eggs in water. *E.g.* Snakes, Turtles, Crocodiles etc.

(iv) **Aves –** They are warm blooded animals with 4 – chambered heart. They have feathers and forelimbs are modified for flight. They breathe through lungs. *E.g.* Pigeon, Sparrow, Ostrich.

(v) **Mammalia –** They are warm blooded animals with 4 – chambered heart. They have mammary glands for milk production. They show care for young ones, skin has hairs and sweat glands. They give birth to young ones.

REPRODUCTION

The production of new organisms from the existing organisms of the same species is known as reproduction.

Asexual Reproduction

(i) Fission :

(1) **Binary fission** – The parent organism divides to form two new organisms. *E.g. Amoeba.*

(2) **Multiple fission** – The parent organism divides to form many new organisms at the same time. *E.g. –Plasmodium.*

(ii) Budding : A small part of the body of the parent organism grows out as a 'bud' which then detaches and becomes a new organism. *E.g. Hydra.*

(iii) Spore formation : The parent plant produces hundreds of microscopic reproductive units (spores). Under favourable conditions, they germinate and produce new plants.

(iv) Regeneration : The process of getting back full organism from its body parts is called regeneration. *E.g. Hydra.*

(v) Vegetative propagation : New plants are obtained from the parts of old plants (like stems, roots, and leaves), without the help of any reproductive organs. *E.g.* banana, orange, rose.

(vi) **Tissue culture:** The production of new plants from a small piece of plant tissue (or cells) removed from the growing tips of a plant in a suitable growth medium (culture solution).

(vii) **Fragmentation :** The breaking up of the body of a simple multicellular organism into two (or more) pieces on maturing, each of which subsequently grows to form a complete new organism, *e.g. Spirogyra* and Sea anemones.

- Artificial propagation of plants includes — **cutting, layering and grafting.**

Sexual Reproduction

In sexual reproduction, a male gamete (germ cells) fuses with a female gamete to form a new cell called '**zygote**'.

- Male gametes are known as **sperms** and these are produced in **testes**. Female gametes are known as **ovum** and are produced in **ovary**.
- When male gamete and female gamete fuse, they form a zygote and the process is known as **fertilization**.

Sexual Reproduction in Flowering Plants

- Flower is meant essentially for sexual reproduction. Different parts of the flowers are **sepals, petals, stamens and carpels**.
- Stamens and carpel are directly concerned with the process of sexual reproduction. **Stamen** is the male reproductive part. **Carpel** is the female reproductive part.
- **Pollination** is the process in which pollen grains are transferred from the anther to stigma of the carpel. It is of two types **self-pollination** and **cross-pollination**.

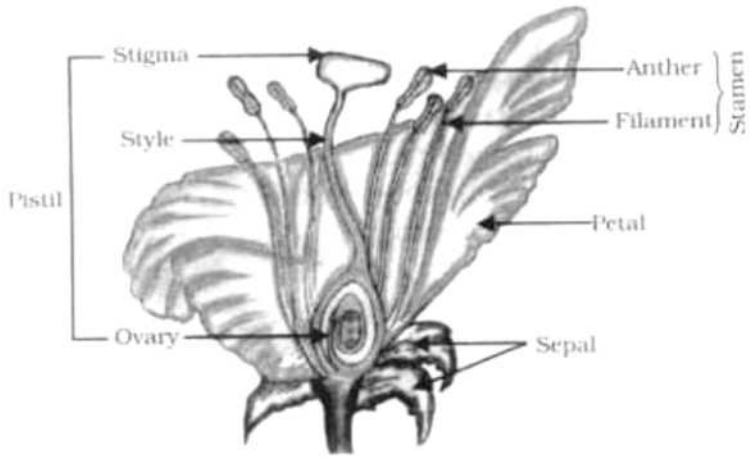

Fig. Longitudinal section of flower

- In the fertilization process **primary endospermic nucleus** is formed.
- After the fertilization process, ovary develops into the fruit whereas ovules into the seed.

REPRODUCTION IN HUMAN BEINGS

- The reproductive organs of human beings become functional after attaining puberty stage. It occurs in between the age group of 13 – 14 years in male and 10 – 12 years in female.
- The sex organ in males are testes and ova in females.
- Male reproductive organ consist of a pair of testes, vas deferens, a pair of epididymis, a pair of ejaculatory duct, urethra, pairs of accessory gland.
- Leydig's cells secrete male sex hormone **testosterone** which is concerned with the production of male sexual characters.

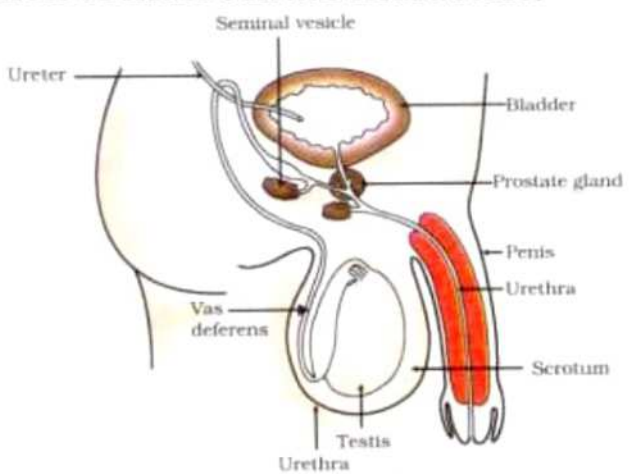

Fig. Human-male reproductive system

- Penis transfers the sperms to female reproductive tract.

