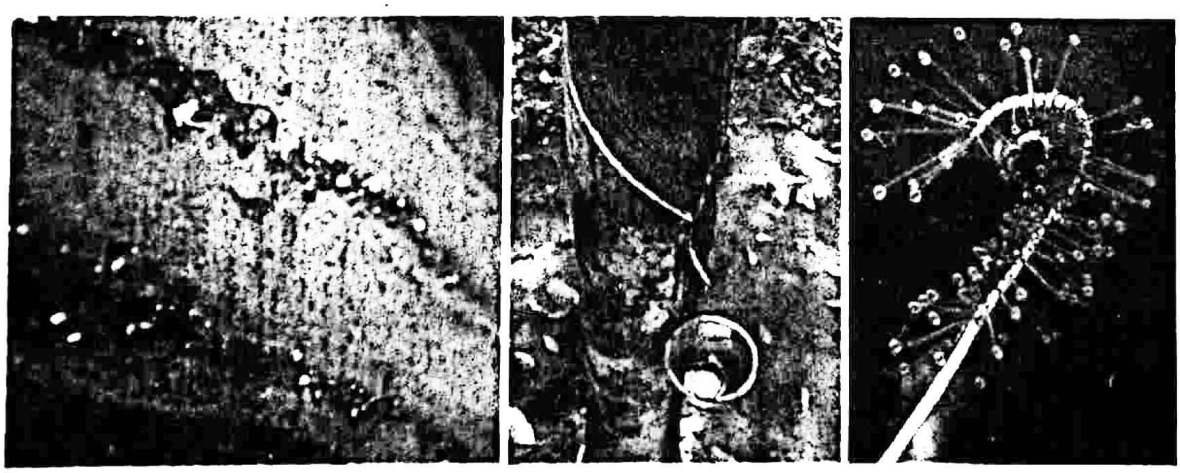
Gums are removed by keekar.

5. Latex

Latex are removed by rubber plants.

6. Mucilage

Mucilage are removed by carnivorous plants and lady finger.



Resin drops from a cut tree | Latex being extracted from a tree | Mucilage drops on a carnivorous plant

Figure11.3: Removal of some wastes in plants

Q.3 Describe osmotic adjustments in plants. OR On the basis of the available amount of water and salts, plants can be divided in how many groups? Explain.

Ans. On the basis of the available amount of water and salts, plants are divided into three groups.

1. Hydrophytes 2. Xerophytes 3. Halophytes

Definition

Hydrophytes are the plants which live completely or partially submerged in freshwater. Such plants do not face the problem of water shortage.

Adaptations

They have developed mechanisms for the removal of extra water from their cells.

Large number of Stomata

Hydrophytes have broad leaves with a large number of stomata on their upper surfaces. This characteristic helps them to remove the extra amount of water.

Examples

The most common example of such plants is water lilly.

2. Xerophytes

Definition

These plants live in dry environments.

Adaptations

i. Cuticle

They possess thick, waxy cuticle over their epidermis to reduce water loss from internal tissues.

ii. Less Stomata

They have less number of stomata to reduce the rate of transpiration.

iii. Deep roots

Such plants have deep roots to absorb maximum water from soil.

iv. Special Parenchyma cells

Some xerophytes have special parenchyma cells in stem or roots in which they store large quantities of water. This makes their stems or roots wet and juicy, called **succulent organs.**

Examples

Cacti (singular *cactus*) are common examples.

3. Halophytes

Definition

These plants live in sea water and are adapted to salty environments. Salts enter in the bodies of such plants due to their higher concentration in sea water. On the other hand, water tends to move out of their cells into the hypertonic sea water.

Adaptations

Holding of large amount of Salts

When salts enter into cells, plants carry out active transport to move and hold large amount of salts in vacuoles. Salts are not allowed to move out through the semi-permeable membranes of vacuoles. So the sap of vacuoles remains even more hypertonic than sea water. In this way, water does not move out of cells.

Hydrophytes Halophytes Xerophytes

Figure 11.4: three groups of plants

Examples

Many sea grasses are included in this group of plant.

Q4. What are the organs of humans which work for homeostasis? Describe skin and lungs in detail.

Ans. Humans have highly developed systems for homeostasis. The following are the main organs which work for homeostasis:

1. Lungs

They remove excess carbon dioxide and keep it in balance.

2. Skin

Skin performs role in maintenance of body temperature and also removes excess water and salts.

3. Kidneys

They filter excess water, salts, urea, uric acid etc. from the blood and form urine.

Explanation

Skin / What is skin? Write its function. (Board 2014)

a. Structure of skin

Our skin consists of two layers:

1. Epidermis is the outer protective layer without blood vessels.
2. Dermis is the inner layer containing blood vessels, sensory nerve endings, sweat and oil glands, hairs and fat cells.

b. Roles of Skin

i. Regulation of body Temperature

Thin layer of fat cells in the dermis insulates the body. Contraction of small muscles attached to hair forms '**Goosebumps**'. It creates an insulating blanket of warm air.

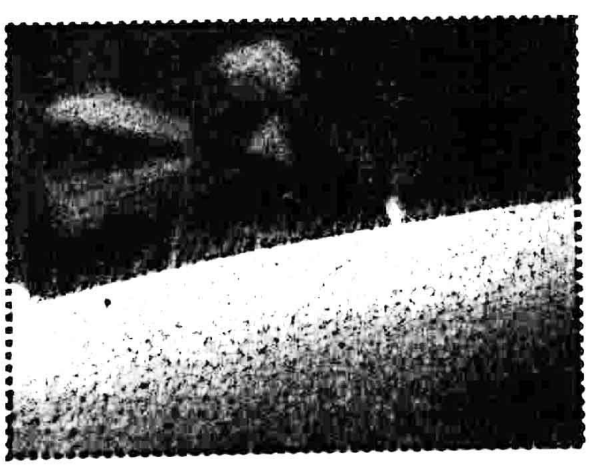


Figure11.5: Goosebumps

Skin helps in providing cooling effect when sweat is produced by sweat glands and excess body heat escapes through evaporation. Metabolic wastes such as excess water, salts, urea and uric acid are also removed in sweat.

Lungs

i. Removal of carbon dioxide

Lungs maintain the concentration of carbon dioxide in blood. During cellular respiration our cells produce carbon dioxide. From cells, this carbon dioxide diffuses into tissue fluid and from there into blood. Blood carries carbon dioxide to lungs from where it is removed in air.

Q5. Describe urinary system of humans. Also describe the structure of nephron?

Ans. Urinary system of Humans

The excretory system of humans is also called the urinary system. It is formed of one pair of kidneys, a pair of ureters, a urinary bladder and a urethra.

Kidneys

Kidneys filter blood to produce urine.

Ureters

The ureters carry urine from kidneys to urinary bladder.

Bladder

The bladder temporarily stores urine until it is released from body.

Urethra

Urethra is the tube that carries urine from urinary bladder to the outside of body.

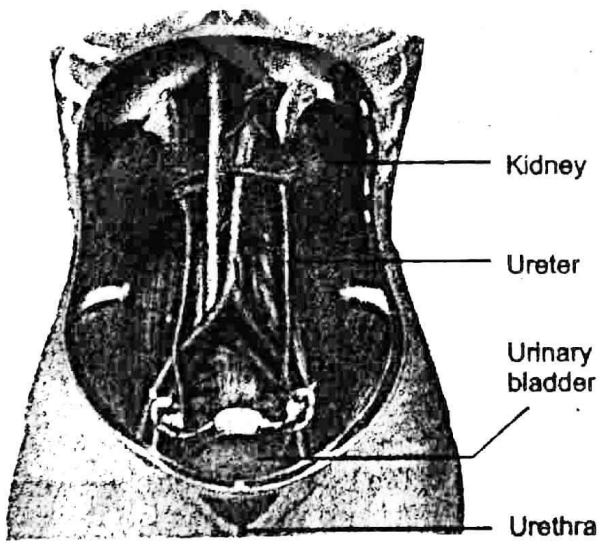


Figure11.6: The Urinary system of humans

Structure of kidney

(i) Colour and shape

Kidneys are dark-red bean shaped organs.

(ii) Size

Each kidney is 10 cm long, 5cm wide and 4 cm thick.

(iii) Weight

Each kidney weighs about 27 grams.

(iv) Location

They are placed against the back wall of abdominal cavity just below diaphragm, one on either side of vertebral column. They are protected by the last 2 ribs. The left kidney is a little higher than the right.

(v) Hilus

The concave side of kidney faces vertebral column. There is a depression, called hilus, near the centre of the concave area of kidney. This is the area of kidney through which ureter leaves kidney and other structures including blood vessels, lymphatic vessels and nerves enter and leave kidney.

(vi) Renal cortex

The longitudinal section of kidney shows two regions. Renal cortex is the outer part of kidney and it is dark in colour.

(vii) Renal medulla

Renal medulla is the inner part of kidney and is pale red in colour.

(viii) Pyramids

Renal medulla consists of several cone-shaped areas called renal pyramids.

(ix) Renal pelvis

Renal pyramids project into a funnel – shaped cavity called renal pelvis, which is the base of ureter.

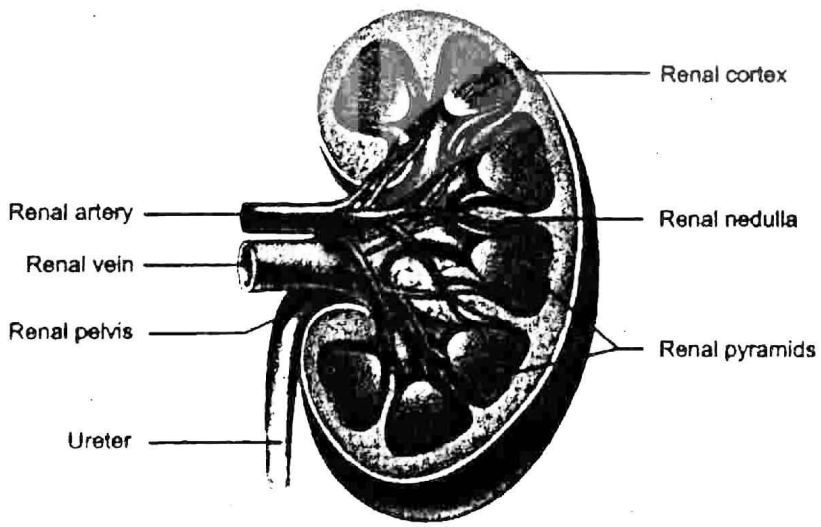


Figure11.7: The anatomy of a kidney

Draw the labeled diagram of human kidney (Board 2014)

Structure of nephron **(Board 2013)**

The functional unit of the kidney is called nephron. There are over one million nephrons in each kidney.

Parts of Nephron

There are two parts of a nephron:

1. Renal corpuscle
2. Renal tubule

1. Renal corpuscle

The renal corpuscle is not tubular and has two parts:

(i) Glomerulus

It is a network of capillaries.

(ii) Bowman's capsule

Bowman's capsule is a cup-shaped structure that encloses glomerulus.

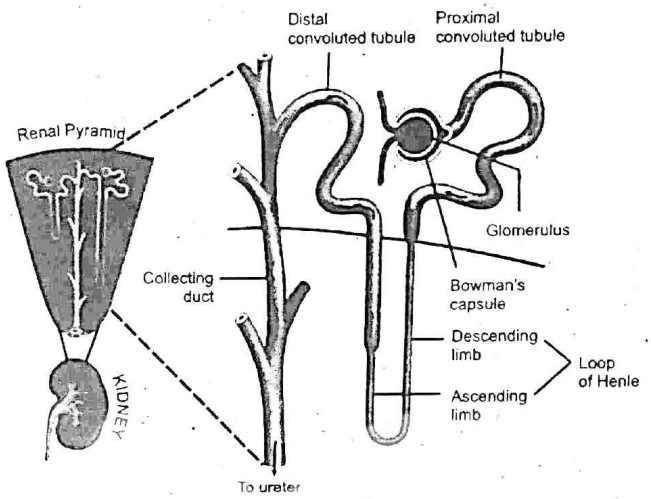


Figure11.8: The structure of a nephron

2. Renal tubule

Renal tubule is the part of nephron which starts after Bowman's capsule. It is sub - divided into following parts:

(i) Proximal convoluted tubule.

First portion of renal tubule is called proximal convoluted tubule.

(ii) Loop of Henle

Next portion is U- shaped and is called the loop of Henle.

(iii) Distal convoluted tubule

The last portion of renal tubule is the distal convoluted tubule.

(iv) Collecting ducts and Papillary ducts

The distal convoluted tubule of many nephrons open in a single collecting duct. Many collecting ducts join together to form several hundred papillary ducts which drain into renal pelvis.

Q.6 Write a note on functioning of kidney.

Functioning of kidney:

Ans. The main function of kidney is urine formation which takes place in three steps:

i. Pressure filtration **ii.** Selective re-absorption **iii.** Tubular secretion

i.Pressure filtration

The first step is pressure filtration. When blood enters the kidney via the renal artery, it goes to many arterioles, and then to the glomerulus. The pressure of blood is very high and so most of the water, salts, glucose and urea of blood is forced out of glomerular capillaries. This material passes into the Bowman's capsule and is now called glomerular filtrate.

ii. Selective re-absorption

The second step is the selective re-absorption. In this step about 99% of the glomerular filtrate is reabsorbed into the blood capillaries surrounding renal tubule. It occurs through osmosis, diffusion and active transport. Some water and most of the glucose is reabsorbed from the proximal

convoluted tubule. Here, salts are reabsorbed by active transport and then water follows by osmosis. The descending limb of Loop of Henle allows the reabsorption of water while the ascending limb of Loop of Henle allows the reabsorption of salts. The distal convoluted tubule again allows the reabsorption of water into the blood.

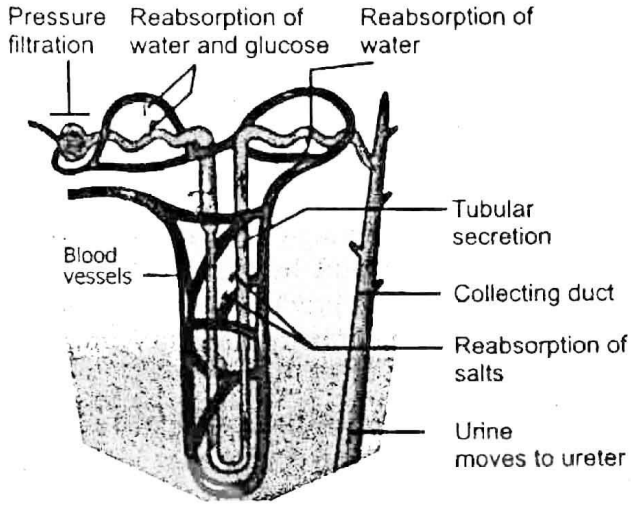


Figure11.9: Functioning of kidney (Nephron)

iii. Tubular secretion

The third step is the tubular secretion. Different ions, creatinine, urea etc. are secreted from blood into the filtrate in renal tubule. This is done to maintain blood at a normal pH (7.35-7.45) after the above mentioned steps, the filtrate present in renal tubules is known as urine. It moves into collecting ducts and then into pelvis.

Q.7 Write the normal composition of urine.

Ans. The normal composition of urine is shown in the following table:

Table 11.1 Normal Chemical composition of urine (source: NASA Contractor Report)

Water	95%
Urea	9.3g/l
Chloride ions	1.87g/l
Sodium ions	1.17g/l
Potassium ions	0.750 g/l
Other ions and compounds	Variable amounts

Q.8 Describe osmoregulatory function of kidney.

Ans. Osmoregulation

Osmoregulation is defined as the regulation of the concentration of water and salts in blood and other body fluids. Kidneys play an important role in osmoregulation by regulating the water contents of blood. It is an important process as excessive loss of water concentrates the body fluids whereas excess intake of water dilutes them.

Dilute urine

When there is excess water in body fluids, kidneys form dilute (hypotonic) urine. For this purpose, kidneys filter more water from glomerular capillaries into Bowman's capsule. Similarly less water is reabsorbed and abundant dilute urine is produced. It brings down the volume of body fluids to normal.

Concentrated urine

When there is shortage of water in body fluids, kidneys filter less water from glomerular capillaries and the rate of reabsorption of water is increased. Less filtration and more reabsorption produce small amount of concentrated (hypertonic) urine. It increases the volume of body fluids to normal. This whole process is under hormonal control.

Q.9 What do you know about Kidney disorders?

Ans. There are many different kidney disorders:

(i) Kidney stones

When urine becomes concentrated, crystals of many salts e.g. calcium oxalate, calcium and ammonium phosphate, uric acid etc are formed in it. Such large crystals cannot pass in urine and form hard deposits called kidney stones. Most stones start in kidneys, some may travel to ureter or urinary bladder.

Causes of Kidney stones

Major causes of kidney stones are:

1. Age
2. Diet (containing more green vegetables, salts, vitamins C and D)
3. Recurring urinary tract infections
4. Less intake of water
5. Alcohol consumption

Symptoms of kidney stones

Following are the symptoms of kidney stones:

1. Severe pain in kidney or in lower abdomen
2. Vomiting
3. Frequent urination
4. Foul- smelling urine with blood and pus

Treatment of kidney stones

(i) Drinking plenty of water

About 90% of kidney stones can pass through the urinary system by drinking plenty of water.

(ii) Surgical treatment

In surgical treatment, the affected area is opened and stone (s) are removed

(iii) Lithotripsy

Lithotripsy is another method for the removal of kidney stones. In this method, non-electrical shock waves from outside are bombarded on the stones in the urinary system. Waves hit the dense stones and break them. Stones become sand-like and are passed through urine.

(ii) Kidney (Renal) Failure

Kidney failure means a complete or partial failure of kidneys to function.

Causes of kidney failure

Following are causes of kidney failure:

i. Diabetes mellitus
ii. Hypertension
iii. Sudden interruption in the blood supply to kidneys
iv. Drug overdoses

Symptoms of kidney failure

Main symptoms include:

i. High level of urea and other wastes in blood
ii. Vomiting
iii. Nausea
iv. Weight loss
v. Frequent urination
vi. Blood in urine
vii. Excess fluids in body may causes swelling of legs, feet and face
viii. Shortness of breath

Treatment of kidney Failure

Kidney failure is treated with:

i. Dialysis
ii. Kidney transplant

1. Dialysis **(Board 2013)**

Dialysis means the cleaning of blood by artificial ways. There are two methods of dialysis:

(1) Peritoneal Dialysis
(2) Haemodialysis

(1)Peritoneal Dialysis

In this type of dialysis, the dialysis fluid is pumped for a time into the peritoneal cavity which is the space around gut. This cavity is lined by peritoneum. Peritoneum contains blood vessels. When we place dialysis fluid in peritoneal cavity, waste materials from peritoneal blood vessels diffuse into the dialysis fluid, which is then drained out. This type of dialysis can be performed at home, but must be done every day.

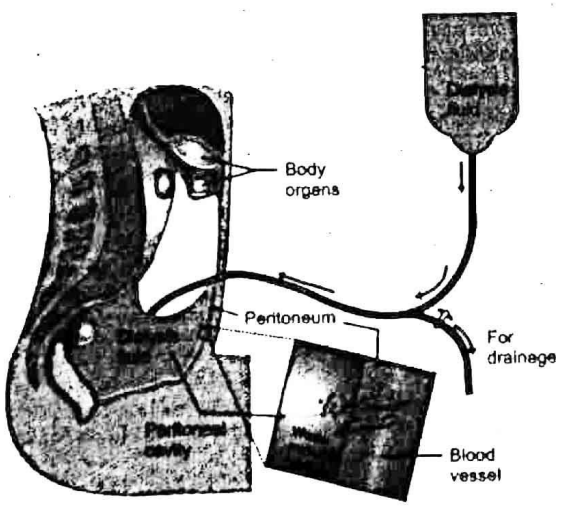


Figure11.10: Peritoneal dialysis

(2)Haemodialysis

In haemodialysis, patient's blood is pumped through an apparatus called dialyzer. The dialyzer contains long tubes, the walls of which act as semi-permeable membranes. Blood flows through the tubes while the dialysis fluid flows around the tubes. Extra water and wastes move from blood into

the dialysis fluid. The cleansed blood is then returned back to body. The haemodialysis treatments are typically given in dialysis centres three times per week.

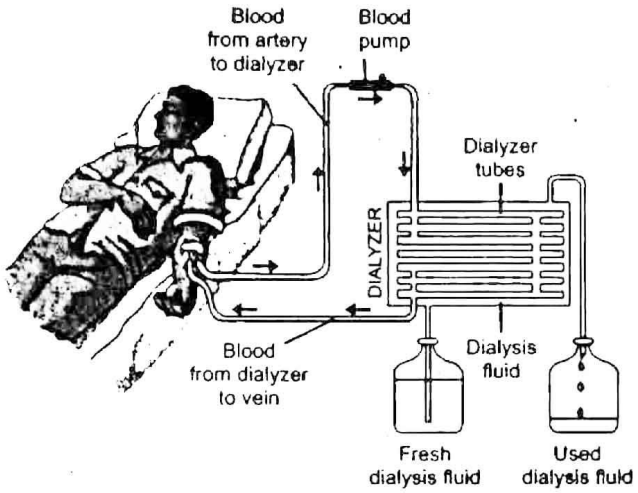


Figure11.11: Haemodialysis

ii) Kidney Transplant

Introduction

Dialysis needs to be repeated after every few days and is unpleasant for patients and attendants. Another treatment for the end-stage kidney failure is kidney transplantation. It is the replacement of patient's damaged kidney with a donor healthy kidney.

Conditions for Transplant

(1) Kidney may be donated by a deceased-donor or living donor.

(2) The donor may or may not be a relative of the patient.

(3) Before transplant, the tissue proteins of donor and patient are matched.

(4) The donor's kidney is transplanted in patient's body and is connected to the patient's blood and urinary system.

(5) The average lifetime for a donated kidney is 10 to 15 years.

(6) When transplant fails, the patient may be given a second kidney transplant. In this situation, the patient is treated through dialysis for some intermediary time.

Problems after transplant

Problems after a transplant may include transplant rejection, infections, imbalances in body salts which can lead to bone problems and ulcers.

Q.10 What are the contributions of Muslim scientists about kidney diseases?

Ans. Contributions of Abu Nasr al-Farabi

Abu Nasr al-Farabi (872-951) was a prominent scientist who wrote many books that contained information about kidney diseases.

Contributions of Al-Zahrawi in removing stones

The genius Abu al Qasim Al-Zahrawi (known as Albucasis 936-1013) is considered to be Islam's greatest surgeon who invented many surgical procedures including the surgical removal of stones from the urinary bladder. His encyclopedia, Al-Tasrif ("The Method") contained over 200 surgical medical instruments he personally designed.

Multiple Choice Questions

1. **The human urinary system consists of;**
   (a) Rectum, lungs, kidneys, ureters
   (b) Kidneys, ureters, urinary bladder
   (c) Skin, liver, lungs, kidneys
   (d) Kidneys, ureters, urinary bladder, urethra

2. **Which organ is responsible for filtering the blood?**
   (a) Intestine (b) Brain
   (c) Stomach (d) Kidney

3. **The tube between kidney and urinary bladder is the;**
   (a) Ureter (b) Urethra
   (c) Renal tubule (d) Nephron

4. **Body balance of water, salts, temperature and glucose is termed as:**
   (a) Excretion (b) Tubular secretion
   (c) Homeostasis (d) Re-absorption

5. **Which is the correct order for the path taken by urine after it leaves the kidneys?**
   (a) Urethra, bladder, ureters
   (b) Bladder, ureters, urethra
   (c) Ureters, bladder, urethra
   (d) Bladder, urethra, ureters

6. **What is the function of the ureter?**
   (a) To store urine
   (b) To carry urine from the kidney to the bladder
   (c) To carry urine out of the body
   (d) To remove wastes from the blood

7. **What waste products are excreted by kidneys?**
   (a) Urea, water & salts
   (b) Salts, water and carbon dioxide
   (c) Urea & water
   (d) Urea & salts

8. **The two main functions of sweat are;**
   (a) To keep the body cool and to remove excess proteins
   (b) To keep the body warm and to filter the blood
   (c) To filter the blood and to remove waste products
   (d) To remove waste products and to cool the body

9. **Which would NOT be present in the filtrate entering the Bowman's capsule of nephron?**
   (a) Water (b) Calcium ions
   (c) Blood cells (d) Urea

10. **During peritoneal dialysis, the waste materials move from:**
    (a) The abdomen to the dialysis fluid
    (b) The dialysis fluid to the peritoneum blood vessels
    (c) The peritoneum blood vessels to the dialysis fluid
    (d) The dialysis fluid to the abdomen

11. **Core temperature of human body remains at about:**
    (a) 35°C (b) 36°C
    (c) 34°C (d) 37°C

12. **Calcium oxalate is deposited in the form of crystals in the leaves and stems of:** 11(022)
    (a) Pines (b) Tomatoes
    (c) Rubber (d) Keekar

13. **Resins are removed by:**
    (a) Conifers (b) Lady finger
    (c) Grasses (d) Keekar

14. **Cacti are examples of:**
    (a) Hydrophytes (b) Xerophytes
    (c) Halophytes (d) None

15. **Organs which work for homeostasis are:**
(a) Lungs (b) Skin
(c) Kidneys (d) All of the above

16. **The depression near the centre of concave area of kidney is called:**
(a) Cortex (b) Hilus
(c) Medulla (d) Pyramids

17. **U–shaped part of renal tubule is called:**
(a) Renal corpuscle
(b) Glomerulus
(c) Loop of Henle
(d) Bowman's capsule

18. **Which of following are not filtered through glomerular capillaries:**
(a) Blood cells
(b) Proteins
(c) Blood cells and Proteins
(d) Urea

19. **The typical volume of urine produced by an average adult per day is:**
(a) 1 liter (b) 2 liters
(c) 5 liters (d) 1.4 liters

20. **By drinking plenty of water how many stones can be avoided?**
(a) 20% (b) 90%
(c) 50% (d) 30%

21. **A method for removing stones in which non-electrical shock waves are bombarded on stones is called:**
(a) Lithotripsy (b) Surgery
(c) Dialysis (d) None

22. **Normal pH of blood is maintained at:**
(a) 7.35 – 7.40 (b) 7.35 – 7.45
(c) 7.30 – 7.40 (d) 7.30 – 7.45

23. **The loss of water in the form of drops from tips of leaf is called:** (B 2013)
(a) Excretion (b) Guttation
(c) Transpiration (d) Evaporation

24. **A method for removal of kidney stone is:** (Board 2013)
(a) Haemodialysis
(b) Peritoneal Dialysis
(c) Lithotripsy
(d) Kidney transplant

25. **In plants the excess water is removed by:**
(a) Respiration
(b) Transpiration
(c) Guttation
(d) Transpiration and Guttation

26. **The 'Nephrons' are mainly made of:**
(a) Renal corpuscle
(b) Renal tubule
(c) Renal corpuscle and renal tubule
(d) Renal pelvis

27. **Which is not the function of kidney?**
(a) pH balance
(b) Blood pressure
(c) Composition of blood
(d) Digestion of proteins

28. **In animals, the excretion of CO_2 takes place by:**
(a) Kidneys (b) Stomach
(c) Lungs (d) Liver

29. **Which one is not the part of kidney?**
(a) Medulla (b) Cerebellum
(c) Nephrons (d) Glomerulus

30. **Metabolic wastes are eliminated by:**
(a) Respriation (b) Excretion
(c) Homeostasis (d) Nutrition

31. **Guttation occurs in:**
(a) Pines (b) Tomatoes
(c) Grasses (d) Lady finger

32. **Water is transported by:**
(a) Xylem
(b) Phloem
(c) Xylem and Phloem
(d) Cambium

33. What is produced during respiration?
(a) CO_2 (b) H_2O
(c) CO_2 and H_2O (d) N_2

34. **Rubber plant produces:**
(a) Gums (b) Mucilage
(c) Latex (d) Resins

35. **Keekar produces:**
(a) Gums (b) Mucilage
(c) Latex (d) Resins

36. **Broad leaves are found in:**
(a) Hydrophytes (b) Mesophytes
(c) Xerophytes (d) Halophytes

37. **Succulent organs are found in:**
(a) Mesophytes
(b) Hydrophytes
(c) Xerophytes
(d) Halophytes

38. **Uric acid is removed by:**
(a) Skin
(b) Kidneys
(c) Kidneys and Skin
(d) Lungs

39. **Which creates an insulating blanket of warm air?**
(a) Dermis (b) Lungs
(c) Liver (d) Goosebumps

40. **Which encloses glomerulus?**
(a) Pyramids
(b) Loop of Henle
(c) Bowman's capsule
(d) Collecting duct

41. **Amount of urea in normal chemical composition of urea in urine is:**
(a) 9.3 g/ℓ (b) 1.87 g/ℓ
(c) 1.17 g/ℓ (d) 0.75 g/ℓ

42. **%age of Potassium ions in urine is;**
(a) 1.8 g/ℓ (b) 1.17 g/ℓ
(c) 0.75 g/ℓ (d) 9.3 g/ℓ

43. **Which is done at home?**
(a) Lithotripsy
(b) Haemodialysis
(c) Peritoneal dialysis
(d) Kidney transplant

44. **Average life for a donated kidney is:**
(a) 8-10 years (b) 5 years
(c) 20 years (d) 10-15 years

45. **Hypotonic urine is formed when water in body fluid is:**
(a) Less (b) Absent
(c) In excess (d) Not filtered

46. **%age of water in Urine is:**
(a) 90% (b) 95%
(c) 80% (d) 100%

47. **The name of the common mineral salt present in sweat is _____.**
(a) Calcium nitrate
(b) Sodium chloride
(c) Potassium chloride
(d) Iron phosphate

48. **In kidney the formation of urine occurs in _____ steps?**
(a) 1 (b) 2
(c) 3 (d) 4

49. **Arterial blood dialysis is also called:**
(a) Lithotripsy
(b) X-rays
(c) Haemodialysis
(d) Kidney transplant

50. **The category of the plants that has adaptations of small and thick leaves to limit water loss is called:**
(a) Hydrophytes (b) Xerophytes
(c) Mesophytes (d) Hygrophytes

51. **Who wrote an encyclopedia "Al Tasrif"?**
(a) Abu Nasr-al-Farabi
(b) Abu al-Qasim Al-Zahrawi
(c) Bu Ali Sina
(d) Darwin

52. **Mucilage is secreted in:**
(a) Carnivorous plants
(b) Lady finger
(c) Carnivorous plants and Lady finger
(d) Keekar

53. **The plants which live in sea water and are adapted to salty environments are called:**
(a) Halophytes
(b) Hydrophytes
(c) Xerophytes
(d) Halophytes and Hydrophytes

54. **Excretion is also a process of:**
(a) Respiration
(b) Co-ordination
(c) Homeostasis
(d) Breathing

55. **Despite eating a meal rich in carbohydrates, the blood glucose level remains about:**
(a) 1 g per liter (b) 2 g per liter
(c) 3 g per liter (d) 4 g per liter

56. **Approximate weight of a Kidney is:** **(Board 2014)**
(a) 10 grams (b) 15 grams
(c) 20 grams (d) 27 grams

57. **The length of each Kidney is:**
(a) 10 cm (b) 15 cm
(c) 20 cm (d) 30 cm

58. **Secretions secreted by conifers are called:** **(Board 2014)**
(a) Resins (b) Gums
(c) Later (d) Mucilage

Answer Key

1.	d	**2.**	d	**3.**	a	**4.**	c
5.	c	**6.**	b	**7.**	a	**8.**	d
9.	c	**10.**	c	**11.**	d	**12.**	b
13.	a	**14.**	b	**15.**	d	**16.**	b
17.	c	**18.**	c	**19.**	d	**20.**	b
21.	a	**22.**	b	**23.**	b	**24.**	c
25.	d	**26.**	c	**27.**	d	**28.**	c
29.	b	**30.**	b	**31.**	c	**32.**	a
33.	c	**34.**	c	**35.**	a	**36.**	a
37.	c	**38.**	c	**39.**	d	**40.**	c
41.	a	**42.**	c	**43.**	c	**44.**	d
45.	c	**46.**	b	**47.**	b	**48.**	c
49.	c	**50.**	b	**51.**	b	**52.**	c
53.	a	**54.**	c	**55.**	a	**56.**	d
57.	a	**58.**	a				

Short Answer Questions

Q.1 What are the major organs involved in homeostasis in human body? State the role of each organ?

Ans. Human beings have highly developed organs for homeostasis which are:

(i) Lungs (ii) Skin (iii) Kidneys

Lungs remove excess carbon dioxide and keep it in balance.

Skin performs role in maintenance of body temperature and also removes excess water and salts.

Kidneys filter excess water, salts, urea, uric acid etc. from the blood and form urine.

Q.2 What is Bowman's capsule?

Ans. One end of the renal tubule is blind and attains a cup shaped structure called Bowman's capsule that encloses glomerulus.

Q.3 Define Homeostasis. **(Board 2013)** **OR**

What is homeostasis. Give an example. **(Board 2013)**

Ans. Homeostasis may be defined as the maintenance of the internal conditions of body in equilibrium, despite changes in the external environment e.g. the core temperature of human body remains at about 37°C despite fluctuations in the surrounding air temperature.

Q.4 Define osmoregulation. **(Board 2014)**

Ans. It is defined as the maintenance of the amounts of water and salts in body fluids i.e., blood and tissue fluids.

Q.5 Define thermoregulation.

Ans. The maintenance of internal body temperature is called thermoregulation e.g., human body temperature is kept constant at 37°C.

Q.6 Define Excretion.

Ans. The process by which metabolic wastes are eliminated from body to maintain the internal conditions at equilibrium is called excretion e.g., urea, salts of uric acid and water are eliminated out of body through excretion.

Q.7 Differentiate between transpiration and Guttation.

Ans:

Transpiration	Guttation
i. It is defined as loss of water from plants surface in the form of vapours. **ii.** It occurs through stomata.	**i.** It is defined as appearance of drops of water on the tips or edges of leaves. **ii.** It occurs through special pores called hydathodes present at leaf tips or edges.

Q.8 What are Hydrophytes?

Ans. Hydrophytes are the plants which live completely or partially submerged in fresh water e.g. water lilly.

Q.9 What are Xerophytes?

Ans. Xerophytes live in dry environment e.g. cacti.

Q.10 What are Halophytes? **(Board 2014)**

Ans. The plants living in sea water and adapted to salty environments are called halophytes e.g. different sea grasses.

Q.11 What is Hilus?

Ans. The concave side of kidney faces vertebral column. There is a depression called hilus, near the centre of the concave area of kidney. This is the area of kidney through which ureter leaves kidney and other structures including blood vessels, lymphatic vessels and nerves enter and leave kidney.

Q.12 What are Renal Pyramids?

Ans. Renal medulla consists of several cone-shaped areas called renal pyramids.

Q.13 What is Renal pelvis?

Ans. Renal pyramids project into a funnel-shaped cavity called renal pelvis which is the base of ureter.

Q.14 What is renal corpuscle?

Ans. The part of nephron which is not tubular and has two parts:

(i) Glomerulus

(ii) Bowman's capsule

Q.15 What is Glomerulus?

Ans. Glomerulus is a network of capillaries and is enclosed by a cup shaped structure called Bowman's capscule.

Q.16 Define renal tubule.

Ans. Tubular part of nephron which starts after Bowman's capsule is called renal tubule. It is sub divided into following parts:

i. Proximal convoluted tubule
ii. Loop of Henle
iii. Distal convoluted tubule
iv. Collecting duct

Q.17 What do you know about proximal convoluted tubule?

Ans. First portion of renal tubule is called proximal convoluted tubule.

Q.18 What is Loop of Henle?

Ans. U – shaped part of renal tubule is called Loop of Henle.

Q.19 What is distal convoluted tubule?

Ans. Last portion of renal tubule is called distal convoluted tubule.

Q.20 What are collecting ducts?

Ans. The distal convoluted tubule of many nephrons open in a single collecting duct. Many collecting ducts join together to form several hundred papillary ducts which drain into renal pelvis.

Q.21 What is a nephron?

Ans. The functional unit of the kidney is called nephron. There are over one million nephrons in each kidney.

Q.22 What is pressure filtration?

Ans. The first step of urine formation is pressure filtration. When blood enters the kidney via the renal artery it goes to many arterioles, and then to the glomerulus. The pressure of blood is very high and so most of the water, salts, glucose and urea of the blood is forced out of glomerular capillaries.

Q.23 What do you know about selective reabsorption?

Ans. It is the second step of urine formation. In this step, about 99% of the glomerular filtrate is re-absorbed into the blood capillaries surrounding renal tubule. It occurs through osmosis, diffusion and active transport.

Q.24 What is the tubular secretion?

Ans. The third step of urine formation is called tubular secretion. Different ions, creatinine, urea etc. are secreted from blood into the filtrate in renal tubule. This is done to maintain blood at a normal pH (7.35 – 7.45).

Q.25 What is lithotripsy. **(Board 2014)**

Ans. It is the method to remove kidney stones. In this method, non-electrical shock waves from outside are bombarded on the stones in the urinary system. Waves hit the dense stones and break them. Stones become sand like and are passed through urine.

Q.26 Define dialysis.

Ans. Dialysis means the cleaning of blood by artificial ways by using a dialyzer. It is of two types:
(i) Peritoneal Dialysis (ii) Haemodialysis

Q.27 What is a dialyzer?

Ans. In haemodialysis, patient's blood is pumped though an apparatus called dialyzer. It contains long tube, the walls of which act as semi-permeable membranes. Blood flows through the tubules and during this extra water and wastes move from blood into the dialysis fluid.

Q.28 What is peritoneal dialysis?

Ans. In this type of dialysis, the dialysis fluid is pumped for a time into the peritoneal cavity which is the space around gut. This cavity is lined by peritoneum. Peritoneum contains blood vessels. When dialysis fluid is placed in peritoneal cavity, waste materials from peritoneal blood vessels diffuse into the dialysis fluid, which is then drained out.

Q.29 What is Haemodialysis?

Ans. In haemodialysis, patient's blood is pumped through an apparatus called dialyzer. It contains long tubing which act as semipermeable membrane. Blood flows through the tubes while the dialysis fluid flows around the tubes. Extra water and wastes move from blood into dialysis fluid. The cleaned blood is returned back to the body.

Q.30 What is glomerulus filtrate?

Ans. In the glomerulus due to high pressure of blood most of the water, salts, glucose and urea of the blood is forced out of glomerular capillaries. This material passes into the Bowman's capsule and is called glomerular filtrate.

Q.31 What are papillary ducts?

Ans. Many collecting ducts join together to form several hundred papillary ducts which drain into renal pelvis.

Q.32 What are ureters?

Ans. Kidneys filter blood to produce urine and the ureters carry urine from kidneys to urinary bladder.

Q.33 What is urethra?

Ans. Urethra is the tube that carries urine from urinary bladder to the outside of body.

Q.34 What is urinary bladder?

Ans. Bladder is an organ of urinary system which temporarily stores urine until it is released from body.

Q.35 What is urinary system?

Ans. Excretory system of human is also called the urinary system. It is composed of:

i. Pair of kidneys **ii.** Pair of ureters **iii.** Urinary bladder and urethra

Q.36 Why transpiration does not take place at night? **(Board 2013)**

Ans. At night, transpiration usually does not occur because most plants have their stomata closed.

Q.37 What do you mean by kidney stone? **(Board 2014)**

Ans. When urine becomes concentrated, crystals of many salts e.g. calcium oxalate, calcium and ammonium phosphate, uric acid etc are formed in it. Such large crystals cannot pass in urine and form hard deposits called kidney stones. Most stones start in kidneys, some may travel to ureter or urinary bladder.

Q.38 What is guttation? How does it differ from dew? **(Board 2014)**

Ans. Guttation

(a)Definition

The appearance of drops of water on the tips or edges of leaves is called guttation. Guttation is not to be confused with dew, which condenses from the atmosphere on to the plant surface.

(b) Explanation

Some plants such as grasses and strawberry force this water through special pores, present at leaf tips or edges, and form drops.

Unit 12

Coordination and Control

Long Answer Questions

Q.1 What do you mean by coordination? Explain its mechanism with examples.

Ans. Coordination

Definition

The coordination is developed when body works as one unit, in which its different organs and systems cooperate and work in harmony with each other.

Explanation

The tissues and organs in the bodies of multicellular organisms do not work independent of each other. They work together performing their many tasks as the needs of the whole body. This means that these activities are coordinated. The process is called coordination. Coordination also enables the organism to respond to happenings in the world around it.

Example No. 1

One familiar example of coordination is the way in which muscles work together during movement. When a boy runs to catch a ball, he uses hundred of muscles to move his arms, legs and back. His nervous system uses information from his sense organs and coordinates these muscles. Due to this coordination, the muscles contract in the correct sequence, power, and length of time. But that is not all. Such activities involve many other kinds of coordination. For example, breathing and heartbeat rates are increased, blood pressure is adjusted, and extra heat is removed fast from the body.

Example No. 2

When we are writing something, our hands and fingers work in collaboration with our muscles, eyes, thoughts etc. and then very intricate movements result.

Q.2 Name the types of coordination. Explain the components of a coordinated action in detail.

Ans. TYPES OF COORDINATION:

There are two types of coordination in organisms:

(i) Nervous coordination

It is brought about by nervous system.

(ii) Chemical coordination

It is brought about by endocrine system.

Animals have both the nervous and chemical coordination systems in their bodies while **plants** and other organisms have only chemical coordination.

Components of coordinated action

A coordinated action has five components.

i. Stimuli

Definition

A stimulus is defined as any change in environment (external and internal), which can provoke a response in organism.

Examples

Examples of stimuli are heat, cold, pressure, sound waves, presence of chemicals, microbial infections etc.

ii. Receptors

Definition

The organs, tissues or cells which are specifically built to detect particular type of stimuli are called receptors.

Examples

Sound waves are detected by ears, light is detected by eyes, chemicals in air are detected by nose.

iii. Coordinators

Definition

These are the organs that receive information from receptors and send messages to particular organs for proper action.

Examples

(i) In nervous coordination, brain and spinal cord are coordinators. They receive information and send messages through neurons in the form of nerve impulses.

(ii) On the other hand, in chemical coordination, various endocrine glands play the role of coordinators. They receive information in the form of various chemicals and send messages by secreting particular hormones in blood.

iv. Effectors

Definition

These are the parts of body which receive messages from coordinators and produce particular responses.

Examples

(i) In nervous coordination, neurons carry messages from coordinators (brain and spinal cord) to muscles and glands, which act as effectors.

(ii) In chemical coordination, particular hormones carry messages from coordinators, (endocrine glands) to particular target tissues, which act as effectors. For some hormones, nephrons act as effectors. Similarly, bones and liver act as effectors for many hormones.

v. Response.

Definition

On receiving the message from coordinators, the effectors perform action. This action is called response. Usually, nervous coordination produces immediate but short living responses while chemical coordination produces slow but long living responses.

Example- Pulling our hand away from something very hot.

The movement of the flower of sunflower towards light are the examples of responses.

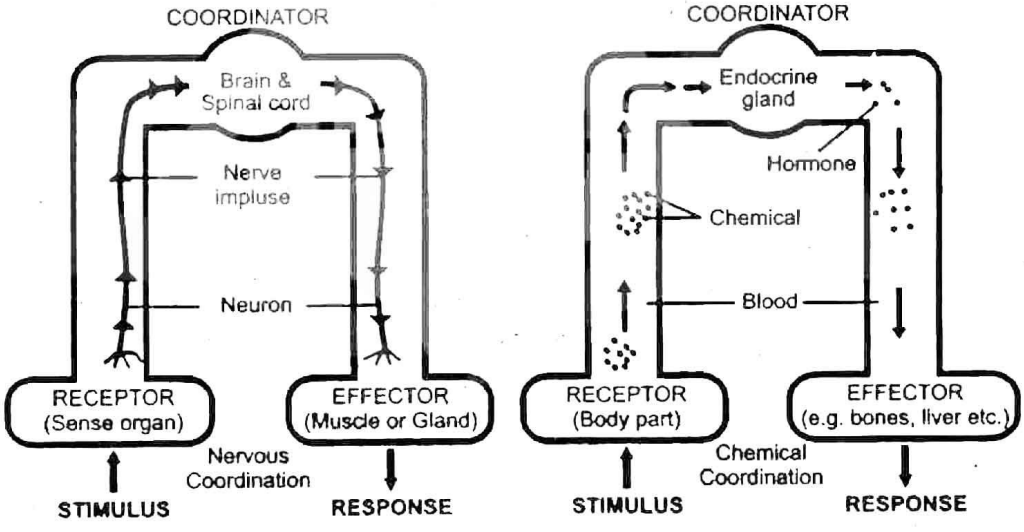


Figure 12.1: Neurons and chemical coordination

Q.3 (a) What do you know about human nervous system?

(b) Explain neuron in detail

Ans. (a) Human Nervous system

The nervous system in man and in other higher animals is composed of two major components.

(1) Central Nervous System (C.N.S)

A system which comprises of brain and spinal cord is called central nervous system.

(2) Peripheral Nervous System (P.N.S)

Peripheral nervous system (P.N.S) consists of nerves that arise from central nervous system and spread in different parts of body.

All these components of human nervous system are made of neurons.

(b) Neuron or Nerve cell

Introduction

Nerve cell or neuron is the unit of nervous system. All the components of human nervous system are made of neurons.

Human Nervous system

The human nervous system consists of billions of neurons plus supporting (neuroglial) cells.

Function of Neurons

Neurons are specialized cells that are able to conduct nerve impulses from receptors to co-ordinators and from coordinators to effectors. In this way, they communicate with each other and with other types of body cells.

Nerve impulse

A nerve impulse is a wave of electrochemical changes that travels along the length of neuron.

Structure of neuron

Neuron consists of:

(a) Cell body

The nucleus and most of the cytoplasm of a neuron is located in its cell body.

(b) Dendrites and axon

Different processes extend out from the cell body. These are called dendrites and axon

(c) Direction of nerve impulses:

Dendrites conduct impulses towards the cell body and axons conduct impulses away from the cell body.

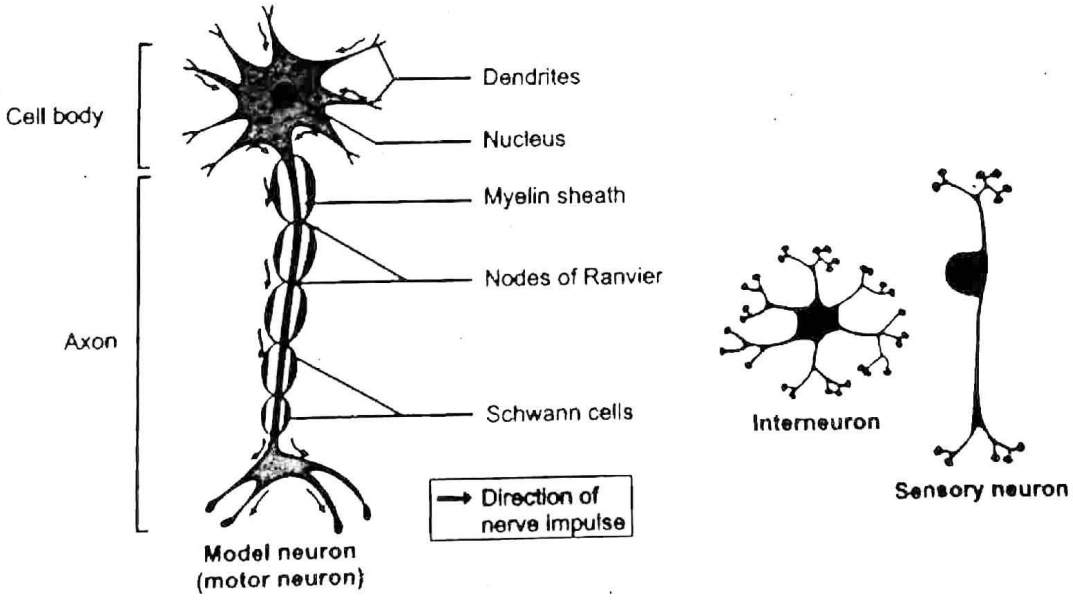


Figure 12.2: Neurons

(d) Schwann Cells

Schwann cells are special neuroglial cells located at regular intervals along axons.

(e) Myelin Sheath

In some neurons, Schwann cells secrete a fatty layer called myelin sheath and it is located over axon. Myelin sheath is an insulator so the membrane coated with this sheath does not conduct nerve impulse. In such a neuron, impulses "jump" over the areas of myelin sheath going from node to node. Such impulses are called **saltatory** (jumping) impulses.

Function of Saltatory Impulses:

This increases the speed of nerve impulses.

(f) Nodes of Ranvier

Between the areas of myelin on an axon, there are non-myelinated points called the nodes of Ranvier.

Types of Neuron

On the basis of their functions, neurons are of three types:

(a) Sensory neurons conduct sensory information (nerve impulse) from receptors towards the CNS. Sensory neurons have one dendrite and one axon.

(b) Interneurons form brain and spinal cord. They receive information, interpret them and stimulate motor neurons. They have many dendrites and axons.

(c) Motor neurons carry information from interneurons to muscles or glands (effectors). They have many dendrites but only one axon.

Q.4 Define nerve. Explain its types. **(Board 2014)**

Ans. Nerve

A nerve means the union of several axons that are enveloped by a covering made of lipid.

Types of nerves

Based on the property of axons, the nerves are classified into three types:

1. Sensory nerves

They contain the axons of sensory neurons only.

2. Motor nerves

They contain the axons of motor neurons only.

3. Mixed nerves

They contain the axons of both i.e. sensory and motor neurons.

Q.5 Explain Central Nervous System (C.N.S) in detail.

Ans. Parts of CNS

CNS consists of two parts:

(i) Brain **(ii) Spinal cord**

(i) Brain

Introduction

In animals, all life activities are under the control of brain. The structure of brain is suitable to perform this function.

Location

Brain is situated inside a bony cranium i.e. a part of skull.

Meninges

Inside cranium, brain is covered by three layers called meninges.

Function of meninges

Meninges protect brain and also provide nutrients and oxygen to brain tissues through their capillaries.

Ventricles

The brain contains fluid filled ventricles that are continuous with the central canal of spinal cord.

Cerebrospinal fluid (CSF)

Fluid within ventricles and central canal is called cerebrospinal fluid (CSF).

Function of CSF

It provides cushioning and ions to brain and spinal cord.

Division of Brain

There are three main regions in the brain of humans and other vertebrates. These are forebrain, midbrain, and hindbrain.

(a) Forebrain (Board 2013)

Introduction

Forebrain is the largest area of brain. It is most highly developed in humans.

Parts of Forebrain

(i) Thalamus

Location

It lies just below the cerebrum.

Functions

It serves as a relay centre between various parts of brain and spinal cord. It also receives and modifies sensory impulses (except from nose) before they travel to cerebrum.
Thalamus is also involved in pain perception and consciousness i.e. sleep and awakening.

(ii) Hypothalamus

Location

It lies above midbrain and just below thalamus.

Size

In humans, it is about the size of an almond.

Function

(a) The most important function of hypothalamus is to link nervous system and endocrine system.

(b) It controls the secretions of pituitary gland.

(c) It controls feelings such as rage, pain, pleasure and sorrow.

(iii) Cerebrum

It is the largest part of forebrain.

Function

It controls skeletal muscles, thinking, intelligence and emotions.

Cerebral hemispheres

Cerebrum is divided into two cerebral hemispheres.

Olfactory Bulbs

The anterior parts of cerebral hemispheres are called olfactory bulbs which receive impulses from olfactory nerves and create the sensation of smell.

Cerebral cortex

The upper layer of cerebral hemisphere i.e. cerebral cortex consists of grey matter.

Grey matter

The grey matter of nervous system consists of cell bodies and non-myelinated axons.

White matter

Beneath this layer is present the white matter. The white matter of nervous system consists of myelinated axons. Cerebral cortex has a large surface area and is folded in order to fit in skull.

Lobes of cerebral cortex

It is divided into four lobes:

Lobe	Functions
Frontal	Controls motor functions, permits conscious control of skeletal muscles and coordinates movements involved in speech
Parietal	Contains sensory areas that receive impulses from skin
Occipital	Receives and analyzes visual information
Temporal	Concerned with hearing and smell

Hippocampus

It is a structure that is deep in the cerebrum. It functions for the formation of new memories. People with a damaged hippocampus cannot remember things that occurred after that but can remember things that occurred before damage.

(b) MIDBRAIN

Location:

Midbrain lies between hindbrain and forebrain and it connects the two.

Functions:

1. It receives sensory information and sends it to the appropriate parts of fore brain.
2. Midbrain also controls some auditory reflexes and posture.

(c) HINDBRAIN / What are parts of hind brain and how they perform their function?

Parts of hindbrain **(Board 2014)**

Hindbrain consists of three major parts:

1. Medulla Oblongata

Location

It lies on the top of spinal cord.

Functions

(i) It controls breathing, heart rate and blood pressure.

(ii) It also controls many reflexes such as vomiting, coughing, sneezing etc.

Information that passes between spinal cord and the rest of brain pass through medulla.

2. Cerebellum

Location

It is behind the medulla oblongata.

Function

It coordinates muscle movements.

3. Pons

Location

It is present on the top of medulla oblongata.

Function

(i) It assists medulla in controlling breathing.

(ii) It also serves as a connection between cerebellum and spinal cord.

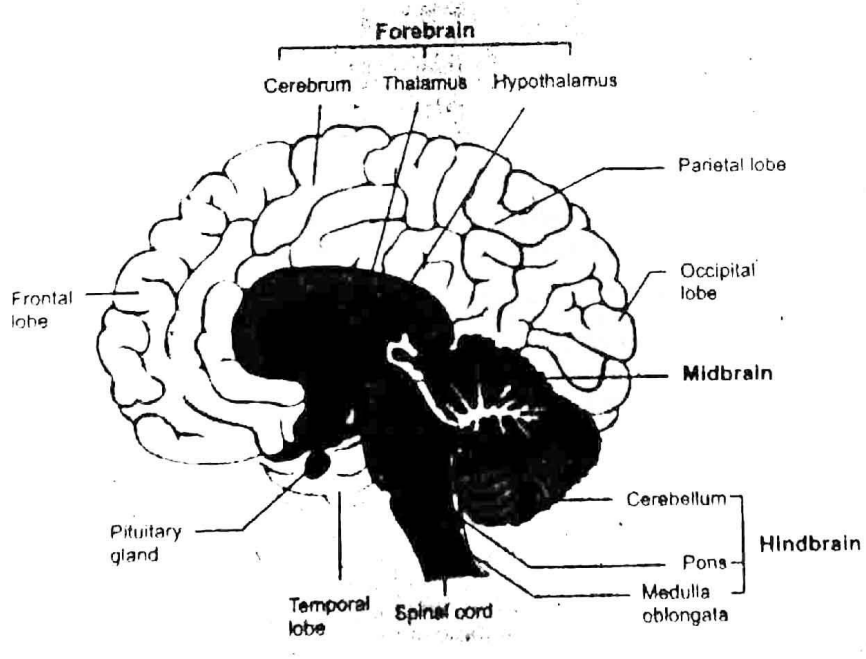


Figure 12.3: Structure of human brain

(ii) SPINAL CORD

Definition

It is a continuation of medulla oblongata.

Location

It starts from brain stem and extends to lower back.

STRUCTURE

The spinal cord is infact a tubular bundle of nerves. It is the continuation of medulla oblongata.

Length

It is roughly 40 cm long.

Width

It is about as wide as our thumb for most of its length.

Meninges

Like brain, spinal cord is also covered by meninges.

Protection of spinal cord

The vertebral column surrounds and protects spinal cord.

Outer Region

The outer region of spinal cord is made of white matter containing myelinated axons.

Central Region

The central region is butterfly-shaped that surrounds the central canal.

Composition

It is made of grey matter containing neuron cell bodies.

SPINAL NERVES

31 pairs of spinal nerves arise along spinal cord. These are "mixed" nerves because each contains axons of both sensory and motor neurons.

ROOTS OF SPINAL NERVES

At the point where a spinal nerve arises from spinal cord, there are two roots of spinal nerves. Both roots unite and form one mixed spinal nerve.

Dorsal root

The dorsal root contains sensory axons and a ganglion where cell bodies are located.

Ventral root

The ventral root contains axons of motor neurons.

