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My Favorite Guide on

# BIOLOGY

**जीवशास्त्र**

**STD - 12<sup>th</sup> (Science)**

With Solutions of  
Board Question Papers  
Feb / March - 2022  
Feb / March - 2023  
Feb / March - 2024  
Feb / March - 2025

**महाराष्ट्रात  
प्रथमच ...**

11<sup>th</sup> आणि 12<sup>th</sup> (Science) ची पुस्तके  
English व Scientific मराठी मधून...

  
DNYANADA PUBLICATION, PUNE

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**PUNE | LATUR PATTERN**

## TOPIC - 01

# REPRODUCTION IN LOWER AND HIGHER PLANTS

### 1.2 Sexual Reproduction

#### Q.8 Define flower and write its function.

**Ans: Flower:** *The flower is specialized reproductive structure of a plant in which sexual reproduction takes place.*

OR

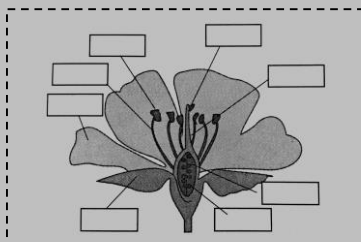
*Flower is defined as a highly specialized reproductive shoot concerned with sexual reproduction in higher plants.*

OR

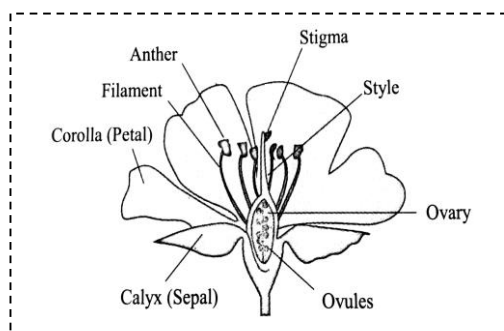
*Flower is a condensed and modified shoot, specialized for sexual reproduction.*

**Function:** The function of flower is to produce haploid gametes and to ensure that fertilization will take place.

#### Q.9 Label the parts of flower in the given diagram.



**Ans:**



#### Q.9 Name the four whorls of a typical flower.

**Ans:** A typical flower consists of Calyx, Corolla, Androecium and Gynoecium.

#### Q.10 What is sexual reproduction.

#### Ans: Sexual reproduction:

- i) It is a mode of reproduction which involves fusion of two compatible gametes or sex cells.
- ii) Sexual reproduction involves two major events viz. meiosis (gamete formation) and fusion of gametes.
- iii) Fusion of male and female gametes (fertilization) results in zygote formation and embryogenesis (embryo formation).
- iv) Fusion of gametes leads to production of genetically dissimilar offsprings.
- v) Variations are useful from the point of view of the survival and the evolution of species, over the time.
- vi) Sequential events that occur in sexual reproduction are grouped into three distinct stages viz. Pre-fertilization, Fertilization and the Post-fertilization.

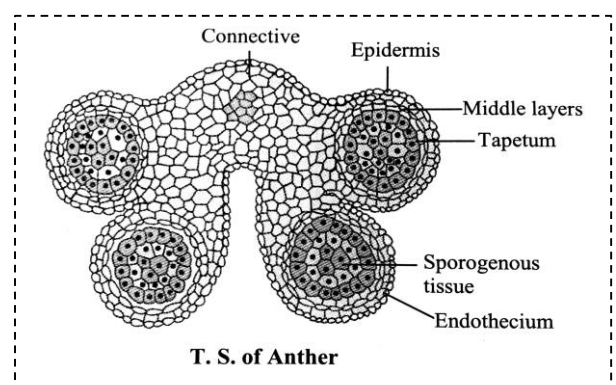
#### Q.11 Explain in detail the structure of an anther.

#### Ans: Structure of an anther:

- i) Anther is upper sac-like fertile part of the stamen.
- ii) An immature stage of anther is represented by group of parenchymatous tissue surrounded by single layered epidermis.
- iii) Anther consists of two anther lobes (ditheous), sometimes anther consists of one lobe (monothecous).
- iv) In ditheous anther four pollen sacs are present, hence called as tetrasporangiate.
- v) Each monothecous anther contains of two pollen sacs.

#### Q.12 With the help of neat and labelled diagram explain the T.S. of anther.

**Ans:**



- i) **Sporogenous tissue:** Some hypodermal cells get transformed into archesporial cells. The archesporial cell divides into an inner sporogenous cell and outer primary parietal cell. Sporogenous cell forms sporogenous tissue. Each cell of sporogenous tissue is capable of giving rise to a microspore tetrad.

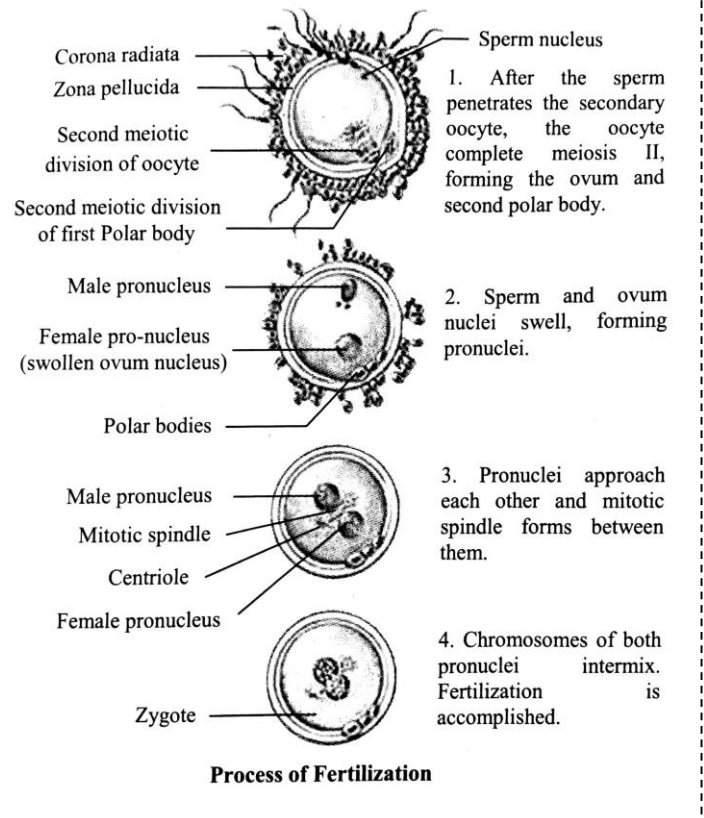
**Q.36 Distinguish between spermatogenesis and oogenesis.****Ans: Spermatogenesis and Oogenesis:**

| No.  | Spermatogenesis                                                                                                  | Oogenesis                                                                                                      |
|------|------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| i    | It is the process of formation of the male gamete (sperm) or spermatozoa from the germinal epithelium of testis. | It is process of formation of the haploid female gamete i.e. egg or ovum from the diploid germinal epithelium. |
| ii   | It occurs in testes.                                                                                             | It occurs in ovaries.                                                                                          |
| iii  | It starts and completes within the testes.                                                                       | It starts inside ovary but is generally completed outside ovary in oviduct.                                    |
| iv   | It begins with primary spermatocytes.                                                                            | It begins with primary oocyte.                                                                                 |
| v    | Upto the formation of spermatids, the cells often remain interconnected.                                         | Oogonia are separated and surrounded by follicle cells                                                         |
| vi   | It begins at puberty.                                                                                            | It begins during fetal development                                                                             |
| vii  | A Spermatogonium forms four spermatozoa / Sperms.                                                                | An Oogonium forms one ovum and 2-3 polar bodies.                                                               |
| viii | All Sperms are motile adapted to swim.                                                                           | Eggs are non-motile, adapted to receive the sperm and develop.                                                 |
| ix   | Sperm are produced in much larger number.                                                                        | Eggs are produced in far lesser numbers.                                                                       |

**2.5 Fertilization/ Syngamy:****Q.37 Describe the process of fertilization.****OR****Q.37 What is capacitation? Give its importance.****Ans: Process of fertilization:**

**Fertilization:** Fertilization is the process which involves fusion of the haploid male and female gametes resulting in the formation of a diploid zygote (2n).

The process of fertilization is internal and it usually takes place in the ampulla of the fallopian / uterine tube. The fertilized egg or zygote further develops into an embryo within the uterus.

**The mechanism of fertilization:****a) Movement of sperm towards egg:**

- The ejaculated semen is made up of sperms and some other secretions. This coagulated semen undergoes liquification and sperms become active.
- Once the sperms reach the vagina around 50% sperms are demobilized / broken / destroyed and the remaining sperms undergo capacitation.

**iii) Capacitation:** Capacitation generally requires 5-6 hours during which the acrosome membrane becomes thin,  $\text{Ca}^{++}$  enters the sperm and sperm tails begin to show rapid whiplash movements.

iv) As a result of capacitation, sperms become extra active and begin to start moving upwards from the vagina to the uterus and to the oviducts.

v) Prostaglandins activate the sperms. The vestibular secretions of the female also enhance sperms motility.

vi) The sperms swim at an average speed of 1.5 to 3.0 mm/min and reach the ampulla. The contraction of uterus and fallopian tubes stimulated by oxytocin of female also aids in movement of sperm. After capacitation the sperms may reach the ampulla within 5 minutes.

## Scientific मराठी स्पष्टीकरण:

**Introduction: (प्रस्तावना)** - प्रत्येक सजीव प्रजनाने आपल्या जातीचे अस्तित्व टिकवून ठेवतो, मागील पिढीतील गुणधर्म पुढच्या पिढीमध्ये अनुवंशीकतेने येतात. मातापित्याची लक्षणे संततीमध्ये संक्रमित होतात. मातापिता व संततीत खुप साम्य असले तरी लहान मोठे भेदही आढळतात. अनुवंशिकतेमुळे मांजराची पिल्ले मांजरासारखी, कुत्र्याची पिल्ले कुत्र्यासारखी असतात. वाटाण्याच्या बी पासून वाटाण्याचे, आंब्याच्या कोयीपासून आंब्याचे झाड निर्माण होते. सजीवातील साम्य, भेद अनुवंशिकतेचे परिणाम आहेत.