- Female reproductive part consist of a pair of ovaries, a pair of fallopian tube, uterus, vagina, external genitalia, mammary glands and accessory glands.
- If sperms are present, fertilization of ovum takes place in the upper end of the **fallopian tube**.
- In the uterus, embryo gets implanted and develops for nine months during pregnancy. **Cervix** is the lower tip of uterus.

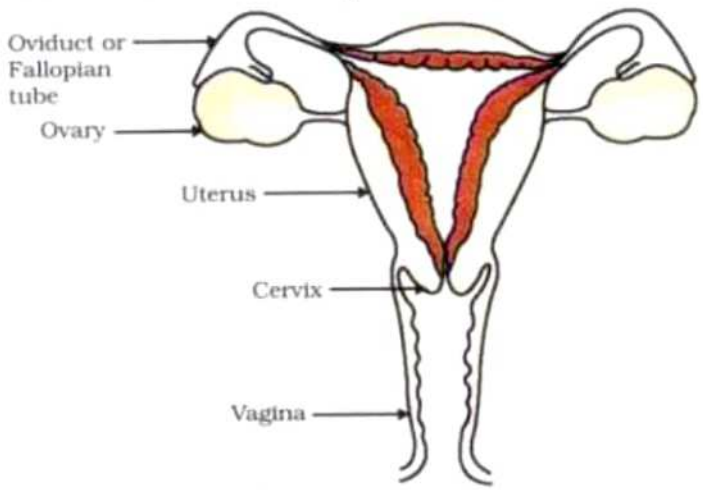

Fig. Human-female reproductive system

- **Vagina** acts as a birth canal during **child birth**.
- Fertility phase lies between tenth and sixteenth days from onset of menses and there is viability of ovum.
- **Fertilization** process occurs in **fallopian tube**. In this process zygote is formed. **Umbilical cord** is produced which is attached to foetus. During this process two hormones are produced which are **estrogen** and **progesterone**. Progesterone stops mensturation and prevents ovulation.
- If the egg is not fertilized, it lives for about one day. Since the ovary releases one egg every month, the uterus also prepares itself every month to recieve a fertilized egg.

Reproductive Health

Barrier methods

(i) **Mechanical barrier method:-** They prevent contraception by preventing either sperms from entering uterus or preventing implantation if fertilization has occurred. The instruments are condom, cervical cap, diaphragms & IUDs method.

(ii) **Hormonal method:** They are used by women for suppresing the production of ovum. *i.e*, oral pills.

(iii) **Surgical techniques:–**

1. **Vasectomy –** A small part of the vas deferens is removed or tied up through a small incision on the scrotum. This prevents the passage of sperms from testes to semen.
2. **Tubectomy–** A portion of both the fallopian tubes is excised to ligated to block the passage of ovum.

- **Sexually Transmitted Diseases (STDs) :** It is a group of infections caused by different types of pathogens that are transmitted by sexual contact between a healthy person and an infected person. Some sexually transmitted diseases (STDs) are Gonorrhoea, Syphilis, Trichomoniasis, Genital worts and AIDS *etc*.

Gestation Perioda of Animals

Gestation Perioda of Animals			
Animal	**Gestation Period**	**Animal**	**Gestation Period**
Buffalo	310 days	Horse	340 days
Elephant	610 days	Leopard	105 days
Lion	120 days	Tiger	103 days
Whale	365 days	Squirrel	40 days
Human	280 days	Dog	61 days

Exercise

DIRECTIONS : This section contains multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which only one is correct.

1. Plants that grow in the desert are called
   (a) hydrophytes
   (b) mesophytes
   (c) xerophytes
   (d) epiphytes
2. Binomial system of a nomenclature means that every organism has
   (a) two names, one scientific and one popular.
   (b) one scientific name consisting of a generic and a specific part.
   (c) one name given by two scientists.
   (d) two names, one denoting the latinised name of the place and the other of the person, who determined it.
3. The main plant body of pteridophyte is
   (a) sporophyte
   (b) epiphyte
   (c) saprophyte
   (d) gametophyte
4. 'The Origin of Species' was written by
   (a) Linnaeus
   (b) Whittaker
   (c) Parasara
   (d) Darwin
5. The kingdom Protista is primarily made up of organisms that are
   (a) eukaryotic and multicellular
   (b) prokaryotic and multicellular
   (c) prokaryotic and single-celled
   (d) eukaryotic and single-celled
6. What were the key evolutionary innovations of the Plantae ?
   (a) Seeds, organelles, flowers
   (b) Roots, cuticle, seeds, flowers
   (c) Roots, hyphae, flowers
   (d) Hyphae, cuticle, organelles

