

## UNIT – VI

### CHAPTER 1. REPRODUCTION IN ORGANISMS

#### What is reproduction?

- Reproduction is the biological process in which an individual gives rise to an offspring similar to itself.

#### Types of Reproduction:

■ ASEXUAL REPRODUCTION

■ SEXUAL REPRODUCTION

- Based on whether there is one or two organisms taking part in process of reproduction

#### Asexual Reproduction:

1. Usually followed by orgs. with relatively simpler organizations.
2. Offsprings produced by single parent.
3. With/without involvement of gamete formation.
4. Offsprings produced are genetically and morphologically similar to each other and to the parent, i.e.. they are **clones**.

#### Modes of asexual reproduction:

##### 1.Binary fission

Cell division of parent cell into 2 daughter cells.

E.g.. Amoeba, Paramecium

##### 2.BUDDING

Parent cell divides to form large cell and small cell, called **bud**, attached to the large cell; the bud gets separated and grows into an adult. E.g., Yeast

- In fungi and algae specialized asexual reproductive units are formed

**Zoospores** in many algae and certain aquatic fungi, **Conidia** (Penicillium), **Buds** (Hydra), **Gemmules** (Sponge).

- In higher plants, **vegetative propagation** is followed using units such as **rhizome, sucker, offset, bulb, tuber etc.** – known as vegetative propagules.

### Examples of Vegetative Propagation:

- **WATER HYACINTH (Terror of Bengal)**

- ✓ One of the most invasive weeds
- ✓ Grows wherever there is standing water
- ✓ Drains oxygen from water- leads to death of fishes.
- ✓ Introduced in India because of its pretty flowers & shape of leaves
- ✓ Vegetative propagation occurs at a phenomenal rate

### II SEXUAL REPRODUCTION:

- Involves formation of male and female gamete by two individuals of the opposite sex.
- Offspring produced by fusion of male and female gametes not identical to each other or to the parents.
- All sexually reproducing organisms share a similar pattern of reproduction.

Different phases in sexual reproduction:

#### 1. JUVENILE PHASE

Period of growth and maturity of an organism before it can reproduce sexually.

#### 2. REPRODUCTIVE PHASE

Period in which org. is capable of reproducing sexually

- Easily seen in higher plants when they come to flower.
- Some plants flower seasonally & some thruout the year
- Few plants exhibit unusual flowering phenomenon

For e.g.. 1. **Bamboo** species flower only once in their lifetime. 2. ***Srobilanthus kunthiana*** (neelakurinji) found in hilly areas of Kerala, Karnataka & Tamil Nadu, flower once in 12 years the latest being in September 2006.

- In animals sexual reproduction is usually seasonal
- In placental mammals there is occurrence of cyclical changes in the activities of ovaries & accessory ducts as well as hormones

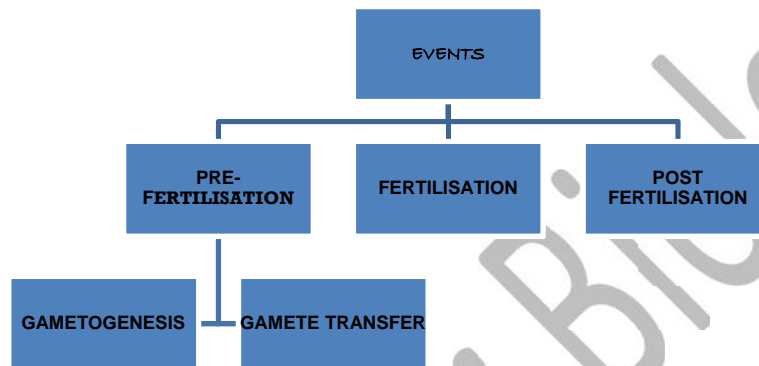
- In non primate mammals like dogs, rats etc these cyclical changes during reproduction is called **oestrus cycle**.
- In primate mammals like apes & humans, these cycles are called **menstrual cycles**.

### **3.SENESCENT PHASE**

End of reproductive phase.

Old age ultimately leads to death

### **EVENTS IN SEXUAL REPRODUCTION:**



#### **1. PRE-FERTILIZATION EVENTS:**

##### **a) GAMETOGENESIS**

- The gametes are usually haploid
- Gametes called homogametes / isogametes when both have same appearance
- When gametes are different, they are called heterogametes; male gamete known as antherozoid /sperm, female is called ovum
- Bisexual orgs. called as homothallic /monoecious whereas unisexual orgs. called heterothallic / dioecious.

##### **b) GAMETE TRANSFER**

- In most of the orgs., male gametes are motile & female gametes are stationary.
- In algae, bryophytes & pteridophytes water is the medium for gamete transfer
- Pollination is the method of gamete transfer in higher plants as pollen grains are carriers of male gametes

## 2. SYNGAMY / FERTILIZATION:

- Syngamy results in formation of a diploid zygote
- In certain animals, female gamete develops into the adult organism without fertilization; such a process is called parthenogenesis - seen in rotifers, lizards turkeys etc.
- Fertilisation may be external or internal

<u>EXTERNAL FERTILIZATION</u>	<u>INTERNAL FERTILIZATION</u>
Syngamy occurs outside the body of the organism	Syngamy occurs inside the body of the organism
Large number of gametes are released in the surrounding medium. Ex. Bony fishes and Amphibians.	Number of ova produced are less, but large number of male gametes are released and they travel towards the ovum. Ex. Birds and Mammals.

## 3. POST FERTILIZATION:

- Events in sexual reproduction after the formation of zygote
- Zygote – vital link that ensures continuity of species b/w orgs. Of one generation & the next
- Development of zygote depends on
  - the type of life cycle of the organisms.
  - the environment it is exposed to.
- Zygote develops into embryo

### Embryogenesis involves:

- cell division to increase the no. of cells
- cell differentiation for the formation of different kinds of tissues
- Based on whether the dev. of zygote occurs inside or outside the body of the female parent, animals are categorized into oviparous and viviparous.

<u>OVIPAROUS</u>	<u>VIVIPAROUS</u>
These animals lay eggs.	These animals give birth to young ones
The fertilized eggs have a calcareous shell to protect them from harsh environment.	Embryo protected inside the mother's body.

- In flowering plants the zygote formed inside the ovule; zygote develops into embryo after which the ovule becomes the seed and ovary becomes the fruit.