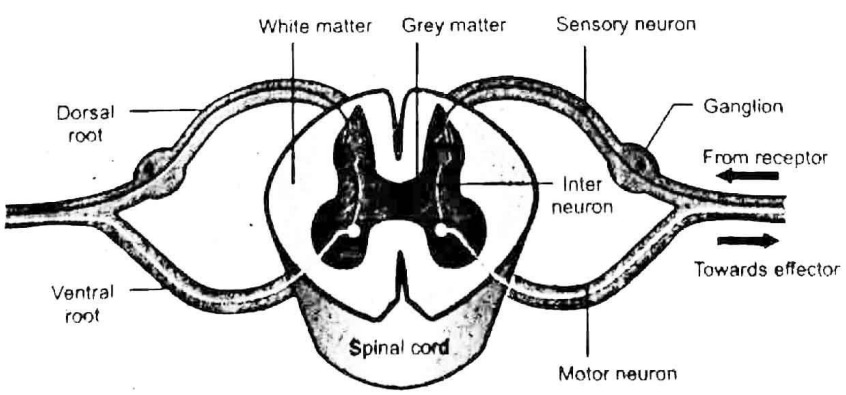


Figure 12.4: Spinal Cord and Spinal Nerves

Functions of Spinal Cord

1. It serves as link between body parts and brain. Spinal cord transmits nerve impulses from body parts to brain and from brain to the body parts.
2. Spinal cord also acts as a coordinator, responsible for some simple reflexes.

Q.6 Explain Peripheral Nervous System (PNS) in detail.

Ans. PERIPHERAL NERVOUS SYSTEM (PNS)

Components of PNS:

The PNS is composed of nerves and ganglia.

Ganglia

Ganglia are the clusters of neuron cell bodies outside the nervous system.

Number of cranial and spinal nerves.

Humans have 12 pairs of cranial nerves and 31 pairs of spinal nerves.

Types of nerves

Some cranial nerves are sensory, some are motor and some are mixed .
On the other hand, all spinal nerves are mixed nerves.

Pathways in PNS formed by Nerves

The cranial and spinal nerves make two pathways:
Sensory pathway which conducts impulses from receptors to CNS.
Motor pathway which conducts impulses from CNS to effectors.

Systems of Motor pathway:

Motor Pathway makes two systems:

1. **Somatic Nervous system**

It is responsible for the conscious and voluntary actions. It includes all of the motor neurons that conduct impulses from CNS to skeletal muscles.

2. **Autonomic Nervous System**

It is responsible for the activities, which are not under conscious control. It consists of motor neurons that send impulses to cardiac muscles, smooth muscle and glands.

Types of autonomic Nervous system

Autonomic nervous system comprises of sympathetic system and parasympathetic system.

(i) Sympathetic nervous system

This system prepares body to deal with emergency situations. This is often called the fight or flight responses. During an emergency situation, this system takes necessary actions. For example; it dilates pupils, accelerates heartbeat, increases breathing rate and inhibits digestion.

(ii) Parasympathetic nervous system

When stress ends, the **parasympathetic nervous system** takes action and normalizes all the functions. It causes pupil to contract, promotes digestion, and slows the rate of heartbeat and breathing rate.

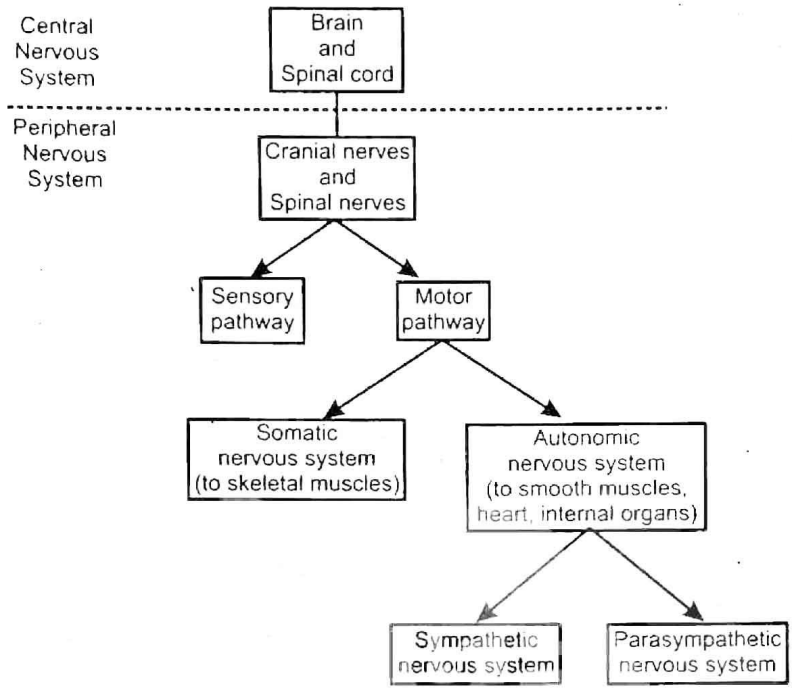


Figure 12.5: Division of the nervous system

Q.7 Define reflex action. Explain it with an example

Ans. REFLEX ACTION

Definition

Sometimes the involuntary response produced by the CNS is very quick. Such a response is called reflex action.

Types of action

When CNS sends impulses to muscles and glands, two types of actions or responses result.

Voluntary Actions

The higher centers of brain control the conscious action or voluntary actions.

Or

The actions which are done by our will are called voluntary actions.

Examples

Picking of book from the table, to take meal three times a day etc.

Involuntary Actions

Definition

When impulses are not passed to the higher centres of brain, it results in responses which are not under conscious control. Such responses are called involuntary actions.

Or

The actions which are not done by our will are called involuntary actions.

Examples

Heart beat, blood pressure etc.

Reflex arc

The pathway followed by the nerve impulses for producing a reflex action is called reflex arc.

Example of Reflex Action

The most common example of reflex action is the withdrawal of hand after touching a hot object.

Explanation

In this reflex action, spinal cord acts as coordinator. Heat stimulates temperature and pain receptors in skin. A nerve impulse is generated which is carried by sensory neurons to the interneurons of spinal cord.

From interneurons, the impulse is passed to the motor neurons which carry it to the muscles of the arm. As a result, the muscles contract to withdraw hand. During it, other interneurons transmit nerve impulses up to brain so that the person becomes aware of pain and what happened.

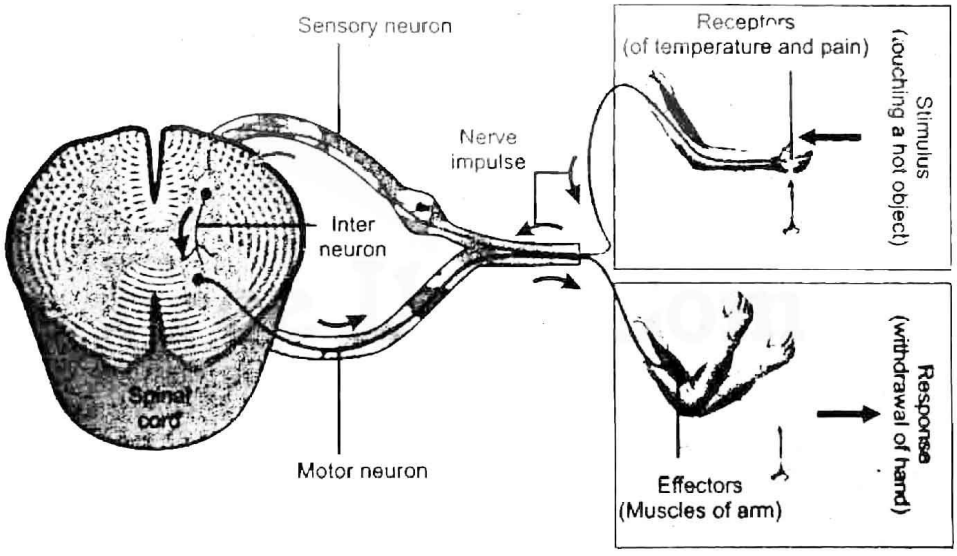


Figure 12.6: Reflex Arc in Reflex Action

Q.8 Describe structure and mechanism of function of human eye.

Ans. Human Eye

Location

Our eyes are located in small portions of skull known as the orbits or eye sockets.

External Structure of Eye

(i) Eyelids

Functions

Eyelids wipe eyes and prevent dehydration.

They spread tears on eyes which contain substances for fighting bacterial infections.

(ii) Eyelashes

Function

Eyelashes prevent fine particles from entering eye.

Internal structure of eye

The internal structure of eye can be divided into three main layers;

(i) Outer layer

The outer layer of eyeball consists of sclera and cornea.

(a) Sclera

It consists of dense connective tissue.

Functions

Sclera gives eye most of its white colour.

It protects the inner components of eye.

It maintains the shape of eye.

(b) Cornea

In the front, sclera forms the transparent cornea.

Function

Cornea admits light to the interior of eye and bends light rays so that they can be brought to a focus.

(ii) Middle Layer Choroid

The middle layer is called choroid.

Structure

It contains blood vessels.

Function

It gives the inner eye a dark colour. The dark colour prevents disruptive reflections within eye.

IRIS

Behind cornea, choroid bends to form a muscular ring called iris.

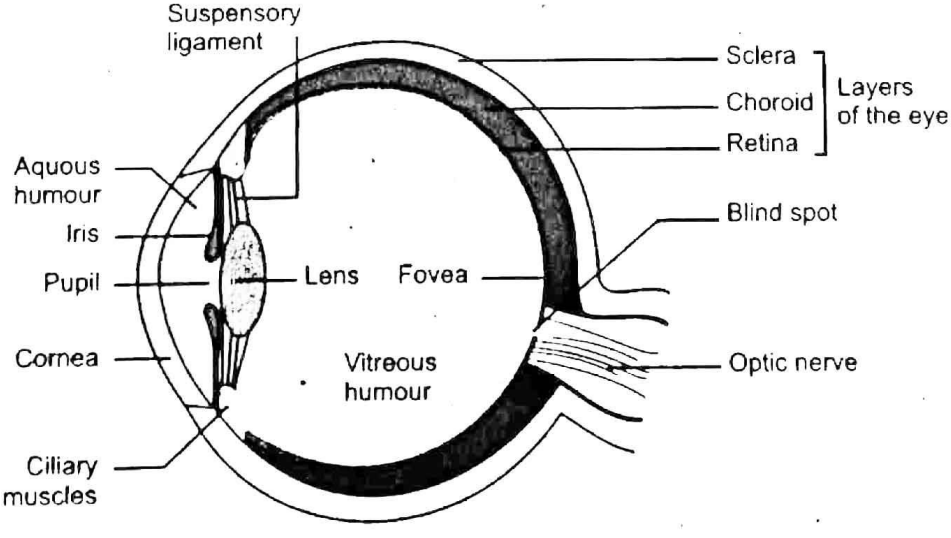


Figure 12.7: Structure of human eye

Pupil

There is a round hole, called pupil, in the centre of iris. After striking the cornea, light passes through the pupil.

Size

The size of pupil is adjusted by the muscles of iris.

Function

Pupil constricts in bright light when the circular muscles of iris contract Pupil dilates in dim light when the radial muscles of iris contract.

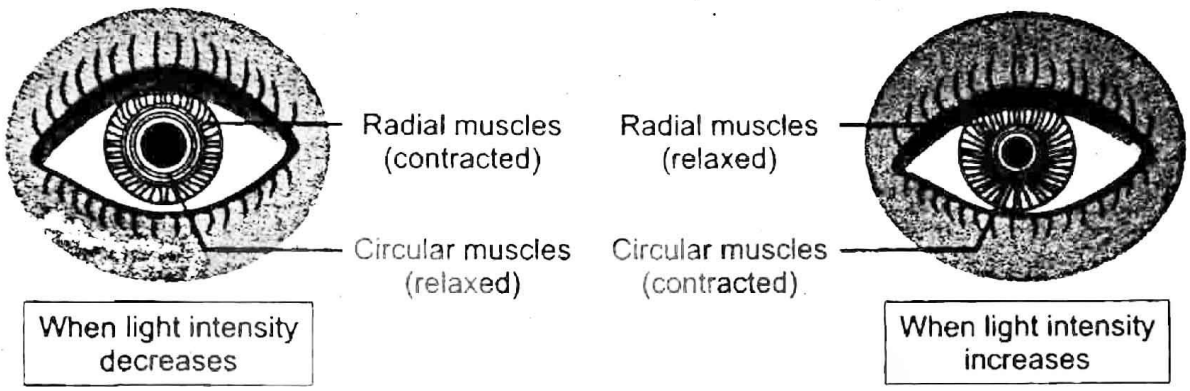


Figure 12.8: Contraction and dilation of pupil

Lens

Behind iris, there is a convex lens.

Function

It focuses light on the retina.

Ciliary muscles and Suspensory Ligaments

Lens is attached to ciliary muscles of eye via/through a ring of suspensory ligament.

Function

To see an object far clearly that is away, ciliary muscles are relaxed and lens becomes less convex. When ciliary muscles contract, lens becomes more convex and round.

(iii)INNER LAYER-RETINA

The inner layer is sensory and is called retina. It contains the photosensitive cells called rods and cones and associated neurons.

Rods

These are sensitive to dim light.

Cones

These are sensitive to bright light and they distinguish different colours.

Points on Retina

Retina has two points, fovea and optic disc.

Fovea

Fovea is a dip in retina directly opposite to lens and is densely packed with cone cells.

Function

It is largely responsible for colour vision and sharpness.

OPTIC DISC

Optic disc is a point on retina where the optic nerve enters retina.

Blind spot

There are no rods and cones at this point, that is why it is also referred to as the blind spot.

Chambers

The iris divides the cavity of eye into two chambers.

Anterior chamber

The anterior chamber is in front of iris i.e. between cornea and iris.

Aqueous humour

The anterior chamber contains a clear fluid known as aqueous humour.

Posterior chamber

The posterior chamber is between iris and retina.

VITREOUS HUMOUR

The posterior chamber contains a jelly – like fluid known as vitreous humour.

Function

It helps to maintain the shape of eye and suspends the delicate lens.

MECHANISM OF VISION

Light from objects enters eye and is refracted when it passes through cornea, aqueous humour, lens and vitreous humour. Lens also focuses light on retina. As a result, the image falls on retina. Rods and cones generate nerve impulses in the optic nerve. These impulses are carried to the brain, which makes the sensation of the vision.

Q.9 Explain the disorders of Eye. **(Board 2013-14)**

Ans. Following are the disorders of eye.

1. Night Blindness

Rods contain a pigment called rhodopsin. When light falls on rhodopsin, it breaks for generating a nerve impulse. In the absence of light, the breakdown products are again converted into rhodopsin. Body synthesizes rhodopsin from vitamin A and that is why the deficiency of vitamin A causes poor night vision. This problem is called night blindness.

2. Colour Blindness

Cones contain a pigment known as iodopsin. There are three main types of cones and each type has a specific iodopsin. Each type of cone recognizes one of the three primary colours i.e. blue, green and red. If any type of the cones is not working well, it becomes difficult to recognize that colour. Such person is not able to distinguish different colours. This disease is called colour blindness and is a genetic problem.

3. Myopia (Short sightedness)

The elongation of eyeball results in myopia. Such persons are not able to see distant objects clearly. The image of a distant object is formed in front of retina.

Cure

This problem can be rectified by using concave lens.

4. Hypermetropia (Long sightedness)

It happens when eyeball shortens. Such persons are not able to see near objects clearly. The image is formed behind retina.

Cure

Convex lens is used to rectify this problem.

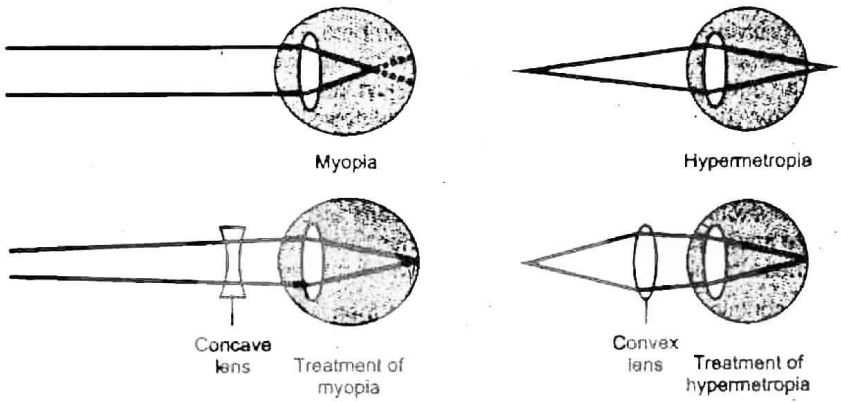


Figure 12.9: Myopia and Hypermetropia

Q.10 What is the contribution of Muslim scientists in the discovery and cure of eye diseases?

Ans. Ali ibn Isa (950-1012) was a famous Arab scientist. He wrote three books on ophthalmology (study of the diseases and surgery of eyes). He described 130 eye diseases and prescribed 143 drugs to treat these diseases.

Ibn al-Haytham (965 – 1039) an Arab scientist, made significant contributions to the principles of eye and vision. He is regarded as the father of optics (study of the behaviour of light). His "Book of Optics" correctly explained and proved the modern theory of vision. He discussed the topics of medicine and eye surgery in his book. He made several improvements to eye surgery and accurately described the process of sight, the structure of eye, image formation in eye and visual system. Ibn al-Haytham also described the principles of pinhole camera.

Q.11 Explain the structure of human ear in detail. Describe its functioning in balancing of body.

Ans. Ear

Hearing is as important as vision. Our ear helps us in hearing and also to maintain the balance or equilibrium of our body.

Structure of Ear

Ear has three main parts i.e.

(a) External ear (b) Middle Ear (c) Internal Ear

(a) External Ear

Parts of external ear

External ear consists of pinna, auditory canal and eardrum (tympanum).

PINNA

Pinna is the broad external part, made of cartilage and covered with skin.

AUDITORY CANAL

Pinna helps to direct sound waves into auditory canal. There are special glands in the walls of auditory canal which produce wax.

Function of hair and wax

The hair and the wax in auditory canal protect ear from small insects, germs and dust. They help to maintain the temperature and dampness of auditory canal.

EAR DRUM

Auditory canal ends in ear drum. This thin membrane separates external ear from the middle ear.

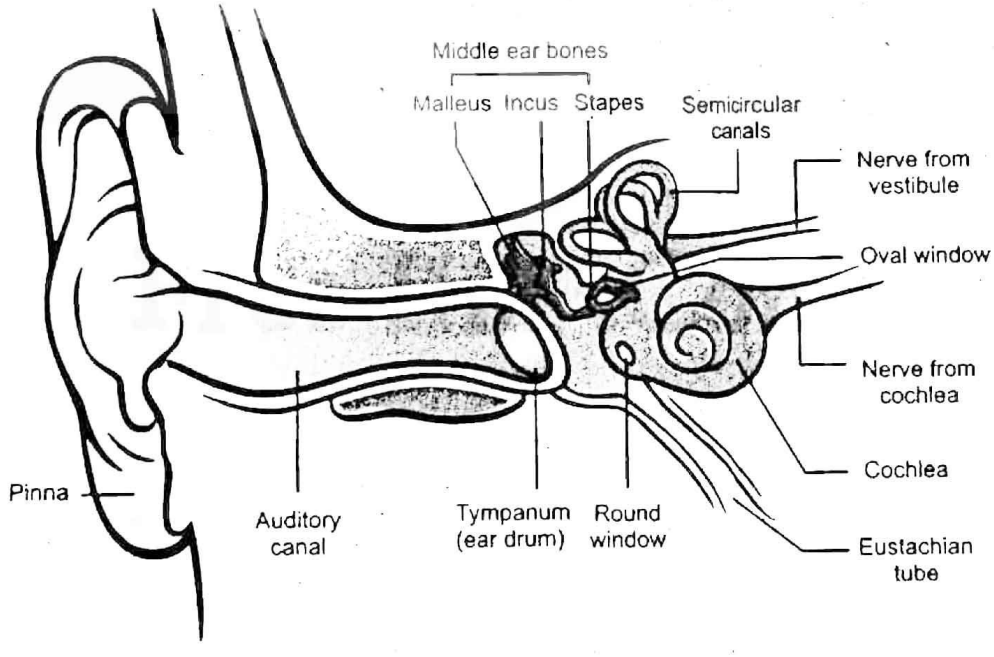


Figure 12.10: Structure of human Ear

(b) Middle ear

Middle ear is a chamber after external ear.

Bones

Three small bones, called middle ear ossicles, are present in a chain in middle ear. These moveble bones include malleus, incus and stapes. These three bones are collectively called middle ear ossicles.

Malleus

It is attached with eardrum, then comes incus and finally stapes.

Stapes

It is the smallest bone of body.

Oval window

Stapes is connected with a membrane called oval window. Oval window separates middle ear from inner ear. Middle ear also communicates with the nasal cavity through eustachian tube.

Function of Eustachian tube.

This tube regulates the air pressure on both sides of ear drum.

(c) Inner ear

Parts of inner Ear

Inner ear consists of three parts i.e. vestibule, semicircular canals and cochlea.

Vestibule

It is present in the centre of inner ear.

Semicircular canals

Three canals called semicircular canals are posterior to the vestibule.

Cochlea

The cochlea is made of three ducts and wraps itself into a coiled tube.

Sound Receptor cells

Sound receptor cells are present within the middle duct of cochlea.

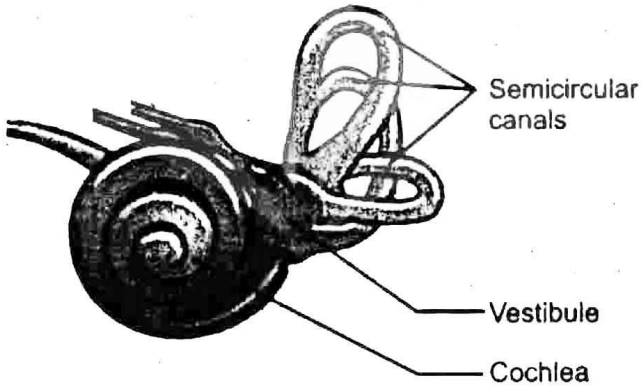


Figure: 12.11: Structure of the inner Ear

The process of hearing

The pinna of the external ear focuses and directs sound waves into auditory canal. The sound waves strike ear drum and produce vibrations in it. From ear drum, the vibrations strike middle ear and produce further vibrations in malleus, incus and then stapes. From stapes, the vibrations strike the oval window and then reach the fluid-filled middle duct of cochlea. The fluid of cochlea is moved and receptor cells are stimulated. The receptor cells generate a nerve impulse, which travels to brain and is interpreted as sound.

Ears maintain the balance of body

Semicircular canal and vestibule help to maintain the balance of body. Semicircular canals contain sensory nerves which can detect any movement of head. Vestibule can detect any change in the posture of body. The neurons coming from these two receptors reach cerebellum through the auditory nerve.

Q.12 What is endocrine system. Describe important endocrine glands.

Ans. Endocrine Glands

Introduction

Endocrine system regulates the activities such as growth, reproduction, maintenance of glucose concentration in blood, reabsorption of water in kidneys etc.

Hormones

Endocrine system uses chemicals to communicate with its effectors. These chemicals are known as hormones. A hormone is a specific messenger molecule synthesized and secreted by endocrine gland.

Types of Gland

They are of two types:

(a) Endocrine Gland

These glands are ductless and release their secretions (hormones) directly into the blood stream. Blood carries the hormone to the target organs or tissues upon which they act.

(b) Exocrine glands

Many glands in our body are exocrine. Such glands have ducts for releasing their secretions e.g. digestive glands, skin glands etc.

Important Endocrine glands

1. Pituitary Gland

Structure

It is a pea-shaped gland.

Location

It is attached to the hypothalamus of brain.

Hormones

Many hormones of pituitary gland influence the secretions of other endocrine glands. However some hormones of this gland act directly on various tissues of body.

Lobes of pituitary gland

There are two lobes of pituitary gland.

(a) Anterior lobe

Hormones

It produces many hormones.

(i) SOMATOTROPHIN

One of its important hormone is somatotrophin (growth hormone).

Function

It promotes the growth of body.

Deficiency – Dwarfism

If the production of this hormone is diminished during growing age, the rate of growth decreases. This condition is called dwarfism.

Over Production-Gigantism

If this hormone is excessively produced after growing age, it leads to gigantism (very tall and overweight).

Acromegaly

If this hormone is excessively produced after growing age, internal organs and body extremities alone grow large. This condition is known as acromegaly. Such persons will have large hand, feet and jawbones.

(ii) Thyroid stimulating hormone

Another important hormone secreted by the anterior lobe of pituitary gland is Thyroid Stimulating Hormone (TSH).

Function

It stimulates thyroid gland to secrete its hormones. The remaining hormones of anterior lobe influence reproductive organs and also control adrenal glands.

(b) Posterior Lobe

(a) Hormones

The posterior lobe of pituitary gland stores and secretes two hormones i.e. oxytocin and vasopressin (Antidiuretic Hormone ADH).

(b) Production of Hormones

These hormones are produced by hypothalamus.

Functions

(i) Vasopressin

(a) Retaining water and less amount of urine

It increases the rate of reabsorption of water from nephrons. When we have low amount of water in body fluids, pituitary gland secretes vasopressin and so more reabsorption of water occurs from nephrons into blood. In this way, body retains water and less amount of urine is produced.

(b) Less water reabsorption and more amount of urine

On the other hand, when body fluids have more than normal water, there is a decline in the secretion of this hormone. If pituitary gland does not secrete this hormone in the required amount, less water is reabsorbed from nephrons and there is excessive loss of water through urine. This condition is known as diabetes insipidus.

(ii) Oxytocin

This hormone stimulates the contraction of uterus walls in mothers for child birth.

It is necessary for the ejection of milk from breast.

2. Thyroid Gland

This is the largest endocrine gland in the human body. It produces two hormones.

Location

It is present in neck region below the larynx.

i. Thyroxin Hormone

It produces a hormone thyroxin. Iodine is required for the production of this hormone.

Deficiency

If a person lacks iodine in diet, thyroid gland cannot make its hormone. In this condition, thyroid gland enlarges. This disorder is called goitre.

Overproduction of Hormone

Hypothyroidism is caused by the under production of thyroxin.

Effects

Low energy production in body, slowing down of heartbeat.

Over –production

Hyperthyroidism is caused by over-production of thyroxin.

Effects / Symptoms

(i) Increase in energy production

(ii) Increase heart beat

(iii) Frequent sweating

(iv) Shivering of hands

Function of Thyroxin

Thyroxin increases the breakdown of food (oxidation) and releases energy in body. It is also responsible for the growth of body.

ii. Calcitonin Hormone

The thyroid gland produces another hormone called calcitonin.

Effects

It decreases the level of calcium ions in blood and promotes the absorption of calcium from blood into bones.

3. Parathyroid gland

Location

These are four glands situated on the posterior side of thyroid gland.

Hormone

This gland produces a hormone known as parathormone.

Function

It increases the level of calcium ions in blood.

Over – production

When there is an increased production of parathormone, more than normal calcium salts are absorbed from the bones and added to blood. Consequently, the bones become brittle.

Deficiency

If there is deficiency in the production of parathormone, blood calcium level falls. It leads to tetany which affects the function of muscles.

4. ADRENAL GLANDS

Location

Two adrenal glands are situated above the kidneys.

Each adrenal gland consists of two parts;

i. Cortex

The outer part is cortex.

ii. Medulla

The inner part is medulla.

Hormone of adrenal medulla

Adrenal medulla secretes a hormone called epinephrine or adrenaline in response to stress.

Emergency Hormone

It prepares our body to overcome emergency situation. Therefore adrenaline is also termed as an emergency hormone.

Hormone of Adrenal cortex

The adrenal cortex secretes many hormones called corticosteroids which maintain the balance of salts and water in blood.

5. Pancreas

This organ has two functions:

Pancreas as Exocrine Gland

The major part of pancreas is a ducted (exocrine) gland. This portion secretes digestive enzymes through a duct into the small intestine.

Pancreas as Endocrine Gland

Some portions of pancreas serve as ductless (endocrine) gland. This portion contains groups of endocrine cells referred to as Islets of Langerhans.

Hormones of Islets of Langerhans

The islets secrete two hormones i.e. insulin and glucagon.

(i) GLUCAGON

It influences the liver to release glucose in blood and blood glucose concentration rises.

(ii) INSULIN

It influences the liver to take excess glucose from blood and so the blood glucose concentration falls.

Deficiency of insulin

If a person's pancreas does not make normal quantity of insulin, the blood glucose concentration rises and the person suffers from diabetes mellitus.

Symptoms of diabetes

Persons with diabetes have:

i. Loss of weight
ii. Weakening of muscles
iii. Tiredness

Diabetes can be controlled by insulin administration. Formerly insulin extracted from animals was used for this purpose. But now human insulin produced from bacteria through genetic engineering is available.

6. GONADS

Definition

Testes and ovaries are the male and female reproductive organs respectively. They are collectively called gonads.

Testes

Testes secrete hormones e.g. testosterone, which is responsible for the development of male secondary sex characters such as growth of hair on face and coarseness of voice etc.

Ovaries

Ovaries secrete estrogen and progesterone which are responsible for the development of female secondary characters such as the development of breast.

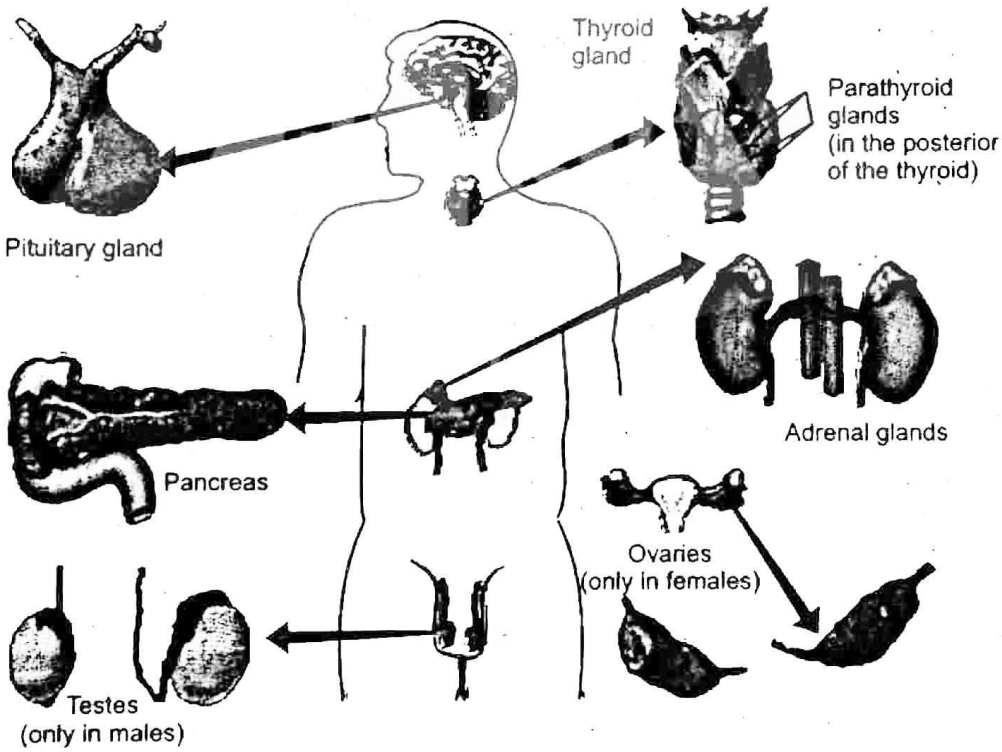


Figure 12.12: Endocrine Glands in Human body

Q.13 What do you mean by feedback Mechanism? Explain.

Ans. Feedback Mechanism

Endocrine glands do not secrete their hormones at a constant rate. The rate varies with the needs of the body. Like many other functions in body, the secretion of hormones is also regulated by feedback mechanisms.

Definition:

Feedback mechanism means the regulation of a process by the output of the same process.

Types:

Feedback mechanisms are of two types i.e. positive and negative feedbacks.

In negative feedback, the output of a process decreases or inhibits the process. This mechanism works to return a condition towards its normal value. For example, when the blood glucose concentration rises, pancreas secretes insulin. It decreases the blood glucose concentration. Decline in the blood glucose concentration to a normal set-point inhibits the secretion of insulin. In other words, the blood glucose concentration (output) controls the process i.e. the secretion of insulin and glucagon.

In positive feedback the changes resulting from a process increase the rate of process. For example, suckling action of an infant stimulates the production of a hormone in mother. This hormone works for the production of milk. More suckling leads to more hormones which in turn leads to more milk production.

Q.14 Explain the disorders of Nervous system.

Ans. Disorders of nervous system can be categorized into two main types i.e.

(i) Vascular Disorders

Vascular disorders are due to any disturbance in the blood supply to nervous system e.g. paralysis.

Paralysis

Paralysis is the complete loss of function by one or more muscle groups. Patients may have weak paralysis throughout his or her body or have paralysis in the lower extremities or in all four limbs

Causes

Following are the causes of paralysis:

(i) It is most often caused by damage to the central nervous system (brain or spinal cord). The damage may be due to stroke i.e. rupture in a blood vessel of brain or spinal cord.

(ii) Blood clotting in blood vessels.

(iii) Poison produced by polio viruses.

(ii) Functional Disorders

Functional disorders are due to any disturbance in nerve impulse generation and transmission e.g. epilepsy.

Epilepsy

Epilepsy is a nervous disorder in which there is abnormal and excessive discharge of nerve impulses in brain. It causes unprovoked seizures in patient. A seizure of epilepsy is a temporary abnormal state of brain marked by convulsions.

Causes

In younger people, epilepsy may be due to genetic or developmental causes.

In people over age 40 years brain tumours are more likely to cause epilepsy.

Head trauma and central nervous system infections may cause epilepsy at any age.

Cure

There is no known cure of epilepsy but medicines can control seizures.

Treatment

Patients of epilepsy have to take medicines daily for the treatment as well as the prevention of seizures. These medicines are termed as anticonvulsant or antiepileptic drugs.

Multiple Choice Questions

1. **Processes that carry nerve impulses away from the cell body are called;**
   (a) Axons
   (b) Dendrites
   (c) Synapses
   (d) Myelin sheath

2. **The portion of the nervous system that is involuntary in action:**
   (a) Somatic nervous system
   (b) Dendrites
   (c) Autonomic nervous system
   (d) Sensory nervous system

3. **Which neurons are present inside the central nervous system?**
   (a) Sensory neurons only
   (b) Motor neurons only
   (c) Sensory and motor neurons both
   (d) Interneurons only

4. **The part of the brain responsible for muscle movement, interpretation of the senses and the memory is the;**
   (a) Pons
   (b) Medulla oblongata
   (c) Cerebrum
   (d) Cerebellum

5. **Apart from hearing, what other major body function is performed by the ear?**
   (a) Hormones secretion
   (b) Body balance
   (c) Reduction in nerve pressure
   (d) All of these

6. **The myelin sheath is formed by _____ which wrap around the axons of some neurons;**
   (a) Nodes of Ranvier
   (b) Axons
   (c) Dendrites
   (d) Schwann Cells

7. **This is not a part of the hindbrain:**
   (a) Pons
   (b) Medulla oblongata
   (c) Cerebrum
   (d) Cerebellum

8. **If you look at an intact human brain, what you see the most is a large, highly convoluted outer surface. This is the;**
   (a) Cerebrum
   (b) Cerebellum
   (c) Pons
   (d) Medulla oblongata

9. **Insulin and glucagon are produced in the;**
   (a) Hypothalamus
   (b) Anterior pituitary
   (c) Liver
   (d) Pancreas

10. **All of these are hormones except:**
    (a) Insulin
    (b) Thyroxin
    (c) Glucagon
    (d) Pepsinogen

11. **The elongation of eye-ball results in:**
    (a) Myopia
    (b) Blindness
    (c) Deafness
    (d) None of these

12. **The pathway followed by the nerve impulses for producing a reflex action is called;**
(a) Reflex action
(b) Reflex arc
(c) Neuron
(d) Spinal cord

13. **Ali Ibn-e-Isa's book on study of diseases and surgery of eye is;**
(a) Biology
(b) Botany
(c) Ophthalmology
(d) Zoology

14. **A coordinated action has components;**
(a) 3 (b) 4
(c) 5 (d) 6

15. **The organs which are specifically built to detect particular type of stimulus are called;**
(a) Receptors
(b) Effectors
(c) Stimuli
(d) All of these

16. **The structural and functional unit of nervous system is;** (B 2013)
(a) Brain (b) Hormone
(c) Neuron (d) Effector

17. **The nervous system consists of billions of neurons and;**
(a) Hormones
(b) Nephrons
(c) Neuroglial cells
(d) Receptors

18. **Nucleus and cytoplasm of neuron is located in;**
(a) Cell body
(b) Dendrites
(c) Axons
(d) Myelin sheath

19. **The sensory layer of eye is;**
(a) Cornea (b) Iris
(c) Sclera (d) Retina

20. **The sensory part of ear is;**
(a) Succulus (b) Stapes
(c) Vestibule (d) Cochlea

21. **Ibn-al-Haytham is famous for his book of:**
(a) Chemistry
(b) Optics
(c) Biology
(d) Coordination

22. **_____is unable to see during day time.**
(a) Rabbit (b) Owl
(c) Cat (d) Human

23. **Which one is the smallest bone of human body?**
(a) Malleus (b) Incus
(c) Stapes (d) Cochlea

24. **_____ gland is pea-shaped.**
(a) Hypothalamus
(b) Pancreas
(c) Pituitary
(d) Adrenal

25. **_____ separates the middle ear from inner ear.**
(a) Malleus
(b) Stapes
(c) Incus
(d) Eustachian tube

26. **Non-Myelinated points between the myelin on an axon are:**
(a) Saltatory nerves
(b) Nodes of Ranvier
(c) Neuroglial cells
(d) Schwann cells

27. **Glucagon is secreted by _____.**

(a) Exocrine part of pancreas
(b) Islets of Langerhans
(c) Pituitary Gland
(d) None of these

28. **_____are sensitive to dim light.**

(a) Rods
(b) Cones
(c) Retina
(d) Cornea

29. **Night blindness is caused due to the deficiency of ___ in body.**

(a) Vitamin A (b) Iodopsin
(c) Protein (d) Fats

30. **The lens found in human eye is;**

(a) Biconcave
(b) Biconvex
(c) Both a and b
(d) None of these

31. **Lobe concerned with senses of hearing and smell:**

(a) Frontal (b) Parietal
(c) Occipital (d) Temporal

32. **The largest part of the fore-brain that controls skeletal muscles, thinking, intelligence and emotions;** **(Board 2013)**

(a) Cerebellum
(b) Cerebrum
(c) Hypothalamus
(d) Thalamus

33. **This is not the part of hind brain:**

(a) Pons
(b) Medulla Oblongata
(c) Cerebrum
(d) Cerebellum

34. **The hormone calcitonin is secreted by:**

(a) Pituitary gland
(b) Thyroid gland
(c) Pancreas
(d) Adernal gland

35. **Central nervous system consists of brain and:**

(a) Effectors
(b) Receptors
(c) Nerves
(d) Spinal cord

36. **Under the influence of which hormone of pituitary gland throxine and calcitonin is produced?**

(a) Thyroid stimulating hormone
(b) Glucagon
(c) Testosterone
(d) Androgens

37. **Which part of human body plays role in balancing the body:**

(a) Eye (b) Ear
(c) Nose (d) Teeth

38. **Female secondary sex characters are controlled by:**

(a) Estrogen
(b) Progesterone
(c) Testosterone
(d) Estrogen and Progesterone

39. **Functional disorder of nervous system is:**

(a) Dwarfism
(b) Paralysis
(c) Epilepsy
(d) Gigantism

40. **Father of Optics is:**
(a) Newton
(b) Ali Ibn Isa
(c) Ibn-al-Haytham
(d) Al-Farabi

41. **Rods and Cones are absent in:**
(a) Optic disc
(b) Blind spot
(c) Retina
(d) Optic Disc and blind spot

42. **Muscular ring formed by choroid is:**
(a) Cornea (b) Pupil
(c) Iris (d) Sclera

43. **Pairs of Cranial nerves are:**
(a) 21 (b) 12
(c) 33 (d) 3

44. **Pairs of Spinal nerves are:**
(a) 2 (b) 33
(c) 31 (d) 12

45. **A connection between cerebellum and spinal cord is:**
(a) Medulla oblongata
(b) Mid brain
(c) Pons
(d) Cerebrum

46. **Brain stem involves:**
(a) Medulla oblongata and Pons
(b) Cerebrum
(c) Mid brain
(d) Medulla oblongata, Pons and Mid brain

47. **Which lobe permits conscious control of skeletal muscles?**
(a) Frontal (b) Occipital
(c) Parietal (d) Temporal

48. **Visual information is received and analysed by which lobe?**
(a) Frontal (b) Occipital
(c) Temporal (d) Parietal

49. **Sensation of smell is created by:**
(a) Cerebrum
(b) Cortex
(c) Olfactory bulbs
(d) Medulla

50. **Which lobe co-ordinates movements involved in speech?**
(a) Frontal (b) Parietal
(c) Occipital (d) Temporal

51. **Layers of brain are called:**
(a) Cranium
(b) Meninges
(c) Lobes
(d) Central canal

52. **Cerebrospinal fluid is present in:**
(a) Ventricles
(b) Central canal
(c) Ventricles and Central canal
(d) Meninges

53. **Sound receptor cells are present in;**
(a) Succulus (b) Stapes
(c) Vestibule (d) Cochlea

54. **The special neuroglial cells located at regular intervals along axons are called:**
(a) Dendrites
(b) Myelin sheath
(c) Schwann cells
(d) Nodes of Ranvier

55. **Which of the following contains sensory areas that received impulses from skin?**
(a) Frontal Lobe
(b) Occipital Lobe
(c) Temporal Lobe
(d) Parietal Lobe

56. **In reflex action, which of the following acts as co-ordinator?**
(a) Brain
(b) Neurons
(c) Reflex Arc
(d) Spinal Cord

57. **Progesterone is secreted by:**
(a) Pancreas
(b) Adrenal glands
(c) Testes
(d) Ovaries

58. **For farsightedness the image is formed:**
(a) Behind the retina
(b) In front of retina
(c) On the retina
(d) On blind spot

59. **The length of spinal cord is:**
(a) 20 cm (b) 30 cm
(c) 40 cm (d) 50 cm

60. **A pigment Iodopsin is present in:**
(a) Rods (b) Cones
(c) Cornea (d) Sclera

61. **Convex lens is used to rectify which problem?**
(a) Hypermetropia
(b) Short sightedness
(c) Night blindness
(d) Myopia

62. **Auditory canal ends in:**
(a) Cochlea
(b) Ear drum
(c) Middle ear
(d) Eustachian tube

63. **Hyperthyroidism is caused by:**
(a) Overproduction of Thyroxin
(b) Under production of Thyroxin
(c) Overproduction of Insulin
(d) Overproduction of glucagon

64. **Parathormone is secreted by:**
(a) Parathyroid gland
(b) Thyroid gland
(c) Adrenal gland
(d) Gonads

65. **Which hormone prepares body to overcome emergency situation?**
(a) Parathormone
(b) Vasopressin
(c) Thyroxin
(d) Adrenaline

66. **The pathway which conduct impulses from CNS to effectors?**
(a) Sensory pathway
(b) Motor pathway
(c) Mixed pathway
(d) Interneuron pathway

67. **In unicellular organisms, co-ordination is brought about by:**
(a) Nerves
(b) Chemicals
(c) Brain
(d) Brain and nerves

68. **Brain and Spinal cord are examples of:**
(a) Stimuli
(b) Receptors
(c) Coordinators
(d) Effectors

69. **Endocrine glands are:**
(a) Effectors
(b) Coordinators
(c) Receptors
(d) Stimuli

70. **In some parts of the body many Neurons cell bodies combine to make a group:** **(Board 2014)**
(a) Nerves (b) Tissues
(c) Ganglion (d) Muscles

71. **In Auditory Canal's wall special glands producer:** (Board 2014)
(a) Wax
(b) Blood
(c) Auditory Fluid
(d) Nerve impulse

72. **If a new born baby feeds on mother's milk, as a result of which production of mother's milk will,** (Board 2014)
(a) Decrease (b) Increase
(c) Stop
(d) Continue with intervals

73. **Which hormone is secreted in case of emergency situation:** (Board 2014)
(a) Oxytocin
(b) Thyroxin
(c) Adrenaline
(d) Calcitonin

Answer Key

1	a	2	c	3	d	4	c	5	b
6	d	7	c	8	a	9	d	10	d
11	a	12	b	13	c	14	c	15	a
16	c	17	c	18	a	19	d	20	d
21	b	22	b	23	c	24	c	25	b
26	b	27	b	28	a	29	a	30	b
31	d	32	b	33	c	34	b	35	d
36	a	37	b	38	d	39	c	40	c
41	d	42	c	43	b	44	c	45	c
46	d	47	a	48	b	49	c	50	a
51	b	52	c	53	d	54	c	55	d
56	d	57	d	58	a	59	c	60	b
61	a	62	b	63	a	64	a	65	d
66	b	67	b	68	c	69	a	70	c
71	a	72	b	73	c				

Short Questions

Q.1 Identify the two types of co-ordination in living organisms. (Board 2013)

Ans. There are two types of coordination in organisms:

(i) Nervous coordination brought about by nervous system.

(ii) Chemical coordination brought about by endocrine system.

Q2. Differentiate between modes of nervous and chemical coordination's.

Ans.

Sr. No.	Components	Nervous Coordination	Chemical Coordination
1	Stimulus	Sense Organs	Body part
2	Sending of message	Neuron	Blood
3	Coordinators	Brain and spinal cord	Endocrine gland
4	Form of message	Nerve impulse	Chemical
5	Response	Muscle or gland (effectors)	Bones, liver etc

Q3. What are the main components of coordination? (Board 2013)

Ans. A coordinated action has five components:

(i) Stimulus (ii) Receptor

(iii) Coordinator (iv) Effector

(v) Response

Q4. Define reflex action and reflex arc.

Ans. Reflex action

When the involuntary response produced by the CNS is very quick, such response is called reflex action.

Reflex arc

The pathway followed by the nerve impulse for producing a reflex action is called reflex arc.

Q5. Trace the path of a nerve impulse in case of a reflex action.

Ans. Stimulus ⟶ Receptor ⟶ Coordinator ⟶ Effector ⟶ Response

Q6. Describe the pupil reflex in dim and bright light. 12(053)

Ans. Pupil constricts in bright light when the circular muscles of iris contract. Similarly, pupil dilates in dim light when the radial muscles of iris contract.

Q7. How would you associate the role of vitamin A with vision and effects on retina?

Ans. Rods contain a pigment called rhodopsin. When light falls on rhodopsin it breaks for generating a nerve impulse. In the absence of light, the break down products are again converted into rhodopsin. Body synthesizes rhodopsin from vitamin A and that is why the deficiency of vitamin A causes poor night vision.

Q8. Define the terms hormone and endocrine system.

Ans. Hormone

A hormone is a specific messenger molecule synthesized and secreted by an endocrine gland.

Endocrine system

The system which regulates the activities of growth, reproduction, maintenance of glucose concentration in blood, reabsorption of water in kidneys is called endocrine system.

Q9. What is hypothalamus?

Ans. Introduction

It lies above midbrain and just below thalamus. In humans it is roughly the size of an almond.

Functions

(i) It links the nervous system and endocrine system.

(ii) It controls the secretions of pituitary gland.

(iii) It also controls feelings such as rage, pain, pleasure and sorrow.

Q10. What is iodopsin?

Ans. Cone cells in retina of eye contains a pigment known as iodopsin. Three types of cones have specific iodopsin. Each cone helps in recognizing three primary colours.ie, red, blue and green.

Q11. Define islets of Langerhans.

Ans. Some portions of pancreas serve as ductless (endocrine) gland. This portion contains groups of endocrine cells referred to as islets of Langerhans. These islets secrete two hormones i.e. insulin and glucagon which maintain amount of glucose in the blood.

Q12. What is nerve impulse?

Ans. In nervous coordination, brain and spinal cord receive information and send messages through neurons in the form of nerve impulses. A nerve impulse is wave of electrochemical changes that travels along the length of neurons.

Q13. What is tympanum?

Ans. In the ear, auditory canal ends in tympanum (eardrum). This thin membrane separates external ear from middle ear.

Q14. What is vitreous humour? **(Board 2014)**

Ans. The iris divides the cavity of eye into two chambers. The posterior chamber is between iris and retina and contains a jelly-like fluid known as vitreous humour.

Q15. Define Acromegaly.

Ans. Abnormal growth due to excessive production of growth hormone after **growing age,** the internal organs and body extremities alone grow large and affected persons have large hands, feet and jawbones.

Q16. Define Antidiuretic hormone.

Ans. The hormone of the posterior pituitary which promotes the reabsorption of water in renal tubules.

Q17. Define Aqueous humour.

Ans. The fluid present in the anterior chamber of the eye i.e. between the cornea and the iris.

Q18. Define Axon.

Ans. A long fibre of neuron that carries nerve impulse away from the cell body of a neuron.

Q19. Define Cell body.

Ans. The part of the nerve cell that contains nucleus and cytoplasm.

Q20. Define Cerebellum.

Ans. The part of the hindbrain which controls muscle movements.

Q21. Define Cerebral hemispheres.

Ans. The division of the cerebrum of the brain into two parts called cerebral hemispheres.

Q22. Define Cerebrospinal fluid (CSF).

Ans. The fluid in the ventricles of the brain and in the central canal of the spinal cord is called CSF.

Q23. Define Cerebrum.

Ans. The largest part of the forebrain; controls many sensory and motor functions.

Q24. Define Cochlea.

Ans. The part of the inner ear; consists of three ducts wrapped in the form of a coiled tube, contains sound receptors.

Q25. Define Colour blindness.

Ans. Genetic disorder in which person fails to recognize the basic colours; blue, green and red.

Q26. Define Cones.

Ans. The photosensitive cells in the retina of the eye; sensitive to bright light and so distinguish different colours.

Q27. What is choroid?

Ans. The middle layer of eye is called choroid. It contains blood vessels and gives the eye a dark colour which prevents disruptive reflections within eye.

Q28. Define Cornea.

Ans. The transparent part of sclera that forms in the front of the eye through which light enters the eye.

Q29. What are Cranial nerves?

Ans. Nerves that arise from or lead to the brain.

Q30. Define dendrites.

Ans. Short and branched projections of neuron's cell body which transmit nerve impulse towards cell body are called Dendrites.

Q31. What is Diabetes mellitus?

Ans. More than normal level of glucose in blood, a condition caused by insufficient concentration of insulin in blood, is called diabetes mellitus.

Q32. What is the cause of dwarfism? (Board 2014)

Ans. Less than normal body growth; a condition caused when growth hormone is insufficient during the growing age.

Q33. What is Ear drum or Tympanic membrane?

Ans. Tympanic membrane; A membrane stretched across the inner end of the auditory canal of the ear is called eardrum.

Q34. What are Effectors?

Ans. The parts of the coordination system that respond when stimulated by nerve impulses or hormones.

Q35. Define Endocrine gland.

Ans. A ductless gland produces secretions which release directly into the blood stream is called endocrine gland.

Q36. What is Epilepsy?

Ans. A nervous disorder characterized by recurrent unprovoked seizures (convulsions).

Q37. What is Epinephrine?

Ans. It is also called adrenaline or emergency hormone it is secreted by adrenal gland.

Q38. Define Estrogen.

Ans. A hormone secreted by the ovaries; promotes development of female secondary sex characteristics and regulates the reproductive cycle.

Q39. Define Eustachian tube.

Ans. The tube between middle ear and the nasal cavity that equalizes the pressure on both sides of the eardrum.

Q40. Define Exocrine gland.

Ans. A gland that discharges its secretion into a duct e.g. digestive glands, skin glands.

Q41. What is Ganglion?

Ans. The aggregation of the cell bodies of neurons is called ganglion.

Q42. Define Grey matter.

Ans. The nervous tissue containing cell bodies and non myelinated processes of the neurons.

Q43. Define Hormone.

Ans. A substance that is secreted by an endocrine gland directly into blood and that produces a specific effect on a particular tissue. E.g., vasopressin, oxytocin, thyroxin etc.

Q44. What is Hypermetropia?

Ans. The condition in which a person is not able to see nearer objects clearly; the eyeball shortens and image is formed behind the retina.

Q45. What is Hyperthyroidism?

Ans. The over-production of thyroxin results in increase of energy production, increased heart-beat, frequent sweating and shivering of hands.

Q46. What is Insulin?

Ans. The hormone produced by the Islets of Langerhans; lowers the blood glucose level is called insulin.

Q47. What is difference between sensory neurons and interneurons? (B-2014)

Ans. Sensory Neurons:

Conduct sensory information (nerve impulse) from receptors towards the CNS, sensory neurons have one dendrites and one axon.

Interneurons

The neurons present in the brain and spinal cord are called Interneurons. They receive information, interpret them and stimulate motor neurons. They have many dendrites and axons.

Q48. Define Iris.

Ans. A muscular ring formed by the bending of the choroid behind the cornea of the eye.

Q49. What is Medulla oblongata?

Ans. Part of the hindbrain; on the top of the spinal cord; controls breathing, heart rate, blood pressure and many reflexes.

Q50. What are Meninges?

Ans. Three layers around the brain and the spinal cord; protect them and provide nutrients and oxygen through their capillaries.

Q51. Define Mixed nerves.

Ans. The nerves containing axons of both the sensory and motor neurons are called mixed nerves. e.g. all spinal nerves are mixed in nature.

Q52. Define Motor nerves.

Ans. The nerves which contain the axons of motor neurons only are called motor nerves.

Q53. Define Myelin sheath.

Ans. The insulating sheath around the axons of some neurons is called myelin sheath.

Q54. What is Myopia.

Ans. The condition in which a person is not able to see distant objects clearly; happens due to elongation of the eyeball and image is formed in front of retina.

Q55. Define Nerve.

Ans. The union of several axons that are enveloped by a covering made of lipid.

Q56. Define Neuron.

Ans. Nerve cell or neuron the unit of the nervous system; able to conduct nerve impulses is called neuron.

Q57. What are nodes of Ranvier?

Ans. The non-myelinated points between the areas of myelin on the axons of neurons.

Q58. Define Optic disc.

Ans. It is also called blind spot. It is a point on the retina of the eye where the optic nerve enters the retina; no photosensitive cells exist at this point.

Q59. What is Oxytocin?

Ans. The hormone secreted by the posterior lobe of pituitary gland; stimulates the contraction of uterus walls in females for child birth; necessary for ejection of milk from the breasts.

Q60. What is Paralysis?

Ans. Complete loss of function by one or more muscle groups due to damage in the nervous system is called Paralysis.

Q61. Define Parathormone.

Ans. This hormone of the parathyroid glands increases the level of calcium ions in the blood.

Q62. Define Parathyroid gland.

Ans. The endocrine glands located on the posterior sides of the thyroid gland secretes parathormone.

Q63. Define Pituitary gland.

Ans. The endocrine gland attached to the hypothalamus that controls many other endocrine glands in the body.

Q64. What are Pons?

Ans. Part of the hindbrain; present on top of the medulla; assists the medulla in controlling breathing and serves as a connection between the cerebellum and the spinal cord.

Q65. Define Progesterone.

Ans. A hormone secreted by ovaries that maintains the uterus during pregnancy is called progesterone.

Define Pupil.

The opening in the centre of the iris of the eye is called pupil.

Define Receptors.

The organs, tissues or cells which detect particular type of stimuli. e.g. eyes, ear etc.

What is Reflex arc?

The nerve pathway over which the nerve impulses travel in a reflex action.

Define Retina.

The innermost and the sensitive layer in the eye is called retina.

Q70. Define Rhodopsin.

Ans. A pigment present in the rods of the retina.

Q71. What are Rods?

Ans. The photosensitive cells present in the retina of the eye sensitive to dim light.

Q72. What are Schwann cells?

Ans. The supporting cells around neurons, form the myelin sheath.

Q73. Define Sclera.

Ans. The tough, white outer layer of the eye which protects the eye.

Q74. What are Semicircular canals?

Ans. The three canals present posterior to the vestibule in the inner ear.

Q75. What are sensory nerves?

Ans. The nerves which contain only the axons of sensory neurons.

Q76. Define Somatotrophin.

Ans. It is also called growth hormone. A hormone of the anterior lobe of pituitary gland promotes the growth of the body.

Q77. What are Spinal nerves?

Ans. The nerves which arise from the spinal cord.

Q78. Define Suspensory ligament.

Ans. The ring that attaches the lens of the eye to the ciliary muscles.

Q79. What is Testosterone?

Ans. The male sex hormone secreted by testis; stimulates the development of male reproductive system and the male secondary sex characteristics.

Q80. Define Thalamus.

Ans. The part of the forebrain; serves as a relay centre between various parts of the brain and spinal cord.

Q81. What is Thyroid?

Ans. The endocrine gland located in front of the trachea; secretes hormones, thyroxin and calcitonin.

Q82. Define Thyroxin.

Ans. The hormone of the thyroid gland increases the breakdown of food and release of energy; also responsible for the growth of body.