7. Choose the correct combination
   (a) Aves and Chordata – Classes
   (b) Annelida and Porifera – Phyla
   (c) Mollusca and Hydrozoa – Classes
   (d) Oligochaeta and Arthropoda – Phyla
8. Five kingdom classification was proposed by
   (a) Woese
   (b) Haeckel
   (c) Darwin
   (d) Whittaker
9. The unique feature of bryophytes being member of kingdom plantae is that
   (a) they lack roots.
   (b) they produce spores.
   (c) they lack vascular tissue.
   (d) their sporophyte is attached to gametophyte.
10. 'Sanjeevani booti' is
   (a) *Selaginella kraussiana*
   (b) *Selaginella chrysocaulos*
   (c) *Selaginella bryopteris*
   (d) None of the above
11. A plant having vascular supply, producing spores but lacking seeds can be grouped under
   (a) bryophyta
   (b) pteridophyta
   (c) gymnosperms
   (d) angiosperms
12. Mycoplasma belongs to:
   (a) Protista
   (b) Monera
   (c) Thallophyta
   (d) Nematoda
13. Which of the following are absent in gymnosperms ?
   (a) Xylem vessels
   (b) Xylem fibres
   (c) Tracheids and fibres
   (d) All of these
14. Porifers are
   (a) generally marine, but few are found in fresh water.

(b) generally found in fresh water, but few are marine.
(c) marine only.
(d) found in fresh water only.

15. If a *Hydra* is cut into two pieces it will result in
(a) growth of mouth and disc according to their position in the parent.
(b) growth without mouth and basal disc.
(c) no regeneration.
(d) growth of mouth and disc at any end.

16. Which is not a feature of Annelida ?
(a) Metameric segmentation
(b) Nephridia
(c) Pseudocoelom
(d) Clitellum

17. Which of the following is an edible 'Fungi' ?
(a) *Mucor*
(b) *Penicillium*
(c) *Agaricus*
(d) *Rhizopus*

18. Radial symmetry is found in
(a) *Hydra*
(b) Starfish
(c) Sponge
(d) Spider

19. Notochord, Dorsal nerve chord and Gill-slits are features seen in :
(a) vertebrata
(b) protozoa
(c) mollusca
(d) porifera

20. Which of the following pairs is correctly matched ?
(a) Water-vascular system - Sponge
(b) Flame cell-Flat worm
(c) Blubber-Kangaroo
(d) Marsupium-*Platypus*

21. Asexual reproduction takes place through budding in
(a) *Amoeba*
(b) *Yeast*

(c) *Plasmodium*
(d) *Leishmania*

22. Which of the following is not a part of the female reproductive system in human beings?
(a) Ovary
(b) Uterus
(c) Vas deferens
(d) Fallopian tube

23. The structures that carry information for inheritance is
(a) chromosomes
(b) nucleolus
(c) endoplasmic reticulum
(d) mitochondria

24. The anther contains
(a) sepals
(b) ovules
(c) carpel
(d) pollen grain

25. In the list of organisms given below, those that are reproduced by the asexual method are
(i) banana
(ii) dog
(iii) *Yeast*
(iv) *Amoeba*
(a) (ii) and (iv)
(b) (i), (iii) and (iv)
(c) (i) and (iv)
(d) (ii), (iii) and (iv)

26. In a flower, the parts that produce male and female gametes (germ cells) are
(a) stamen and anther
(b) filament and stigma
(c) anther and ovary
(d) stamen and style

27. The capacity of organisms to reproduce after being cut into many pieces is called
(a) budding
(b) fission
(c) regeneration
(d) reproduction

28. Which of the following is the correct sequence of events of sexual reproduction in a flower?
    (a) Pollination, fertilisation, seedling, embryo
    (b) Seedling, embryo, fertilisation, pollination
    (c) Pollination, fertilisation, embryo, seedling
    (d) Embryo, seedling, pollination, fertilisation
29. Offspring formed by asexual method of reproduction have greater similarity among themselves because
    (i) asexual reproduction involves only one parent.
    (ii) asexual reproduction does not involve gametes.
    (iii) asexual reproduction involves two parents.
    (iv) asexual reproduction occurs before sexual reproduction.
    (a) (i) and (ii)
    (b) (i) and (iii)
    (c) (ii) and (iv)
    (d) (iii) and (iv)
30. Characters transmitted from parents to offspring are present in
    (a) cytoplasm
    (b) ribosome
    (c) Golgi bodies
    (d) genes
31. The main method of propagation of banana, orange, rose and jasmine is
    (a) sexual reproduction
    (b) vegetative reproduction
    (c) fission
    (d) fusion
32. Characters that are transmitted from parents to offspring during reproduction show
    (a) only similarities with parents.
    (b) only variations with parents.
    (c) both similarities and variations with parents.
    (d) neither similarities nor variations.
33. A feature of reproduction that is common to Amoeba, *Spirogyra* and Yeast is that

(a) they reproduce asexually.
(b) they are all unicellular.
(c) they reproduce only sexually.
(d) they are all multicellular.

