Sexual Reproduction in Flowering Plants

1) Define the following

① **Dithecous** :- Each lobe in anther has two theca. Thus they are called as Dithecous.

② **Sporogenous tissue** :- When the anther is young, in the centre of each microsporangium a group of compactly arranged cells called 'Sporogenous tissue'.

③ **microsporogenesis** :- As the anther develops, the cells of Sporogenous tissue [Pollen mother cell] undergo meiotic division to form microspores. This is called microsporogenesis.

④ **microspore tetrad** :- Early, these microspores are arranged in a cluster of 4 cells are called 'microspore tetrad'.

⑤ **Sporopollenin** :- The outer hard layer is called exine made up of sporopollenin the most resistant organic material.

⑥ Monocarpellary :- If a single pistil is present in female flower called monocarpellary.

⑦ Multicarpellary :- If more than one pistil are present in female flower called multicarpellary.

⑧ Apocarpus :- In multicarpellary If pistils are free called apocarpus.

⑨ Syncarpus :- If pistils are fused called syncarpus.

⑩ Megasporogenesis :- The formation of megaspores from the megaspore mother cell (MMC) is called megasporogenesis.

⑪ Monosporic development :- In a majority of flowering plants, one of the megaspores is functional & developed into female gametophyte, while other three degenerate. This is called monosporic development.

(12) Pollination :- (If) It is a process of in which transfer of pollen grains on to the stigma are called pollination.

(13) Pollen / nector robbers :- Many insects consume pollen or nector without bringing pollination They are called pollen robbers.

(14) Emasculation :- In a bisexual flowers, removal of anthers from the flower bud before dehiscence by using a pair of forceps is called emasculation.

(15) Bagging :- Emasculated flower are covered with butter paper bags to prevent contaminat-ions of the stigma with unwanted pollen grains is called Bagging.

(16) Triple fusion :- The male gamete fuses with the two polar nuclei to produce primary endosperm nucleus (3n) (PEN) Because it involves the fusion of 3 nuclei, it is called Triple fusion.

(17) Double fertilization :- Since two types of fusions - syngamy & triple fusion occurs in embryo sac it is called double fertilization.

(18) Embryogeny :- The early stages of embryo development is called 'embryogeny'.

(19) Apomixis :- In some species like asteraceae and grasses, seeds are produced without fertilization. This is called apomixis

(20) Polyembryony :- Occurence of more than one embryo in a seed is called 'polyembryony'.

2. Differentiate among true fruits, False fruits and Parthenocarpic fruits [3].

Ans ① True fruits :- Fruits are develops from ovary are called True fruits.
Ex :- Coconut, mango, chilly.

② False fruits :- The thalamus of the flower is converts into fruits.
ex :- Apple, Cashew nuts, Strawberry.

③ Parthenocarpic fruits :- In some few species of plants, fruits are developed without fertilization. This is called Parthenocarpic fruits.
Ex :- Banana.

3. Differentiate among Autogamy, Geitonogamy & Xenogamy [3].

Ans→ (i) Autogamy:- This is the type of Pollination, where pollination is occured within the same flower.

(ii) Geitonogamy:- Transfer of pollens from anther of one flower to the stigma of another flower of the same plant.

(iii) Xenogamy:- Transfer of Pollens from the anther to the stigma of different plants.

4. Differentiate between free nuclear endosperm & Cellular endosperm with example [3].

Free nuclear endosperm	Cellular endosperm
• The PEN undergoes repeated nuclear division to gives rise to free-nuclei. This is called (ou) Free nuclear endosperm ex- Tender coconut water	• After this cell wall formation occurs and the endosperm becomes cellular endosperm ex- white kernel- copra of coconut

5. Explain the structure of microsporangium / mature anther. (5).

Ans * In a T.S a microsporangium appears circular in outline.

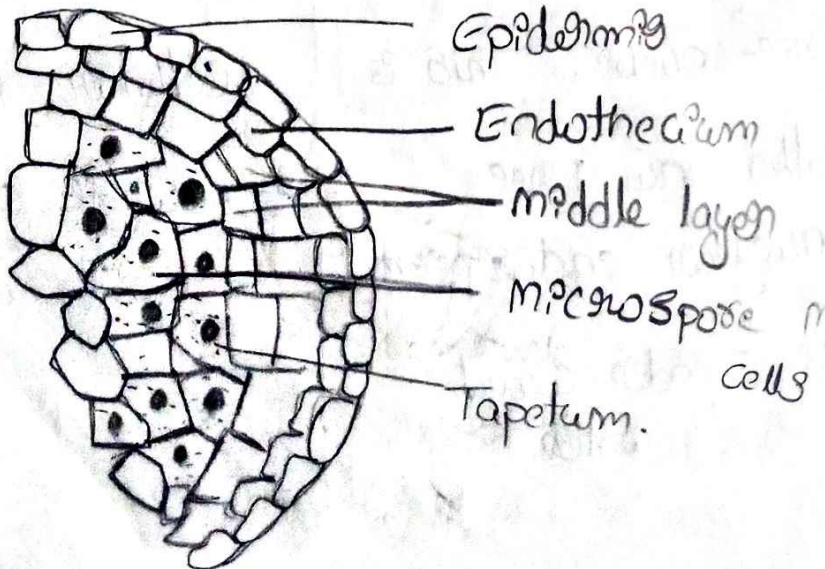
* It is surrounded by 4 wall layers they are epidermis, endothecium, middle layers and tapetum.

* The outer 3 layers perform the protection and release of pollen from the anther.

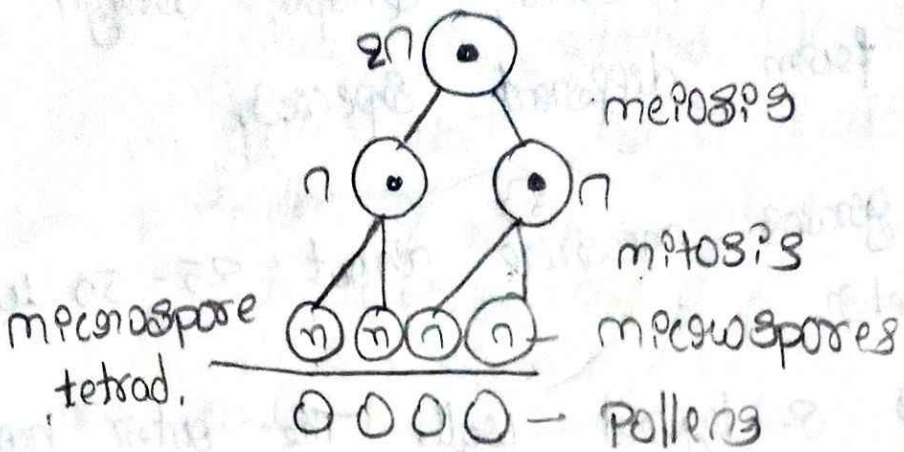
* The cells of tapetum have dense cytoplasm and have more than one nucleus will nourish the developing pollen grains.

* When the anther is young in the centre of each microsporangium, a group of 8 compactly arranged cells called sporogenous tissue.

6. Draw a labelled diagram of microsporangium [5]



7. Describe the process of microsporogenesis with a sketch. (5).



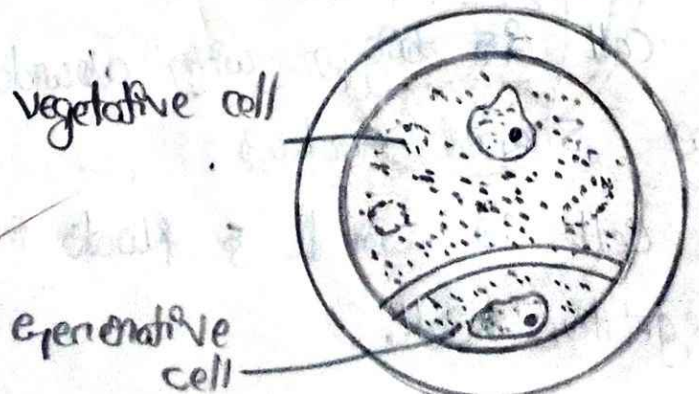
* As the anther develops, the cells of sporogenous tissue [PMC] undergo meiotic division to form microspores. This is called microsporogenesis.

* Early, these microspores are arranged in a cluster of 4 cells called microspore tetrad.

* As the anthers mature and dehydrate, the microspores dissociate and develop into pollen grains and these pollen grains are released with the dehiscence of anther.

8. Describe the structure of the pollen grain with a diagram [3].

Ans-



P.T.O

* They represent male gametes, are in different size, colour, shape, design from different species.

* Pollen grains measure about 25-50 μm in diameter.

* It has 2 layered wall. The outer hard layer is called exine made up of sporopollenin the most resistant organic (compound) material

* It can with stand high temperature strong acids & alkali.

* No enzyme that degrade sporopollenin is known. Exine has prominent apperture called called germ pore. Because of sporopollenin, Pollen grains can be preserved as fossils.

* The inner wall is called intine It is thin & continuous. made up of cellulose & Pectin.

* When pollen grain is matured, it contains two cells - The vegetative cell & generative cell.

* The vegetative cell is bigger with abundant food & irregular shaped nucleus.

* The generative cell is small & floats in the cytoplasm of vegetative cell.

9. Explain the structure of megasporangium / anatropous ovules (5).

Ans * The ovule is attached to the placenta by a stalk called funicle, in the region of hilum. Hilum forms the junction b/w ovule & funicle.

* Each ovule has one or two envelops called integuments, which encircle the ovule, except at a small opening called micropyle.

* Opposite to micropyle, is the basal part of ovule called the 'chalaza'.

* Within the integuments, is a mass of cells called 'necellus' They have reserve food materials

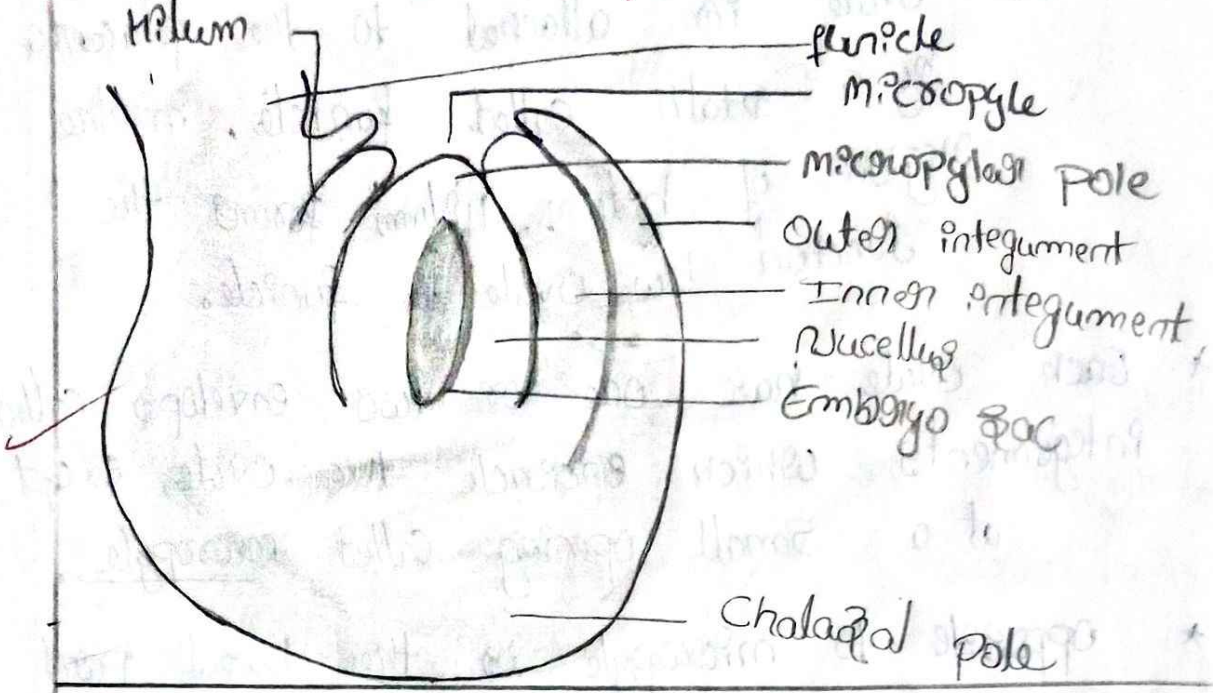
* The embryo sac or female gametophyte is present inside the nucellus.

* This embryo sac is formed from a megaspore through reduction division.

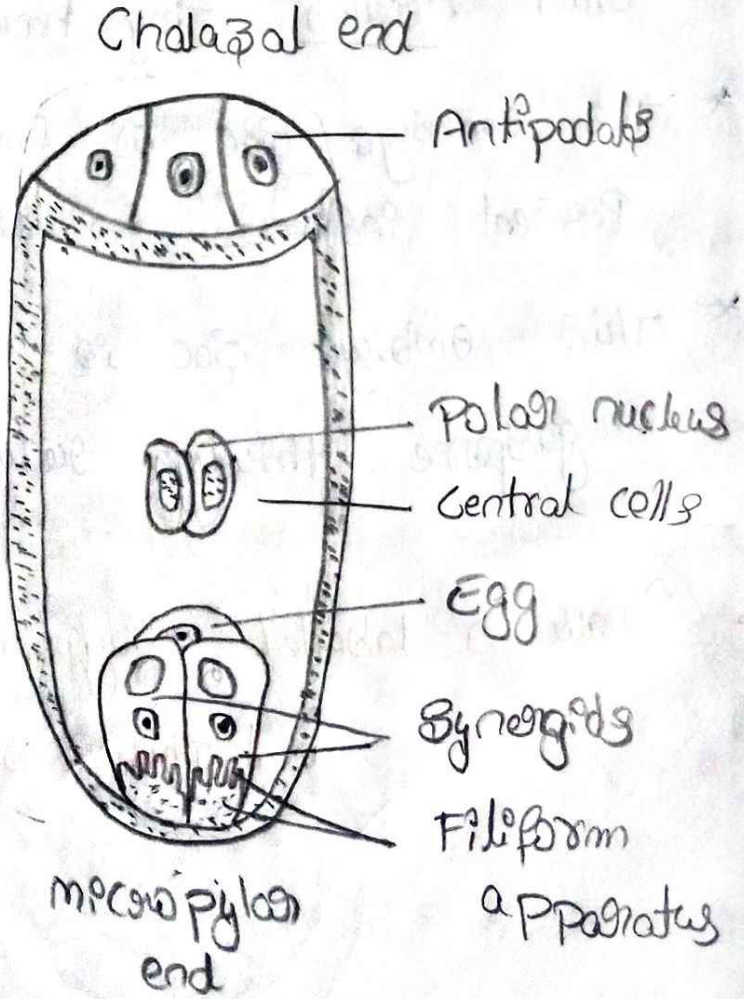
10. Draw a labelled diagram of megasporangium anatropous ovules (5).

P.TO

10. Draw a labelled diagram of megasporangium (or) anatrophous ovule [5].



11. Describe the structure of female gametophyte (or) Embryo sac with a diagram [3]



- In a majority of flowering plants, one of the megaspores is functional and developed into female gametophyte, while other three degenerate. This is called monosporic development.

- The nucleus of the functional megaspore divides mitotically to form 2 nuclei, which moves to the opposite poles.

- Two more sequential divisions result in the formation of 4 nucleate and later 8 nucleate stage of the embryo sac.

- In this nuclear divisions are not followed by cell wall formation. But after 8 nucleate stage. cell wall is formed to organisation of 7 gametophyte.

- Within the embryo sac. egg apparatus which consists two synergids and one egg cell is present at the micropylar end 3 antipodal cell are present at chalazal end.

- In the middle central cell consists two polar nuclei. Thus a matured embryo sac has 7 cells but 8 nucleus.

12. What are the feature of wind pollinated flowers (5).

Ans- • It requires light pollens.
• It requires non-sticky pollens
• Well exposed stamens for easily dispense of pollens & easy trap.
• Wind pollinated flowers have single ovule in each ovary.
• ex- maize, grass.

13. How water pollination occurs in vallisneria & seagrass [3].

Ans:- Vallisneria :- In vallisneria, the ♀ flower reach the surface of water & pollen grains are also released on to the surface of water, which are carried by water currents.

Sea grass :- In sea grassed ♀ flower is submerged in H_2O & pollens are released inside the H_2O, which are long and ribbon like carried by water current, In water pollinated plants. Pollen grains are covered with mucilage to protect from wetting.

14. How plants discourage self pollination & encourage cross pollination by adopting outbreeding devices. (5)

Ans- (i) Pollen release and stigma receptivity are not synchronised.