Q83. What is Vasopressin?

Ans. Antidiuretic hormone; the hormones secreted by the posterior lobe of pituitary gland; responsible for the reabsorption of water from renal tubules of the nephron.

Q84. What is Vestibule?

Ans. Part of the inner ear, helps to maintain balance of the body.

Q85. Define Brain stem.

Ans. The medulla oblongata, pons and midbrain connects the rest of brain to spinal cord. This is called brain stem.

Q86. What is nerve-growth factor?

Ans. Unlike ordinary cells, mature neurons never divide. But a protein called nerve-growth factor promotes the regeneration of broken nerve cells. The degenerating brain cells could be repaired by using embryonic stem cells.

Q87. What do you know about deafness?

Ans. Introduction

It is a state in which hearing is not possible.

Causes

(i) The defect of ear drum, cochlea, middle ear, ossicles or auditory nerve may cause deafness.

(ii) Infection in Eustachian tube may spread to middle ear too.

(iii) Ear drum may be damaged by an infection in auditory canal.

(iv) Excessive noise, strong blows on cheek, pointed objects entering auditory canal and attack from insects may also affect hearing.

Q88. How thundering and lightning is produced?

Ans. A thunderstorm is characterized by the presence of lightning and a thunder.

(a) Lightning

The lightning is caused by an electrical charge due to the movement of water droplets or crystals carried by wind.

(b) Thunder

The sudden increase in pressure and temperature from lightening produces a sound of thunder.

Q89. Why the flash of lightning is followed after some seconds by a roar of thunder?

Ans. This time difference is due to the fact that sound travels slower than light.

Q90. What are the functions of hormones in animals?

Ans. Following are the functions of hormones in animals:

(i) Stepwise process of metamorphosis

(ii) Cell division in invertebrates

(iii) Migration in birds

Q91. Why the urine output is low in summer?

Ans. Due to increased sweating, the water level of blood is lowered. As a result, pituitary gland releases more Antidiuretic hormone (ADH) into blood which lowers the amount of urine.

Q92. What is Tetany?

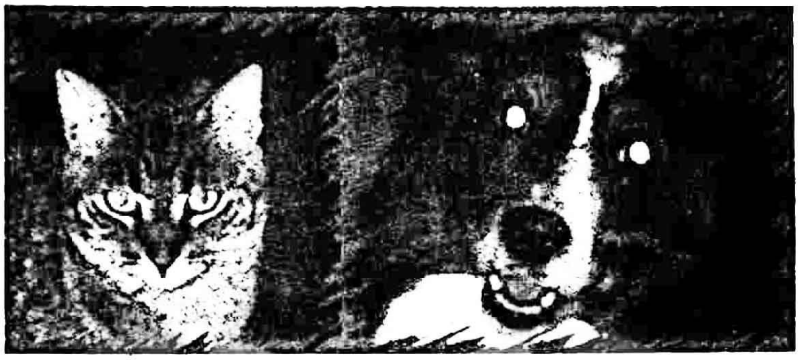
Ans. It is marked by sharp flexion of the wrist and ankle joints, muscle twitching, cramps and convulsions. It is due to decreased blood calcium level.

Q93. What is BGC test?

Ans. The amount of glucose in blood is measured by BGC (Blood Glucose Concentration test). It is used to diagnose diabetes. The blood glucose concentration is maintained at the rate of 80 to 120 mg per 100 ml of blood.

Q94. Why the eyes of cat and dog shine in the night?

Ans. The reason for this is the presence of tapetum behind the eye which is a layer capable of reflecting light.

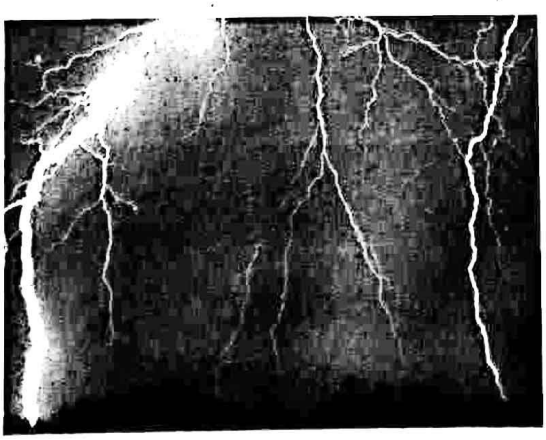


Q 95. Why Owl is not able to see during day time?

Ans. The reason for this is the deficiency of cones which receive and sense the bright light. But the presence of more rods gives it greater power of vision during night. All animals that search for prey during night have this characteristic.

Q96. What do you know about lightening and thunder?

Ans. Lightening is caused by an electrical charge due to the movement of water droplets or crystals carried by the wind. The sudden increase in pressure and temperature from lightening produces rapid expansion of the air. This expansion of air produces a sound of thunder.



Q97. Define coordination and give example. **(Board 2013)**

Ans. Definition: The coordination is developed when body works as one unit in which its different organs and systems co-operates and work in harmony with each other.

Example:

When we are writing something, our hands and fingers work in collaboration with our muscles, eyes, thoughts etc. and then very intricate movements result.

Q98. Write names of three main parts of brain. **(Board 2013)**

Ans. Three main parts of brain are:

a. Forebrain b. Midbrain c. Hindbrain

Q99. What is salutatory impulse? **(Board 2013)**

Ans. In a neuron, impulses 'jump' over the areas of myelin going from node to node. Such impulses are called salutatory impulses. This increases the speed of nerve impulse.

Q100. Define coordinators. Give an example also. **(Board 2014)**

Ans. Definition:

These are the organs that receive information from receptors and send messages to particular organs for proper action.

Examples:

i. In nervous co-ordination, brain and spinal cord are coordinators.

ii. In chemical coordination, various endocrine glands play the role of coordinators.

Q101. Define Reflex action with example. **(Board 2014)**

Ans. Definition:

Sometimes the involuntary action produced by the CNS is very quick. Such a response is called reflex action.

Example

The most common example of reflex action is the withdrawal of hand after touching a hot object.

Unit 13

Support and Movement

Long Answer Questions

Q.1 What do you mean by Support and movement?

Ans. Introduction

Multicellular organisms having greater sizes, need support to keep their body mass as one unit. This is particularly true for those organisms who live on land. In human, skeleton is responsible for support and movement.

(I) Movement: Movement is a general term meaning the act of changing place or position by entire body or by its parts. There are two types of movements:

1) Movement of body parts
2) Locomotion

(II) Locomotion: Locomotion is the movement of an animal as a whole from one place to another.

Q.2 Define human skeleton. Describe its types and role.

Ans: Skeleton

Skeletal system or skeleton is defined as the framework of hard articulated structures that provide physical support, attachment for skeletal muscles and protection for bodies of animals.

Types of skeleton

It is of two types:

(i) Endoskeleton: The skeleton which is present on inside the body is called endoskeleton. e.g. in Vertebrates and Human.

(ii) Exoskeleton: The skeleton which is present outside of the body e.g. in arthropods.

Parts of Skeleton: There are two parts of skeleton:

1) Cartilage
2) Bones

In the living body, skeleton is very much alive. Bones and cartilage are made up of living cells having nerves and blood vessels in them. They grow and have the ability to repair themselves.

Role of Skeleton system: Skeletal system provides:

1) Movements
2) Protection
3) Support

1-Movements: Skeleton works very closely with the muscular system to help the body for movement.

2-Protection: Skeleton provides protection to many of our internal organs e.g. skull protects brain, vertebral column protects spinal cord and ribs protect many organs especially heart and lungs.

3- Support: Skeleton provides support to our body mass e.g. vertebral column provides main support to our body mass.

Q.3 Write a note on cartilage and bone in Human skeleton?

Ans. Introduction

Overall, the human skeleton is made of bony framework but in certain parts, this frame work is supplemented by cartilage.

Connective Tissue

Both cartilage and bones are types of connective tissues in animals. Most of the connective tissues contain collagen fibres in a matrix.

Explanation

(i) Cartilage

Definition

Cartilage is a dense, clear blue-white firm connective tissue but less strong than bone.

Chondrocytes

The cells of cartilage are called chondrocytes.

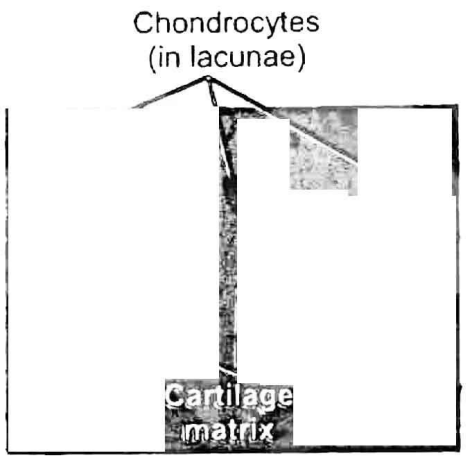


Figure 13.1: Chondrocytes in cartilage matrix

Lacuna

Each chondrocyte lies in a fluid space called lacuna present in the matrix of cartilage.

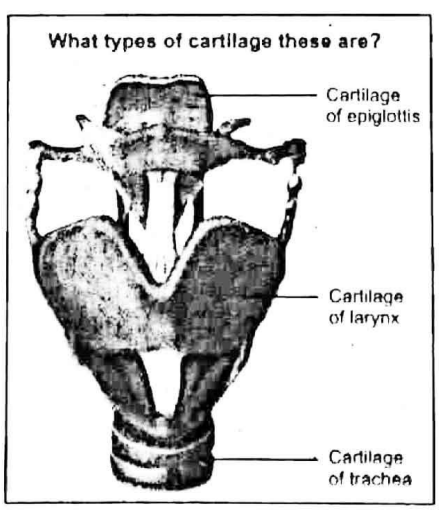
Collagen Fibres

The matrix of cartilage also contains collagen fibres.

No Blood vessels in cartilage

Blood vessels do not enter cartilage.

Types of Cartilage **(Board 2014)**



There are three types of cartilage:

1. Hyaline cartilage
2. Elastic Cartilage
3. Fibrous cartilage

1) **Hyaline Cartilage:** Hyaline cartilage is strong and flexible cartilage. It is found covering the ends of the long bones, in the nose, larynx, trachea and bronchial tubes.

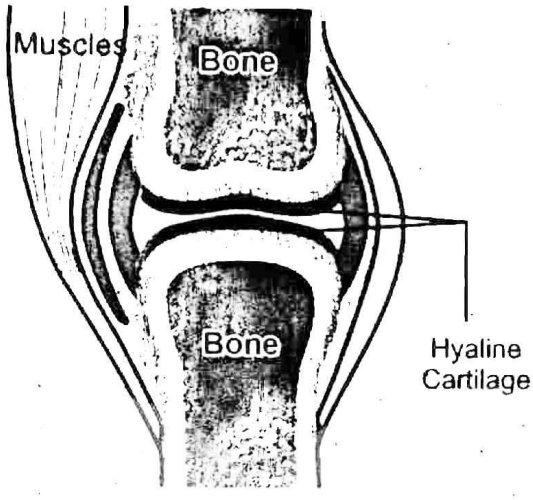


Figure 13.2: Hyaline cartilage

2) **Elastic Cartilage:** Elastic cartilage is similar to hyaline cartilage. It is also quite strong but has elasticity due to a network of elastic fibers in addition to collagen fibers. It is found in epiglottis and pinna etc.

3) **Fibrous Cartilage:** Fibrous cartilage is very tough and less flexible due to large number of their collagen fibers present in knitted form. It is found in intervertebral discs.

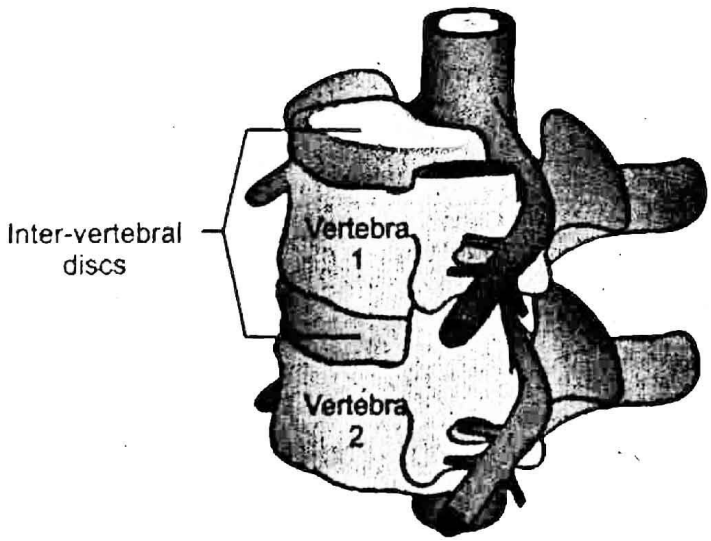


Figure 13.3: Fibrous cartilage

(ii) Bone:

Definition

Bone is the hardest connective tissue in body. Bones not only move, support and protect the various parts of body but also produce red and white blood cells and store minerals.

Structure of a bone

1) **Compact bone** The hard outer layer of a bone is called compact bone.
2) **Spongy bone** Interior of bone is soft and porous called spongy bone, it contains blood vessels and bone marrow. Babies are born with about 300 soft bones some of these bones later fuse together, so that the adult skeleton has 206 hard bones.

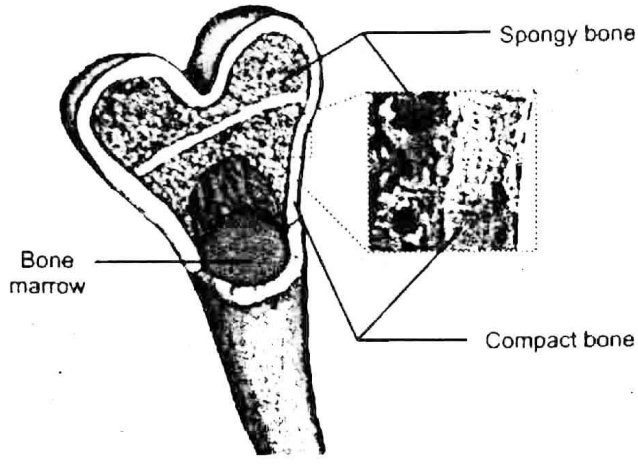


Figure 13.4: compact and spongy bone

3) **Matrix of bones** Like cartilage, the matrix of bones also contains collagen. But it also contains minerals e.g. calcium and phosphate. Bones contain different types of cells.
4) **Osteocyte**

Mature bone cells are called osteocytes.

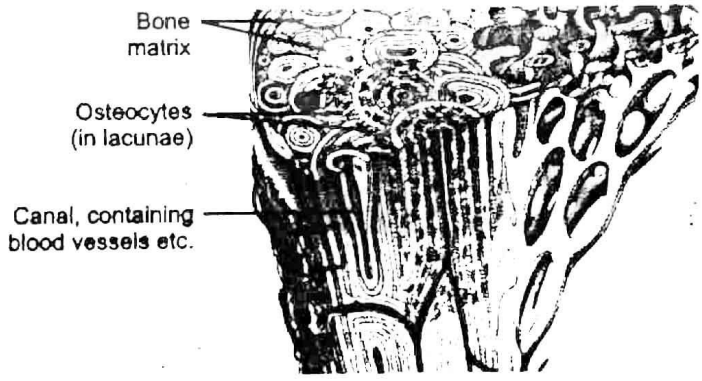


Figure 13.5: The internal structure of bone

Q.4 What are the components of human skeleton?

Ans. Introduction

206 bones are present in the adult human skeleton. Skeleton can divide into two parts:

1. Axial Skeleton Bones are organized into a longitudinal axis i-e axial skeleton. Axial Skeleton consists of 80 bones in the head and trunk of body.

Parts

It is composed of five parts:

i. **Skull** Contains 22 bones out of which 8 are cranial bones (enclosing the brain) and 14 are facial bones.
ii. **Middle ear ossicles** 6 bones are present in middle ear (3 in each ear).
iii. **Hyoid bone** It is present in neck.
iv. **Vertebral column** It contains 33 bones and these bones are called vertebrae.
v. **Chest** Chest is made up of a chest bone called sternum and ribs. 24 ribs are present in 12 pairs.

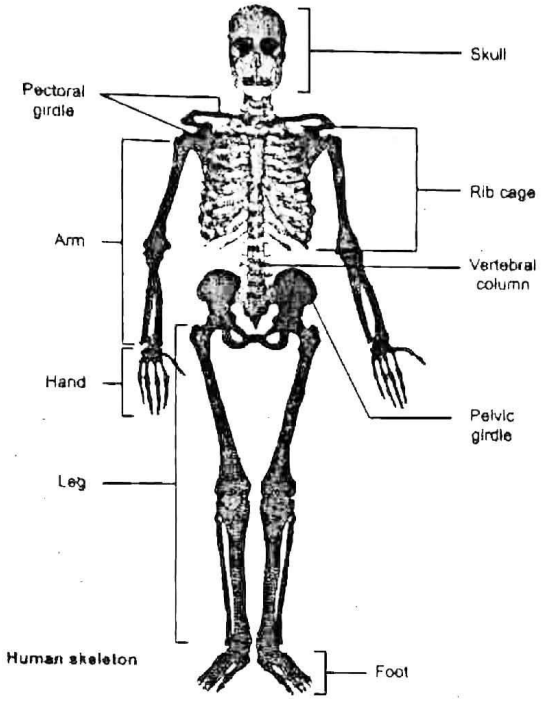


Figure 13.6: Human Skeleton

2. Appendicular skeleton:

Apendicular skeleton is attached to the axial skeleton. Appendicular skeleton is composed of 126 bones.

Parts

It is divided into two parts.

1) **Pectoral Girdle (Shoulders):** It is called shoulder girdle and made up of 4 bones. Arms have six bones. Both hands have 54 bones.

2) **Pelvic Girdle (hips):** It has two bones. Legs have 6 bones and feet have 54 bones.

Q.5 Define Joint and write down the types of Joints. **(Board 2014)**

Ans. Joints: A joint is a location at which two or more bones make contact. Joints allow movement and provide mechanical support.

Types of joints: Joints can be classified on the basis of degree of movement they allow.

1) Immoveable joints (Fixed)
2) Slightly moveable joints
3) Moveable joints

1. **Immoveable joints:** Such joints allow no movement e.g. the joints between the skull bones.
2. **Slightly moveable joints:** Such joints allow slight or little movements e.g. joints between the vertebrae.

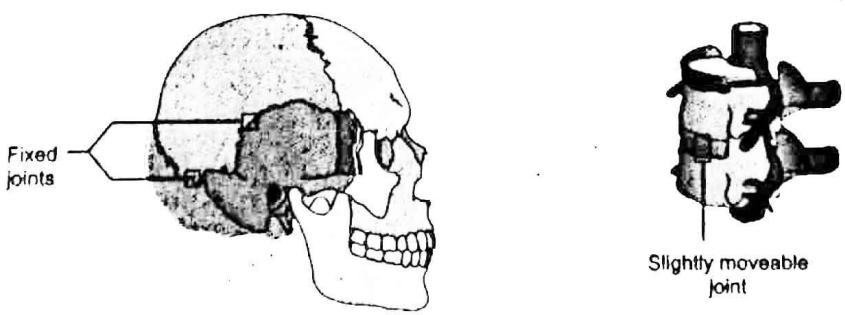


Figure 13.7: Fixed and slightly moveable joints

3. **Moveable joints:** They show a variety of movements e.g. shoulder joint, hip joint, elbow joint, knee joint etc.

Types of Moveable Joints

There are many types of moveable joints:

1) Hinge joint
2) Ball and socket joint

1. **Hinge joints:** Hinge joint move back and forth like the hinge on a door and allow movements in one plane only. The knee and elbow are hinge joints.

2. **Ball and socket joints:** These joints allow movement in all directions. The hip and shoulder joints are ball and socket joints.

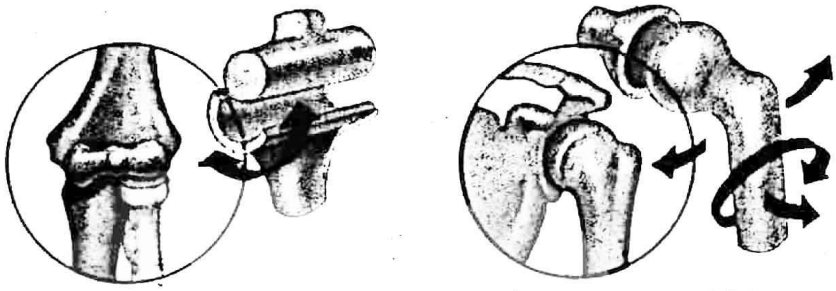


Figure 13.8: Two types of Moveable Joints

Q.6 Describe the role of tendons and ligaments.

Ans Introduction

Tendons and ligaments are bands of connective tissue (made of collagen).

Tendons

Tendons are bands of connective tissues in which collagen fibers are tightly packed. These are tough bands which attach muscles to bones. When muscle contracts, tendon exerts a pulling force on the attached bone, which moves as a result.

Ligaments

Ligaments are also the bands of connective tissues having highly packed collagen fiber. Ligaments are strong but flexible bands and join one bone to another at joints.

Function

They prevent dislocation of bones at joints.

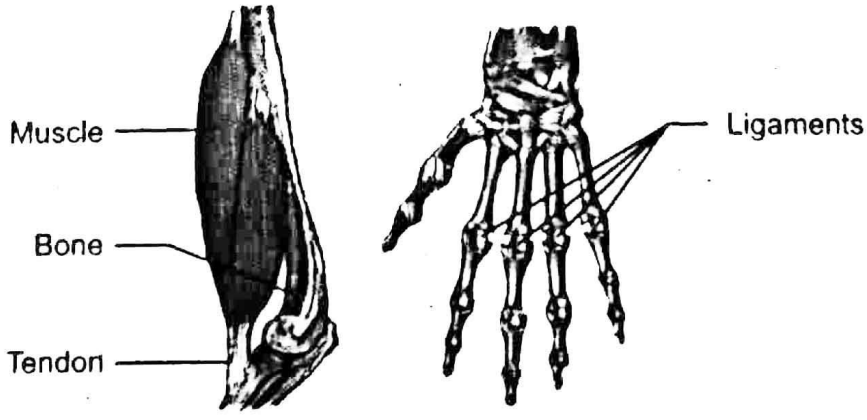


Figure 13.9: Tendons and Ligaments

Q.7 How skeletal muscles, are involved in the movement of the skeleton?

Ans. When bones move at joints, they produce movement. The movements in bones are brought about by the contractions of skeletal muscles, which are attached with bone by tendons. The combination of several muscles bring about activities e.g. walking, running, playing etc.

Origin: One end of skeletal muscle is always attached with some immoveable bone. This end of muscle is called origin.

Insertion: Other end of muscle is attached with a moveable bone and is called insertion.

Muscles can only contract or pull but cannot expand or push the bones. When muscle is stimulated by a nerve impulse, it contracts to become shorter and thicker. Due to this contraction, muscle pulls the moveable bone at insertion.

Role of Skeletal Muscles

(a) Antagonism: Skeletal muscles are usually in pairs of antagonists. In an antagonistic pair, both muscles do opposite jobs. When one muscle contracts the other relaxes and this phenomenon is called antagonism or antagonistic action.

(b) Flexor: When a muscle in an antagonistic pair contracts and bends the joints, it is called flexor muscle and movement is called flexion.

(c) Extensor: When a muscle contracts and straightens the joint, it is known as extensor and the movement is called extension.

Example: (Movement of arm)

(a) Antagonistic Pair

Bicep and triceps are antagonistic pair of muscles and are involved in the movement of arm.

(b) Biceps

Biceps is a flexor muscle in front of the upper arm bone.

(c) Triceps

Triceps is an extensor muscle on the back of arm. Both of these muscles have their origin at pectoral girdle and insertion at one of the two bones of forearm.

(d) Working

When biceps contracts, the forearm (insertion end) is pulled upward. It is flexion of elbow joint. During this flexion, triceps muscle relaxes. When triceps contracts, forearm is pulled down. It is an extension at elbow joint. During it, biceps relaxes. Similar pairs, working antagonistically across other joints, provide for almost all the movements of skeleton.

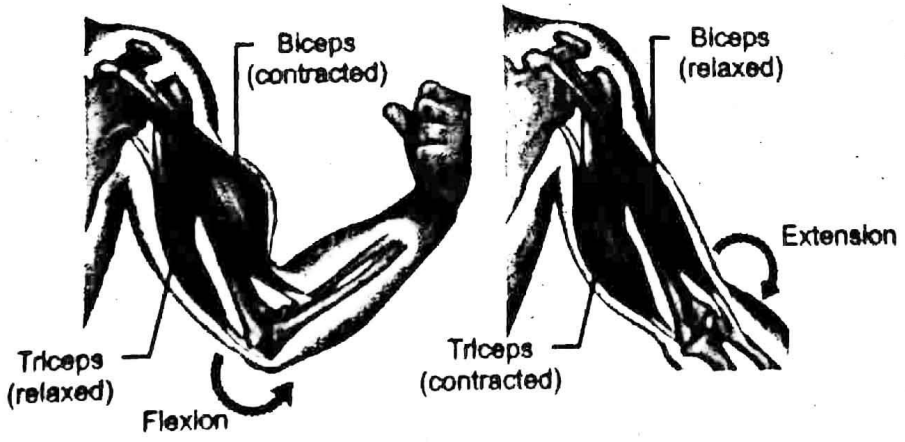


Figure 13.10: Action of Antagonistic Muscles (Biceps and Triceps) at Elbow

Q.8 Write a note on disorders of skeletal system?

Ans. The following are the disorders of skeletal system:

1. Osteoporosis: In Osteoporosis, there is a decrease in the density of bones due to the loss of calcium and phosphorus. It is a bone disease in adults especially in old people. It is more common in old women. In women, estrogen deposits minerals in bones. When reproductive cycle stops in female, not enough estrogen is secreted and no minerals are deposited at bones and women becomes victim of osteoporosis.

Causes:

i. Malnutrition (lack of protein and Vitamin C)
ii. Lack of physical activities
iii. Deficiency of estrogen hormone in women
iv. Decrease in the secretion of growth hormones in old age and it also leads to decreased deposition of minerals in bone matrix.

2. Arthritis

Introduction: Arthritis means "inflammation in joints". It is also very common in old age and in women.

Symptoms

It is characterized by pain and stiffness in joints particularly in the weight bearing joints e.g; in hip joint and ankle joint etc.

Treatment

It includes pain killer and anti-inflammatory medicines.

Types of Arthritis:

1) Osteoarthritis

It is due to the degeneration in the cartilage present at joints or due to decreased lubricant production at joints. In this arthritis, fusion of the bones at joint may occur and joints may become totally immoveable.

2) Rheumatoid arthritis

It involves the inflammation of the membranes at joints. Its symptoms include fatigue, low grade fever, pain and stiffness in joints.

3) Gout: It is characterized by the accumulation of uric acid crystals in moveable joints. It generally attacks the toe joints.

Multiple Choice Questions

1. **Find the ball-and-socket joint;**
   (a) Joint in the finger bones
   (b) Joint of neck and skull bones
   (c) Joint at elbow
   (d) Joint at pelvic girdle and leg bones

2. **All these are the parts of axial skeleton of humans except:**
   (a) Ribs
   (b) Sternum
   (c) Shoulder girdle
   (d) Vertebral column

3. **The disorders in which there is an accumulation of uric acid in joints:**
   (a) Gout
   (b) Rheumatoid arthritis
   (c) Osteoporosis
   (d) Osteoarthritis

4. **What is correct about tendons?**
   (a) Tendons are flexible and they join muscles with bones
   (b) Tendons are non-elastic and they join bones with bones
   (c) Tendons are non-elastic and they join muscles with bones
   (d) Tendons are flexible and they join muscles with muscles

5. **How many bones make our skull?**
   (a) 14 (b) 22 (B-13)
   (c) 24 (d) 26

6. **What are the main components of a bone?**
   (a) Marrow, spongy bone, wax
   (b) Marrow, compact bone, wax
   (c) Compact bone and marrow
   (d) Compact bone, spongy bone, marrow

7. **What do some bones produce?**
   (a) mucous (b) hormones
   (c) oxygen (d) blood cells

8. **How would you define skeletal system?**
   (a) All the bones in body
   (b) All the muscles and tendons
   (c) All the body's organs, both soft and hard tissues.
   (d) All the bones in body and the tissues that connect them

9. **Find the INCORRECT statement:**
   (a) Bone is where most blood cells are made
   (b) Bone serves as a storehouse for various minerals
   (c) Bone is a dry and non-living supporting structure
   (d) Bone protects and supports the body and its organs

10. **The purpose of rib cage is to:**
    (a) Protect the stomach
    (b) Protect the spinal cord
    (c) Protect the heart and lungs
    (d) Provide an object to which the lungs can attach

11. **There are ____ types of joints.**
    (a) 2 (b) 3
    (c) 4 (d) 5

12. **The skeletal system outside the body is called;**
    (a) endoskeleton
    (b) exoskeleton
    (c) normal skeleton
    (d) Exoskeleton & Endoskeleton

13. **In our body skeleton works very closely with the ____ system.**
    (a) Muscular (b) Nervous
    (c) Endocrine (d) All of these

14. **Babies are born with about _____ soft bones.**
    (a) 206 (b) 250
    (c) 300 (d) 350

15. **Vesalius was born in;**
(a) Brussels (b) London
(c) Birmingham (d) Sidney

16. **_____ is the longest bone in our body.**
(a) Arm (b) Leg
(c) Thigh (d) Foot

17. **_____ is the smallest bone in our body**
(a) Thigh (b) Stapes
(c) Ankle (d) Knee-cap

18. **Which joints allow no movement?**
(a) Moveable joints
(b) Slightly moveable joints
(c) Immoveable joints
(d) None of these

19. **Muscles can only;**
(a) Contract (b) Push
(c) Expand (d) All of above

20. **Pair of skeletal muscles are called:**
(a) Extensor (b) Flexor
(c) Antagonistic (d) None of these

21. **When a muscle contracts, the point of attachment which is pulled is called**
(a) Origin (b) Insertion
(c) Origin and Insertion (d) None

22. **When the reproductive cycle stops in female, _____ hormone is less produced.**
(a) Androgen (b) Esterogen
(c) Insulin (d) none of these

23. **In gout _____ is accumulated in immoveable joints.**
(a) Glucose (b) urea
(c) Uric acid (d) Ammonia

24. **Inflammation of membrane at joints is called;**
(a) Osteoarthrits
(b) Rheumatoid arthritis
(c) Arthritis
(d) Gout

25. **_____ joint move only in one plane.**
(a) Ball & socket
(b) Hinge joint
(c) Moveable joint
(d) Slightly moveable joints

26. **_____ prevents dislocation of bones at joints.**
(a) Ligament (b) Tendons
(c) Salts (d) Joint

27. **Bone can store;**
(a) Urea (b) Salts
(c) Uric acid (d) Minerals

28. **Cranial bones are;**
(a) 8 (b) 10
(c) 12 (d) 22

29. **Bones which enclose brain are called;**
(a) Cranial bones (b) Cervical bones
(c) Vertebrae (d) None of above

30. **Lacuna is present in the _____of cartilage.**
(a) Bone (b) Matrix
(c) Collagen (d) Cartilage

31. **Disease of bones in which there is a decrease in the density of the bones due to loss of calcium and phosphorus is:** (Board 2013)
(a) Osteoporosis
(b) Osteoarthritis
(c) Rheumatoid arthritis
(d) Gout

32. **Which allows movement in all directions:**
(a) Shoulder & Knee Joints
(b) Hip & Elbow Joints
(c) Hip & Shoulder Joints
(d) Elbow & Knees Joints

33. **The bending of arm at elbow is:**
(a) Relaxation (b) Contraction
(c) Flexion (d) Extension

34. **Vertebral Column consists of following number of bones:**
(a) 10 (b) 20
(c) 23 (d) 33

35. **Which one cannot show movement from one place to an other place?**
(a) Bacteria (b) Animals
(c) Plants (d) Human beings

36. **Place where two or more bones meet at a point is called**
(a) Origin (b) Joint
(c) Insertion (d) Tendons

37. **The muscle of the arm at elbow joint causes straightening of the arm, it is called:**
(a) Extension (b) Extensor
(c) Flexion (d) Flexor

38. **Fore limbs are the part of:**
(a) Appendicular skeleton
(b) Axial skeleton
(c) Exoskeleton
(d) Exoskeleton and Endoskeleton

39. **Osteoporosis is due to deficiency of**
(a) Carbon (b) Nitrogen
(c) Calcium (d) Phosphorus

40. **The example of slightly moveable joint is:**
(a) Joint of elbow
(b) Joint of knee
(c) Joint of shoulder
(d) Joints of vertebral column

41. **Pain and stiffness in weight bearing joints are symptoms of:**
(a) Arthritis
(b) Gout
(c) Rheumatoid arthritis
(d) Osteoporosis

42. **How many bones are present in right hand?**
(a) 56 (b) 43
(c) 28 (d) 27

43. **Which of the following provides main support to our body mass?**
(a) Skull
(b) Body
(c) Vertebral column
(d) Spinal cord

44. **How many bones are present in middle ear?**
(a) 2 (b) 3
(c) 5 (d) 6

45. **Fatigue, low grade fever, pain and stiffness in joints are symptoms of:**
(a) Arthritis
(b) Osteoarthiritis
(c) Gout
(d) Rheumatoid Arthritis

46. **Blood vessels do not enter:**
(a) Bone (b) Matrix
(c) Cartilage (d) Lacuna

47. **Fibrous cartilage is present in:**
(a) Pinna
(b) Nose
(c) Intervertebral discs
(d) Epiglottis

48. **How many ribs are there in man?**
(a) 22 (b) 12
(c) 24 (d) 33

49. **Movement of an animal as a whole is:**
(a) stimulus (b) response
(c) locomotion (d) movement

50. **Mark the False statement about bones:**
(a) Contain chondrocytes
(b) Ability to store minerals
(c) Contains blood vessels
(d) Hardest connective tissue

51. **Which of the following stores minerals?**
(a) Bone (b) Cartilage
(c) Cartilage and bone (d) Joints

52. **Pelvic Girdle contains bones:**
(a) 33 (b) 02
(c) 54 (d) 12

53. **Which are tough bands?**

(a) Flexors (b) Ligaments

(c) Tendons (d) Insertions

54. **Deposition of uric acid in joints is due to:** **(Board 2014)**

(a) Osteoarthritis

(b) Gout

(c) Osteoporosis

(d) Rheumatoid Arthritis

55. **An example of ball and socket joint is:** **(Board 2014)**

(a) Elbow joint (b) Shoulder joint

(c) knee joint (d) Finger joint

Answer Key

1	d	**2**	c	**3**	a	**4**	c	**5**	b	**6**	d
7	d	**8**	d	**9**	c	**10**	c	**11**	b	**12**	b
13	a	**14**	c	15	a	16	c	**17**	b	**18**	c
19	a	**20**	c	21	b	22	b	**23**	c	**24**	b
25	b	**26**	a	**27**	d	**28**	a	**29**	a	**30**	b
31	a	**32**	c	33	c	34	d	**35**	c	**36**	b
37	b	**38**	a	39	c	40	d	**41**	a	**42**	d
43	c	**44**	b	**45**	d	**46**	c	**47**	c	**48**	c
49	c	**50**	a	**51**	a	**52**	b	**53**	c	**54**	b
55	b										

Short Answer Questions

Q.1 Write the two characteristics of animals?

Ans. Movement and locomotion are the characteristics of animals.

Q.2 What do you mean by movement?

Ans. Movement is a general term meaning, the act of changing place or position by entire body or by its parts.

Q.3 How many types of movement are?

Ans. There are two types of movement:

i. Movements of body parts **ii.** Locomotion

Q.4 What do you mean by locomotion?

Ans. Locomotion is the movement of an animal as a whole from one place to another.

Q.5 What is sternum?

Ans: Chest bone is called sternum.

Q.6 What do you know about osteoarthritis? **(Board 2013)**

Ans: It is due to degeneration in cartilage present at joints or due to decrease in lubricant production at joints. In this arthritis, fusion of the bones at joint may occur and joints may become totally immoveable.

Q.7 What is Rheumatoid arthritis? Or Write down causes of Rheumatoid Arthritis, also give its two symptons. **(Board 2014)**

Ans: It involves the inflammation of the membranes at joints. Its symptoms are fatigue, low grade fever, pain and stiffness of joints.

Q.8 What do you mean by "Exoskeleton"?

Ans. The skeleton system of some invertebrates e.g. arthropods are at the outside of the body, and are called exoskeleton.

Q.9 What is skeleton? Define briefly.

Ans. Skeleton system or skeleton is defined as the framework of hard, articulated structure that provides physical support, attachment for skeletal muscles and protection for the bodies of animals.

Q.10 What do you mean by endoskeleton?

Ans. Like other vertebrates, the human skeleton is on the inside of body and is called endoskeleton.

Q.11 What is the role of skeletal system?

Ans. The big functions of skeletal system are protection, support and movement of a body. Skeleton works very closely with the muscular system to help us in movement. Similarly skeleton also provides protection to many internal organs e.g. skull protects brain and vertebral column. It also provides the main support to our body mass.

Q.12 What do you know about bone and cartilage?

Ans. Bone and cartilage are types of connective tissues in animals. Most connective tissue contains collagen fibers in a matrix. Cartilage is dense clear firm connective tissue while bone is hardest connective tissues.

Q.13 Define cartilage. Write names of its two types. (Board 2014)

Ans. Definition:

Cartilage is a dense, clear blue-white firm connective tissue (but less strong than bone).

Names of two types:

1. Hyaline Cartilage
2. Elastic Cartilage

Q.14 What are the cells of cartilage called?

Ans. The cells of cartilage are called chondrocytes.

Q.15 Where the chondrocyte lies?

Ans. Each chondrocyte lies in a fluid space called lacuna, present in the matrix of cartilage.

Q.16 How many types of cartilage are there?

Ans. There are three types of cartilage:

i. Hyaline cartilage **ii.** Elastic cartilage **iii.** Fibrous cartilage

Q.17 What are tendons and ligaments?

Ans. Tendons and ligaments are connective tissues that contain tightly packed collagen fibers. Tendons are tough bands and attach muscles to bones. Ligaments are flexible bands and join one bone to another at joints.

Q.18 What do you know about Hyaline cartilage?

Ans. Hyaline cartilage is a strong yet flexible. It is found covering the ends of the long bones, in the nose, larynx, trachea and bronchial tubes.

Q.19 What is Elastic cartilage?

Ans. Elastic cartilage is similar in structure to hyaline cartilage. It is also quite strong but has elasticity due to a network of elastic fibers in addition to collagen fibers. It is found in epiglottis, pinna etc.

Q.20 What is fibrous cartilage?

Ans. Fibrous cartilage is very tough and less flexible due to large number of thick collagen fibers present in knitted form. It is found in intervertebral dics.

Q.21 What is a Bone? (Board 2013)

Ans. Bone is a hardest connective tissue in body.

Working

Bones not only move, support and protect the various parts of body but also produce red and white blood cells and store minerals.

Q.22 What are compact bones and spongy bones?

Ans. The hard outer layer of a bone is called compact bone while the interior of bone is soft and porous called spongy bone.

Q.23 What matter does bone contain?

Ans. Spongy bone contains blood vessels and bone marrow. Matrix of bones contain collagen, calcium and phosphate. Bone also contain different types of cells.

Q.24 With how many bones babies are born.

Ans. Babies are born with about 300 soft bones. Some of these bones later fuse together, so the adult skeleton has 206 hard bones.

Q.25 What are mature bone cells called?

Ans. The mature bone cells are called osteocytes.

Q.26 Who was Andreas Vesalius? What do you know about him?

Ans. Andreas Vesalius is honoured for developing modern anatomical studies. He was born in Brussels, Belgium. He made many discoveries in anatomy based on studies made by dissection of human dead bodies. His book contained the most accurate depictions of the whole skeleton and muscles of the human body.

Q.27 What are the components of human skeleton?

Ans. The 206 bones in the adult human skeleton are organized into a longitudinal axis i.e. axial skeleton, to which appendicular skeleton is attached.

Q.28 How many bones are present in axial skeleton? Give detail.

Ans. Axial skeleton consists of the 80 bones in the head and trunk of body. It is composed of five parts:-

i. Skull contains 22 bones out of which 8 are cranial bones (enclosing the brain) and 14 are facial bones.
ii. There are 6 middle ear ossicles (3 in each ear).
iii. There is also a hyoid bone in neck.
iv. Vertebral column contains 33 bones (vertebrae).
v. The chest is made of a chest bone called sternum and 24 (12 pairs) ribs.

Q.29 How many bones are there in appendicular skeleton?

i. Appendicular skeleton is composed of 126 bones.
ii. Pectoral (shoulder) girdle is made of 4 bones.
iii. Arms have six (06) bones.
iv. Both hands have 54 bones.
v. Pelvic girdle (hips) has 2 bones.
vi. Legs have 06 bones.
vii. Both feet have 54 bones.

Q.30 Describe upper and lower jaw in mammals and vertebrates?

Ans. The upper jaw is fixed with skull and is composed of two bones. The lower jaw is mobile and articulates with the skull. In lower vertebrates, the lower jaw is made up of more than one bone while in mammals it is made of single bone.

Q.31 How mammals improve hearing?

Ans. During evolution, mammals modified the lower jaw bones and incorporated four of them into the middle ear (in the form of malleus and incus in both ears). This adaptation proved beneficial for mammals. Lower jaw with single bone is stronger and the malleus and incus also improve hearing.

Q.32 What is a joint?

Ans. A joint is the location at which two or more bones make contact. They allow movement and provide mechanical support.

Q.33 At which basis, joints can be classified?

Ans. Joints can be classified on the basis of degree of movement they allow.

Q.34 What do you know about immoveable or fixed joints? (Board 2013)

Ans. Such joints allow no movements e.g. the joint between the skull bones.

Q.35 What do you know about slightly moveable joints?

Ans. Such joints allow slight movements e.g. joints between the vertebrae.

Q.36 What do you know about moveable joints? (Board 2013)

Ans. They allow a variety of movements e.g. shoulder joint, hip joint, elbow joint, knee joint etc.

Q.37 What are the main types of moveable joints?

Ans. The main types of moveable joints are:

(i) Hinge joints

(ii) Ball-and-socket joints

Q.38 Define Hinge joints and give one example. (Board 2014)

Ans. Hinge joints move back and forth like the hinge on a door and allow movements in one plane only.

Example

The knee and elbow are hinge joints.

Q.39 What are ball-and-socket joints?

Ans. Ball and socket joints allow movement in all directions.

Example:

Hip and Shoulder joints.

Q.40 What would have happened if neck joint were a ball-and-socket joint?

Ans. Then we can move freely our neck in all directions.

Q.41 What is the role of tendons and Ligaments tissues?

Ans. Role of Tendons

Tendons are tough bands and attach muscles to bones. When a muscle contracts, tendon exerts a pulling force on the attached bone, which moves as a result.

Role of Ligaments

Ligaments are strong but flexible bands and join one bone to another at joints. They prevent dislocation of bones at joints.

Q.42 Differentiate between origin and insertion of a skeletal muscle. (Board 2014)

Ans. Origin

One end of a skeletal muscle is always attached with some immoveable bone. This end of muscle is called as origin.

Insertion

The other end of muscle which is attached with a moveable bone is called as insertion.

Q.43 What do you know about "Antagonists"?

Ans. Skeletal muscles are usually in pairs of antagonists. In an antagonistic pair, both muscles do opposite jobs.

Q.44 What is meant by antagonism? (Board 2013)

Ans. When one muscle contracts, the other relaxes and this phenomenon is known as antagonism.

Q.45 What is meant by "Flexor" muscle and Flexion?

Ans. When a muscle contracts and bends a joint, it is known as flexor muscle and the movement is called as flexion. Biceps is an example of flexor muscle.

Q.46 What is meant by extensor muscle and extension?

Ans. When a muscle contracts and straightens the joint, it is known as extensor muscle and the movement is called extension.

Example

Triceps is an example of the extensor muscle.

Q.47 Which point of attachment is pulled when a muscle contracts?

Ans. When muscle contracts, it pulls the moveable bone (at insertion).

Q.48 Describe briefly about osteoporosis? (Board 2013)

Ans. Osteoporosis is a disorder of skeletal system. It is a bone disease in adults, especially in old people. It is more common in old women. In osteoporosis, there is a decrease in the density of bones due to loss of calcium and phosphorus.

Q.49 What is a function of estrogen?

Ans. The function of estrogen is to deposit minerals in bones. When the reproductive cycle stops in females, not enough estrogen is secreted.

Q.50 Describe Arthritis. Write the names of its types.

Ans. Arthritis means "inflammation in joints". It is also very common in old age and in women.

Symptoms

Pain and stiffness in joints particularly in the weight bearing joints e.g. hip and ankle joints.

Treatment

Pain killer and anti-inflammatory medicines are supposed to decrease the symptoms.

Types

i. Osteo-arthritis ii. Rheumatoid arthritis iii. Gout

Q. 51 Differentiate between cartilage and bone? (Board, 2013)

Ans. Cartilage is a dense clear, blue-white, firm connective tissues. It is found covering important body parts. e.g., nose, epiglottis, trachea etc. Bones are the hard connective tissue providing movement, support and protection to various body parts.

Q. 52 What is the role of skeleton in support and movement?

Ans. Skeleton provides protection to internal organs e.g. skull protects brain and support to body mass and can move the body by muscles.

Q.53 What are biceps and triceps?

Ans: Biceps is a flexor muscle on the front of the upper arm bone while Triceps is an extensor muscle on the back of arm.

Q.54 What is chondrocyte?

Ans: The cells of cartilage are called chondrocyte.

Q.55 What are cranial bones?

Ans: The bones which enclose the brain are called cranial bones. They are eight in number.

Q.56 What is Gout?

Ans: It is characterized by the accumulation of uric acid crystals in moveable joints. It generally attacks the toe joints.

Q.57 Define Lacuna?

Ans Cells of cartilage (chondrocytes) lies in a fluid space called lacuna.

Q.58 Define Osteocytes.

Ans. The mature bone cells are called osteocytes.

Q.59 Write down two disorders along with one reason of each of human skeletal. (Board 2014)

Ans. The disorders of human skeletal system are:

1. Osteoporosis:

It is a bone disease. In it, there is a decrease in the density of bones due to loss of calcium and phosphorus.

2. Osteoarthritis:

It is due to degeneration in the cartilage present at joints or due to decreased lubricant production at joints.

Unit 14

Reproduction

Long Answer Questions

Q.1 Define reproduction. Write its importance?

Ans: Reproduction

It is defined as the production of individuals of the same species i.e. the next generation of species.

Importance

(a) Continuation of species

Reproduction is essential for the continuation of species.

(b) Transmission of genetic material

It ensures that the genetic material of one generation is transmitted to the next. Each generation produces more offsprings for the next generation. Only the fittest and the best survive and reach the reproductive age.

This ensures that the advantageous characteristics are transmitted to the next generation.

Q2. Define asexual reproduction. Describe the different methods of asexual reproduction.

Ans. Definition

Asexual reproduction is simple cell division that produces an exact duplicate of an organism. It does not involve the fusion of gametes.

Types of Asexual Reproduction

There are many types of asexual reproduction, they produce individuals that are genetically identical to each other and to the parent.

(1) Binary fission

(a) Introduction

Binary fission means "division into two", it is the simplest and most common method of asexual reproduction.

(b) Occurrence

Binary fission occurs in prokaryotes (Bacteria), many unicellular eukaryotes e.g. protozoa and some invertebrates.

(c) Examples

(i) Binary Fission in Bacteria

(i) During binary fission in bacteria, the DNA is duplicated and so two copies of DNA are formed.

(ii) The two copies move towards the opposite poles of the cell.

(iii) The cell membrane invaginates in centre and divides the cytoplasm into two.

(iv) New cell wall is deposited between the two cross walls. It results in the formation of two daughter bacteria, which grow in size and divides again.

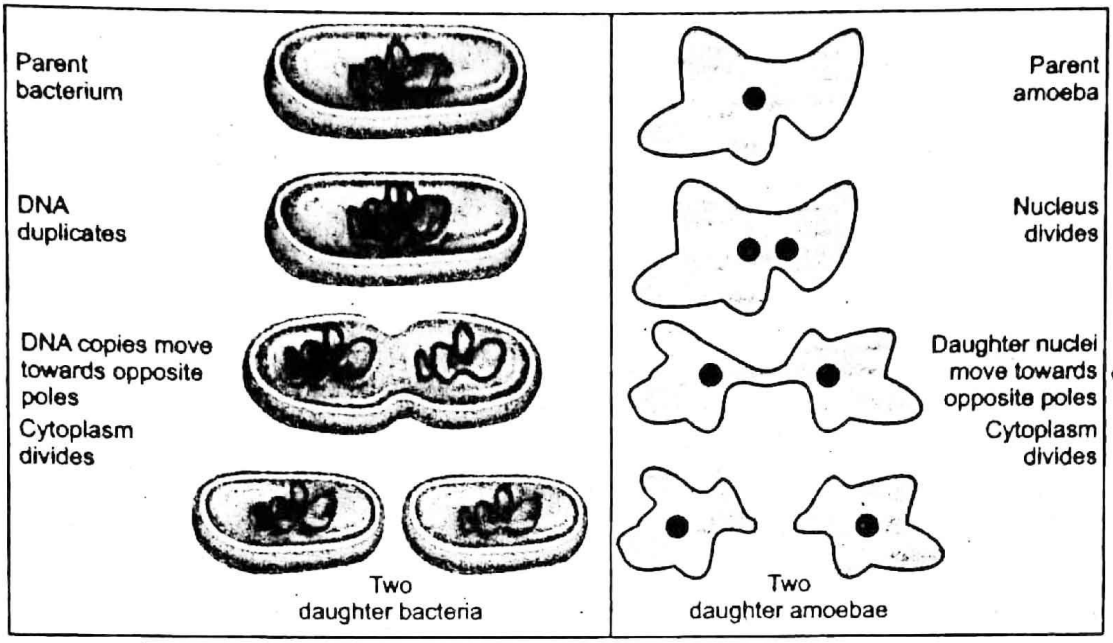


Figure 14.1: Binary fission in a bacterium (Left) and in an amoeba (right)

(ii) Binary fission in unicellular Eukaryotes (*Amoeba*)

It occurs in the following way:

(i) The nucleus of parent organism divides into two by mitosis.

(ii) It is followed by the division of cytoplasm.

(iii) So two daughter cells of almost equal size are formed.

(iv) Daughter cells grow in size and then divide again.

(iii) Binary fission in invertebrates

During this asexual reproduction, body is cut into two halves and the missing body parts are regenerated in both halves. e.g., planaria and many echinoderms.

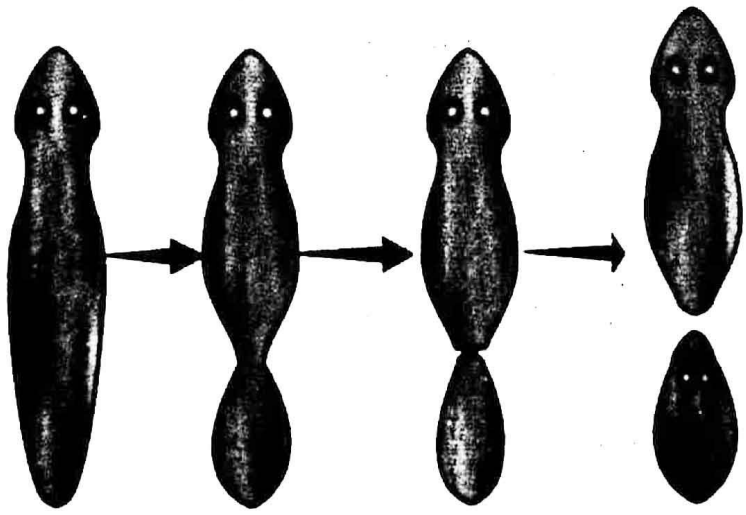


Figure 14.2: Binary Fission in a Planarian

(2) Fragmentation

Introduction

In fragmentation, certain worms grow to full size, they spontaneously break up into 8 or 9 pieces. Each piece develops into a mature worm and the process is repeated.

Example

If a planarian breaks into many pieces instead of two, it will also be called as fragmentation.

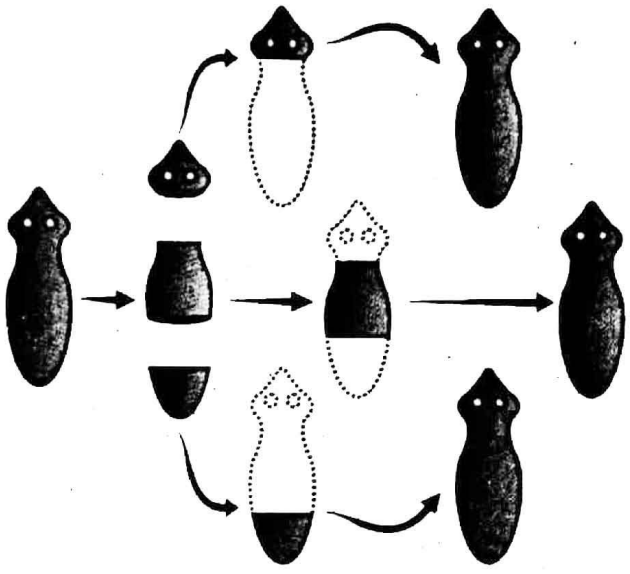


Figure 14.3: Fragmentation in a Planarian

(3) Budding / Explain budding with example. **(Board 2014)**

(a) Definition

In budding, a bud develops as a small outgrowth on parent's body.

(a) Budding in yeast

(i) In yeast, a small bud is formed on one side of the cell.

(ii) The nucleus of the cell divides and one of the daughter nuclei is passed into the bud.

(iii) Parent cell may form more than one bud at a time.

(iv) Each bud enlarges and may separate from parent body.

(v) In some cases, the buds never separate and as a result, colonies of individuals are formed.

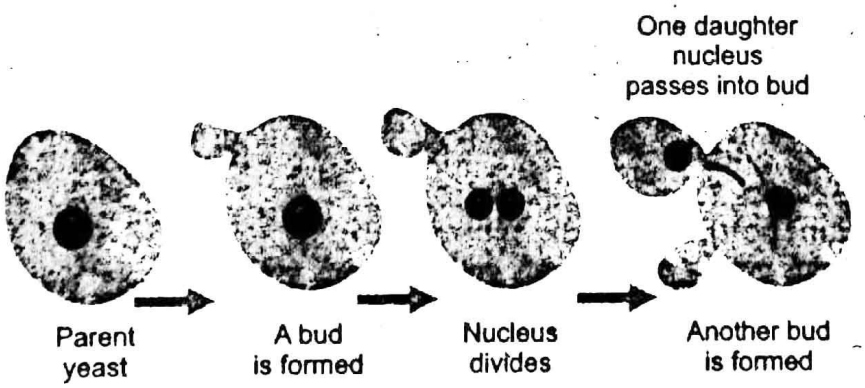


Figure 14.4: Budding in Yeast

(b) Budding in sponges, hydra and corals

(i) A small bud is formed on the side of bodies of these organisms, by mitosis.

(ii) This bud enlarges by the formation of more cells.

(iii) It then detaches from the parent body and grows into new organisms in hydra. But in corals, the buds do not detach and form big colonies.

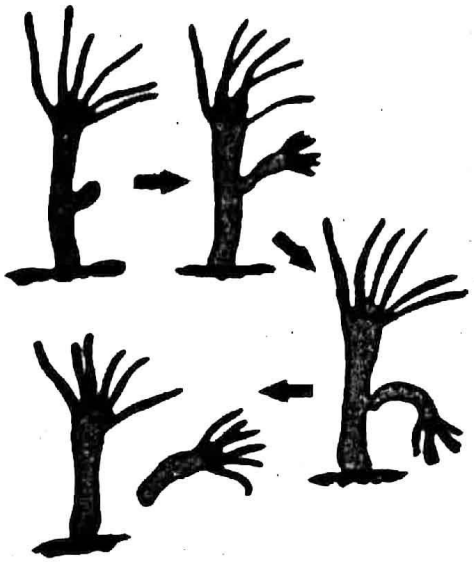


Figure 14.5: Budding in hydra

4- Spore formation

(a) Introduction

It is generally seen in most fungi.

(b) Examples

(i) Spore formation in *Rhizopus*

When *Rhizopus* reaches the reproductive age, its body cells form thick walled spore sacs called sporangia (sing: sporangium). Inside each sporangium, a cell divides many times and forms many daughter cells, called spores. Each spore is covered by a thick wall called cyst and it survive unfavourable conditions. When sporangia mature, they burst and release spores. Under favourable conditions, the spores germinate and develop into new *Rhizopus*.