**i) Heredity (अनुवंशिकता)** - एका generation (संक्रमणातून) दुसऱ्या generation मध्ये characters (लक्षणे) transmit (संक्रमित) होण्याच्या प्रक्रियेला heredity म्हणतात. किंवा parents (मातापित्याची) शारीरिक किंवा मानसिक लक्षणे offsprings (संततीमध्ये) संक्रमित होण्याच्या प्रक्रियेस Heredity असे म्हणतात.

**ii) Variation (भेद)** - Variations म्हणजेच parents आणि त्यांची offsprings यांच्यातील असा फरक कि, एका माता-पित्याची वेगवेगळी आपत्ये किंवा एकाच जातीतील अनेक जीव यांच्यातील भेद होय.

**iii) Genetics (अनुवंश शास्त्र)** - Heredity आणि variations यांचा अभ्यास करणाऱ्या शास्त्राला Genetics असे म्हणतात.

**Mendel ने त्याच्या experiments साठी garden pea plant निवडले त्याची कारणे-**

- Pea plant (वाटाण्याचे झाड) cultivation (लागवडीसाठी) अतिशय सोपे आहे.
- हे वर्षभरासाठी चालणारे झाड असून त्यांची life cycle (जीवनचक्र) ३ ते ४ महिन्यात पूर्ण होते, तसेच त्याच्या एका वर्षात तीन generations (पिढ्यांचा) अभ्यास करता येतो.
- हे झाड लहान असते, आणि अनेक seeds (बिया) तयार करते.
- कमी जागेत Mendel ने हजारो झाडे लावली.
- वाटाण्याच्या झाडाला मोठ-मोठी फुले येतात, जि की self-pollinating (स्वयं-परागण) करणारी असतात.
- हे झाड emasculation (नपुसक करण्यासाठी) आणि cross (संकरणासाठी) अगदी सोपे आहे.
- हे झाड complete dominance दाखवते.
- हे अनेक बिया येणारे झाड असून त्याच्या सर्व बिया viable (जीवनक्षम) म्हणजेच फलनशील असतात.
- हे झाड सात वेगवेगळ्या प्रकारची वैशिष्टे दाखवते.

**Mendels च्या प्रयोगाच्या यशाची कारणे-**

- Mendel ने एकावेळेस एकच लक्षण असलेल्या inheritance चा अभ्यास केला.

ii) त्याने त्याचा प्रयोग दुसऱ्या आणि तिसऱ्या generations पर्यंत चालूच ठेवला.

iii) त्याने त्याच्या प्रयोगासाठी pea plant चीच निवड केली.

iv) Purity of characters (शुद्ध वंशक्रम) निर्माण करण्यासाठी त्याने अनेक generations च्या नोंदी ठेवल्या.

v) त्याने visible characters (दर्शनीय लक्षणांची) निवड केली.

vi) Natural pollination होऊ नये म्हणून त्याने वेगवेगळ्या plots मध्ये लागवड केली.

vii) त्याच्या प्रयोगातील अनेक results नोंदवण्यासाठी त्याने mathematics (संख्याशास्त्राचा) आधार घेतला.

**वेगवेगळ्या Genetic terms-**

**१) Character (वैशिष्ट)**- प्रत्येक सजीवाचे काही वैशिष्ट असते. उदा. खोडाची उंची.

**२) Factor (घटक)**- हा सजीवांच्या शरीरामध्ये असलेला एका घटक/कण असून तो Inheritance (अनुवंशिकता) आणि character च्या expression (प्रगटीकरण) करतो.

**३) Gene (जनुके)**- हा DNA चा विशिष्ट segment (खंड) असून त्याचा उपयोग inheritance आणि character चे expression यासाठी होतो.

**४) Trait (लक्षण)**- Inherited character (अनुवंशिक लक्षण) आणि त्याचे शोधण्यायोग्य विभेदन.

उदा. Tall (उंच) or dwarf (बुटके).

**५) Allelomorphs/alleles (युग्म विकल्पी)**- दोन किंवा दोन पेक्षा अधिक forms of genes (जनुकीय विकल्पीना) allelomorphs म्हणतात.

**६) Dominant allele (प्रभावी विकल्पी)**- ह्या allele मध्ये heterozygous (विषम युग्मनजते) मध्येही phenotypic effect (दृश्यप्ररूप परिणाम) दिसून येतात. थोडक्यात ह्या allele मध्ये संकरामध्ये फक्त प्रभावी लक्षणे प्रगट होतात.

**७) Recessive allele (अप्रभावी विकल्पी)**- ह्या allele मध्ये heterozygote मध्ये phenotypic effect दिसून येत नाहीत.

**८) Genome (संजीन/संचजीन)**- Chromosomes च्या haploid set मधील gene च्या एकुण set ला genome म्हणतात.

**९) Gene pool (जीन संकोष)**- दिलेल्या time मध्ये breeding population मधील सर्व genes ची genetic information ला Gene pool म्हणतात.

**१०) Genotype (जनुकविधा)**- ह्या जनुकीय घडणीमध्ये केवळ एकच लक्षण किंवा लक्षणांचा संच असतो.

**११) phenotype (स्वरूपविधा)**- एखाद्या gene चे दिसणारे वैशिष्ट किंवा सजीवांचे बाह्य रूप म्हणजेच phenotype होय.

**१२) Homozygous individual (समयुग्मनजी)**- एखाद्या organism मधील दोन्हीही genes (जनुके) सारखी असतात, तर त्याला homozygous individual (प्रभावी समयुग्मनजी) म्हणतात.

**Multiple choice Questions**

**i) During replication of DNA, the separated strands are prevented from recoiling by using -----**

**(Feb/Mar-2022)**

- a) single strand binding protein
  - b) reverse transcriptase
  - c) endonuclease
  - d) polymerase
- Ans:** a) single strand binding protein

**ii) Histones are rich in -----** **(Feb/Mar-2023)**

- a) Lysine and Arginine
- b) Leucine and Methionine
- c) Serine and Leucine
- d) Phenyl alanine and Lysine

**Ans:** a) Lysine and Arginine

**iii) Which one of the following is not a part of lac operon?** **(Feb/Mar-2024)**

- a) Promoter
- b) Regulator
- c) Inducer
- d) Operator

**Ans:** c) Inducer

**1) Griffith worked on -----**

- A) Bacteriophage
- B) Drosophila
- C) Frog eggs
- D) Streptococci

**2) The molecular knives of DNA are -----**

- A) Ligases
- B) Polymerases
- C) Endonucleases
- D) Transcriptase

**3) Translation occurs in the -----**

- A) nucleus
- B) cytoplasm
- C) nucleolus
- D) lysosomes

**4) The enzyme required for transcription is -----**

- A) DNA polymerase
- B) RNA polymerase
- C) Restriction enzyme
- D) RNase

**5) Transcription is the transfer of genetic information from -----**

- A) DNA to RNA
- B) tRNA to mRNA
- C) DNA to mRNA
- D) mRNA to tRNA

**6) Which out of the following is NOT an example of inducible operon?**

- A) Lactose operon
- B) Histidine operon
- C) Arabinose operon
- D) Tryptophan operon

**7) In the RNA molecule, which nitrogen base is found in place of thymine?**

- A) Guanine
- B) Cytosine
- C) Thymine
- D) Uracil

**8) How many codons are needed to specify three amino acids?**

- A) 3
- B) 6
- C) 9
- D) 12

**9) Which of the following is NOT part of protein synthesis?**

- A) Replication
- B) Translation
- C) Transcription
- D) All of these

**10) Place the following event of translation in the correct sequence**

- i) Binding of met-tRNA to the start codon.
  - ii) Covalent bonding between two amino acids.
  - iii) Binding of second tRNA.
  - iv) Joining of small and large ribosome subunits.
- A) iii, iv, i, ii    B) i, iv, iii, ii    C) iv, iii, ii, i    D) ii, iii, iv, i

**11) Length of DNA double helix molecule, in a typical mammalian cell is approximately -----**

- A) 2.2  $\mu$ m
- B) 2.2 mm
- C) 2.2 meters
- D) 1.2  $\mu$ m

**12) A nucleosome is a portion of the chromosome contains ----**

- A) Only histone
- B) Both DNA and histone
- C) Only DNA
- D) Both DNA and RNA

**13) In an octamer of the nucleosome, core DNA consist of base pairs.**

- A) 46
- B) 146
- C) 246
- D) 346

**14) In eukaryotic organisms, replication of DNA takes place only ----- in the cell cycle.**

- A) once
- B) twice
- C) thrice
- D) none of the above

**15) Formation of mRNA from DNA is called as -----**

- A) transcription
- B) translation
- C) translocation
- D) transformation

**16) The process of removal of introns and joining of exons is called**

- A) capping
- B) tailing
- C) termination
- D) splicing

**17) In E. coli, a chain terminating protein called ---- stops the synthesis of mRNA.**

- A) sigma factor
- B) beta factor
- C) rho factor
- D) delta factor

**18) Viruses multiplying the process of reverse transcription are known as -----**

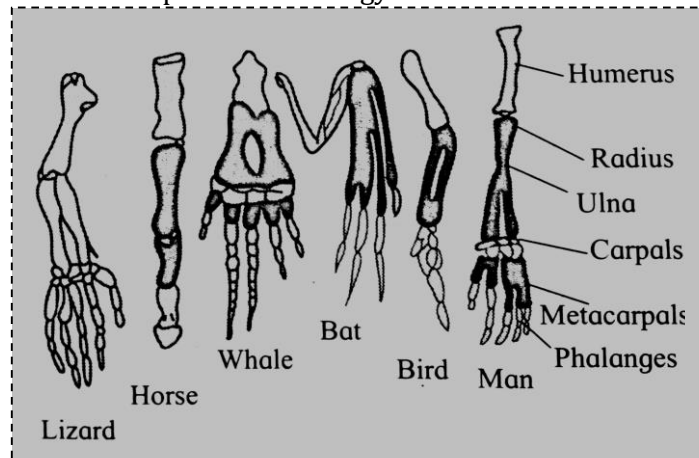
- A) protein viruses
- B) retroviruses
- C) DNA viruses
- D) Prions

**Q.37 Explain homologous organs to support evolution.****OR****Q.37 What are homologous organs? Give examples. (Feb/Mar-2023)****Ans: Homologous organs:**

- i) Homologous organs are those organs, which are structurally similar but perform different functions.
- ii) The structural similarities between the homologous organs indicates that they have a common ancestry.
- iii) Differences in homologous organs are examples of divergent evolution or adaptive radiation.