(ii) By inhibiting pollen germination on the stigma

(iii) Production of unisexual flowers [monoecious] ex- castor, maize it prevents only autogamy but not geitonogamy.

(iv) In some plants ♂ & ♀ flowers are present in different plant. [diecious]
ex- Papaya! This prevents both autogamy & geitonogamy.

15. Write a note on double fertilization (3)

Ans- * After entering, pollen tube releases 2 gamets in cytoplasm of synergids, one ♂ gamete fuses with nucleus of egg cell to form diploid zygote (2n) called syngamy.

* The ♂ other gamete fuses with two polar nuclei to produce primary endosperm nucleus (3n) PEN Because it involves fusion of 3 nuclei it is called triple fusion.

* Since two types of fusions- Syngamy and triple fusion occur in embryo-sac are called double fertilization.

* A unique character of angiosperms. Primary endosperm cell develop into the endosperm and zygote develops into an embryo.

16. Differentiate b/w monocot embryo & dicot embryo [3]

	Monocot Embryo		Dicot Embryo
1	It has only one cotyledon called scutellum,	1.	It has an embryonal axis.
2	which is situated towards one side of embryonal axis.	2.	It has two cotyledons
3	At the lower end is radical & root cap, enclosed in a sheath called coleorrhiza	3.	Above the cotyledons is the epicotyle. which terminates into plumule
4	Above the scutellum is epicotyl, which has a shoot apex enclosed in hollow stem called coleoptile	4.	below the cotyledons is the hypocotyl which terminates into radicle (or) root tip. which ~~converted into~~ covered with a root cap.

17. What are the advantages of seeds to angiosperm (5).

Ans → (1) Seeds helps the species to grow in other areas.

(2) As seeds have reserve food, young seedlings are nourished until photosynthesis start.

(3) Hard seed coats protect the young embryo.

(4) Seeds generate new genetic recombinations and variations.

(5) Dehydration & dormancy of seeds helps in storage, can be used as food throughout the year & also sowing in next season.

---

18. Mention the Important features of entomophilous / Insect Pollinated flowers (3).

Ans → * Insect pollinated flowers are colourful.

* large in size.

* flowers has fragrant.

* Flowers are rich in nector.

* Because of sticky nature of pollens, they get attached to animals / insect body.

26/6/23 Seen

3rd chapter : HUMAN REPRODUCTION :-

1) Define the following [1]

(a) Gametogenesis :- Formation of gametes are called gametogenesis.

(b) Insemination :- Transfer of sperms into female genital tract is called insemination.

(c) Fertilization :- Fusion of male & female gametes

(d) Implantation :- Formation and development of zygote, blastocyst and its attached to uterine wall is called implantation.

(e) Gestation :- The Embryonic development is called Gestation.

(f) Parturition :- Delivery of the baby.

(g) Spermatogenesis :- In male, sperms are produced from the testis. This is called spermatogenesis.

(h) Oogenesis :- In female, Ovum is produced from the ovary. This is called Oogenesis.

(i) Spermiogenesis :- Spermatids are transformed it into Spermatozoa [sperms] by the process called Spermiagenesis.

(j) Spermiation :- First sperms are attached to sertoli cells and finally released from seminiferous tubules by the process called Spermiation.

(k) Ovulation :- The graffian follicle ruptures to release ovum from the ovary. in this process is called ovulation.

(l) Menarche :- The first menstruation begins at puberty is called menarche.

(m) Menopause :- Menstrual cycle ceases around 50 years of age. Called menopause.

(n) Cleavage :- As zygote moves towards the isthamus, mitotic division starts. This is called cleavage.

(o) Placenta :- The chorionic villi and uterine tissue jointly form a structural and functional unit between embryo and maternal body called placenta.

(P) Foetal ejection reflex :- The signals from fully developed foetus and the placenta induce mild uterine contractions called foetal ejection reflex.

(q) Lactation :- The mammary glands start producing milk at the end of pregnancy are called lactation.

(r) Colostrum :- The milk produced in early few days is called colostrum. It is rich with antibodies, is essential for the new-born babies to develop resistance.

2. Describe the structure of male reproductive system in human [5].

Ans->

* It includes a pair of testes, accessory ducts, glands & external genitalia.

* The testes are situated outside the abdominal cavity in a pouch called scrotum, which maintaining 2-2.5°C lower temperature than body temperature, necessary for spermatogenesis.

* Each testes is oval in shape, about 4-5 cm in length and 2-3 cm in width. Each testes has about 250 compartments called testicular lobules.

* Each lobule contains 1-3 seminiferous tubules, where sperms are produced.

* Each seminiferous tubule has two types of cell - germ cells & sertoli cells.

* Germ cells undergo meiotic division to form sperms, while sertoli cells provide nutrition to germ cells.

* In between seminiferous tubules, interstitial cells or Leyding cell are present, which secrete hormones called Androgens.

* The additional ducts include rete testis, vasa efferentia, epididymis and vas deferens.

* The seminiferous tubules open into vasa efferentia through rete testis. The vasa efferentia open into vasa efferentia through leads to vas deferens and this leads to urinary bladder.

* All these ducts store & transport the sperms from the testies to outside through urethra.

* The urethra originates from the urinary bladder and extends through the penis and opens as urethral meatus.

* Penis is the ♂ external genitalia, made up of special tissue helps in erection for insemination.

* The enlarged end of penis is called glans penis covered by a loose skin called fore skin.

* The accessory glands are seminal vesicles, Prostate and bulbourethral glands. These glands secrete seminal plasma rich in fructose, calcium & enzymes.

3. Describe the structure of female reproductive system in human [5].

Ans→ * This consists of a pair of ovaries, a pair of oviducts, uterus, cervix, vagina and external genital & also mamary glands.

* All these help in ovulation, fertilisation, pregnancy, birth and child care.

* Ovaries are the primary of sex organs, located one on each side of lower abdomen, measuring 2-4 cm in length. Produce ovum (egg) and hormones.

* These ovaries are connected to pelvic wall and uterus by ligaments. Each ovary are covered with thin epithelium, & inside ovarian stroma. This stroma is divided into peripheral cortex & inner medulla.

* Additional ducts are oviducts, uterus and vagina. Each fallopain tube is about 10-12 cm long extends from ovary to the uterus..

* Near the ovary, funnel-shaped <u>infundibulum</u> which possess finger like projections called <u>fimbriae</u>.

* They help in collection of ovum after ovulation. This infundibulum leads to <u>ampulla</u> then

then isthmus, which is connected to uterus.

* The uterus also called womb is supported by ligaments uterus opens into vagina through cervix.

* The cavity of cervix is called cervical canal, which along with the vagina forms birth canal.

* The uterus has 3 layers - outer perimetrium, middle myometrium, & inner glandular endometrium.

* The endometrium undergoes cyclic changes during menstrual cycle, while myometrium has strong contraction during delivery.

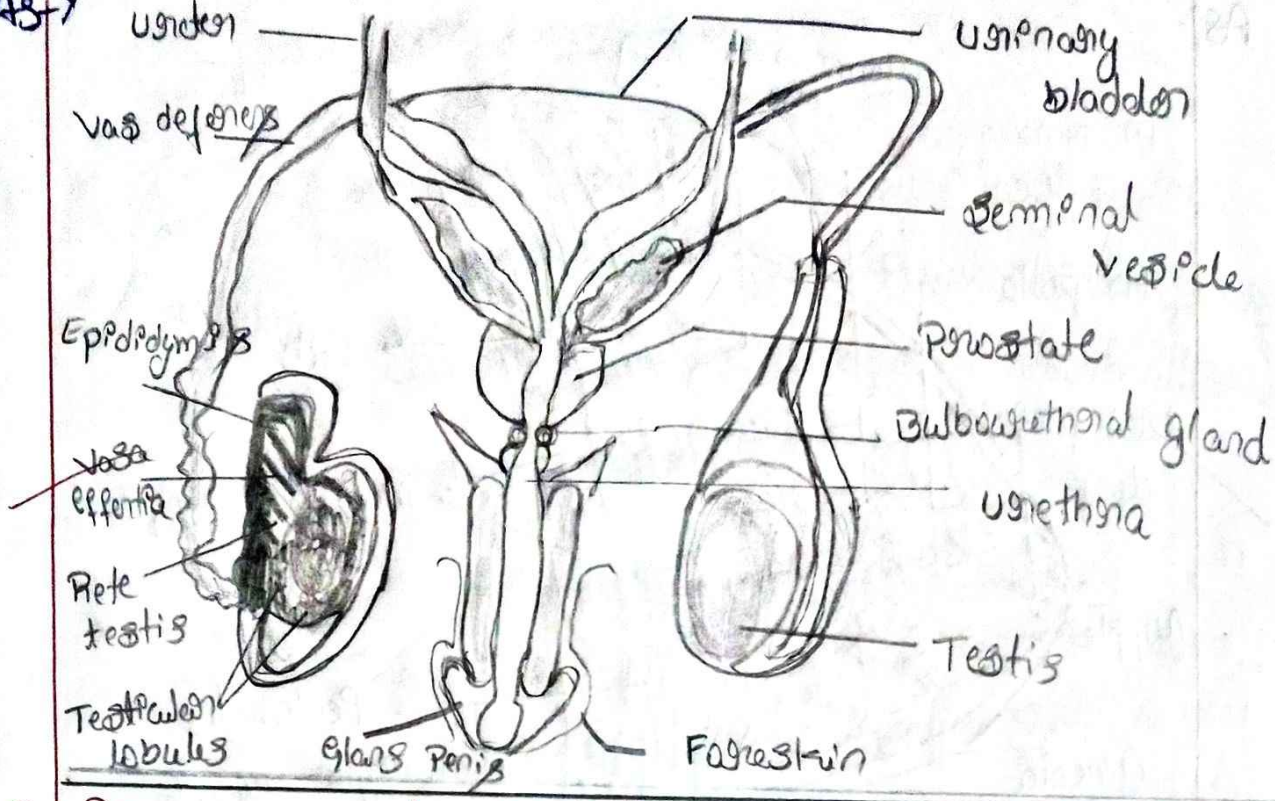
* Female external genitalia includes mons pubis, labia majora, labia minora, hymen & clitoris.

* Vagina is covered partially by a membrane called hymen. which is often torn during first inter course & also during active participation in sports, cycling etc..

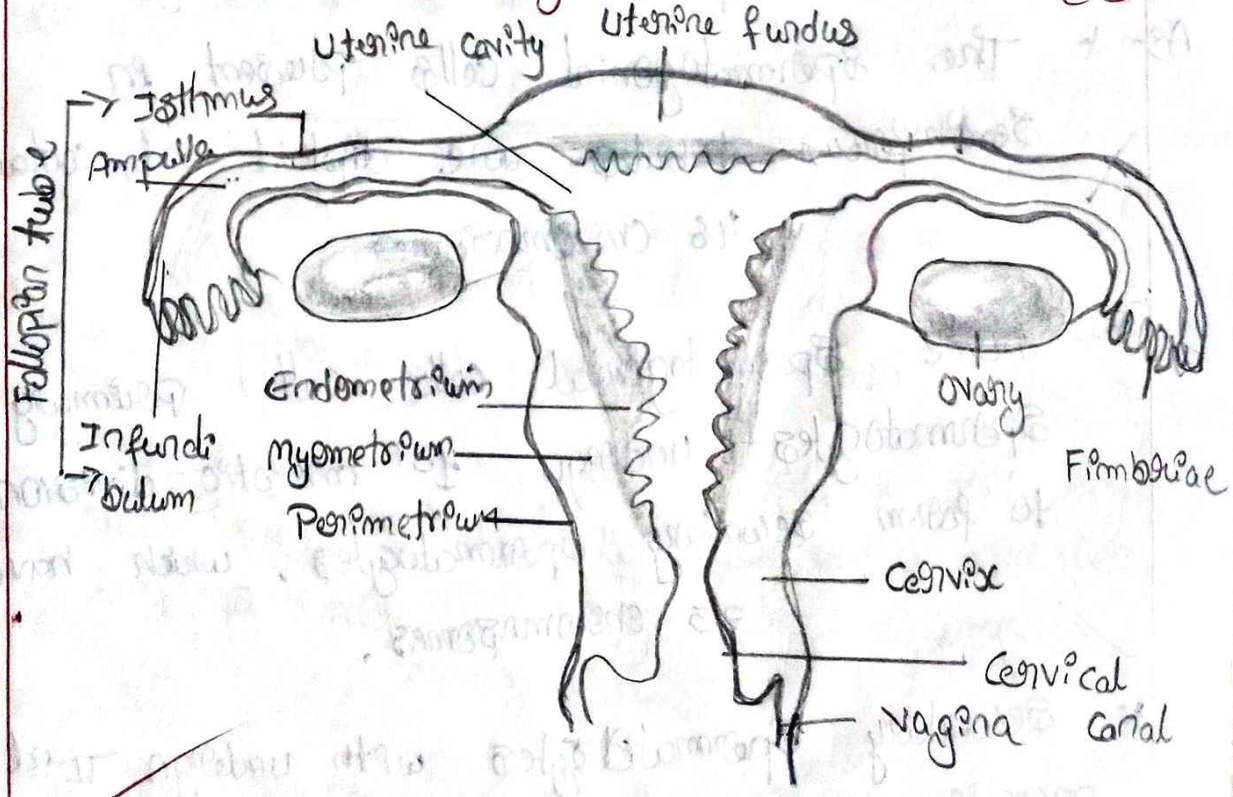
* In fact presence or absence of hymen is not an ide indication of virginity.

4. Draw a neat labelled diagram of male reproductive system in human [5].

As→

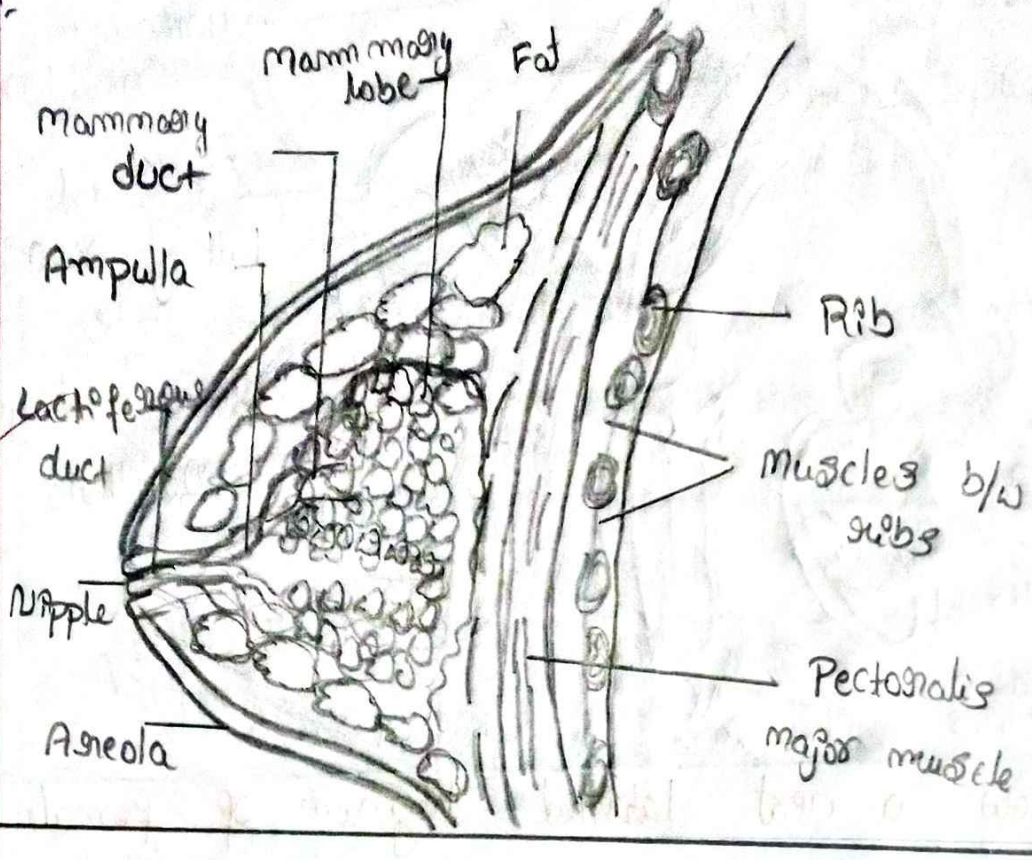


5. Draw a neat labelled diagram of female reproductive system in human [5].



6. Draw a neat labelled diagram of sectional view of mammary gland (3).

As:-



7. Write a brief note on spermatogenesis (3).

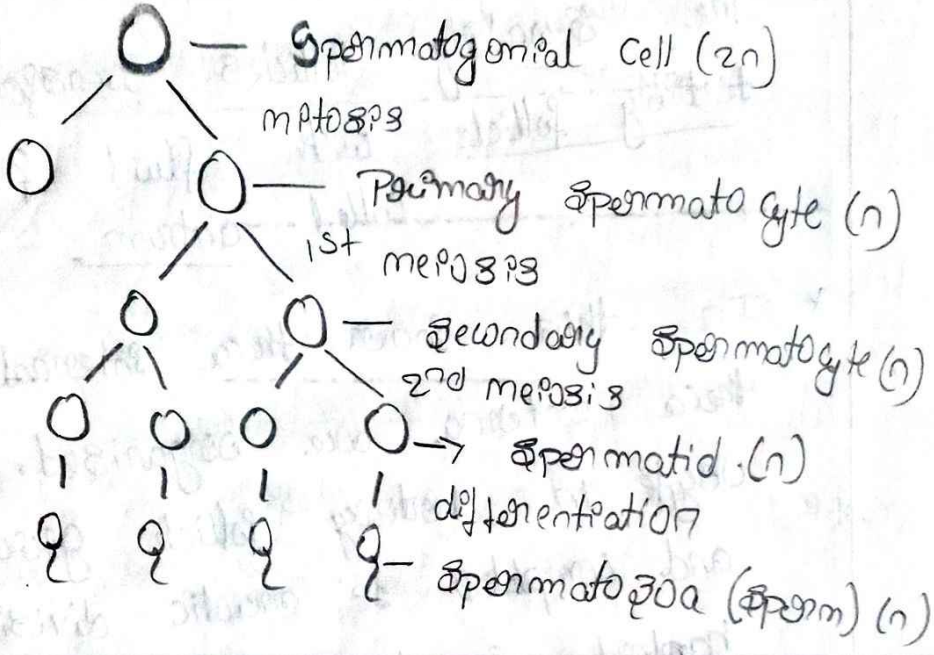
As * The spermatogonial cells present in seminiferous tubules are diploid and contain 46 chromosomes.