34. Which among the following has specialised tissue for conduction of water?
(i) Thallophyta
(ii) Bryophyta
(iii) Pteridophyta
(iv) Gymnosperms
(a) (i) and (ii)
(b) (ii) and (iii)
(c) (iii) and (iv)
(d) (i) and (iv)

35. The reptile with a four chambered heart is
(a) crocodile
(b) turtle
(c) lizards
(d) snakes

36. Which among the following have scales?
(i) Amphibians
(ii) Pisces
(iii) Reptiles
(iv) Mammals
(a) (i) and (iii)
(b) (iii) and (iv)
(c) (ii) and (iii)
(d) (i) and (ii)

37. Which among the following have open circulatory system?
(i) Arthropoda
(ii) Mollusca
(iii) Annelida
(iv) Coelenterata
(a) (i) and (ii)
(b) (iii) and (iv)
(c) (i) and (iii)
(d) (ii) and (iv)

38. Organisms without nucleus and cell organelles belong to
(i) fungi
(ii) protista

(iii) cyanobacteria
(iv) archae bacteria
(a) (i) and (ii)
(b) (iii) and (iv)
(c) (i) and (iv)
(d) (ii) and (iii)

39. The fertilized egg or the zygote gets implanted in the
(a) fallopian tube
(b) ovary
(c) uterus
(d) vagina

40. Meena and Hari observed an animal in their garden. Hari called it an insect while Meena said it was an earthworm. Choose the character from the following which confirms that it is an insect.
(a) Bilateral symmetrical body
(b) Body with jointed legs
(c) Cylindrical body
(d) Body with little segmentation

41. Factors responsible for the rapid spread of bread mould on slices of bread are
(i) large number of spores.
(ii) availability of moisture and nutrients in bread.
(iii) presence of tubular branched hyphae.
(iv) formation of round shaped sporangia.
(a) (i) and (iii)
(b) (ii) and iv)
(c) (i) and (ii)
(d) (iii) and (iv)

42. Which of the following statements are true for flowers?
(i) Flowers are always bisexual.
(ii) They are the sexual reproductive organs.
(iii) They are produced in all groups of plants.
(iv) After fertilisation they give rise to fruits.
(a) (i) and (iv)
(b) (ii) and (iii)
(c) (i) and (iii)
(d) (ii) and (iv)

43. The following figures illustrate binary fission in *Amoeba*

(iii) cyanobacteria
(iv) archae bacteria
(a) (i) and (ii)
(b) (iii) and (iv)
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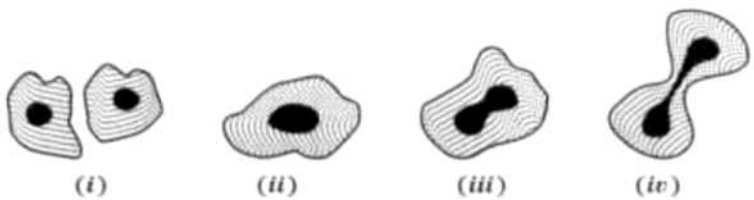


The correct sequence is

(a) (i), (iii), (iv), (ii)
(b) (ii), (iii), (iv), (i)
(c) (iv), (iii), (ii), (i)
(d) (iii), (iv), (ii), (i)

44. Which among the following statements are true for unisexual flowers?

(i) They possess both stamen and pistil.
(ii) They possess either stamen or pistil.
(iii) They exhibit cross pollination.
(iv) Unisexual flowers possessing only stamens cannot produce fruits.

(a) (i) and (iv)
(b) (ii), (iii) and (iv)
(c) (iii) and (iv)
(d) (i), (iii) and (iv)

45. Which among the following statements are true for sexual reproduction in flowering plants?

(i) It requires two types of gametes.
(ii) Fertilisation is a compulsory event.
(iii) It always results in formation of zygote.
(iv) Offspring formed are clones.

(a) (i) and (iv)
(b) (i), (ii) and (iv)
(c) (i), (ii) and (iii)
(d) (i), (ii) and (iv)

46. Which among the following is not the function of testes at puberty?

(i) Formation of germ cells.
(ii) Secretion of testosterone.
(iii) Development of placenta.
(iv) Secretion of estrogen.

(a) (i) and (ii)
(b) (ii) and (iii)
(c) (iii) and (iv)
(d) (i) and (iv)

47. The organ modified for flight in birds is

(a) hindlimbs
(b) neck

(c) forelimbs
(d) fingers

48. Mucus glands in the skin and three chambered heart are seen in
(a) Reptilia
(b) Aves
(c) Pisces
(d) Amphibia

49. Cartilaginous skeleton is seen in
(a) Tuna
(b) Sharks
(c) Mandarin fish
(d) Pterois volitans

50. Calcium carbonate structures form the skeleton of
(a) Mollusca
(b) Echinodermata
(c) Protochordata
(d) Nematodes

51. The largest group of animals is seen in
(a) Porifera
(b) Annelida
(c) Arthropoda
(d) Nematoda

52. *Marsilea* and Horse-tails belong to
(a) thallophyta
(b) angiosperms
(c) pteridophyta
(d) bryophyta

53. Naked seeds, perennial, evergreen, woody plants are characteristic features of
(a) gymnosperms
(b) bryophyta
(c) angiosperms
(d) pteridophyta

54. The highest taxon in the hierarchy of classification is
(a) kingdom
(b) class

(c) phyllum
(d) genus

55. Unicellular organisms divide due to
(a) fusion
(b) fission
(c) budding
(d) sexual reproduction

56. *Plasmodium* divides by
(a) budding
(b) fusion
(c) multiple fission
(d) binary fission

57. Advantage of vegetatively reproduced organism is
(a) dissimilar organisms
(b) genetic similarity in offsprings
(c) genetic variation
(d) varied offsprings