**iv) Examples of homologous organs:**

- a) Forelimbs of vertebrates such as lizard, bird, bat, horse, whale and man, all of them have humerus, radius, ulna, carpals, metacarpals and phalanges in their forelimbs. Forelimbs of these vertebrates are structurally similar but perform different functions.
- b) Vertebrate heart and brain.
- c) In plants, thorns of Bougainvillea and tendrils of Cucurbita represent homology.

**Q.38 Explain the analogous organs. Give examples of it.****Ans: Analogous organs:**

- i) Analogous organs are those which are structurally dissimilar but functionally similar.
- ii) These organs have external superficial similarity due to similar functions but they are different anatomically.
- iii) Analogous organs lead to convergent evolution i.e. different organisms shows same superficial structural similarities due to similar functions or habitat.
- iv) These organs do not help to trace the common ancestry. Thus, analogous organs do not have significant role in evolution

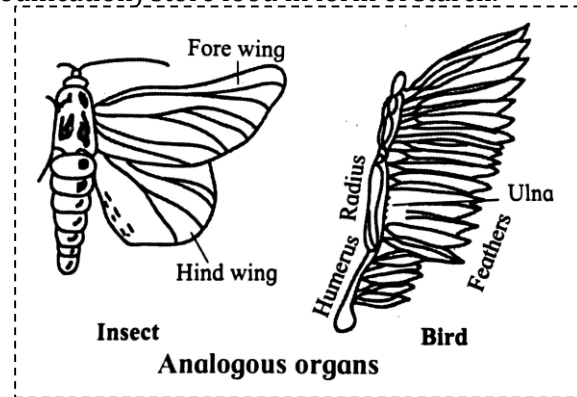
**Examples of analogous structures:**

i) Wings of butterfly (insects) and of birds look superficially alike but they are not anatomically similar structures though they perform similar functions.

ii) Eye of the octopus (mollusca) and of mammals. They differ in their retinal position, structure of lens and origin of different eye parts.

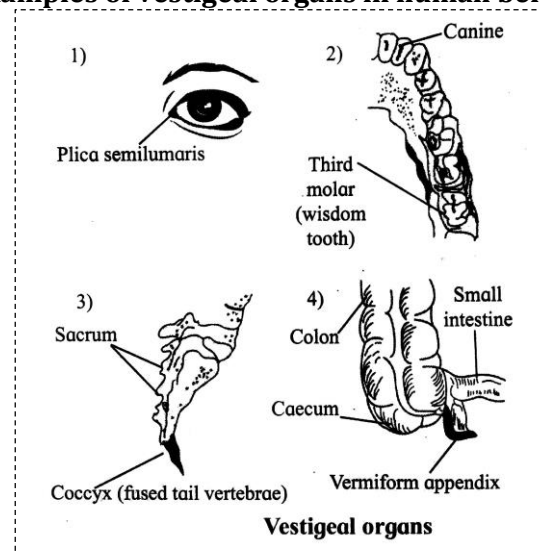
iii) The flippers of penguins (birds) and dolphins (mammals).

iv) Sweet potato (root modification) and potato (stem modification) store food in form of starch.

**Q.39 Explain vestigial organs with examples.****OR****Q.39 What is vestigial organ? (Feb/Mar-2024)-1m**

**Ans: Vestigial organs:** Vestigial organs or rudimentary organs are imperfectly developed and non-functional, degenerate structures which were functional in some related and other animals or in ancestors.

- i) The vestigial organs are no longer required by the organism but indicate the relationship with those organisms in whom these organs are fully developed.

**Examples of vestigial organs in human beings:**

## Scientific मराठी स्पष्टीकरण:

**Introduction: (प्रस्तावना):** वनस्पतीच्या सर्व आवश्यक क्रियांसाठी पाणी महत्वाचा घटक आहे. सर्व भूपृष्ठीय वनस्पती, पाणी आणि क्षारांचे अभिशोषण मुळसंस्थेमार्फत मातीतून करतात. एकपेशिय मुलकेश पाण्याचे अभिशोषण करण्यास मदत करतात. वनस्पतीमध्ये जमिनीतून मुळ, खोड, पान असा पाण्याचा सलग मार्ग असतो. आणि वातावरणातून पुन्हा जमिनीकडे असतो. पानांमधून पाण्याचे वातावरणामध्ये उत्सर्जन होते. या प्रकरणात मुळामध्ये पाणी कसे शिरते? पेशीमार्फत पाणी वनस्पतीच्या सर्वात वरच्या भागापर्यंत कसे पोहचते? तसेच अन्नाचे स्थानांतरण व खनिज पोषण या विषयी सर्व गोष्टी शिकणार आहोत.

### Role of water (पाण्याची भूमिका):

जीवनामध्ये पाणी हे अतिशय उपयुक्त व महत्वाचा घटक आहे. जीवद्रव्यामध्ये पाणी मुख्य असते. विविध chemical reactions घडण्यासाठी aqueous medium (पाणी माध्यम) आवश्यक असते. पाण्याच्या high specific heat (उच्च विशिष्ट उष्णतेमुळे), high heat of fusion (उच्च उष्णतेच्या एकत्रीकरणामुळे), आणि high heat of vapourization (उच्च बाष्पीभवनामुळे) त्याचे temperature constant (स्थिर) ठेवले जाते, यामुळे metabolic rate (चयापचयाचा दर) हा stable (स्थिर) ठेवला जातो. विविध organic materials (कार्बनी पदार्थांसाठी) पाणी हे उत्कृष्ट solvent (द्रावक) आहे. Living organisms च्या functioning (कार्ये करण्यासाठी), growth (वृद्धी), व developments (विकास) यांसाठी पाणी आवश्यक आहे. वनस्पतीमध्ये प्रकाश-संश्लेषण क्रियेत पाणी अत्यावश्यक असते. पाणी turgidity (पेशीची फुगीरता) व plant organs (वनस्पतीची अंगे) यांवर नियंत्रण ठेवते. कार्बनी व अकार्बनी पदार्थांचे translocation (स्थानांतरण), movements of gametes (युग्मकांची हालचाल), dispersal of fruits (फळांची स्फुटनशिलता) आणि germination of seeds (बीजांकुरण) आणि यासारख्या वेगवेगळ्या process मध्ये water चा role महत्वाचा आहे. पाण्याचा उपयोग stomata (पर्णरंध्रे) मध्ये त्यांच्या opening and closing होण्यासाठी खूप होतो. Carbohydrates (कार्बोहायड्रेट्स), proteins (प्रथिने), nucleic acid (न्युक्लिक आम्ल), enzymes (विकरे) and pigments (रंगद्रव्ये) पाण्याशिवाय त्यांची कार्ये करू शकत नाहीत.

**Structure of root (मूळाचे भाग):** Typical roots चे प्रामुख्याने चार भाग पडतात.

**i) Region of growth (पेशी विभाजनाचा भाग):** हा भाग apex मध्ये असतो, हा meristematic region असतो व त्यामध्ये सतत cell division (पेशी विभाजन) होत असते. हा root cap ने cover (वेढलेला) असतो.

**ii) Region of cell elongation (पेशी दिर्घीकरणाचा भाग):** पेशी विभाजनाच्या भागाच्यापाठीमागे cell elongation (पेशी दिर्घीकरणाचा भाग) येतो, या भागामध्ये minerals (खनिजे) absorb केली जातात.

**iii) Region of root hairs (मुलकेशाचा भाग / अभिशोषणाचा भाग):** cell elongation च्या पाठीमागे root hairs चा भाग येतो, याला मुलकेशाचा भाग म्हणतात. यामध्ये root hairs (मुलकेश) पाणी absorb करतात.

**iv) Region of maturation (परिपक्वतेचा भाग):** हा खोडाच्या जवळचा region आहे. यामध्ये permanent (स्थायी) व matured (परिपक्व) cells असतात.

### Structure of a root hairs (मुलकेशाची रचना):

i) Absorption region मधील epiblema / epidermal cells ह्या root hairs (मूलकेश) निर्माण करतात.

ii) प्रत्येक root hair (मुलकेश) हा long (लांबट), delicate (नाजूक) असून त्याला branch (शाखा) फुटत नाहीत. तसेच ते prolongation of epidermal cells (अभित्वचा पेशीचे लांबट भाग) असतात.

iii) प्रत्येक root hair हा tubular (गोल), unicellular (एकपेशीय), व colourless (रंगहीन) असतो.

iv) Root hair (मूलकेशाची) cell wall (पेशिभित्तीका) ही pectic compounds (पेक्टिक संयुगे) व cellulose चे बनलेली असते.

v) Cell wall (पेशी-भित्तीका) सर्व प्रकारच्या पदार्थांना (solutes व water) यांना मुक्तपणे पेशीमध्ये ये-जा करू देते, म्हणून पेशी-भित्तीका freely permeable (मुक्त पारगम्य) असते.

vi) Cell wall च्या आत plasma membrane (प्रद्रव्य पटल) असते. ते selectively permeable (निवडक्षम पारपटल) असते.

vii) Plasma membrane च्या आत granular cytoplasm (कणीदार पेशीद्रव्य) असते, व पेशीद्रव्यात nucleus (केंद्रक) व large vacuole (मोठ्या रिक्तिका) असतात. रिक्तिका पेशीद्रव्याने भरलेल्या असतात.

### Source of water for plants:

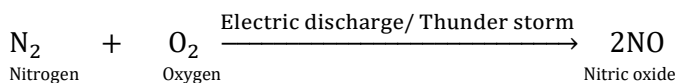
वनस्पतीसाठी soil (माती) हा पाण्याचा मुख्य source आहे, परंतु soil मधले सर्व पाणी हे वनस्पतीसाठीच उपलब्ध नसते.

**A) Hygroscopic water- (आर्द्रता जल):** जे water, मातीच्या particals (कणांना), adhesive forces (आसंगी बलाने) घट्ट धरून ठेवते, त्या water ला hygroscopic water (आर्द्रता जल) म्हणतात, याला bound water (बद्ध जल) असेही म्हणतात. हे जल वनस्पतीसाठी उपलब्ध नसते.

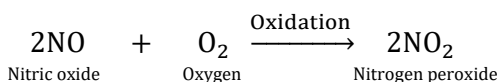
**B) Combined water- (संयोजित जल):** Silicon व aluminium च्या hydrated oxides (सजलीकरणाच्या) oxides च्या स्वरूपात जे water उपलब्ध असते, त्या water ला combined water (संयोजित पाणी) असे म्हणतात. यालाही bound water म्हणतात, हेही water वनस्पतींना उपलब्ध नसते.