* Some spermatogonial cells called primary spermatocytes undergo 1st meiotic division to form secondary spermatocytes. which have 23 chromosomes.

* Secondary spermatocytes with undergo IInd meiotic division to form 4 equal spermatids with 23 chromosomes each.

* Spermatids are transformed into spermato-zoa [sperms] by the process called spermiogenesis.

* First, sperms are attached to sertoli cells and finally released from seminiferous tubules by the process called spermiation.



8. Write a brief note on Oogenesis [3].

Ans * Millian of oogonial cells are formed during the embryonic stage within each foetal ovary.

* No oogonia are formed after birth. These oogonial cells start divide and enter into prophase Ist stage and become Primary oocytes.

* Each primary oocyte is surrounded by a layer of granulosa cells and is called Primary follicle.

* From birth to puberty large number of Primary follicles degenerate, only 60,000-80,000 are left in each ovary.

* The primary follicles surrounded by more layer of granulosa cells to become <u>secondary follicles</u>.

* The secondary follicles transforms into <u>tertiary follicle</u> with fluid filled cavity called <u>antrum</u>.

* In this inner theca internal & outer theca externa are organised. The primary oocyte in tertiary follicle grows in size and completes 1st meiotic division to form haploid secondary oocyte and a tiny polar body.

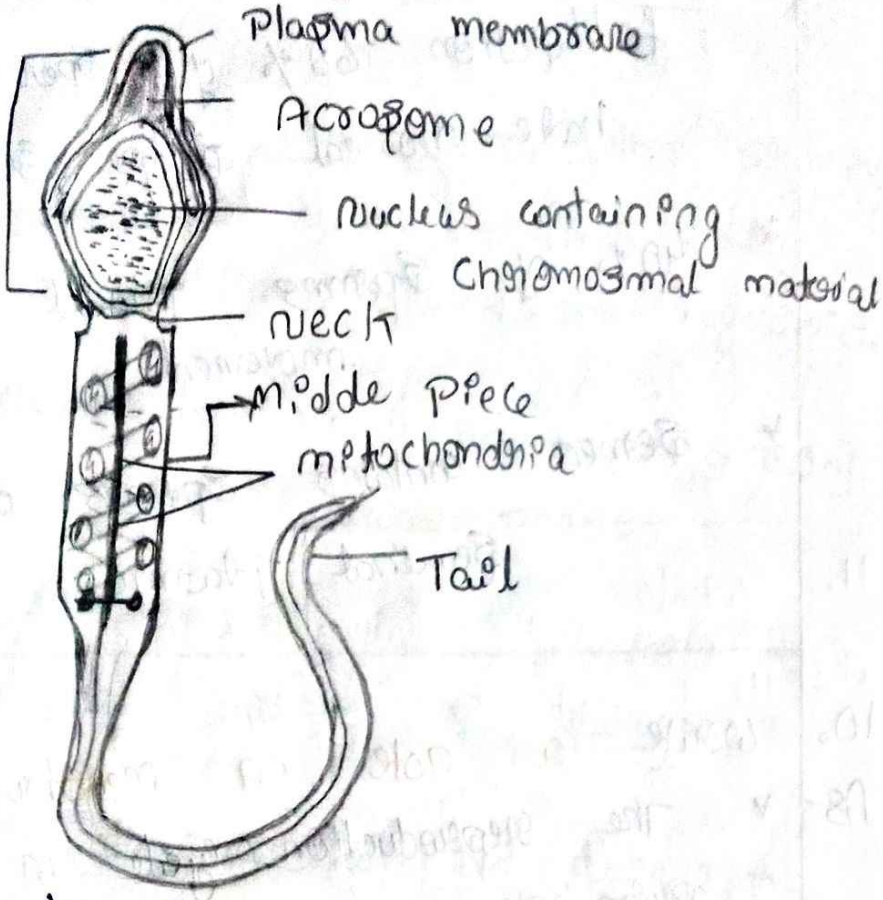
* Tertiary follicle further changes into mature <u>Graffian follicle</u>.

* In this secondary oocyte forms a new membrane called <u>zona pellucida</u>.

* Then the Graffian follicle ruptures to release ovum from the ovary. in the process called <u>ovulation</u>.

9. Describe the structure of human sperm with a diagram (3).

Ans:-



* Sperm is composed of a head, a neck, a middle piece and tail. Sperm is covered by the plasma membrane.

* The head contains haploid nucleus, the anterior portion of which is a cap like structure called acrosome helps in fertilization. Acrosome contains enzymes.

* The middle piece has number of mitochondria, which give energy for the movement of sperms.

* Tails also helps in the motility of sperms.

* At a time man ejaculates 200-300 million sperms. But for normal fertilization 60% of sperms should have normal shape & size.

* 40% of sperms should show great movement.

* Semen contains sperms along with seminal plasma.

---

10. Write a note on menstrual cycle [5].

Ans- * The reproduction cycle in female primates is called menstrual cycle.

* The first menstruation cycle begins at puberty and is called 'menarche'.

* Menstruation is repeated at an interval of 28/29 days.

* The ovum is release egg in 14th day of menstruation cycle. This cycle starts with menstrual flow. which lasts for 3-5 days.

* This is due to breakdown of endometrium of the uterus & blood vessel which forms liquid & come out through vagina.

* This occurs only when ovum is not fertilised. This is menstrual phase.

* Next is follicular phase. In this primary follicles grows to become Graffian follicle at the same time endometrium regenerates.

* The secretion of gonadotropins [LH & FSH] increases during follicular phase.

* These hormones stimulates follicular development and secretion of estrogens.

* LH & FSH attain a peak level during the mid-cycle. LH induces rupture of Graffian follicle to release ovum. This is called ovulatory phase.

* Next phase is 'lectal phase' In this remaining parts of the Graffian follicle into corpus luteum.

* The corpus luteum secretes progesterone essential for maintence of endometrium, which provides the implantation of fertilised ovum, & other events of pregnancy.

* During pregnancy, menstrual cycle stops when ovum is fertilized. the corpus luteum degenerates which leads to new menstrual cycle.

* Menstrual cycle ceases around 50 years of age. This is called menopause.

11. What are the functions of Placenta? (3)

Ans- (1) The placenta supplies O_2 & nutrients to the embryo.

(2) It removes CO_2 and excretory wastes from the embryo through umbilical cord.

(3) The placenta also produces hormones like
- Human Chorionic gonadotropin (hCG),
- Human Placental lactogen (hPL).
- estrogen
- Progesterone.

(4) Ovary produces relaxin in the later phase of pregnancy.

12 How sex of the baby is decided? (3)

Ans- Sex of the baby can be decided at zygote stage. Ovum has 'x' chromosome, while 50% of sperms have 'x' chromosome and 50% of sperms have 'y' chromosome.

If sperm with 'x' chromosome fuses with ovum, then the baby will be female.

If sperm with 'y' chromosome fuses with ovum, then the baby will be male.

13. Describe the brief about pregnancy and embryonic development in human (3).

Ans * After implantation finger like structures called <u>chorionic villi</u> appear on trophoblast.

* The chorionic villi & uterine tissue jointly form a structural & functional unit between embryo & maternal body called <u>Placenta</u>.

* The placenta supplies O_2 & nutrients to the embryo, & it removes CO_2 & excretory wastes from the embryo through <u>umbilical cord</u>.

* The placenta also produces hormones like human chorionic gonadotropin [hCG], human placental lactogen [hPL] estrogens, progesterone.

* All these hormones support the foetal growth. & ovary produces relaxin in later phase of pregnancy.

* Simultaneously the inner mass cells differentiate into ectoderm, endoderm & mesoderm, which have certain cells called stem cells.

* These stem cells have the potency to give rise to all the tissues & organs.

* The human pregnancy lasts for 9 months and above Heart is developed in 1st month, fingers & digits in 2nd month.

* Limbs & external genitalia in 3rd month, movent of foetus & hairs on head during 5th month, body is covered with hairs, eylids are separated, eyelashes are formed in 6th month. by the end of 9 months,

* Foetus is fully developed & ready for delivery.

Seen 12/7/23 Seen 12/7/23

Chapter - 4

REPRODUCTIVE HEALTH

1. Define the following

(a) Reproductive health :- reproductive health means a total well being in physical, emotional, behavioural and social aspects of reproduction.

(b) Ammiocentesis :- Determination of sex. based on chromosomes in amniotic fluid, which surrounds the embryo.

(c) Withdrawl (or) Coitus interuptus :- it is another method, in which the (P) male partern withdraws his penis from the vagina just before ejaculation.

(d) Lactational amenorrhea :- Lactitional amenorrhea is a method, where during lactation period after parturition, ovulation does not occur. During this period chances of conception are nill.

(e) vasectomy :- is done in male, in which, a small part of the vas deferens is removed or tied up through a small incision on the scrotum.

(f) Tubectomy :- is done in female. In which a small part of fallopian tube is removed or tied up through a small incision in abdomen or through vagina.

(g) ART :- The couples could be assisted to have children through certain special techniques known as Assisted Reproductive technologies.

2. Expand the followings :

(a) WHO :- world health organisation.

(b) RCH :- Reproductive and child health care.

(c) AIDs :- Acquired Immuno Defeciency Syndome.

(d) CDRI :- Central Drug Research Institute.

(e) MMR :- Maternal mortality rate.

(f) IMR :- Infant mortality rate.

(g) IUDs :- Intra uterine Device.

(h) MTP :- Medical Termination of Pregnancy.

(i) VD :- Venereal diseases

(j) PID :- Pelvic Inflammatory diseases.

(k) STD :- Sexually Transmitted Diseases.

(l) HIV :- Human Immuno virus.

(m) ART : Assisted Reproductive technologies.

(n) IVF & ET :- In vitro Fertilization and Embryo Transfer.

(o) ZIFT :- Zygote Intra Fallopian transfer.

(p) GIFT :- Gamete Intra Fallopian transfer.

(q) IUI : Intra uterine insemination.

(r) ICSI :- Intra cytoplasmic sperm injection.

(s) AI : Artificial insemination.

(t) IUT : Intra uterine Transfer.

(u) RTI :- Reproductive tract infection.

3. Name the oral contraceptive pill is taken once in a week [1]

→ Saheli

4. Explain the contraceptive method (5)

Ans ① Natural / Traditional methods :- It includes Periodic abstinence in which couples avoid copulation from day 10 to 17 of the menstrual cycle. Because this is fertile Period. By this conception can be prevented. Withdrawal or coitus interruptus is another method. In which the ♂ partner withdraws his penis from the vagina just before ejaculation. Lactational amenorrhea is method where during lactation after parturition, ovulation does not occur. During this Period chances of conception are nil.

---

② Barrier methods :- In this meeting of sperms & ovum are prevented by using different barriers.

The ♂ & ♀ condoms made up of thin rubber or latex sheath are used to cover penis and vagina before coitus this prevent conception and also STD & AIDS.

Nirodh is a popular male condom.

Diaphragms, Cervical caps & vaults are female condoms are made up of rubber are inserted into female reproductive tract during coitus

• They are reusable. Along with these barriers spermicidal creams, jellies & foams are also used to make contraception more effective.

---

③ IUDs :- Another effective and popular method is Intra uterine Device. (Instead by) inserted by doctors or expert, nurses in uterus. IUDs are available in different forms.

ⓐ non-medicated IUDs - ex- Lippes loop.
ⓑ copper-releasing IUDs - ex: CuT, Cu7, multiload-375,
ⓒ Hormone-releasing IUDs :- ex :- Progestasert, LNG 20.

---

④ Oral administration: using of small doses of pills of either progestogens or progestogen-estrogen combinations is another contraceptive method used by females. These pills have to be taken daily for a period of 21 days, starting from menstruation after a gap of 7 days. They inhabit ovulation & implantation.

Saheli :- The new oral contraceptive, which contains a non-steroidal preparations and has to be taken once in a week.

P.T.O

(5) Injections or Implants :- progestogens and estrogens can also be used in the form of injection & implants under the skins. Their action is similar to that of Pills. Administration of these injections or implants and IUDs (within 72 hours of) are very effective in emergency contraception as in rape within 72 hours of coitus or unprotected intercourses.

---

(6) Sterilisation :- This is done through surgical methods, which prevent the transport of gametes there by prevent conception.

Vasectomy :- is done in male, in which, a small part of the vas deferens is removed or tied up through a small incision on the scrotum.

Tubectomy :- is done in female, in which, a small part of fallopian tube is removed or tied up through a small incision in the abdomen or through vagina

5. What is MTP? Why is MTP done, What is the safe period for MTP. (3)

As→ The Intentional or voluntary termination of pregnancy before full term is called MTP.

• MTP done:- ① To remove unwanted pregancies due to unprotected intercourse or failure of contraception or rapes.

② MTPs are also done, where pregnancies become harmful to both mother & foetus.

• MTP's are safe upto 12 weeks of Pregnancy.

---

6. Define STD. Mention the symptoms of STD. How can STDs be controle (5)

As→ Diseases which are transmitted through sexual intercourse are called sexually transmitted diseases. or venerial diseases or Reproductive tract infections (RTI).

Symptoms:- Itching, fluid discharge, slight Pain, swelling in genital regions these are symptoms of STDs.

P.T.O

Controlling measures of STDs.

(i) Avoid sex with unknown partner / multiple partners.

(ii) Always use condoms during coitus.

(iii) In case of doubt one should go to a qualified doctor.

---

7. What is Infertility? Give reason for Infertility. (3)

Ans → Infertility it means couples are unables to produces children inspite of unprotected sexual co-habitations.

Reasons (i) Physical. congenital, diseases, drugs. Immunological or Psychological.

---

8. Which are ART Explain them in brief (5).

Ans → (1) Invitro fertilisation & Embryo transfer (IVF & ET):- is popularly known as Test tube baby Programme, in which ova & sperms are collected from wife & husband / donar and induced to form

zygote in the laboratory. The zygote with 8 blastomers are transferred into the follopian tube [Zygote Intra Follopian transfer] [ZIFT] and Embryo with more than 8 blastomores transferred into uterus IUT - [Intra uterine Transfer] to complete its development of Embryos formed by IVF are also transferred.

Gamete Intra follopian transfer [GIFT] :-
In this ovum collected from donor and transferred into the follopian tube of another female who can not produce ovum, but provide suitable environment for fertilisation and development.

Intra Cytoplasmic Sperm injection (ICSI) :-
This is a procedure to form an embryo in the laboratory in which a sperm is directly injected into the ovum.

Artificial insemination (AI) :- In this technique, semen is artificially collected from the husband or a donor and introduced into the vagina or uterus. [IUI - Intra uterine insemination]

Though options are many, emotional, religious and social factors do not permit to adopt these methods. One of the best methods for couples looking for parenthood is to adopt orphaned children legally.

9. Give Examples for male & Fe-male condoms (2)

Ans ① Nirodh is a popular male condom.