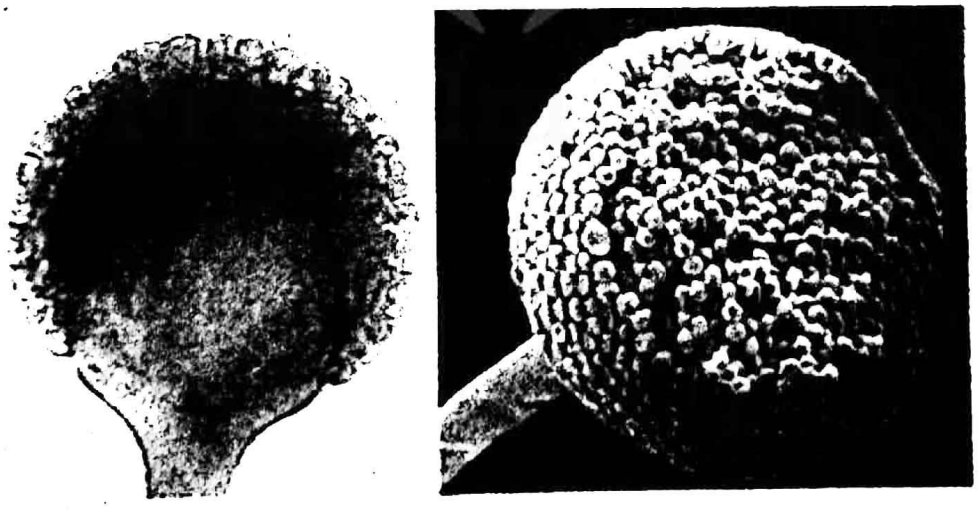


Figure 14.6: Spore Formation in Rhizopus,
mature sporangium (Left), Sporangium bursts (Right)

(ii) Endospore Formation in bacteria

Under unfavourable conditions, some species of bacteria reproduce by forming spores, e.g., *Clostridium* and *Bacillus* species. Thick walled spores are formed inside bacterial cells. They are called endospores.

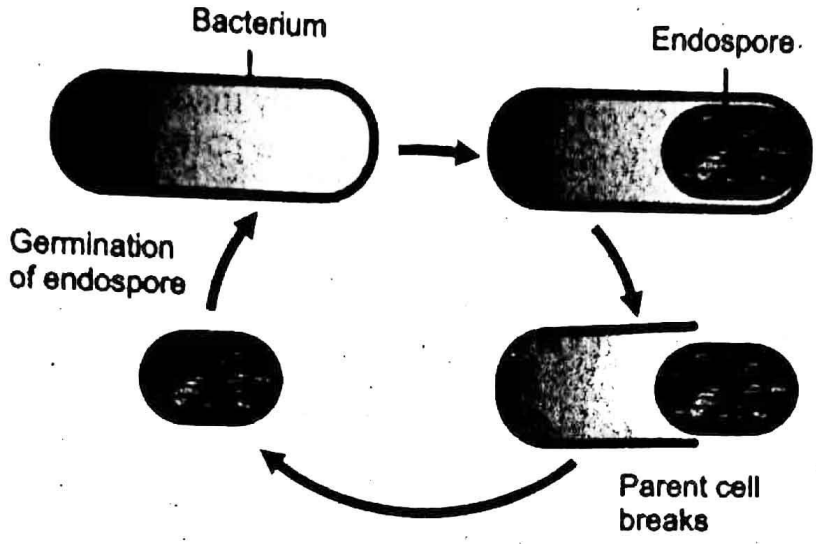


Figure 14.7: Spore Formation in a Bacterium

5- Parthenogenesis

Definition

It is also a form of asexual reproduction. In it, an unfertilized egg develops into new offspring.

Examples

(i) Some fishes, frogs and insects reproduce by means of parthenogenesis.

(ii) Parthenogenesis in Honeybee

Queen honeybee lays eggs in the cells of honeycomb. Many eggs remain unfertilized and develop into haploid males (drones) by parthenogenesis and eggs that are fertilized by male bees develop into diploid females.

6- Vegetative Propagation

Definition

The process in which vegetative parts of plants i.e. roots, stems or leaves give rise to new plant is called vegetative propagation.

Occurrence

It occurs naturally and artificially.

(1) Natural Vegetative Propagation

It occurs naturally in several ways.

(i) Bulbs

Definition

Bulbs are short underground stems surrounded by thick, fleshy leaves that contain stored food.

Explanation

Adventitious roots arise from the base of bulb while shoots arise from the top of the base.

Examples: Tulips, onions and lilies reproduce by bulbs

(ii) Corms

Introduction

Corms are short and swollen underground stems containing stored food.

Explanation

Buds are present at the top of corm. Shoot grows from a bud and forms a new plant.

Examples

Dasheen and garlic

(iii) Rhizomes

Introduction

These are horizontal underground stems with scale leaves.

Explanation

Enlarged portions on rhizome are called nodes. Buds are produced at nodes which give rise to shoot. The lower surface of rhizome produces adventitious roots.

Examples

Ginger, ferns and water lilies reproduce by rhizomes.

(iv) Stem Tubers

Definition

These are the enlarged portions of an underground stem (rhizome).

Explanation

There are aggregations of tiny buds in the form of "eyes" along the surface of tuber. Each bud develops into shoot that grows upward and also produces roots.

Examples

Potatoes and Yams

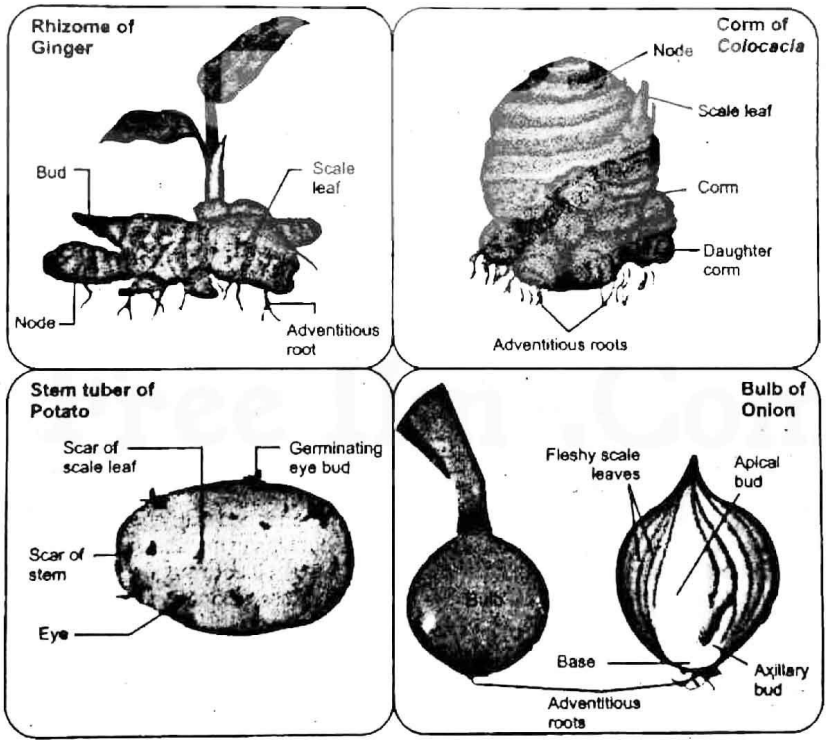


Figure 14.8: Some Types of Natural Vegetative Propagation

(v) Suckers

Definition

Suckers are lateral stems close to ground level.

Explanation

A sucker grows underground from some distance and then turn up, producing the new plant.

Example

Mint and *chrysanthemum*

(vi) By Leaves

Introduction

Vegetative propagation by leaves is not common and is seen in plants such as *Bryophyllum* (*Pather Chut*).

Explanation

This plants has fleshy leaves and adventitious buds are present at the margins of leaves. When leaf falls on ground, the buds grow into new plants.

Figure 14.9: A Bryophyllum leaf with Buds

2- Artificial Vegetative Propagation

The following two are the most common methods of artificial vegetative propagation:-

(i) Cuttings

Introduction

In this method, cuttings may be taken mainly from the stems or roots of parent plant. These cuttings must have a meristematic region from which growth can occur. When cuttings are placed in a suitable soil (sufficient nutrients, water and sunlight), they form roots and shoots which develop into a new plant identical to parent.

Examples

Stem Cuttings

Roses, ivy, grapevines, and sugarcane

Root Cuttings

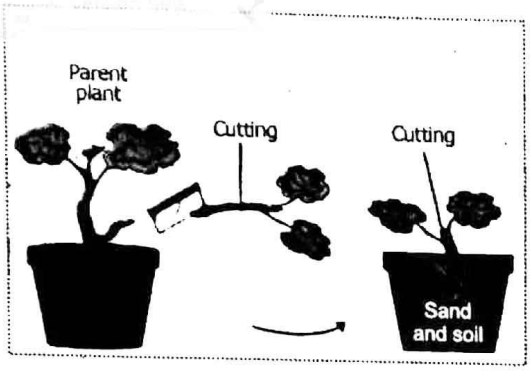
Sweet potato is an enlarged root. Farmers place it in moist sand or soil until it produces several plantlets. Then the plantlets are removed and planted. This process is used to produce many plants from a single plant and all plants are same. This method has been very beneficial on sugarcane plantation.

(ii) Grafting

Introduction

In grafting, a piece of stem is cut from the plant and is attached with another plant with established root system. After a while, the vascular bundles of the attached stem piece and the host plant are connected to each other. The stem piece and the plant begin to grow together.

Examples: Roses, peach trees, plum trees and grapes.



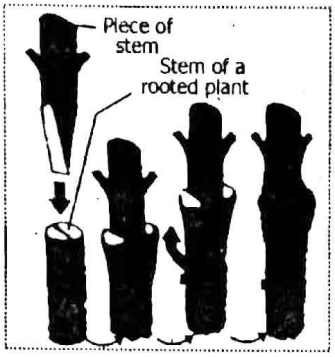


Figure 14.10: Product of Artificial Vegetative Propagation: Cutting (left) and Grafting (right)

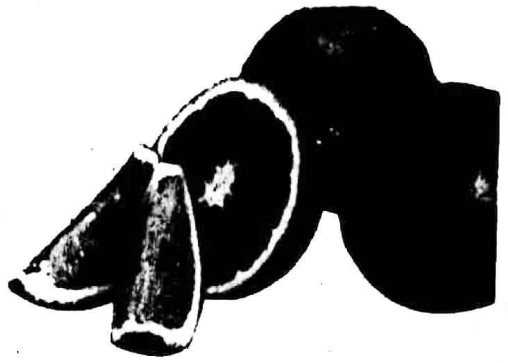


Figure 14.11: Product of Artificial vegetative propagation: Seedless oranges

Q.3 What are advantages and disadvantages of vegetative propagation of plants. (Board 2014)

Ans: Advantages

(i) The offsprings produced are genetically identical. Therefore beneficial characteristics can be preserved.

(ii) No need of any mechanism of pollination.

(iii) It helps to increase number of plants at a rapid rate.

(iv) The organs of this method enable many plants to pass over unfavourable conditions.

(v) Seedless fruits can be grown only by vegetative propagation.

Disadvantages

(i) The plants do not have genetic variations.

(ii) Species specific diseases can attack and this can result in the destruction of an entire crop.

Q.4 Describe Tissue culture and Cloning. (Board 2014)

Ans: (1) Cloning

Cloning is the latest method of vegetative propagation.

Explanation

Identical offsprings are produced from a single parent using its vegetative tissue or cell.

Micro-Propagation

This method of propagation is also called micro-propagation since it uses only a small part of plant.

(2) Tissue Culture

Introduction

It is the technique applied in cloning.

Explanation

(i) Tissues are taken from any part of plant and are put in a suitable nutrient medium.

(ii) The tissue cells start mitosis and produce masses of cells called calluses which are transferred to other medium containing different hormones.

(iii) Calluses grow into new small plants which are then planted in pots and then in fields.

Q5. Explain the sexual reproduction in plants.

Ans.

1. Sexual Reproduction

Sexual reproduction involves the production of gametes and their fusion i.e., fertilization.

2. **Production of Gametes**

Gametes are produced in special structures in plant body.

3. **Sexually Reproducing Plants**

i. Non-Seed Producing plants (Mosses and ferns)

ii. Seed Producing Plants

a. Gymnosperms

b. Angiosperms (flowering plants)

4. **Use of Different Methods for Fertilization**

Plant groups use different methods for bringing the sperm and egg cells together.

a. In Mosses and Ferns

Sperms are motile and can swim to egg cells. Therefore, these plants require water (in the form of dew or rain) for sexual reproduction.

b. Gymnosperms and anagiosperms

These plants have special methods for carrying their sperms to egg cells. They do not need water for reproduction.

5. **Alternation of generation** **(Board 2013)**

In the life cycle of flowering plants, two different generations alternate with each other. One generation is diploid and produces spores called sporophyte. The other generation is haploid and produces gametes called gametophyte generation. This phenomenon in which two generations alternate with each other during life cycle is called alternation of generation.

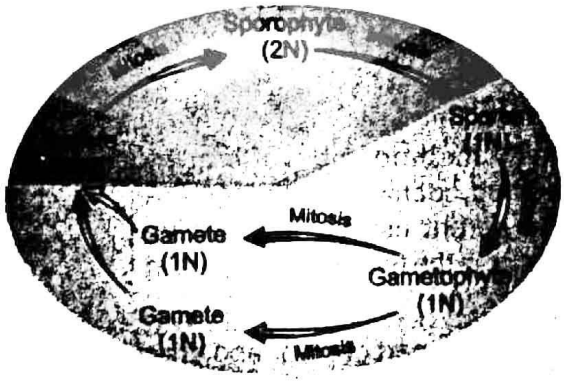


Figure 14.12: An overview of Alternation of generation

6. **Sporophyte Generation**

i. Dominant

In most plants, sporophyte generation is dominant. It means that it is big in size and is independent.

ii. Production of Spores

Sporopyte produces haploid spores by meiosis and spores develop into gametophyte.

7. **Gametophyte Generation**

i. Small in size:

It is small in size and depends upon sporophyte.

ii. Production of gametes

It produces gametes by mitosis. The male and female gametes fuse and form diploid Zygote. The zygote undergoes repeated mitosis and develop into a new diploid sporphyte.

8. Structure of flower (Board 2013)

Flower is the reproductive structure. The flower components are arranged in the form of whorls. The outer two whorls in a flower are the non-reproductive whorls while the inner two whorls are the reproductive whorls.

(i) Calyx

It is the outermost whorl and usually green in colour. Its individual units are called sepals.

(ii) Corolla

It is the second whorl and is often coloured brightly. Its individual units are called petals. It attracts the insects which are the agents of pollination.

(iii) Androecium

It is the male reproductive part and its units are called stamens. Each stamen has a thread like filament at the end of which anther is attached. Another has pollen sacs in which haploid microspores (pollen grains) are produced during meiosis. Microspore makes the male gametophyte generation. The nucleus of microspore undergoes mitosis and produces two nuclei i.e. tube nucleus and generative nucleus. The generative nucleus produces two sperms by mitosis. So a germinated microspore has a tube nucleus and two sperms. This is the male gametophyte.

(iv) Gynoecium

It is the female reproductive part of flower. Its units are called carpels. Each carpel is made up of basal ovary, middle style and upper stigma. Inside ovary, there is one to many ovules. Each ovule has one haploid macrospore (produced by meiosis). Macrospore undergoes mitosis and produces an egg cell and some associated structures. This is the female gametophyte.

9. Pollination

When pollen grains mature, they are transferred to stigma and it is called pollination. On reaching the stigma, the tube nucleus of pollen grain makes a pollen tube. The pollen tube contains a tube nucleus and two sperms.

Entry of Sperms in Female gametophyte

The tube grows through style and ovary and enters ovule. Here, it bursts and releases the sperms. Both sperms enter the female gametophyte.

10. Double Fertilization

One sperm fuses with egg and forms a diploid zygote, the other sperm fuses with diploid fusion nucleus and forms a triploid (3N) nucleus called endosperm nucleus. Since the process of fertilization involves two fusions, it is called double fertilization.

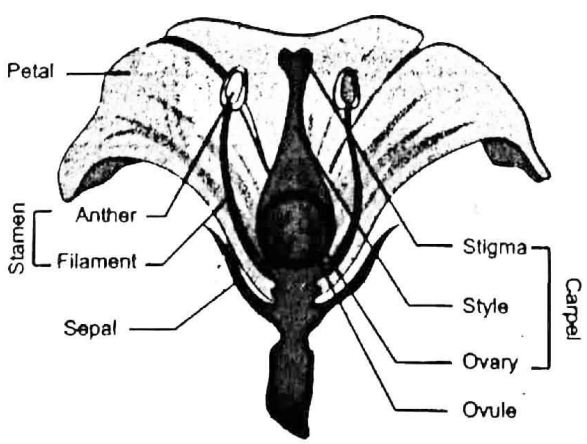


Figure 14.13: Structure of a Flower

11. Formation of embryo and Endosperm

Zygote develops into embryo and endosperm nucleus.

12. Formation of seed and Fruit

Ovule then becomes seed and ovary changes into fruit.

13. Formation of a new plant

When seeds mature, they are dispersed. If seeds get suitable conditions, their embryos develop into new plants.

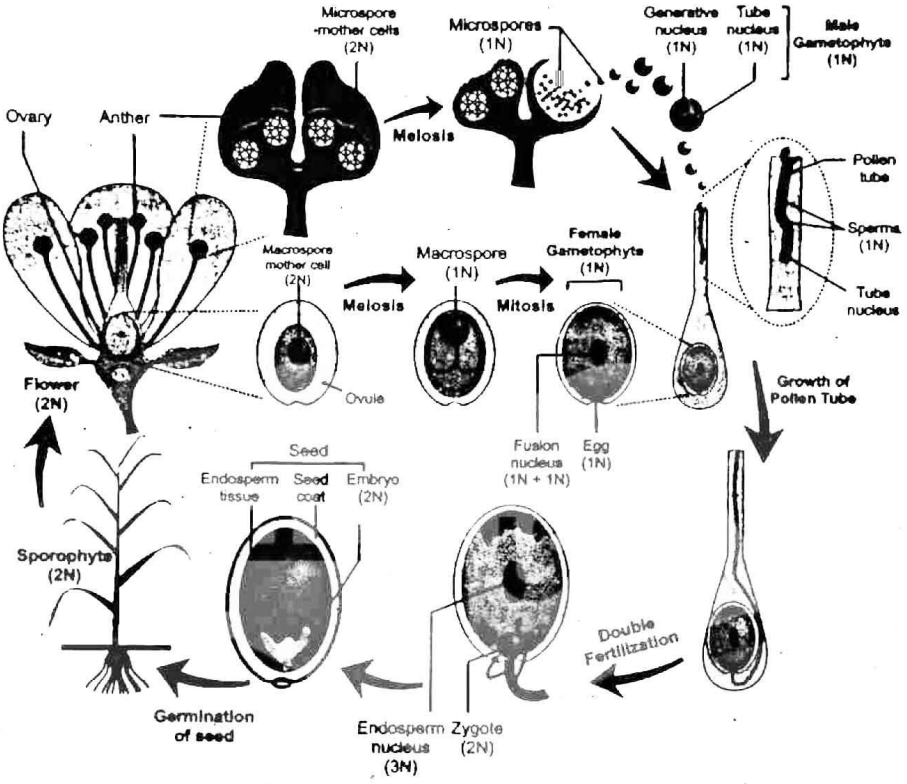


Figure 14.14: Life Cycle of a Flowering Plant

Q6. What is pollination? Write its types.

Ans. Pollination

The transfer of the pollen grains from flower anther to stigma is called pollination.

Types of Pollination

There are two types of pollination:

(i) Self pollination

The transfer of pollen grains from the anther to the stigma of same flower or other flower of same plant is called self pollination.

(ii) Cross pollination

The transfer of pollen grains from the flower on one plant to the flower on other plant of same species. It is brought about by various agencies like wind, water, birds etc. and man.

Figure 14.15: Self Pollination (Left) and Cross Pollination (Right)

Q.7 Describe the structural adaptations of insect pollinated and wind pollinated flowers.

Ans: The insect pollinated and wind pollinated flowers have structural adaptations that facilitate the transfer of pollen grains between two plants. Some of these adaptations are described below:

Table 14.1: Adaptations in insect-pollinated and wind-pollinated flowers

Feature	Insect Pollinated Flowers	Wind pollinated Flowers
Size	Generally large	Generally small
Colour	Petals brightly coloured	Petals green or dull in colour
Nectar	Produce nectar	Do not produce nectar
Floral arrangement	Flowers face upwards	Flowers hang down for easy shaking
Stamens and stigmas	Enclosed inside ring of petals	Hang out of ring of petals
Pollen grains	Small number produced/ heavy and sticky	Large number produced/light with smooth surface
Stigma	Pinhead shaped with no branches	Feathery branches for catching pollen
Examples:	Buttercup, rose, wallflower, sunflower, orchid etc.	grasses, hazel, willow, corn etc.

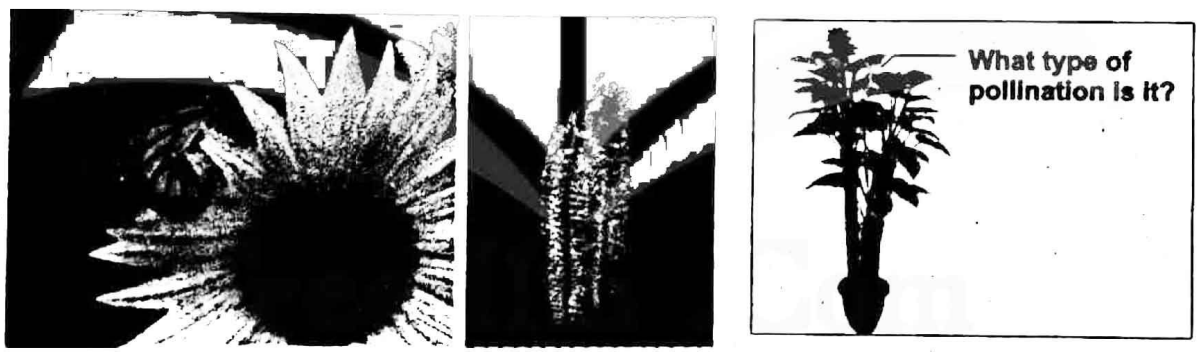


Figure 14.16: Insect-pollinated flower (left) and a wind-pollinated (right) flowers)

Q8. Explain the development and structure of seed.

Ans. Introduction

After fertilization in female gametophyte, zygote divides repeatedly by mitosis and develops into an embryo. At this stage, ovule changes into seed and this completes process of sexual reproduction in plants.

Structure of seed

It consists of three parts

1. Embryo formed from zygote.
2. Endosperm tissue formed from endosperm nucleus.
3. Seed coat developed from the wall of ovule.

Seed coat

It develops from the wall of ovule. It may be a thin or thick layer. Seed coat protects embryo from mechanical injury and from drying out.

Hilum

There is a scar on the seed coat called hilum. It is where the seed is attached to the ovary wall.

Micropyle

At one end of hilum, is micropyle. Seed uses this micropyle for absorption of water.

Development of seed

Emboryo is an immature plant. It consists of a radicle, a plumule and two cotyledons. The radicle of the embryo develops into new root while plumule develops into new shoot. The embryonic stem above the point of attachment of cotyledons is called epicotyl and embryonic stem below the point of attachment of cotyledon called hypocotyl. In angiosperms, the stored food is derived from the endosperm tissue.

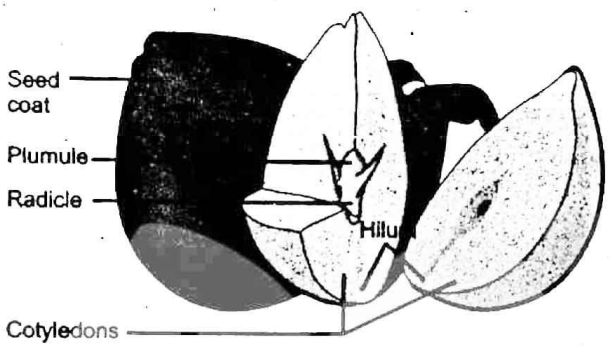


Figure 14.17: The Structure of seed

Q9. Explain the germination of seed.

Ans. Definition

Seed germination is a process by which a seed embryo develops into a seedling.

Process of germination

During germination, the embryo soaks up water which causes it to swell, splitting the seed coat. Root is the first structure that emerges from the radicle present in seed. It grows rapidly and absorbs water and nutrients from soil. In the next phase, plumule develops into tiny shoot which elongates and comes out of soil.

Types of germination

On the basis of elongation of hypoctyl and epicotyl, there are two types of germination:

(i) Epigeal germination

In epigeal germination, the hypocotyl elongates and forms a hook pulling the cotyledons above the ground. Examples are beans, cotton and papaya.

(ii) Hypogeal germination

In this germination, the epicotyl elongates and forms the hook. In this type, the cotyledons stay underground. Examples are pea, maize and coconut.

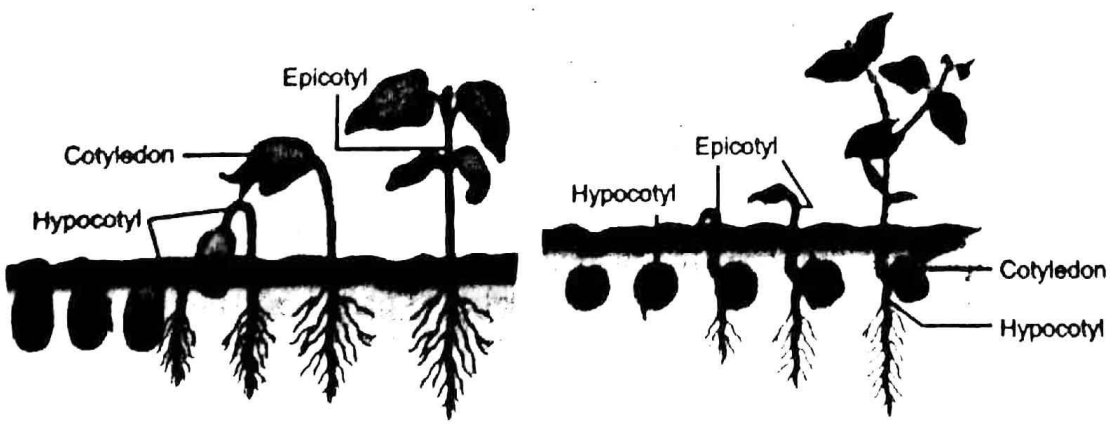


Figure 14.18 Types of Seed Germination. Epigeal (Left) and hypogeal (Right)

Q10. Describe the conditions for seed germination.

Ans. External conditions

The most important external conditions include water, oxygen and favourable temperature.

Water (moisture)

Seeds of most plants have low water content, and germination cannot occur until seed coat or other tissues have imbibed water. The absorbed water is used in the digestion of stored food and helps in elongation of hypocotyl and epicotyl.

Oxygen

Oxygen is essential for the respiration in the cells of embryo.

Temperature

Seeds differ greatly in their temperature, required for germination. The optimum temperature for the germination of the seeds of most plants ranges from 25-30^{0}C.

Internal Conditions

The internal conditions include a live embryo and sufficient food storage.

Q11. What is gametogenesis? Explain the spermatogenesis and oogenesis in detail.

Ans. Definition

The formation of gametes is called gametogenesis.

Explanation

During gametogenesis, diploid (2N) gamete mother cells undergo meiosis and form haploid (1N) gametes. The male and female gametes are formed in specialized organs called gonads.

Male Gonads

Male gonads are called testes and the production of sperms in testes is called spermatogenesis.

Female Gonads

Female gonads are called ovaries and the production of egg cells in ovaries is called oogenesis.

Spermatogenesis

Some cells in the walls of the seminiferous tubules of testes divide repeatedly by mitosis to form large number of diploid spermatogonia. Some spermatogonia produce primary spermatocytes. Each primary spermatocyte undergoes meiosis–I and produces two haploid daughter cells called secondary spermatocytes. By meiosis-II, they produce four haploid spermatids. Their nuclei shrink and some structures are formed e.g. a corner called acrosome, a tail and a mitochondrial ring. After these changes, the spermatids are called sperms.

Oogenesis

Some cells of ovary prepare structures called follicles in which many diploid oogonia are present. Some oogonia produce diploid primary oocytes. One of the primary oocyte produces two haploid cells by meiosis. The smaller cell is called first polar body and the large one is called secondary oocytes. The secondary oocyte completes meiosis II and produces two haploid cells i.e. a second polar body and an egg cell.

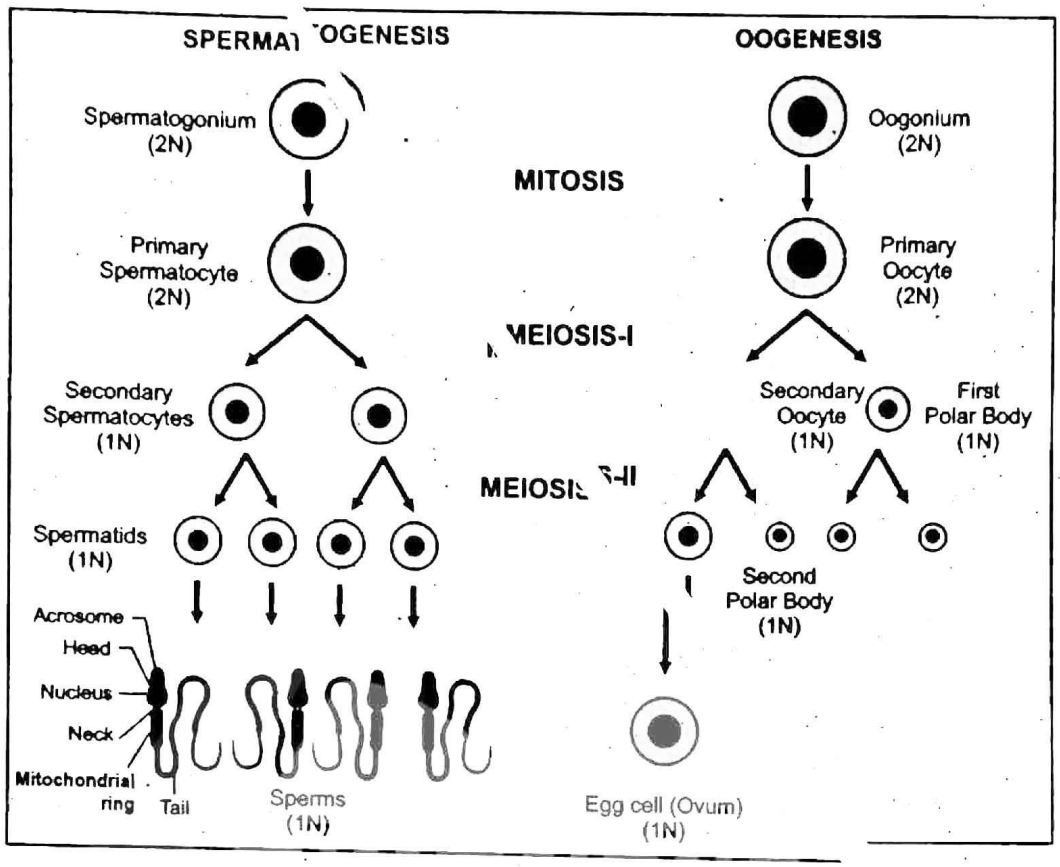


Figure 14.19 Gametogenesis in Animals

Q.12 Define fertilization and explain its types.

Ans. Fertilization

After the formation of gametes, fertilization occurs. There are two mechanisms by which fertilization can take place:

(1) External fertilization

Introduction

In external fertilization, egg cells are fertilized outside the body.

Explanation

It occurs in aquatic environment and both the male and female animals release their gametes in to their surroundings at almost the same time. In external fertilization, there is risk of loss of gametes due to environmental hazards such as predators.

Examples

It occurs in many invertebrates and the first two groups of vertebrates i.e. fishes and amphibians.

Figure 14.20: External Fertilization in Fish

Internal fertilization

Introduction

Egg cells are fertilized within the reproductive tract of female.

Explanation

Such animals provide protection to the developing embryo. After fertilization, reptiles and birds make protective shells around their egg cells and then lay these eggs. Extra protection is provided to embryo and mother supplies all that embryo needs. In mammals, the development of fertilized egg into new body takes place within the mother's body.

Examples

Examples are reptiles, birds and mammals.

Figure 14.21: Reptiles and bird's egg provided protection and Food to Embryo

Q.13 Explain reproduction in Rabbit.

Ans. Rabbits are small mammals found in several parts of the world.

Male reproductive system

The male reproductive system of rabbit consists of:

i) A pair of testes

ii) Associated ducts

iii) Glands

Testes produce sperms, ducts transport these sperms to external genitalia and glands add secretions to sperms.

(1) Testes

They are located in a bag of skin called scrotum. Each testis consists of coiled tubes called seminiferous tubules. Sperms are formed in these tubules.

(2) Associated ducts

Epididimys: When sperms are mature, they accumulate in the collecting ducts of testes and then pass to epididimys.

Vas Deferens

From epididimys, sperms move to a sperm duct called vas deferens.

Both sperm ducts join urethra just below urinary bladder and it transports both sperm and urine.

Semen

Semen is the material containing 10% sperms and 90% fluid.

(3) Glands

As sperm pass down the ducts from testes to urethra, associated glands add various secretions.

i) **Prostate Gland:** It produces a secretion to neutralize the acidity of fluid.

ii) **Cowper's Gland:** It produces secretions that lubricate the ducts.

iii) **Seminal Vesicles:** They produce secretions that provide nutrients for sperms.

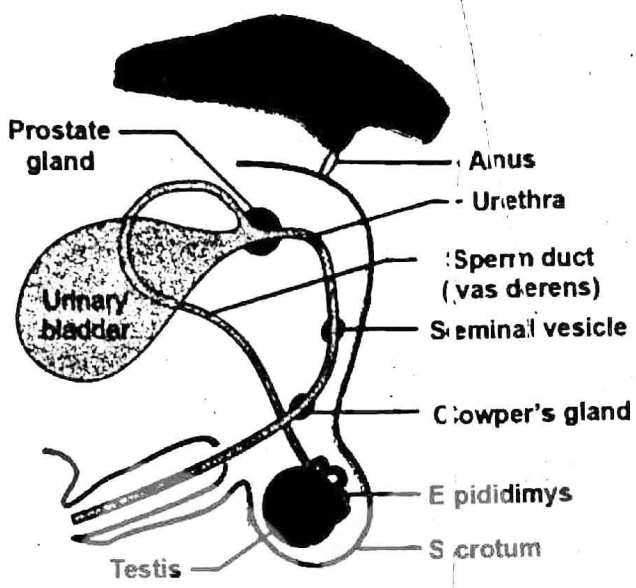


Figure 14.22: Male Reproductive System of Rabbit

Female reproductive system **(Board 2014)**

It consists of:

(i) Ovaries

(ii) Associated ducts.

(i) Ovaries

a. Definition

Ovaries are small oval organs situated in the abdominal cavity just ventral to kidneys.

b. Egg Cells

The outer region of ovary produces egg cells.

c. Follicles

The specialized cells called follicles surrounds and nourishes each egg cell.

(ii) Associated ducts

a. Fallopian tube

From ovaries, egg cells are released into fallopian tubes

b. Uterus

Fertilization occurs in fallopian tubes and the fertilized egg is carried to uterus.

c. Uterus horns

The uterus is divided into two parts or horns.

d. Birth canal

The horns join and open into vagina or birth canal.

e. Cervix

Cervix is the portion of uterus where sperms of male are deposited.

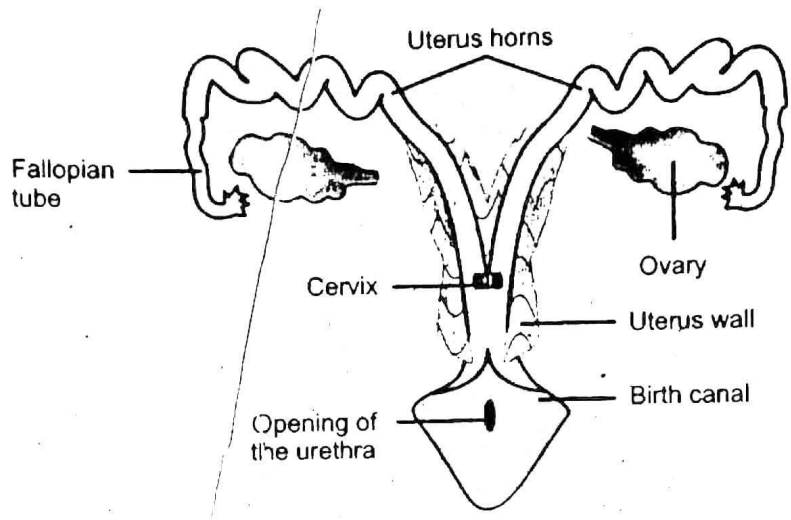


Figure 14.23: Female Reproductive System of Rabbit

Fertilization and development

Rabbit can breed throughout the year but male rabbits are commonly sterile during the summer months. Male rabbit deposits its sperms into female vagina. Sperms swim through cervix and uterus to fallopian tubes where they fertilize the egg cells.

Embryo

Zygote is carried to uterus where zygote started dividing and is now called embryo. Embryo is implanted in uterus walls.

Placenta

A connection called placenta is established between embryo and uterus wall.

Development of new Offspring

Embryo develops into a new offspring in 30-32 days after which it is born.

Q.14 Describe Growth in Human population and its consequence.

Ans: Pakistan's Population

Pakistan's population in the year 2007-08 was 163,775,000. By the end of this decade, our population is expected to exceed 176 million.

High growth rate in past

Pakistan's population had relatively high growth rate in past. When population exceeds the carrying capacity of an area, it results in overpopulation.

Problems with human overpopulation

(i) Shortage of Fresh Water
(ii) Deforestation and loss of ecosystem.
(iii) More population and global warming
(iv) High infant and child mortality rate due to poverty.
(v) Shortage of housing units, hospitals, jobs, educational institutions and food.

Preventive measures to control population

(i) People should be educated about the problems of overpopulation.
(ii) Pakistan's Ministry of Population Welfare has taken a number of steps to make people aware of the hazards of overpopulation and to stabilize the population to match our resources.

Logo of an organization working for awareness of overpopulation

The United Nations Population Fund
UNFPA began operations in 1969. It is the largest international organization funding for population and health programmes. The UNFPA works in over 140 countries, for awareness about the consequences of overpopulation.

Q15. Explain the social implications of AIDS and other Sexually Transmitted Diseases. (STD's).

Ans. AIDS

AIDS is a sexually transmitted disease and transmitted through sexual act. AIDS stands for Acquired Immuno Deficiency Syndrome. It is caused by Human Immuno Deficiency Virus (HIV). The virus destroys white blood cells which results in the loss of resistance against infections. It is a fatal disease.

Spreading

It spreads through transfer of body fluid such as blood and semen.

Cause: Main causes are:

i) Unprotected sexual activities.
ii) Use of infected needles.
iii) Transfusion of infected needles.

Role of National AID control programme (NACP) and Non-Government organizations (NGOs)

Pakistan Federal Ministry of health established NACP in 1987. The main objective of this programme is to help the public for the prevention of HIV transmission. The frequency of HIV infection in Pakistan is low but still at risk.

For improvement, NACP started services through TV and radio channels and print media in 2005. The objective are:

- Change public attitude for safe sexual activities
- Create demand for information on HIV and AIDS
- Improve attitudes and behaviour among health care workers.

Multiple Choice Questions

1. **Growing an entire new plant from part of the original plant is called;**
   (a) Budding
   (b) Regeneration
   (c) Fragmentation
   (d) Vegetative propagation
2. ***Rhizopus* reproduces asexually by;**
   (a) Binary fission
   (b) Budding
   (c) Spore formation
   (d) Endospore formation
3. **A corm develops into new garlic plant. This is the process of;**
   (a) Vegetative propagation
   (b) Regeneration
   (c) Meiosis
   (d) Gametogenesis
4. **Which is not an advantage of grafting?**
   (a) The graft is identical to the parent plant
   (b) Grafting allows the propagation of seedless fruits
   (c) The graft combines the characteristics of two plants
   (d) Grafting may allow for the faster production of desirable fruits
5. **Pollination is the transfer of pollens from;**
   (a) Anther to stigma
   (b) Stigma to anther
   (c) Sepal to petal
   (d) Petal to sepal
6. **Double fertilization in plants means;**
   (a) Fusion of two sperms with two egg cells
   (b) Fusion of one sperm with egg cell and other sperm with fusion nucleus
   (c) Fusion of two sperms with single egg cell
   (d) Fusion of tube nucleus with fusion nucleus and sperm egg cell
7. **After fertilization in plants, the fruit develops from;**
   (a) Ovule wall
   (b) Ovary wall
   (c) Petals
   (d) Anther
8. **Which part of female reproductive system receives egg cells from the ovary?**
   (a) Fallopian tube
   (b) Uterus
   (c) Vagina
   (d) Collecting duct
9. **Inside testes, sperms are produced in;**
   (a) Vas deferens
   (b) Sperm duct
   (c) Seminiferous tubules
   (d) Collecting duct
10. **Which of these cell has haploid number of chromosomes?**
    (a) Spermatogonium
    (b) Primary spermatocyte
    (c) Secondary spermatocyte
    (d) All of these
11. **During binary fission, the nucleus of parent organism divides into two by;**
    (a) Sexual reproduction
    (b) Meiosis
    (c) Mitosis
    (d) None of these
12. **If a planarian breaks into many pieces instead of two, it will be called;**
    (a) Budding
    (b) Spore formation
    (c) Binary fission
    (d) Fragmantaion

13. In fungi, the spore is covered by a thick wall called;
(a) Sporangium
(b) Sporophyte
(c) Cyst
(d) Endospores

14. The eggs of the honeybee remain unfertilized and develops into haploid males by;
(a) Budding
(b) Parthenocarpy
(c) Regeneration
(d) Parthenogenesis

15. In tissue culture technique, cell starts mitosis and produce masses of cells called;
(a) Clonning
(b) Graftings
(c) Calluses
(d) Rhizome

16. During binary fission, how many cells are formed?
(a) Two daughter cells
(b) Four cells
(c) Many cells
(d) All of these

17. In _____, the buds do not detach from the parent body.
(a) Hydra (b) *Amoeba*
(c) Bacteria (d) Corals

18. Spores which are formed inside bacterial cells are called;
(a) Cysts (b) Spores
(c) Endospores (d) All of these

19. Which of followings reproduces by bulbs?
(a) Garlic (b) Ginger
(c) Ferns (d) Tulips

20. Which method of propagation is also called micro-propagation?
(a) Cuttings (b) Tissue culture
(c) Grafting (d) Suckers

21. Flowers of wind pollination produce;
(a) Petals
(b) Nectar
(c) No nectar
(d) Do not reproduce

22. Buttercup is an example of;
(a) Wind pollinated flower
(b) Insect pollinated flower
(c) Water pollinated flower
(d) None of these

23. Which of these germinate by epigeal germination?
(a) Pea (b) Maize
(c) Beans (d) Coconut

24. The optimum temperature for the germination of the seeds of most plants ranges from;
(a) 20 – 30° C (b) 25 – 35°C
(c) 25 – 30°C (d) 20 – 25°C

25. Many diploid oogonia are present in;
(a) Follicles (b) Sperms
(c) Spermatids (d) Scrotum

26. In which group of mammals, the fertilized egg does not develop inside the mother's body?
(a) Chordates
(b) Egg laying mammals
(c) Placental mammals
(d) All of these

27. Where the sperms of rabbit are produced?
(a) Cowper's glands
(b) Prostate gland
(c) Collecting ducts
(d) Seminiferous tubules

28. Where the sperms of male rabbit are deposited in the female rabbit?
(a) Horns (b) Cervix
(c) Follicle (d) Ovaries

29. Horizontal underground stems are called:
(a) Corms (b) Rhizomes
(c) Tubers (d) Bulbs

30. **Which part of flower is changed into fruit?** (Board 2013)
(a) Ovule (b) Ovary
(c) Petals (d) Anther

31. **An example of Rhizome is:** (Board 2013)
(a) Onion (b) Garlic
(c) Ginger (d) potato

32. **Method of asexual reproduction found in *Amoeba* is:** (Board 2013)
(a) Binary Fission (b) Fragmentation
(c) Budding (d) Spore formation

33. **Double fertilization is a feature of:**
(a) Seedless plants
(b) Gymnosperms
(c) Flowering plants
(d) Ferns

34. **Simplest and common method of asexual reproduction is:**
(a) Tissue culture (b) Parthenogenesis
(c) Cloning (d) Binary fission

35. **Gametophyte is produced from:**
(a) Gametes (b) Zygote
(c) Spores (d) Sporophyte

36. **Roses, ivy, grapevines and sugarcane reproduce by:**
(a) Leaves
(b) Suckers
(c) Cuttings
(d) Suckers and Cuttings

37. **In which of the following, hypogeal germination takes place;**
(a) Beans (b) Maize
(c) Cotton (d) Papaya

38. **When was NACP established?**
(a) 1947 (b) 1997
(c) 1987 (d) 2000

39. **Into which part, ovule changes after fertilization?**
(a) Fruit (b) Seed
(c) Flower (d) Leaf

40. **In Honeybee the drones are:**
(a) Female flies
(b) Male flies
(c) Workers
(d) Male and female flies

41. **When Pakistan Federal Ministry of Health established NACP?**
(a) 1947 (b) 1977
(c) 1987 (d) 2010

42. **In rabbit, embryo develops into a new offspring in:**
(a) 40 – 42 days (b) 30 – 40 days
(c) 30 – 32 days (d) 280 days

43. **By the end of 2010, our population was;**
(a) 176 million (b) 400 million
(c) 180 million (d) 500 million

44. **In male rabbit, each testis consists of a mass of coiled tubes called the:**
(a) Epididimys
(b) Cowper's gland
(c) Seminiferous tubules
(d) Vas deferens

45. **When secondary oocyte completes Meiosis II, how many haploid cells result:**
(a) 2 (b) 3
(c) 4 (d) 5

46. **Which of the following are internal conditions for germination of seed:**
(a) Oxygen
(b) Live embryo
(c) Sufficient food storage
(d) Live embryo and sufficient food storage

47. **The endosperm nucleus is:**
(a) Haploid (b) Diploid
(c) Triploid (d) Tetraploid

48. **Which of the following reproduces by grafting?**
(a) Ivy
(b) Pather Chut
(c) Plum Trees
(d) Both Ivy and Pather Chut

49. **The second whorl of the flower is:**
(a) Calyx (b) Corolla
(c) Androecium (d) Gynoecium

50. **In which of the following, an unfertilized egg develops into new offspring?**
(a) Vegetative propagation
(b) Spore formation
(c) Parthenogenesis
(d) Budding

51. **Binary fission does not take place in:**
(a) Echinoderms (b) Bacteria
(c) Planaria (d) Hydra

52. **Which of the following also reproduces through fragmentation?**
(a) Planaria (b) Hydra
(c) Bacterium (d) Yeast

53 **Which generation is haploid?**
(a) Sporophyte
(b) Endospore
(c) Gametophyte
(d) Sporophyte and Endospore

54. **Female reproductive part of flower is:**
(a) Androecium (b) Calyx
(c) Corolla (d) Gynoecium

55. **Ferns reproduce by:**
(a) Corms (b) Rhizome
(c) Tubers (d) Bulb

56. **In most plants, Sporophyte is:**
(a) Small in size
(b) Dominant
(c) Independent
(d) Dominant and independent

57. **Spermatids are:**
(a) Motile (b) Active
(c) Non-motile (d) Sperms

58. **Which forms egg cell?**
(a) Follicles
(b) Primary oocytes
(c) First polar body
(d) Secondary oocyte

59. **Placenta is a structure which belongs to:**
(a) birds (b) mammals
(c) reptiles (d) amphibians

60. **UNFPA works in how many countries?**
(a) 150 (b) 160
(c) 140 (d) 100

61. **Ovary change into after ripen:** **(Board 2014)**
(a) Into seed (b) Into fruit
(c) Into flower (d) Into nectar

62. **Sperms and fluid collectively called:** **(Board 2014)**
(a) Hormones (b) Semen
(c) Follicle (d) Scrotum

63. **In which of the following animal groups, external fertilization takes place;**
(a) Reptiles (b) Amphibians
(c) Birds (d) Mammals

64. **Pollen grains are produced in anther of flower by:**
(a) Meiosis
(b) Mitosis
(c) Binary fission
(d) Multiple fission

65. ***Rhizopus* reproduces by:** **(Board 2013)**
(a) Binary Fission
(b) Budding
(c) Spore formation
(d) Parthenogenesis

Answer Key

1	d	**2**	c	**3**	a	**4**	c	**5**	a	**6**	b
7	b	**8**	a	**9**	c	**10**	c	**11**	c	**12**	d
13	c	**14**	d	**15**	c	**16**	a	**17**	d	**18**	c
19	d	**20**	b	**21**	c	**22**	b	**23**	c	**24**	c
25	a	**26**	b	**27**	d	**28**	b	**29**	c	**30**	b
31	c	**32**	a	**33**	c	**34**	d	**35**	c	**36**	c
37	b	**38**	c	**39**	b	**40**	b	**41**	c	**42**	c
43	a	**44**	c	**45**	a	**46**	d	**47**	c	**48**	c
49	b	**50**	c	**51**	d	**52**	a	**53**	c	**54**	d
55	b	**56**	d	**57**	c	**58**	d	**59**	b	**60**	c
61	b	**62**	b	63	b	**64**	a	65	c		

Short Answer Questions

Q1. Define reproduction.

Ans. Reproduction is defined as the production of individuals of the same species i.e. the next generation of species.

Q2. What are types of reproduction?

Ans. (i) Asexual reproduction

It means the simple cell division that produces an exact duplicate of an organism.

(ii) Sexual reproduction

It involves the joining of male and female sex cells i.e gametes.

Q3. Define binary fission.

Ans. Binary fission means division into two. It is the simplest and most common method of asexual reproduction. It occurs in prokaryotes, many unicellular eukaryotes e.g. protozoa and some invertebrates.

Q4. What is Fragmentation?

Ans. The type of asexual reproduction in which the organisms break up into pieces. For example, planarian breaks into 8-9 pieces instead of two.

Q5. Define Budding.

Ans. It is the type of asexual reproduction in which a bud develops as a small outgrowth on parents body. For example, in yeast, a small bud is formed on one side of body of cell. The nucleus of cell divides and one of the nucleus is passed on to bud and form new cell.

Q6. Differentiate between spore and endospore. **(Board 2013)**

Ans. Spore

In most of fungi like *rhizopus*, when they reaches at reproduction age, its body cells form thick walled sacs called sporangia. Inside each sporangia, a cell divides many times and forms many daughter cells called spore.

Endospore

Under unfavourable conditions, some species of bacteria reproduce by forming spores e.g., *Clostridium* and *Bacillus* species. Thick walled spores are formed inside bacterial cell. This is called endospores.

Q7. Define Parthenogenesis.

Ans. Type of asexual reproduction in which an unfertilized egg develops into new offspring. For example, some fishes, frogs and insects reproduce by means of parthenogenesis.

Q8. What is Vegetative propagation?

Ans. When vegetative parts of plants i.e. the roots, stems or leaves give rise to new plants, the process is called vegetative propagation.

Q9. What is Cuttings?

Ans. In this method, cuttings may be taken mainly from stems or roots of parent plant. When cuttings are placed in a suitable soil and under light conditions, they may form roots and shoots. These roots and shoots grow and develop into a new plant. Examples are roses, ivy and grapevines.

Q10. Define Grafting.

Ans. In this method, a piece of stem is cut from the plant and is attached with another plant. After a while, the vascular system of attached stem and the host plant are connected. The stem piece and the plant begin to grow together. Examples are Roses, peach trees and various seedless fruits.

Q11. What is Alternation of Generation in plants. **(Board 2014)**

Ans. In the life cycle of flowering plants, the two generations alternate with each other. The phenomenon in which the sporophyte generation gives rise to gametophyte and gametophyte generation gives rise to sporoplyte is called alternation of generation.

Q12. Define Double fertilization. **(Board 2013)**

Ans. The type of fertilization in which one sperm fuses with egg and forms a zygote. The other sperm fuses with the diploid fusion nucleus and forms a triploid endosperm nucleus. This process is called double fertilization.

Q13. What is Pollination?

Ans. The transfer of pollen grains from flower's anther to stigma.

Types

a) Self pollination

The transfer of pollen grains from the anther to the stigma of the same flower or the other flower of same plant.

b) Cross pollination

The transfer of pollen grains from the flower on one plant to the flower on other plant of same species.

Q14. What is seed coat?

Ans. It is the outer protective covering of a seed. It may be paper thin layer or thick and hard. Seed coat protects embryo from mechanical injury and from drying.

Q15. Define Hilum.

Ans. Hilum is a scar on seed coat, where the seed is attached to ovary wall.

Q16. Give the Difference between epicotyl and hypocotyl.

Ans. The embryonic stem above the point of attachment to cotyledon is called epicotyl and the embryonic stem below the point of attachment to cotyledon is called hypocotyl.

Q17. Differentiate between epigeal and hypogeal germination. **(Board 2013)**

Ans. In epigeal germination, the hypocotyl elongates and forms a hook, pulling the cotyledons above the ground, e.g. beans and cotton while in hypogeal germination, the epicotyl elongates and forms the hook, the cotyledons stay underground e.g. pea and maize.

Q18. Define Germination.

Ans. It is a process by which a seed embryo develops into a seedling.

Q19. What is Fertilization?

Ans. After the formation of gametes, fertilization occurs. These are of two types:

(a) External fertilization

In external fertilization, egg cells are fertilized outside the body. It requires both the male and the female animals to release their gametes into their surroundings at the same time. It occurs in most of the invertebrates, fishes and amphibians.

(b) Internal fertilization

In internal fertilization, egg cells are fertilized within the reproductive tract of female. It occurs in reptiles, birds and mammals.

Q.20 Define Semen.

Ans. It is the materials containing sperms in a fluid. It consists of 10% sperms and 90% fluid.

Q.21 Define acrosome.

Ans. Cap-like head of sperm cell which helps it in penetrating the egg cell is called acrosome.

Q.22 What do you know about cervix?

Ans: In female reproductive system, the part which separates uterus from vagina is called cervix.

Q.23 What is Cowper's gland? Where sperms of male are deposited.

Ans: An accessory gland in rabbit's male reproductive system which provides lubrication to the ducts. Cervix is the portion of uterus where sperms of male are deposited.

Q.24 Define Epididimys.

Ans: A storage area for sperms on the upper part of the testes is called epididimys.

Q.25 Define Fallopian tube.

Ans: A part of the female reproductive system, receives egg cell discharged from the ovary.

Q.26 What is Follicle?

Ans: A structure in the ovary in which the mature egg develops.

Q.27 What is parthenocarpy?

Ans: The process in which ovaries develop into fruit without the fertilization inside the ovules present in them, it results in seedless fruits e.g. bananas.

Q.28 What is prostate glands?

Ans: An accessory gland in the male reproductive system, produces a secretion that neutralizes the acidity.

Q.29 What is seminal vesicle?

Ans: The associated gland in male reproductive system produces secretions having nutrients for the sperms.

Q.30 Define seminiferous tubule.

Ans: These are coiled tubes present in testes and sperms are formed in these tubules.

Q.31 Define uterus horn.

Ans: The two separate parts of the uterus in the female rabbit are like horns so they are called uterus horns.

Q.32 What is vas deferens?

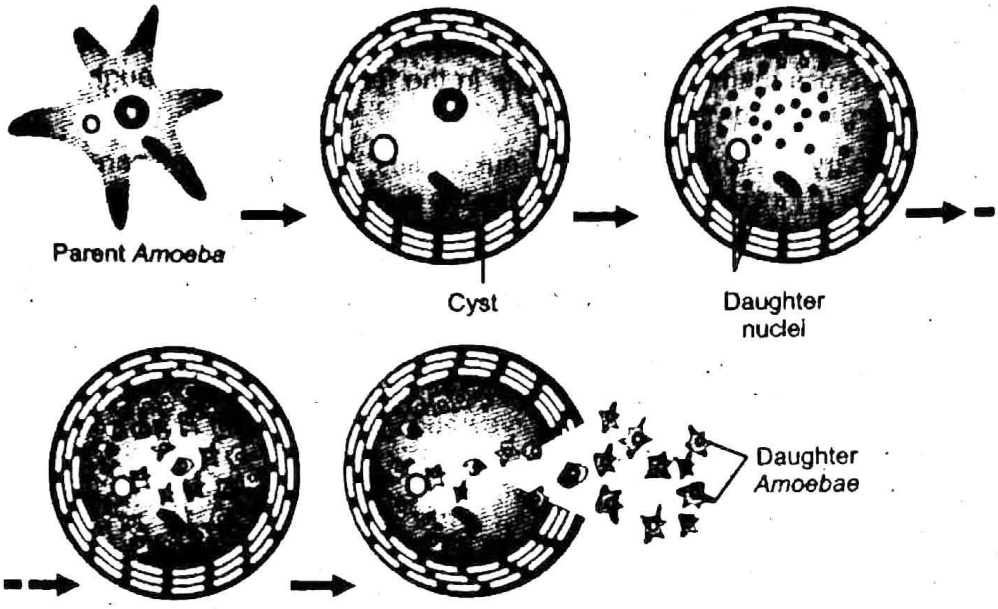
Ans: The tubes that carry sperms from each testis to the urethra.