**Q.71 Explain physical nitrogen fixation.****Ans: Physical Nitrogen fixation:**

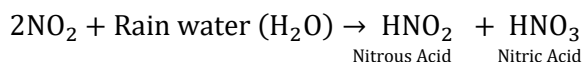
i) It occurs in several steps and starts with combination of atmospheric nitrogen with oxygen under the influence of electric discharge and thunder storm to produce nitric oxide.



ii) The nitric oxide is then oxidized to nitrogen peroxide in the presence of oxygen.



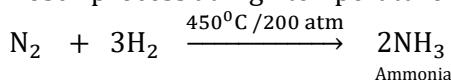
iii) During rains, the nitrogen peroxide combines with rain water to form nitrous acid and nitric acid which come to ground along with rains.



iv) On ground, the alkali radicals of soil react with nitric acid to produce nitrites and nitrates (absorbable form).



**v) Industrial nitrogen fixation:** It occurs by Haber Bosch process at high temperature and pressure.



vi) Ammonia is then converted to urea as it is less toxic.

**Q.72 Explain biological nitrogen fixation with example.****Ans: Biological nitrogen fixation:**

i) It is carried out by prokaryotes called as 'Nitrogen fixers' or Diazotrophs'.

ii) It accounts nearly 70% of natural nitrogen fixation.

iii) Nitrogen fixers are either symbiotic or free living.

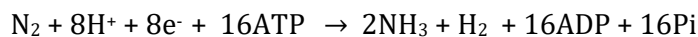
**iv) Symbiotic N<sub>2</sub> fixation:**

The best known nitrogen fixing symbiotic bacterium is Rhizobium. This soil living/ dwelling bacterium forms root nodules in plants belonging to family Fabaceae e.g. beans, gram, groundnut etc.

v) Azotobacter, Azospirillum are free living nitrogen fixing bacteria.

vi) The cyanobacteria fix significant amount of nitrogen in specialized cells called heterocysts.

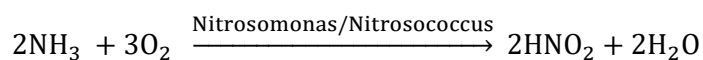
vii) Nitrogen fixation is high energy requiring process and nitrogen fixers use 16 molecules of ATP to fix each molecule of nitrogen to form ammonia.

**Q.73 Write a short note on Nitrification.****Ans: Nitrification:**

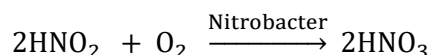
i) Most of the soil bacteria participate in converting ammonia into nitrate, the form of nitrogen which can be used by plants and animals.

ii) This involves two steps performed by two different types of bacteria:

1) Soil bacteria like Nitrosomonas, Nitrosococcus, etc. convert ammonia into nitrogen-di-oxide (nitrite).



2) Then another type of soil bacterium called Nitrobacter adds a third oxygen atom to create nitrate.



3) These bacteria are chemoautotrophs. By metabolizing nitrogen along with oxygen, they obtain energy to power their own life processes.

**Q.74 Name the bacteria responsible for conversion of nitrite to nitrate.**

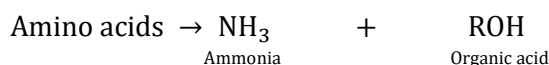
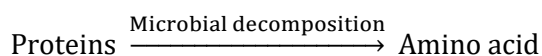
**Ans:** Chemoautotrophs like Nitrobacter are responsible for conversion of nitrite to nitrate.

**Q.75 What is Ammonification?****Ans: Ammonification:**

i) After the death of plants and animals, various fungi, actinomycetes and some ammonifying bacteria decompose the tissues.

ii) In this process, they convert organic nitrogen into amino acid and then to ammonia released back into the ecosystem.

iii) Ammonia (NH<sub>3</sub>) is now available for uptake by plants and other micro-Organisms for growth.

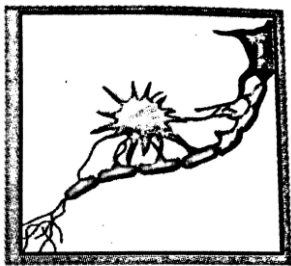


### Q.10 Explain the different types of neuroglial cells and give their functions.

**Ans:** Different types of neuroglial cells are as follows:

**i) Oligodendrocytes:** They are found in central nervous system. These cells have few branches. Oligodendrocytes mainly form myelin sheath around the central axons, which form the white matter of CNS.

**ii) Microglia or brain macrophages:** These are small sized cells found in CNS with few branches. They are derived from monocytes and act as macrophages. They reach the site of injury, dead neurons and cell debris in the CNS. They mediate immune response in the CNS.



Oligodendrocytes



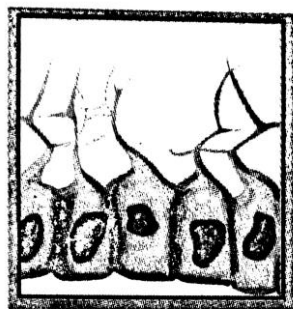
Microglia

**iii) Astrocytes:** These are star shaped and the most abundant glial cells of CNS. They have varied roles in the brain, secretion and absorption of neural transmitter and maintenance of blood-brain barrier BBB. They regulate the transmission of electrical impulses with the brain.

**iv) Ependymal cells:** They are found in CNS. These cells form single layer of squamous or columnar cells, often ciliated epithelial cells lining the ventricles or brain cavities and central canal of spinal cord. They are mainly responsible for production and probably also for circulation of CSF in brain ventricles and central canal.



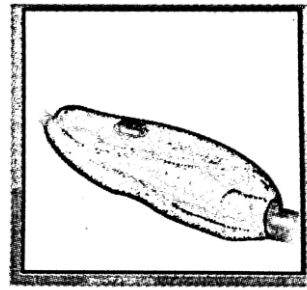
Astrocytes



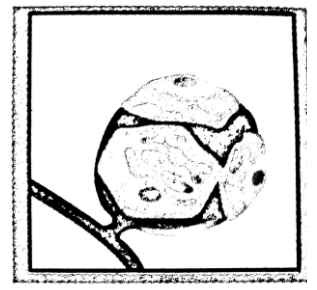
Ependymal cell

**v) Schwann cells:** These are the most abundant glial cells of PNS. They produce myelin sheath around medullated nerves of PNS.

**vi) Satellite cells:** These cells are found in PNS. They support the functions of neurons



Schwann cells



Satellite cells

### Q.11 What is blood brain barrier (BBB)?

**Ans:** Blood brain barrier (BBB):

i) Blood brain barrier prevents the passage of ions and large molecules from the blood into the brain tissue.

ii) The endothelial cells lining the blood capillaries and astrocytes help in this process.

### Q.12 Complete the table.

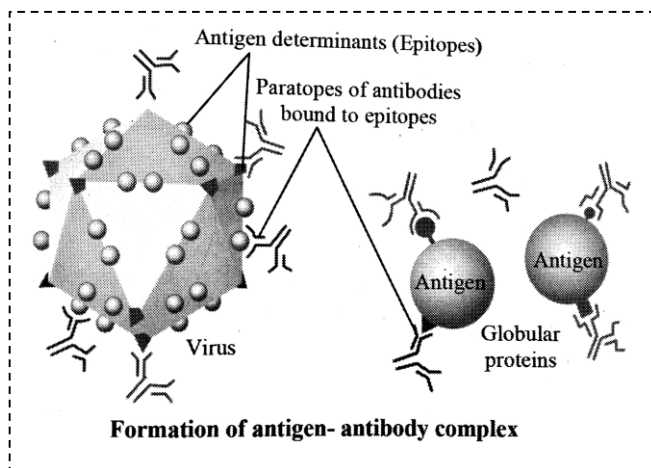
| Location | Cell types       | Function                                                       |
|----------|------------------|----------------------------------------------------------------|
| PNS      | -----            | Produce myelin sheath                                          |
| PNS      | satellite cells  | -----                                                          |
| -----    | Oligodendrocytes | Form myelin sheath around the central axon                     |
| CNS      | -----            | Phagocytose pathogens                                          |
| CNS      | -----            | Form the epithelial lining of brain cavities and central canal |

**Ans:**

| Location | Cell types                     | Function                                                       |
|----------|--------------------------------|----------------------------------------------------------------|
| PNS      | Schwann cell                   | Produce myelin sheath                                          |
| PNS      | satellite cells                | Support the function of neurons                                |
| CNS      | Oligodendrocytes               | Form myelin sheath around the central axon                     |
| CNS      | Microglia or brain macrophages | Phagocytose pathogens                                          |
| CNS      | Ependymal cells                | Form the epithelial lining of brain cavities and central canal |

**Q.21 Write a note on antigen-antibody complex.****Ans: Antigen-antibody complex:**

- Study of antigen – antibody interaction is called serology.
- Antibodies are always antigen specific. Combining sites of antigen, called antigenic determinants or epitopes react with corresponding antigen binding sites of antibodies called paratopes.
- Specificity of an antibody for an antigen lies in its sequence of amino acids within the variable regions of the two chains.
- These are active sites of an antibody where the molecules bind to specific antigens.
- Both the arms have same amino acid sequence and therefore bind the same kind of antigen.
- Thus, each antibody can join two antigens in a Lock and Key manner forming an antigen–antibody complex.

**Q.22 Distinguish between Antigen and Antibody.****Ans: Antigen and Antibody:**

| No. | Antigen                                                                                   | Antibody                                                                          |
|-----|-------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| i   | Any foreign material which brings about an immune response in the body is called antigen. | Glycoproteins formed in the body to fight against antigens is called as antibody. |
| ii  | It triggers the formation of antibodies.                                                  | It is produced against antigens.                                                  |
| iii | It may be either a protein or polysaccharide.                                             | It is proteinaceous in nature.                                                    |
| iv  | It may be a free molecule or component of microbial cell surface.                         | It is extruded from surface of plasma cells.                                      |
| v   | Shapes of antigens are                                                                    | Antibodies are Y-                                                                 |

|  |           |         |
|--|-----------|---------|
|  | variable. | shaped. |
|--|-----------|---------|

**Q.23 Write a note on antigens on blood cells.****Ans: Antigens on blood cells:**

There are several known antigens on the surface of human red blood cells. These antigens give rise to different blood groups.