② Diaphragms, cervical caps & vaults are the female condoms.

10. Give examples for STD (3)

Ans:- Gonorrhoea, Syphilis, genital herpes, Chlamydiasis, genital warts, trichomoniasis, hepatitis B, and AIDS.

11. Mention the types of IUDs with example (3)

Ans ⓐ Non-medicated IUDs :- ex- Lippes loop.

ⓑ Copper-releasing IUDs :- ex- CuT, Cu7, multiload-375.

ⓒ Hormone-releasing IUDs :- ex- Progesta sert, Lnev-20.

Seen 21/02/22 Seen 21/7/23

Chapter - 5.

Principles of inheritance & variation :-

1. Define the following

a) Genetics :- It is a branch of biology. deals with inheritance and variation of characters from parents to offspring.

b) Inheritance :- It is a process by which characters are passed from parent to offspring.

c) Variation : it the degree, by which progeny differ from parents.

d) Alleles : Alleles :- alleles are the different forms of the same gene.

e) Homozygous :- Because, TT & tt contains same types of alleles, they are called Homozygous.

f) Heterozygous :- Tt contains different types of alleles, they are called Heterozygous

g) Phenotype : what we observe the plant from outside. that is tall & dwarf called phenotype

h) Genotype : the type of genes / alleles that plant contains is it genotype.

(i) Dominant :- The trait which is expressed in F_1 generation is called Dominant factor.

(j) Recessive : The trait which is not expressed in F_1 generation is called recessive character.

(k) Monohybrid cross :- The cross between two homozygous parents having one contrasting trait is called 'monohybrid cross.

(l) Test cross :- Mendel crossed F_2 tall with dwarf plants. This is called test cross.

(m) Dihybrid cross : Mendel also crossed the pea plants that differed in two characters. This is called Dihybrid cross.

(n) Linkage : The physical association of genes is called linkage.

(o) Recombination : Synthesis of non-parental type is called recombination.

(p) Mutation :- If DNA sequence is altered, that leads to mutations.

(q) Point Mutation : If mutation arise due to change in a single base pair of DNA that is known as point mutation.

(q) Frame shift mutation :- Deletions & Insertions of base pairs of DNA causes frame shift mutation.

(r) Mutagens : many physical & chemical factors [For eg. UV radiation] may induce mutations, These factors are called mutagens.

(t) Pedigree analysis :- In humans study of family history for several generations provide about inheritance. this is called Pedigree analysis.

(u) Aneuploidy : The gain or loss of chromosome is called Aneuploidy.

(v) Polyploidy : During cell division if the cytokinesis is failed after telophase, then the whole set chromosomes are increased. This is called 'polyploidy'.

(w) Trisomy : when one extra copy of chromosome is included in an individual that is called trisomy.

(x) Monosomy : when an individual lack one chromosomes. that is called monosomy.

2) Explain Mendel's monohybrid cross experiment (or) inheritance of one gene (5)

Ab- Mendel crossed tall & dwarf pea plants to study the inheritance of one gene [factor]. He collected the seeds produced from this cross & grew them. The new plant generation is called F1 hybrid, generation or progeny or F_1 generation. Mendel observed that all plants in F_1 generation were tall. Then he self-pollinated the tall F_1 plants. In F_2 generation he observed 3 tall : 1 dwarf plants. The tall and dwarf trait were indentical to their parents and did not show any intermediate character or blending.

Based on these observations, Mendel conclude that some thing is responsible for transfer of traits from parents to offspring through gamets. He called this as factors, now we call them as 'genes'. So genes are the units of inheritance. Genes which code for a pair of contrasting traits are called alleles. That means alleles are different forms of same gene.

We use alphabetical symbols for each alleles/gene. Capital letter is used for traits expressed in F_1 generation and small letter is used for other traits. For example 'T' is used for Tall and 't' used for dwarf.

so that the alleles would be 'TT', Tt and tt
Because TT & tt contain same type of alleles, they are called homozygous. Tt contains different types of alleles, it is called heterozygous.

What we observe the plant from outside, that is tall & dwarf is called 'phenotype'.
The type of genes/alleles that plant contains is its genotype. ex- TT, Tt, tt.

* The trait, which is expressed in F_1 generation is called 'dominant factor' ex- 'T'
* The trait, which is not expressed in F_1 generation is called recessive factors ex- 't'.
* The cross b/w two Homozygous parents having one contrasting traits is called monohybrid cross ie TT x tt

When the tall & dwarf plant produce gametes, the alleles separate or segregate from each other and only one allele enters to gamete. During fertilization 'T' from one parent [Pollen] and 't' from other parent (egg) are united to form zygote and later produce F_1 generation having 'Tt', which is heterozygous. This can be understood by drawing checker board or Punnet square developed by Reginold. C. Punnet.

Example

(i) Parents (P_1) Tall x dwarf

Phenotype →

(ii) Genotype TT tt

(iii) Gametes (T) (t)

(iv) F_1 generation Tt - Tall [Heterozygous]

Parents (P_2)

Phenotype Heterozygous Tall x Heterozygous Tall

genotype → Tt Tt

gametes (T) (t) (T) (t)

F_2 generation

3 tall : 1 dwarf

	T	t
T	TT	Tt
t	Tt	tt

1 homozygous tall (TT)

2 Heterozygous tall (Tt)

1 homozygous dwarf (tt).

Phenotypic ratio :- 3 : 1

genotypic ratio :- 1 : 2 : 1

3) Explain mendel's Test cross (3).

As- In order to determine the genotype of a tall plant at F_2 generation i.e whether the tall plants have either the genotype TT or Tt, mendel crossed F_2 tall with dwarff plants. This is called Test cross.

Flow Chart:

Tall — Dwarf

tt × TT

	t	t
T	Tt	Tt
T	Tt	Tt

All are tall

Tall — Dwarf

Tt × tt

	t	t
T	Tt	Tt
t	tt	tt

1:1 ratio

Tall : dwarf.

---

4) Explain mendel's Dihybrid cross expt / inheritance of two genes (5)

As- mendel also crossed the pea plants that differed in two character. This is called dihybrid cross.

He crossed round shape yellow colour seed with wrinkle shaped green colour seeds. All the plants in F_1 were Round yellow. In F_2 he got round yellow, round green, wrinkled yellow & wrinkled green in ratio 9:3:3:1 (Phenotypic)

The genotype of round yellow is RRYY which is dominant. The genotype of wrinkled green is rryy which is recessive.

Flow chart:

Parents (P_1) Round yellow × wrinkled green

genotype – RRYY rryy

Gametes – (RY) (ry)

F_1 generation –

RrYy – Round yellow.

Self-pollination

Parents (P_2). Hetero Round yellow × Hetero Round yellow

genotype – RrYy RrYy

Gametes (RY) (rY) (Ry) (ry) (RY) (rY) (Ry) (ry)

	RY	rY	Ry	ry
RY	RRYY	RrYY	RRYy	RrYy
rY	RrYY	rrYY	RrYy	rrYy
Ry	RRYy	RrYy	RRyy	Rryy
ry	RrYy	rrYy	Rryy	rryy

9 – Round yellow

3 – Round green

3 – wrinkled yellow

1 – wrinkled green.

9 : 3 : 3 : 1

5) Explain the incomplete dominance (5)

A:- Some plants show deviation from mendellian principles. For example in dog flower plant [Snapdragon or Antirrhinum species], when a cross is made b/w true breed red flower (RR) with true breed white flower (rr) all flowers in F_1 were pink (Rr) and in F_2 1 red (RR), 2 pink (Rr) and 1 white (rr) in the ratio of 1:2:1 both phenotypic & genotypic. This because of incomplete dominance of gene R

Parents (P_1) → Red flower × white flower

genotype → RR rr

gametes → (R) (r)

F_1 → Rr - all pink

Parents (P_2) Pink flower × Pink flower

genotype → Rr Rr

gametes → (R) (r) (R) (r)

F_2 →

1 RR → red

2 Rr → Pink

1 rr → white

	R	r
R	RR	Rr
r	Rr	rr

Phenotypic ratio = 1:2:1

genotypic

6) With an example write a note on co-dominance / multiple allelism (3)

Ans- In co-dominance F_1 generation resembles both parents. A good ex for this is ABO blood groupings in human beings. The plasma membrane of RBC contains A & B type sugars, production of which is controlled by 'I' gene. I gene has 3 alleles → I^A, I^B & i

I^A gene produces A type sugar
I^B gene produces B type sugar
i gene don't produces any sugar.

Based on this different blood groups. Parents & offspring genotypes are follows:

Allel from Parent 1	Allel from Parent 2	Genotypes of offspring	Blood type of offspring
I^A	I^A	$I^A I^A$	A
I^A	I^B	$I^A I^B$	AB
I^A	i	$I^A i$	A
I^B	I^B	$I^B I^B$	B
I^B	I^A	$I^A I^B$	AB
I^B	i	$I^B i$	B
i	i	ii	O

ABO blood groupings in man can also be given for example of multiple allelism.

7) Who proposed chromosomal theory of inheritance? (1)

Ans Sutton

8) State the Laws of Dominance (1)

(i) Characters / traits are controlled by factors.

(ii) Factors occur in pairs

(iii) In dissimilar pair factors one factor is dominant and the other one is recessive.

9) State the Law of Segregation. (1)

→ This Law states that alleles donot blend / mix.

10) State the Law of Independent assortment (2)

Ans This law states that when a pair of traits combined in a hybrid, segregation of one pair of characters is independent of the other character.

11) Why Morgan selected drosophila for his experiment (3)

Ans (i) In these flies ♂ male & female ♀ can be easilly differentiate.

(ii) They produce large no of progeny.

(iii) They complete their life-cycle within the 2 weeks.

12) Differentiate b/w male Heterogamety & female Heterogamety (3)

Ans (1) In mammals including human and insects, males have X-Y- sex chromosomes and females have XX-sex chromosomes. This type of sex-determination is called male Heterogamety.

(2) In some organisms ex- birds, male is having pair of same sex-chromosome (ZZ) and female has different type sex chromosome (ZW) this is called Female Heterogamety.

---

13. Write a note on sex determination in human (3)

Ans- In human out of 23 pairs of chromosome 22 pairs present both in male & female, so these are called autosomes, & one pair of XX chromosome present in female and one pair of XY chromosome present in male. During spermatogenesis 50% of sperms contain X chromosome. 50% of sperms contains Y chromosome, but egg contains only 'X' chromo

If sperms contains X chromo fuses with egg, the zygote develops into female, if sperm contains Y chromosomes fuses with egg, then zygote develops into male. That is why sperm decides the sex

14) Give examples for mendelian disorders (3)

AS - • Haemophilia.
• Cystic fibrosis.
• Sickle-cell anaemia.
• Colour blindness.
• Phenylketonuria.
• Thalassemia.

15) Give examples for Chromosomal disorder (3)

AS ① Down's syndromes.
② Klinefelter's syndromes.
③ Turner's syndromes.

16) Write a note on haemophilia, sickle cell anaemia and Phenylketonuria.

AS ① Haemophilia :

This is a sex-linked recessive disease, which transmits from unaffected carrier ♀ to some of the ♂ progeny. In this disease a protein, responsible for clotting of blood is affected, this result in continuous bleeding. The possibility of ♀ becoming a haemophilic is rare. Queen Victoria was a carrier of this disease and she transferred this disease to her many offspring.

P.T.O

(2) Sickle cell anaemia :-

It is an autosome linked recessive trait which is transmitted to the offspring, when both parents are carriers. This disease is controlled by a pair of alleles Hb^A & Hb^S. Homozygous individuals having Hb^S Hb^S show the disease, but heterozygous individuals Hb^A Hb^S are only the carriers. In the sickle cell anaemic person, at the 6th position of beta globin chain of molecule, instead of glutamic acid, valine is present. This leads in the change in shape of RBC from biconcave disc to sickle like.

(3) Phenylketonuria :- This is also inherited as the autosomal recessive trait. The affected individual lack an enzyme, that converts amino acid phenylalanine into tyrosine. As a result phenylalanine accumulated in the brain result in mental retardation, and also it is excreted through the urine.

17) Write a note on Down's Syndrome, Klinefelter's Syndrome, Turner's Syndrome (3)

Ans ① Down's Syndrome:

This is due to an additional copy of chromosome no 21 ~~trim~~ 21 (trisomy of 21). this was first described by Down. The affected individual has short stature, round head, furrowed tongue, Partially open mouth, palm is broad. & Physical, Psychomotor & mental development is retarded.

② Klinefelter's Syndrome:- Klinefelter's Syndrome

This is due to a additional copy of the X- chromosome resulting a Karyotype of 47(XXY) This individual has overall masculine (♂) character. but also shows feminine (♀) character, i.e development of breast - Gynaecomastia. This ~~indical~~ individual is sterile.

③ Turner's Syndrome:

In this absence of one X- chromosome i.e 45(XO), such females are sterile and lack secondary sexual characters, ovaries are rudimentary.

18. By taking T & t how can we write the genotypic ratio in mathematical form (1).

Ans By taking T & t, it can be written as

$$\left(\frac{1}{2}T + \frac{1}{2}t\right)^2 = \left(\frac{1}{2}T + \frac{1}{2}t\right) \times \left(\frac{1}{2}T + \frac{1}{2}t\right)$$

$$= \frac{1}{4}TT + \frac{1}{2}Tt + \frac{1}{4}tt$$

Seen
14/08/23

14/8/23

Chapter - 6

Molecular Basis of Inheritance

① What are the salient features of the double helix model of DNA (5)

Ans → ① It is made up of two strands.

② Two chains have anti-parallel polarity. That is one chain has 5' → 3' and other chain has 3' → 5'.

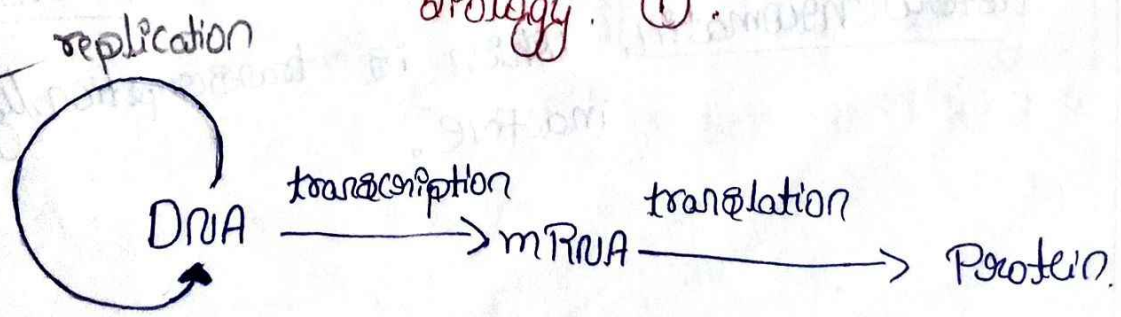
③ Adenine pairs with Thymine with double H-bond [A = T]. Guanine pairs with Cytosine with 3-H-bond [G ≡ C].

④ Two chains are coiled in right-handed fashion. Length of one turn is 3.4 nm [1 nm is 1 billion of metre - 10^{-9}] each turn has 10 bps. and distance b/w two bp is 0.34 nm.

⑤ The arrangements of n bases and H-bond gives stability to DNA.

---

② Write the central dogma of molecular biology. (1)



③ Write a note on nucleosome (3)

AS- * In eukaryotes, a positively charged histones which are the proteins rich in lysine & arginine aminoacids. Histone are organised to form 8 molecule called histone octamer.

* The negatively charged DNA is wrapped around histone to form nucleosome.

* Each nucleosome contains 200 bp.

* Number of nucleosome are united to form chromatin which are thread like coloured bodies. Nucleosomes in chromatin are seen as beads on string.

* This chromatin is further coiled to form chromosome, which is seen in metaphase stage

* Chromatin requires non-histone chromosomal proteins (NHC) for their condensing.

* Loosely packed chromatin is called Euchromatin where transcription is more.

* Densly packed chromatin is called Hetero chro - Heterochromatin, which is transcriptionally inactive.

(4) How Griffith conducted experiment to search for genetic material (3).

Ans- F. Griffith in 1928 took Streptococcus pneumoniae for his experiments. There are two strains in this bacteria. One is smooth strain (S-strain) has mucous coat and cause pneumonia in mice. The other one Rough strain (R- strain) has no coat and donot cause pneumonainnia

His experiment was like this

S- strain → inject into mice → Mice die
R- strain → inject into mice → Mice live
Heat killed
S- strain → inject into mice → Mice live

Heat killed S-strain
+
live R- strain → inject into mice → Mice die

By this he concluded that, some material is transformed from heat killed S-strain to R-strain and R-strain became, S-strain. This phenomenon is called Transforming principle.