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## **CHAPTER 2 - SEXUAL REPRODUCTION IN FLOWERING PLANTS**

### **FLOWER - the fascinating organs of angiosperms**

- Flower is the reproductive organ of angiosperms.
- It consist of :-
  1. Calyx
  2. Corolla
  3. Androecium
  4. Gynoecium

### **PRE- FERTILISATION – STRUCTURES AND EVENTS**

- Hormonal and structural changes initiated leading to differentiation and development of floral primordium.
- Inflorescences are formed which bear floral buds and then flowers
- Androecium and gynaecium differentiate and develop.

### **STAMEN**

- Stamen consist of
  1. Anther – terminal bilobed structure

Filament – long slender stalk. Proximal end of the filament is attached to the thalamus or petal.

### **STRUCTURE OF ANTHER**

- Anther has 2 lobe (bilobed). Each lobe consist of 2 theca. Hence it is dithecous
- Anther is a tetragonal structure which consist of 4 micro sporangia located 2 in each lobe.
- Microsporangium develop into pollen sacs.
- Pollen sacs run longitudinally and contain pollen grains.

### **STRUCTURE OF MICROSPOROANGIUM**

- A typical microsporangium appears circular in outline.
- It is surrounded by 4 walls.
  1. Epidermis - protects and help in dehiscence of anther.
  2. Endothecium
  3. Middle layers
  4. Tapetum - nourishes the developing pollen grain
- SPOROGENOUS TISSUE

Compactly arranged homogenous cells which are present at centre of each microsporangium when the anther is young

### **MICROSPOROGENESIS**

- Process of formation of microspores from pollen mother cell through meiosis.
- The cells of the sporogenous tissue/microspore mother cell ( $2n$ ) meiotically divide to form microspores which are arranged in a cluster of 4 cells called MICROSPORE TETRAD.
- When the anther matures and dehydrates, the microspore dissociate from each other and develop into pollen grains
- Thousands of pollen grains formed inside a microsporangium- released with dehiscence of anther.

### **POLLEN GRAINS**

Pollen grains are male gametophyte- spherical in shape.

### **STRUCTURE OF POLLEN GRAIN**

- Pollen grains are made of 2 layered Wall,
  1. EXINE - Made of sporopollenin- most resistant organic matter known,
  2. INTINE
    - Thin and continuous layer
    - made of cellulose and pectin

### 3. Germ pores

- apertures on exine where sporopollenin is absent
- forms pollen tube.

4. A plasma membrane surrounds cytoplasm of pollen grain.

### MATURE POLLEN

- A mature pollen consist of 2 cells

### VEGETATIVE CELL

- ☐ Bigger
- ☐ Abundant food reserve
- ☐ Large irregular nucleus
- ☐ Responsible for the development of pollen grain

### GENERATIVE CELL

- ☐ Small
- ☐ Involved in syngamy
- ☐ Dense cytoplasm and nucleus.
- Pollen grains cause allergy and bronchial afflictions
- Leading to chronic respiratory disorders like asthma, bronchitis Eg :- Parthenium (carrot grass)

### POLLEN PRODUCTS

- Rich in nutrient.
- Pollen tablets and syrup
  - food supplements
  - claims to increase performance of athletes and race horse.

### **Period of viability**

- Once shed the pollen grains have to land on the stigma before they lose viability if they have to bring about fertilisation.
- Period of viability depends on temperature and humidity  
eg:-cereals – 20 mins and members of rosaceae, leguminoseae, solanaceae – take months.
- Pollen grains stored by CRYOPRESERVATION.
- Used in crop breeding programmes.

### **PISTIL, MEGASPORANGIUM, EMBRYO SAC**

- GYNAECIUM- female reproductive part of flower
- Gynaecium with 1 pistil – monocarpellary
- Gynaecium with more than 1 pistil – multicarpellary
- Fused pistil – syncarpous
- Free pistil – apocarpous.

### **PISTIL**

Pistil consist of

1. Stigma
  2. Style
  3. ovary
    - ovarian cavity
    - placenta
- Ovules arise from placenta.
    - single ovule – wheat, paddy
    - Many ovules- papaya, water melons.etc



### **MEGASPORANGIUM(OVULE)**

- Ovule is a small structure attached to placenta.
- Funicle – stalk by which ovule is attached to placenta
- Hilum- junction b/w ovule and funicle
- Integuments- protective envelops
- Micropyle-small opening at the tip of ovule into where pollen tube enters
- Chalaza-basal part of ovule
- Nucellus(2n)-mass of cells enclosed in integuments. Has abundant food reserve.

### **MEGASPOROGENESIS**

- Process of formation of megaspores from megaspore mother cells is called MEGASPOROGENESIS.
- Megaspore mother cells divide meiotically to form 4 megaspore(haploid)
- out of 4, only 1 megaspore is functional and forms gametophyte and the rest degenerate.

### **FEMALE GAMETOPHYTE(EMBRYO SAC)**

- The embryo sac develops from the functional megaspore(n).
- MONOSPORIC DEVELOPMENT:-formation of embryo sac from a single megaspore.