Q.33 How multiple fission in *Amoeba* takes place?

Ans: Some unicellular organisms (e.g. *Amoeba*) form hard walls called cysts around them under unfavourable conditions.

When favourable conditions return, the nucleus of parent divides into many daughter nuclei and the division of cytoplasm occurs.

Each cytoplasm along with nucleus form daughter cell, so a large number of daughter cells are formed from a single parent. This is how multiple fission takes place in *Amoeba*.



Q.34 What is difference between spermatogenesis and oogenesis? **(Board 2013)**

Ans: The process of formation of sperms in testes is called spermatogenesis while the process of formation of eggs in ovaries is called oogenesis.

Unit 15

Inheritance

Long Answer Questions

Q.1 Define the following terms:
Genetics, inheritance, traits and genes

Ans.

Genetics

It is a branch of biology in which we study inheritance.

OR

The branch of biology which describes that how traits and characteristics are transferred from parents to offspring is called genetics.

Inheritance

It means the transmission of characteristics from parents to offspring.

Traits

Characteristics which are transmitted from parents to offspring are called traits. e.g., in man height, colour of the eyes, intelligence etc.

Genes

The chromosomes carry the biological units of inheritance called the genes.

Q.2 What are chromosomes and genes. Describe the structure of chromosomes.

Ans. Genes

Genes consist of DNA. They contain specific instructions for protein synthesis.

Or

Units of inheritance, located on chromosomes are called genes.

Chromosomes

(a) Introduction

Hereditary material found in the nucleus of every cell is called chromosomes.

(b) Constant number

Body cells have a constant number of paired chromosomes.

(c) Homologous chromosomes

The two chromosomes of a pair are known as homologous chromosomes. In human body cells, there are 23 pairs for a total of 46 chromosomes.

(d) Chemical composition

They are made of chromatin material (chromatin). Chromatin is a complex material, made of DNA and proteins (histone).

(e) Nucleosomes

DNA wraps around histone proteins and forms round structures, called nucleosomes. DNA is also present between nucleosomes.

Beads on a string

The nucleosomes and the DNA between them look like beads on a string.

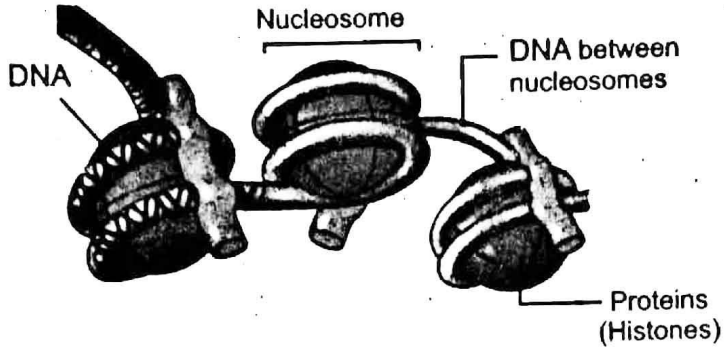


Figure 15.1: Chemical composition of chromosome

Chromosomes

The fibers consisting of nucleosomes condenses into compact forms and get the structure of chromosomes.

Q.3 Describe structure of DNA.

Ans. James Watson and Francis Crick

In 1953, James Watson and Francis Crick proposed structure for DNA.

Double Helix

According to Watson-Crick model, a DNA molecule consists of two polynucleotide strands which are coiled around each other in the form of double helix.

Sugar-phosphate Backbone

There is phosphate-sugar backbone on the outside of double helix.

Nitrogenous Bases

Nitrogenous Bases are present on the inside of double helix.

Base Pairing

In double helix, the nitrogenous bases of opposite nucleotides form pairs through hydrogen bonds.

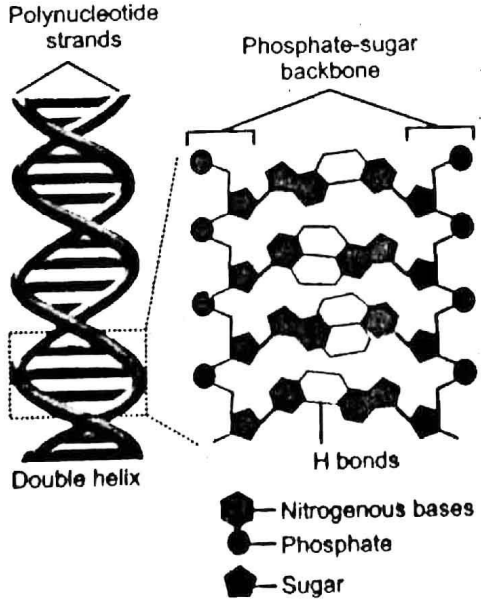


Figure 15.2: The Watson and Crick model of DNA

Specificity in Base pairing

Pairing is very specific. The nitrogenous base Adenine of one nucleotide forms pair with Thymine of opposing nucleotide while Cytosine forms pair with Guanine.

Hydrogen Bonding

There are two hydrogen bonds between Adenine and Thymine while there are three hydrogen bonds between Cytocine and Guanine.

Q.4 Describe DNA Replication.

Ans. Definition

It is a process in which one parental DNA is divided into two genetically identical daughter DNA molecules. DNA replication takes place before cell division.

Purpose

It is done to make the copies of chromatids of chromosomes.

Unwinding of DNA strands

First step in DNA replication is unwinding of DNA. As a result, two strands are separated, much like two sides of zipper.

Template strands

Each strand of parental DNA acts as a template.

Complimentary strands

New strands are called as complimentary strands.

Base pairing

Nitrogenous bases of nucleotides in template strands make pair with nitrogenous bases of nucleotides in complimentary strands.

New (Daughter) DNA Double helix

One template and one complimentary strands together form a new DNA double helix, genetically identical to parents.

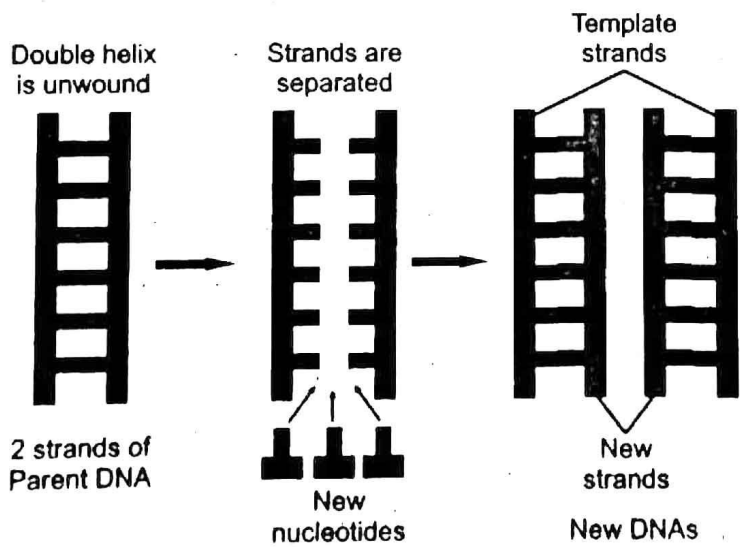


Figure 15.3: How does DNA replicate?

Q.5 How does DNA of chromosome work? **(Board 2014)**

Ans: DNA

DNA is the genetic material. It performs its role by giving instructions for synthesis of specific proteins. Cell is actually controlled by its DNA. It is the DNA which makes characteristics or traits of cell or organism.

Roles of proteins

Proteins may have different roles. Some perform structural roles e.g. Keratin while other acts as enzymes to control all bio-chemical reactions of cells.

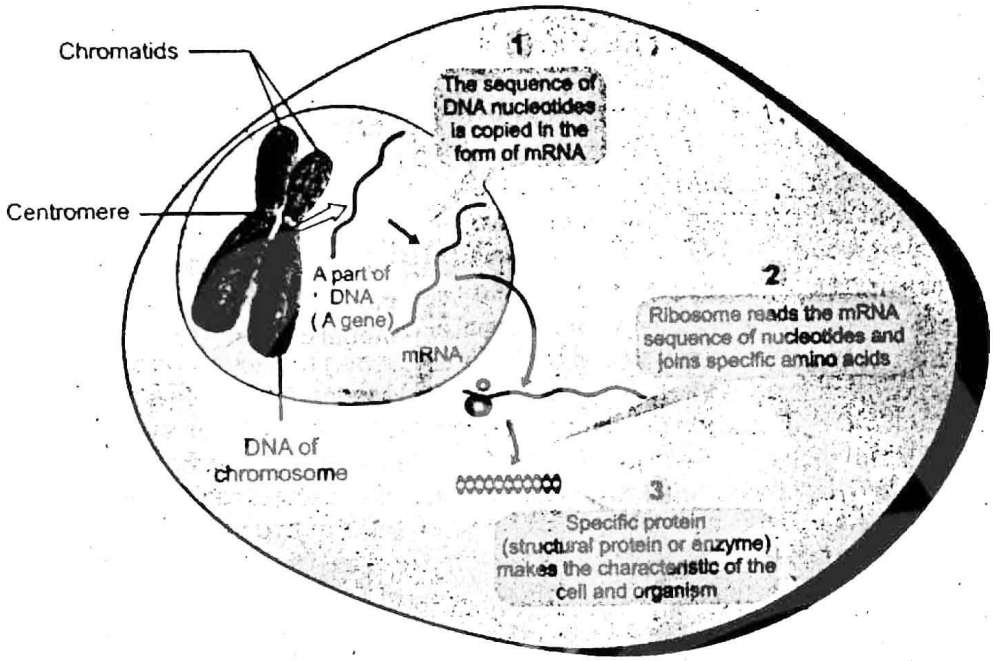


Figure 15.4: Working of DNA (also called the central Dogma)

Traits

Traits are made by specific proteins.

Sequence of Amino acids

Sequence of amino acids is controlled by specific sequence of nucleotides in DNA.

Protein Synthesis

Protein synthesis takes place in two steps:

(i) Transcription **(ii)** Translation

Transcription

It is a process in which specific sequence of DNA nucleotides is copied in the form of messenger RNA (mRNA) nucleotides.

Translation

The mRNA carries sequence of its nucleotides to ribosomes. The ribosome reads this sequence and joins specific amino acids, accordingly to it, to form protein. This is called as translation.

Q.6 Describe role of genes and alleles.

Ans. Gene

The part of DNA (sequence of nucleotides) that contains the instructions for the synthesis of a particular protein is known as a gene.

Gene Loci

DNA of each chromosome contains thousand of genes which are in pairs, one on each homologous chromosome. The locations or positions of genes on chromosomes are known as loci.

Role of Gene

Each gene determines a particular trait in an organism. Each individual carries at least one pair of genes for each trait.

Representation of gene pairs

Pairs of genes are represented by a letter or symbol. Both members of a gene pair may be the same like 'AA' or 'aa' or 'BB' and different in others like 'Aa' or 'Bb'. It means that a gene exists in more than one alternate forms of genes.

Alleles

The alternate forms of a gene are called alleles. If an individual has 'Aa' gene pair, 'A' and 'a" are the alleles of one another. Both alleles are located on the one member separately of the homologous pair.

Separation of Alleles

When chromosomes separate during meiosis, alleles also separate and each gamete gets one of the two alleles. When gametes of both parents unite, the zygote receives one allele from each parent.

Figure 15.5: Location of alleles on chromosomes

Q.7 What is Genotype? Explain its different types. (Board 2013)

Ans: Genotype

The specific combination of genes in an individual is known as the genotype of that individual. It is of two types:-

(i) Homozygous (ii) Heterozygous

(i) Homozygous Genotype

The genotype in which the gene pair contains two identical alleles (AA or aa) is called as homozygous genotype.

(ii) Heterozygous genotype

The genotype in which the gene pair contains two different alleles (Aa) is called as heterozygous genotype.

Explanation with example

Albinism

It is a condition in which normal body pigments are absent. Like other traits, it is also controlled by one pair of genes.

Recessive trait

Albinism is recessive trait i.e., it is produced when both recessive alleles are present in an organism.

Alleles for a trait

Two alleles for a gene pair are represented as 'A' and 'a'. Allele 'A' produces normal body pigments while allele 'a' does not produce pigments.

Three combinations

Three combinations i.e. genotypes are possible for these two alleles.

(i) AA (ii) Aa (ii) aa

Dominant allele

In heterozygous condition one allele masks or prevents the expression of other. It is called as dominant allele and it is represented by capital letter.

Recessive allele

In heterozygous condition, one allele is not expressed, it is called as recessive allele. It is always represented by lower case letters.

Genotype AA or Aa

If genotype is 'AA' or 'Aa', the individual will produce pigments.

Genotype aa

If genotype is 'aa', no pigments will be produced and individual will be albino.

Conclusion

So it is concluded that allele 'A' dominates allele 'a' because in 'Aa' individual pigments are produced and the effect of 'a' is suppressed by 'A'.

Phenotype

The expression of genotype in the form of trait (in albinism, being albino or having normal pigmentation) is known as phenotype.

Q.8 What do you know about Gregor Mendel? Why he selected pea plant for his genetic experiments?

Ans: Gregor Mendel

Gregor Mendel was monk (priest) in Austria. He developed the fundamental principles of genetics.

Special factors

Mendel proposed that there are "special factors" in organisms which control expression of traits and their transmission to next generations. These factors were eventually termed as genes.

Mendel used 28,000 pea plants in his experiments.

Pea Plant (*Pisum sativum*)

Mendel selected pea plant to carry out large number of genetic experiments. He argued that an organism for genetic experiments should have the following features:

1. There should be a number of different traits that can be studied.
2. The organism should have contrasting traits e.g. for the trait of height there should be only two very different phenotypes i.e. tallness and dwarfness.
3. The organism (if it is a plant) should be self-fertilizing but cross fertilization should also be possible.
4. The organism should have short but fast life cycle.

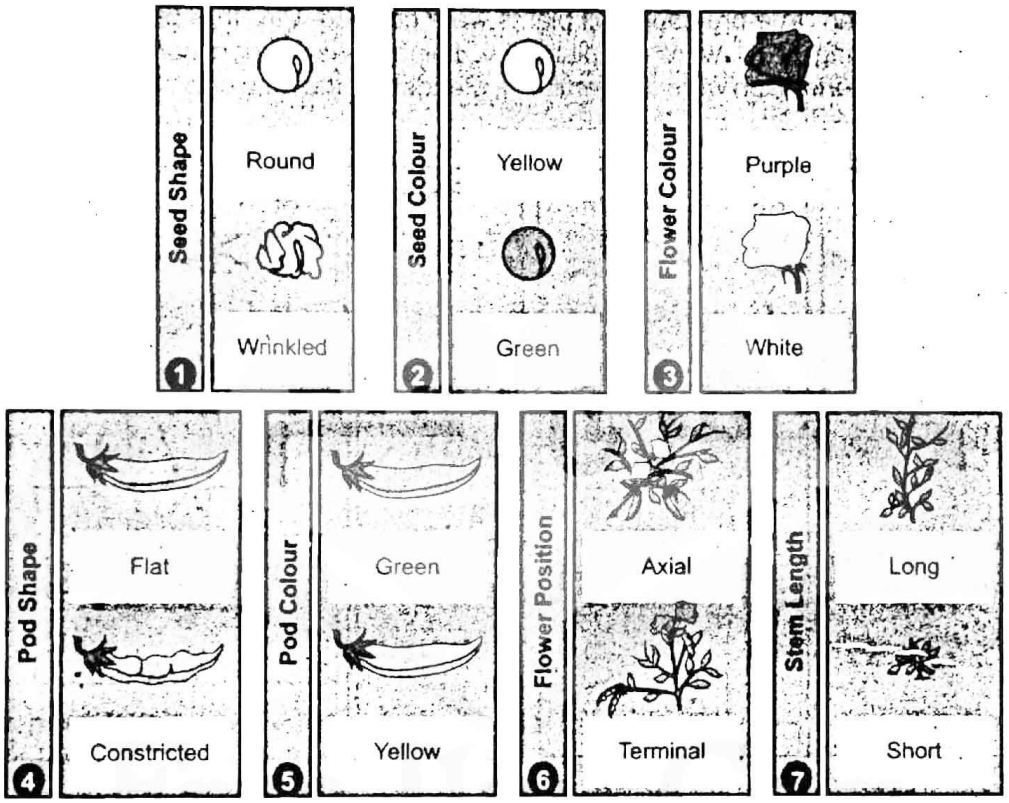


Figure 15.6: Traits in pea plant studied by Mendel

Cross pollination can also be done by transferring the pollen grains from the flower on one plant to the flower on another plant. Each trait studied in pea plant had two distinct forms.

Q.9 Define and Explain Mendel's law of segregation.

Ans: Definition

In each organism, genes are present in pairs. During gamete formation the genes (alleles) of each pair segregate from each other and each gamete receives one gene from the pair. When gametes of male and female parents unite, the resulting offspring again gets the genes in pairs. This is called as Mendel's law of segregation.

Explanation

Seed shape

Mendel studied the inheritance of seed shape first. Seed shape is a trait, like other traits in pea plant, which has two distinct forms:

1. Round seed shape
2. Wrinkled seed shape

Monohybrid cross

A cross in which only one trait is studied at a time is called as monohybrid cross.

P1 Generation

The parental generation is denoted as P1 generation. Mendel crossed true breeding round seeded plant with true breeding wrinkled seeded plant.

F1 Generation

The offspring of P1 generation are called as F1 generation (first filial).

Dominant trait

The trait which appear in F1 generation is called as dominant trait.

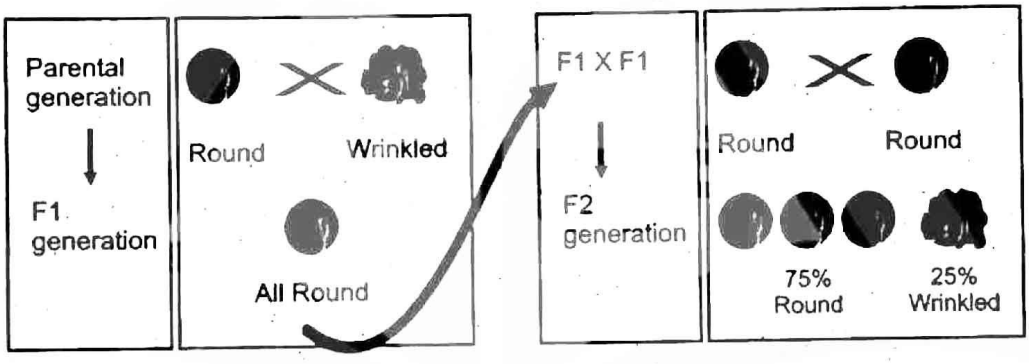
Recessive trait

The trait which does not appear in F1 generation is called as recessive trait.

So Mendel declared the trait round seeds as dominant while wrinkled seeds as recessive trait.

Self-fertilization / F2 Generation

The offspring of P1 generation are called as F1 generation. Later on, Mendel planted F1 seeds and allowed new plants to self-fertilize. As a result, he got 7324 seeds out of which 5474 round and 1850 wrinkled.



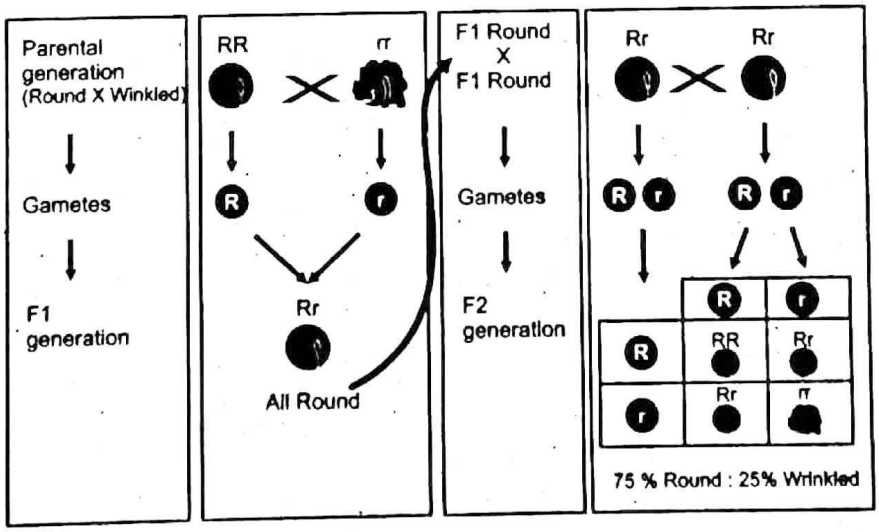
Phenotypic Ratio

In F2 seeds, phenotypic ratio would be 3 round: 1 wrinkled

Height

Mendel also studied inheritance of height in pea plant and he got same results.

When true breeding tall plants were crossed with true breeding short plants, all offsprings of F1 generation were tall i.e. Tallness is dominant trait. When members of F1 generation were-self-fertilized, Mendel got ratio of tall to short plants in F2 as 3:1.



Discrete factors

Mendel concluded that the traits under study were controlled by discrete factors which are no called as genes.

Q.10 Define and Explain Mendel's Law of Independent Assortment. (Board 2013)

Ans: Definition

Alleles of a gene pair segregate (get separated and distributed to gametes) independently from the alleles of other gene pair. This is called as law of independent assortment.

Dihybrid Cross

It is a cross in which two contrasting traits are studied at a time.

In next crosses, Mendel studied dihybrid crosses.

Traits

Traits under study were as follows:-

Seed shape

It has two distinct forms:-

(a) Round

(b) Wrinkled

Seed Colour

It has also two distinct forms:-

(a) Yellow

(b) Green

Dominance

The trait of round seed was dominant over wrinkled, similarly yellow seed colour was dominant over green.

Alleles controlling traits

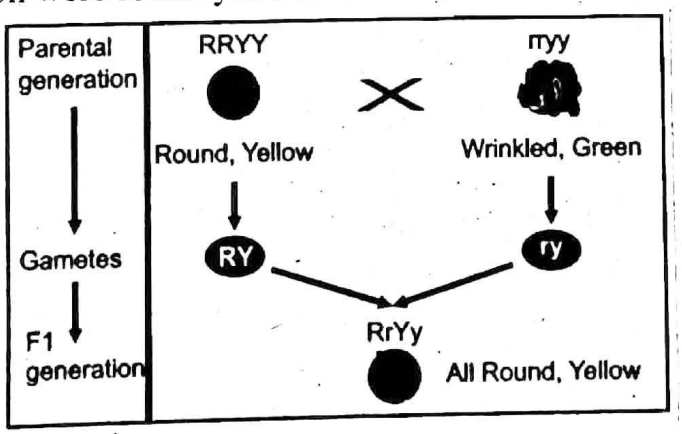
Round seed shape is controlled by 'R' and wrinkled by 'r', similarly yellow seed colour is controlled by 'Y' and green by 'y'.

P1 Generation

Mendel crossed the true breeding plant that had Round yellow seeds with true breeding wrinkled green seeds.

F1 Generation

All seeds in F1 generation were round yellow.



F2 generation

When F1 seeds grow into plants they were self fertilized. This cross produced seeds with four phenotypes. There were 315 round yellow seeds, 108 round green seeds, 101 wrinkled yellow seeds and 32 wrinkled green seeds.

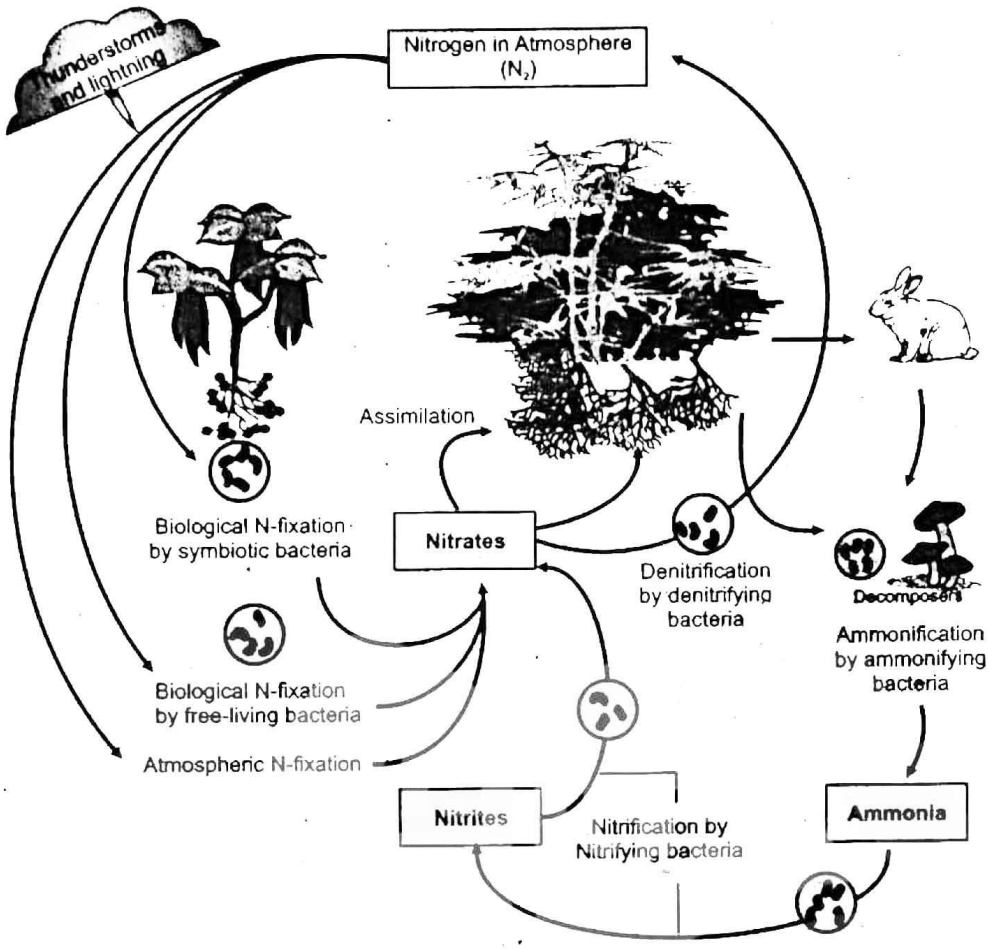


Figure 16.8: Nitrogen Cycle

Q 8 Explain various types of interactions in an ecosystem.

Ans: In all ecosystems, there are many kinds of interaction among living organisms.

(i) Intraspecific interactions

The interactions between the members of the same species are called intraspecific interactions

(ii) Interspecific interactions

The interactions between the members of different species are called interspecific interactions.

Some important interactions among living organisms in ecosystem are given below:

1. Competition **2.** Predation **3.** Symbiosis

1) Competition

In ecosystems, the natural resources e.g. nutrients, space etc. are usually in short supply. So, there is competition among the organisms of ecosystem for the utilization of resources. The competition may be intraspecific or interspecific.

Intraspecific competition is always stronger and more severe than the interspecific competition. Competition helps in maintaining a balance between the available resources and the number of individuals of a species.

2) Predation

Definition

It is an interaction between two animals of different species or between a plant and an animal. In predation, one organism (the predator) attacks, kills and feeds on other organism (the prey). All carnivore animals are predators. Some examples of predation are given below:-

Genotype	Antigen produced	Phenotype	Relationship between alleles
I^AI^A or I^Ai	Antigen A	Blood group A	Allele I^A is dominant over i
I^BI^B or I^Bi	Antigen B	Blood group B	Allele I^B is dominant over i
ii	No Antigen	Blood group O	Allele I is recessive
I^AI^B	Antigen A & Antigen B	Blood group AB	Alleles I^A and I^B are co-dominant

Allele i

Allele i does not produce any antigen and the phenotype is blood group O.

Complete Dominance

Allele I^A and I^B are completely dominant over allele *i*.

Genotype I^A I^B

In heterozygous genotype I^A I^B, each of the two alleles produces the respective antigens and neither of them dominates over the other. So blood group will be AB.

Incomplete Dominance

It is a situation where in heterozygous genotypes, both the alleles express as a blend (mixture) and neither allele is dominant over the other. As a result of this blending, an intermediate phenotype is expressed.

In Four O Clock plants, the 3 flower colours are red, pink and white. There is no specific gene responsible for producing pink flowers.

Four O Clock plant

Flower colour

The trait of flower colour is controlled by two alleles i.e. 'R' and 'r'.

Allele 'R'

Allele 'R' is responsible for giving red colour to flower.

Allele 'r'

Allele 'r' is responsible for giving white colour to flowers.

True Breeding Plants

True breeding plants 'RR' and 'rr' have red and white coloured flowers respectively.

Heterozygous plants of F1 Generation

When homozygous red flowered plant (RR) is crossed with homozygous white flowered pla (rr), the heterozygous (Rr) plants of F1 generation produce pink flowers.

Blending

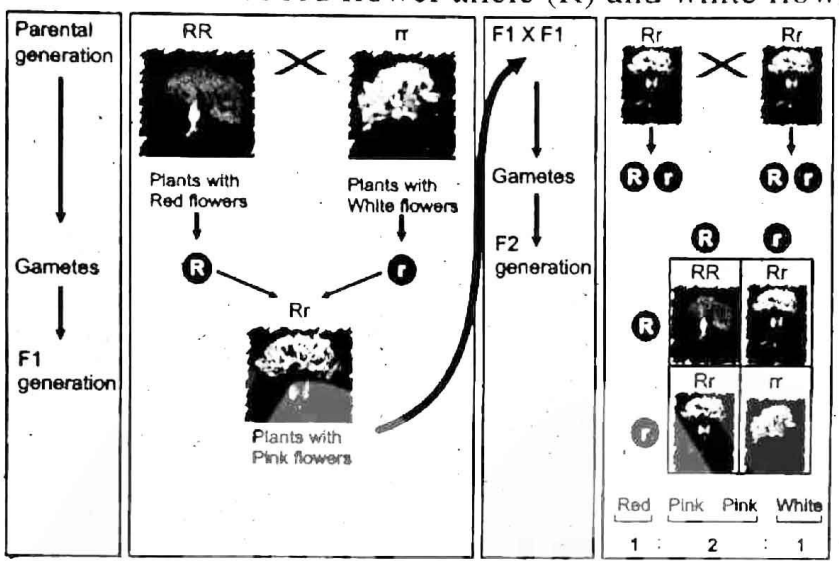
Pink colour is blend of red and white colours.

F2 Generation

When two heterozygous plants with pink flowers (Rr) are crossed, F2 generation show phenotype of red, pink and white flowers in the ratio 1:2:1.

Conclusion

Thus, it is concluded that neither of red flower allele (R) and white flower allele (r) is dominant.



Q.12 Define variations. Discuss their sources and types.

Ans. Definition

Differences shown by the individual of same species are called as variations.

Sources of variations

(a) Genetic Recombination

The genetic recombination produced through crossing over results in gametes with variations.

(b) Mutation

Mutation (changes in DNA) are important source of variations.

(c) Combination of Sperm with egg

During fertilization, one of the millions of sperms combines with a single egg. The chanc involved in this combination also act as the source of variations.

(d) Gene Flow

Movement of genes from one population to another is also an important source of variations.

(e) Combination of Chromosomes

Variations are also caused by different combinations of chromosomes in gametes and then i zygote.

Types of Variations

(i) Continuous variations

In continuous variations, the phenotypes show a complete range of measurements from on extreme to the other.

Such variations are controlled by many genes and also affected by environmental factors.

Examples

Height in Man

Weight in Man

Feet size in Man

Intelligence in Man

Height in Man

In every human population, the individuals have range of heights (from very small to tall). No population can show only two or three distinct heights.

(ii) Discontinuous variations

Discontinuous variations show distinct phenotypes. The phenotypes of such variations cannot be measured. The individuals of population have distinct phenotypes which can easily be distinguished from each other.

Discontinuous variations are controlled by the allele of a single gene pair. Environment has no effect on such variations.

Example

Blood groups in Man

In human population, an individual has one of the four distinct phenotypes (blood groups) and cannot have in between.

Q.13 What is Biological or Organic Evolution? Explain with the help of Darwin's theory of natural selection.

Ans: Biological/Organic Evolution

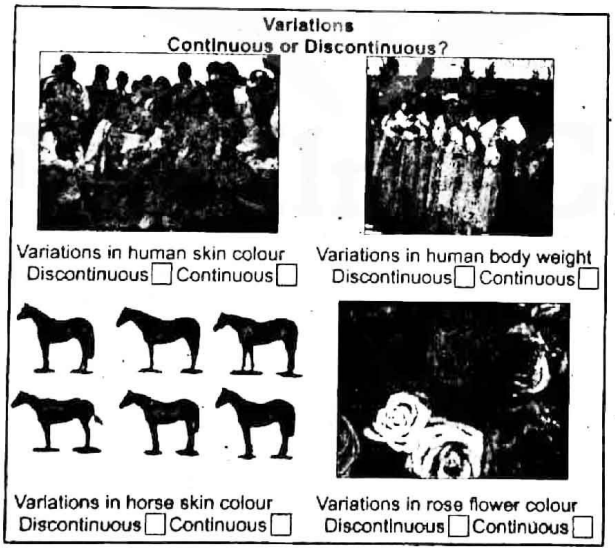
It is a change in the characteristics of a population or species of organisms over the course of generations.

The changes in an individual are not considered as evolution because evolution refers to populations and not to individuals.

Processes

Organic evolution includes two major processes:-

- Alteration in genetic characteristics (traits) of a type of organism over time.
- Creation of new types of organisms from a single type.



Buffon

Lamarck

French biologist C. de Buffon (1707–1788) was the first to hint at evolution. His countryman J. de Lamarck (1744–1829) was the first to propose a mechanism of evolution. Lamarck's ideas were soon rejected due to the vagueness of the mechanisms he proposed.

Theory of Natural Selection

Charles Darwin (1809 – 1882) proposed the mechanism of organic evolution in 1838. It was called as "The theory of natural selection". "Darwin proposed after his 5-year voyage on HMS (His Majesty's Ship) Beagle. He also published a book "On the Origin of Species by means of Natural Selection" in 1859.

Early response to Darwin's theory

Darwin theory of evolution was not widely accepted because of lack of sufficient evidence. Modern evolutionary theory began in the late 1920's and early 1930s.

Some scientists proved that the theory of natural selection and Mendelian genetics are the same ideas just as Darwin has proposed.

Importance of study of evolution

It determines the ancestry and relationships among different kinds of organisms.

Theory of special creation

The anti-evolution ideas support that all living things had been created in their current form only a few thousand years ago. It is known as the "theory of special creation."

MECHANISM OF EVOLUTION

Natural selection

It is a process by which the better genetic variations become more common in successive generations of a population.

Variations in population

Almost every population contains several variations for the characteristics of its members. These variations are of two types:

(i) Morphological Variations

(ii) Physiological Variations

Evolutionary Fitness of Organism

The central concept of Natural selection is the evolutionary fitness of an organism.

Fitness means an organism's ability to survive and reproduce. Organisms produce more offspring than can survive and these offspring vary in fitness.

Struggle for survival

These conditions produce struggle for survival among the organisms of a population.

Favourable variations

The Organisms with favourable variations are able to reproduce and pass these variations to their next generations.

Unfavourable Variations

On the other hand, rate of the transmission of unfavourable variations to next generations is low. It means that unfavourable variations are selected against their transmission to next generations.

Examples

Skin colour in Mouse

There are three variations in skin colour of mouse population:-

- Light coloured
- Medium coloured
- Dark coloured

Cat preys upon light and medium coloured mouse.

First Generation

In first generation, light coloured mouse is preyed upon by cat. Only medium and dark coloured mouse can make their next generations.

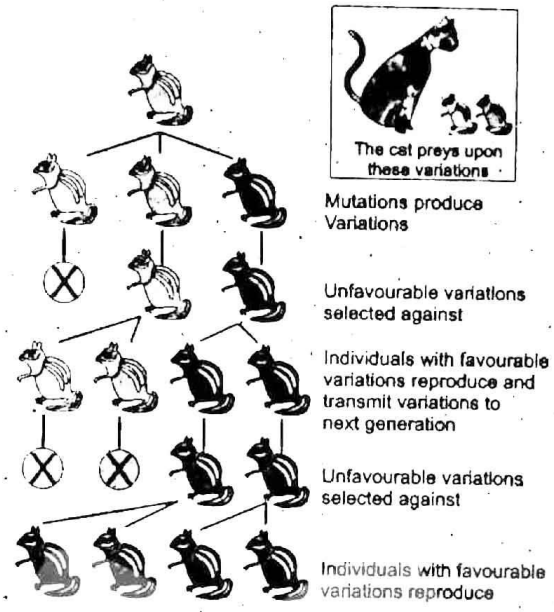


Figure 15.7: The concept of natural selection

Next Generation

In next generation, population again contains light, medium and dark coloured mouse. Cat preys upon the light and medium coloured mouse. Now only dark coloured mouse make new generation.

Favourable Variations

It happens in many generations, we will see only the dark coloured mouse in the population.

Natural selection

As a result of natural selection, the alleles that give more fitness of characteristics (favourable variations) than other alleles become more common within population.

Colour Variations in Moth

In England, moths had two variations i.e.,

(i) Dark coloured moth

(ii) White coloured moth

Light coloured tree trunk

The moths used to rest on the light coloured tree trunks (on which white lichens had grown).

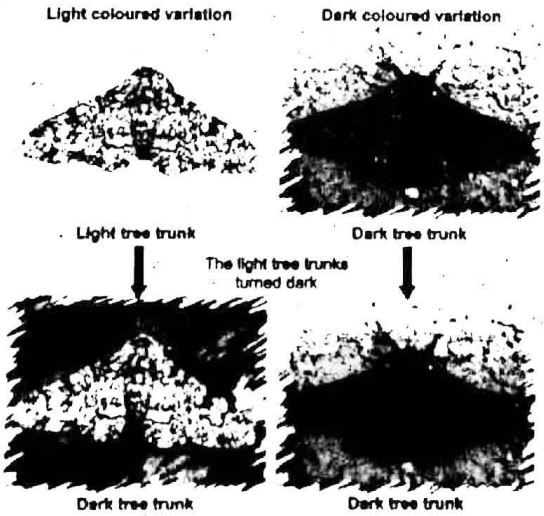


Figure 15.8: White and dark coloured moths

Favourable variations

In those days, light colour was favourable variation as they were invisible to predatory birds while resting on light coloured tree trunks.

Industrial Revolution

After industrial revolution in England, the lichens on tree trunks died due to polluted air and naked tree trunks turned dark.

The Unfavourable variation

Now the white moth variation became unfavourable or harmful because a white moth resting on dark tree trunk was easily visible to predatory birds.

Natural Selection

The natural selection selected dark moths to reproduce. In this way, dark coloured moth became more common and at last white moths disappeared from population. In this case, the dark colour variation in moth may be considered an adaptation to environment.

Conclusion

So it is concluded that individuals with favourable variations become major part of population while individuals with harmful or unfavourable variations become rare.

Q.14 What is artificial selection? Explain it. **(Board 2014)**

Ans. Definition

Artificial selection (or selective breeding) means intentional breeding between individuals for certain traits or combination of traits.

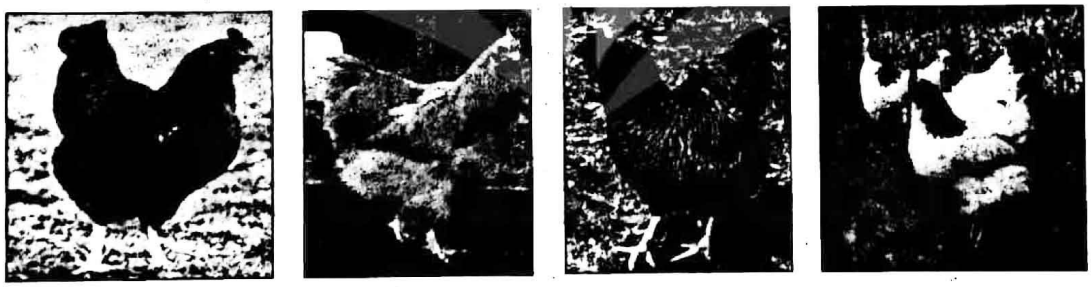


Figure 15.9: Breeds of hen produced through artificial selection

Historical Background

(a) Abu Rayhan Biruni

The term artificial selection was expressed by the Persian scientist Abu Rayhan Biruni in the 11th century.

(b) Charles Darwin

Charles Darwin also used this term in his work on natural selection. He noted that many domesticated animals and plants had special properties that were developed by:

- Intentional breeding among individuals with desirable characteristics;
- Discouraging the breeding of individuals with less desirable characteristics.

Desirable characteristics

Animals or plants having desirable characteristics are selected for breeding. In this way, many new generations with desirable characteristics are produced.

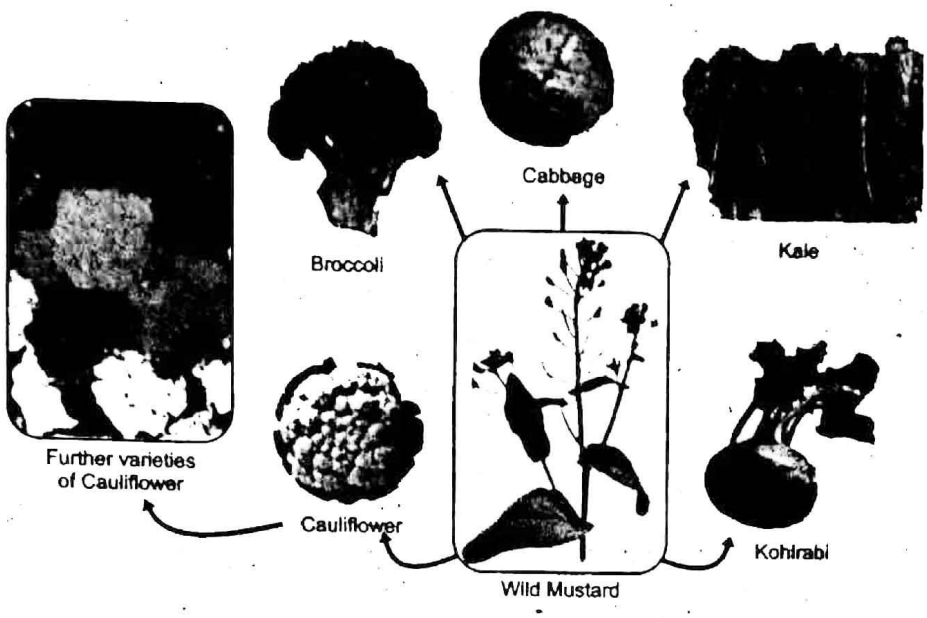


Figure 15.10: Plant varieties produced through artificial selection in wild mustard

Breeds

In artificial selection, the bred animals are known as breeds.

Varieties or Cultivars

In artificial selection, bred plants are known as varieties or cultivars.

Examples

(i) Numerous breeds of sheep, goat, cow, hen etc have been produced by artificial selection to increase the production of wool, meat, milk, eggs etc.

(ii) Similarly, varieties of plants have been produced for better quantity and quality of cereals, fruits and vegetables.

Multiple Choice Questions

1. **An organism's expressed physical trait, such as seed colour or pod shape, is called its:**
   (a) Genotype (b) Phenotype
   (c) Karyotype (d) Physical type
2. **An organism has two different alleles for a single trait. Its genotype is said to be;**
   (a) Homozygous (b) Heterozygous
   (c) Hemizygous (d) Homologous
3. **In the cross-pollination between a true-breeding yellow pod plant and a true-breeding green pod plant, where green pod colour is dominant, the resulting offsprings (F1 generation) will be;**
   (a) ¼ green, ¾ yellow
   (b) All yellow
   (c) ¼ yellow, ¾ green
   (d) All green
4. **How many genetically different kinds of gametes an individual with genotype AAbb can produce?** (B-2014)
   (a) 1 (b) 2
   (c) 4 (d) 8
5. **Which of the following statements regarding genes is FALSE?**
   (a) Genes are located on chromosomes
   (b) Genes consist of a long sequence of DNA
   (c) A gene contains information for the production of a protein
   (d) Each cell contains a single copy of every gene
6. **Mendel's primary contribution to our understanding of inheritance was;**
   (a) The idea that genes are found on chromosomes
   (b) Explanation of the patterns of inheritance
   (c) The discovery of alleles
   (d) Determining that informations contained in DNA are for protein synthesis
7. **A purple-flowered pea plant has the genotype PP. Which of the following statements about this plant is FALSE?**
   (a) Its phenotype will be white flowers
   (b) It has a homozygous dominant genotype
   (c) When bred to a white-flowered plant, all offspring will be purple flowered
   (d) All the gametes produced will have the same flower colour allele
8. **Charles Darwin proposed that organisms produce many more offspring than can possible survive on the limited amount of resources available to them. According to Darwin, the offspring that are most likely to survive are those that;**
   (a) Are born first and grow fastest
   (b) Are largest and most aggressive
   (c) Have no natural predators
   (d) Are best adapted to the environment
9. **Branch of biology that deals with the study of inheritance is called as;**
   (a) Artificial selection
   (b) Natural selection
   (c) Genetics
   (d) Histology
10. **Transmission of characteristics from parents to offsprings is called as;**
    (a) Replication (b) Inheritance
    (c) Co-dominance (d) Mutation

11. **Chromosomes carry units of inheritance called as;**
(a) Chromatin (b) DNA
(c) genes (d) None of these

12. **Genes contain instructions for the synthesis of;**
(a) Fats (b) Carbohydrates
(c) Vitamins (d) Proteins

13. **How many pairs of homologous chromosomes are there in human body cell?**
(a) 22 (b) 23
(c) 40 (d) 46

14. **Chromatin is made up of;**
(a) DNA
(b) Protein
(c) DNA + protein
(d) None of these

15. **DNA wraps around histone protein and forms rounded structures called as;**
(a) Nucleosomes (b) Ribosomes
(c) Lysosomes (d) mRNA

16. **In _____ James Watson and Francis Crick proposed the structure of DNA.**
(a) 1951 (b) 1953
(c) 1955 (d) 1957

17. **In 1953, ____ proposed the structure of DNA.**
(a) James Watson
(b) Francis Crick
(c) Both a and b
(d) None of these

18. **A DNA molecule consists of ____ polynucleotide strands.**
(a) 2 (b) 3
(c) 4 (d) 5

19. **Outside backbone of double helix is made up of;**
(a) Sugar
(b) Phosphate
(c) Sugar-phosphate
(d) None of these

20. **Inside of double helix consists of;**
(a) Nitrogenous bases
(b) Sugar
(c) Sugar-phosphate
(d) Phosphate

21. **Adenine always pairs with;**
(a) Guanine (b) Cytosine
(c) Uracil (d) Thymine

22. **Cytocine always pairs with;**
(a) Guanine (b) Adenine
(c) Uracil (d) Thymine

23. **How many hydrogen bonds are formed between adenine and thymine?**
(a) 1 (b) 2
(c) 3 (d) 4

24. **How many hydrogen bonds are formed between cytosine and guanine?**
(a) 1 (b) 2
(c) 3 (d) 4

25. **Copies of chromatids of chromosomes are made through the process called;**
(a) Inheritance
(b) Transcription
(c) Translation
(d) Replication

26. **Specific proteins have specific number and sequence of;**
(a) Enzymes
(b) Amino Acids
(c) Loci
(d) Allele

27. **Sequence of amino acids in a protein is controlled by sequence of ---- in DNA.**
(a) Genes (b) Loci
(c) Nucleotides (d) alleles

28. **Specific sequence of DNA nucleotides is copied in the form of mRNA in a process;**
(a) Replication
(b) Translation
(c) Inheritance
(d) Transcription

29. **Ribosome reads the sequence of mRNA nucleotides and joins specific amino acids to form proteins. This step is known as;** (Board 2013)
(a) Combination
(b) Transcription
(c) Translation
(d) Replication

30. **The position of gene on chromosome is known as;**
(a) Locus (b) Allele
(c) Genotype (d) Genome

31. **In which part of cell, transcription takes place?**
(a) Cytoplasm (b) Nucleus
(c) Ribosome (d) Golgi Apparatus

32. **Which component of cell is involved in translation?**
(a) Ribosome
(b) Mitochondria
(c) Golgi apparatus
(d) Nucleus

33. **The alternate forms of a gene are called as;**
(a) Genome
(b) Genotype
(c) Alleles
(d) None of these

34. **The Specific combinations of genes in an individual is known as;** (Board 2013)
(a) Phenotype
(b) Genotype
(c) Karyotype
(d) Phenocopy

35. **It is a condition in which normal body pigments are absent;**
(a) Colour blindness
(b) Albinism
(c) Diabetes
(d) Sickle cell anaemia

36. **Dominant alleles are represented by _____ letter and recessive alleles by _____ letters.**
(a) Capital, lowercase
(b) Lowercase, capital
(c) Lower case, lowercase
(d) Capital, capital

37. **Expression of genotype in the form of trait is:**
(a) Genome
(b) Phenotype
(c) Complete dominance
(d) Incomplete dominance

38. **Who developed fundamental Principles of genetics?**
(a) Lamark (b) Gregor Mendel
(c) Charles Lyll (d) Charles Darwin

39. ***Pisum sativum* is scientific name of;**
(a) Onion (b) Frog
(c) Mustard plant (d) Pea plant

40. **Each trait studied in Pea plant had _____ distinct form.**
(a) 1 (b) 2
(c) 4 (d) 6

41. **It is situation where two different alleles of a gene pair express themselves completely, instead of showing a dominant- recessive relationship is called;**
(a) Incomplete dominance
(b) Co-dominance
(c) Complete dominance
(d) None of these

42. **Among following which is an example of co-dominance?**
(a) Blood group A
(b) Blood group B
(c) Blood group AB
(d) Blood group O

43. **Among following, which is the genotype of blood group O?**
(a) I^Ai (b) I^Bi
(c) I^AI^B (d) ii

44. **It is a situation where in heterozygous genotypes, both the alleles express as a blend and neither allele is dominant over the other;**
(a) Incomplete dominance
(b) Co-dominance
(c) Complete dominance
(d) None of these

45. **Pink Flowered Four O Clock plant is an example of;**
(a) Incomplete dominance
(b) Co-dominance
(c) Complete dominance
(d) None of these

46. **How many types of differences shown by individuals of same species?**
(a) 1 (b) 2
(c) 4 (d) 6

47. **Among following, which is the source of variations?**
(a) Mutation
(b) Crossing over
(c) Gene flow
(d) All of these

48. **Which variations show distinct phenotypes and phenotypes of such variations cannot be measured?**
(a) Discontinuous variations
(b) Continuous variations
(c) Both a and b
(d) None of these

49. **Example of discontinuous variation is;**
(a) Blood group
(b) Height in Man
(c) Intelligence
(d) None of these

50. **In which type of variations, the phenotypes show a complete range of measurements from one extreme to the other is;**
(a) Discontinuous
(b) Continuous
(c) Both a and b
(d) None of these

51. **It is change in characteristics of a population or species of organisms over the course of generations;**
(a) Replication
(b) Transcription
(c) Evolution
(d) Translation

52. **All living things had been created in their current form only a few thousand years ago. This idea is known as;**
(a) Theory of special creation
(b) Evolution
(c) Variations
(d) None of these

53. **Who proposed the mechanism of organic evolution in 1838?**
(a) Charles Darwin
(b) Charles Lyll
(c) Lamark
(d) Gregor Mendel

54. **Charles Darwin published a book "On the Origin of Species by means of Natural selection" in;**
(a) 1858 (b) 1859
(c) 1869 (d) 1870

55. **It is the process by which the better genetic variations become more common in successive generations of population;**
(a) Variation
(b) Artificial selection
(c) Selective breeding
(d) Natural selection

56. **Variations selected for their transmission to next generation are;**
(a) Favourable
(b) Continuous
(c) Discontinuous
(d) None of these

57. **In which part of cell, transcription takes place?**
(a) Cytoplasm
(b) Nucleus
(c) Ribosomes
(d) Golgi Appartus

58. **Which is favourable variation in moths before industrial revolution?**
(a) Light colour (b) Dark colour
(c) Medium colour (d) None of these

59. **Which is favourable variation in moths after industrial revolution?**
(a) Light colour (b) Medium colour
(c) Dark colour (d) None of these

60. **Intentional breeding between individuals for certain traits, or combination of traits is called as:**
(a) Variations
(b) Evolution
(c) Natural selection
(d) Artificial selection

61. **A dominant allele only supresses the expression of recessive allele, it does not affect its:**
(a) Length (b) Working
(c) Nature (d) Position

62. **Mendel used _____ pea plants in his experiments.**
(a) 2800 (b) 28000
(c) 28,0000 (d) 28,00000

63. **True breeding means:**
(a) Homozygous
(b) Hetrozygous
(c) Both homozygous and hetrozygous
(d) None

64. **The possible number of chromosomal combinations are:**
(a) 70 millions (b) 70 billion
(c) 70 trillion (d) 80 trillion

65. **_____ gave the first hint at evolution?**
(a) Charles Darwin (b) Lamarck
(c) C.de Buffon (d)R. C. Punnett

66. **mRNA is synthesized by:**
(a) DNA Polymerase
(b) RNA Polymerase
(c) RNA Ligase
(d) Ribosomes

67. **Feet size in Man is an example of:**
(a) Continuous variations
(b) Discontinuous variations
(c) Gene flow
(d) Heredity variations

68. **In artificial selection, bred plants are known as:**
(a) Breeds
(b) Cultivars
(c) Varieties
(d) Cultivars and varieties

69. **What is the Diploid (2n) number of humans?**
(a) 23 (b) 16
(c) 26 (d) 46

70. **What condenses into a chromosome?**
(a) Nucleoplasm
(b) Nucleolus
(c) Chromatin material
(d) Cytoplasm

71. **What make the backbone of DNA molecule?**
(a) Phosphate
(b) Deoxyribose
(c) Nitrogenous bases
(d) Phosphate + Deoxyribose

72. **The first filial generation is denoted by**
(a) P1 (b) P2
(c) F1 (d) F2

73. **Physical appearance or colour of an organism is called:** **(Board 2014)**
(a) Genotype
(b) Karyotype
(c) Phenotype
(d) Physical power

74. **What will be the colour of flowers produced as a result of cross between red and white flowered 4'O Clock plants?** **(Board 2014)**

(a) Pink (b) Red

(c) White (d) Purple

75. **Which of the following genes will be termed as Homozygous Recessive,** **(Board 2014)**

(a) RRYY (b) RrYy

(c) RrYY (d) rryy

Answer Key

1	b	**2**	b	**3**	d	**4**	a	**5**	b
6	b	**7**	a	**8**	d	**9**	c	**10**	b
11	c	**12**	d	**13**	b	**14**	c	**15**	a
16	b	**17**	c	**18**	a	**19**	c	**20**	a
21	d	**22**	a	**23**	b	**24**	c	**25**	d
26	b	**27**	c	**28**	d	**29**	c	**30**	a
31	b	**32**	a	**33**	c	**34**	b	**35**	b
36	a	**37**	b	**38**	b	**39**	d	**40**	b
41	b	**42**	c	**43**	d	**44**	a	**45**	a
46	b	**47**	d	**48**	a	**49**	a	**50**	b
51	c	**52**	a	**53**	a	**54**	b	**55**	d
56	a	**57**	b	**58**	a	**59**	c	**60**	d
61	c	**62**	b	**63**	a	**64**	c	**65**	c
66	b	**67**	a	**68**	d	**69**	d	**70**	c
71	d	**72**	c	**73**	c	**74**	a	**75**	d

Short Answer Questions

Q.1 Define Genetics.

Ans. It is a branch of biology which deals with the study of inheritance.

Q.2 Define Inheritance.

Ans: Inheritance means the transmission of characteristics from parents to offspring.

Q.3 What are traits? Write two human traits. (Board 2014)

Ans. Characters which are transmitted from parents to offspring are called traits. In man, height, eye colour etc are examples of traits and are inheritable.

Q.4 What are Genes?

Ans. Genes are segments of DNA. Each specific gene contains instructions for the synthesis of specific protein.

Q.5 What are homologous chromosomes? (Board 2013) OR / What are Homologous chromosomes? How many of these exist in man? (Board 2014)

Ans. The body cells have constant number of paired chromosomes. The two chromosomes of a pair are called as homologous chromosomes. For example, in human body cells, there are 23pairs of homologous chromosomes for a total of 46 chromosomes.