5) List out the properties of genetic material
(or)
DNA v/s RNA (5)

As- * DNA is genetic material in majority of organisms. RNA is genetic material in TMV, QB bacteriophage etc.

* A molecule as a genetic material should fulfil the following.
(i) It is able to replicate.
(ii) It should be chemically & structurally stable.
(iii) It should show mutation.
(iv) It should express itself.

* Both DNA & RNA have the ability of duplication.

* DNA is less reactive, but more stable, compared to RNA. that is why DNA is better genetic material.

* Presence of Thymine is also gives stability to DNA, uracil is present in RNA.

* Both DNA & RNA are able to mutate, in RNA because of it unstable, mutation is faster than DNA.

* RNA can directly code for proteins, hence characters are easily expressed, but DNA is dependent on RNA for synthesis of proteins.

* For storage of genetic information DNA is better & for transmission of genetic material RNA is better.

⑥ Why replication of DNA is called as semi-conservative reproduction (2)

As→ After replication, each DNA molecule, would have one parental and one newly synthesised strand. This is called semiconservative DNA replication.

---

⑦ Differentiate between Template strands & Coding strands (2)

As ① Template strands:- The DNA strand in 3' → 5' direction, on which RNA is synthesised is called template strands.

② Coding strands:- Other strand is coding strands.

---

⑧ Differentiate between monocistronic & Polycistronic (2)

As- ① Monocistronic:- If one cistron is present as in eukaryotes in a gene is called monocistronic.

② Polycistronic:- Gene contains many cistrons as in prokaryotes is called Polycistronic.

---

⑨ Mention the types of RNA Polymerase & there products in Eukaryotes (3).

As- ① In Eukaryotes, RNA polymerase I synthesis rRNA.

② RNA polymerase II synthesise precursor of mRNA, heterogeneous nuclear RNA (hnRNA).

③ RNA Polymerase III synthesise tRNA, 5 sr RNA and snRNA [small nuclear RNA].

(10) Define :-

(1) Splicing :- In splicing, introns are removed & exons are joined in definite order.

(2) Capping :- In capping methylguanosine triphosphate is added to 5' end of hnRNA.

(3) Tailing :- In tailing adenylate is added to 3' end.

---

(11) What are the salient features of genetic code (5).

Ans * Codon is tripled, 61 codons code for amino acids 3 codons donot code for any amino acid, hence they are called 'stop codons'.

* One codon codes one amino acid. This is called unambiguous (or) specific.

* One amino acid is coded by more than one codon this is called- code is degenerate.

* Code is universal.

* AUG codes for methionine and also acts as 'initiator codon'.

(10) Describe Lac operon switch off & switch on concept (5).

Jacob & Monod described the Lac operon in bacteria. Here structural genes are regulated by promoter & regulatory genes.

Lac means lactose, which is an inducer and operon is the bacteria.

The Lac operon consist one regulator gene (i) and 3 structural genes [z, y, a] 'z' code for β-galactosidase, 'y' codes permease, and 'a' codes transacetylase. Permease increases permeability of the cell to β-galactosidase. All these help in metabolism of lactose.

Lactose regulates switching off & switching on of operon when lactose (inducer) is absent, then repressor protein from i gene binds to the operator region, which prevent RNA polymerase to transcribe the operon. This is Lac operon switch off concept.

When lactose or inducer is present, the repressor is inactivated by inducer, then RNA polymerase continue the transcription. This is called Lac operon switch on concept.

(13) What are the goals of HGP? (5)

Ans (i) Identify 20,000 - 25,000 genes in humans DNA

(ii) Determine the sequences of 3 billion bps.

(iii) Store this information in databases.

(iv) Improve tools for data analysis.

(v) Transfer this technology to other sectors.

(vi) Solve ethical, legal, social issues arise from this project.

---

(14) List out the salient features of HGP (5).

Ans (1) Human genome contains 3.1647 billion bps.

(2) The average gene consists 3000 bases. The largest gene dystrophin contains 2.4 million bps.

(3) Total number of genes estimated are 30,000

99.9% bps are same in all people.

(4) 50% genes function are not known.

(5) Less than 2% genome codes for proteins.

(6) Sequences of DNA are repeated many times.

(7) Chromosome 1 has 2968 genes and Y has 231 genes.

(8) Scientists identified 1.4 million locations, where single base DNA differences occur in humans

(15) Write the important steps of DNA finger printing (5).

Ans (i) Isolation of DNA.

(ii) Digestion of DNA by restriction endonucleases.

(iii) Separation of DNA fragments by electrophoresis.

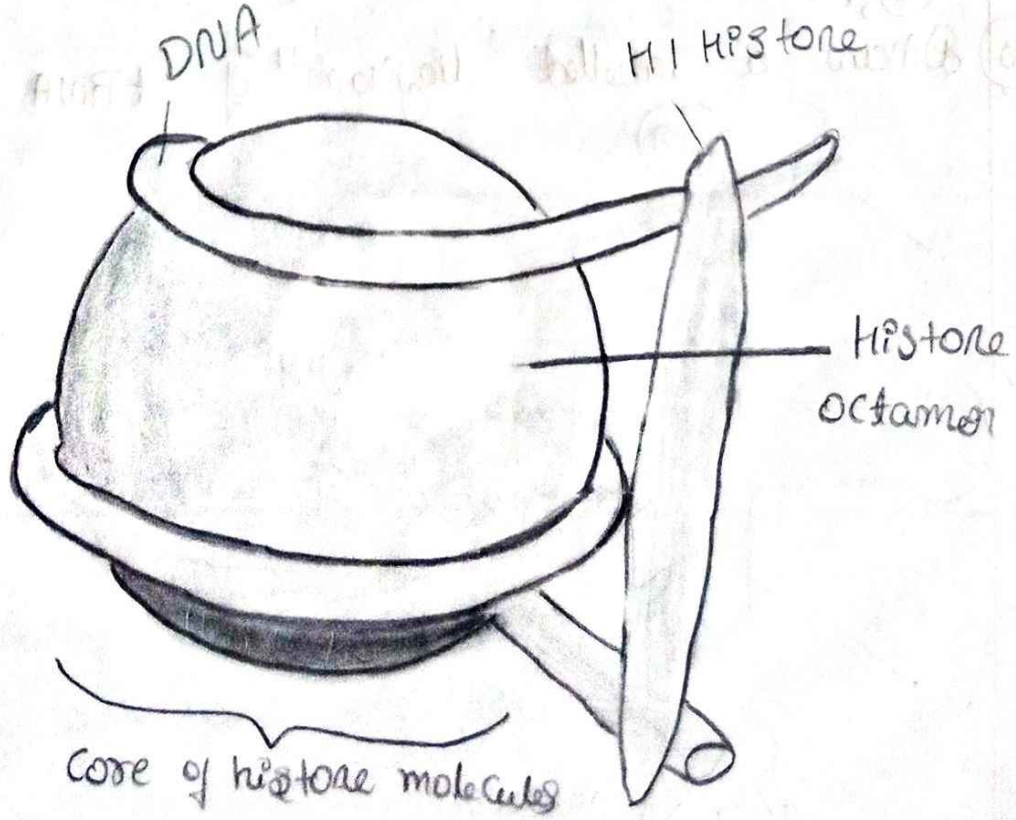
(iv) Transferring of separated DNA fragments to synthetic membranes, such as nitrocellulose (or) nylon.

(v) Hybridisation is done by using labelled VNTR probes.

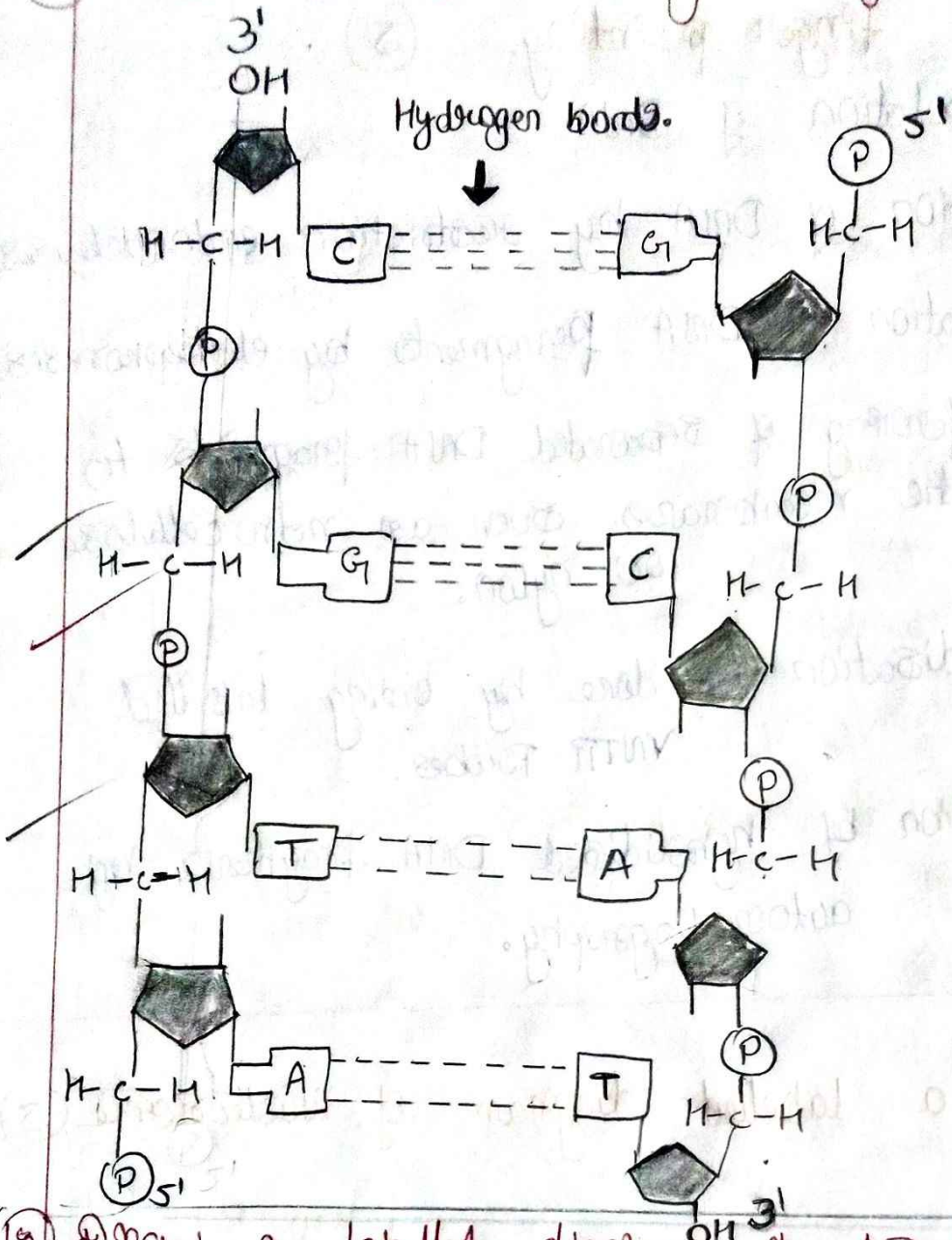
(vi) Detection of hybridised DNA fragments by autoradiography.

---

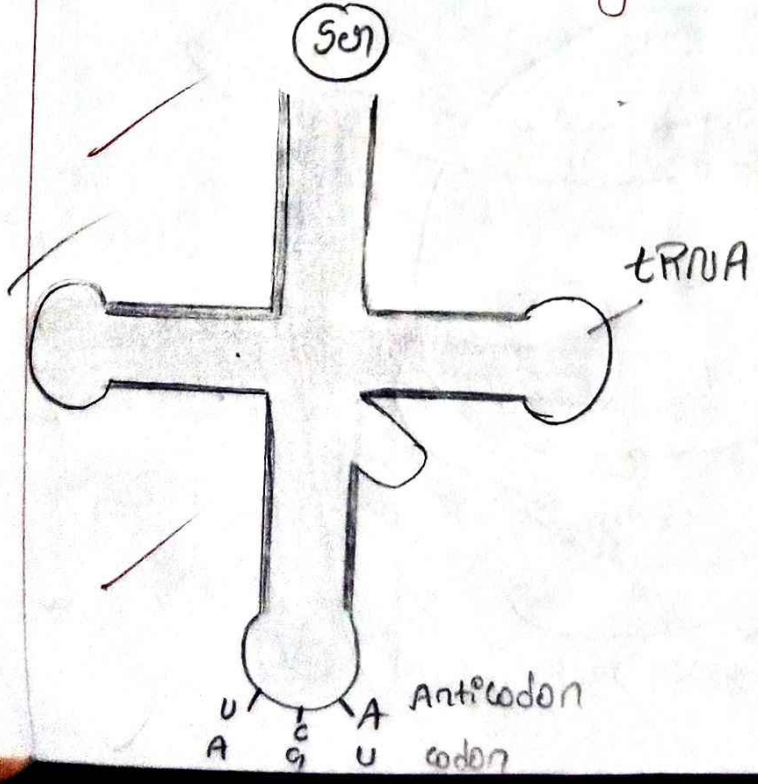
(16) Draw a labelled diagram of Nucleosome (3)



(17) Draw a labelled diagram of DNA (5).



(18) Draw a labelled diagram of tRNA (2/3).



(19) How many base pairs present in Bacteriophage, E-coli & Human. (3)

As Bacteriophage — 48502 base pairs.

E-coli — 4.6×10^6 base pairs,

Human — 3.3×10^9 base pairs.

---

(20) Give Example for Purines & Pyrimidines (2)

As * Adenine and Guanine are purines.

* Cytosine, uracil & Thymine are pyrimidines"

---

(21) Write the Nucleoside form of AGTCU (1)

As

N. base	Nucleoside
(1) Adenine →	Adenosine / deoxy adenosine
(2) Guanine →	Guanosine / deoxy guanosine
(3) Cytosine →	Cytidine / deoxy cytidine
(4) Thymine →	Thymidine / deoxy thymidine
(5) uracil →	uridine / deoxy uridine.

---

(22) Name the important component of DNA (2)

As nitrogen base, pentose sugar [ribose in RNA, deoxyribose in DNA] and phosphate group.

---

(23) State Chargaff's rule (1)

As The ratios between A and T and G & C are constant & equal.

(24) Who proposed the double helix model of DNA (1).

As- Watson and Crick.

(25) Define :-

① Replication :- The two strands of DNA open and act as template for the synthesis of new strands.

② Transcription :- The copying of genetic information from DNA into RNA is called Transcription.

(or)

DNA synthesis of mRNA.

③ Translation :- It is the process of the polymerization of amino acids to form a polypeptide chain.

(or)

Synthesis of proteins.

(26) At what levels regulation of gene takes place (2)

AS (i) Transcriptional level.

(ii) Processing level.

(iii) Transport of mRNA from nucleus to cytoplasm.

(iv) Translational level.

---

(27) Differentiate between EST & SA (3)

AS Expressed Sequence Tags :-

Identifying the genes which are expressed as RNA This is called Expressed Sequence Tags (EST).

Sequence annotation :- Other type is sequencing the whole set of genome with coding & non-coding sequences and later arranging the coding sequences only this is called as Sequence annotation.

---

(28) Who proposed Central dogma of molecular biology (1).

AS - Crick.

Seen 26/9/23

Seen
26/9/23

Evolution :-

1. Define :-

1) Evolutionary Biology :- evolutionary biology is the study of history of life forms.

2) Saltation :- mutations cause speciation and it is called 'Saltation'.

3) Gene pool :- Sum total of genes and their alleles in a population.

4) Gene migration :- When a section of population migrates to another place, then the frequency of genes change in original as well as in new population. This is called gene migration.

5) Genetic drift :- When the frequency of genes change suddenly in a population, it is called genetic drift.

6) Spores / Panspermia :- Some scientists believe that life came from outside through spores.

7) Founder effect :- Sometime change in allele frequency will cause the formation of new species. The original population is founder. Hence the effect is founder effects.

(2) Which theory explains the origin of universe [1]

AS- Big Bang theory.

(3) Who proposed chemical evolution theory? [1]

AS- Oparin and Haldane.

(4) What are the 3 views of religious people (3)

AS- (i) All living organisms, that we see today were created as such.

(ii) The diversity was same since creation and will be the same in future.

(iii) The earth is about 4000 years old.

(5) Explain the evidences for evolution (5)

AS- (1) Fossils :- Fossils are hard parts of life-forms found in rocks. Study of fossils gives us

(a) different geological period in which fossils existed.

(b) The life forms varied over time.

(c) New forms have arisen at different times in the history of earth. All this is called Palintological evidence.