58. Vegetative propagation in *Bryophyllum* is due to
(a) buds in the notches of leaves
(b) corm
(c) stem
(d) root

59. The structures involved in asexual reproduction of *Rhizopus* is
(a) buds
(b) sporangia
(c) callus
(d) cell

60. Variations in a population is due to
(a) DNA copying
(b) error in DNA copying
(c) cell division
(d) budding

61. The germ cell in plants are seen in
(a) stem
(b) leaves
(c) root
(d) stamens and carpels

62. The embryo gets nutrition from the mothers blood with the help of
(a) placenta
(b) ovary
(c) corpus luteum
(d) fallopian tube

63. The formation of germ cells in males occur in
(a) testes
(b) ovary
(c) ureter
(d) urethera

Hints & SOLUTIONS

1. **(c)**
2. **(b)**
3. **(a)**
4. **(d)** Charles Darwin's Origin of Species is a seminal work in scientific literature and arguably the pivotal work in evolutionary biology. It introduced the theory that populations evolve over the course of generations through a process of natural selection.
5. **(d)**
6. **(b)**
7. **(b)**
8. **(d)** Whittaker was most active in the areas of plant community analysis, succession, and productivity. He also first proposed the five-kingdom taxonomic classification of the world's biota into the Animalia, Plantae, Fungi, Protista, and Monera.
9. **(c)**
10. **(c)**
11. **(b)**
12. **(b)** Monera is an obsolete biological kingdom of the former five-kingdom system of scientific classification. It comprised most organisms with a prokaryotic cell organization. For this reason the kingdom was sometimes called Prokaryota or Prokaryotae.
13. **(a)**
14. **(a)**
15. **(a)**
16. **(c)**
17. **(c)**
18. **(a)** Radial symmetry is found only in Coelenterata and ctenophora. Hydra belongs to Coelenterata. While starfish belongs to Echinodermata.

The adult echinoderms are radially symmetrical but larvae are bilaterally symmetrical.

19. **(a)** The defining characteristic of a vertebrate is considered the backbone or spinal cord, a brain case, and an internal skeleton, but the latter do not hold true for lampreys, and the former is arguably present in some other chordates.
20. **(b)**
21. **(b)**
22. **(c)**
23. **(a)** A chromosome is a single large macromolecule of DNA, and constitutes a physically organized form of DNA in a cell. It is a very long, continuous piece of DNA (a single DNA molecule), which contains many genes, regulatory elements and other intervening nucleotide sequences.
24. **(d)**
25. **(b)**
26. **(c)**
27. **(c)** In biology, regeneration is an organism's ability to replace body parts. It is a specific method of healing that is ability to regrow lost limbs, severed nerve connections, and other wounds. It can be seen in the organisms of *Planaria* and starfish.
28. **(c)**
29. **(a)**
30. **(d)**
31. **(b)** When an individual organism increases in size via cell multiplication and remains intact, the process is called "vegetative growth". However, in vegetative reproduction, the new plants that result are new individuals in almost every respect except genetically.

32. **(c)**
33. **(a)**
34. **(c)**
35. **(a)** A crocodile is any species belonging to the family Crocodylidae sometimes classified instead as the subfamily Crocodylinae. Its a reptile with four chambered heart.
36. **(c)**
37. **(a)**
38. **(b)**
39. **(c)** The fertilized egg or zygote gets implanted in the uterus after the process of fertilization. The uterus is a bag like structure that holds the embryo till the birth of the child.
40. **(b)** Insects belongs to phylum - Arthropoda which have jointed appendages while earthworm belongs to phylum Annelida whose body surface is characterised by the presence of segments but it lacks joint appendages.
41. **(c)**
42. **(d)**
43. **(b)** When Amoeba undergoes fission nucleus divides first and then the cytoplasm.
44. **(b)**
45. **(c)**
46. **(c)**
47. **(c)** The forelimbs of the birds are modified as the flight organs. The Aves have been able to specialize in the art of flight due to the wings they have developed.
48. **(d)** Amphibians are a taxon of animals that include all living tetrapods that do not have amniotic eggs, are ectothermic and generally spend part of their time on land. Amphibians are able to breathe through their skin.

49. **(b)** Cartilage is another common component of skeletal systems, supporting and supplementing the skeleton. The human ear and nose are shaped by cartilage. Some organisms have a skeleton consisting entirely of cartilage and without any calcified bones at all, for example sharks.

50. **(b)** All echinoderms exhibit five fold radial symmetry in portions of their body at some stage of life, even if they have secondary bilateral symmetry. They also have a mesodermal endoskeleton made of tiny calcified plates and spines, that forms a rigid support contained within tissues of the organism.

51. **(c)** Arthropods are the largest phylum of animals and include the insects, arachnids, crustaceans, and others. More than 80% of described living animal species are arthropods, with over a million modern species described and a fossil record reaching back to the late proterozoic era.

52. **(c)** The term pteridophytes has traditionally been used to describe all seedless vascular plants so is synonymous with "ferns and fern allies". *Marsilea and Horse-tails belong to Pteridophytes.*

53. **(a)** Gymnosperms are a group of Spermatophyte seed-bearing plants with ovules on the edge or blade of an open sporophyll, the sporophylls usually arranged in cone-like structures. The term gymnosperm, meaning "naked seeds" and referring to the unenclosed condition of the seeds, as when they are produced they are found naked on the scales of a cone or similar structure.