Q.6 How is chromatin/ chromosome made up of?

Ans. Chromatin or chromosome is made up of DNA and protein.

Q.7 What is nucleosome?

Ans. In chromatin, DNA wraps around histone proteins and form round structure called as nucleosome. DNA is also present between nucleosomes. In this way, nucleosomes and DNA between them look like beads on string.

Q.8 Define Double helix.

Ans. DNA consists of two polynucleotide strands which are coiled around each other in the form of Double helix. There is phosphate-sugar backbone on outside, while nitrogenous bases are on inside of double helix.

Q.9 Define DNA replication.

Ans. It is a process in which one parental DNA is divided into two genetically identical daughter DNA molecules.

Q.10 What is the purpose of DNA replication?

Ans. DNA replication is done to make the copies of chromatids of chromosomes.

Q.11 How does DNA work?

Ans. DNA is genetic material. It performs its role by giving instructions for the synthesis of specific proteins. Some proteins perform structural role while others act as enzymes to control all bio-chemical reactions of cells.

Q.12 Differentiate between transcription and translation.

Ans. i. Transcription

It is a process in which specific sequence of DNA nucleotides is copied in the form of messenger RNA (mRNA).

ii. Translation

The mRNA carries the sequence of its nucleotides to ribosomes. Ribosomes read this sequence and joins specific amino acids, according to it proteins are synthesized.

Q.13 Define a Gene. Write symbols of Genes for any two traits. **(Board 2014)**

Ans. Definition

Particular segment of DNA that contains instructions for synthesis of particular protein is called as gene.

OR

Particular sequence of nucleotides that contains instructions for synthesis of particular protein is called as gene.

Symbols of Genes

The trait of round seeds (controlled by allele R) was dominant over wrinkled (controlled by allele r) seeds. Similarly yellow seed (controlled by Y) was dominant over green (controlled by y).

Q.14 Define Allele.

Ans. Genes occur in pairs on homologous chromosomes. Each member of gene pair is called as allele. The alternative forms of a gene are called as alleles e.g. 'A' and 'a' are two alternative forms of a gene or 'B' and 'b' are two another alternative forms of a gene.

Q.15 Define Locus.

Ans. Location or position of gene on chromosome is called as its locus.

Q.16 What is genotype? Describe its Types.

Ans. The specific combinations of genes in an individual is known as genotype. It has two types i.e. Homozygous and Heterozygous

(i) Homozygous Genotypes

The genotype in which gene pair contains two identical alleles (AA,aa) is called as homozygous genotype.

(ii) Heterozygous genotype

The genotype in which gene pair contains two different alleles (Aa) is called as heterozygous genotype.

Q.17 Define Albinism

Ans. It is a condition in which normal body pigments are absent.

Q.18 Differentiate between dominant alleles and recessive allele.

Ans. i. Dominant Allele

In the heterozygous condition, one allele masks or prevents the expression of the other, such allele is called as dominant allele. Dominant alleles are represented by capital letters e.g., I^A I^B

ii. Recessive Allele

The allele which is not expressed is called as recessive allele. Recessive alleles are represented by lower case letters e.g., ii.

Q.19 What features should be present in an organism used for genetic experiments?

Ans. Organism used in genetic experiments should have following features:-

- There should be number of different traits that can be studied.
- The organism should have contrasting traits e.g. for the trait of height, there should be only two very different phenotypes i.e. Tallness and dwarfness.

- The organisms (if it is plant) should be self-fertilizing but cross fertilization should also be possible.
- The organism should have a short but fast life cycle.

Q.20 Differentiate between monohybrid cross and dihybrid cross. OR Define monohybrid and dihybrid cross. **(Broad 2014)**

Ans. A cross in which only one trait is studied at a time is called as monohybrid cross e.g. cross between true-breeding round seeded plant and true breeding wrinkled seeded plant. In this case one trait i.e seed shape is under study.

A cross in which two traits are studied at a time is called as dihybrid cross e.g. cross between true breeding round yellow seeded plants and wrinkled green seeded plants. In this case, two traits i.e. seed shape and seed colour are under study.

Q.21 What is meant by P_1, F_1 and F_2 generations?

Ans. P1 generation

First parental generation is known as P1 generation.

F1 generation

Means first filial. The offspring of P_1 generation are called as F_1 generation.

F2 Generation

Means second filial. The offspring of F_1 generation are called as F_2 Generation.

Q.22 Define Law of Segregation. **(Board 2013)**

Ans. This law states that during gamete formation, the genes (alleles) of each pair segregate from each other and each gamete receives one gene from the pair when the gametes of male and female parents unite, the resulting offspring again gets the genes in pairs.

Q.23 Define Mendel's Law of independent assortment.

Ans. This law states that the alleles of a gene pair segregate (get separated and distributed to gametes) independently from the alleles of other gene pairs.

Q.24 Define co-dominance. Give an example. **(Broad 2014)**

Ans. It is a situation in which two different alleles of a gene pair express themselves completely, instead of showing a dominant-recessive relationship. As a result, heterozygous organisms shows a phenotype that is different from both homozygous parents.

For example human blood group AB.

Q.25 Define incomplete dominance. Give example.

Ans. It is a situation in which phenotypic expression of heterozygous organism is intermediate to phenotype expressions shown by both homozygous organisms. Both alleles in heterozygous organisms express this blend (mixture) and neither allele is dominant over the other.

For example pink flowered four o'clock plant.

Q.26 Define variation. Give sources of variations.

Ans. Differences shown by individuals of same species are called variations. Important sources of variations are as following:-

(i) Crossing Over (ii) Mutation

(iii) Random Fertilization (iv) Gene flow

Q.27 Define Gene flow.

Ans. Movement of genes from one population to other population is called gene flow.

Q.28 Describe types of variations with examples.

Ans. There are two types of variations:

1. Continuous variations

Those variations in which phenotypes show a complete range of measurements from one extreme to other are called as continuous variations.

Height, weight, feet size, intelligence etc. are examples of continuous variations. In every human population, the individuals have a range of heights. No populations can show only two or three distinct heights. Continuous variations are controlled by many genes and are then affected by environmental factors.

2. Discontinuous variations

These are the variations which show distinct phenotypes which can be easily distinguished from each other. The phenotypes of such variations cannot be measured.

Blood groups are good examples of discontinuous variations. In human population, an individual has one of the four distinct blood groups and cannot have in between. Such variations are controlled by alleles of single gene. The environment has little effect on this type of variations.

Q.29 Define Organic or Biological Evolution.

Ans. Organic or Biological evolution is change in characteristics of population or species of organisms over the course of generations.

The changes in an individual are not considered as evolution because evolution refers to populations, not to the individuals.

Q.30 What processes are involved in Organic evolution.

Ans. There are two major processes involved in organic evolution.

- Alteration in genetic characteristics (traits) of a type of organisms over time.
- Creation of new types of organisms from a single type.

Q.31 What is anti-evolution or theory of special creation? **(Board 2013)**

Ans. The anti-evolution idea supports that all living things had been created in their current form only a few thousand years ago. It is also known as theory of special creation.

Q.32 Define Natural selection.

Ans. Natural selection is process by which the better genetic variations become more common in successive generations of population.

Q.33 Define Artificial selection/selective breeding

Ans. Artificial selection (selective breeding) means intentional breeding between individuals for certain traits or combination of traits.

Q.34 Differentiate between breeds and varieties or cultivars.

Ans. In artificial selection, the bred animals are known as breeds, while bred plants are known as varieties or cultivars.

Q.35 Define genotype and phenotype. (Board 2013)

Ans. Genotype

The specific combination of genes in an individual is known as genotype.

Phenotype

The expression of genotype in the form of trait is known as phenotype.

Q.36. What is template strand?

Ans. The strand of DNA to which new strand is formed called template strand.

Q.37. Define Punnett Square?

Ans. It is a diagram used to predict an outcome of a particular cross or breeding experiment. The gametes of both parents having all possible genetic make-up (set-ups) are determined.

Q.38. What will be Genotype of plants produced as a result of cross between two plants having Genotype Rr? (Board 2014)

Ans. When two heterozygous plants with pink flowers (Rr) are crossed, F2 generation shows phenotypes of red, pink and white flowers in ratio 1 : 2 : 1.

Unit 16

Man and His Environment

Long Answer Questions

Q.1 Define environment and ecology.

Ans: Environment

An environment is the sum of physical (abiotic) and biological (biotic) components which influence that organism.

Ecology

The study of the interrelationship between living organisms and their environment is called ecology. **Or** The study of the interaction of organisms with their environment.

Q. 2 Explain Levels of Ecological Organization.

Ans: In ecosystem, the levels of organization range from organism to biosphere. The followings are the levels of ecological organization:-

1. Species

A species is a group of organisms which can interbreed freely in nature to produce fertile offspring.

Examples

Human, Cat, Dog etc.

2. Population

A group of organisms of the same species inhabiting a specific geographical area at a particular time is called population.

Example:- Number of rats in a field.

3) Community

All the populations that live in a habitat and interact in various ways with one another are collectively called a community.

Example

Forest is an example of community.

4) Ecosystem

Living organisms cannot live isolated from the nonliving part of their environment. The biotic (living organisms) and abiotic components (air, water, light, soil etc.) of environment interact with each other to form a stable system. The self-sufficient unit of an environment that is formed as a result of interactions between its biotic community and the abiotic components is called ecosystem.

Examples

i. A pond, a lake and a forest are examples of natural ecosystems.

ii. An aquarium is an example of artificial ecosystem.

5) Biosphere

Definition

All ecosystems of the world together form the biosphere. It includes all the ecosystems of the planet Earth. In other words, the biosphere consists of all organisms present on the earth and all regions of the Earth where they live.

Range

Biosphere ranges from the floor of oceans to the tops of the highest mountains.

Thickness

It is about 20 km thick. The biosphere makes a thin layer surrounding the planet Earth. If you consider the Earth as of the size of an apple, then the biosphere will be as thick as the apple's skin.

Q. 3 Explain Components of Ecosystem.

Ans. An ecosystem is comprised of two basic parts:-

1) Biotic Components **(Board 2014)**

Definition

The living parts (organisms) of the ecosystem is called biotic components.

Examples

- Producers (Plants, Algae and Cyanobacteria)
- Consumers (Animals, Protozoa)
- Decomposers (Bacteria and Fungi)

2) Abiotic Components

The non-living factors present in ecosystem are called abiotic components.

Examples:

i) Air **ii)** Water **iii)** Soil **iv)** Light **v)** Temperature

Biotic Components **(Board 2013)**

1) Producers

Definition

These are the autotrophs in an ecosystem. These organisms are able to synthesize complex organic compounds (food) from inorganic raw materials. Producers form the basis of any ecosystem.

Examples

(i) In terrestrial ecosystems, plants are the main producers.

(ii) In aquatic ecosystems, the main producers are the algae (phytoplankton) and Shallow water rooted plants.

2) Consumers

Definition

These are the heterotrophs in an ecosystem. These organisms are unable to synthesize their food and so depend upon producers for food. The animals are the major consumers of all the ecosystems.

Examples

Animals, Fungi, Protozoans and many of the Bacteria.

Types of Consumers

i. Herbivores

These animals feed directly on plants or products of plants. They are also called primary consumers.

Examples

Cattle, deer, rabbit, grasshopper etc.

ii. Carnivores

Those animals that feed upon other animals are called carnivores. The carnivores are of following types:

Types of carnivores

a) Primary carnivores

Those carnivores that feed upon herbivores are called primary carnivores. They are secondary consumers.

Examples

Fox, frog, predatory birds, many fishes and snakes.

b) Secondary carnivores

Those carnivores that feed upon primary carnivores are called secondary carnivores. They are tertiary consumers.

Examples

Wolf and owl etc.

c) Tertiary carnivores

Those carnivores that feed upon secondary carnivores are called tertiary carnivores. They are not eaten by any other animals. So they are also called top carnivores.

Examples

Lion, Tiger etc.

Omnivores

Those consumers that eat animal flesh as well as plants and plant products are called omnivores.

Examples

Human and Crow etc.

3) Decomposers or Reducers

Those organisms that break down the complex organic compounds of dead matter (of plants and animals) into simple compounds. They secrete digestive enzymes into dead and decaying organic matter to digest the organic material. Products of digestion are absorbed for their own use and remaining substances are added to the environment for reuse. The minerals, which are released by decomposers, are used as nutrients by the producers.

Examples

Bacteria and fungi.

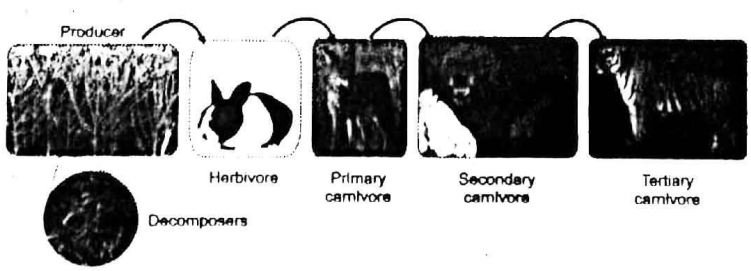


Figure 16.1: Producers, Consumers and Decomposers

Q4 Explain Flow of Energy in an Ecosystem.

Ans. In an ecosystem, energy as well as materials travels from one trophic level to the next.

Trophic Level

Trophic level is the level at which an organism feeds in food chain. The first trophic level is made of producers; the second of primary consumers and so on.

Flow of Energy

The flow of energy in different trophic levels of ecosystem is unidirectional. The following is an overview of the flow of energy in an ecosystem.

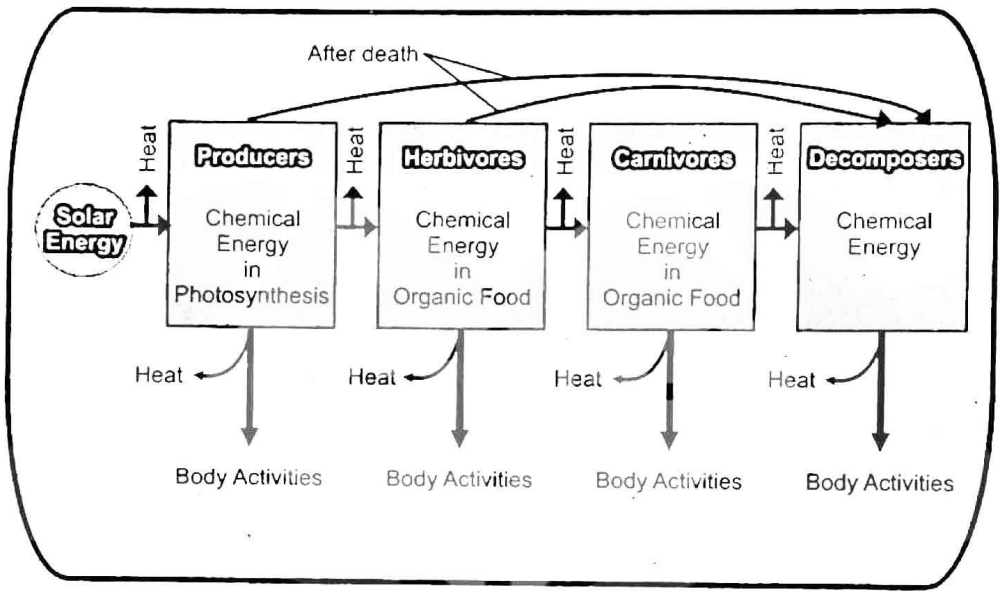


Figure 16.2: Energy flow in an ecosystem

Source of Energy in an Ecosystem

The Sun is the primary source of energy for all ecosystems. Producers get solar energy and transform it into chemical energy by the process of photosynthesis. They store this energy in their tissues and also transform it into mechanical and heat energy during their metabolic activities.

Movement of Energy

The energy in producers' tissues flows to herbivores when producers are eaten. Herbivores transform it into mechanical and heat energy during their metabolic activities and store the rest in their tissues. Carnivores eat herbivores and get energy. They also use it for their body activities and store the rest in their tissues. After the death of producers and consumers, the energy stored in their tissues is used by the decomposers.

Storage and Expenditure of Energy.

The storage and expenditure of energy in an ecosystem is in accordance with the basic law of thermodynamics i.e. "energy can neither be created nor destroyed but can be transformed from one form into another". In an ecosystem there is,

- Constant flow of energy from the Sun through producers to consumers and decomposers.
- A significant decrease in useful energy during transfer of energy at each trophic level.

Q. 5 Explain Flow of Materials in an Ecosystem.

Ans: Introduction

The materials flow from one trophic level to the next by means of food chains and food webs.

Food Chain

A food chain is a series of organisms within an ecosystem, in which each organism feeds on the one before it and is fed by one after it.

Example

Grass ---------- Grasshopper ---------- Sparrow ---------- Hawk

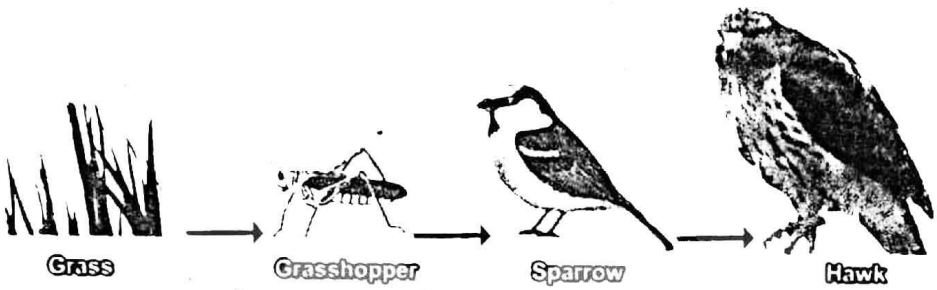


Figure 16.3: A Simple Food Chain

The base of food chain is always formed by a producer. It is eaten by a primary consumer, which is preyed upon by secondary consumer. The secondary consumer may be eaten by a tertiary consumer. A food chain, can therefore, be represented as,

Producer---------- Primary Consumer---------- Secondary Consumer---------- Tertiary Consumer

A food chain involves a nutritive interaction among the biotic components of an ecosystem. Usually there are 4 or 5 trophic levels. Shorter food chains provide greater available energy and vice - versa.

Food Web

In nature, food chains are very complex, as one organism may be the food source of many other organisms. So there is a web like structure formed by these interlinked food chains. Such interconnected food chains collectively make food web. OR

It may also be defined as, "a network of food chains which are interconnected at various trophic levels".

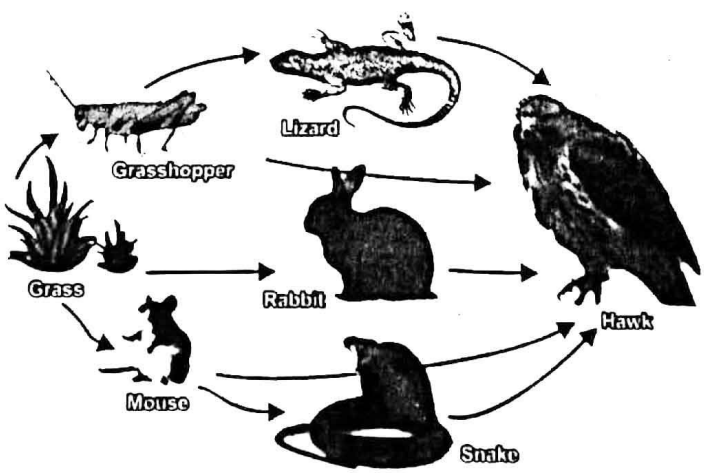


Figure 16.4: A Food Web in Grassland Ecosystem

Q.6 Describe types of Ecological Pyramids. **(Board 2014)**

Ans: Definition

Ecological pyramid can be defined as, "A representation of the number of individuals or amount of biomass or energy present in various trophic levels of a food chain".

Explanation

In 1927, Charles Elton (an English ecologist) developed the concept of ecological pyramids. He noted that the animals present at the beginning of food chain are abundant in number while the animals present at the end of food chain are fewer in number.

Types of Pyramids

Ecological pyramids are of three types:

1) Pyramid of Numbers

It is the graphic representation of the number of individuals per unit area at various trophic levels of a food chain.

Example

Usually, producers are present in large number, primary consumers are in lesser number, and secondary consumers are fewer. So, the producers are of smallest size but maximum in number, while the tertiary consumers are larger in size but lesser in number.

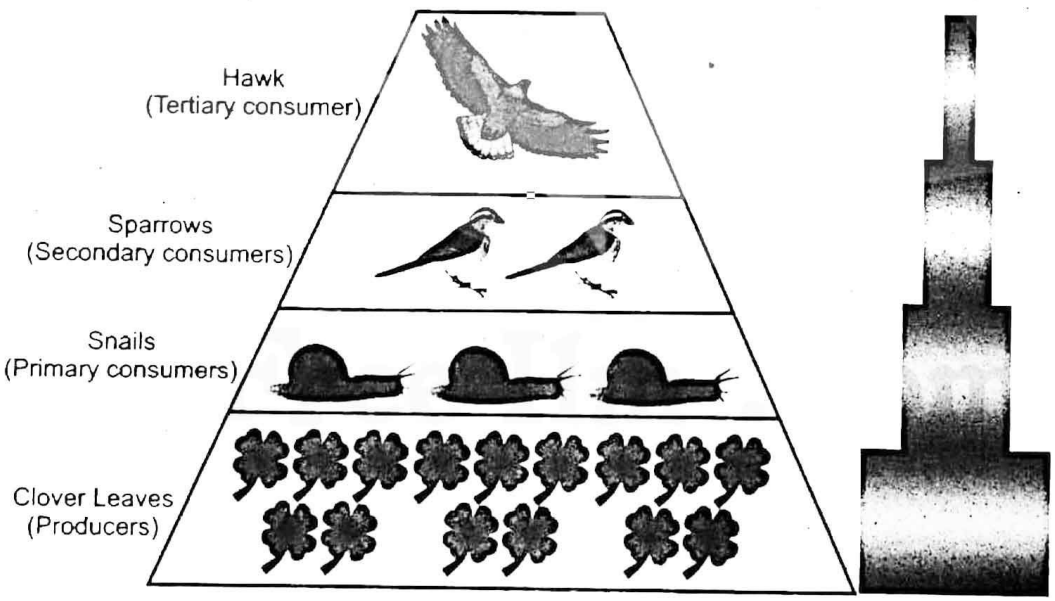


Figure 16.5: Pyramid of Numbers in an Ecosystem

2) Pyramid of Biomass

It is the graphic representation of biomass present per unit area at various trophic levels of a food chain.

Example

In a terrestrial ecosystem, the maximum biomass is of producers and there is progressive decrease in biomass from lower to higher trophic levels.

Biomass

The total amount of living or organic matter in an ecosystem at any time is called "biomass".

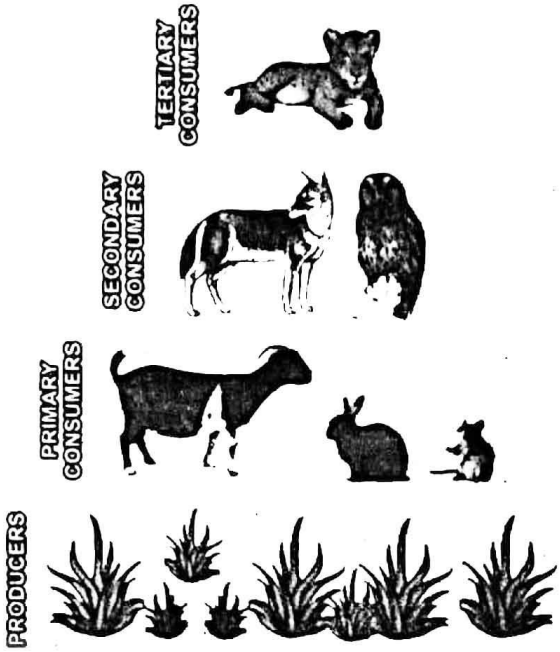


Figure 16.6: Pyramid of Biomass in an Ecosystem

3) Pyramid of Energy

It is a graphic representation of energy present in a biomass of living organisms at various trophic levels of a food chain.

Example

The amount of energy is decreased from producers to decomposers as some amount of energy is used by the organisms to perform work while some of it is lost.

Q. 7 Define biogeochemical cycles. Also explain different cycles in ecosystem.

Ans. Source of bioelements

Environment provides bioelements which are used by organisms for their bodies and metabolism. The materials are continuously recycled between organisms and environment. They are also called nutrient cycles.

Biogeochemical cycles

Biogeochemical cycles are the cyclic pathways through which materials move from environment to organisms and back to the environment.

1. Carbon Cycle

Introduction

Carbon atom is the principal building block of many kinds of biomolecules.

Occurrence of Carbon

Carbon is found as graphite and diamond in nature. It also occurs as carbon dioxide in atmosphere.

Sources of Carbon

Major sources of carbon for the living world are:

- Carbon dioxide present in atmosphere and water.
- Fossil fuels like peat, coal, natural gas and petroleum also contain carbon.
- Carbonates of Earth's crust also give rise to carbon dioxide.

Effects of upsetting of carbon cycle

The balance of carbon cycle has been upset by human activities such as deforestation and excessive burning of fossil fuels. As a result, the amount of carbon dioxide in atmosphere is increasing, causing the green house effect and global warming.

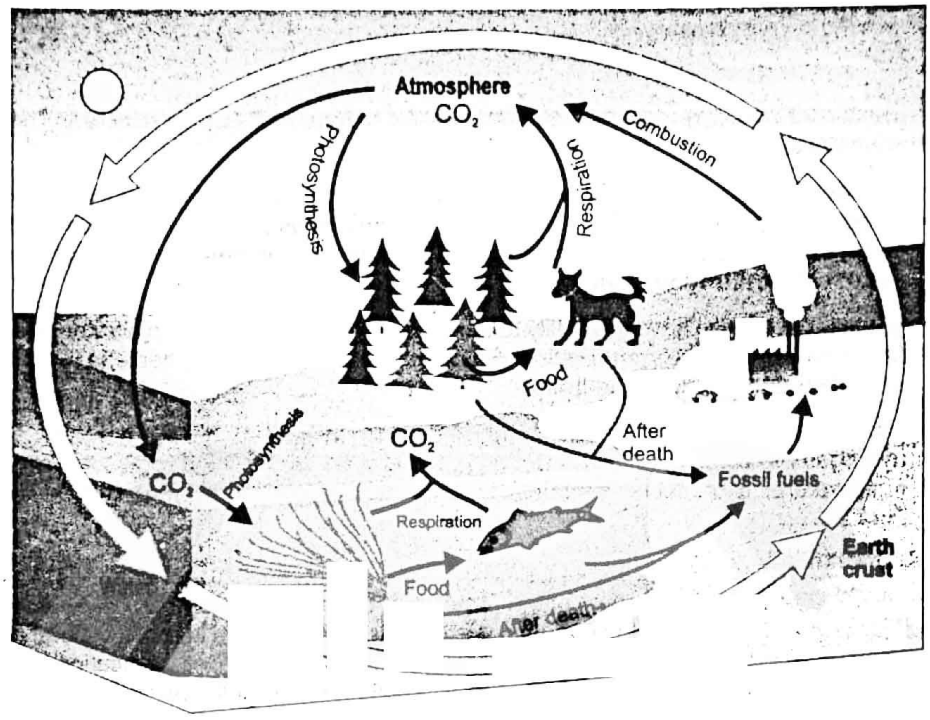


Figure 16.7: Carbon Cycle

Steps of Carbon Cycle

(a) Entry of Carbon into Living Organisms

The major process that brings carbon from the atmosphere or water into living world is photosynthesis.

(b) Transfer of Carbon

Producers take in carbon dioxide from atmosphere and convert it into organic compounds and becomes a part of the body of producers. This carbon enters in food chains and is passed to herbivores, carnivores and decomposers.

(c) Release of Carbon

- Carbon dioxide is released back to environment by respiration of producers and consumers.
- It is also released by the decomposition of organic wastes and dead bodies by decomposers.
- Burning of wood and fossil fuels also add large amount of carbon dioxide into atmosphere.

2) Nitrogen Cycle

Importance of Nitrogen

Nitrogen is an important component of all biomolecules like proteins and nucleic acids (DNA and RNA). These are the most abundant biomolecules in the body of all living organisms.

Unavailability of molecular Nitrogen

Atmosphere is the reservoir of free gaseous nitrogen. Living organisms are unable to use this gaseous nitrogen directly from atmosphere (except for nitrogen fixing bacteria). It has to be converted into nitrates to be utilized by plants.

Steps of Nitrogen Cycle

Nitrogen cycle consists of following steps:

a) **Formation of Nitrates**

b) **Assimilation**

c) **Denitrification**

a) **Formation of Nitrates**

It is done by following ways:

i) **Nitrogen fixation**

Conversion of nitrogen gas into nitrates is called nitrogen fixation. It occurs in the following ways:

- **Atmospheric nitrogen fixation**

Thunderstorms and lightning convert atmospheric gaseous nitrogen into nitrous acid and nitric acid. The acids in turn combine with other salts to produce 'nitrates' this is called atmospheric nitrogen fixation.

- **Biological nitrogen fixation**

Some bacteria also have the ability to transform gaseous nitrogen into nitrates. It is called biological nitrogen fixation. Some of these nitrogen fixing bacteria live as symbionts and many are free living.

- **Industrial nitrogen fixation**

Nitrogen fixation is also done in industries. In industrial nitrogen fixation, hydrogen is combined with atmospheric nitrogen under high pressure and temperature. It produces ammonia which is further converted into ammonium nitrate.

ii) **Ammonification**

Ammonification is the breakdown of proteins of dead organisms and nitrogenous wastes (urea, uric acid etc.) to ammonia. It is done by ammonifying bacteria.

iii) **Nitrification**

After the formation of ammonia, it is converted into nitrites and nitrates. This is called nitrification and is done by nitrifying bacteria. Firstly ammonia is converted into nitrites by bacteria called *Nitrosomonas*. The nitrites are then converted into nitrates by other bacteria called *Nitrobacter*.

b) Assimilation

The nitrates when absorbed by plants and utilized for making proteins, nucleic acids etc. Animals take nitrogenous compounds from plants. The utilization of nitrates by organisms is called assimilation.

c) Denitrification

It is a biological process in which nitrites and nitrates are reduced to gaseous nitrogen by denitrifying bacteria. In this way nitrogen is returned to the atmosphere.

Effect of excessive denitrification

Excessive denitrification reduces soil fertility and is stimulated by water logging, lack of aeration and accumulation of organic matter in the soil.

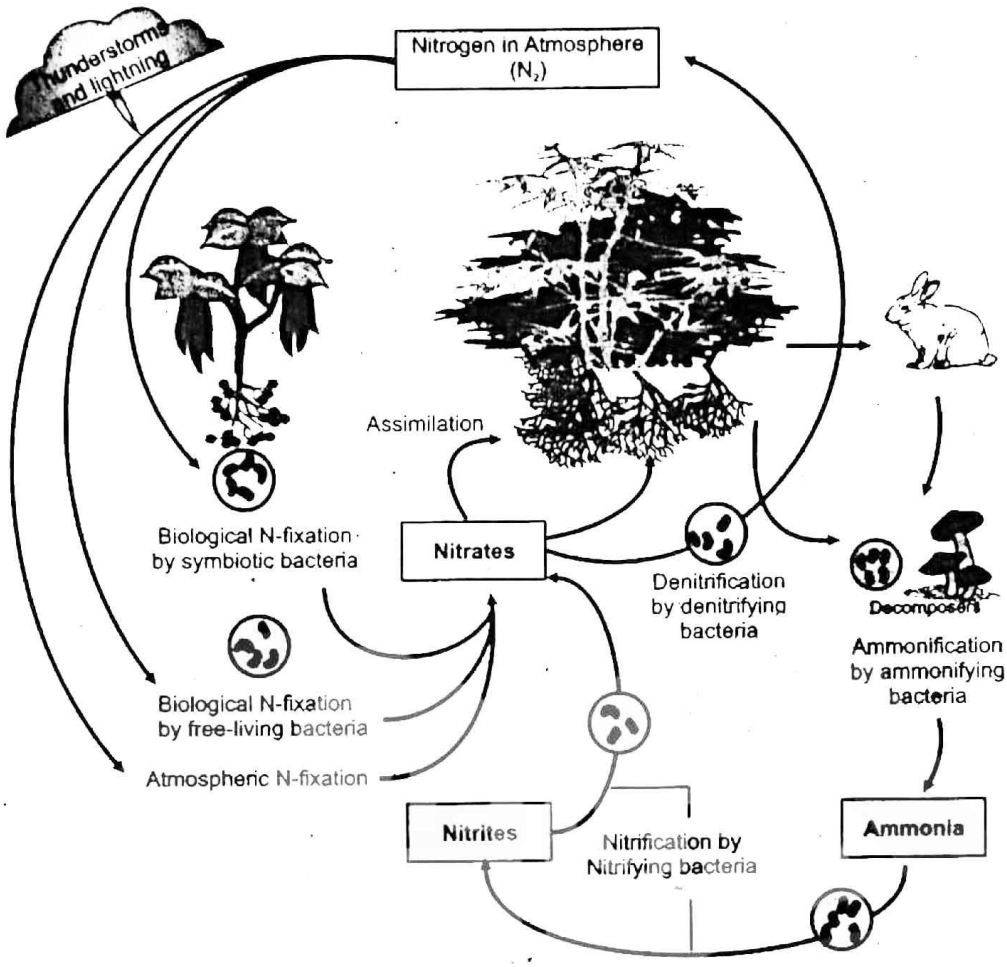


Figure 16.8: Nitrogen Cycle

Q 8 Explain various types of interactions in an ecosystem.

Ans: In all ecosystems, there are many kinds of interaction among living organisms.

(i) Intraspecific interactions

The interactions between the members of the same species are called intraspecific interactions

(ii) Interspecific interactions

The interactions between the members of different species are called interspecific interactions.

Some important interactions among living organisms in ecosystem are given below:

1. Competition **2.** Predation **3.** Symbiosis

1) Competition

In ecosystems, the natural resources e.g. nutrients, space etc. are usually in short supply. So, there is competition among the organisms of ecosystem for the utilization of resources. The competition may be intraspecific or interspecific.

Intraspecific competition is always stronger and more severe than the interspecific competition. Competition helps in maintaining a balance between the available resources and the number of individuals of a species.

2) Predation

Definition

It is an interaction between two animals of different species or between a plant and an animal. In predation, one organism (the predator) attacks, kills and feeds on other organism (the prey). All carnivore animals are predators. Some examples of predation are given below:-

Examples

1. Frog preys upon mosquito and fox preys upon rabbit. There are some examples where a predator is preyed upon by a second predator and then the second one is preyed upon by a third predator. For example, frog (predator 1) is preyed upon by a snake (predator 2) and the snake is preyed upon by an eagle (Predator 3).

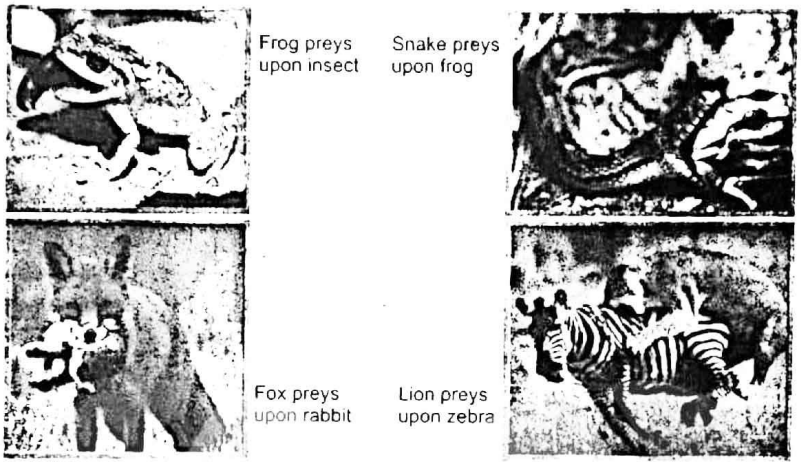


Figure 16.9: Examples of Predators and Their Preys

2. Certain plants (Pitcher plant, Sundew, Venus fly trap etc.) are carnivorous and live as predators. Such plants live in the areas where minerals and other nutrients are lacking. They feed on insects to fulfill their nitrogen requirements. These plants have mechanism to attract insects. For example, they secrete sweet nectar that attracts the insects searching for food. Their leaves are also modified to capture the prey.

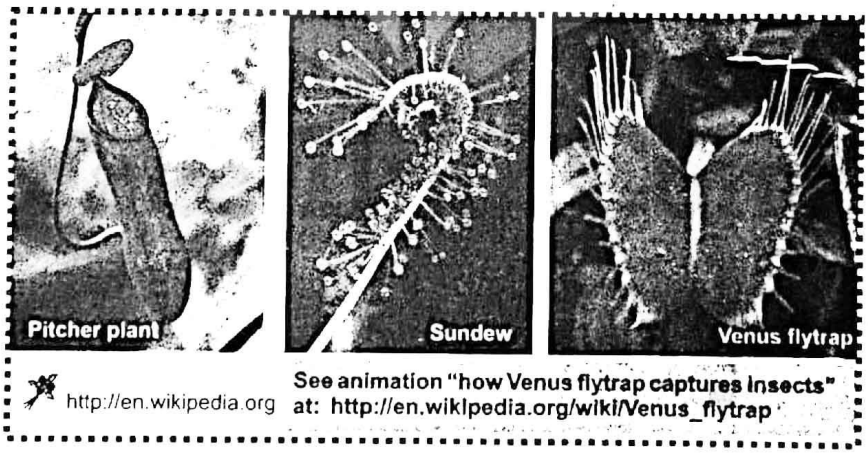


Figure 16.10: Predator Plants

Importance of predation

Predation keeps the prey population under check, so as to maintain an ecological balance. Humans benefit from this interaction in the biological control of weeds and pests. In order to control pests in an area, their predators are released there.

3) Symbiosis

Definition

It is a relationship between members of different species, in which they live together for longer or shorter periods of time.

Example

Lichens (Association between algae and fungi)

Types of symbiosis

A. Parasitism **(Board 2013)**

Definition

It is a type of symbiosis in which smaller partner (parasite) derives food and shelter from the body of larger partner (host) and, in turn, harms it.

Host

The organism on which a parasite feeds is called host.

Parasite

Parasite is an organism that gets shelter and food from its host and in return harms it. Host can survive without parasite, but parasite cannot survive without host.

Types of Parasites

a) Ectoparasites

Ectoparasites live outside i.e. on the surface of host's body and get food from there.

Examples

Mosquitoes, leeches, lice etc.

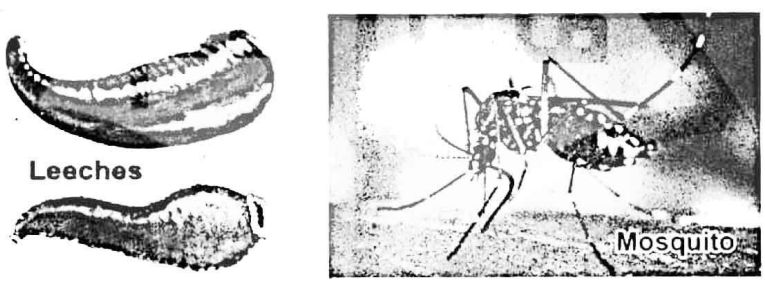


Figure 16.11: Ectoparasites

b) Endoparasites

Endoparasites live inside the body of host and get food and shelter from there.

Examples

Bacteria, viruses, tapeworm, Ascaris, Entamoeba, Plasmodium etc.

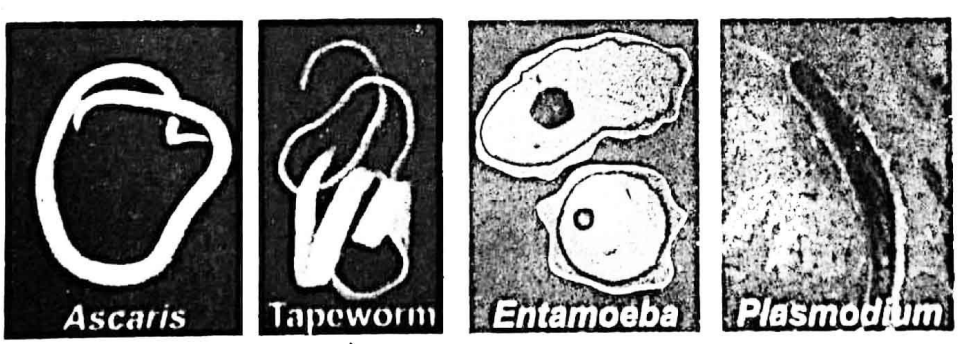


Figure 16.12: Some Endoparasites

Parasitic Plants

Some plants (e.g. Cuscuta, also called dodder) are parasites on other plants. Parasitic plants grow special types of roots (haustoria) into host body and suck the required nutrients from the vascular tissues of host.

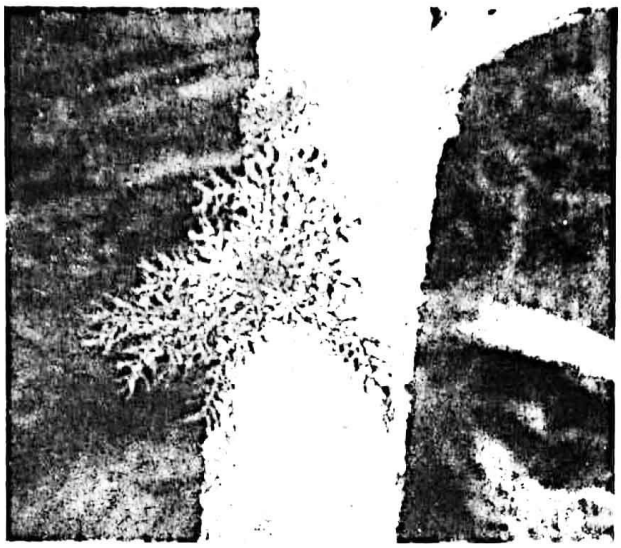


Figure 16.13: A parasitic plant and its host tree trunk

Types of Parasitism

a) Temporary Parasitism

In temporary parasitism, the parasite spends most of its life cycle as independent free- living organisms. Only a part of its life cycle is spent as a parasite. Leech, bed bug, mosquito are common temporary parasites of humans.

b) Permanent Parasitism

In permanent parasitism, the parasites spend their whole life cycles as parasites. Many disease causing bacteria and all viruses are permanent parasites.

B) Mutualism

The type of symbiosis in which both partner get benefit from each other and neither is harmed.

Examples

(i) Termites eat wood but are unable to digest it. A protozoan called zooflagellate lives in its intestine. It secretes 'cellulase' enzyme to digest the cellulose of wood. In turn, the termite provides food and shelter to the protozoan.

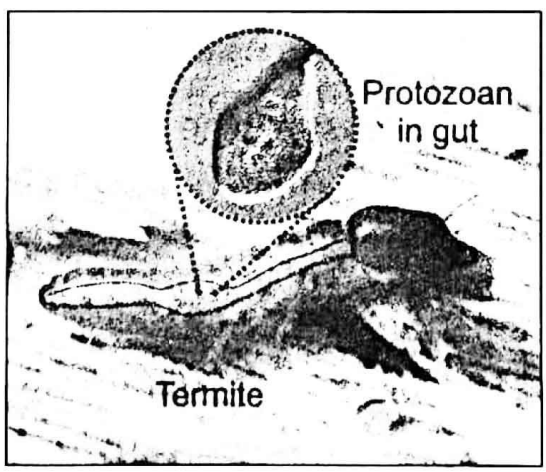


Figure 16.14: Termite, with a Protozoan in its gut

(ii) The nitrogen fixer bacteria *Rhizobium* live in the root nodules of leguminous plants like pea, gram etc. The bacteria obtain food and shelter from plants while in return they fix gaseous nitrogen into nitrates for the plant which is required for their growth.

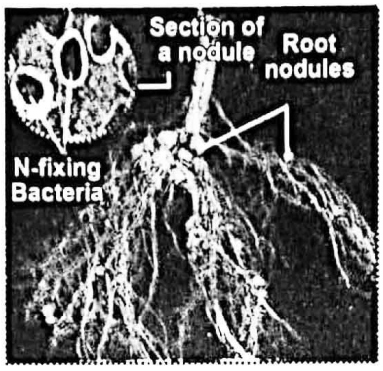


Figure 16.15: Bacteria in Root Nodules

C) Commensalism

It is a type of symbiosis in which one partner is benefited while the other is neither benefited nor harmed.

Examples

i. Epiphytes are small plants found growing on other larger plants for space only. They absorb water and minerals from the atmosphere and prepare their own food. The larger plants are neither benefited nor harmed in any way.

ii. Sucker fish attaches to the surface of sharks by its sucker. In this way, the shark provides easy transport to the sucker fish to new feeding grounds.

Figure 16.16 (a): An Epiphyte Orchid Plant Growing on a Tree Trunk.

Figure 16.16 (b): A Sucker Fish Attached with Shark

iii. An example of commensalism (Honey Guide bird and Badger)

The honey guide bird feeds on wax and the larvae present in honeycombs. It flies around looking for honeycombs, but it is not strong enough to open the comb. Badgers are large mammals that feed on honey. When a honey guide bird goes to find honeycombs, the badger follows it. When

the bird find a honeycomb, it calls the badger. Sometimes the bird has to stop and wait for the slow-moving badger. After reaching there, the badger open the honeycomb and both of them eat their foods together. Traditionally, humans have also used these birds to find honeybee colonies.

Q. 9 Explain Ecosystem Balance and Human Impact.

Ans: (a) Interaction among organisms

The interactions among organisms and between organisms and their abiotic components of their environment produce steady and balanced ecosystem.

(b) Biogeochemical cycles

Biogeochemical cycles also maintain the balance in ecosystems by recycling natural resources, so that they do not deplete.

(c) Disturbance of the balance in ecosystem

Humans try to modify environment (e.g. cutting of trees) to fulfill their needs. This has upset the delicate balance in ecosystems and nature as well. Some of the human impacts on the balance of ecosystems and nature are described as follows;

1. Global Warming

(a) Process of temperature increase

The addition of greenhouse gases (e.g. carbon dioxide, methane, ozone) in atmosphere increases the temperature of the earth. These gases in the lowest part of Earth's atmosphere do not allow solar radiations to reflect back into space. As a result, heat remains within the Earth's atmosphere and increases its temperature. This is called global warming.

(b) Effect of global warming

Due to global warming, polar ice-caps and glaciers are melting faster than the time taken for new ice layers to form. Sea water is also expanding causes sea level to rise. Due to melting glaciers, rivers overflow and cause floods.

(c) Threat to the Maldives' Survival

Scientists fear that the sea level is rising up to 0.9 cm a year. Rise in sea level has worst effects on coastal countries. Most of the islands of the Maldives are less than 1 metre above sea level. It is estimated that within 100 years, the Maldives might become uninhabitable and the citizens would be forced to evacuate.

(d) Green House Effect

It refers to the phenomenon in which certain gases (Carbon dioxide, methane, nitrous oxide) called greenhouse gases trap heat in the atmosphere. These gases act like the glass in a green house, which does not allow the inner heat to escape. When sunlight reaches the surface of the earth, much of its energy is transformed into heat energy. The earth surface reflects this heat energy towards space as infrared radiation. The greenhouse gases trap these and send it back to earth which increases temperature.

2. Acid rains

Certain chemicals such as oxides of sulphur and nitrogen when react with water vapours in the presence of sunlight to form sulphuric acid and nitric acid. These acids remain as vapours at high temperatures. As temperature falls, the acids begin to condense into liquid form and mix with rain or snow. On the way down to the earth, this makes rain acidic with pH range of 3-6.

Effects of acid rains

1) Lowering in pH

Acid rain destroys the necessary nutrients present in the water of rivers and lakes etc. It also lowers the pH of water. Most of the aquatic animals cannot survive at this pH.

2) Damages to Plants

Acid rain washes nutrients out of soil, damages the bark and leaves of trees and harms root hairs. Leaf pigments (chlorophyll) are also destroyed.

3) Corrosion on Metallic surfaces

Metallic surfaces exposed to acid rain are easily corroded. Fabrics, paper and leather products also lose their material strength.

4) Weakening on Building Material

Building materials such as limestone, marble, dolomite, mortar and slate are weakened with acid rains because of formation of soluble compounds. The building of famous Taj Mahal has been corroded at many places, due to acid rains.

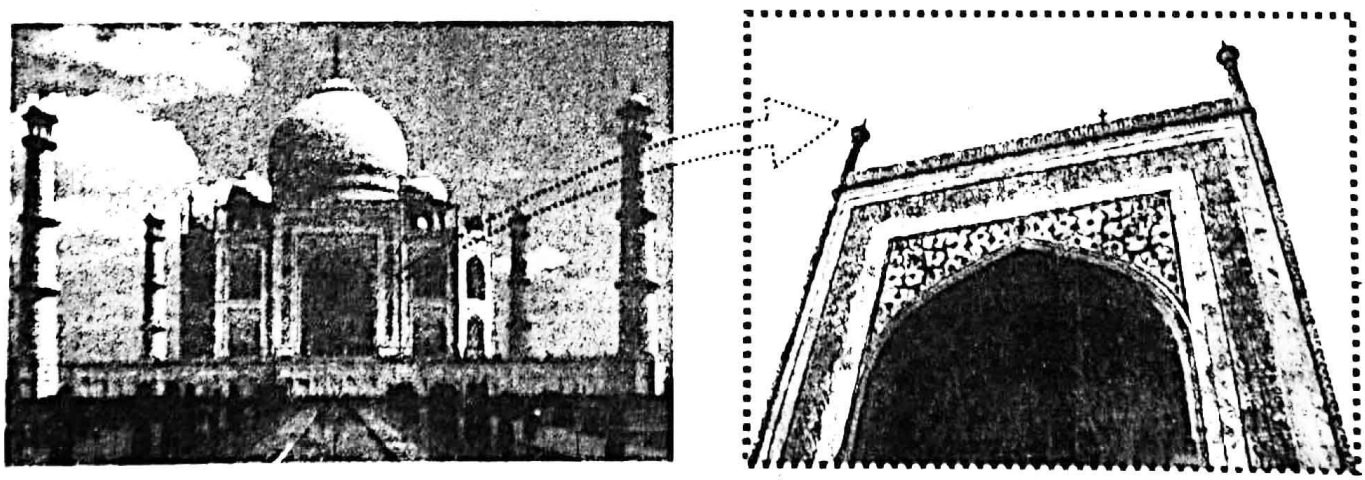


Figure 16.17: Taj Mahal and its Corroded Door

3. Deforestation:

Definition

Deforestation means clearing of forests by natural causes or humans.

Causes of deforestation

- Large areas of forests have been cleaned for agriculture, factories, roads, rail tracks and mining.
- Humans cut trees for getting wood (lumber), which is then used for making structures and for heat production.
- Human preys upon forest animals, which are the predators of many insect pests. In this way, insect pests destroy forests by eating the shoots and spreading diseases.

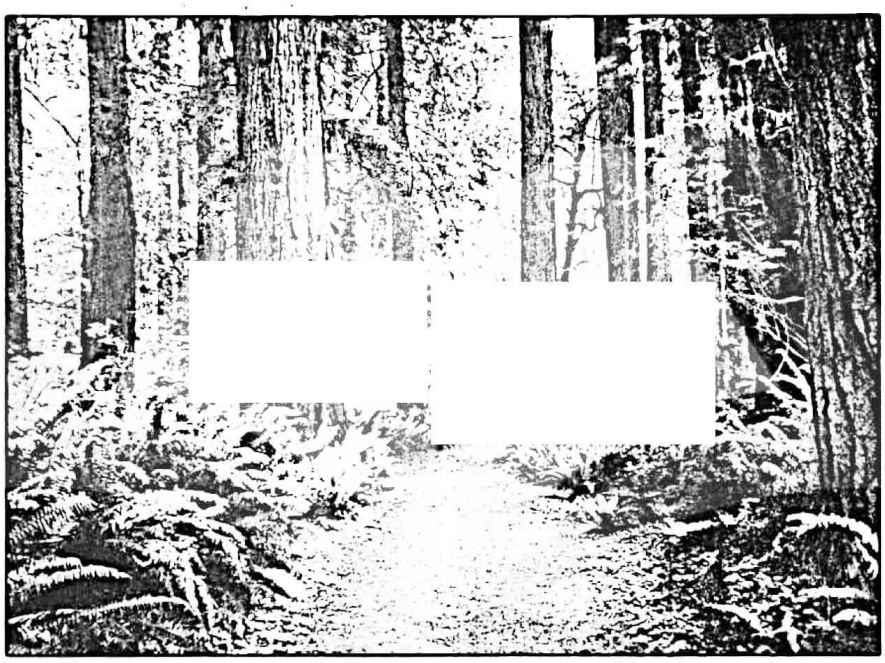


Figure 16.18: Forests are Cut for Making Roads

Effects of deforestation

- Floods
- Droughts
- Landslides
- Soil erosions
- Global warming
- Loss of habitat of many species

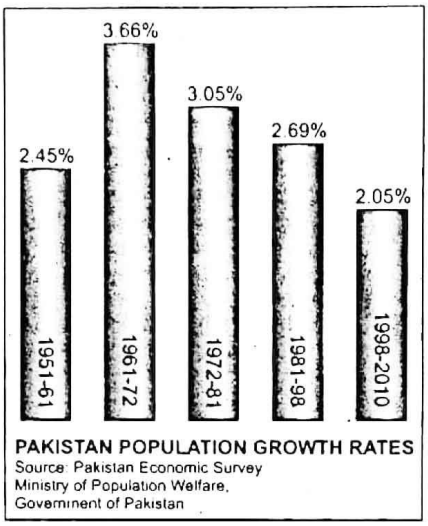
4. Overpopulation

Growth of population

When the industrial revolution started some 250 years ago, the world population was 600 million that time seems like a lot of people but now the world population is almost ten times at 6 billion and will grow to 8 billion by 2025.

Causes of Overpopulation

Better health facilities and lowered mortality rates have contributed in population growth.



PAKISTAN POPULATION GROWTH RATES
Source: Pakistan Economic Survey
Ministry of Population Welfare,
Government of Pakistan

Year	Population	Year	Population
1981	85,096,000	1999	132,790,000
1984	92,284,301	2002	144,902,409
1987	99,953,232	2005	155,772,000
1990	107,975,060	2008	166,111,487
1993	116,444,165	2009	169,708,303
1996	126,409,851	2010	173,510,000

The Population of Pakistan
Source: The World Bank

5. Urbanization:

Definition

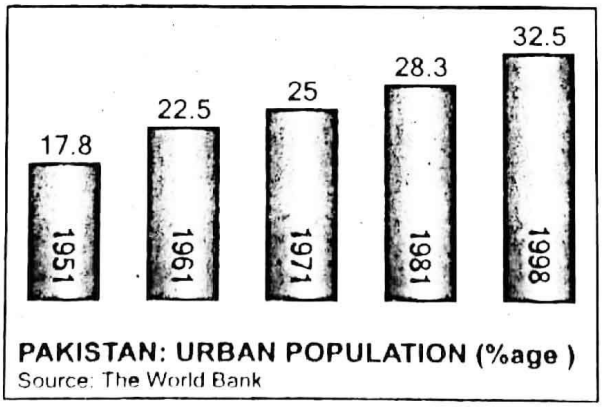
Urbanization means growing of cities.

Cause of urbanization

People move from rural areas to cities in search of better jobs, education opportunities and higher standards of living.

Effects of rapid urbanization

1. If there is rapid urban growth, the governments find it difficult to provide even the basic facilities like health, education, shelter, water, electricity etc.
2. Most of the migrants in cities do not find good jobs and become the part of urban poor.
3. There is overcrowding in schools, hospitals etc.
4. The slum areas increase in number and people living there are at greater risk of diseases.



PAKISTAN: URBAN POPULATION (%age)
Source: The World Bank

Methods to solve problems created by urbanization

Urbanization is a global problem and cannot be stopped but it can be managed. The current level of urbanization in Pakistan is about 32% which is not high by global standards. A planned urbanization can solve many problems.

1. The cities should have thick green belts in their surroundings to control pollution.
2. The open spaces in cities should be reserved through zoning and land plans.
3. The urban spread out should also be controlled.
4. Utilization of public transport instead of individual transports also proves effective way to manage urbanization.

Q. 10 Define and explain different types of Pollution.

Ans. Definition

Pollution is defined as any undesirable change in the physical, chemical or biological characteristics of air, water and land that may harmful for humans, other living organisms and natural resources.

Pollutants

The agents which are responsible for pollution are called pollutants.

Types of Pollutants

Pollutants are of two types i.e. biodegradable and non-biodegradable.

Sources of pollutants

They may be the industrial effluents, domestic wastes, medical wastes.

Examples

CO_2, CO, SO_2, CFCs etc.