P.T.O

(2) Study of comparative anatomy & morphology of organism of today and those existed years ago. For example man, cheetah, whale, bat have same pattern of bones in fore limbs, but perform different functions. They have same bone like humerus, radius, ulna, carpals, metacarpals and phalanges in their fore limbs. These structures are called homologous. This type of evolution is called divergent evolution. In plants also, the thorns and tendrils of Bougainvillea and cucurbita represent homology. Homology is based on divergent evolution. Analogy is the opposite to homology based on convergent evolution. ex- wings of butterfly and birds. They have no similiar structures, but have same functions. Other examples of analogy are eyes of octopus & mammals.

(3) Similarities in proteins and genes performing a given function give clues to common ancestry.

(4) There is another example for evolution by natural selection. Before industrialisation in England (1850), there were more white winged moths on trees than dark winged. After industrialisation (1920), there were more dark-winged in the square area. This is because during post-industrialisation period, the tree trunks became dark due to smoke. Under this white winged moths did not survive from predators. That is why dark winged moths survived better.

Lichens are used as industrial pollution indicators, because they will not grow in polluted area.

(5) Excess of use of herbicides, pesticides, antibiotics, drugs resulted in the selection of resistant varieties in lesser time.

(6) Differentiate between homologous & analogous organs (3).

Ans Homologous organs :- They have same bones like humerus, radius, ulna, carpals, metacarpals and phalanges in their fore-limbs. These structures are called homologus.

Analogous it opposite to homology is based on convergent evolution. ex:- wings of butterfly & birds. & eyes of octopus & mammals.

(7) What is adaptive radiation? Give examples?

As Evolution of different species from the original species in same geographical area is called 'Adaptive radiation'.

ex:- Australian marsupials, Finches.

(8) Define convergent evolution with example (2)

As When more than one adaptive radiations are there in an isolated geographical area, it is called 'convergent evolution'.

Ex- placental mammals.

(9) What are the 2 keys of Darwinian theory

As- Branching descent and Natural Selection (2) are the two key concepts of Darwinian theory.

(10) State Hardy-Weinberg principle. Mention the factors affecting Hardy-Weinberg Principle (3)

As "The frequency of alleles (or) genes in a population are constant from generation to generation"

Factors affecting H-W-equillibrium

(1) Gene migration or gene flow. (3) Natural Selection.

(2) Genetic drift. (4) Mutation

(11) Write a note on brief account of evolution (5)

Ans 2000 million years ago. (mya) first cellular forms appeared on this earth. These cells had the ability to release O_2. This is similar to photosynthesis. Where H_2O is split with the help of solar energy. Single-celled organism became multi-cellular. By the time of 500 mya invertebrates were formed. Jawless fishes evolved around 350 mya. Sea weeds and few plants existed around 320 mya. First plants invaded the land. A fish coelacanth found in South Africa was extinct. These evolved into Coela Amphibians. Amphibians evolved into reptiles. 200 mya reptiles were dominant. Some reptiles went back to H_2O became fishes.

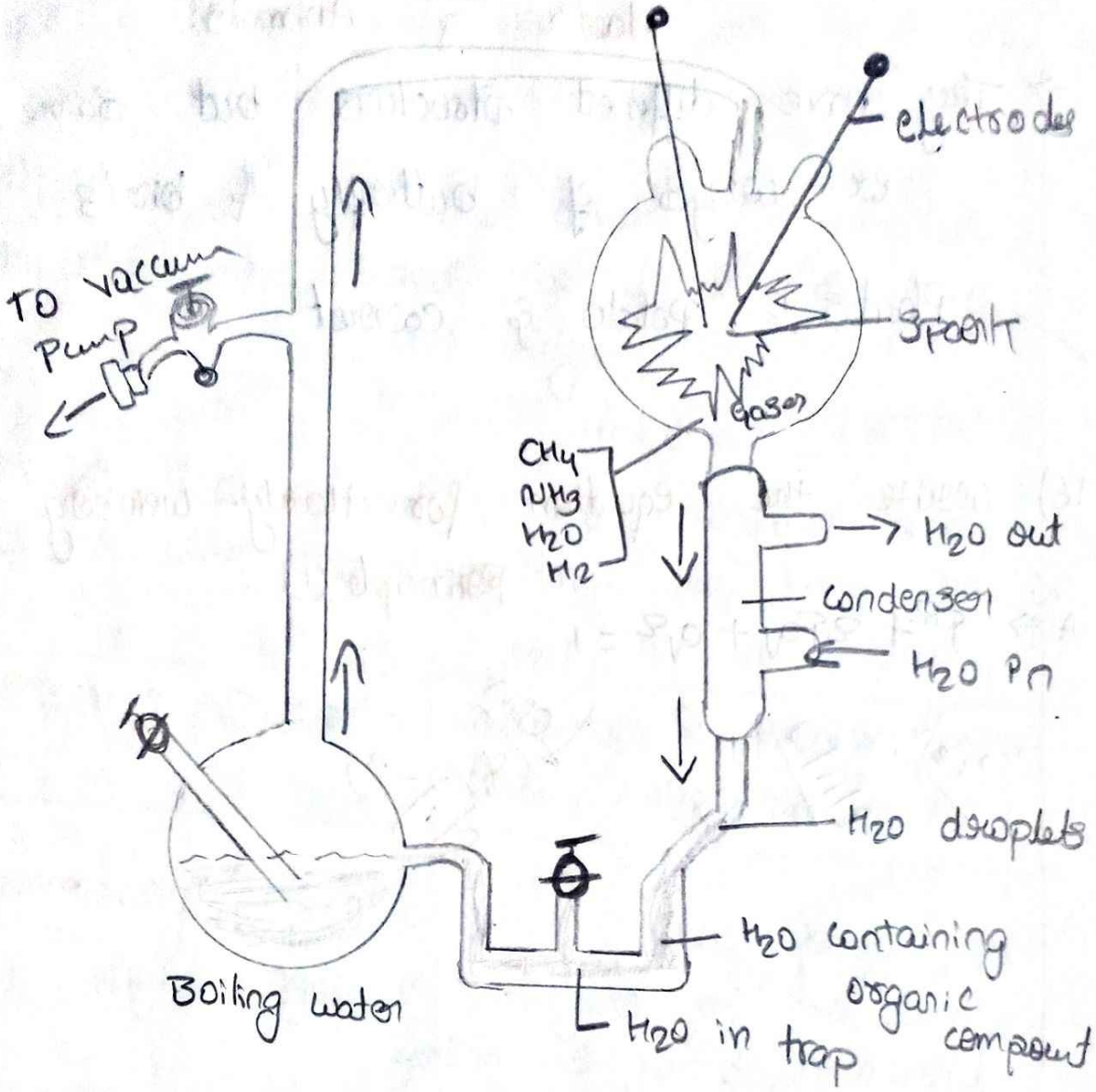
Ex:- Ichthyosaurs, Tyrannosaurus was the biggest dinosaur about 20 feet in height. 65 mya dinosaurs disappeared. This is because either, climatic change killed them (or) they evolved into birds.

The first mammals were ~~shows~~ shrews Horse like hippopotamus, bear, rabbit were present in South America. Due to continental drift, when S. America joined with N. America the animals of both continents were mixed.

(12) Write a note on origin & evolution of man (3)

Ans 15 mya primates Dryopithecus and Ramapithecus evolved. Dryopithecus was ape-like and Ramapithecus was man-like. 3-4 mya man-like primates walked in eastern Africa. 2 mya Australopithecus live in East African grasslands. They hunted with stone weapons and ate fruits. He was called Homo habilis. The brain was 650-800 cc. Homo erectus evolved 1.5 mya. His fossils were discovered in Java in 1891. He had 900 cc brain. Neanderthal man with 1400cc brain lived in Asia between 1,00,000 - 40,000 years. In ice-age b/w 75,000 - 10,000 years modern Homo-sapiens arose. Agriculture came 10,000 years.

(13) Draw a labelled diagram of Miller's experiment



(14) Give example for homologous organs in Plants & animals (2)

They have same structural but different function

Plants : Tendrills of pumpkin thorn of Lemon.

ex:- Fore limbs of Cheetah, man, bat.

15) Give example for analogous organs in plants & Animals.

→ They have different structures but same function

ex- wings of butterfly & birds

Plants :- Potato & carrot

16) Write the equation for Hardy-Weinberg Principle (1)

A → $p^2 + 2pq + q^2 = 1$

Seen 8/11/23

Seen 8/11/23

HUMAN HEALTH & DISEASE

① Define :

Health : Health is the state of complete Physical, mental and social well-being of our body.

Disease : When one or more organs are affected with symptoms then we have disease.

Pathogen : Disease causing organisms are called pathogens.

Immunity : The ability of our body to fight against pathogens by immune system is called immunity.

Innate immunity : - This is non-specific immunity, gained at the time of birth.

Acquired immunity : - It is pathogen specific and work on the basis of memory.

Allergy : The sudden response of the immune system to certain antigens is called allergy.

Allergens : - Allergy causing agents.

MALT :- There is lymphoid tissue located within the lining of respiratory, digestive, urinogenital tract called Mucosa associated lymphoid tissue [MALT] It consists of 50% of lymph tissue in man.

Contact inhibition : that means neighbour cells control the rate of cell division.

---

(2) Name the causing organisms of Typhoid, Pneumonia, common cold, Malaria, amoebiasis, ascariasis, elephantiasis (or) Filariasis, ringworm disease [1].

Ans→

1) Typhoid :- Caused by a bacteria Salmonella typhi

2) Pneumonia :- caused by Streptococcus pneumoniae and Haemophillus influenzae.

3) Common cold :- Caused by Rhinovirus

4) Malaria :- Caused by Protozoan called Plasmodium.

5) Amoebiasis :- Caused by a protozoan parasite Entamoeba histolytica.

6) Ascariasis :- Caused by intestinal parasite Ascaris.

7) Elephantiasis / Filariasis :- by Wuchereria.

8) Ringworms :- by Trichophyton & Epidermophyton.

③ Differentiate between infectious and non-infectious diseases (2).

Infectious diseases	non-infectious diseases
* which are easilly transmitted from one person to another. ex:- AIDS. influenza.	* which do not transfer from person to person. ex:- cancer.

④ Differentiate between primary response and secondary response.

Primary response	Secondary response
when our body attacks the pathogen for the first time it is called Primary response.	when the same pathogens enters our body second time. our body response suddenly due to memory. This is called secondary response.

⑤ Differentiate between Humoral immunity and cell-mediated immunity.

Humoral Immunity	cell mediated immunity
B-lymphocytes produce antibodies, which are circulated through the blood to do their function. this type of immunity is called humoral immunity.	T-lymphocytes donot produce antibodies, but they help B-lymphocytes to produces antibodies. Thus the T-lymphocytes are responsible for cell-mediated immunity.

6) Differentiate between Active immunity & Passive immunity (3)

Active Immunity	Passive Immunity
When antigens enter into our body antibodies are produced. This is called active immunity	when ready-made antibodies are given to kill pathogens in our body, it is called Passive immunity

7) Differentiate between vaccination & Immunisation (2)

Vaccination	Immunisation
In vaccination, inactivated Pathogens are introduced into body.	If a person is infect with deadly microbes or in case of snake bites. Performed antibodies are given. This is called Passive immunisation.

8) Differentiate between Begin tumour & malignant tumour (3)

Begin tumour	Malignant tumour
They remain in the same location, donot spread to other parts, cause little damages.	These tumors contains continuosly dividing cells called neoplastic cells, which move to other parts through blood, compete with normal cells for nutrients & causing the damages. This property of cancer cell is called metastasis.

(9) Write a note on life cycle of Plasmodium (3)

→ When ♀ Anopheles mosquito bites man, sporozoites of plasmodium enters the body. They multiply in the liver cells and attack the RBC, and rupture them. Then RBC's release a toxic - haemozoin, which causes high fever and chill every 3-4 days. When ♀ Anopheles mosquito bites again the infected person - sporozoites enter the mosquito stomach for further development. Later these sporozoites are stored in their salivary gland like this cycle repeats. Thus plasmodium has 2 hosts - human & mosquito.

---

(10) Mention 4 barriers of innate immunity (2).

Ans 1) Physical barriers.
2) Physiological barriers
3) Cellular barriers
4) Cytokine barriers.

---

(11) Mention the types of Antibodies (2)

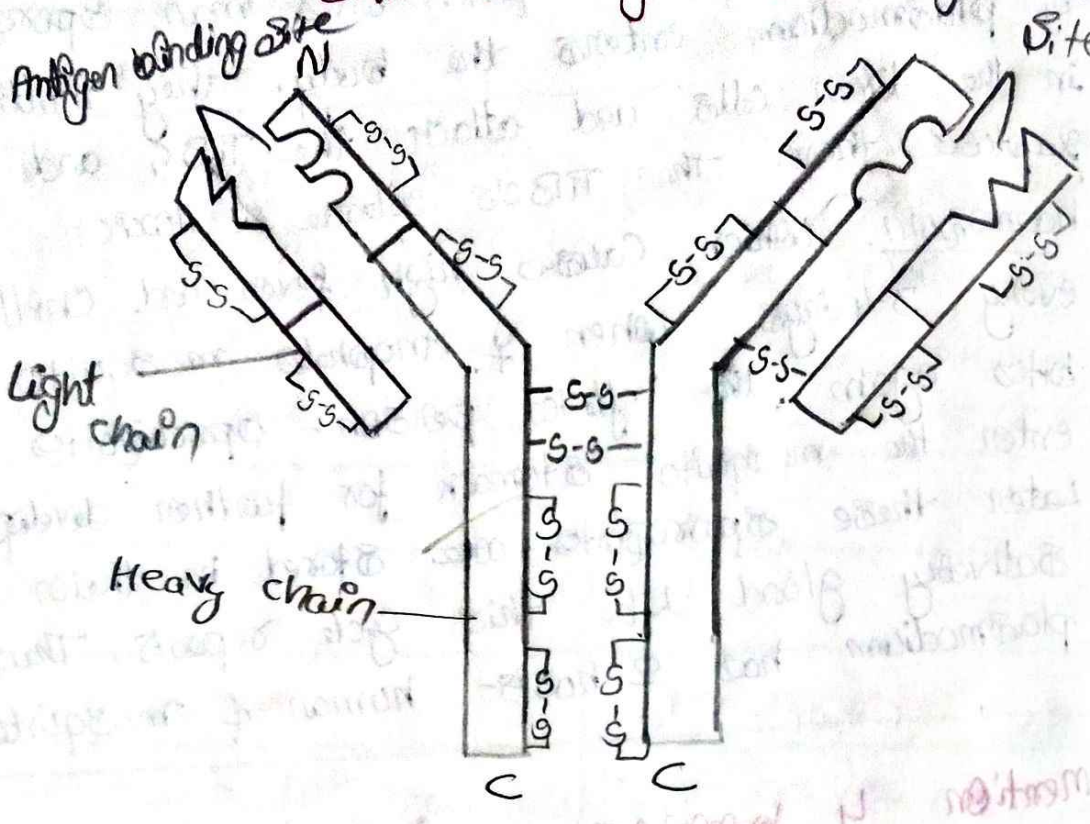
Ans → IgA, IgM, IgE, IgG → GAME

---

(12) Write the symbolic representation of an antibody (1)

→ H_2L_2

(13) Describe the structure of an antibody with a diagram (3) Antigen binding site



Each antibody has 4 peptide chains. Two small chains are called light chains and two longer chains are called heavy chains. So antibody is represented by H_2L_2.

Different types of Antibodies.

IgA, IgM, IgE, IgG.

---

(14) Write a note on lymphoid organ (3)

These are the organs in which, lymphocytes are originated, matured and differentiated. Lymphoid organs are bone marrow and thymus. After maturation, (lymphocytes) lymphocytes migrate to secondary lymphoid organs like spleen, lymphonodes, tonsils, peyer's patch in small intestine and appendix. These provide sites for interaction of

of lymphocytes with antigen.

Bone-marrow is the main lymphoid organ, where all types of blood cells and lymphocytes are produced. thymus, a lobed organ, located near the heart is a large at the time of birth, but keeps reducing in size with age. Spleen is a bean shaped, contains mainly lymphocytes and phagocytes which acts as a filter, by trapping blood-borne micro-organisms. Both bone marrow and thymus provide micro-environments for the development of the T-lymphocytes. Spleen is also a reservoir of erythrocytes. Lymph nodes present in different points along the lymphatic system trap micro-organisms and antigens present in lymph and tissue fluid.

---

(15) Explain in Brief about Transmission & Prevention of AIDS (5).

→ Transmission

(i) Sexual contact with infected person.
(ii) By transfusion of contaminated blood.
(iii) By sharing infected needles.
(iv) Infected mother to her child through placenta.
(v) Drug addicts who take drugs intravenously.