54. **(a)** A taxon is assigned a rank and can be placed at a particular level in a systematic hierarchy reflecting evolutionary relationships.The Kingdom is the highest taxon in the hierarchy of classification.

55. **(b)** Binary fission is the form of asexual reproduction in single-celled organisms by which one cell divides into two cells of the same size, used by most prokaryotes.

56. **(c)** Merogony is an asexual replication process used by some Protozoan parasites that increases the number of infective cells by multiple fission. It is the process by which the *Plasmodium* increases the infective cells.

57. **(b)** Vegetatively reproduced organisms show genetic similarity in offsprings. This genetic similarity is because the offsprings are produced from a single parent.

58. **(a)** The *Bryophyllum* is a section in the plant genus Kalanchoe of the Crassulaceae family. There are about twenty to thirty species in the group, native originally of South Africa, Madagascar, Australia and Asia. The group is notable for vegetatively growing small plantlets on the fringes of the leaves; these eventually drop off and develop into new plants.

59. **(b)** A sporangium (pl., sporangia) is a plant or fungal structure producing and containing spores. Sporangia occur on angiosperms, gymnosperms, ferns, fern allies, mosses, algae, and fungi.Microsporangia are the structures on the stamens of flowers called anthers, and the pollen-producing structures on the microsporophylls of male conifer cones.Megasporangia are the comparable "female" structures on these plants, associated with the flower carpel and the megasporangial cone.

60. **(b)** Variations are caused due to errors resulting the DNA copying during the process of meiosis.Crossing over is the process seen during meiosis

resulting in the genetic variations.An error during crossing over results in an error in the DNA copying.

61. **(d)** Androecium possess one or two whorls of stamens, each a filament topped by an anther where pollen is produced. Pollen contains the male gametes. Gynoecium possess one or more pistils. The female reproductive organ is the carpel: this contains an ovary with ovules which contain female gametes.

62. **(a)** Placenta is a structure that is formed out of the fingerlike projection both from the mother and child. It later on becomes like a tube like structure that has both arteries and veins. The embryo gets the nutrition from the mothers blood with the help of the placenta.

63. **(a)** The testicle is the male generative gland in animals. Male mammals have two testicles, which are often contained within an extension of the abdomen called the scrotum. It produces the germ cells.

Chapter 3 Control And Coordination Of Life Processes

INTRODUCTION

- The various processes essential for maintenance of life are called **life processes**, which are **nutrition**, **respiration, transportation** and **excretion, etc.**
- These processes are needed to prevent damage and break-down for which energy is required.
- Living organisms take energy from outside in the form of food to the inside by the process of **nutrition**.
- The living organisms use the chemical energy for carrying out various life processes which obtained from food through **chemical reactions.**
- Most of the food sources are carbon-based, because of the dependency of life on carbon-based molecules.
- Most common chemical means of break-down molecules is **oxidising-reducing reactions**.
- For the break-down of molecules oxygen is taken inside from outside the body.
- During the occurrence of chemical reactions inside the body, by-products are also formed which are harmful to the body.
- The adjustment of all the vital activities of life is called as coordination.
- The vital processes of life are controlled by endocrine system and nervous system.
- The response of the part of plant to light is called phototropism.

NUTRITION

Nutrition is a process by which an organism obtains its food.

There are Different Types of Nutrition

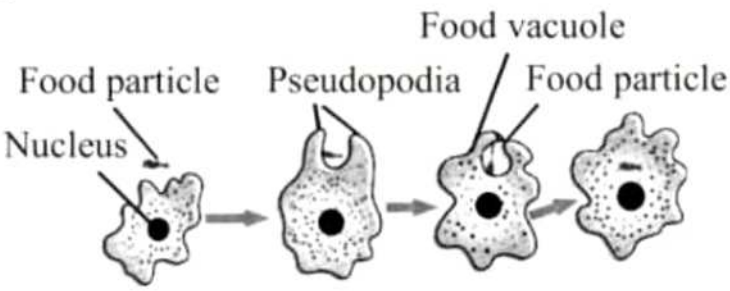
(i) **Autotrophic Nutrition :** Autotrophs contain chlorophyll pigment, which is capable of trapping and fixing the solar energy. This energy is utilized for synthesising food from the raw materials like carbon dioxide, water and a few minerals. *E.g.* green plants, Euglena.

(ii) **Heterotrophic Nutrition :** A heterotrophic organism is a consumer which derives its nutrition from other organisms. *E.g.* all animals, most bacteria and fungi.

(iii) **Parasitic Nutrition :** These animals live on or inside the body of the host and obtain their food. *E.g.* Tapeworm, *Cuscuta* (amarbel), etc.

(iv) **Saprophytic Nutrition :** Animals depend on dead decaying organic matters. *E.g.*, fungi, bacteria.

(v) **Holozoic Nutrition:** The complex organic food material is taken into its body by the process of ingestion, the ingested food is digested and then absorbed into the body cells of the organism. *E.g.* man, cat, dog, fish, *Amoeba*, etc.