**a) ABO Blood Groups:**

- The A, B and O blood groups were discovered by Karl Landsteiner in 1900.
- He found two antigens or agglutinogens on the surface of human red blood cells and named them as antigen A and antigen B.
- He also noticed the corresponding antibodies or agglutinins in the serum called 'a' and 'b'.
- In ABO system, the blood groups are determined by the presence or absence of antigen A and antigen B. The blood group of person is classified into four groups A, B, AB and O.

| Blood group             | Genotype               | Antigen on Surface of RBC | Antibody in Serum              | Can donate blood to | Can receive blood from |
|-------------------------|------------------------|---------------------------|--------------------------------|---------------------|------------------------|
| A                       | $I^A I^A$ or $I^A I^O$ | A                         | Antibody b                     | A, AB               | A, O                   |
| B                       | $I^B I^B$ or $I^B I^O$ | B                         | Antibody a                     | B, AB               | B, O                   |
| AB (universal acceptor) | $I^A I^B$              | A and B                   | Nil                            | AB                  | A, B, AB, O            |
| O (universal donor)     | $I^O I^O$              | Nil                       | Both Antibody a and Antibody b | A, B, AB, O         | O                      |

**b) Blood group A:** Individuals, with blood group 'A' have the antigen A on the surface of their red blood cells (RBCs) and antibody 'b' in their plasma.

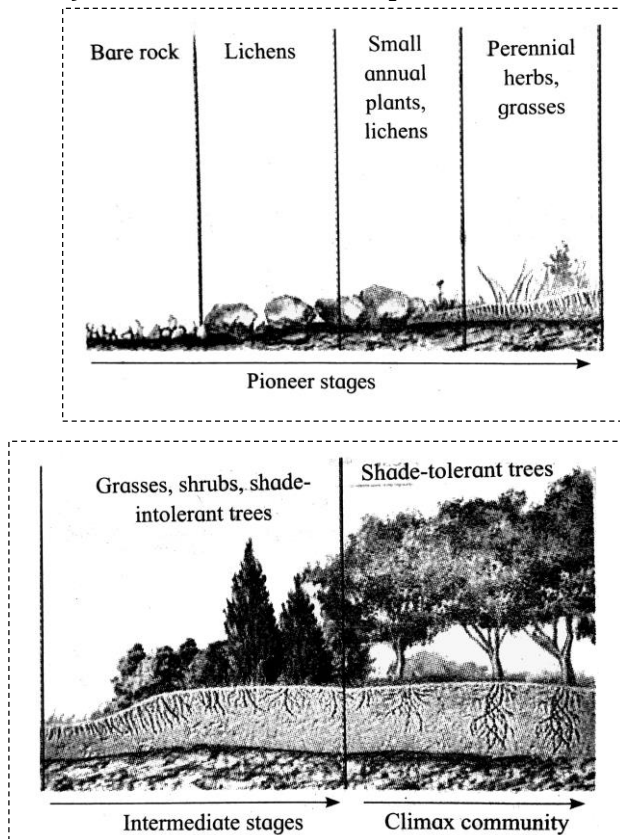
**Q.38 Distinguish between primary succession and secondary succession.**

**Ans: Primary succession and Secondary succession:**

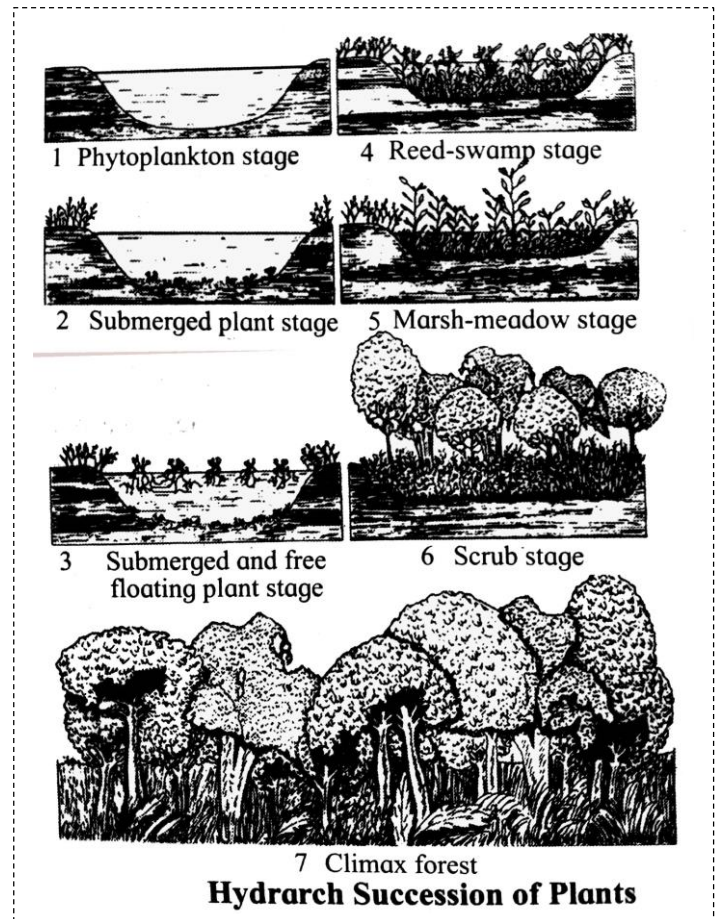
| No  | Primary Succession                                                                     | Secondary Succession                                                             |
|-----|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| i   | It starts in the area where no living organisms ever existed                           | It starts in an area which has lost all the living organisms once existed.       |
| ii  | It starts in an area like bare rocks, newly formed pond or reservoir, cooled lava etc. | It starts in an area like abandoned farm, cut or burnt forest, flooded land etc. |
| iii | It is a very slow process.                                                             | It is comparatively faster process.                                              |

**Q.39 Draw neat sketches of Xerarch succession and Hydrarch succession of plants.**

**Ans: a) Xerarch succession of plants:**



**b) Hydrarch succession of plants:**



**Q.40 What are the types of ecological succession based on water availability?**

**Ans: Types of ecological succession based on water availability:**

- The amount of water determines the pattern of ecological succession in the given area.
- Depending on the availability of water, there are two types of succession— **hydrarch** succession (hydrosere) and **xerarch** succession (xerosere).
- Hydrarch succession takes place in wetter areas and the successional series progress from hydric to the mesic conditions.
- Xerarch succession takes place in dry areas and the series progress for xeric to mesic conditions.
- Hence, both hydrarch and xerarch successions lead to medium water conditions (mesic)— neither too dry (xeric) nor too wet (hydric).

**Mesodermal चे प्राक्तनः**

Mesodermal हा सर्व प्रकारचे muscles, connective tissues, skin चे dermis, adreanal cortex kidney, circulatory system, Heart blood vessels व blood तयार होतात.

**Endoderm चे प्राक्तनः**

Endoderm पुढे विकसित होऊन stomach, आणि intestine (आतड्या), tongue, tonsils, lungs, trachea, bronchi, larynx, urinary bladder, vagina, vestibule, liver आणि pancreas आणि असे बरेच अवयव तयार करतात.

**Pregnancy** - एक किंवा एकापेक्षा हि जास्त embryos uterous मध्ये carry करण्याचा अवस्थेला pregnancy म्हणतात. मानवातील गर्भावस्था ही fertilization झाल्यापासून साधारणतः २६६ दिवसांपर्यंत असते, किंवा शेवटच्या menstrual cycle पासून २८० दिवस इतक्या काळासाठी राहते. मानवी गर्भावस्थेचे तीन महिन्याचे तीन भाग पाडले जातात.

**a) पहिला trimester-**

- हा काळ माता आणि गर्भ यांच्यामध्ये बरेच बदल दर्शवणारा असतो.
- पहिल्या २ ते ४ आठवड्यात embryo, endometrium कडून nutrients directly मिळवतो.
- हा पहिला trimester organogenesis आणि body organ development साठी खूप महत्वाचा असतो.
- ८ वा आठवड्यापर्यंत प्रौढातील सर्व प्रकारचे अवयव तयार असतात. फक्त ते अविकसित अवस्थेत असतात. गर्भाला तेव्हा भ्रूण (Foetus) म्हणतात. तो केवळ ५ सेमी एवढ्याचा लांबीचा असतो. याच दरम्यान मातेमधेही बदल होतात.
- Progesterone ची level वाढल्याने तिच्या प्रजोत्पादन संस्थेतही बदल होतात. Placenta चा भाग वाढतो, गर्भाशय मोठे होते आणि ovulation व menstrual cycle थांबते.

**b) दुसरा trimester (तिमाही):**

- गर्भाशयाचा आकार वाढतो
- गर्भ सक्रिय होऊन ३० सेमी पर्यंत त्याची लांबी होते.
- Hormones च्या level स्थिर होतात, कारण HCG पातळी उतरते. Corpus luteum च्यास पावते व progesterone निर्मिती placenta कडे जाते व गर्भाशयाच्या राखली जाते.

**c) तिसरी trimester (तिमाही):**

- गर्भ ३ ते ४ किलोचा होतो व त्याची लांबी ५० सेमी होते. गर्भ वाढेल तसे गर्भाशय विस्तारते.
- मातेचे abdominal organs दबतात व किंचीत displaced होतात. वारंवार, मुत्रविसर्ग होतो, पचनात अडथळे येणे व पाटीच्या स्नायूंचे ताण येतो.

**Placenta (नाळ / जरायू)-**

हा तात्पुरता अवयव, केवळ eutherian mammals (सस्तन) प्राण्यांमध्ये आढळतो. Placenta हा अवयव माता व गर्भ दोघांचा tissue पासून बनतो.

**Placenta ची कार्ये:**

- आईकडून, गर्भाकडे रक्ताद्वारे अन्नपदार्थ पुरवण्याचे कार्य करतो.
- आई व गर्भ यांच्यामध्ये gases exchange करण्याचे काम placenta करतो.
- Placenta foetus चा nutritive, respiratory आणि excretory organ म्हणून कार्य करतो.
- गर्भ आणि मातेच्या Haemoglobin मधील oxygen च्या आकर्षणातील फरकावरून गर्भाच्या रक्ताकडून oxygen ची मागणी लक्षात येते.
- Antibodies आणि hormones चे देखील पुरवठा हा placenta मार्फत होतो.
- Liver (यकृत) form होण्याआधी हा थोड्या प्रमाणात glycogen साठवून ठेवतो.
- हा endocrine tissue म्हणून कार्य करतो आणि विविध Hormones तयार करतो, जसे की HCG, HPL, estrogen व progesterone इत्यादी.
- Pregnancy संपेपर्यंत corpus luteum ला stimulate करतो.