P.T.O

Prevention of AIDs :

we should have knowledge of AIDs Don't die of ignorace. The followings

1. Making blood safe from HIV.
2. using disposable needle & syringes
3. controlling drug abuse.
4. Advocating safe sex & promoting regular check up.

---

(16) Explain in Brief about causes, Detection & Treatment of Cancer (5)

AS- **Causes of Cancer**

Cancer causing agents are called Carcinogens

1. Ionising radiations like x-rays, γ-rays.
2. Non-ionising radiations like uv-rays.
3. Tobacco
4. Some (~~oncogenic~~) oncogenic viral genes.
5. cellular oncogens.

Cancer detection & diagnosis :

Early detection of cancer is essential to treat successfully. Detection is based on biopsy, histopathological studies, blood & bone marrow for leukemia,

In biopsy, a piece of affected tissue is cut into thin sections, stained and observed under microscope. X-rays, CT (computed tomography) MRI (Magnetic Resonance Imaging) are useful to detect cancer. Antibodies and molecular biological techniques are also used to detect cancer cells and genes which are inherited.

Treatment of cancer: Treatment of cancer are surgery, radio-chemo- and immunotherapy. In radiotherapy, tumor cells are irradiated without damaging normal cells. Several drugs are used to kill cancerous cells. Tumour cells inactivate our immune system. Thus α-Interferon are injected to activate immune system, which destroys the tumour.

(17) Name the plants from which opioids, cannabinoids and coca-alkaloids are extracted (3).

Ans 1) Opioids - Poppy plants (Papaver somniferum)

2) Cannabinoids - Cannabis sativa

3) Coca alkaloids - Erythroxylem coca.

(18) What are the effects of Smoking, Tobacco chewing, Drugs & Alcohol abuse (5)

Ans:- Smoking and Tobacco Chewing, Alcohol.
It stimulates adrenal gland to release adrenaline and non-adrenaline hormones into blood, resulting in the increase of B.P and heart rate. Smoking is associated with increase chance of cancer, lung, urinary bladder, throat, bronchitis are effect emphysema, coronary heart diseases and gastric ulcer etc. It also increases CO concentration in the blood, which reduces Hb and O_2 in the body. And depression, defective in reproductive organs, abnormal menstrual cycle, baldness, enlargement of breast glands, stunted growth.

(19) Write the preventive & controle measures of Drugs & Alcohol abuse (5)

(i) Avoid undue peer pressure:
A child should not be pushed forcefully to perform beyond his limits. like in studies, sports and other activities.

(ii) Education and counselling - we should guide the children in a proper way through education and counselling we have to channelise the child's energy into sports, music, reading, yoga etc..

(iii) Seeking help from parents and peers: whenever the youths face problems, parents and peers should guide them properly to overcome of anxiety & guilt.

(iv) Looking for danger signs: Friends, if they find some one using drugs or alcohol immediately bring this to the notice of parents or teachers.

(v) Seeking professional and medical help: Drug/ alcohols abused persons are given advise from qualified psychologists, psychiatrists. Deaddiction and rehabilitation programmes may help the affected individual to overcome this problem and lead a normal life.

(20) What are Pathogens & give examples (2)

→ Disease causing organisms are called pathogens

ex:- bacteria, fungi, viruses, protozoans, helminthes.

(21) Name the Test by which typhoid is detected? (1)

→ Widal test

(22) What is withdrawal syndrome? mention its symptoms.

→ If regular dose is not taken, the body shows abnormal characters, which is suffered as 'withdrawal syndrome'

These symptoms are anxiety, shakiness, nausea and sweating this is called 'dependence'.

Seen 28/11/23

Seen 29/11/23

10. MICROBES IN HUMAN WELFARE

① Define :-

Toddy :- A drink is made by fermenting sap from palms.

Fermenters : In Industry, beverages and antibiotics are produced by growing microbes in large vessels called Fermenters.

Flocs :- flocs are masses of bacteria & fungi.

BOD :- BOD means, the amount of O_2 needed to consume all organic matter in a litre of H_2O were oxidised by bacteria.

Slurry : The biogas plant consists a concrete tank, in which, bio-wastes and dung is collected. This is called Slurry.

② How microbes are useful in house hold products.

Ans (i) Lactobacillus (or) LAB - (Lactic Acid Bacteria)

It helps in conversion of milk to curd. They produce acids, which partially digest the milk proteins. They also increase vitamin B_{12} and they check disease causing microbes in stomach.

(ii) The dough, which is used to make dosa. (or) Idli is fermented by bacteria, in which CO_2 is released. In the same way, the dough used to make bread is fermented by baker's yeast.

(iii) Toddy :- a drink is made by fermenting sap from palms. microbes are used to ferment fish, soyabean and bamboo to make food. The large holes in Swiss cheese are due production of CO_2 by a bacterium Propionibacterium shermanii. Roquefort cheese is prepared by fungi.

---

(3) Name the bacteria from which Swiss cheese is prepared.

A→ Propionibacterium shermanii.

---

(4) Name the yeast used to prepare bread & Ethanol.

A→ Saccharomyces cerevisiae.

---

(5) From which fungi Penicillin is prepared?

→ Penicillium notatum.

(6) Name the microbes from which the following acids are prepared.

(a) Citric acid :- Aspergillus niger (fungus)
(b) Acetic acid :- Acetobacter acti (bacteria)
(c) Butyric acid :- Clostridium butylicum (bacteria)
(d) Lactic acid :- Lactobacilles (bacteria).

---

(7) Mention the function of following enzymes.

(a) Lipases :- They are used in laundry to remove oily stains.

(b) pectinases & proteases :- They help the bottle juices to be kept clears

(c) Streptokinase :- It is used as clot bluster to remove clots from the blood vessels of patients.

(d) Cyclosporin A : It is used as an immunosuppressive agent in organ transplant patient.

(e) Statins :- It is used as blood-cholesterol lowering agents.

(3) How microbes are useful in sewage water treatment?

Microbes in sewage treatment :-

Sewage water contains human excreta, organic matter and microbes, many of them are pathogens. Before disposal, sewage is treated in sewage treatment plants (STPs) to make it less polluting. Present in the sewage is done by heterotrophic bacteria, present in the sewage. It is carried out in two stages.

Primary treatment :- In this floating debris is removed by sequential filtration. Then the grit (soil & other particles) are removed by sedimentation. Solids that settle form primary sludge the supernatant forms the effluent. This efficient is taken for secondary treatment.

Secondary Treatment or Biological treatment

In aeration tanks, the primary effluent is passed, where it is constantly rotated and air is pumped into it. This allows growth of flocs (masses of bacteria & fungi) These flocs consume major part of organic matter in effluent. This reduces BOD.

BOD (Biological O_2 demand). BOD means, the amount of O_2 needed to consume all organic matter in a litre of H_2O were oxidised by bacteria. The greater the BOD of sewage, more is its polluting potential.

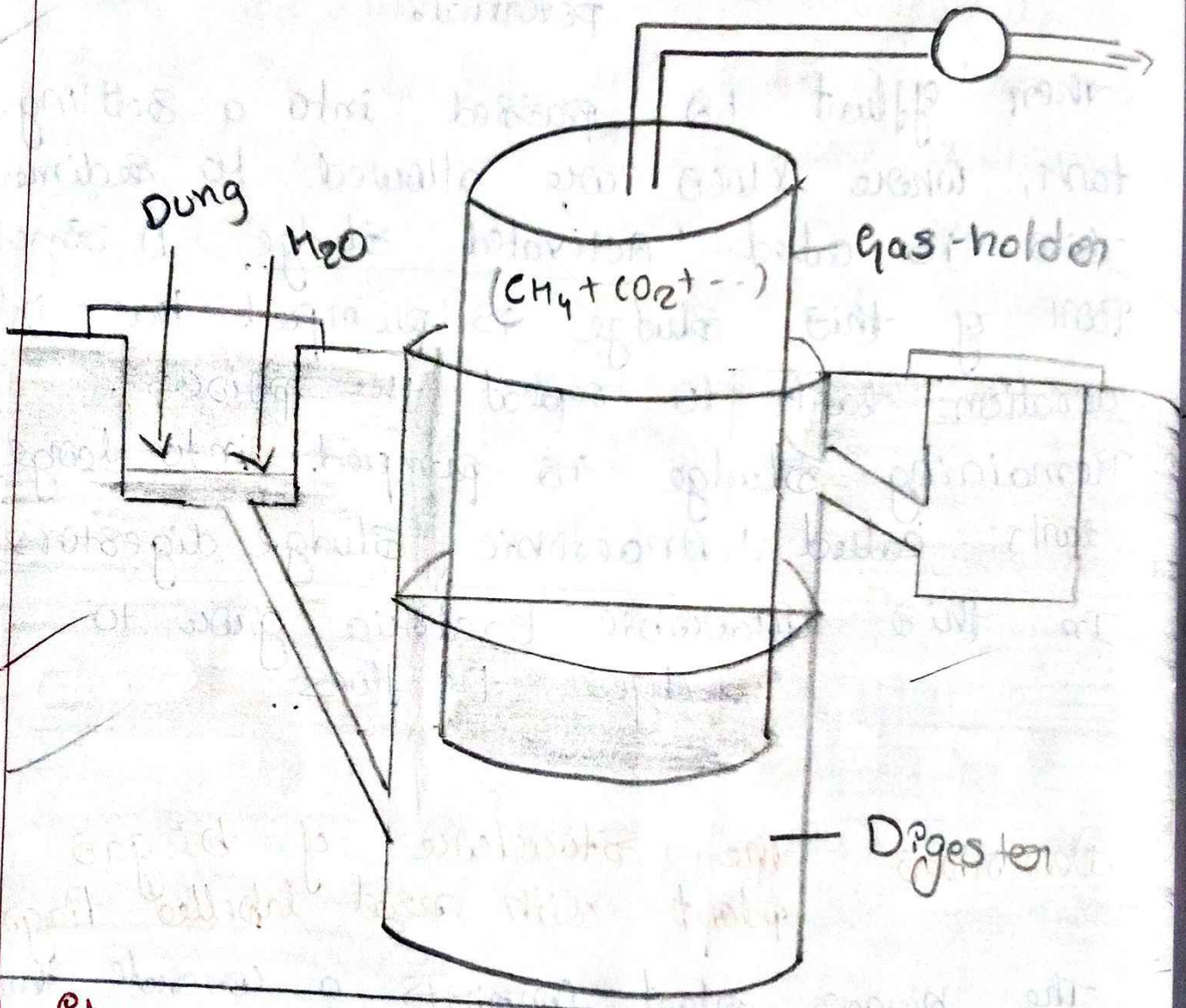
Then effluent is passed into a settling tank, where flocs are allowed to sediment. This is called 'Activated sludge'. A small part of this sludge is pumped back into aeration tank to repeat the process. Remaining sludge is pumped into large tank called 'Anaerobic sludge digestors'. In this anaerobic bacteria grow to digest the flocs

---

(9) Describes the structure of biogas plant with neat labelled diagram.

→ The biogas plant consists a concrete tank, in which, bio-wastes and dung is collected. This is called slurry. Over the slurry. Over the slurry, floating cover is placed. Due to microbial activity, biogas is produced which is supplied to houses for cooking and lighting purpose. The spent slurry (waste slurry) is used as fertilizer. The bio-gas plants are more in rural areas because of excess availability of dung and

The biogas technology in India was developed by Indian Agricultural Research Institute (IARI) and Khadi and village Industries commission (KVIC).



10) Give example for microbes which act as bio-fertilizers.

→ * Rhizobium
* Mycorrhiza
* Nostoc
* Anabaena
* Oscillatoria.

(11) Write a note on microbes as a bio-control agents.

→ Continuous using of insecticides and pesticides to control diseases and pests in plants will harmful to human beings, also pollute soil, H_2O, fruits, vegetables & crops. To avoid this microbes are used to control many pests and diseases without any side effects. These microbes reduce our dependence on toxic chemical.

The beetle with red and black markings - Lady bird, dragon-flies kill many mosquitos. Bacillus thuringiensis (Bt), which releases toxins into the gut of larvae, and get killed. Through genetic engineering now toxin genes of these bacteria are introduced into plants to resist over pests. Ex- Bt cotton.

The fungal species Trichoderma is used to control many diseases Baculoviruses belongs to genus Nucleopolyhedroviruses are used to control insects and other arthropods. They have no negativ impacts on plants and animals. In Integrated Pest management (IPM) programme, beneficial microbes are conserved.

Seen 2/1/24

Seen 2/1/24

11. Biotechnology - Principles and processes

① **Define :-**

Biotechnology :- The integration of natural science and organisms, cells, parts there of and molecular analogues for product & service.

Palindromic sequence :- Palindrome means a sequence of base pairs, that reads same on the two strands.

For ex :- 5' – GAATTC – 3'
3' – CTTAAG – 5'.

Elution :- The separated bands of DNA are cut out from the agarose gell. This is called elution.

Plasmid :- Plasmid is a self-replicating circular extra chromosomal DNA present in prokaryotes.

② Mention two important techniques of bio-technology. (2)

Ans- (i) Genetic engineering.
(ii) Chemical engineering.

(3) What are the areas of biotechnology (3)

A: Producing genetically modified organisms, test tube baby, DNA vaccine, correcting a detective gene are all part of biotechnology.

---

(4) What three important steps should remember in GMO (3).

A: (i) Identification of DNA with desirable genes

(ii) Introduction of this DNA into the host.

(iii) Maintenance of this DNA in the host and transfer to its progeny.

---

(5) Which are the tools of r-DNA technology? (3)

A: * Restriction enzymes.
* Polymerase enzymes.
* ligase enzymes.
* vectors/ Plasmids
* host organisms.

---

(6) Differentiate between exonucleases & endonucleases (2)

Exonucleases :- which remove nucleotides from the ends of DNA

Endonucleases :- which cut the nucleotides within the DNA.

(1) How DNA fragments are separated by using gel electrophoresis? (3)

A:- Separation and Isolation of DNA fragments

The DNA fragments obtained by the action of restriction endonucleases, can be separated by a technique called 'gel electrophoresis'. Since DNA fragments are negatively charged, they are allowed to move towards positive pole in an electric field, through agarose gel medium. Agarose is a natural polymer extracted from sea weeds. The smaller DNA fragments will move faster.

To see these fragments, staining the DNA with ethidium bromide is done and followed by exposure to U.V. radiation. Then we can see bright orange coloured bands of DNA. The separated bands of DNA are cut out from the agarose gel. This is called 'elution'. Later these fragments are used to make r-DNA.

6) List out the important features of a vector / plasmid. (3).

B (i) Origin of replication (ori)

(ii) Selectable marker

(iii) cloning sites

(iv) vectors for cloning genes in plants and animals.

---

7) How host is made compitent to receive r-DNA / c-DNA? (5).

B ① In order to take up r-DNA into host cell. These two are treated with concentration of divalent cation like calcium.

② This can be done by incubating the host cells along with r-DNA on ice and also giving heat shock (42°c) and then back to ice.

③ Through micro-injection, r-DNA is directly injected into animal cells nucleus.

④ In plants, cells are bombarded with gold or tungsten micro-particles coated with r-DNA. This is called bioliastics or gene gun.

⑤ Some time disarmed pathogen is also used to inject the host cells along with r-DNA.

(10) Explain the important steps of r-DNA Technology. (5).

Ans:- Processes of R-DNA Technology:-

(1) Isolation of the DNA:- Within the cell, DNA is associated with RNA, proteins, Polysaccharides and lipids. To remove all these from DNA, the cells (bacteria/plant/animals) are treated with enzymes like lysozyme, Cellulase, Chitinase proteases & ribonucleases. The last two enzymes digest proteins and RNA respectively. After this treatment, chilled ethanol is added. Then fine threads of DNA is collected.

(2) Cutting of DNA at specific locations:- Restriction enzymes are used to cut the desirable DNA sample and also plasmid/vector DNA. This can be checked by using Agarose gel electrophoresis. Then a piece of desirable gene and the cut vector are mixed and ligase enzyme is added. Then we get r-DNA.

(3) Amplification of gene of interest using PCR Polymerase chain reac^n (PCR) is used to make multiple copies of desirable DNA or gene in vitro conditions, using two sets of primers and the enzyme DNA Polymerase using nucleotides.

Primers are small chemically synthesised oligonucleotides that are complementary to DNA. 1 billion copies can be made by using thermostable DNA polymerase [isolated from Thermus aquatius bacteria] which remain active during high temperature. then desired gene is ligated with a vector.