### **FORMATION OF EMBRYO SAC**

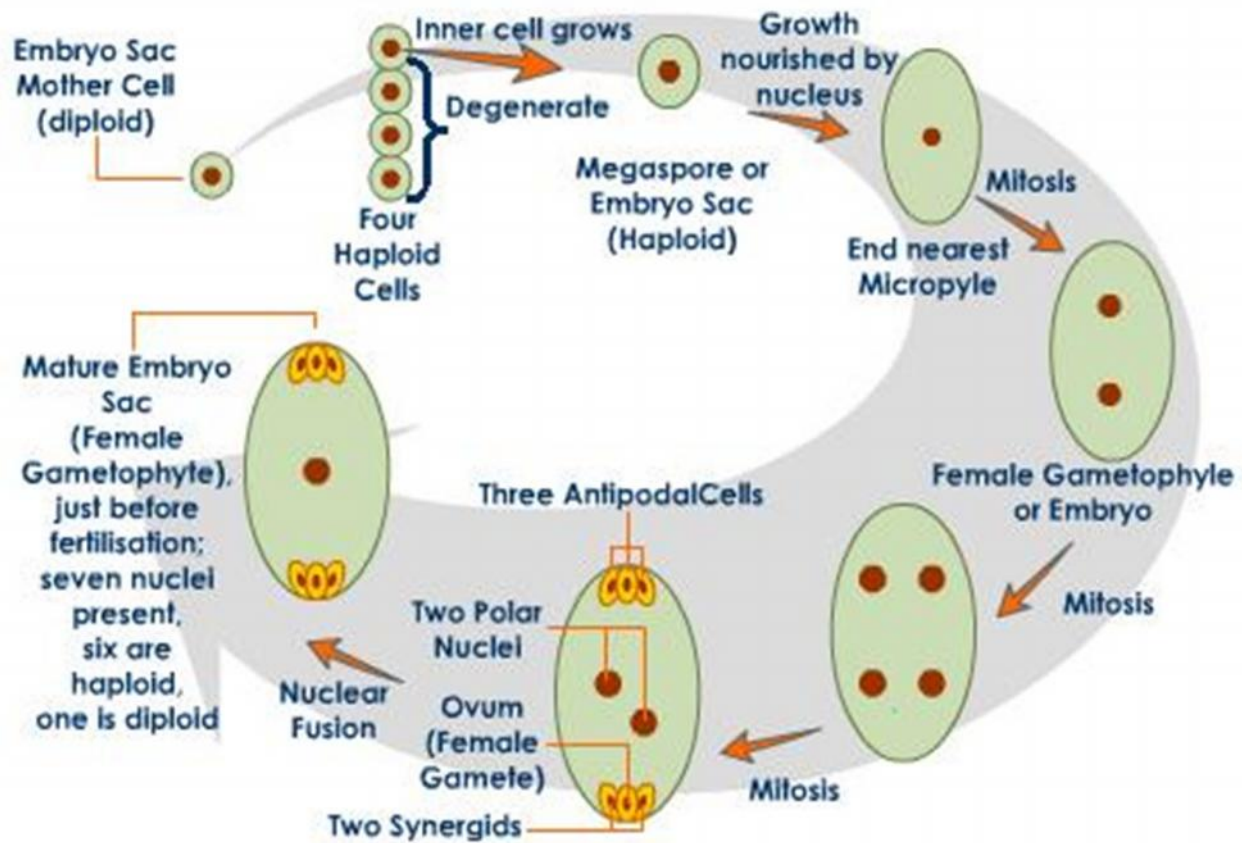
- Nucleus of functional megaspore divides mitotically to form 2 nuclei which move to opposite poles forming 2-nucleate embryo sac.
- 2 more mitotic nuclear division result in 4-nucleate and later 8- nucleate stages of embryo sac.
- Then cell wall is laid down leading to organisation of female embryo sac.

### **STRUCTURE OF EMBRYO SAC**

- Egg apparatus - present at the micropylar end.
- consist of 2 synergids and 1 egg cell

Synergids have cellular thickenings at micropylar tip called FILIFORM APPARATUS – guides the pollen tube into the synergid

- Antipodal- 3 cells present at chalaza end
- POLAR NUCLEI- Large central cell.



## POLLINATION

- The transfer of pollen grains from anther to stigma of a pistil is called pollination.
- Based on the source of pollen, pollination is of 3 types:-
  - AUTOGAMY
  - GEITONOGAMY
  - XENOGAMY

## AUTOGAMY

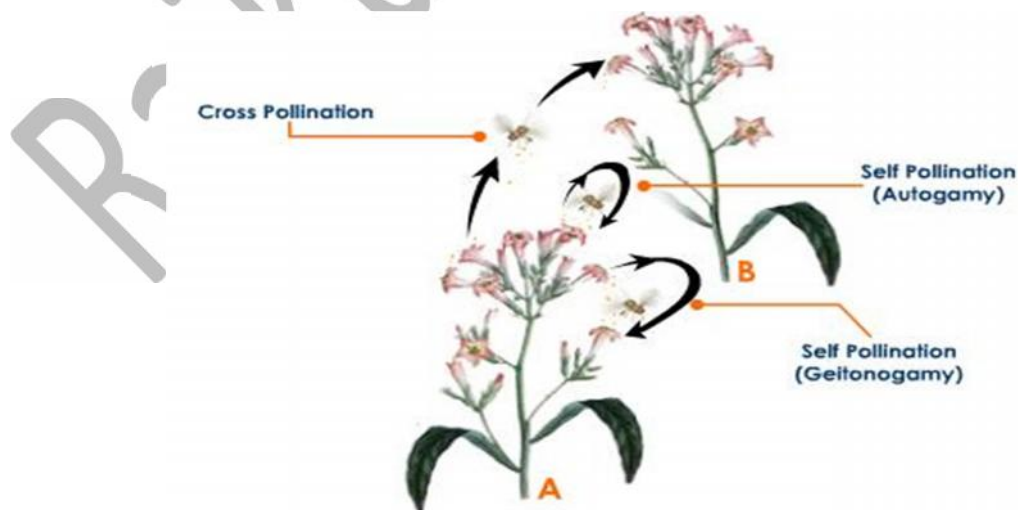
- Transfer of pollen grains from anther to stigma of the SAME flower.
- REQUIREMENT:-
  - ❖ Synchrony in pollen release and stigma receptivity.
  - ❖ Closeness of stigma and anther
    - ✓ Chasmogamous flowers- flowers with exposed anthers and stigma
    - ✓ Cleistogamous flowers-flowers which do not open at all
    - ✓ Cleistogamy is disadvantageous because there is no chance of variation.
    - ✓ Eg:- oxalis ,viola

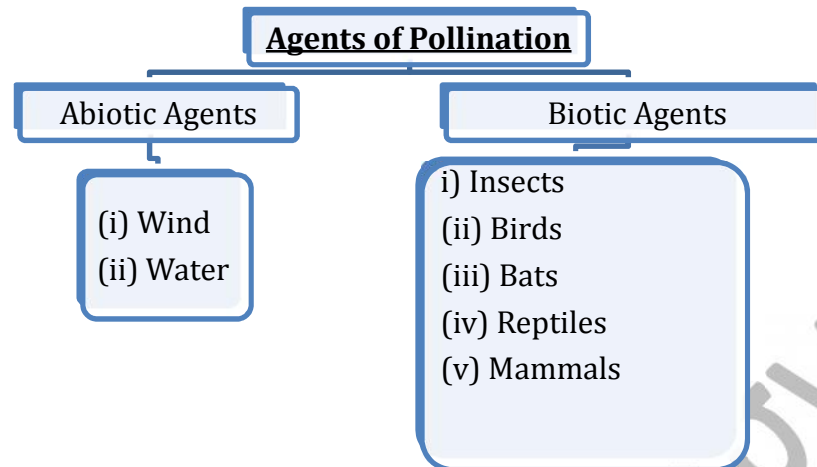
## GEITONOGAMY

- **Transfer of pollen grains from anther to stigma of another flower of the same plant.**
- **Genetically similar**
- **Eg:- cucurbits**