**Parturition (प्रसूती):**

Parturition च्या काळात uterine wall च्या स्नायूंचे आकुंचन जोराने होते, त्याला labour (प्रसव वेदना) म्हणतात. यात मोठ्या प्रमाणात उर्जा खर्ची पडते. जन्मापूर्वी दोन आठवडे गर्भ pelvic region मध्ये डोके खाली असलेल्या अवस्थेत स्थिरावते. गर्भावस्था पूर्ण झाल्यावर प्रसव वेदना सुरु होतात.

**Parturition च्या तीन अवस्था खालील प्रमाणे:****१) First stage (प्रथमावस्था):**

- ही १२ तासांसाठी राहते.
- Uterine wall च्या नियमित आकुंचन लहरी सुरु होतात, त्या वरून खाली असतात.
- त्यामुळे गर्भ खाली cervix ढकलला जातो. Cervix expand झालेले असते.
- Aminon आणि chorion फटतात.
- Amniotic द्रव बाहेर पडतो व योनीमार्ग बुळबुळीत होतो.
- Uterine wall पासून placenta ओढली जाऊन गर्भ मोकळा होतो.

**२) Second stage (द्वितीयावस्था):**

- २० min ते १ तासाची अवस्था uterus आकुंचनाची शक्ती वाढते. त्याचबरोबर abdominal wall ही आकुंचन पावते.
- त्यामुळे गर्भ हळूहळू विस्तारित cervix आणि योनीमार्गात सरकतो. त्याचे डोके पुढे असते शेवटी ते बाह्यजगात विसर्जित होते.
- Placenta गर्भाजवळ दोन ठिकाणी बद्ध असते, त्या दोन बंधनाच्या मध्ये ती कापली जाते व बाळ मातेपासून पूर्ण वेगळे होते.

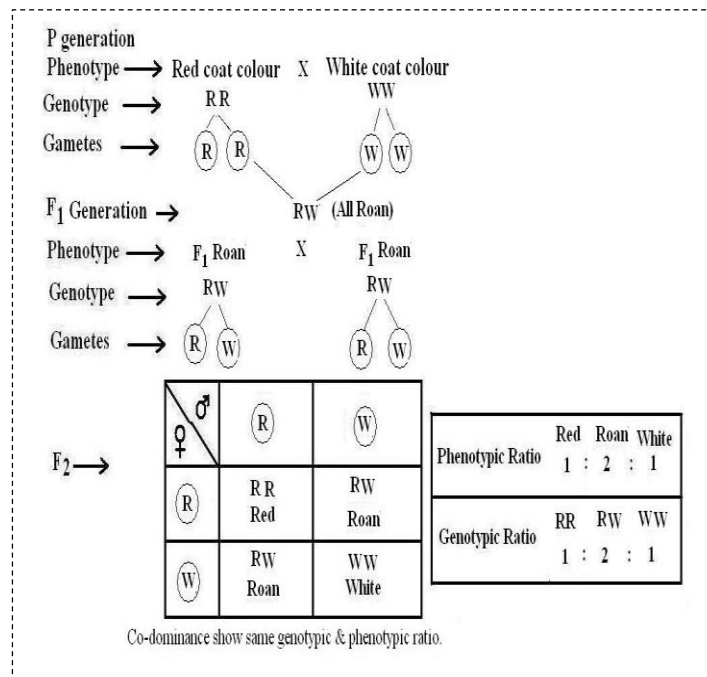
**Q.26 With the help of a graphical representation explain co-dominance. Also mention the phenotypic and genotypic ratio obtained.**

**OR**

**Q.26 Explain the co-dominance with suitable example.**

**Ans: Co- dominance:** In co-dominance dominance both the genes express equally in F<sub>1</sub> hybrids. Such alleles which are able to express themselves independently even if present together in hybrids are called co-dominant alleles.

e.g. Coat colour in cattle.



**Explanation:**

- Classic example of co-dominance is coat colour in cattle.
- There are two types, one with red coat (skin with red colour hair) and the other with white coat (with white hair).
- When red cattle (RR) are crossed with white cattle (WW), F<sub>1</sub> hybrids (RW) have roan colour.
- Roans have the mixture of red and white colour hair. Thus both the traits are expressed equally.
- In F<sub>2</sub> generation, (produced by interbreeding of roans) red (RR), roans (RW) and white (WW) are produced in the ratio 1:2:1. Thus in co-dominance also genotypic and phenotypic ratio are identical.

**Q.27 Explain the statement: Law of dominance is not universal.**

**Ans:** In a cross between two organisms pure for any pair (or pairs) of contrasting characters, the character that appears in F<sub>1</sub> generation is called dominant and the one which is suppressed is called recessive.

In many cases, the dominance is not complete or absent. Phenomenon of dominance is significant as the harmful recessive traits are masked, i.e. not expressed in the presence of its normal dominant allele. e.g. In humans a form of idiocy, diabetes and haemophilia are recessive characters.

Thus, law of dominance is significant and true, but it is not universally applicable.

**Q.28 Distinguish between Incomplete dominance and Co- dominance. (Feb/Mar-2022)-2m**

**Ans: Incomplete dominance and Co- dominance:**

| No. | Incomplete dominance                                                                                     | Co-dominance                                                                                                                                          |
|-----|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| i   | It is the phenomenon in which neither of the alleles of a gene is completely dominant over the other.    | It is the phenomenon in which two alleles of a gene are equally dominant and express themselves in the presence of the other, when they are together. |
| ii  | In case of incomplete dominance, the phenotype of hybrids is intermediate between phenotypes of parents. | In co-dominance, both the genes are expressed equally.                                                                                                |
| iii | e.g. Pink colour flower of mirabilis jalapa.                                                             | e.g. Roan coat colour in cattle.                                                                                                                      |

**Q.29 What are multiple alleles? Explain its inheritance with suitable example.**

**Ans: Multiple alleles:** "More than two alternative forms of a gene in a population occupying the same locus on a chromosome are called multiple alleles".

**Explanation:**

- Multiple alleles arise by mutations of a wild type of gene.
- A gene mutates several times producing a series of alternative expressions.
- Wild type of gene is always dominant over mutant gene.
- Mutant genes may show co-dominance / incomplete dominance.

v) Multiple alleles do not undergo crossing over.

### e.g. *Drosophila*

i) In *Drosophila* the gene for normal wing is wild type and dominant.

ii) The wild gene is mutated to series from nicked wings, notched wings, strap wings and no wings.

| Phenotype       | Genotype         |
|-----------------|------------------|
| Normal wings    | Vg +             |
| Nicked wings    | vg <sup>ni</sup> |
| Notched wings   | vg <sup>no</sup> |
| Strap wings     | vg <sup>st</sup> |
| Vestigial wings | vg               |

### e.g. ABO blood groups in human beings.

i) The gene I controls the ABO groups.

ii) The I has three allele I<sup>A</sup>, I<sup>B</sup> and i.

iii) The gene i do not produce any sugar.

iv) The genes I<sup>A</sup> and I<sup>B</sup> produce slightly different form of sugars.

v) The genes I<sup>A</sup> and I<sup>B</sup> are completely dominant over gene i.

vi) The genes I<sup>A</sup> and I<sup>B</sup> are co-dominant.

| Genotype                                          | Phenotype (Blood group) |
|---------------------------------------------------|-------------------------|
| I <sup>A</sup> I <sup>A</sup> or I <sup>A</sup> i | A                       |
| I <sup>B</sup> I <sup>B</sup> or I <sup>B</sup> i | B                       |
| I <sup>A</sup> I <sup>B</sup>                     | AB                      |
| i i                                               | O                       |

**Q.30 What is pleiotropy? Explain its inheritance with suitable example.**

**OR**

**Q.30 Write a note on pleiotropy.**

**Ans: Pleiotropy** – “When a single gene controls two (or more) different traits, it is called pleiotropic gene and this phenomenon is called pleiotropy / pleiotropism”.

### Explanation:

i) The normal / healthy gene for normal shape of RBCs is Hb<sup>A</sup> and it is dominant.

ii) The recessive gene Hb<sup>S</sup> leads to a disease called Sickle-cell anaemia.

iii) If the genotype is Hb<sup>A</sup> Hb<sup>A</sup> it is normal condition i.e. no Sickle-cell anaemia.

iv) If the genotype is Hb<sup>A</sup> Hb<sup>S</sup> it is carrier. It is normal at normal Oxygen level, but in Oxygen deficiency leads to mild Sickle-cell anaemia i.e. RBCs become half moon shaped.

v) If the genotype is Hb<sup>S</sup> Hb<sup>S</sup> it leads to severe Sickle-cell anaemia and dies in embryonic stage.

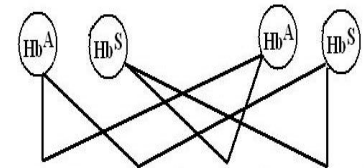
vi) Thus the gene for Sickle-cell anaemia is lethal in homozygous (Hb<sup>S</sup> Hb<sup>S</sup>) condition and produces Sickle-cell trait in heterozygous carrier (Hb<sup>A</sup> Hb<sup>S</sup>).

vii) A marriage between two carriers will produce normal, carrier and Sickle-cell anaemic children in 1:2:1 ratio.