Nutrition in *Amoeba*

NUTRITION IN PLANTS

Photosynthesis is the process by which autotrophic chlorophyll containing organisms manufacture their own energy sources (simple sugars) from intracellular chemical reaction of carbon dioxide and water in presence of sunlight and chlorophyll.

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6H_2O + 6O_2$$

- **Chlorophyll** remains present in chloroplasts which is of green colour.
- CO_2 is obtained through **stomata**, which opens and closes by the turgidity of guard cells. The guard cells swell when water flows into them, causing the stomatal pore to open. Similarly the pore closes if the guard cells shrink.
- The factors which affect photosynthesis are light, CO_2, water, temperature.

NUTRITION IN ANIMALS

Human Digestive System

It is made up of two parts

(i) Alimentary canal and (ii) Digestive Glands.

- Alimentary canal is about nine meters long which starts from mouth and extends to anus.
- Saliva has an enzyme named **ptylain** which digests starch into maltose.
- The lining of alimentary canal has muscles that contract rythmically in order to push the food forward. This movement occurs all along the gut and the movement is called **peristaltic movement**.
- **Oesophagus** opens into J-shaped stomach and is on the left side of abdomen.
- Protein digestion starts in the stomach.
- Small intestine is a coiled and narrow tube which is divided into three parts : **duodenum, middle jejunum, distal ileum**.
- Small intestine is the site of the complete digestion of carbohydrates, proteins and fats.
- **Gall bladder** stores bile salts and pigments, secreted by the liver.
- Pancreas lies parallel to and beneath the stomach.
- Liver produces bile which emulsifies fat and make food alkaline.

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- **Assimilation** is the process in which the absorbed food is taken in body cells and used for energy, growth and repair.

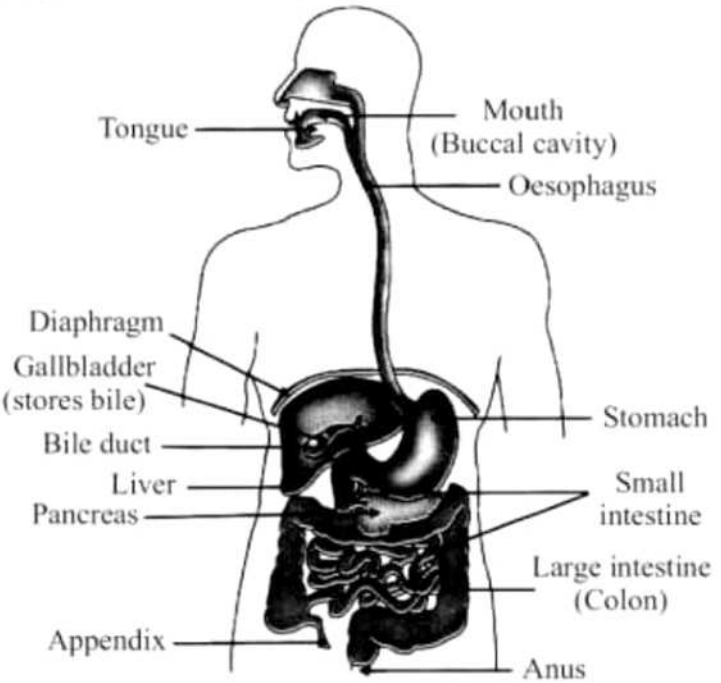


Fig. Human alimentary canal

SOME DIGESTIVE GLANDS

Liver

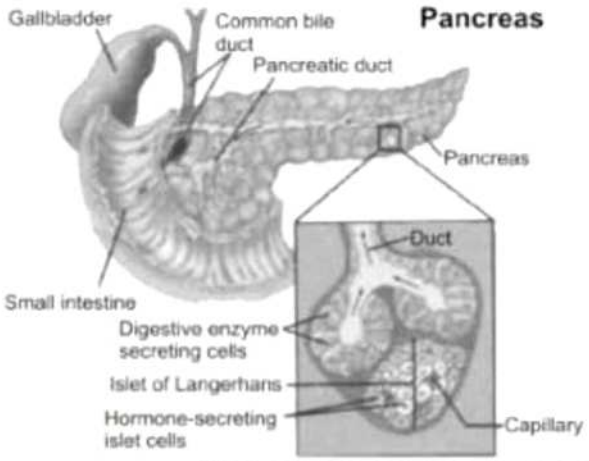
- It is the largest gland in the human body and secretes bile juice, which is stored in gall bladder.
- It regulates the quantity of glucose in the blood by converting extra glucose into glycogen or glycogen (during deficiency of glucose) is converted into glucose.
- It destroys dead RBC and controls temperature. It converts excess of amino acid into ammonia (which is converted into urea by Ornithine cycle). Urea comes out from the body through kidney.
- If there is any obstruction in bile duct, liver cells stop taking bilirubin from the blood, consequently it spreads throughout the body causing **jaundice**.

Pancreas

- It is the second-largest gland of the human body and has Islets of Langerhans and exocrine

part secreting enzymes for carbohydrate, protein and nucleic acid digestion.

- The most common part is the b–cells, which produces insulin, a hormone the deficiency which causes diabetes melitus.
- Excess of insulin causes hypoglycemia, in which glucose level of blood falls.