## XENOLOGY

- **Transfer of pollen grains from anther to stigma of another flower of different plant**
- **Genetically different pollen grains are brought to the stigma.**





### Adaptations in flowers for Pollination

#### I. Wind Pollination

- ✓ pollen grains :- light, non- sticky, winged
- ✓ anther :- well exposed
- ✓ stigma :- large and feathery
- ✓ flower :- one ovule, arranged as inflorescence

eg : corn cob

#### II. Water Pollination

- *Bryophytes, Pteridophytes, Algae*

- ✓ pollen grains : protected by mucilaginous covering

eg : Fresh water plants- Vallisneria, Hydrilla

Sea grass- Zostera

### Main features of wind and water pollinated plants

- produce pollen grains in large no.
- do not produce nectar

#### Vallisneria

- Female flower - reach the water surface by long coiled stalk
- Male flower or pollen grains – released onto the water surface - carried by water currents – some eventually reach the stigma

## Zostera

- **Female flower** remains submerged
- **Pollen grains** - long, ribbon like
  - released inside water
  - carried by water currents to reach female flower

### III. Insect Pollination

- Flowers : large, colourful, fragrant, rich in nectar
- Pollen grains : sticky
- Stigma : sticky

#### Certain rewards to pollinators:

- nectar and (edible) pollen grains as foods
- provide safe place for laying eggs

Eg : Amorphophallus, Yucca

#### Outbreeding Devices

#### **Continued self-pollination – Inbreeding depression**

#### Ways to avoid Self-pollination :

- (i) Pollen release & stigma receptivity – not synchronised
- (ii) Stigma and anther – placed at diff positions
- (iii) Self-incompatibility
- (iv) Production of unisexual flowers

eg: castor, maize (prevents autogamy)

papaya (prevents autogamy & geitonogamy)

### Pollen – Pistil Interaction

All events –from deposition of pollen on stigma till the pollen tube enters the ovule **Pollen-pistil interaction**

- Recognition of compatible pollen
- Germination of pollen grains
- Development of Male Gametophyte

### Artificial Hybridization

- Crossing diff varieties of species- hybrid individual- with desirable characters of the parent plants
- desired pollen grains for pollination- stigma protected from contamination
- **Emasculation** : removal of anther
- **Bagging** : flower covered- bag made up of butter- prevent contamination of stigma – unwanted pollen

Bagged flower- attains receptivity- mature pollen grains- dusted on the stigma- rebagged- fruits allowed to develop

- ✓ Double Fertilisation
- ✓ Syngamy
- pollen tube releases male gametes into synergids
- fusion of 1 of male gametes and egg cell
- fusion of 2<sup>nd</sup> male gamete and polar nuclei =Triploid endosperm nucleus- PEN (**Triple Fusion**)
- PEN – now called primary endosperm cell – **endosperm**

### Post- fertilisation Events

All events that occur in a flower, after double fertilisation is called **Post- fertilisation events**

### **Major events are :**

- (i) Development of endosperm
- (ii) Development of embryo
- (iii) Maturation of ovule into seed
- (iv) Maturation of ovary into fruit

### **Endosperm**

† 2 types of endosperm development :

- (i) Free nuclear type (common method)
- (ii) Cellular type

- † Cells of endosperm— store food materials- used for developing embryo
- † Non-Albuminous/Non-Endospermic seeds- endosperm completely utilised- before maturation of seeds. Eg: pea
- † Albuminous/Endospermic seeds- a portion of endosperm remain in mature seeds. Eg: castor

### **Embryo**

- † Embryogeny – early stages of embryo development
- † **Zygote      Proembryo      mature embryo** ( heart-shaped)
- † Embryo consists of:
  - embryonal axis
  - cotyledons
  - plumule
  - radicle

### **Monocotyledonous Seed**

- Scutellum = Cotyledon
- Coleorrhiza: undifferentiated sheath covering radical & root cap
- Coleoptile: sheath covering plumule

## Seed

- Fertilised and mature ovule forms Seed
- Seed consists of:
  - cotyledon(s)
  - embryonal axis
- Seed coat- double layered- formed by integuments
  - **Testa** (outer)
  - **Tegmen** (inner)
- Micropyle:-small opening on seed coat
  - facilitates entry of  $H_2O$  &  $O_2$  into see (germination)
- Hilum:- scar on seed coat
- Seed Albuminous / Non-Albuminous
- Perisperm : remnants of nucellus that is persistent. Eg: Black pepper
- **Dormancy**: state of inactivity

## Advantages of Seeds

- To plants
  - (i) seeds- reserve food materials- nourish seedling
  - (ii) seed coat- protection to young embryo
  - (iii) seeds of large no of species –live for several years
  - (iv) seeds- better adaptive strategies- dispersal to new habitats- better survival
- To mankind
  - (i) used as food- throughout the year
  - (ii) seed- basis of agriculture



## **Fruit**

- Parthenocarpic fruit
- False fruit
- True fruit
- Fruit formed from the ovary : True fruit
- if ovary transform to fruit without fertilisation: Parthenogenesis. Eg : Banana
- Parthenocarpy – induced with gibberellins & auxins
- False fruit: any part other than ovary- forms part of fruit. Eg: Apple

## **Apomixis & Polyembryony**

Other modes of reproduction

### **Apomixis**

- Form of asexual reproduction- mimics sexual reproduction- seed formed without fertilisation
- Formation of apomictic seeds :
  - diploid cell(formed without meiosis)- develop into embryo without fertilisation
  - cells of nucellus (2n) surrounding embryo sac- protrude into embryo sac- develop into embryos. Ex. Citrus and Mango.