(4) Insertion of R-DNA into the host cell/organism

The host cells, after making them competent to receive the r-DNA, for ex - r-DNA bearing gene for resistance to an antibiotic (Ampicillin) is transferred into E. coli the host become transformed into ampicillin resistant cells. If we spread the host cells on agar plates containing ap ampicillin only transformed cells will grow, others die. That is why here ampicillin resistance gene is called a selectave marker.

(5) Obtaining the foreign gene product :-

The ultimate aim of all recombinant technologies is to produce proteins from r-DNA to express in organisms. That resultant proteins are called re-combinant proteins. They are to be produced in large scale. We use bio-reactors to produce large quantities of required proteins from disirable gene / DNA, A bio reactor provides

(10) Explain the important steps of r-DNA Technology. (5).

Ans:- Processes of R-DNA Technology:-

(1) Isolation of the DNA:- within the cell, DNA is associated with RNA, proteins, Polysaccharides and lipids. To remove all these from DNA, the cells (bacteria/plant/animals) are treated with enzymes like lysozyme, Cellulase, Chitinase proteases & ribonucleases. The last two enzymes digest proteins and RNA respectively. After this treatment, chilled ethanol is added. Then fine threads of DNA is collected.

(2) Cutting of DNA at specific locations:- Restriction enzymes are used to cut the desirable DNA sample and also plasmid/vector DNA. This can be checked by using Agarose gel electrophoresis. Then a piece of desirable gene and the cut vector are mixed and ligase enzyme is added. Then we get r-DNA.

(3) Amplification of gene of interest using PCR Polymerase Chain reac^n (PCR) is used to make multiple copies of desirable DNA or gene in vitro conditions, using two sets of primers and the enzyme DNA Polymerase using nucleotides.

Primers are small chemically synthesised oligonucleotides that are complementary to DNA. 1 billion copies can be made by using thermostable DNA polymerase [isolated from Thermus aquatius bacteria] which remain active during high temperature. then desired gene is ligated with a vector.

(4) Insertion of R-DNA into the host cell / organism

The host cells, after making them competent to receive the r-DNA, for ex - r-DNA bearing gene for resistance to an antibiotic (Ampicillin) is transferred into E. coli the host become transformed into ampicillin resistant cells. If we spread the host cells on agar plates containing ~~ap~~ ampicillin only transformed cells will grow, others die. That is why here ampicillin resistance gene is called a selectave marker.

(5) Obtaining the foreign gene product :-

The ultimate aim of all recombinant technologies is to produce proteins from r-DNA to express in organisms. That resultant proteins are called re-combinant proteins. They are to be produced in large scale, we use bio-reactors to produce large quantities of required proteins from disirable gene / DNA, A bio reactor provides

Optimum PH, substrate, temperature, salts, vitamins, O_2 for better products

The common used reactors are stirred-tank-reactors type.

A stirred tank reactor is usually cylindrical to facilitate the mixing of contents. This reactor has

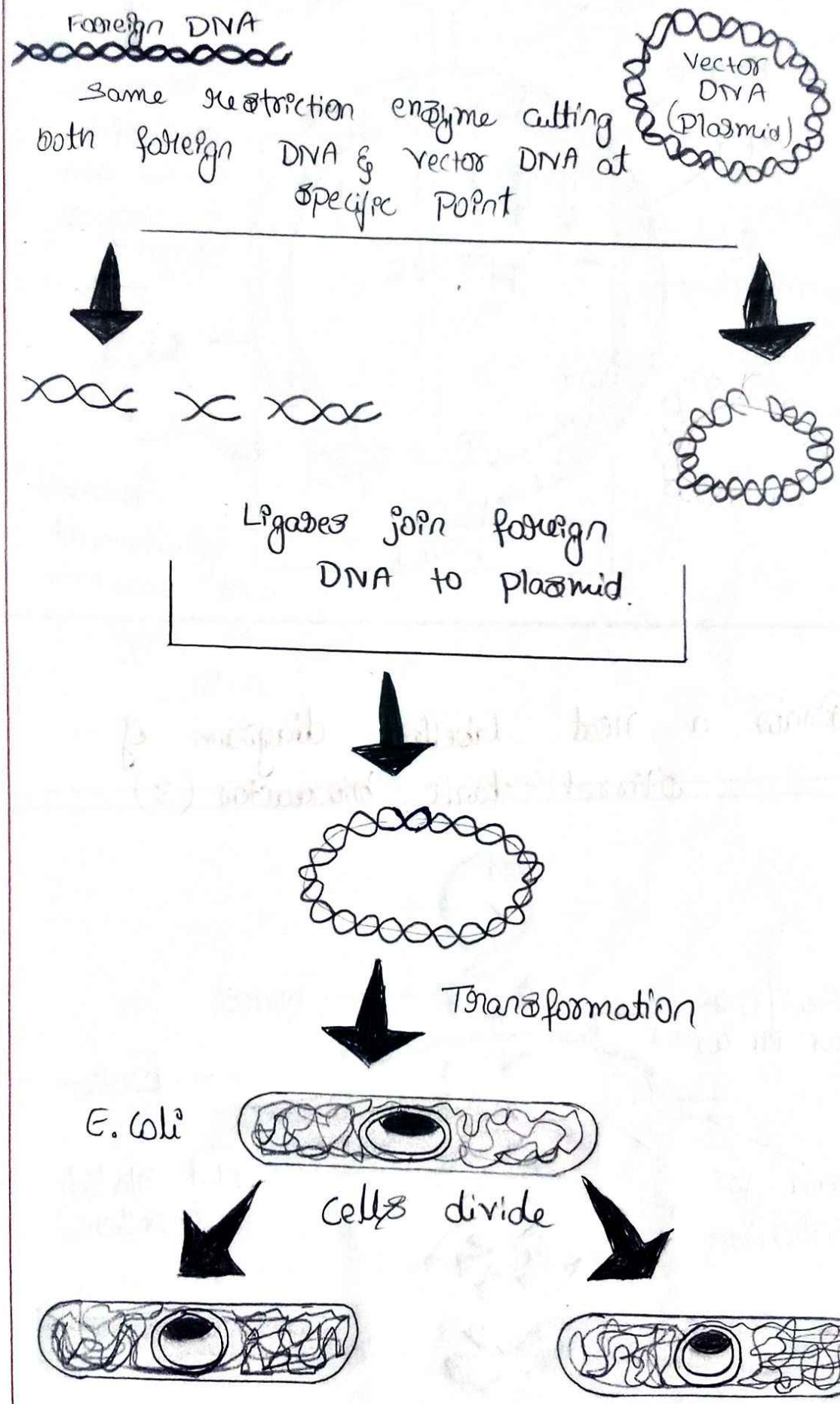
(i) agitator system
(ii) O_2 delivery system
(iii) Foam control system
(iv) temperature control system
(v) PH controling system
(vi) sampling parts.

---

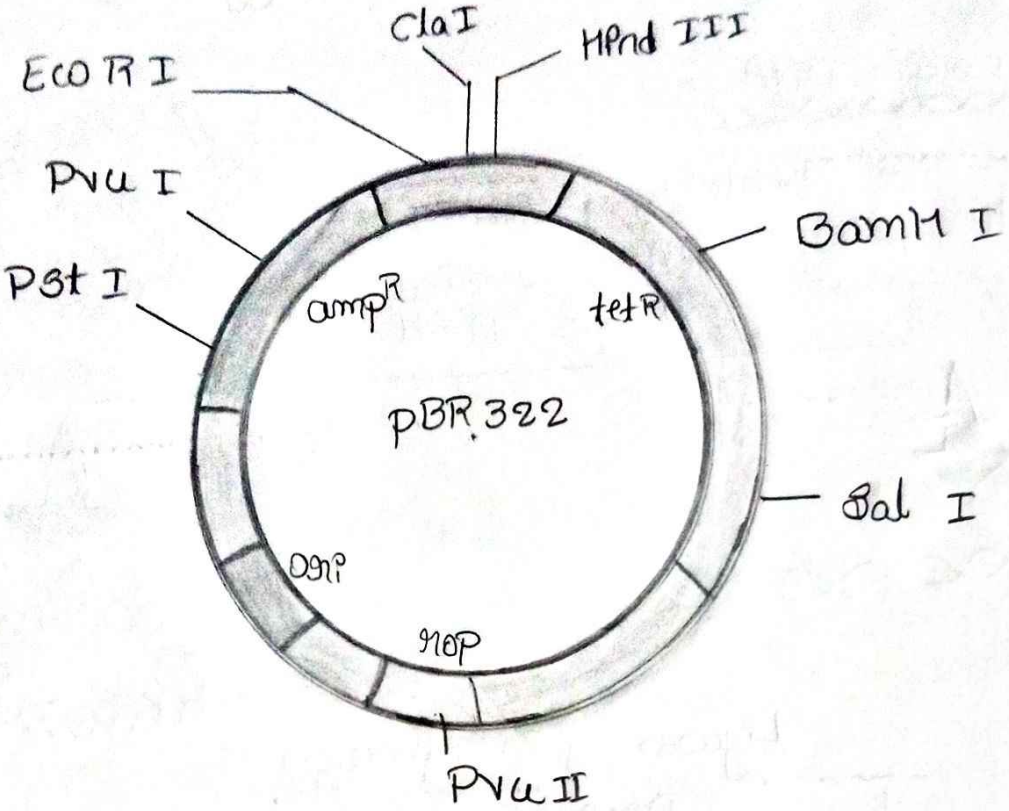
(6) Down stream processing:

After biosynthetic stage, product is subjected through a series of processes before marketing. This includes separation and purification, which are collectively called down stream processing. It varies from product to product.

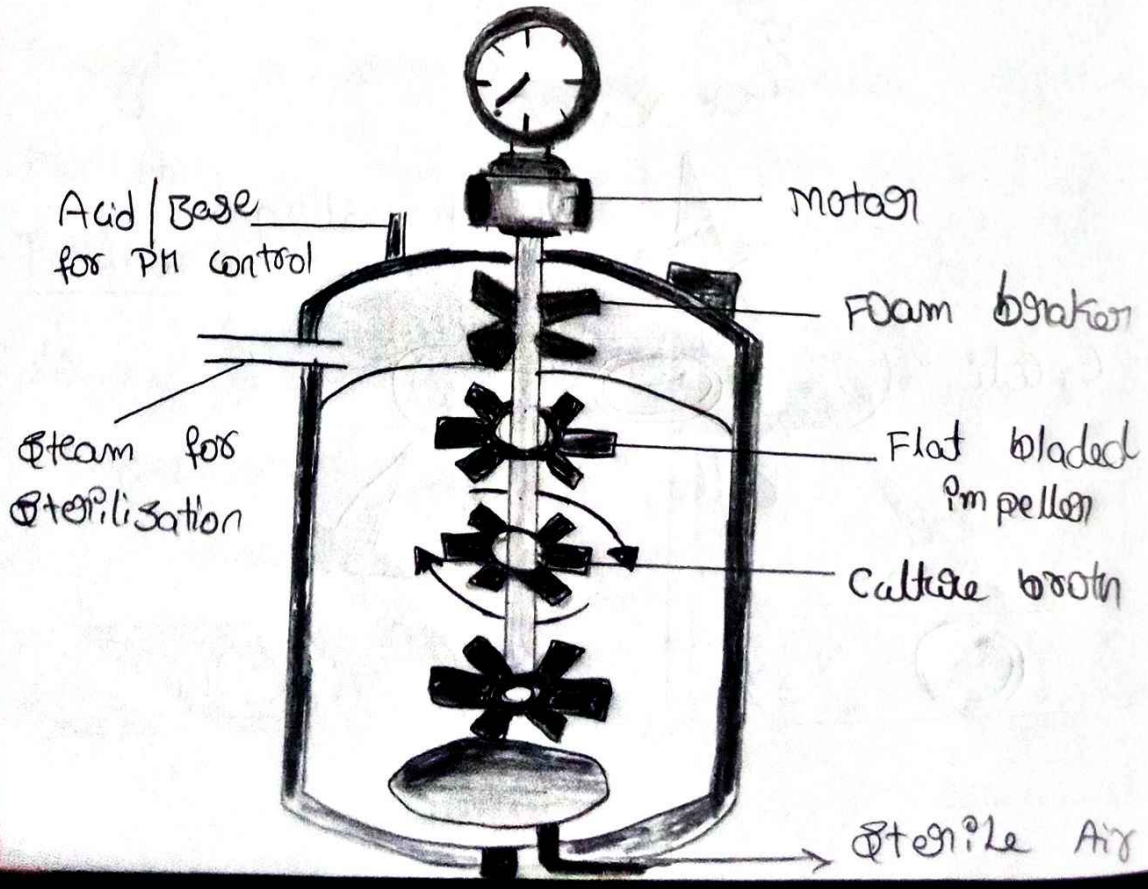
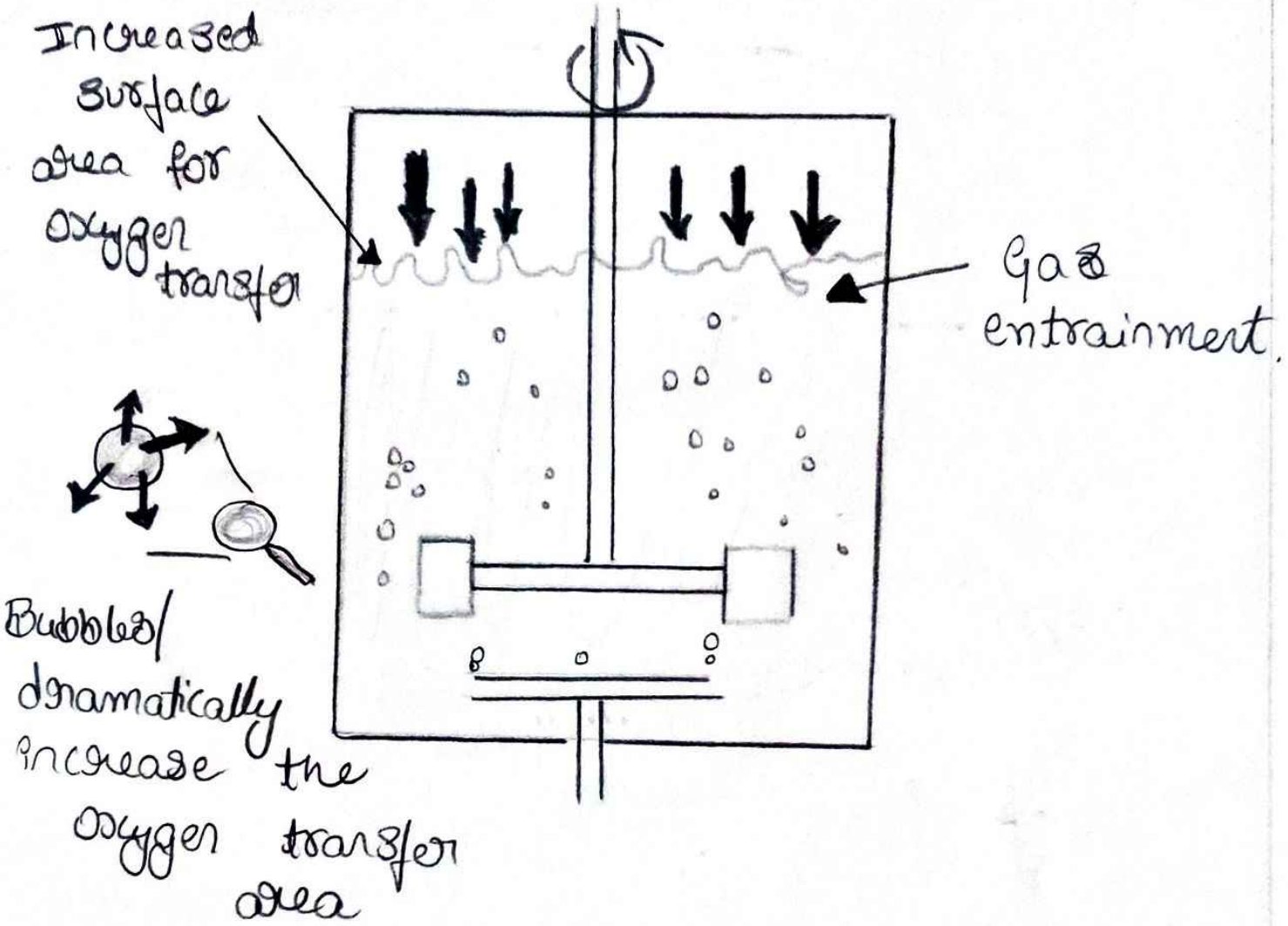
(11) Write the diagramatic representation of r-DNA technology (5)



(12) Draw a neat labelled diagram of PBR -322 (3)



(13) Draw a neat labelled diagram of Stirred tank bioreactor (3)



(14) Draw a neat labelled diagram of Sparged tank bioreactor. (3)