DIGESTION OF FOOD

Name of the digestive juice	Name of the enzymes	Substrate	End product
Saliva	Ptyalin (Salivary amylase)	Starch	Maltose
Intestinal juice	Sucrase (invertase), Maltase, Lactase	Sucrose, Maltose, Lactose	Glucose, fructose and galactose
Gastric Juice	Pepsin, Rennin	Proteins, Casein	Peptones, calcium caseinate
Pancreatic Juice	Trypsin, Chymotrypsin, Carboxy peptidases	Proteins, Peptides	Proteoses and peptides, Amino acid

VITAMIN REQUIRED BY THE BODY

Vitamin	Chemical Name	Function in Body	Deficiency Disease	Sources
B_1	Thiamine	Part of coenzyme for respiration	**Beri-beri:** nerve and heart disorders	Cereals, legumes, beans, nuts.
B_2	Riboflavin	Part of coenzyme FAD needed for respiration	**Ariboflavinosis:** skin and eye disorders	Milk, yogurt, meat, leafy greens, whole grains.
B_{12}	Cyanoco-balamin	Coenzyme needed for making red blood cells, bone, blood and nerve changes	**Pernicious anaemia**	Meat, fish, poultry, shellfish, eggs, cheese, milk.
B_3	Nicotinic acid ('niacin')	Part of coenzymes NAD, NADP used in respiration	**Pellagra:** skin, gut and nerve disorders	Widespread in food.
C	Ascorbic acid	Not precisely known	**Scurvy:** degeneration of skin teeth and blood vessels	Citrus fruits, e.g. lemon
A	Retinol	Not fully known but forms part of visual pigment rhodopsin	**Xerophthalmia:** dry eyes	Milk, eggs, meat, fish liver oils, green leafy vegetables.
D	Cholecalciferol	Stimulates calcium absorption by small intestine, needed for proper bone growth	**Rickets:** bone deformity	Exposed to sunlight, dairy products, egg yolk, fish liver oils, oysters, yeast
E	Tocopherol	Not precisely known	**Infertility**	Plant oils, green leafy vegetables, egg yolk, nuts, seeds, and liver
K	Phylloquinone	Involved in blood clotting	**Possible haemorrhage**	Bacterial synthesis in the digestive tract, Green leafy vegetables, cabbage and milk

MINERAL REQUIRED BY BODY

Minerals	Source	Function
Sodium (Na)	Table salt is present in processed foods, milk, breads, vegetables, and meats	Needed for proper fluid balance, nerve transmission, and muscle contraction
Chloride	Table salt in large amount is present in processed foods, small amounts in milk, meats, breads, and	Needed for proper fluid balance, stomach acid
Potassium	Meat, milk, fresh fruits and vegetables, whole grains, legumes	Needed for proper fluid balance, nerve transmission, and muscle contraction
Calcium	Milk and milk products, canned fish with bones (salmon, sardines), fortified tofu and fortified soy milk, greens (broccoli, mustard green), legumes	Important for healthy bones and teeth, helps muscles relax and contract, important in nerve functioning, blood clotting, blood pressure regulation, immune system health
Phosphorus	Meat, fish, poultry, eggs, milk, processed foods	Important for healthy bones and teeth, found in every cell, part of the system that maintains acid-base balance
Magnesium	Nuts and seeds, legumes, leafy green vegetables, seafood, and chocolate	Needed for making protein, muscle contraction, nerve transmission, immune system health
Sulfur	Occurs in foods as part of protein, meats, poultry, fish, eggs, milk, legumes, nuts	Important for protein synthesis
Iron	Organ meats, red meats, fish, poultry, shellfish (especially clams), egg yolks, legumes, dried fruits dark, leafy greens, iron-enriched breads and cereals, and fortified cereals	Part of a molecule hemoglobin found in red blood cells that carries oxygen in the body, needed for energy metabolism
Iodine	Seafood, foods grown in iodine-rich soil, iodized salt, bread, dairy products	Found in thyroid hormone, which helps regulate growth, development, and metabolism

RESPIRATION

Respiration is a complex process which includes breathing *i.e.* exchange of O_2 and CO_2 and oxidation of food to release energy.

- There are two types of Respiration :

Aerobic Respiration

Occurs in the presence of O_2. It involves two steps :

(a) Glycolysis,
(b) Krebs cycle.

$$\text{Glucose} \xrightarrow[\text{(in cytoplasm)}]{\text{Glycolysis}} \text{Pyruvic acid}$$

$$\xrightarrow[\text{(in mitochondria)}]{\text{Oxygen (Krebs cycle)}} 6CO_2 + H_2O + 38ATP$$

- ATP is the main source of energy. One ATP releases 30.5 KJ/mol energy. ATP can be used in the cells for the contraction of muscles, protein synthesis, conduction of nerve impulses and many other activities.

Anaerobic Respiration

Takes place in certain bacteria and yeast which release energy in the absence of O_2.

$$\text{Glucose} \xrightarrow[\text{(in cytoplasm)}]{\text{Glycolysis}} \text{Pyruvic acid}$$

$$\xrightarrow[\text{Yeast fermentation}]{\text{in absence of } O_2} \underset{\text{Ethanol}}{2C_2H_5OH} + 2CO_2 + 2ATP$$