### **Polyembryony**

- Occurrence of more than one embryo in a seed
- Often associated with apomixes. Eg: Citrus, groundnut

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## **CHAPTER – 3 : HUMAN REPRODUCTION**

### **The Male Reproductive System**

It consists of :

- The primary sex organs i.e. a pair of testes
- The secondary sex organs i.e. the duct system and the associated glands
- External genitalia

#### *Testes*

- Scrotum – a pouch in which testes are situated
- Testicular lobules
- Seminiferous tubules – contain Spermatogonia and Sertoli cells- Leydig cells are on outside

#### *Accessory Ducts*

- ◆ Rete testis
- ◆ Vasa efferentia
- ◆ Epididymis
- ◆ Vas deferens
- ◆ Urethra

#### *Accessory Glands*

- A pair of seminal vesicles
- Prostate gland
- Bulbourethral gland

Secretions of these glands constitute the seminal plasma rich in fructose, calcium and certain enzymes.

Secretions of bulbourethral glands also help in lubrication of penis.

#### *External Genitalia*

- ◆ The penis is the external genitalia in human males.

- ◆ It is made up of special erectile tissue that helps in erection of the penis to facilitate insemination.

The enlarged tip of the penis is called glands penis covered by foreskin.

## **The Female Reproductive system**

It consists of:

- The primary sex organ that is a pair of ovaries
- Secondary sex organs- the duct system consisting of a pair of fallopian tube, a uterus, cervix and vagina
- External genitalia

Mammary glands

## **Female Reproductive System**

### **Ovaries**

- ◆ Produce female gametes called ova
- ◆ Located in abdominal cavity
- ◆ Each ovary is almond shaped body
- ◆ Covered by a thin epithelium, enclosing the ovarian stroma
- ◆ Stroma is divided into 2 regions :

Peripheral cortex

Inner medulla

### **Fallopian Tube**

- ◆ Part closer to ovary-funnel shaped infundibulum
- ◆ Infundibulum possesses finger like projections-fimbriae
- ◆ Wider part of oviduct –ampulla
- ◆ Last part of oviduct-isthmus

### **Uterus**

- Covered by three layered wall:
  - ❖ Perimetrium – outer most layer

- ❖ Myometrium- middle layer
- ❖ Endometrium-inner most layer

### **External Genitalia**

- Mons pubis – cushion of fatty tissues covered by skin and pubic hair
- Labia majora – fleshy folds of tissue extending down from mons pubis , surrounding the vaginal opening
- Labia minora – paired folds of tissue under labia majora
- Clitoris – tiny finger-like structure which lies at the upper junction of the two labia minora , above the urethral opening
- Hymen – a membrane covering the opening of vagina partially

### **Mammary Glands**

- ◆ Consists of glandular tissue and variable amount of fat
- ◆ Glandular tissue divided into 15-20 mammary lobes
- ◆ Each lobe contains clusters of cells called alveoli opening into mammary tubules
- ◆ Mammary tubules join to form mammary duct
- ◆ Mammary ducts join to form mammary ampulla connected to lactiferous duct
- ◆ Milk secreted by cells of alveoli, stored in the lumen of alveoli

### **GAMETOGENESIS**

The process of formation of gametes is called gametogenesis

It is of two types:

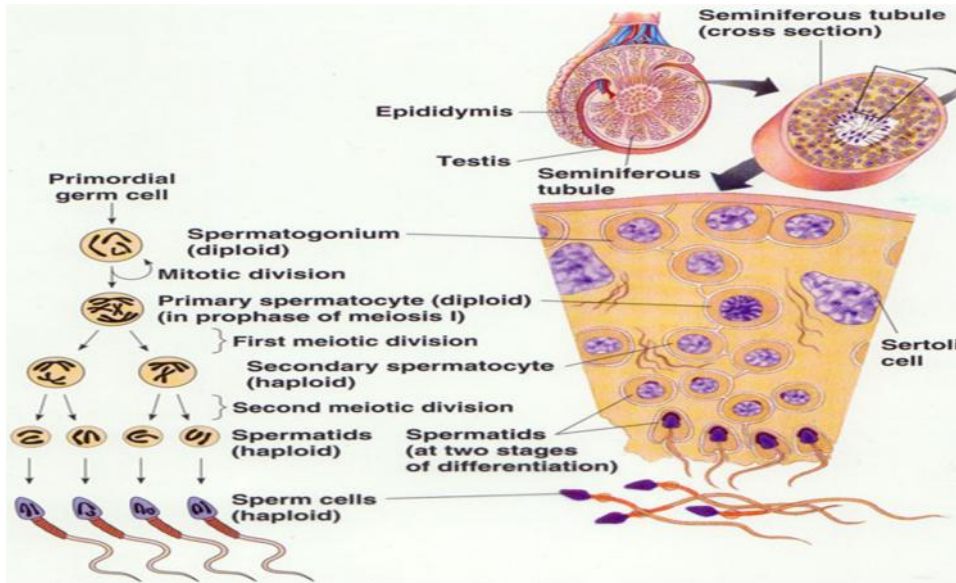
1. SPERMATOGENESIS IN MALES
2. OOGENESIS IN FEMALES

### **Spermatogenesis**

***The process of formation of sperms in males is called spermatogenesis***

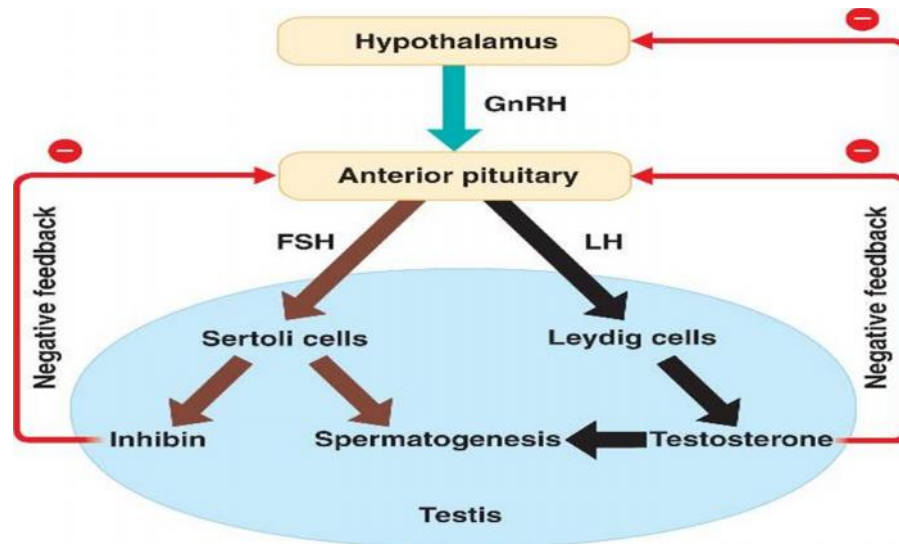
- ◆ The spermatogonia present on the inner wall of seminiferous tubules multiply by mitotic division.
- ◆ Some called primary spermatocytes undergo meiosis