Types of Pollution

A) Air Pollution

Definition

It is defined as the change of composition in the air by the addition of harmful substances (e.g. industrial and automobile gases and particulate matter).

Sources of Air Pollution

All sources of air pollution are related to human activities. Burning of coal produces a lot of smoke and dust whereas burning of petroleum produces sulphur dioxide. In addition to these, air pollutants include the carbon monoxide, carbon dioxide, nitrogen oxides, hydrocarbons, particulate matter and traces of metals. Different industries produce air pollution in the following ways:-

- **Fertilizer Industries**

  Fertilizer industries release oxides of sulphur and nitrogen, hydrocarbons, particulate matter and fluorine.

- **Thermal Industries**

  Thermal industries are coal based and their pollutants are fly ash, soot and sulphur dioxide.

- **Textile Industries**

  Textile industries release cotton dust, nitrogen oxides, chlorine, smoke and sulphur dioxide.

- **Steel Industries**

  Steel industries release carbon monoxide, carbon dioxide, sulphur dioxide, phenol, fluorine, cyanide, particulate matter etc.

Effects of air Pollution (Board 2013)

1. Global Warming

It is known that global warming is one of the consequences of air pollution. According to estimates, at the current rate of increase, the average global temperature will go up by 3°C to 8°C in next 100 years. Other effects of air pollution are as follows;

2. Smog Formation

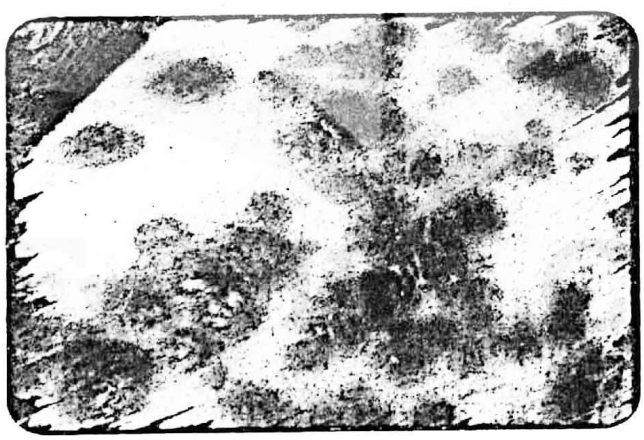
When pollutants like hydrocarbons and nitrogen oxides combine in the presence of sunlight, smog is formed. This is a mixture of gases. It forms a yellowish brown haze especially during winter and hampers visibility. It also causes many respiratory disorders and allergies as it contains polluting gases.

3. Acid Rains

The air pollutants like sulphur dioxide and nitrogen oxides react with water vapours in the atmosphere producing acid rains.

4. Ozone Depletion

Upper layer (stratosphere) of the atmosphere has ozone (O_3) which absorbs ultraviolet rays present in the sun's radiations. However the air pollutants like chlorofluorocarbons (CFCs) destroy the ozone molecules and so break the ozone layer. Ozone holes are created which permit UV rays to reach the Earth's surface. The UV rays increase the temperature and also cause skin cancers.



The harmful effects of the UV rays are visible in the countries such as Australia and New Zealand where the rate of skin cancer is higher than the other regions of the world.

Control of Air Pollution

For effective control of air pollution, it is important to create public awareness about the ill effects of air pollution. Air pollution can be controlled by following ways:

1) Afforestation

It means the establishment of new forests by planting on non-forest areas. Forests are effective means to control air pollution because plants can filter and absorb air pollutants.

2) Modification of industrial effluents

The air pollutants coming from industries should be passed through filters and other devices, so that the particulate matter is removed before the waste gases are released out. The smoke producing units should have long chimneys to take the polluting gases far above and then disperse over a larger area. Industries should also invest for solar cookers or for producing bio gas.

3) Environment friendly fuels

Lead-free fuels should be used in automobiles. Similarly sulphur-free fuel should be used in coal-based industry to reduce pollution by sulphur dioxide.

B) Water Pollution

Definition

It is the change in the composition of water by the addition of harmful substances. Water pollution severely affects the health of people.

Sources of Water Pollution

- **Sewage**

Sewage is one of the major pollutants of water. It contains organic matter and the excreta of humans and other animals. Organic matter encourages the growth of micro-organisms which spread diseases.

- **Industrial Wastes**

i. The wastes of industries (acids, alkalis, dyes and other chemicals) are disposed in nearby water bodies. These wastes change the pH of water and are harmful or even fatal to aquatic organisms.

ii. Certain industries release a lot of hot water from their cooling plants. It results in heating up of water bodies and kills aquatic life.

- **Fertilizers and Pesticides**

Fertilizers and pesticides enter into water bodies with the rain water flow and the ground water by seepage. These chemicals remain in water for a long time and can enter food chains. They cause a number of diseases in animals.

- **Petroleum Hydrocarbons**

Oil tankers and offshore petroleum refineries cause oil leakage into water. Oil floats on the water surface and prevents atmospheric oxygen from mixing in water. So, aquatic animals begin to die due to shortage of oxygen.

- **Heavy Metals**

Some heavy metals e.g. Lead, Mercury, Arsenic and Cadmium also make the water polluted. Such metals can be present in the water, released from industrial and urban areas. If water with such heavy metals is given to plants, the metals enter the vegetables that grow on these plants. Such contaminated vegetables are harmful for human health.

Diseases in humans

i. Heavy metals reduce growth and development, and cause cancer and nervous system damage.

ii. Mercury and Lead can cause joint diseases such as rheumatoid arthritis, diseases of Kidneys, circulatory system and nervous system.

Tanneries

There are more than 200 tanneries (industry where raw skin is treated to make leather) operating in Kasur city.

(a) Industrial Discharge

The industry discharges 9000 cubic meters of water daily into the nearby water bodies. This water contains heavy metals and becomes the part of the underground water.

(b) Effects

(i) In 2003, a survey showed that two-thirds of residents and 72% of tannery workers suffered cancer, infections of the Kidneys, or loss of eyesight.

(ii) Tests showed that the drinking water was contaminated with Lead, Mercury and Chromium.

(c) Kasur Tannery Pollution control project

Pakistan government and the United Nations development programme (UNDP) launched the Kasur tannery pollution control project. The project has established an effluent treatment plant, chromium plant and a solid waste disposal site.

Effects of water pollution

The followings are the major effects of water pollution.

I. Eutrophication

Enrichment of water with inorganic nutrients (nitrates and phosphates) is called eutrophication. The sewage and fertilizers contain large amount of inorganic materials. When sewage and fertilizers reach water bodies, the nutrients present in them promote algal blooms (excessive growth) there. Rich algal growth leads to increase in the number of decomposers.

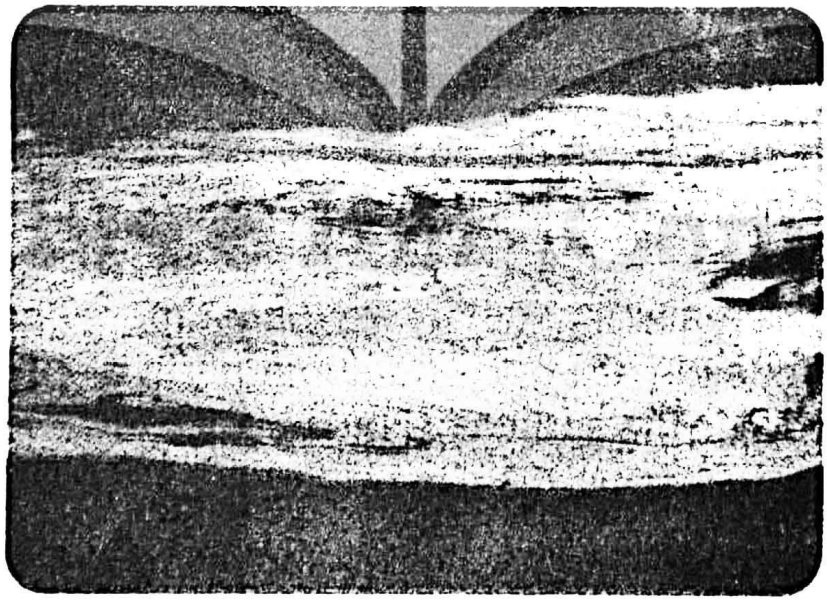


Figure 16.19: Eutrophication in a Lake

Harmful effects of eutrophication

1) Decomposers use the oxygen present in water and it results in the depletion of oxygen.

2) Algal bloom also reduces the light reaching the lower layers of water.

II. Food chain Contamination

The non-biodegradable water pollutants may stay in water for long times. From water, they enter into small organisms, which are fed upon by fish. The fish in turn are fed upon by land animals including humans.

III. Epidemics

Organic pollutants in water facilitate the growth of germs. Such polluted water causes epidemics like cholera, gastroenteritis etc.

Control of Water Pollution

The following methods should be used to control water pollution:

1) Public should be made aware of the dangers of water pollution.
2) Before releasing the sewage into water bodies, it must be treated through sewage treatment techniques.
3) Industrial wastes should also be treated before they are released into water bodies.

C) Land Pollution

Definition

It is the change in the composition of land (soil) by the addition of harmful substances.

Land is an important resource as it is the basis for the growth of producers. In the recent times, soil has been subjected to the pollution.

Causes of Land Pollution

1) The pesticides used in agriculture have chemicals that stay in soil for long times.
2) The acid rains change the pH of soil making it unsuitable for cultivation.
3) The household and other city garbage lies scattered in soil in the absence of a proper disposal system.
4) Materials like polythene block the passage of water into soil and so decrease the water holding capacity of soil.

Figure 16.20 Can We Control Land Pollution?

5) Many industries produce harmful chemicals which are disposed off without being treated.
6) Improper disposal of nuclear wastes also causes radioactive substances to remain in soil for a long time.
7) Open latrines in villages and some part of the cities are also the source of land pollution.

Control of Land Pollution

- There should be suitable and safe disposal of wastes including nuclear wastes.
- Non- biodegradable materials like plastic, glass, metals etc. should be recovered and recycled.
- Inorganic pesticides should be replaced by organic pesticides.

D) Noise Pollution

Definition

Unwanted, unpleasant and annoying sounds are termed as noise. Noise is also considered as a form of pollution.

Effects

Annoyance and aggression, hearing loss, depression, hypertension etc.

Q.11. Explain Conservation of Nature.

Ans. Definition

Conservation of nature means the conservation of natural resources. Everything that we use or consume e.g. food, petrol etc. is obtained from natural resources.

Types of resources

a. Renewable natural resources

b. Non-renewable resources

a) Renewable natural resources

The renewable natural resources e.g. air is reproduced easily.

b) Non-renewable resources

The non-renewable resources (e.g. minerals and fossil fuels) are not replenished once they get depleted. We have to conserve the non-renewable resources because their reserves are limited and humans are heavily dependent on them for daily needs. The renewable resources too have to be judiciously used. To ensure sustainable use of resources in our environment, we should act upon the principle of 'The 3R' i.e. Reduce, Reuse and Recycle.

The R1: Reduce

We should use the natural resources less and should not waste them. We should use this principle at different places, in our daily lives. We should not waste water, electricity, fuel etc. We should turn off the tap when not in use. We should bath with a bucket instead of shower. The lights and fans should be off when we are not in room. We should take public transport or walk short distances instead of using motor fuel. We should not waste food and should give unused food to poor people.

The R2: Reuse

We should use things again and again. We should not throw away materials such as glass containers, plastic bags, paper, cloth etc. These should be reused at domestic levels rather than being thrown. It also reduces solid waste pollution.

A recycling of one tonne of paper can save 17 trees.

The R3: Recycle

Materials such as paper, plastic, glass etc. can be recycled. This decreases the volume of refuse and helps in conservation of natural resources.

The R4: Reforest

Trees should be planted. Trees make our environment more cool, shady and green.

Plans for the Conservation of Nature

The following are the projects and plans of our government for the conservation of other resources.

1- National Conservation Strategy

In 1992, Pakistan developed the National Conservation Strategy. The main objectives of this strategy are conservation of natural resources and improved efficiency in the use of resources. It also covers the policies for promoting efficiency and conservation of energy resources.

2- National Drinking Water and Sanitation Policy

The Federal Ministry of Environment has launched the national Drinking Water and Sanitation Policy. It focuses on the provision of clean drinking water to entire population and the conservation of the water resources. Water purification plants are being installed all over the country.

3- Mass awareness for water Conservation and Management

In 2006, the UNDP (UN Division for Sustainable Development) launched the project "Mass Awareness for Water Conservation and Management". The objective of the project was to launch a comprehensive awareness campaign for the conservation and management of water resources in Pakistan.

4- Society for conservation and protection of Environment

The organization SCOPE (Society for Conservation and Protection of Environment) works with the government for mass awareness and research of the conservation of natural resources in Pakistan.

Clean water, air, fuels, agricultural land and forests appeared to be plentiful earlier, but now these are becoming scarce. If we continue depleting them like this, we will be creating untold misery for ourselves and for our future generations.

Role of WWF

The WWF (old name is World Wildlife Fund but now it is called World Wide Fund for Nature) is working on many projects related to the conservation of nature. The following are some important programmes of WWF-Pakistan (in collaboration with the government of Pakistan).

1) Improving sub-watershed management and environmental awareness around Ayubia National Park.
2) Plantation of trees of Jatropha and Mangroves at District Thatta, Sindh.
3) District-wise forest covers assessment of Pakistan.
4) Saving Wetlands Sky High Programme (for the conservation and management of high altitude wetlands).
5) Indus Basin Water Security Project (to protect the water-flow needed for the maintenance of river ecosystem and for the benefit of nearby areas).
6) Regional Climate Risk Reduction in Himalayas.

Q.12 Write a note on Dengue Fever.

Ans: Introduction

It is a viral infection transmitted through a mosquito *Aedes aegypti.*

Occurrence

It has become a major health problem in tropical and sub-tropical countries, including Pakistan.

Types of Dengue Virus

There are four types of dengue viruses. Recovery from infection by one provides lifelong immunity against that virus but provides no protection against infection by the other three.

Dengue Infection per year

According to WHO, there are 50 million dengue infections worldwide every year. Now there are 2.5 billion people at risk from dengue.

Spreading

The female *Aedes* mosquito gets the virus when it bites an infected person. When an infected mosquito bites another person, viruses enter his/her blood and attack white blood cells. Inside WBCs, viruses reproduce and destroy them.

In severe cases, the virus affects liver and bone marrow. As a result there is a decrease in the production of blood platelets and patient suffers from bleeding.

Other symptoms

High fever, severe headache, pain behind eyes, muscle joint pains and rash

Adult → Eggs of Aedes → Larva of Aedes → Pupa of Aedes

DHF and DSS

Sometimes, dengue fever converts into dengue haemorrhagic fever (DHF) or into dengue shock syndrome (DSS). DHF results in bleeding, low levels of blood platelets and blood plasma leakage. In DSS, the blood pressure falls dangerously low.

Treatment

There is no vaccine or treatment for dengue fever.

Control

(a) Check the spreading of *Aedes*

At present, the only method of controlling dengue virus transmission is to check the spread of *Aedes* mosquitoes. *Aedes aegypti* breeds primarily in the containers used for water storage, discarded plastic containers, used automobile tyres and other items that collect rainwater.

(b) Proper solid waste disposal

The mosquitoes can be controlled through proper solid waste disposal and improved water storage practices.

(c) Killing the Larvae of the Mosquito

Small fish and crustaceans have also been used for killing the larvae of the mosquito. Insecticide sprays have not proved efficient in killing the mosquitoes because spray does not penetrate all habitats of adult mosquitoes.

Multiple Choice Questions

1) **Which of the following is the abiotic component of an ecosystem?**
   (a) Producers (b) Herbivores
   (c) Carnivores (d) Oxygen

2) **When we eat the onion, our trophic level is;**
   (a) Primary consumer
   (b) Secondary Consumer
   (c) Decomposer
   (d) Producer

3) **Identify the correctly matched pair:**
   (a) Rainfail- biotic factors in ecosystem
   (b) Global warming- formation of fossil fuels
   (c) Renewable natural resources-air
   (d) Corn- secondary consumer

4) **In the food chain tree --- caterpillar --- robin --- hawk --- coyote, which is secondary consumer?**
   (a) Caterpillar (b) Robin
   (c) Hawk (d) Coyote

5) **In an ecosystem the flow of _____ is one way, while _____ is/are constantly recycled.**
   (a) Minerals, energy
   (b) Energy, minerals
   (c) Oxygen, energy
   (d) Glucose, water

6) **In the food chain "grass --- rabbit --- fox --- bear --- mushroom", how many types of decomposers are present?**
   (a) 1 (b) 2
   (c) 3 (d) 4

7) **Organisms in the ecosystem that are responsible for the recycling of plant and animal wastes are;**
   (a) Consumers (b) Producers
   (c) Decomposers (d) Competitors

8) **Which form of Nitrogen is taken by the producers of the ecosystem?**
   (a) Nitrogen gas (b) Ammonia
   (c) Nitrites (d) Nitrates

9) **The type of environment in which a particular species lives is called;**
   (a) Ecosystem (b) Habitat
   (c) Biosphere (d) Community

10) **Which of the following organisms are decomposers?**
   (a) Fungi (b) Algae
   (c) Bacteria (d) Both a & c

11) **The lowest trophic level of an ecosystem always includes:**
   (a) Herbivores (b) Carnivores
   (c) Producers (d) Decomposers

12) **Habitat destruction can result in a loss of:**
   (a) Species (b) Population
   (c) Community (d) Ecosystem

13) **The type of symbiotic relationship in which one member get benefit and other is unaffected is called:**
   (a) Parasitism (b) Mutualism
   (c) Commensalism (d) Predation

14) **Which one is not an example of abiotic factor?**
   (a) Decomposers (b) Light
   (c) Water (d) Soil

15) **An organism that actively hunts other organisms is called:**
   (a) Prey (b) Predator
   (c) Parasite (d) Host

16) **The type of symbiotic relationship in which one member get benefit and other is harmed is called:**
   (a) Parasitism (b) Mutualism
   (c) Commensalism (d) Predation

17) **Organisms that make their own food with help of sunlight, CO_2 and H_2O are called;**
(a) Consumers (b) Producers
(c) Decomposers (d) Predators

18) **The conversion of ammonia to nitrates is carried out by soil bacteria. This process is called:**
(a) Nitrification
(b) Denitrification
(c) Nitrogen fixation
(d) Assimilation

19) **A group of organisms, similar to one another, which can interbreed in nature and produce fertile offspring:**
(a) Species (b) Genus
(c) Family (d) Population

20) **Water, soil, air, temperature, wind and sunlight are examples of:**
(a) Biotic factors (b) Biomass
(c) Environment (d) Abiotic factors

21) **A relationship between two organisms in which individual of one species may kill and eat individuals of other species is called:**
(a) Symbiosis (b) Competition
(c) Predation (d) Mutualism

22) **A relationship between species in which both species benefit is called:**
(a) Parasitism (b) Mutualism
(c) Symbiosis (d) Commensalism

23) **The self-sufficient unit of an environment that is formed as a result of interaction between its biotic community and its abiotic components is known as:**
(a) Biosphere (b) Habitat
(c) Ecosystem (d) Food web

24) **A network of all the feeding relationships in an ecosystem is called:**
(a) Food chain (b) Food web
(c) Trophic level (d) Energy flow

25) **The thickness of biosphere is:**
(a) 02 km (b) 20 km
(c) 50 km (d) 200 km

26) **-------- get solar energy and transform it into chemical energy by the process of photosynthesis.**
(a) Decomposers (b) Producers
(c) Consumers (d) Predators

27) **The materials flow from one trophic level to the next by means of;**
(a) Food chains (b) Food web
(c) Both a & b (d) None

28) **The base of food chain is always formed by;**
(a) Producers (b) Consumers
(c) Decomposers (d) Heterotrophs

29) **In 1927, ---------- developed the concept of ecological pyramids.**
(a) Kelvin
(b) Lamarck
(c) Charles Elton
(d) Charles Darwin

30) **_____ atom is the principal building block of many kinds of biomolecules.**
(a) Oxygen (b) Carbon
(c) Hydrogen (d) Nitrogen

31) **Which one of the following is not an example of fossil fuels?**
(a) Plants (b) Peat
(c) Coal (d) Natural Gas

32) **The major process that brings carbon from atmosphere into living world is:**
(a) Photosynthesis (b) Respiration
(c) Both a & b (d) None

33) **Nitrogen is an important component of:**
(a) Proteins (b) Nucleic Acid
(c) Lipids (d) Both a & b

34) **___ is the breakdown of the proteins of dead organisms to ammonia.**
(a) Ammonification
(b) Nitrification
(c) Denitrification
(d) None

35) **The utilization of nitrates by organisms is called:**
(a) Nitrification
(b) Ammonification
(c) Assimilation
(d) Denitrification

36) **Which one of the following is not a temporary parasite?**
(a) Mosquito (b) Virus
(c) Leech (d) Bed bug

37) **Which one of the following is not an endoparasite?**
(a) *Ascaris* (b) Plasmodium
(c) *Entamoeba* (d) Mosquito

38) **An epiphyte is an example of:**
(a) Parasitism (b) Mutualism
(c) Commensalism (d) Symbiosis

39) **Which one is an example of epiphyte?**
(a) Mosquito (b) Orchid
(c) Rhizobium (d) Plasmodium

40) **Which of the following is not an example of green house gas?**
(a) CO_2 (b) Methane
(c) Oxygen (d) Nitrous Oxide

41) **The current level of urbanization in Pakistan is about _____ which is not high by global standards.**
(a) 23 % (b) 32 %
(c) 36 % (d) 39 %

42) **Abiotic component of ecosystem is;** (Board 2013)
(a) Producers (b) Herbivores
(c) Carnivores (d) Oxygen

43) **A symbiotic interaction in which both partners get benefits;** (Board 2013)
(a) Mutualism
(b) Commensalism
(c) Parasitism
(d) Predation

44) **The consumers that eat animal flesh as well as plants and plant products are called:** (Board 2013)
(a) Herbivores (b) Carnivores
(c) Omnivores (d) Insectivores

45) **Living of nitrogen fixer bacteria in the root nodules of leguminous plants is an example of;** (Board 2013)
(a) Predation
(b) Parasitism
(c) Mutualism
(d) Commensalism

46) **The perfect cycle is;**
(a) Carbon cycle
(b) Nitrogen cycle
(c) Water cycle
(d) All of the above

47) **Nitrogenous waste includes;**
(a) Ammonia
(b) Urea
(c) Uric acid
(d) All of the above

48) **Plants show competition for;**
(a) Space
(b) Light
(c) Water and Minerals
(d) All of the above

49) **Flow of energy is always;**
(a) Unidirectional
(b) Two directional
(c) Multidirectional
(d) No directional

50) **IPCC stands for;**

(a) International project of climate change
(b) Intergovernmental Project of climate change
(c) Intergovernmental panel on climate change
(d) International panel on climate change

51) **The temperature of Earth's surface has increased _____per decade in the past 30 years;**

(a) 0.1°C (b) 0.2°C
(c) 0.3°C (d) 0.4°C

52) **Since 1800, amount of CO_2 in atmosphere has increased about;**

(a) 20% (b) 30%
(c) 40% (d) 50%

53) **Since 1800, amount of nitrous oxide has increased about;**

(a) 2% (b) 6%
(c) 8% (d) 10%

54) **According to estimate at the current rate of increase, the average global temperature will go upto by____ in the next 100 years.**

(a) 8°C (b) 6-8°C
(c) 3-8°C (d) 5-8°C

55) **Pakistan growth rate in 1991 was;**

(a) 2% (b) 2.50%
(c) 2.69% (d) 2.89%

56) **In 2003, a survey on tanneries in Kasur City showed that _____of residents suffered from cancer infections of kidney or loss of eyesight.**

(a) $\frac{1}{4}$ (b) $\frac{2}{3}$
(c) $\frac{1}{3}$ (d) $\frac{2}{4}$

57) **Recycling of one tonne paper can save.**

(a) 10 trees (b) 15 trees
(c) 18 trees (d) 17 trees

58) **_____people are at risk of dengue.**

(a) 1.5 billion (b) 2.5billion
(c) 3.5 billion (d) 2.5 million

59) **Scientists fear that sea level is rising upto _____per year.**

(a) 0.8 cm (b) 10 cm
(c) 0.9 cm (d) 9 cm

60) **It is estimated that Maldives might become uninhabitable within;**

(a) 50 years (b) 80 years
(c) 100 years (d) 130 years

61) **When living and non-living interact to produce a stable system in which exchange of material with flow of energy takes place, it forms a/an:**

(a) Environment
(b) Stable community
(c) Ecosystem
(d) Ecological succession

62) **The living organisms which cannot prepare their own food but obtain ready made food from others, are;**

(a) Primary and Secondary consumers
(b) Secondary and tertiary consumers
(c) Only primary consumers
(d) All types of Consumers.

63) **How many tanneries are operating in Kasur city;**

(a) More than 300 (b) More than 200
(c) 500 (d) 1000

64) **Upper layer of the atmosphere is called;**

(a) Biosphere (b) Lithosphere
(c) Hydrosphere (d) Stratosphere

65) **At which trophic level in a food chain, carnivores get food?**

(a) First trophic level
(b) Second trophic level
(c) Fourth trophic level
(d) Third trophic level

66) **Fungi digest the dead organic matter with the help of;**
(a) Enzymes (b) Acids
(c) Hormones (d) Bases

67) **Which is an ectoparasite?**
(a) Liver fluke (b) Ascaris
(c) Tape worm (d) Leech

68) **The favourable variations tend to be;**
(a) Eliminated
(b) Passed to next generation
(c) Unexpressed
(d) Changed

69) **Habitat is an example of;**
(a) Biological character
(b) Chemical character
(c) Physical Character
(d) Behavioural character

70) **A group of organisms which can interbreed freely in nature to produce fertile offspring is called;**
(a) Population (b) Community
(c) Species (d) Ecosystem

71) **An Aquarium is an example of Ecosystem;**
(a) Natural (b) Artificial
(c) Aquatic (d) Terrestrial

72) **Graphic representation of the number of individuals per unit area at various trophic levels of a food chain is called;**
(a) Pyramid of Biomass
(b) Pyramid of numbers
(c) Pyramid of energy
(d) Food web

73) **More than normal denitrification change the richness of soil as;16(085)**
(a) Increase (b) Less **(Board 2014)**
(c) Bad (d) Finished

74) **An example of Carnivore plants is:** **(Board 2014)**
(a) Rose plant (b) Mosses
(c) Pitcher plant (d) Ferns

Answers Key

1	d	**2**	a	**3**	c	**4**	b	**5**	b	**6**	a
7	c	**8**	d	**9**	b	**10**	d	**11**	c	**12**	a
13	c	**14**	a	**15**	b	**16**	a	**17**	b	**18**	a
19	a	**20**	d	**21**	c	**22**	b	**23**	c	**24**	b
25	b	**26**	b	**27**	c	**28**	a	**29**	c	**30**	b
31	a	**32**	a	**33**	d	**34**	a	**35**	c	**36**	b
37	d	**38**	c	**39**	b	**40**	c	**41**	b	**42**	d
43	a	**44**	c	**45**	c	**46**	a	**47**	d	**48**	d
49	a	**50**	c	**51**	b	**52**	b	**53**	c	**54**	c
55	c	**56**	b	**57**	d	**58**	b	**59**	c	**60**	c
61	c	**62**	d	**63**	b	**64**	d	**65**	d	**66**	a
67	d	**68**	b	**69**	c	**70**	c	**71**	b	**72**	b
73.	b	**74.**	c								

Short Answer Questions

Q.1 What are the different levels of ecological organization?

Ans. The different levels of ecological organization are:

(i) species (ii) population (iii) community (iv) ecosystem (v) biosphere

Q.2 Define ecosystem and its components.

Ans. The self-sufficient unit of an environment that is formed as a result of interactions between its communities and the abiotic components is called ecosystem. Its components are:

Biotic components	Abiotic components
The living parts of the environment are called biotic components. **Examples:** • Producers (Plants, Algae and Cyanobacteria) • Consumers (Animals; Protozoa) • Decomposers (Bacteria and Fungi)	The non-living parts of the environment are called abiotic components. **Examples:** • Temperature • Air • Water • Soil and Light

Q.3 How flow of energy is different from that of materials?

Ans. The flow of energy in different trophic levels of ecosystem is unidirectional while the flow of materials is two directional. It flows from one trophic level to another by means of food chains and food web.

Q.4 Define food chain. Give one example **(Board 2014)**

Ans: A food chain is a series of organisms within an ecosystem, in which each organism feeds on the one before it and is fed by one after it.

Example

Grass → Grasshopper → Sparrow → Hawk

Q.5 Define food web.

Ans: In nature, food chains are very complex, as an organism may be the food source of many other organisms. So there is a web like structure formed by these interlinked food chains. Such interconnected food chains collectively make food web. OR

It may also be defined as, "a network of food chains which are interconnected at various trophic levels".

Q.6 What do you mean by the concept of 3Rs with reference to the conservation of natural resources?

Ans: It means Reduce, Reuse and Recycle the materials. Many materials such as paper, plastic, glass etc can be recycled. This decreases the volume of refuse and helps in the conservation of natural resources.

Q.7 Define Acid rains.

Ans: Certain chemicals such as oxides of sulphur and nitrogen when react with water vapours in the presence of sunlight to form sulphuric acid and nitric acid. These acids remain as vapours at high temperatures. As temperature falls, the acids begin to condense into liquid form and mix with rain or snow, on the way down to the earth. This makes rain acidic with pH range of 3-6.

Q.8 What is ammonification?

Ans: Ammonification is the breakdown of the proteins of dead organisms and nitrogenous wastes (urea, uric acid etc.) to ammonia. It is done by ammonifying bacteria.

Q.9 What is atmospheric nitrogen fixation?

Ans: Thunderstorms and lightning convert atmospheric gaseous nitrogen into nitrous acid and nitric acid. The acids in turn combine with other salts to produce 'nitrates' this is called atmospheric nitrogen fixation.

Q.10 What are biogeochemical cycles. **(Board 2013-14)**

Ans: Biogeochemical cycles are the cyclic pathways through which materials move from environment to organisms and back to the environment. e.g. carbon cycle, nitrogen cycle etc.

Q.11 What is biological nitrogen fixation?

Ans: Some bacteria also have the ability to transform gaseous nitrogen into nitrates. It is called biological nitrogen fixation. Some of these nitrogen fixing bacteria live as symbionts and many are free living.

Q.12 Define Biosphere. **(Board 2014)**

Ans: All ecosystems of the world together form the biosphere. It includes all the ecosystems of the earth. In other words, the biosphere consists of all organisms present on the earth and all regions of the earth where they live. Biosphere ranges from the floor of oceans to the top of the highest mountains. It is about 20 km thick.

Q.13 What is carbon cycle?

Ans: The biogeochemical cycle in which carbon flows between organisms and the environment is called carbon cycle.

Q.14 What are carnivores? Write the types of carnivores.

Ans: Those animals that feed upon other animals are called carnivores.

Types of carnivores

a) **Primary carnivores**

Those carnivores that feed upon herbivores are called primary carnivores.

Examples

Fox, frog, predatory birds, many fishes and snakes.

b) **Secondary carnivores**

Those carnivores that feed upon primary carnivores are called secondary carnivores.

Examples

Wolf and owl etc.

c) **Tertiary carnivores**

Those carnivores that feed upon secondary carnivores are called tertiary carnivores. They are not eaten by any other animals. So they are also called top carnivores.

Examples

Lion, Tiger etc.

Q.15 Define commensalism with examples. **(Board 2014)**

Ans: It is a type of symbiosis in which one partner is benefited while the other is neither benefited nor harmed.

Example

Epiphytes are small plants found growing on other larger plants for space only. They absorb water and minerals from the atmosphere and prepare their own food. The larger plants are neither benefited nor harmed in any way.

Q.16. Differentiate between intraspecific competition and interspecific competition.

Ans:

Intraspecific competition:	**Interspecific competition:**
The competition between the members of the same species are called Intraspecific competition.	The competition between the members of different species are called Interspecific competition.

Q. 17 What are consumers?

Ans: These are the heterotrophs in an ecosystem. These organisms are unable to synthesize their food and so depend upon producers for food. The animals are the major consumers of all the ecosystems.

Examples

Animals, Fungi, Protozoans and many of the Bacteria.

Q.18 What are decomposers?

Ans: Those organisms that break down the complex organic compounds of dead matter (of plants and animals) into simple compounds. They secrete digestive enzymes into dead and decaying organic matter to digest the organic material. Products of digestion are absorbed for their own use and remaining substances are added to the environment for reuse.

Examples

Bacteria and fungi

Q.19 Define Deforestation and describe its causes.

Ans: Deforestation means clearing of forests by natural causes or humans.

Causes of deforestation

- Large areas of forests have been cleaned for agriculture, factories, roads, rail tracks and mining.
- Humans cut trees for getting wood (Timber), which is then used for making structures and for heat production.
- Human preys upon forest animals, which are the predators of many insect pests. In this way insect pests destroy forests by eating the shoots and spreading diseases.

Effects of deforestation

- Floods
- Droughts
- Landslides
- Soil erosions
- Global warming
- Loss of habitat of many species

Q.20 What is meant by denitrification? **(Board 2013)**

Ans: It is a biological process in which nitrites and nitrates are reduced to gaseous nitrogen by denitrifying bacteria. In this way, nitrogen is returned to the atmosphere.

Q.21 What is ecological pyramid?

Ans: Ecological pyramid can be defined as, "A representation of the number of individuals or amount of biomass or energy present in various trophic levels of a food chain".

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Q.22 Define environment.

Ans: An organism's environment is the sum of physical (abiotic) and biological (biotic) conditions which influence that organism.

Q.23 What is eutrophication?

Ans: Enrichment of water with inorganic nutrients (nitrates and phosphates) is called eutrophication.

Q.24 What is Global Warming and describe its effects.

Ans: The addition of greenhouse gases (e.g. carbon dioxide, methane, ozone) in atmosphere increases the temperature of the earth. Gases in the atmosphere do not allow solar radiations to reflect back into space. As a result, heat remains within the earth's atmosphere and increases its temperature. This is called global warming.

Effect of global warming

Due to global warming, polar ice-caps and glaciers are melting faster than the time taken for new ice layers to form. Sea water is also expanding causes sea level to rise due to melting glaciers, rivers overflow and cause floods.

Q.25 Differentiate between intraspecific interactions and interspecific interactions.

Ans:

Intraspecific interactions	Interspecific interactions
The interactions between the members of the same species are called Intraspecific interactions.	The interactions between the members of different species are called Inerspecific interactions.

Q.26 Define mutualism. **(Board 2014)**

Ans: The type of symbiosis in which both partner get benefit from each other and neither is harmed.

Example

Termites eat wood but are unable to digest it. A protozoan lives in its intestine. It secretes 'cellulase' enzyme to digest the cellulose of wood. In turn, the termite provides food and shelter to the protozoan.

Q. 27 What are natural resources?

Ans: Every thing we use e.g. food, petrol etc. is obtained from natural resources. They are of two types. (i) Renewable (ii) Non-renewable

Q.28 What is nitrification?

Ans: After the formation of ammonia, it is converted into nitrites and nitrates. This is called nitrification and is done by nitrifying bacteria.

Q.29 What is nitrogen cycle?

Ans: The flow of nitrogen between environment and the organisms is called nitrogen cycle.

Q.30 What is nitrogen fixation?

Ans: Conversion of nitrogen gas into nitrates is called nitrogen fixation.

Q.31 What are non-renewable resources and renewable resources?

Ans: The renewable natural resources e.g. air are reproduced easily but the non-renewable resources (e.g. minerals and fossils fuels) are not replenished once they get depleted.

Q.32 What is overpopulation?

Ans: Increase in population beyond the carrying capacity of an area or environment is called over population.

Q.33 Define phytoplankton?

Ans: Photosynthetic organisms that float on the surface of water, are called phytoplankton.

Q.34 Define Pollution and pollutants.

Ans: Pollution is defined as any undesirable change in the physical, chemical or biological characteristics of air, water and land that may harmful for humans, other living organisms and natural resources. The substances that actually cause pollution are called pollutants.

Q.35 Define parasitism.

Ans: It is a type of symbiosis in which smaller partner (parasite) derives food and shelter from the body of larger partner (host) and, in turn, harms it.

Q.36 What is predation?

Ans: An interaction between animals of two species or a plant and an animal, in which the predator attacks, kills and feeds on the smaller animal called prey.

Q.37 What are producers?

Ans: These are the autotrophs in an ecosystem. These organisms are able to synthesize complex organic compounds (food) from inorganic raw materials. Producers form the basis of any ecosystem.

Examples

Plants, Algae and Cyanobacteria

Q.38 Define pyramid of biomass.

Ans: It is a graphic representation of biomass present per unit area at various trophic levels of a food chain.

Example

In a terrestrial ecosystem, the maximum biomass is of producers and decomposers have lesser biomass.

Q.39 Define pyramid of numbers.

Ans: It is a graphic representation of the number of individuals per unit area at various trophic levels of a food chain.

Example

Usually, producers are present in large number, primary consumers are in lesser number, and secondary consumers are fewer.

Q.40 Define symbiosis. **(Board 2014)**

Ans: It is a relationship between members of different species, in which they live together for longer or shorter period of time.

Example

Lichens (Association between algae and fungi)

Q.41 Define Ecology.

Ans: The study of the interrelationship between living organisms and their environment is called ecology.

Q. 42 Define Species.

Ans: A species is a group of organisms which can interbreed freely in nature to produce fertile offspring.

Example

Human, Cat, Dog etc.

Q.43 Differentiate between Population and Community.

Ans:

Population	Community
A group of the organisms of the same species inhabiting a specific geographical area at a particular time is called a population. **Example** Number of rats in a field.	All the populations that live in a habitat and interact in various ways with one another are collectively called a community. **Example** Forest is an example of community.

Q.44 Define Ecosystem. **(Board 2014)**

Ans: The self-sufficient unit of an environment that is formed as a result of interactions between its biotic communities and the abiotic components is called ecosystem.

Q.45 What are herbivores?

Ans: These animals feed directly on plants or products of plants. They are also called primary consumers.

Examples

Cattle, deer, rabbit, grasshopper etc.

Q.46 What are omnivores?

Ans: Those consumers that eat animal flesh as well as plants and plant products are called omnivores.

Examples

Human, Crow

Q.47 Define trophic level.

Ans: Trophic level is the level at which an organism feeds in food chain. The first trophic level is made of producers; the second of primary consumers and so on.

Q.48 Define pyramid of energy.

Ans: It is a graphic representation of energy present in a biomass of living organisms at various trophic levels of a food chain.

Example

The amount of energy is decreased from producers to decomposers as some amount of energy is used by the organisms to perform work while some of it is lost as heat.

Q.49 What is meant by assimilation?

Ans: It is a process in which the nitrates are absorbed by plants and are utilized for making proteins, nucleic acid etc. Animals take nitrogenous compounds from plants. The utilization of nitrates by organisms is called assimilation.

Q.50 What is parasite?

Ans: A parasite is an organism that gets shelter and food from its host and in return harms it.

Examples

Plasmodium, Amoeba etc.

Q.51 Differentiate between ectoparasites and endoparasites.

Ans:

Ectoparasites	Endoparasites
Ectoparasites live outside i.e. on the surface of host's body and get food from them.	Endoparasites live inside the body of host and get food and shelter.
Examples	**Examples**
Mosquitoes, leeches, lice etc.	Bacteria, viruses, tapeworm, Ascaris, Entamoeba, Plasmodium etc.

Q.52 Define Urbanization.

Ans: Urbanization means growing of cities. People move from rural areas to cities in search of better jobs, education opportunities and higher standards of living.

Q.53 What are primary consumers? Give one example. **(Board 2013)**

Ans: The organisms which feed directly on plants or products of plants are called primary consumers e.g. sheep, goat etc.

Q.54 Write four effects of air pollution. **(Board 2013)**

Ans:
i. Smog formation
ii. Acid rains
iii. Ozone depletion
iv. Global warming

Q.55 Define pollutants.

Ans: The substance that actually cause pollution called pollutants. They may be industrial effluents, domestic wastes, medical wastes etc. Pollutants are of two types:-

a. Biodegradable and
b. Non-biodegradable

Q.56 What is noise? Write its Effects.

Ans: Unwanted and annoying sounds are termed as noise. Effects of noise pollution are aggression, hearing loss, depression, hypertension etc.

Q.57 What is green house effect?

Ans: Certain gases trap heat in environment. These gases act like the glass in a green house which does not allow the inner heat to escape. When sunlight reaches to earth surface, much of its energy is converted into heat energy. Earth reflects the heat energy back into space in the form of infra-red radiation. Green house gases (CO_2,CH_4,Nitrous oxide) trap these infra-red radiations and send it back to earth.

Q.58 What is global warming?

Ans: The addition of green house gases (e.g; carbon dioxide, methane, ozone) in atmosphere increases the temperature of the earth. These gases remain in the lowest part of earth's atmosphere and do not allow solar radiations to reflect back into the space. As a result, heat remains within the Earth's atmosphere and increases its temperature. This is called global warming.

Unit 17

Biotechnology

Long Answer Questions

Q.1 Define biotechnology? Explain its background.

Ans: Definition **(Board 2014)**

Biotechnology is defined as the use of living organisms in processes for the manufacture of useful products or for services.

Background

(a) Old Biotechnology

Although the term biotechnology is new, the discipline itself is very old. Fermentation and other such processes which are based on the natural capabilities of organisms, are commonly considered as old biotechnology.

(b) Modern Biotechnology

Genetic engineering i.e. the artificial synthesis, modification, removal, addition and repair of genetic material (DNA) is considered as modern biotechnology. It is done to alter the characteristics of organisms.

(c) Isolation of enzymes of DNA Synthesis

The work on genetic engineering started in 1944 when it was proved that DNA carries the genetic information.

Scientists isolated the enzymes of DNA synthesis and then prepared DNA outside cells.

(d) Cutting and Pasting of DNA

In 1970s, scientists were able to cut and paste the DNA of organisms.

(e) Preparation of insulin and human growth hormone

In 1978, scientists prepared human insulin by inserting the insulin gene in bacteria. Human growth hormone was also synthesized in bacteria.

(f) Human Genome Project

In 1990, the **Human Genome Project** was launched to map all the genes in human cell. The complete map of human genome was published in 2002.

Q.2 Since when have humans been using microorganisms?

Ans: Humans began using microorganisms as early as 4000 BC for making wine, vinegar, cheese, yogurt etc. Some of these processes have become a part of every home that we may even hesitate to refer them as biotechnology.

Q.3 What do you know about Dolly?

Ans: In Scotland, in 1997, an embryologist Ian Wilmut produced a sheep (Dolly) from the body cell of an adult sheep.

Q.4 Write down scope and importance of biotechnology in three different fields. (B-2014)

Ans: In recent years, biotechnology is growing as a separate science. It has attracted the attention of many intellectuals from diverse fields like agriculture, medicine, microbiology and organic chemistry.

The scope for biotechnology is so wide that it is difficult to recognize the limits.

The following are some areas of the application of biotechnology:

1. Biotechnology in the field of medicine./Write the scope and importance of biotechnology in the field of medicine (Board 2014)

(a) Synthesis of insulin and interferon

In the field of medicine, biotechnologists synthesized insulin and interferon (antiviral protein) from bacteria and released for sale.

(b) Vaccines and Antibodies

A large number of vaccines and antibodies; human growth hormone and other medicines have also been produced.

(c) Synthesis of enzymes

Various enzymes are being synthesized for medicinal as well as industrial use.

(d) Gene therapy and forensic medicines

Gene therapy (treatment through genes) has become important in recent years.

Biotechnology also proved much beneficial in forensic medicines. The study of DNA helps in the identification of criminals.

2. Biotechnology in the field of food and agriculture

(a) In Food Production

Fermented foods (e.g. pickles, yogurt), malted foods (e.g. powdered milk: a mixture of barley, wheat flour and whole milk), various vitamins and dairy products are produced by using microorganisms.

(b) In Wine and beer Production

Wine and beer are produced in beverage industry. Biotechnology has also revolutionized research activities in the area of agriculture.

(c) Transgenic Plants and Animals

Transgenic (organisms with modified genetic set-up) plants are being developed, in which desirable characteristics are present e.g., more yields and resistance against diseases, insects and herbicides.

Transgenic goats, chickens, cows give more food and milk etc. Many animals like mice, goats, cows etc. have been made transgenic to get medicines through their milk, blood or urine.

3. Biotechnology and environment

(a) Biotechnology and environment issues

Biotechnology is also being used for dealing with environmental issues, like pollution control, development of renewable sources for energy, restoration of degraded lands and bio-diversity conservation.

(b) Sewage Water Treatment

Bacterial enzymes are used to treat sewage water to purify.

(c) Transgenic Microbes

Microbes are being developed to be used as biopesticides, biofertilizers, biosensors etc. Such transgenic micro-organisms are also used for the recovery of metals, cleaning of spilled oils and for many other purposes.

Q.5 What is Fermentation and write down its types.

Ans. Cellular respiration;

In cellular respiration glucose molecule goes through oxidation reduction reactions to release energy in the form of ATP.

Fermentation

Fermentation is the process in which there is incomplete oxidation – reduction of glucose.

Fermentation has been in the knowledge of man since centuries but it was believed that it is purely a chemical process.

Louis Pasteur and Fermentation

In 1857, Pasteur convinced the scientific community that all fermentations are the results of microbial activity. He showed that fermentation is always accompanied by the development of micro-organisms. There are many kinds of fermentation and each kind is a characteristic of particular microbial group.

Types of Fermentation **(Board 2013)**

Fermentations are classified in terms of the products formed. The initial steps of carbohydrate fermentation are identical to those of respiration. The process begins with glycolysis, in which the glucose molecule is broken into two molecules of pyruvic acid. Different micro-organisms proceed the further reactions in different ways. It results in the formation of various products from pyruvic acid.

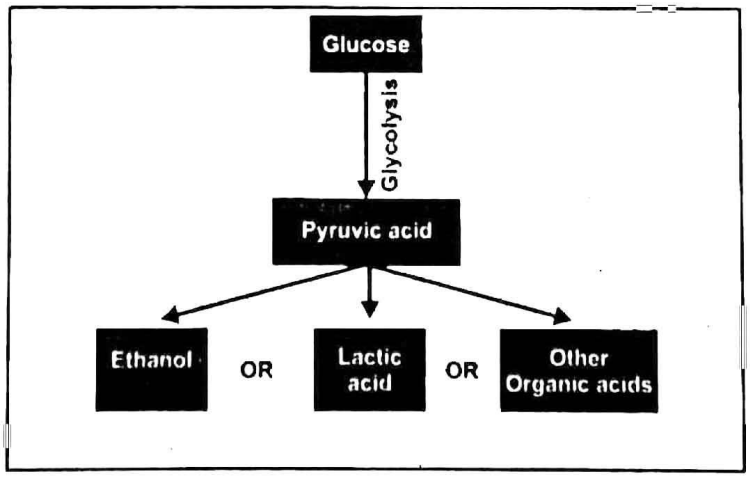


Figure 17.1: Carbohydrate Fermentation and its Products

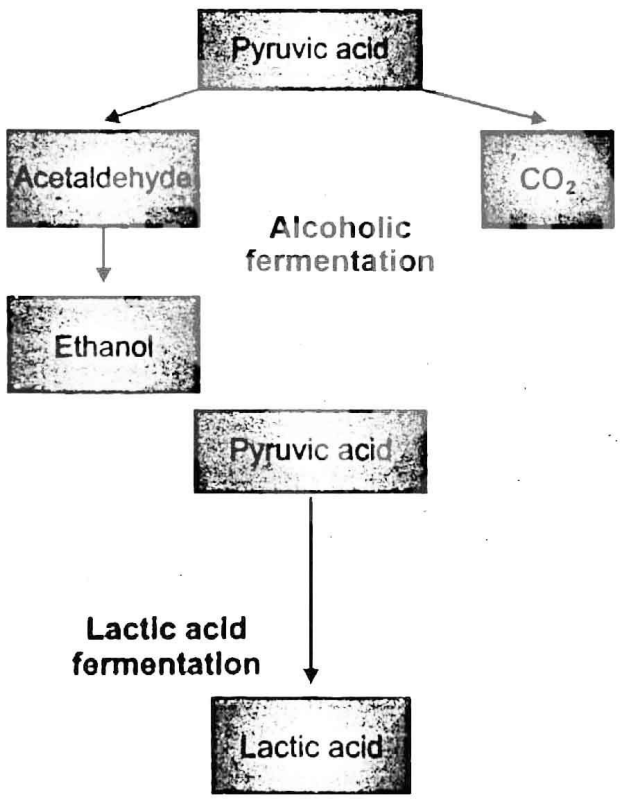
The two basic types of carbohydrate fermentation are:

1. Alcoholic Fermentation (by yeast)

This fermentation is carried out by many types of yeast such as *saccharomyces cerevisiae*. This process is quite important and is used to produce bread, beer, wine and distilled spirits. In this process, carbon dioxide is removed from pyruvic acid. The product i.e. acetaldehyde is then reduced to ethanol. The carbon dioxide produced during this fermentation causes the rise of the bread.

2. Lactic acid Fermentation (by bacteria)

In this process, pyruvic acid is reduced to lactic acid. It is carried out by many bacteria e.g. *Streptococcus* and many *Lactobacillus* species. It is quite important in dairy industry where it is used for souring milk and also for production of various types of cheese.



Q.6 What are applications of fermentation in biotechnology?

Ans. In beginning, the meaning of fermentation process was the use of microorganisms for the production of foods (cheese, yogurt, fermented pickles and sausages, soy sauce), beverages (beers, wines) and spirits. However, in biotechnology the term "fermentation" means the production of any product by the mass culture of microorganisms.

Applications of fermentation

In fermentation, maximum growth of an organism is obtained for the production of desired products of commercial value. Traditionally, only food and beverage products were produced by using fermentation. Now many other products e.g. industrial chemicals are also being produced.

a) Fermented foods

Fermentation often makes the food more nutritious, more digestible and tastier. It also tends to preserve the food, lowering the need for refrigeration. The following groups are included in the fermented foods.

1) Cereal products

Bread is the commonest type of fermented cereal product. Wheat dough is fermented by *S.cerevisiae* along with some lactic acid bacteria.

2) Dairy products

Cheese and yogurt are important fermentation products. Cheese is formed when a milk protein is coagulated. This happens when the acid produced by lactic acid bacteria reacts with milk protein. Yogurt is made from milk by different lactic acid bacteria.

3) Fruit and vegetable products

Fermentation is usually used, along with salt and acid, to preserve pickle, fruits and vegetables.

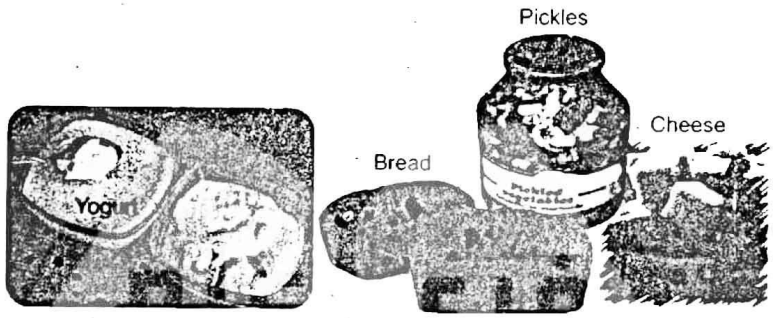


Figure 17.2: Fermented Foods

4) Beverage products.

Beer is produced from cereal grains which have been malted, dried and ground into fine powder. Fermentation of the powder is done by yeast. This process breaks the glucose present in powder into pyruvic acid and then into ethanol. Grapes can be directly fermented by yeast to wine.

b) Industrial products

The following are important industrial products produced through the process of fermentation.

Products	Microorganisms used	Some uses
Formic acid	*Aspergillus*	Used in textile dyeing, leather treatment, electroplating, rubber manufacture
Ethanol	*Saccharomyces*	Used as solvent, used in the production of vinegar and beverages
Gylcerol	*Saccharomyces*	Used as solvent, used in the production of plastics, cosmetics and soaps, used in printing, used as sweetner.
Acrylic acid	*Bacillus*	Used in printing; used as sweetener. Used in the production of plastics.

Q.7. What is fermenter and write down its types. **(Board 2014)**

Ans. Fermenter

Fermenter is a device that provides optimum environment to micro-organisms to grow into a biomass, so that they can interact with a substrate, forming the product.

Types

Fermentation is carried out in fermenters, in the following two ways:-

1) Batch Fermentation

In this process, the tank of fermenter is filled with the raw materials to be fermented. The temperature and pH of microbial fermentation is properly adjusted and nutritive supplements are added. All the material is steam sterilized. The pure culture of micro-organisms is added to fermenter from a separate vessel.

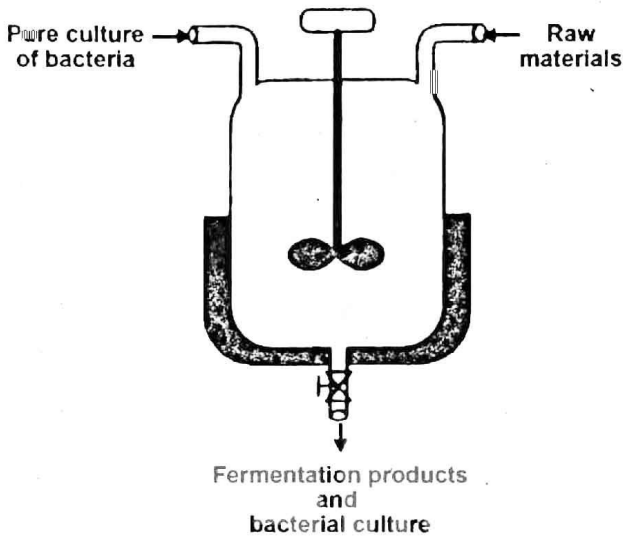


Figure 17.3 A batch Fermenter

Fermentation proceeds and after the proper time the contents of fermenter are taken out. Fermenter is cleaned and the process is repeated. Thus, fermentation is a dis-continuous process divided into batches.

2) Continuous fermentation

In this process, the substrate is added to fermenter continuously at a fixed rate. This maintains the micro-organisms in growth phase. Fermentation products are taken out continuously. The design and arrangements for continuous fermentation are more complex.

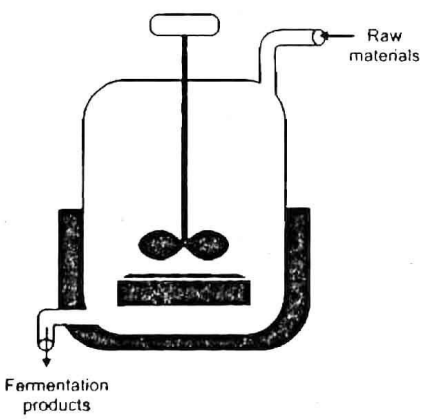


Figure 17.4 A Continuous Fermenter

Q.8 Write two advantages of using fermenters. **(Board 2014)**

Ans. Advantages of using fermenters

(1) Controlled Environment

For each biotechnological process, the environment provided to the organisms must be monitored and controlled. Such a controlled environment is provided by fermenters. A fermenter optimizes the growth of the organisms by controlling many factors, like nutrients, oxygen, growth inhibitors, pH and temperature.

(2) Production of materials in bulk quantities

A fermenter may hold several thousand litres of the growth medium. So fermenters allow the production of materials in bulk quantities. Massive amounts of medicines, insulin, human growth hormone and other proteins are being produced in fermenters and this production proves much inexpensive.

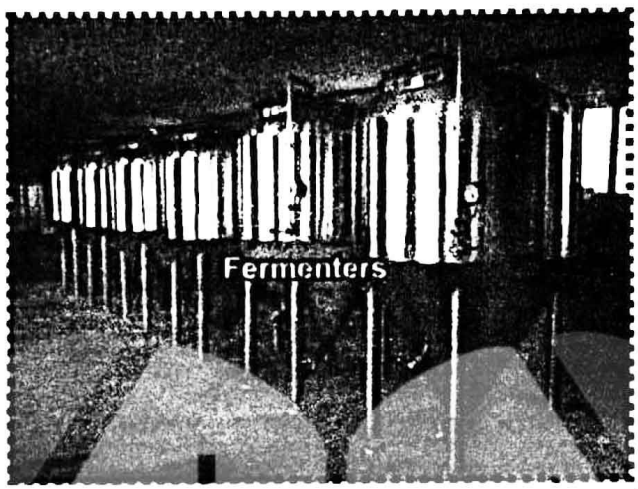


Figure 17.5: Fermenters used in food and Pharmaceutical industry

Q.9 What is genetic engineering and write down it objectives.