(Recessive homozygous dies, therefore the ratio is 1:2:0)

Parents Phenotype Sickle-cell carrier X Sickle-cell carrier  
Genotype Hb<sup>A</sup> Hb<sup>S</sup> Hb<sup>A</sup> Hb<sup>S</sup>

Gametes



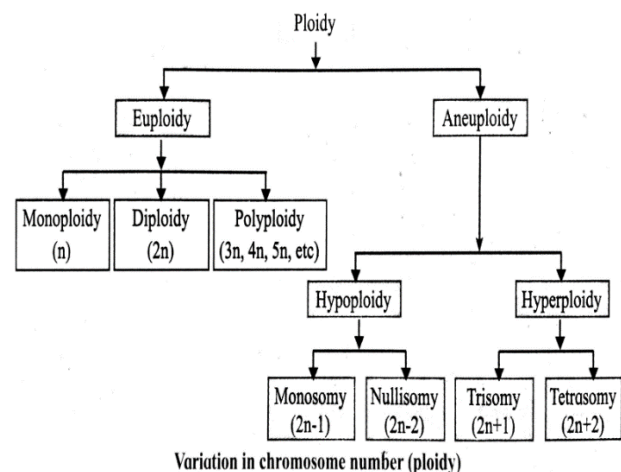
Offsprings Genotype Hb<sup>A</sup> Hb<sup>A</sup> Hb<sup>A</sup> Hb<sup>S</sup> Hb<sup>A</sup> Hb<sup>S</sup> Hb<sup>S</sup> Hb<sup>S</sup>

| Genotype                        | Phenotype           | Number |
|---------------------------------|---------------------|--------|
| Hb <sup>A</sup> Hb <sup>A</sup> | Normal              | 1      |
| Hb <sup>A</sup> Hb <sup>S</sup> | Sickle-cell carrier | 2      |
| Hb <sup>S</sup> Hb <sup>S</sup> | Sickle-cell anaemic | 0      |

Normal Sickle-cell carrier  
1 : 2

**Q.36 Draw the chart representing the variation in chromosome number.**

**Ans:**



**Q.62 Explain External structure of human heart**

OR

**Q.62 Describe Pericardium.**

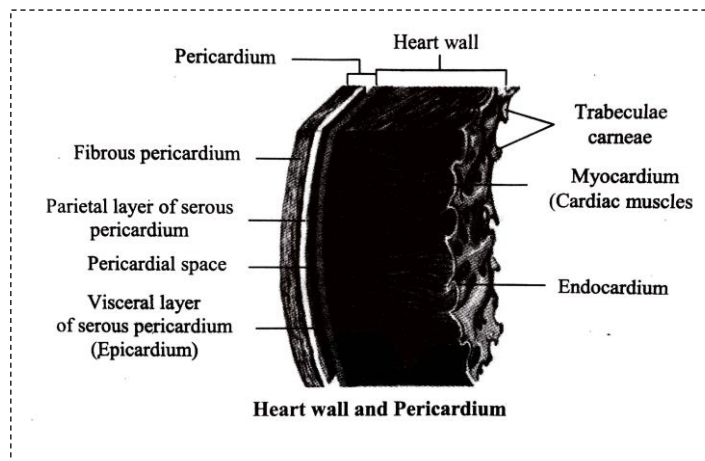
OR

**Q.62 Draw neat and labelled sketch of external structure of human heart.**

OR

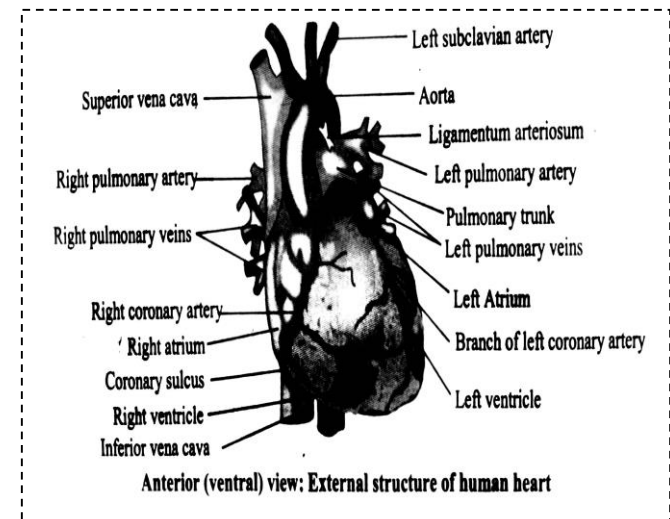
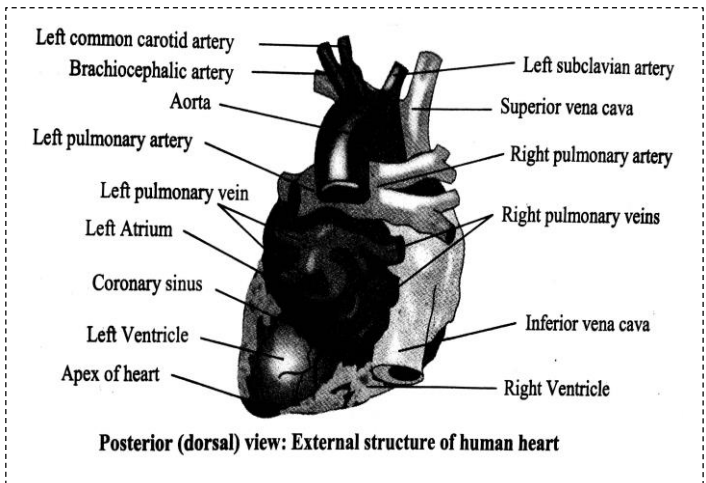
**Q.62 Draw and label the heart wall and peridium****Ans: Human Heart:****A) Features of human heart:**

- i) **Origin:** Human heart is mesodermal in origin.
- ii) **Shape:** It is conical in shape. It has broad base towards the upper side and narrow apex.
- iii) **Size:** It is roughly of the size of one's clenched fist.
- iv) **Weight:** In males - 300gm, In females 250gm
- v) **Colour:** It is reddish brown in colour.
- vi) **Location:** It lies in the mediastinum i.e. space between two lungs.
- vii) **Pericardium:**
  - 1) Heart is enclosed in a membranous sac called pericardium.
  - 2) Pericardium is formed of two main layers - outer fibrous and inner serous pericardium.
  - 3) Serous pericardium is soft, moist and elastic.
  - 4) It is formed of squamous epithelium and is further divisible into two layers as parietal and visceral layer.
  - 5) Parietal and visceral layers of serous pericardium are separated by a pericardial space. This space is filled with pericardial fluid (about 50ml) which acts as a shock absorber and protects the heart from mechanical injuries.
  - 6) It also keeps the heart moist and acts as lubricant.

**B) Structure of heart wall:**

- i) It shows three layers, viz. epicardium, myocardium and endocardium.
- ii) The outer layer is the epicardium, middle myocardium and inner endocardium.

- iii) Epicardium is thin and formed of a single layer of flat squamous epithelium resting on basement membrane.
- iv) Myocardium is the middle thick layer formed of cardiac muscles.
- v) Endocardium is a single thin layer formed of squamous epithelium.
- vi) The epicardium and endocardium are protective in function whereas myocardium is responsible for contraction and relaxation of heart.

**C) External structure of heart:**

- i) The human heart is four chambered. The two superior chambers are called atria (auricles) and inferior two are called ventricles.
- ii) Externally, the atria are separated from ventricles by a transverse groove called coronary sulcus or atrio-ventricular groove.
- iii) The two ventricles are externally separated from each other by two grooves, the anterior and posterior inter-ventricular sulci.
- iv) Coronary arteries and coronary veins run through these sulci.

**Q.11 Explain the 'Rivet Popper Hypothesis'.****Ans: 'Rivet Popper Hypothesis':**

i) Paul Ehrlich, an ecologist from Stanford gave an analogy to explain significance of diversity. It is called Rivet Popper Hypothesis.

ii) He compared aeroplane to ecosystem and the species as rivets that keep all parts of the aeroplane together. There are thousands of rivets needed to hold all the parts of the aeroplane together.

iii) If each passenger decides to pop even one rivet, initially, not much of the turbulence will be experienced but slowly, as number of popped rivets will increase, there will be a serious threat to the safety of the aeroplane. Also, which rivets are removed will also matter. Suppose, rivets at key positions such as the ones that bind the wings to the body of the aeroplane, are removed, situation will become serious.

iv) Thus, we can say that relationship between diversity and well being of ecosystem is not linear. But, it is certain that loss of species may not pose threat to the ecosystem only initially. However, loss of key species will certainly cause threat in very short span of time. It will affect food chains, food web, energy flow, natural cycles, etc. In short, it will affect the balance of ecosystem.

**15.3 Biodiversity Current Scenario****Q.11 How many species do really exist on earth and how many of them are found in India?****Ans: 1) Number of species existing on Earth:**

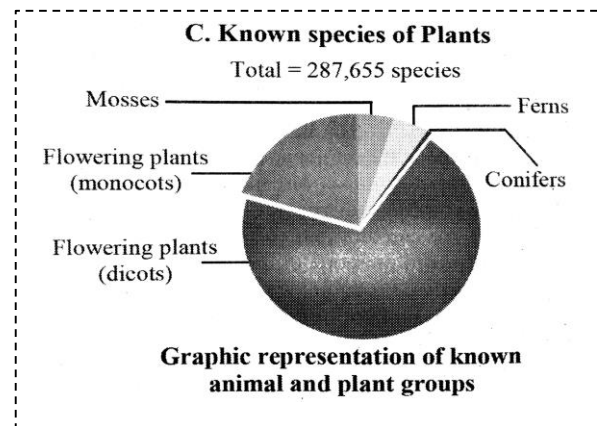
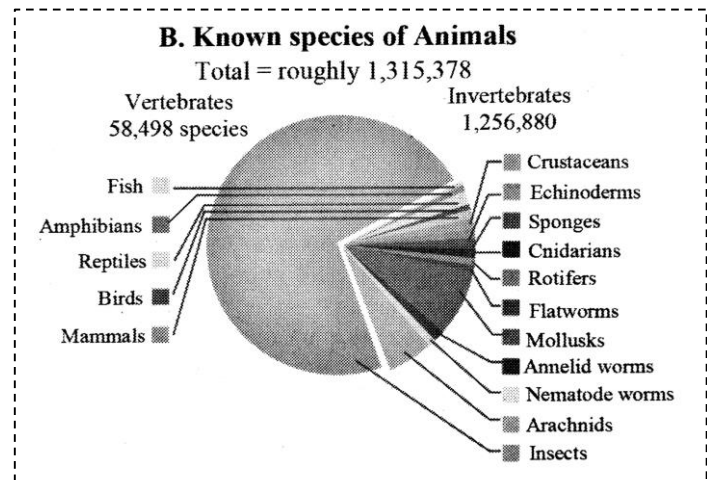
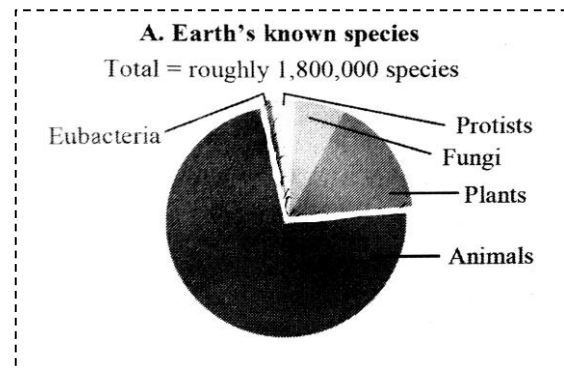
i) Some exorbitant numbers like existence of 20 to 50 million varieties have been made. But Robert May - has given convincing estimate of about 7 million species round the globe.

ii) Following pie charts show relative share of various plant and animal groups- in the existing knowledge of biodiversity.