- ◆ Primary spermatocytes complete 1<sup>st</sup> meiotic division, forms 2 equal haploid secondary spermatocytes
- ◆ Secondary spermatocytes undergo 2<sup>nd</sup> meiotic division to form 4 haploid spermatids
- ◆ Spermatids transform into spermatozoa (sperms)-spermiogenesis
- ◆ Sperm heads get embedded in sertoli cells, finally released from seminiferous tubules-spermiation



### Hormonal control of spermatogenesis

- ◆ Spermatogenesis initiated due to increase in secretion of gonadotropin releasing hormone by hypothalamus
- ◆ Increase in GnRH act on anterior pituitary and stimulate secretion of 2 gonadotropins, LH and FSH
- ◆ LH acts on Leydig cells and stimulates them to secrete androgens .
- ◆ FSH acts on Sertoli cells, stimulates secretion of some factors which help in spermiogenesis



### Structure of Sperm

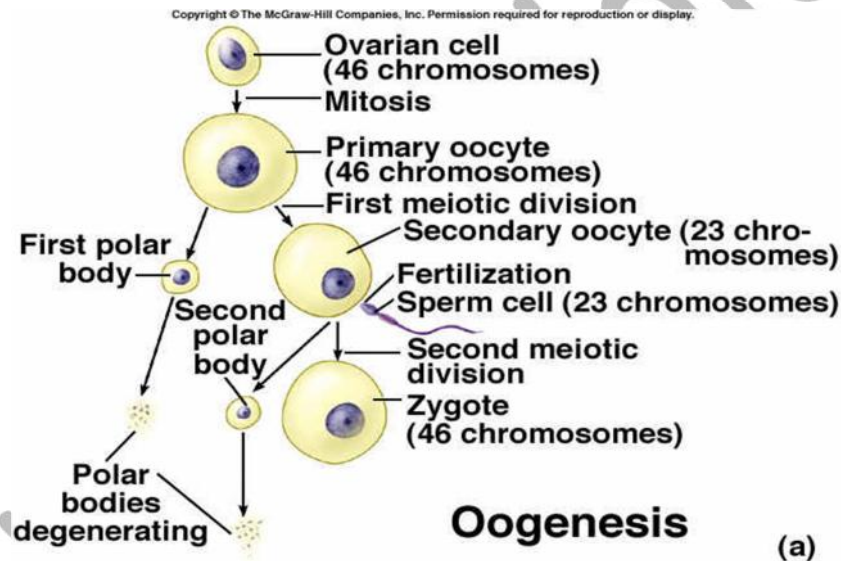
- Composed of head, neck, middle piece and a tail
- Plasma membrane envelopes the whole body of sperm
- Sperm head contains an elongated haploid nucleus, the anterior portion of which is covered a cap like structure, acrosome.
- Acrosome- filled with enzymes that help fertilisation of ovum
- Middle piece possesses numerous mitochondria-energy for movement of tail
- Sperms released from the seminiferous tubules are transported by the accessory ducts .
- Secretions of epididymis, vas deferens, seminal vesicle, prostate – essential for maturation and motility of sperms
- Semen – seminal plasma along with sperms
- Functions of male accessory glands controlled by testicular hormones (androgens)

### Oogenesis

***The process of formation of a mature female gamete is called oogenesis***

- Oogonia start division, enter into prophase I of meiosis-primary oocytes
- Each primary oocyte gets surrounded by a layer of granulosa cells-primary follicle
- Primary follicles gets surrounded by more layers of granulosa cells-secondary follicles

- Secondary follicle transforms into a tertiary follicle characterised by a fluid filled cavity called antrum
- The primary oocyte within the tertiary follicle grows in size, completes 1<sup>st</sup> meiotic division
- It results in unequal division, formation of large haploid secondary oocyte and tiny 1<sup>st</sup> polar body
- Tertiary follicle changes into graafian follicle
- Secondary oocyte forms a new membrane-zona pellucida
- Ovulation – graafian follicle ruptures to release the secondary oocyte (ovum) from the ovary



## Menstrual cycle

The cyclic changes that occur in the reproductive organs of primate females is called menstrual cycle

The events in a menstrual cycle can be studied under four phases

### ❖ Menstrual phase

- It lasts for 3-5 days
- It results due to breakdown of endometrial lining of uterus and its blood vessels



#### ❖ Follicular phase

- Endometrium is regenerated by proliferation of its cells
- These changes are due to increased levels of FSH , LH, Estrogen
- FSH controls follicular phase, stimulates growth of follicles , secretion of Estrogen
- FSH and LH reach their peak level in the middle of the cycle

#### ❖ Ovulatory phase

- Peak level of LH induces rupture of mature graafian follicle and release of ovum-ovulation

#### ❖ Luteal phase

- Ruptured follicle transforms into corpus luteum
- It secretes large quantities of progesterones

❖ In absence of fertilisation, corpus luteum degenerates. This causes disintegration of endometrium

❖ Menstrual cycle ceases at the age of 45-50- menopause

### **Fertilisation and Implantation**

The process of fusion of a sperm with an ovum is called fertilisation.

Fertilisation can only occur if the ovum and sperms are transported simultaneously to the ampullary – isthmic junction .