Ans. Definition

Genetic engineering or recombinant DNA technology involves the artificial synthesis, modification, removal, addition and repair of the genetic material (DNA).

Development of Genetic Engineering

Genetic engineering developed in the mid – 1970s when it became possible to cut DNA and to transfer particular pieces of DNA from one type of organism into another.

As a result, the characteristics of the host organism could be changed. If host organism is a microorganism, such as a bacterium, the transferred DNA is multiplied many times as the micro-organism multiplies. Consequently, it is possible to obtain millions of copies of a specific DNA inside a bacterial cell.

Objectives of genetic engineering

The important objectives of genetic engineering are as follows:

1) Isolation of gene

Isolation of a particular gene or part of gene for various purposes such as gene therapy.

2) Production of RNA and protein

Production of particular RNA and protein molecules.

3) Production of enzymes, drugs and organic chemicals

Improvement in the production of enzymes, drugs, and commercially important organic chemicals.

4) Production of desirable plants

Production of varieties of plants having particular desirable characteristics.

5) Treatment of genetic defects

Treatment of genetic defects in higher organisms.

Q.10 Write down basic steps in genetic engineering. **(Board 2013)**

Ans. All the objectives of genetic engineering can be obtained by some basic methodologies such as:

1) Isolation of gene of interest

In the 1st step, the genetic engineer identifies the gene of interest in a donor organism. Special enzymes called restriction endonucleases, are used to cut the identified gene from the total DNA of donor organism.

2) Insertion of the gene into a vector

Vector is selected for the transfer of the isolated gene of interest to the host cell. The vector may be a plasmid (the extra chromosomal DNA present in many bacteria) or a bacteriophage.

The gene of interest is attached with the vector DNA by using endonuclease (breaking enzymes) and ligase (joining enzymes). The vector DNA and the attached gene of interest are collectively called recombinant DNA.

3) Transfer of recombinant DNA into Host Organism

Recombinant DNA is transferred to the target host. In this way, host organism is transformed into a genetically modified organism (GMO).

4) Growth of the GMO

The GMO are provided suitable culture medium for growth to give as much copies of the gene of interest as needed.

5) Expression of the gene

The GMO contains the gene of interest and manufactures the desired product which is isolated from culture medium.

Q.11 What are different achievements of genetic engineering?

Ans. Various achievements of genetic engineering are as follows:

1) Formation of human insulin

Human insulin gene was transferred into bacteria. The genetically modified bacteria became able to synthesize insulin. Diabetics are now receiving this insulin.

2) Formation of human growth hormone

In 1977, an *E.coli* bacterium was created that was capable of synthesizing the human growth hormone.

3) Formation of thymosin hormone

The hormone thymosin which may prove effective against brain and lung cancer has been produced by genetically modified micro-organisms.

4) Formation of beta-endorphin

Beta-endorphin, a pain killer produced by the brain, has also been produced by genetic engineering techniques.

5) Formation of vaccines

Genetic engineers produced a safe vaccine against the foot and mouth disease (a viral disease in cattle, goats and deer). Similarly many vaccines have been produced against human disease such as hepatitis-B.

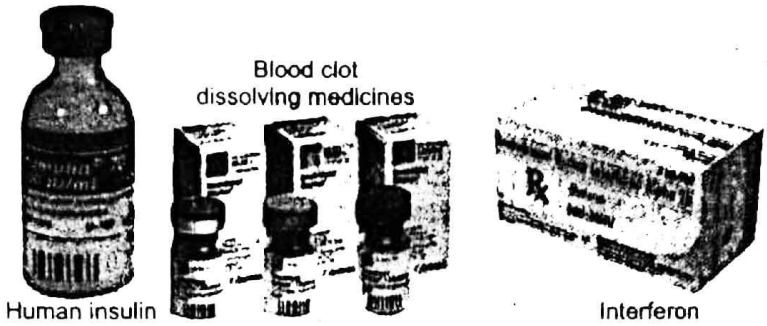


Figure 17.6 Some medicines produced by genetic engineers.

6) Formation of interferons

Interferons are anti-viral proteins produced by cells infected with viruses. In 1980, interferon was produced in the genetically modified micro-organisms for the 1st time.

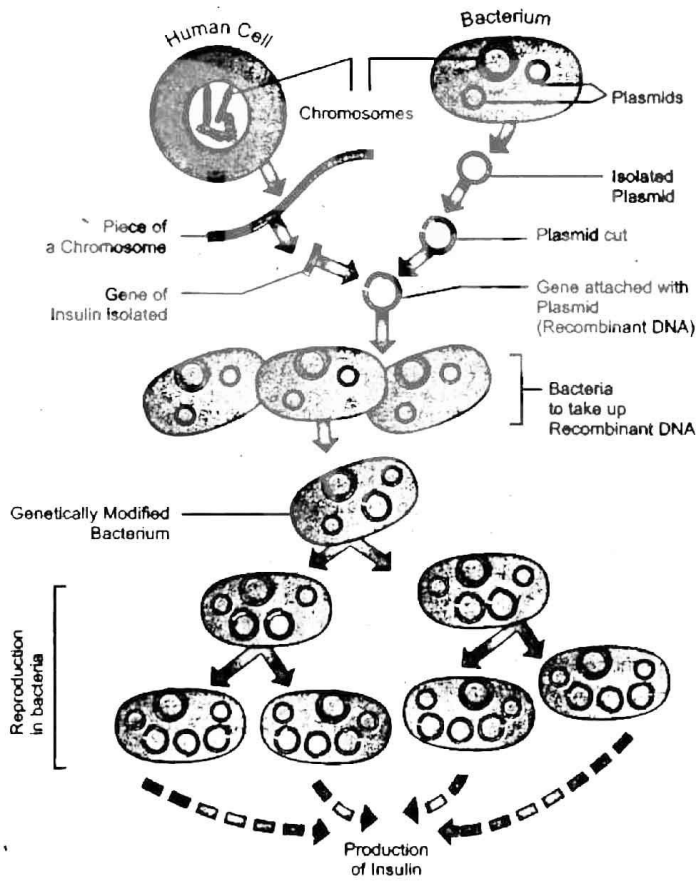


Figure 17.7 Production of insulin through genetic engineering

7) Formation of urokinase enzyme

The enzyme urokinase which is used to dissolve blood clots, has been produced by genetically modified micro-organisms.

8) Elimination of inherited diseases

Now it has become possible to modify the genes in the human egg cell. This can lead to the elimination of inherited diseases like haemophilia.

9) Cure of blood diseases

Genetic engineering techniques can also be used to cure blood diseases like thalassemia and sickle cell anaemia which result from defects in single genes. Normal genes could be transferred into the bone marrow.

10) Formation of nitrogen fixing plants

Genetic engineers have developed plants that can fix nitrogen directly from the atmosphere. Such plants need less fertilizers.

Q.12 What is single cell protein? Give its role in the service of humanity.

Ans. Definition

Single-cell protein (SCP) refers to the protein content extracted from pure or mixed cultures of algae, yeasts, fungi or bacteria.

OR

It is known as single cell protein because the micro-organisms used as producers are unicellular or filamentous individuals.

Production of Single Cell Protein

For the production of single cell proteins, the microorganisms are grown in fermenters. These microorganisms utilize a variety of substrate like agricultural wastes, industrial wastes, natural gas like methane etc.

Production of novel protein

Microorganisms grow very vigorously and produce a high yield of protein. The protein content produced by microorganisms is also known as novel protein or minifood.

Better management of Food Shortage Problem

Due to overpopulation, the world is facing the problem of food shortage. In future, the conventional agricultural methods might not be able to provide a sufficient supply of food (especially proteins). For a better management of food shortage problems (in human and domestic animals), the use of microbes as the producers of single cell proteins has been successful on experimental basis.

Work of Prof. Scrimshow

This technique was introduced by Prof. Scrimshow of Massachusetts Institute of technology. Scientist and food technologists believe that single cell proteins will substitute the other protein rich foods in human and animal feeds.

Significance of single cell protein

(a) High yield of SCP

All scientists recognize the significance of the production of single-cell proteins. The micro-organisms grow very vigorously and produce a high yield. It has been calculated that 50 kilogram of yeast produces about 250 tons of proteins within 24 hours.

Algae grown in ponds produce 20 tons (dry weight) of protein per acre/year. This yield of protein is 10-15 times higher than soybeans and 20-50 times higher than corn.

When single cell proteins are produced by using yeasts, the products also contain high vitamin content.

(b) Raw Material in the Production of Single cell Proteins

In the production of single cell proteins, industrial wastes are used as raw materials for micro-organisms. It helps in controlling pollution.

(c) Use of SCP in Future

The use of single cell proteins has good prospects in future because they contain all essential amino acids. Moreover the production of single-cell proteins is independent of seasonal variations.

(d) Limited land Area Required

SCP is gaining popularity day by day because it requires limited land area for production.

Multiply Choices Questions

1. **Find the correct match for the fermentation product and the organism involved;**
   (a) Formic acid – *Saccharomyces*
   (b) Ethanol – *Saccharomyces*
   (c) Ethanol – *Aspergillus*
   (d) Glycerol – *Aspergillus*

2. **Which is not an objective of genetic engineering?**
   (a) Production of cheese and yogurt by lactic acid bacteria
   (b) Isolation of a particular gene, or part of a gene
   (c) Production of RNA and protein molecules.
   (d) Correction of genetic defects in higher organisms

3. **Which of these is an anti-viral protein?**
   (a) Urokinase (b) Thymosin
   (c) Insulin (d) Interferon

4. **The first step in genetic engineering is:**
   (a) Growth of the genetically modified organism
   (b) Transfer of the recombinant DNA into the host organism
   (c) Isolation of the gene of interest
   (d) Insertion of gene into a vector

5. **The work on genetic engineering started in:**
   (a) 1944 (b) 1955
   (c) 1945 (d) 1943

6. **Scientists are able to cut and paste the DNA of organism in:**
   (a) 1944 (b) 1970
   (c) 1990 (d) 2002

7. **Scientists prepared human insulin by inserting the insulin gene in bacteria in:**
   (a) 1970 (b) 1978
   (c) 1990 (d) 2002

8. **Human genome project was launched in:**
   (a) 1990 (b) 1970
   (c) 1978 (d) 2002

9. **In alcoholic fermentation, which bacteria is used?**
   (a) *Saccharomyces*
   (b) *Lactobacillus*
   (c) *Streptococcus*
   (d) Both B and C

10. **Which of these micro-organism is used in the production of formic acid?**
    (a) *Aspergillus*
    (b) *Bacillus*
    (c) *Saccharomyces*
    (d) None

11. **Glycerol is produced by:**
    (a) *Aspergillus*
    (b) *Bacillus*
    (c) *Saccharomyces*
    (d) *Streptococcus*

12. **Which one is used to dissolve blood clots?**
    (a) Urokinase (b) Interferons
    (c) Thymosin (d) Vaccine

13. **The complete map of human genome was published in:**
    (a) 2002 (b) 1944
    (c) 1978 (d) 1990

14. **50 kilogram of yeast produces how many tons of proteins within 24 hours.**
    (a) 250 (b) 150
    (c) 350 (d) 450

15. **Interferon was produced by genetically modified microorganisms in;**
(a) 1980 (b) 1944
(c) 1990 (d) 1970

16. **500,000 sheep brains were required to produce how much milligrams of human growth hormone?**
(a) 5 (b) 10
(c) 15 (d) 20

17. **Which one is effective against brain and lung cancer?**
(a) Beta – endorphin (b) Vaccine
(c) Thymosin (d) Insulin

18. **Which one is not used for the production of plastics?**
(a) *Bacillus* (b) *Aspergillus*
(c) *Saccharomyces* (d) none of these

19. **Alcoholic fermentation is carried out by;** **(Board 2013)**
(a) Yeast (b) Bacteria
(c) Virus (d) Algae

20. **Enzyme used to cut the identified gene from the total DNA of donor organism is;** **(Board 2013)**
(a) Endonuclease
(b) Ligase
(c) Restriction Endonuclease
(d) Amylase

21. **Vector transmits;**
(a) Bacterium (b) Parasite
(c) Pathogen (d) Both B and C

22. **Which is an important application of Biotechnology?**
(a) Respiration (b) Decomposition
(c) Digestion (d) Fermentation

23. **In glycolysis, glucose molecule is broken down into two molecules of:**
(a) Pyruvic acid (b) Lactic acid
(c) Formic acid (d) Acrylic acid

24. **Who produced the Dolly sheep?**
(a) Louis Pasteur
(b) Walther Flemming
(c) Ian Wilmut
(d) Mendel

25. **Who invented Pasteurization?**
(a) Louis pasteur
(b) Walther Flemming
(c) Carolus Linnaeus
(d) Aristotle

26. **Who introduced the term "single cell Protein"?**
(a) Mendel (b) Loius Pasteur
(c) Scrimshow (d) Ian Wilmut

27. **The use of living organisms in processes for the manufactures of useful products for services is called:**
(a) Genetic Engineering
(b) Biotechnology
(c) Vaccination
(d) Maltation

28. ***Streptococcus* and *Lactobacillus* are:**
(a) Viruses (b) Fungi
(c) Bacteria (d) Algae

29. **When Pasteur convinced the scientific community that all fermentations are the results of microbial activity?**
(a) 1957 (b) 1857
(c) 1900 (d) 2010

30. **Which one is the commonest type of fermented cereal product?**
(a) Pickles (b) Bread
(c) Jams (d) Powdered milk

31. **In the synthesis of bear, fermentation of fine powder of cereal grains is done by?**
(a) Yeast (b) Bacteria
(c) Viruses (d) All of the above

32. **Which one is used in the production of Vinegar and Beverages?**
(a) *Aspergillus* (b) *Bacillus*
(c) *Saccharomyces* (d) *Lactobacillus*

33. **The vector DNA and the attached gene of interest are collectively called:**
(a) GMO
(b) Recombinant DNA
(c) DNA
(d) Endonucleases

34. **Wheat dough is fermented by:**
(a) Yeast (b) *S. cerevisiae*
(c) *Lactobacillus* (d) *Streptococcus*

35. **Organisms with modified genetic set up are called:**
(a) Dolly
(b) Transgenic organisms
(c) Breed
(d) Vector

36. **The process in which glucose molecule is broken into two molecules of pyruvic acid is called:**
(a) Fermentation
(b) Genetic Engineering
(c) Glycolysis
(d) Biotechnology

37. **Which one is used as a Sweetener?**
(a) Formic acid (b) Ethanol
(c) Glycerol (d) All of these

38. **DNA carries genetic information, it was proved in?**
(a) 1970's (b) 1944
(c) 1978 (d) 2000

39. **When was DNA prepared outside the cells?**
(a) 1944 (b) 1953
(c) 1970's (d) 1990

40. **Scientists were able to cut and paste the DNA of organisms in;**
(a) 1953 (b) 1970's
(c) 1944 (d) 1990

41. **Human Genome project was launched?**
(a) 1970 (b) 1990
(c) 1991 (d) 2000

42. **Complete human genome map was published in?**
(a) 1976 (b) 2004
(c) 2002 (d) 2012

43. **Malted food is / are;**
(a) Powdered milk
(b) Mixture of barely
(c) Whole milk
(d) All of these

44. **Fermented food is/are;**
(a) Pickles (b) Yogurt
(c) Both A and B (d) Wheat flour

45. **Which is used for souring milk and for production of various types of cheese?**
(a) *Lactobacillus*
(b) *Streptococcus*
(c) Both *lactobacillus and streptococcus*
(d) *Saccharomyces*

46. **Fermentation makes the food more?**
(a) More Digestible
(b) Less Nutritious
(c) Tasteless
(d) Less digestible

47. **Grapes can directly be fermented by yeasts to:**
(a) Formic acid (b) Wine
(c) Pyruvic acid (d) Ethanol

48. **Which product is used in electroplating?**
(a) Formic acid
(b) Ethanol
(c) Glycerol
(d) Acrylic acid

49. **Which maintains the microorganisms in growth phase?**
(a) Fermenter
(b) Continuous fermenter
(c) Batch fermenter
(d) All of these

50. A joining enzyme is;

(a) Thymosin
(b) Endonuclease
(c) Ligase
(d) Urokinase

51. A breaking enzyme is;

(a) Recombinant DNA
(b) Ligase
(c) Urokinase
(d) Endonuclease

52. SCP has good prospects for future because it contains all important;

(a) Nutrients (b) Amino acids
(c) Lipids (d) Fats

53. It is a catabolic process:

(a) Photosynthesis
(b) Fermentation
(c) Fragmentation
(d) None of these

54. To preserve fruits, vegetables and pickles we add; (Board 2014)

(a) Water and yogurt
(b) Salt and acid
(c) Flour and salt
(d) Onion and garlic

55. An enzyme produced by genetically modified organisms used to break up blood clots is called;

(a) Lipase (b) Amylase
(c) Urokinase (d) Peptidase

Answer Key

1	b	**2**	a	**3**	d	**4**	c	**5**	a	**6**	b
7	b	**8**	a	**9**	a	**10**	a	**11**	c	**12**	a
13	a	**14**	a	**15**	a	**16**	a	**17**	c	**18**	b
19	a	**20**	c	**21**	d	**22**	d	**23**	a	**24**	c
25	a	**26**	c	**27**	b	**28**	c	**29**	b	**30**	b
31	a	**32**	c	**33**	b	**34**	b	**35**	b	**36**	c
37	c	**38**	b	**39**	a	**40**	b	**41**	b	**42**	c
43	d	**44**	c	**45**	c	**46**	a	**47**	b	**48**	a
49	b	**50**	c	**51**	d	**52**	b	**53**	b	**54**	b
55	c										

Short Questions

Q.1 How would you define fermentation with reference to biotechnology?

Ans: Fermentation is the process in which there is incomplete oxidation reduction of glucose.

Q.2 Name any two industrial products made by fermentation? Also describe their uses in the industry.

Ans: Two industrial products are:

(i) Formic acid

It is used in textile dyeing, leather treatment, electroplating, rubber manufacture.

(ii) Ethanol

It is used as solvent and used in the production of vinegar and beverages.

Q.3 What are the products of the two types of carbohydrate fermentation?

Ans: In alcoholic fermentation, CO_2 and ethanol are the products. In lactic acid fermentation, lactic acid is the product.

Q.4 Give an example how biotechnology is helping for better environment?

Ans: Bacterial enzymes are used to treat sewage water to purify.

Q.5 In biotechnology, what is meant by genetically modified organism (GMO)? How is it made?

Ans: In biotechnology, recombinant DNA is transferred to the target host. In this way, host organism is transformed into a genetically modified organism (GMO).

Q.6 What is Batch fermentation?

Ans: In this process, the tank of fermenter is filled with the raw materials to be fermented. The temperature and pH for microbial fermentation is properly adjusted and nutritive supplements are added. All the material is steam sterilized. The pure culture of microorganisms is added to fermenter from a separate vessel.

Q.7 Define Biotechnology. **(Board 2014)**

Ans: It is defined as the use of living organisms in processes for the manufacture of useful products or for services.

Q.8 What is continuous fermentation?

Ans: In this process, the substrate is added to fermenter continuously at a fixed rate. This maintains the micro-organisms in growth phase. Fermentation products are taken continually.

Q.9 Define Fermentation. **(Board 2013)**

Ans: It is a process in which incomplete oxidation reduction of glucose takes place.

Q.10 What is Fermenter?

Ans: Fermenter is a device that provides optimum environment to microorganisms to grow into a biomass, so that they can interact with a substrate forming the product. Fermentation is carried out in fermenters.

Q.11 What is Genetically modified organism GMO?

Ans: GMO is genetically modified organism. Recombinat DNA is transferred to the target host. In this way the host organism is transformed into genetically modified organism (GMO).

Q.12 What is Recombinant DNA?

Ans: The vector DNA and the attached gene of interest are collectively called recombinant DNA.

Q.13 What is Restriction endonucleases?

Ans: Special enzymes, called restriction endonucleases are used to cut the identified gene from the total DNA of donor organism.

Q.14 What is Single cell protein? **(Board 2013)**

Ans: Single cell protein (SCP) refers to the protein content extracted from pure or mixed culture of algae, yeasts, fungi or bacteria.

Q.15 What is Transgenic organism?

Ans: Organism with modified genetic set up is known as transgenic organism.

Q.16 Define vector?

Ans: A vector is a carrier or transmitter which is selected for transfer of the isolated gene of interest to the host cell. The vector may be a plasmid or a bacteriophage.

Q.17 What is Genetic donor?

Ans: The organism from which the gene of interest is taken during the process of genetic engineering is called genetic donor.

Q.18 Define Plasmid.

Ans: The extra chromosomal DNA present in many bacteria is called plasmid.

Q.19 What is Alcoholic fermentation?

Ans: This fermentation is carried out by many types of yeast such as saccharomyces cerevisiae. In this process, carbondioxide is removed from pyruvic acid. The product acetaldehyde is then reduced to ethanol. The CO_2 production causes the rise of the bread. It is used to produce bread, beer, wine and distilled spirits.

Q.20 What is Lactic acid fermentation?

Ans: In this process, pyruvic acid is reduced to lactic acid. It is carried out by many bacteria. e.g. *Streptococcus* and many *Lactobacillus* species. It is quite important in dairy industry where it is used for souring milk and also for production of various types of cheese.

Q.21 What is Beta-Endorphin?

Ans: It is a pain killer produced by the brain, has also been produced by genetic engineering techniques.

Q.22 What is thymosin?

Ans: It is a hormone which is effective against brain and lung cancer.

Q.23 What is ligase?

Ans: Ligase is an enzyme which is used to join the DNA.

Q.24 Write any two objectives of genetic engineering? **(Board 2013)**

Ans. i. Production of particular RNA and Protein molecules.

ii. Treatment of genetic defects in higher organisms.

Q.25 Define genetic engineering **(Board 2013)**

Ans: Genetic engineering or recombinant DNA technology involves the artificial synthesis, modification, removal, addition and repair of the genetic material DNA.

Q.26 Define Dolly

Ans: In Scotland in 1997, an embryologist Ian Wilmut produced a sheep named Dolly from the body cell of an adult sheep.

Q.27 What are interferons?

Ans: Interferons are anti-viral protein produced by cells infected with viruses.

Q.28 What is urokinase?

Ans: Urokinase is an enzyme which is used to dissolve blood clots, has been produced by genetically modified microorganisms. .

Q.29 What is Human Genome Project?

Ans: Human Genome Project was launched to map all the genome in human cell. The complete map of human genome was published in 2002.

Q.30 What is meant by single cell protein? How are these produced? (Board 2014)

Ans: Definition:

Single-cell protein (SCP) refers to the protein content extracted from pure or mixed cultures of algae, yeasts, fungi or bacteria.

Production of single Cell Protein

For the production of single cell proteins, the microorganisms utilize a variety of substrates like agricultural wastes, industrial wastes, natural gas like methane etc.

Q.31 What is meant by Recombinant DNA Technology? Give its one benefit. (Board 2014)

Ans: A technology in which a vector is selected for the transfer of the isolated gene of interest to the host cell. The vector may be a plasmid or a bacteriophage. The gene of interest is attached with the vector DNA by using endonuclease and ligase. The vector DNA and the attached gene of interest are collectively called recombinant DNA. This recombinant DNA is transferred to target host and host organism is transformed into a genetically modified organisms (GMO).

Q.32 Name two basic types of Fermentation. (Board 2014)

Ans: 1. Alcoholic fermentation (by yeast)

2. Lactic acid fermentation (by bacteria)

Unit 18

Pharmacology

Long Answer Questions

Q.1 What is pharmacology? Explain.

Ans. Pharmacology

Pharmacology is the study of drug composition, properties, medical applications and sources of drugs.

Explanation

Clinical pharmacology was present in the Middle Ages. Early pharmacologists focused on natural substances. It was developed in 19th century as a biomedical science.

Q.2 Define Drug. What are its types?

Ans. Definition

Any substance that is absorbed into the body of a living organism, alters normal body function is known as a drug.

Types

Drugs are broadly classified into two types:

i. Pharmaceutical drug OR Medicinal drug

It is defined as any chemical substance used in the diagnosis, cure, treatment or prevention of diseases.

ii. Addictive drugs

Some drugs often make person dependent on them, or addicted. These may be called as addictive drugs.

Q.3 Differentiate between pharmacology and pharmacy?

Ans: Pharmacology is the study of drug composition, properties, medical applications and sources of drugs while pharmacy is the study of preparation of medicines and drugs. Both terms are not synonymous. Though in common usage, the two terms are confused.

Q4. What is Materia Medica?

Ans: Until 1890, the subject of pharmacology was known as Materia Medica.

A page fr[illegible]he book of Materia Medica

Q.5 What are prescription drugs and Non-prescription drugs? Give examples.

Ans. Prescription drugs

These are sold only on physician's prescription. These include barbiturates, tranquillizers, antibiotics etc.

Non-Prescription drugs

These are sold over the counter because these are considered safe enough. These include aspirin and some cough medicines.

Q.6 What are the sources of drugs? Give examples?

Ans. Drugs

Any substance that absorbed into the body of a living organism, alters normal body function is known as a drug.

Sources of drugs:

Drugs are obtained from the following sources.

1. Synthetic Drugs

The drugs which do not occur naturally but are synthesized in laboratory. Pharmaceutical companies produce these drugs. e.g. Aspirin.

2. Drugs from Plants and fungi

Many important medicines are obtained from plants and fungi. These medicines include:

i. Antibiotics

The antibiotic penicillin comes from a fungus.

ii. Cardiotonics

The cardiotonic digitalis made from leaves of purple flowered plant foxglove used to stimulate heart.

iii. Analgesics

The pain reliever morphine is made from opium, which comes from the juice of opium poppy plant.

iv. Addictive

Many addictive illegal drugs e.g., marijuana are also obtained from plants.

Figure 8.1: Digitalis (Foxglove)

3. Drugs from animals

Drugs obtained from animals are usually their glandular products. Fish liver oil, musk, bees wax, certain hormones and antitoxins are obtained from animal sources.

4. Drugs from minerals

Several common drugs are obtained from minerals:-

i. The mineral iodine is used in making tincture of iodine, a liquid that helps to prevent infection when applied to cuts and bruises.

ii. The powder form of silver nitrate is applied on wounds to stop bleeding and prevent infection.

iii. While testing soil, researcher resulted in the development of one antibiotic terramycin which is used to treat many infections.

5. Drugs from bacteria

Many antibiotics are obtained from bacteria i.e. streptomycin etc.

Q.7 How drugs are classified? Describe the usage of important medicinal drugs?

OR Write any three medicinal drugs. Explain in detail. **(Board 2014)**

Ans. Drugs are classified on the basis of their chemical properties and modes of action.

1. Analgesics

(Pain killers)

Reduce pain e.g. aspirin, paracetamol etc.

2. Antibiotics

Inhibit or kill bacteria and treat bacterial infections e.g. tetracycline, cephalosporin etc.

3. Sedatives

Induce sedation by reducing irritability or excitement e.g. Diazepam.

4. Vaccines

Vaccines are used to develop immunity against viral and bacterial infections e.g. vaccines against small pox, whooping cough, hepatitis B etc.

5. Antiseptics

Reduce the possibility of infections on skin.

6. Antibiotics

Inhibit or kill bacteria within or on the body. Sir Alexander Fleming discovered the antibiotic penicillin from the fungus *penicillium notatum.*

7. Disinfectants

Destroys microorganisms found on non-living objects. Joseph Lister introduced carbolic acid to sterilize surgical instruments and to clean wounds.

Q8. Describe the things to remember while using the medicines.

Ans. Following things should keep in mind before using medicines:

(i) We should always check the instructions on doctor's prescription slip and take medicine accordingly.

(ii) Before using, we should check the expiry date because expired medicines may prove poisonous.

(iii) Never take medicines prescribed for someone else even if you think you have the same medical problem.

(iv) Antibiotics must be taken for a specific number of days. Otherwise problem may come again.
(v) We must consult with the doctor before we stop taking a medicine or consider a new treatment.
(vi) Some medicines are not suitable for children, and there are special children's dosages for many medicines.
(vii) Do not take medicine in the dark.
(viii) If you are patient, carry medicines and dosage instructions with you, whenever you are out of home.
(ix) Always keep healthcare products out of the reach of children
(x) Do not use the medicine if there are signs of tampering. Inform the pharmacist and manufacturer about it.

Q.9 Write a note on addictive Drugs. **(Board 2014)**

Ans. Major categories of addictive drugs are:

1. Sedatives

(a) Introduction

These drugs interact with central nervous system to depress its activities. Sedative drugs have following effects:

(b) Effects:

i. Induce dizziness
ii. Lethargy
iii. Slow brain function and depression
iv. Long term use of sedative induce suicidal thoughts

2. Narcotics

(a) Introduction

Narcotics are strong pain killers. These drugs are often prescribed in conjunction with other less potent pain killers (paracetamol or aspirin).

(b) Uses of Narcotics

i. These are used to relieve pain for patients with chronic diseases such as cancer.
ii. These are also used to relieve acute pain after operations.
iii. The abused narcotic i.e. heroin is a semi synthetic drug from morphine. It affects on central nervous system and causes drowsiness.
iv. Some people may abuse narcotics for ecstatic effects
v. Morphine and codeine are derived from poppy. Morphine is used to relieve pain.
vi. Heroin is prescribed as a strong analgesic under the name diamorphine in many western countries. It is used for acute pain such as in severe physical trauma, myocardial infarction, post surgical pain etc.

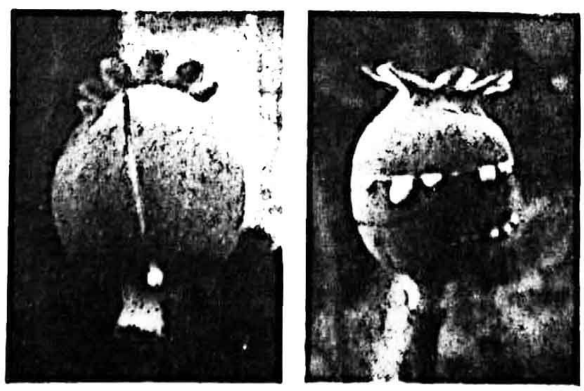


Figure 18.2 The Fruits of the opium poppy plant

3. Hallucinogens (Board 2014)

(a) Introduction

Hallucinogens are the drugs that cause changes in perception, thought, emotion and consciousness.

(b) Groups

It has two groups:

i. Mescaline

Which comes from a cactus.

ii. Psilocin

Which comes from a mushroom.

(c) Effects

Physiologically, hallucinogens affects on:

i. Sympathetic nervous system.
ii. Causing dilation of pupils.
iii. Constriction of some arteries.
iv. Rise in blood pressure.

3. Marijuana (Hashish)

(a) Introduction

Marijuana (Hashish) is a hallucinogen which is smoked. It is the Marijuana most commonly used drugs in the world.

(b) Sources:

It is obtained from the flowers, stems and leaves of the marijuana plant *(Cannabis sativa)* and *(C. indica).*

Effects

i. Small doses of marijuana result in a feeling of well-being that lasts two to three hours.
ii. High doses increases heart rate.
iii. It affects the production of sperms in men.
iv. It weakens the short term memory.

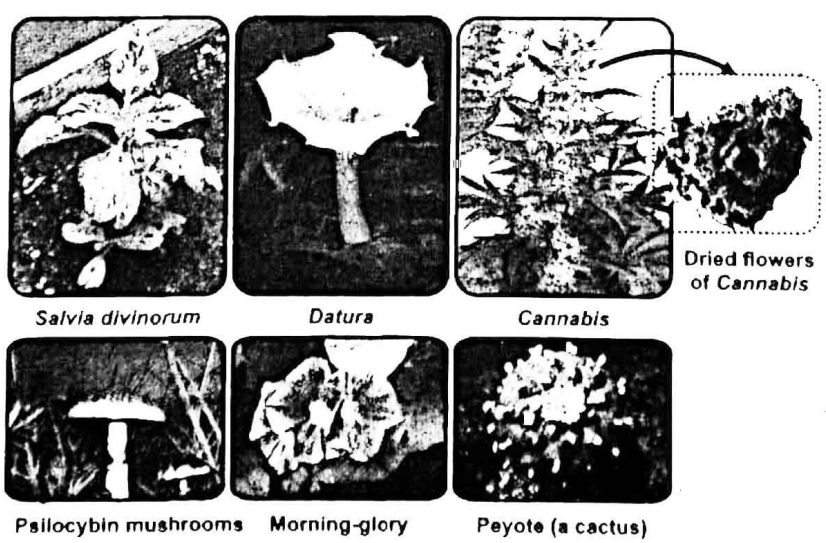


Figure 18.3: Plants from where hallucinogens are obtained

Q.10 What is drug addiction? Discuss its associated problems?

Ans. Drugs addiction

Some drugs often make person dependent on them or addicted. By using such drugs, the person's body become familiar to it and the user cannot function well without it. This is called drug addiction.

Drug addiction and associated problems

Drug abusers go through withdrawal of social contact or communication. Many studies by the experts of social sciences prove that there exists a close relationship between drug addiction and crime.

Problems of drug addiction

1. Law violation

The compulsion for narcotic drugs makes every drug addict a law violator and criminal. Mere possession of a narcotic drug is a violation of the law. Thus, every drug addict is subjected to arrest by the police.

The jails and prisons of our country are full of such people who have committed no other crime than the illegal possession of narcotics.

2. Involvement in Crimes

Most drug addicts get involved in various crimes e.g. Robbery, shoplifting, burglary, embezzlement etc.

3. Psychic patients

Drug addicts may commit violent crimes since so many become psychic patients.

4. Weak social behaviour

The addicts are very weak in their social behaviour. They face social stigma. i.e. the society dislikes them because of their unpredictable behaviours.

Q.11 What are antibiotics? How do they work? OR Discuss their uses.

Ans.

Antibiotics

An antibiotic is a drug that kills or retards the growth of bacteria. They are the chemicals produced by or derived by microorganisms (bacteria and fungi).

Bactericidal Antibiotics

Antibiotics are used to treat many different bacterial infections. Some antibiotics are "bactericidal", meaning that they kill bacteria.

Bacteriostatic Antibiotics

Antibiotics are those which work by stopping bacterial growth.

Broad-spectrum Antibiotics

Some antibiotics can be used to treat a wide range of infections and are known as broad-spectrum antibiotics.

Narrow-spectrum Antibiotics

Others are only effective against a few type of bacteria and are called narrow spectrum antibiotics.

Q.12 Describe the main groups of antibiotics?

Ans. Three major groups of antibiotics are described below:

1. Cephalosporins

Caphalosporins interfere with synthesis of bacterial cell wall and so are bactericidal. They are used to treat pneumonia, sore throat, tonsillitis, bronchitis etc.

2. Tetracyclines

These are broad spectrum bacteriostatic antibiotics and inhibit bacterial protein synthesis. Tetracyclines are used in the treatment of infections of respiratory tract, urinary tract, intestine etc.

Precaution

These are not used in children under age of 8, and during period of tooth development.

3. Sulpha Drugs-Sulfonamides

Sulpha drugs are synthetic antibiotics that contain sulfonamide group. These are broad spectrum bacteriostatic antibiotics.

Uses

They are used to inhibit folic acid synthesis in bacteria. They are used to treat pneumonia and urinary tract infections.

Q.13 Describe the antibiotic resistance?

Ans.

Antibiotic resistance

Antibiotics are most important in medicine but unfortunately bacteria are capable of developing resistance to them. Such bacteria are not affected by commonly used antibiotics, this condition is called antibiotic resistance.

Ways of resistance

Bacteria have number of ways of developing resistance.

i. Stopage by internal mechanism

Sometimes, their internal mechanism stops the working of antibiotics.

ii. Gene transfer

Bacteria can also transfer the genes responsible for antibiotic resistance between them. Such bacteria make it possible for other bacteria to acquire resistance.

iii. Efficacy

Another cause of antibiotic resistance is their use in diseases in which they have no efficacy (e.g. antibiotics are not effective against infections caused by viruses).

Problems Related to Resistance to antibiotics

1. Some bacterial infections are becoming more difficult to treat,
2. Some of the resistant bacteria can be treated with more powerful antibiotics.
3. Some infections do not eliminate even with new antibiotics.

Q.14 What are vaccines? Who introduced world's first vaccination?

Ans. Definition: **(Board 2014)**

A vaccine is a material containing weakened or killed pathogens and is used to produce immunity to a disease by stimulating the production of antibodies.

World's First vaccination

In 1796, a British physician, Edward Jenner, infected a young boy with cowpox, by injecting pus cells. After the boy had recovered from cowpox, Jenner injected the pus cells from a smallpox patient into him. The boy did not get smallpox.

So it became clear that intentional infection with cowpox protected people from small pox. This method was named vaccination and the substance used to vaccinate is called a "vaccine".

A painting showing Edward Jenner, injecting the boy, it was the world's first vaccination.

Q.15 Describe the mode of action of vaccines?

Ans. Antigens

Pathogens contain special proteins called antigens.

Antibodies

When pathogens enter the body (blood) of host, these proteins stimulate the immune response in host i.e. synthesis of antibodies. Antibodies bind to pathogens and destroy them.

Memory cells

These cells are produced which remain in blood and provide protection against future infections with the same pathogen.

Action of vaccine / Working of Vaccine **(Board 2014)**

When a vaccine i.e. weakened or dead pathogen is introduced into bloodstream, the white blood cells are stimulated; B-Lymphocytes recognize the weakened or dead pathogens as enemies and start producing antibodies against them. These antibiotics remain in blood and provide protection against pathogens. If real pathogens enter blood, the already present antibodies kill them.

Q.16 When and why children are vaccinated?

Ans. Children are required to be vaccinated before attending school. The vaccination of children has resulted in marked decrease of common diseases i.e., whooping cough, polio, small pox and others. Some vaccines do not provide life time immunity.

Multiple Choice Questions

1. **Antibiotics are used for the;**
   (a) Treatment of viral infections
   (b) Treatment of bacterial infections
   (c) Immunization against infections
   (d) Both a and b
2. **The substances used for the treatment, cure, prevention or diagnosis of disease are called;**
   (a) Medicinal drugs
   (b) Narcotics
   (c) Hallucinogens
   (d) Sedatives
3. **Aspirin is categorized as:**
   (a) A drug from animals
   (b) A synthetic drug
   (c) A drug from plants
   (d) A drug from minerals
4. **The drugs used to reduce pain are known as;**
   (a) Analgesics (b) Antiseptics
   (c) Antibiotics (d) Sedatives
5. **Which of the following drugs is obtained from plants?**
   (a) Aspirin (b) Opium
   (c) Cephalosporin (d) Insulin
6. **Which of these addictive drugs are also used as painkillers?**
   (a) Narcotics (b) Sedatives
   (c) Hallucinogens (d) All can be used
7. **Sulfonamides affect bacteria in the following way:**
   (a) Break the cell wall
   (b) Inhibit protein synthesis
   (c) Stop the synthesis of new cell wall
   (d) Stop the synthesis of folic acid
8. **What is true about vaccines?**
   (a) Protect against the future viral and bacterial infections
   (b) Treat the existing bacterial infections only
   (c) Treat existing infections and also protect against future infections
   (d) Protect against viral infections only
9. **Until 1890, the subject pharmacology was known as:**
   (a) Clinical pharmacology
   (b) Materia Medica
   (c) Pharmacy
   (d) All of these
10. **A cardiotonic digitalis is obtained from a plant:**
    (a) Poppy (b) Fungi
    (c) Cannabis (d) Foxglove
11. **The role of antiseptics is:**
    (a) Destroy microorganisms
    (b) Kill bacteria
    (c) Inhibit bacteria
    (d) Reduce possibility of infections
12. **Who introduced the idea of sterile surgery for first time?**
    (a) Alexander Fleming
    (b) Joseph Lister
    (c) Pasteur
    (d) Aristotle
13. **When Sir Alexander Fleming was awarded Nobel prize on the discovery of penicillin?**
    (a) 1881 (b) 1955
    (c) 1945 (d) 1912
14. **Expired drugs can cause damage to:**
    (a) Heart (b) Brain
    (c) Kidneys (d) Stomach
15. **The most prescribed medications in modern medicine are:**
    (a) Antibiotics
    (b) Sedatives
    (c) Cardiotonics
    (d) Hallucinogens

16. A medicine for lowering blood pressure, which has sulfonamide group is:
(a) Aspirin
(b) Penicillin
(c) Thiazide diuretics
(d) Teramycine

17. Edward Jenner introduced the world's first:
(a) Vaccination
(b) Antigen
(c) Antibiotics
(d) Addictive drugs

18. In case of tetanus vaccination which is for limited time, ____ are used for continuous protection.
(a) B-Lymphocytes
(b) Booster shots
(c) Antibiotics
(d) None of these

19. The methods of administering vaccines is/are;
(a) Injection (b) Mouth
(c) Nasal spray (d) All of these

20. When the antibiotics are not effective against viral infections, then it is called;
(a) Efficiency (b) Efficacy
(c) Inefficiency (d) resistance

21. The medicine reduces the pain; (Board 2013)
(a) Aspirin (b) Quinine
(c) Chloroquine (d) Resochin

22. This drug belongs to Hallucinogens; (Board 2013)
(a) Morphine (b) Codeine
(c) Heroin (d) Mescaline

23. Cardiotonic is used to stimulate the heart, it is made from the leaves of purple flowered plant called:
(a) Rose (b) Jasmine
(c) Hibiscus (d) Foxglove

24. The powder form of _____ is applied on wounds to stop bleeding and prevent infection:
(a) Ammonium nitrate
(b) Silver nitrate
(c) Sodium phosphate
(d) Sulphur

25. Diazepam is included in:
(a) Analgesics
(b) Antibiotics
(c) Sedatives
(d) Vaccines

26. Long term use of _____ drug induced suicidal thoughts:
(a) Analgesics (b) Vaccines
(c) Antibiotics (d) Sedatives

27. Mescaline comes from:
(a) Mushroom (b) Poppy plant
(c) Cactus (d) Sunflower

28. The scientific name of marijuana plant is:
(a) *Rosa Indica*
(b) *Brassica campestris*
(c) *Putrenzeva*
(d) *Cannabis sativa*

29. _____ is not used in children under the age of 8 and during the period of tooth development:
(a) Cephalosporins (b) Tetracyclines
(c) Sulpha Drugs (d)Thiazide Diuretics

30. In which year a British physician Edward Jenner infected a young boy with cowpox by injecting pus cells:
(a) 1786 (b) 1696
(c) 1756 (d) 1796

31. Drugs obtained from animals are usually their _____ products.
(a) Catabolic (b) Anabolic
(c) Waste (d) Glandular

32. **_____ recognize the weakened or dead pathogens as enemies and start producing antibodies against them.**
(a) Antigens
(b) Lymphocytes
(c) Vaccines
(d) None

33. **_____ destroy microorganisms found on non-living objects.**
(a) Sedatives (b) Antibiotics
(c) Disinfectants (d) Antiseptics

34. **Pathogens contain special proteins called:**
(a) Lymphocytes (b) Antigens
(c) Antibiotics (d) Antibodies

35. **Which of following is/are broad spectrum antibiotics?**
(a) Tetracyclines
(b) Sulfonamides
(c) Cephalosporins
(d) Tetracyclines and Sulfonamides

36. **Which of following drug is derived from a mushroom?**
(a) Marijuana (b) Mescaline
(c) Morphine (d) Psilocin

37. **Antibiotics are derived from microorganisms:**
(a) Bacteria
(b) Fungi
(c) Bacteria and Fungi
(d) Viruses

38. **Bacteriostatics are antibiotics:**
(a) Kill bacteria
(b) Stop bacterial growth
(c) Enhance bacterial growth
(d) Lessen bacterial growth

39. **Which of following is not an antibiotic?**
(a) Penicillin
(b) Tetracycline
(c) Thiazide diuretics
(d) Sulfa drugs

40. **Penicillin is derived from fungus**
(a) *Penicillium candidum*
(b) *Penicillium expansum*
(c) *Penicillium notatum*
(d) *Penicillium chrysogenum*

41. **Example of non-prescription drug is:**
(a) Aspirin
(b) Antibiotics
(c) Barbiturates
(d) Tranquillizers

42. **Which of following is/are an example of prescription drug:**
(a) Barbiturates and Aspirin
(b) Tranquillizers
(c) Aspirin
(d) Barbiturates and Tranquillizers

43. **Which of following is an example of synthetic drug?**
(a) Digitalis
(b) Penicillin
(c) Aspirin
(d) Streptomycin

44. **Which of following affects production of sperms in men?**
(a) Codeine (b) Morphine
(c) Marijuana (d) Mescaline

45. **Paracetamol is a/an:**
(a) Analgesics (b) Antibiotics
(c) Sedatives (d) Vaccines

46. **Small doses of _____ result in feeling of well-being that lasts two to three hours.**
(a) Mescaline (b) Marijuana
(c) Heroin (d) Morphine

47. **Which of following are used to relieve pain for patients with chronic diseases such as cancer.**
(a) Sedatives
(b) Narcotics
(c) Hallucinogens
(d) Mescaline

48. **Antibiotics used to treat a few types of bacteria are called _____ antibiotics.**
(a) Broad Spectrum
(b) Narrow Spectrum
(c) Large Range spectrum
(d) Narrow and Broad Spectrum

49. **Sir Alexander Fleming is _____ biologist.**
(a) Italian (b) English
(c) Scottish (d) Swedish

50. **Early Pharmacologist focused on:**
(a) Synthetic chemical extract
(b) Microbial Extracts
(c) Plant Extracts
(d) Animal Extracts

51. **Which cells in body provide protection against future infections?**
(a) Red Blood cells
(b) Thrombocytes
(c) Memory cells
(d) Platelets

52. **Drugs which make a person dependent on them are:**
(a) Antibiotics
(b) Addictive
(c) Clinical
(d) Non prescription

53. **Aspirin is a a/an;**
(a) Prescription
(b) Non prescription
(c) Synthetic drug
(d) Synthetic & Non-Prescription drug

54. **Medicines which are used to stimulate heart rate are called:**
(a) Antibiotics (b) Cardiotonics
(c) Analgesics (d) Pain killer

55. **A Cardiotonic is:**
(a) Penicillin (b) Aspirin
(c) Digitalis (d) Opium

56. **Penicillin is obtained from:**
(a) Plants (b) Fungus
(c) Animals (d) Bacteria

57. **From the leaves of foxglove, which is obtained?**
(a) Opium
(b) Tincture of iodine
(c) Antitoxin
(d) Digitalis

58. **The example of a pain reliever is;**
(a) Silver nitrate
(b) Morphine
(c) Marijuana
(d) Mescaline

59. **An example of illegal addictive drug is:**
(a) Marijuana (b) Penicillin
(c) Digitalis (d) Foxglove

60. **Drugs which are obtained from animals are:**
(a) Musk and Bees wax
(b) Musk
(c) Bees wax
(d) Mush and tincture of Iodine

61. **Hallucinogen which is smoked is;**
(a) Datura
(b) Marijuana
(c) Psilocin
(d) Mescaline

62. **Which inhibit or kill bacteria?**
(a) Aspirin (b) Tetracycline
(c) Diazepam (d) Paracetamol

63. **Who discovered penicillin?**
(a) Fleming (b) Lister
(c) Jenner (d) Louis Pasteur

64. **Which are aroused for ecstatic effects?**
(a) Sedatives
(b) Hallucinogens
(c) Narcotics
(d) Marijuana

65. **Most commonly abused Narcotic is:**
(a) Morphine (b) Codeine
(c) Caffeine (d) Heroin

66. **Which is derived from Cactus?**
(a) Psilocin (b) Diazepam
(c) Mescaline (d) Morphine

67. **What affects sympathetic Nervous system?**
(a) Sedative (b) Hallucinogens
(c) Narcotics (d) Analgesics

68. **High doses of _____increases heart rate?**
(a) Marijuana
(b) Hashish
(c) Marijuana & Hashish
(d) Morphine

69. **Which interfere with synthesis of bacterial cell wall?**
(a) Cephalosporins
(b) Tetracyclines
(c) Tetracyclines & Cephalosporins
(d) Sulfonamide

70. **Which should not be used during period of tooth development?**
(a) Cephalosporins
(b) Sulfonamides
(c) Tetracyclines
(d) Hallucinogens

71. **A medicine for lowering blood pressure is:**
(a) Cephalosporins
(b) Sulpha drugs
(c) Tetracyclines
(d) Thiazide diuretics

72. **Who introduced Carbolic Acid?**
(a) Sir Alexander Fleming
(b) Louis Pasteur
(c) Joseph Lister
(d) Edward Jenner

73. **The example of Sedative is:**
(a) Aspirin
(b) Diazepam
(c) Carbolic acid
(d) Tetracycline

74. **The drugs that causes changes in perception, thought, emotion and consciousness are:**
(a) Narcotics
(b) Sedatives
(c) Hallucinogens
(d) Morphine

75. **Morphine and Codeine are derived from:**
(a) Poppy
(b) Foxglove
(c) Sheesham
(d) All of these

76. **Which one is prescribed as a strange Analgesic under the name diamorphine in many Western countries:**
(a) Paracetamol
(b) Aspirin
(c) Heroin
(d) Marijuana

77. **To which granp aspirin belong;** **(Board 2014)**
(a) Obtained from animals
(b) Obtained from plants
(c) Synthetic
(d) Obtained from bacteria

78. **Which of the following addictive drugs is obtained from opium?**
(a) Morphine **(Board 2014)**
(b) Marijuana
(c) Mescaline
(d) Psilocin

Answer Key

1	b	**2**	a	**3**	b	**4**	a	**5**	b
6	a	**7**	d	**8**	c	**9**	b	**10**	d
11	d	**12**	b	**13**	c	**14**	c	**15**	a
16	c	**17**	a	**18**	b	**19**	d	**20**	b
21	a	**22**	d	**23**	d	**24**	b	**25**	c
26	d	**27**	c	**28**	d	**29**	b	**30**	d
31	d	**32**	b	**33**	c	**34**	b	**35**	d
36	d	**37**	c	**38**	b	**39**	c	**40**	c
41	a	**42**	b	**43**	c	**44**	c	**45**	a
46	b	**47**	b	**48**	b	**49**	b	**50**	c
51	c	**52**	b	53	d	54	b	**55**	c
56	b	**57**	d	58	b	59	a	**60**	a
61	b	**62**	b	63	a	64	c	**65**	d
66	c	**67**	b	**68**	c	**69**	a	**70**	c
71	d	**72**	c	73	b	74	c	**75**	a
76	c	**77**	c	78	a				

Short Answer Questions

Q.1 Define pharmacology and distinguish it from pharmacy?

Ans.

Pharmacology

It is the study of drug composition, properties and medical applications. Sources of drugs are also studied in pharmacology.

Pharmacy

While pharmacy is the study of preparation of medicines and drugs. Pharmacology is not synonymous with pharmacy.

Q.2 Differentiate between medicinal drug and addictive drug.

Ans.

Medicinal drug

It is defined as any chemical substance used in the diagnosis, cure, treatment or prevention of diseases.

Addictive drug

Some drugs often make person dependent on them or addicted. The person's body becomes familiar to it and user cannot function well without it, these are called addictive drugs.

Q.3 Differentiate between analgesic and antibiotic?

Ans. Analgesic (pain killers) reduces pains e.g. paracetamol etc.

Antibiotic

Antibiotic are chemicals which inhibits or kills bacteria and treat bacterial infection e.g. tetracycline etc.

Q.4 What is marijuana? To which category of addictive drugs it belongs?

Ans. Marijuana is a hallucinogen which is smoked. It is obtained from flowers, stems, leaves of the marijuana plant, It belongs to the category of hallucinogens which result in a feeling of well being that lasts two to three hours.

Q.5 Differentiate between narcotics and hallucinogens?

Ans.

Narcotics

Narcotics are strong painkillers. These drugs are often prescribed in conjunction with other less potent painkillers. These are used to relieve pain, but some people may abuse narcotics for ecstatic effects.

Hallucinogens

Hallucinogens are the drugs that cause changes in perception, thought, emotion and consciousness.

Q.6 What is Aspirin?

Ans. A pain killer medicine, synthesized in Laboratory having the composition as Acetaminophen.

Q.7 What do you know about bactericidal and bacteriostatic?

Ans. The antibiotics that they kill bacteria e.g. cephalosporins are called bactericidal.

Bacteriostatic

The antibiotics that they work by stopping bacterial growth e.g. sulphonamides.

Q.8 What is cardiotonic?

Ans. Medicines for giving strength to heart muscles is called cardiotonics.

Q.9 Define the term cephalosporin?

Ans. A group of antibiotics, interfere with synthesis of bacterial cell wall and so are bactericidal. It is used to treat pneumonia, sorethroat, tonsillitis, bronchitis etc.

Q.10 What is heroin?

Ans. A commonly abused narcotic, derived from morphine, affects the central nervous system and causes drowsiness, hypertension etc.

Q.11 What is Morphine?

Ans. A commonly used narcotic, derived from the juice of opium, acts directly on the CNS to relieve pain , has a high potential for addiction.

Q.12 What are sedatives?

Ans. The types of drugs that interact with the central nervous system to depress its activities, make a person calm or drowsy e.g. diazepam.

Q.13 What do you know about sulfonamide and tetracycline?

Ans. Sulfonamide

Sulpha drugs are synthetic anti-biotics that contain sulfonamide group. They are broad spectrum bacteriostatic antibiotics. They inhibit the folic acid synthesis in bacteria and used to treat pneumonia and urinary tract infections.

Tetracycline

Broad spectrum bacteriostatic inhibit bacterial protein synthesis. It is used in the treatment of infections of respiratory tract, urinary tract, intestine etc.

Q.14 What is vaccine?

Ans. The material used to produce immunity to a disease by stimulating the production of antibodies.

Q.15 Define the term disinfactants?

Ans. Disinfactants destroy microorganism found on non-living objects.

Q.16 What is tincture of iodine?

Ans. The mineral iodine is used in making tincture of iodine, a liquid that helps to prevent infection when applied to cuts and bruises.

Q.17 Make a difference between broad spectrum and narrow spectrum antibiotics?

Ans.

Broad Spectrum Antibiotics

Some antibiotics can be used to treat a wide range of infections and are known as broad spectrum antibiotics.

Narrow Spectrum Antibiotics

Antibiotics used against a few types of bacteria are called narrow spectrum antibiotics.

Q.18 What is role of antibodies? (Board 2013)

Ans. When pathogens enter the body (blood) of host, these proteins stimulate an immune response in host i.e. synthesis of "antibodies". Antibodies bind to pathogens and destroy them. In addition, "memory cells" are produced, which remain in blood and provide protection against future infections with the same pathogens.

Q.19. Define antibiotics. (Board 2013)

Ans. An antibiotics is a drug that kills or retards the growth (reproduction) of bacteria. They are the chemicals produced by or derived from microorganisms (bacteria and fungi).

Q.20. Name two drugs obtained from animals. (Board 2013)

Ans. Fish liver oils, musk, bee's wax, certain hormones and antitoxins are obtained from animal sources.

Q.21. What are the functions of antibiotics? (Board 2013-14)

OR Define drug. Name one synthetic drug.

Ans. Antibiotics are used to treat many different bacterial infections. Some antibiotics are bactericidal meaning that they kill bacteria. Others are 'bacteriostatic meaning that they work by stopping bacterial growth.

Q.22. What is meant by drug?" Give one example. (Board 2013)

Ans. Any substance that, when absorbed into the body of a living organism, alters normal body function is known as a drug e.g. Aspirin, is an example of synthetic drug.

Q.23. Write the name of two drugs which are obtained from minerals. (Board 2013)

Ans. (i) Tincture of Iodine

(ii) Silver Nitrate

Q.24. Which antibiotic is obtained from soil?

Ans. Terramycine is obtained from the soil which is used to treat many infections.

Q.25. Differentiate between antiseptic and antibiotics.

Ans. Antiseptic reduces the possibility of infection on skin while antibiotics inhibit or kill bacteria within or on the body.

Q.26. Write the contributions of Sir Alexander Fleming in the field of pharmacology.

Ans. Sir Alexander Fleming discovered the antibiotic penicillin from the fungus *Penicillium notatum* for which he was awarded the Nobel Prize in 1945.

Q.27. Write the important contributions of Joseph Lister in the field of surgery.

Ans. Joseph Lister was an English surgeon. He promoted the idea of sterile surgery for the first time. He introduced carbolic acid to sterilize surgical instruments and to clean wounds.

Q.28. Is vaccines provide life time immunity?

Ans. Some vaccines do not provide life time immunity. For example Tetanus vaccines are only effective for a limited period of time. In such cases, booster shots are necessary to maintain continuous protection.

Q.29. Write two functions of B.Lymphocytes. (Board 2014)

Ans. B.Lymphocytes recognize the weakened or dead pathogens as enemies and start producing antibodies against them. These antibodies remain in blood and provide protection against pathogens. If real pathogens enter blood, the already present antibodies kill them.