**2) Number of species existing in India:**

i) India occupies a share of 8.1% of total biodiversity wealth of the earth.

ii) One of the 12 megadiversity countries of the globe, India has 2.4% of total land area of the world. Around 45000 plant species and nearly double the number of animal varieties have been identified from India's natural wealth.

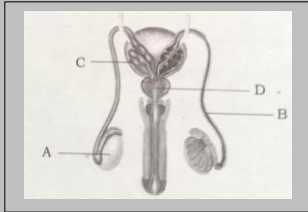


**Q.13 Describe the male reproductive system in human beings. OR**

**Q.13 Explain the following parts of male reproductive system along with labelled diagram showing these Parts.**

Testis, vasa deferentia, epididymis, seminal vesicle, prostate gland and penis

**Q.13 Identify A, B, C, D, in the given diagram of human reproductive system: (Feb/March-2022)-2M**



**Ans:** The male reproductive system consists of the following:

- A) Primary sex organ: Testes
- B) Secondary or accessory sexual organs
- C) External genitalia: Penis

**A) Primary sex organ:**

**a) Scrotum (Scrotal sac):**

- i) It is a pouch of pigmented skin arising from lower abdominal wall.
- ii) The wall of scrotum consists of smooth muscles called dartos tunic.
- iii) Scrotum is divided into two compartments (right and left) by muscle septum.
- iv) Each compartment encloses a testis, epididymis and a testicular end of spermatic cord.
- v) It lies below the pubic symphysis in front of upper part of thigh and behind the penis.

**Function:** Scrotum protects testes and acts as thermo-regulator.

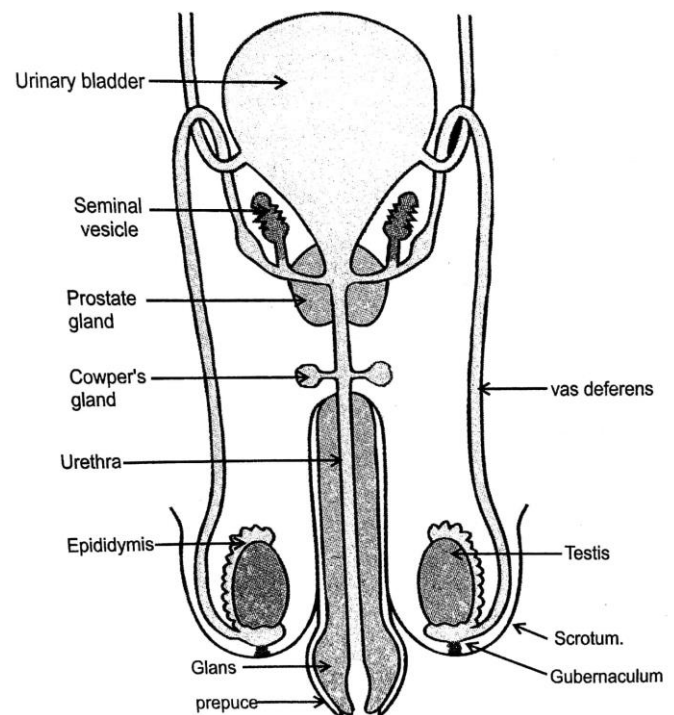
**b) Testes:**

- i) Testes are a pair of primary sex organs which are mesodermal in origin.
- ii) Testes are located outside the abdomen in scrotum, i.e. extra abdominal in position.
- iii) They are suspended in the scrotal sac by the spermatic cord.
- iv) Each testis is connected to the wall of scrotum by short fibromuscular band called gubernaculum.
- v) They are soft, smooth, pinkish oval organs about 4.5 cm long, 2.5 cm wide and 3 cm thick.
- vi) The outermost covering of the testis is formed of dense fibrous membrane called tunica albuginea.

**Function:**

- i) Testes produces sperms.

- ii) It secretes male sex hormone called testosterone.



**Fig. Human-Male Reproductive system**

**B) Secondary or accessory sex organs:**

It includes,

- a) Accessory ducts
- b) Accessory glands

**a) Accessory ducts:** It includes rete testis, vasa efferentia, epididymis and vas deferens.

**1) Rete testis:** The seminiferous tubules are closed at one end, but on the other end, they join to a network of tubules called rete testis. The rete testis open into vasa efferentia.

**2) Vasa efferentia:** Vasa efferentia are 15 to 20 fine convoluted ductules arising from the rete testis and join to the epididymis by piercing through tunica albuginea.

**3) Epididymis:**

- i) Epididymis are a pair of 'C' shaped organs situated on the postero-lateral side of each testes.
- ii) Each shows the presence of highly coiled duct, about 6 meters long.
- iii) They are further differentiated into three regions, viz. upper wider head or caput, middle narrower body or corpus and lower duct called tail or cauda.

**Q.18 (B)- Describe the histological structure of human testis. OR**  
**Q.18 Describe histological structure of Testis with well label diagram. (Feb/March-2024)-4M**

**Ans: Histology of Testis:**

i) Externally, each testis is covered by three layers. These are:

**a) Tunica vaginalis:** It is the outermost incomplete peritoneal covering made up of connective tissue and epithelium.

**b) Tunica albuginea:** It is the middle layer formed by fibrous connective tissue.

**c) Tunica vasculosa:**

i) It is the innermost layer formed of delicate connective tissue, supporting a network of blood capillaries.

ii) Each testis contains about 200-300 tubules called seminiferous tubules.

iii) These are lined by a single layer of cuboidal germinal epithelium which undergo spermatogenesis.

iv) In the germinal epithelium, various stages of spermatogenesis such as spermatogonia, primary spermatocytes, secondary spermatocytes, spermatids and sperms are seen.

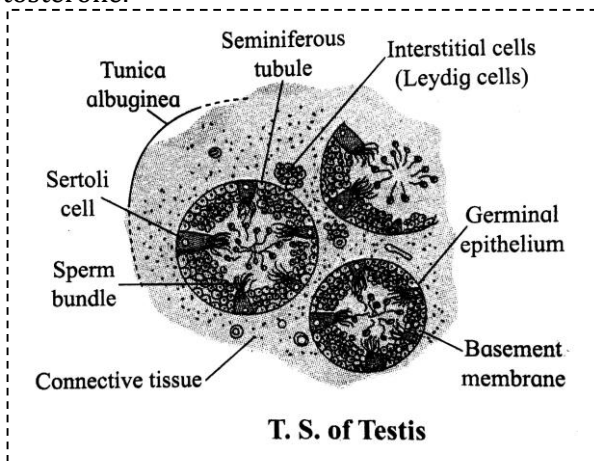
v) Between these cells, few large and pyramidal cells called nurse cells or sertoli cells are present.

vi) Bundles of sperms are seen attached to Sertoli cells.

vii) These cells provide nourishment to the sperms till maturation.

viii) In between seminiferous tubules, connective tissue containing blood vessels, nerves, lymph vessels and groups of interstitial cells (Cells of leydig) is present.

ix) Interstitial cells produce male hormone testosterone.



**Q.19 Describe the female reproductive system in human beings.**

**Ans:** The human female reproductive system consists of:

- A) Internal genitalia                      B) External genitalia.
- C) Accessory glands

**A) Internal genitalia:** includes ovaries, fallopian tubes, uterus, vagina.

**a) Ovaries:**

i) These are a pair of female primary sex organs situated in the lower part of the abdomen.

ii) Ovaries are almond-shaped bodies measuring about 3 cm in length, 1.5 cm in width and 1 cm thick.

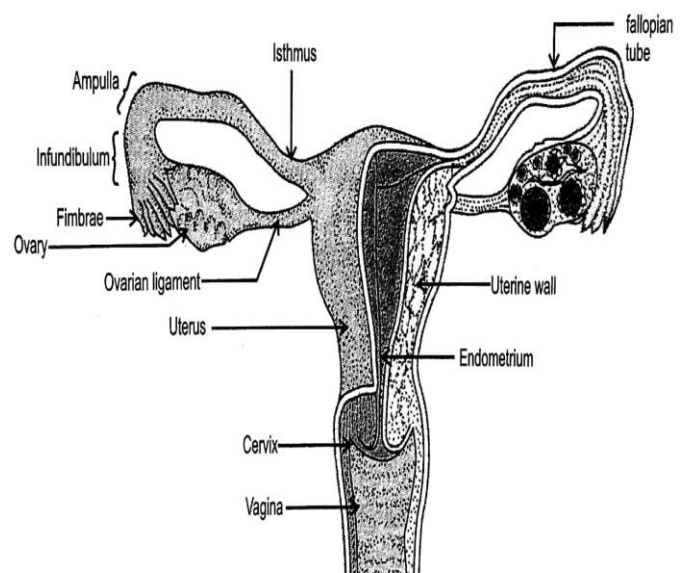
iii) Each ovary is suspended from the dorsal body wall by a fold of peritoneum called mesovarium.

iv) Ovary is connected to uterus by an ovarian ligament, and it is connected to lateral body wall by a suspensory ligament.

v) The outer region of the ovary is composed of developing follicles and middle region from the stroma which contains connective tissues, blood vessels and mature follicles.

vi) Stroma is divided into two regions: a peripheral cortex and an inner medulla

**Functions:** Ovaries produce female gametes, i.e. ova as well as female sex hormones – oestrogen and progesterone which control menstrual cycle and secondary sexual characters.



**Fig. Female Reproductive system**

# अशाच प्रकारे ...

सर्व Topics च्या सर्व प्रश्नांची उत्तरे अगोदर English मध्ये दिली असून त्याचे स्पष्टीकरण Scientific मराठीमध्ये दिले आहे...

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