#### **Events during fertilisation :**

- ☐ Sperm comes in contact with zona pellucida
- ☐ Induces changes in membrane that block entry of additional sperms
- ☐ Secretions of acrosome help sperm enter the cytoplasm of ovum
- ☐ Meiotic division of secondary oocyte
- ☐ Haploid ovum and 2<sup>nd</sup> polar body formed
- ☐ Formation of zygote



## **Implantation**

- ☐ zygote moves towards uterus
- ☐ Blastomeres (2,4,8,16 daughter cells)
- ☐ morula (8-16 blastomeres)
- ☐ blastocyst
- ☐ Blastomeres in blastocyst arrange into an outer layer trophoblast and an inner group of cells attached to trophoblast
- ☐ Uterine cells rapidly divide and cover the blastocyst

Blastocyst gets embedded in endometrium of uterus (implantation)

## **Pregnancy and embryonic development**

- Inner layer grows out as finger like projections called villi into the uterine stroma
- Chorionic villi and uterine tissue get interdigitated to form placenta
- Placenta secretes hormones like hCG, hPL, estrogens, progesterones (to maintain pregnancy)
- Inner cell mass differentiates into an outer layer called ectoderm and an inner layer called endoderm
- Mesoderm appears between ectoderm and endoderm
- Stem cells

## **Features of embryonic development**

- The human pregnancy lasts for 9 months
- 1<sup>st</sup> month – embryo's heart is formed
- 2<sup>nd</sup> month – foetus develops limbs and digits
- 12 weeks (1<sup>st</sup> trimester) – major organ systems are formed
- 5<sup>th</sup> month – 1<sup>st</sup> movements of foetus and appearance of hair on head

- 24 weeks (2<sup>nd</sup> trimester) – body covered with fine hair, eye lids separate, eye lashes formed.

### **Parturition and Lactation**

- Gestation period – 9 months
- Parturition – the process of delivery of the foetus (childbirth)
- Signals for parturition originate from the fully developed fetus and placenta inducing mild uterine contractions called foetal ejection reflex
- It triggers the release of oxytocin from maternal anterior pituitary gland

Oxytocin acts on uterine muscle, causes stronger uterine contractions, which in turn stimulates further secretion of oxytocin

### **Lactation**

- The mammary glands undergo differentiation during pregnancy and starts producing milk towards the end of pregnancy by the process called lactation.
- The milk produced during the initial few days of lactation – colostrum
- It contains several antibodies essential to develop resistance for new-born.

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## **CHAPTER-4 REPRODUCTIVE HEALTH**

- WHO- WORLD HEALTH ORGANISATION have defined it as a total well-being in all aspects of reproduction i.e., physical, emotional, behavioural & social.

### **Reproductive health – problems and strategy:**

- India was among the 1<sup>st</sup> countries to initiate actions & plans to attain total reproductive health as a social goal.
- These programmes are called as 'FAMILY PLANNING'
- Improved programmes currently in operation have a popular name 'Reproductive & Child Health Care Programmes' (RCH)

### **HOW HAS THE GOVERNMENT TAKEN MEASURES???**

- Through the help of audio-visuals & print media.
- Even family members, close relations are involved in the awareness.
- Sex education was introduced in schools to provide awareness.
- Proper information about reproductive organs, adolescence & related changes, safe & hygienic sexual practices, sexually transmitted diseases, AIDS etc. would help people to understand much about these aspects.

### **Amniocentesis**

- It is a fetal sex determination test based on the chromosomal pattern in the amniotic fluid surrounding the developing embryo.
- How is it misused? - They are misused for sex determination of unborn child and increase female foeticides.

### **Population explosion & Birth control:**

- The world's population being 2 billion in 1900 was relocated to 6 billion in 2000.
- India's population was about 350 million during Independence & almost reached billion.
- A rapid decline in death rate, MMR & IMR as an increase in number of people in reproductive age are the reason for this.

### Why such population explosion?

MOST OF THE URBAN PEOPLE ARE UNEDUCATED.

GIRLS WERE GIVEN INTO EARLY MARRIAGE AT 18 YEARS OF AGE.

### CONTRACEPTIVE METHODS:

- Through media – HUM DO HAMARE DO!!!! (WE 2 , OURS 2)
- SAHELI - it is a contraceptive method developed by scientists in CDRI - Central Drug Research Institute.

### Contraceptive Methods:

- Natural methods
- Barriers
- I U Ds
- Oral contraceptives
- Injectable implants
- Surgical Methods

### 1.Natural Methods:

- *Avoids meeting of sperm & ovum.*
- **Periodic Abstinence**- *Avoids couples from coitus from day 10 – 17 of menses when ovulation is expected.*
- **Fertile Period**- *Chances of fertility is very high during this period*
- **Withdrawal or coitus interruptus** - *Male partner withdraws his penis from vagina before ejaculation avoiding insemination.*
- **Lactational amenorrhea**- *Absence of menstrual cycle during first six months of lactational period.*

### 2.Barrier Methods:

- Condoms -Thin rubber used to cover penis in male or vagina & cervix in females .

- Diaphragms, Cervical caps & vaults are all barriers for females to cover cervix during coitus.

#### ADVANTAGES OF BARRIER METHODS:

1. They are disposable.
2. They can be self –inserted.
3. They are reusable.
4. Prevents conception by blocking entry of sperm thru cervix.

#### INTRA UTERINE DEVICES (IUD'S):

- Devices inserted by doctors or nurses in uterus thru vagina.
- E.g. cu T, cu7, multiload 375, lippes loop.
- Cu ions released suppress sperm motility & fertilising capacity of sperms .
- Hormone releasing IUDs makes the uterus unsuitable for implantation & cervix hostile to the sperm .

#### ORAL PILLS:

- Pills are taken daily for 21 days.
- They are very effective with less side effects .
- Saheli - new oral contraceptive contains a non-steroidal preparation .
- It's a once a week ' pill with high contraceptive value.
- Injection or implantation of progesterone /estrogen under the skin.

#### SURGICAL METHOD:

- This method is also called as STERILISATION.
- It is advisable for male/female partner as a terminal method to prevent any more pregnancies.
- In male, they're called vasectomy, where the vas deferens is cut or tied .
- In female, its called tubectomy, where a small part of the fallopian tube is cut or tied up.
- This method is highly effective but their reversibility is very poor.

#### **Side effects of contraceptive method:**

- It is very important that the selection of contraceptive method should be taken under the consultation of the doctors.

- However, their possible ill-effects like nausea, abdominal pain, breakthrough bleeding, irregular menstrual bleeding or even breast cancer.
- These symptoms SHOULD NOT BE TOTALLY IGNORED.

### **WHAT IS MTP?**

INTENTIONAL OR VOLUNTARY TERMINATION OF PREGNANCY BEFORE FULL TERM IS CALLED MEDICAL TERMINATION OF PREGNANCY (MTP) OR INDUCED ABORTION.

### **WHY MTP?**

- MTP IS DONE TO GET RID OF UNWANTED PREGNANCIES DUE TO CASUAL UNPROTECTED INTERCOURSE OR FAILURE OF THE CONTRACEPTIVE USED DURING COITUS OR RAPE.
- MTPS ARE ALSO ESSENTIAL IN CERTAIN CASES WHERE CONTINUATION IN PREGNANCY COULD BE HARMFUL OR EVEN FATAL TO THE MOTHER OR TO THE FOETUS OR BOTH.

### **SEXUALLY TRANSMITTED DISEASES (STDs)**

DISEASES OR INFECTIONS WHICH ARE TRANSMITTED SEXUALLY THROUGH SEXUAL INTERCOURSE IS CALLED AS SEXUALLY TRANSMITTED DISEASES (STD) OR VENEREAL DISEASES (VD) OR REPRODUCTIVE TRACT INFECTIONS. STDs CAN BE CLASSIFIED AS VIRAL, BACTERIAL, PROTOZOAN, FUNGAL ETC.

### **HOW ARE STDs CAUSED?**

Depending on the disease, STDs can be spread with any type of sexual activity. STDs are most often caused by viruses and bacteria.

### **VARIOUS TYPES OF SEXUALLY TRANSMITTED DISEASES**

The various types of sexually transmitted diseases include gonorrhoea, syphilis, genital herpes, chancroid and of course the most common HIV leading to AIDS.

### **CHLAMYDIASIS**

- CHLAMYDIASIS IS A SEXUALLY TRANSMITTED DISEASE IN HUMANS CAUSED BY THE BACTERIUM CHLAMYDIA TRACHOMATIS. CHLAMYDIASIS IS A MAJOR INFECTIOUS CAUSE OF HUMAN GENITAL AND EYE DISEASES.
- CHLAMYDIASIS WAS ONCE THE MOST IMPORTANT CAUSE OF BLINDNESS. THE INFECTION CAN SPREAD FROM EYE TO EYE BY FINGERS, SHARED TOWELS, EYE SEEKING FLIES, AND CLOTHS ETC.

### **PREVENTION**

STDs are a major threat to a healthy society. Therefore early detection or prevention and cure of these Diseases are given prime consideration under Reproductive health-care programmes.

Though all people are vulnerable to these infections, their incidences are reported to be very high among the age group of 15-24years. These infections can be prevented by following a few simple rules which include:

- AVOID SEX WITH UNKNOWN PARTNERS OR MULTIPLE PARTNERS
- ALWAYS USE CONDOMS DURING COITUS
- IN CASE OF DOUBT, GO TO A QUALIFIED
- DOCTOR FOR EARLY DETECTION AND
- GET COMPLETE TREATMENT IF
- DIAGNOSED WITH DISEASE.

### **INFERTILITY**

A large no of couples all over India are infertile, i.e., they are unable to produce children in spite of Unprotected sexual co-habitation. The reasons for this could be many-physical, congenital, diseases, drugs, Immunological or even psychological.

**Assisted Reproductive Technologies (ART) are special techniques that assist couples to have children.**

### **VARIOUS TYPES OF ASSISTED REPRODUCTIVE TECHNOLOGIES (ART) INCLUDE:**

- IN-VITRO FERTILISATION (IVF)
- INTRA CYTOPLASMIC SPERM INJECTION(ICSI)
- GAMETE INTRA FALLOPIAN TRANSFER(GIFT)
- ARTIFICIAL INSEMINATION (AI)

### **In Vitro Fertilisation (IVF)**

FERTILISATION OUTSIDE THE BODY IN SIMILAR ALMOST SIMILAR CONDITIONS AS THAT IN THE BODY. IN THIS METHOD, POPULARLY KNOWN AS TEST TUBE BABY PROGRAMME, OVA FROM THE WIFE / DONOR (FEMALE) AND SPERMS FROM THE HUSBAND / DONOR (MALE) ARE COLLECTED AND ARE INDUCED TO FORM THE ZYGOTE UNDER SIMULATED CONDITIONS IN THE LAB. THE ZYGOTE OR EARLY EMBRYOS COULD THEN BE TRANSFERRED INTO THE FALLOPIAN TUBE (ZIFT-ZYGOTE INTRA FALLOPIAN TRANSFER)

### **INTRA CYTOPLASMIC SPERM INJECTION(ICSI)**

INTRA CYTOPLASMIC SPERM INJECTION (ICSI) IS ANOTHER SPICALIZED PROCEDURE TO FORM AN EMBRYO IN THE LAB IN WHICH A SPERM IS DIRECTLY INJECTED INTO THE OVUM.

### **GAMETE INTRA FALLOPIAN TUBE (GIFT)**

TRANSFER OF AN OVUM COLLECTED FROMA DONOR INTO THE FALLOPIAN TUBE OF ANOTHER FEMALE WHO CANNOT PRODUCE ONE,BUT CAN PROVIDE SUITABLE ENVIRONMENT FOR FERTILISATION ABD FURTHER DEVELOPMENT IS ANOTHER METHOD ATTEMPTED.

### **Artificial Insemination (AI)**

INFERTILITY CASES EITHER DUE TO INABILITY OF THE MALE PARTNER TO INSEMINATE THE FEMALE OR DUE TO VERY LOW SPERMS COUNTS IN THE EJACULATES COULD BE CORRECTED BY ARTIFICIAL INSEMINATION.

IN THIS TECHNIQUE, THE SEMEN COLLECTED EITHER FROM THE HUSBAND OR A HEALTHY DONOR IS ARTIFICALLY INTRODUCED INTO THE VAGINA OR INTO THE UTERUS (IUI - INTRA UTERINE INSEMINATION) OF THE FEMALE.

ADOPTION – can be done from orphanage / relatives.

### **Counseling and information on infertility**

It is important to involve both partners in all aspects of management. Discussions of wishes, plans, beliefs and motives are important.

Counselling should be made available to all infertile couples.

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