18. Human Reproduction

Asexual Reproduction

Life span

- It is the period between the birth and natural death of an organism.

Reproduction

- It is a biological process through which living organisms produce offspring that are similar to themselves. Reproduction is of two types: sexual and asexual.

Asexual reproduction

- It requires only one parent; thus, it does not involve the fusion of gametes.
- Offspring produced are exact copies of their parents.
- Clones are morphologically and genetically similar individuals.
- **Binary fission** is a mode of asexual reproduction where a single cell is halved. Example: *Amoeba* and *Paramecium*
- Fragmentation is a mode of asexual reproduction seen in *Spirogyra*.

Organisms and their reproductive structures

Organisms	Asexual reproductive structures
Hydra and yeast	Buds
Chlamydomonas	Zoospores
Penicillium	Conidia
Sponge like *Sycon*	Gemmules

Vegetative propagation

- This term is used for asexual reproduction in plants.
- It is the ability of plants to reproduce by producing new plants from vegetative propagules such as runners, rhizome, sucker, tuber, offset and bulb.

Vegetative propagules	Examples
Eyes	Potato
Rhizome	Ginger
Bulbil	*Agave*
Leaf buds	*Bryophyllum*
Offset	Water hyacinth

Male and Female Reproductive Systems

- Reproductive events in humans –

Gametogenesis → Insemination → Fertilisation → Implantation → Gestation → Parturition

- **Male reproductive system:** It includes

1. A pair of testes
2. Accessory glands and ducts
3. External genitalia

- Testes are located outside the abdominal cavity, within the scrotum.
- Scrotum acts as temperature regulator.
- Testes contain seminiferous tubules that contain two types of cells.

1. Spermatogonia (male sperm cell)
2. Sertoli cells, which provide nutrition to spermatids (sperm)

- Outside seminiferous tubules, there are Leydig cells. Leydig cells are also known as interstitial cells. They secrete the male hormone, testosterone.
- **Male sex accessory ducts are**

1. Rete testis
2. Vasa efferentia
3. Epididymis
4. Vas deferens

- Male external genitalia include the penis. It facilitates insemination.
- **Male accessory glands are**

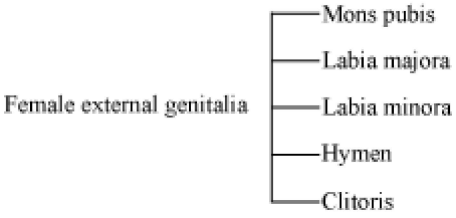
1. Seminal vesicles
2. Prostate gland
3. Bulbourethral gland

- **Female reproductive system**: It consists of

1. A pair of ovaries
2. A pair of oviducts (fallopian tube)
3. Uterus
4. Vagina
5. External genitalia
6. A pair of mammary glands

- Female accessory ducts are oviduct, uterus and vagina.
- The fallopian tube is divided into isthmus, amphulla and infundibulum.

Uterus has three layers
- Perimetrium
- Myometrium
- Endometrium

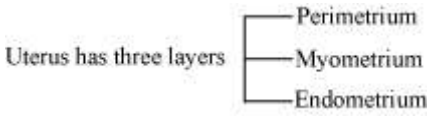


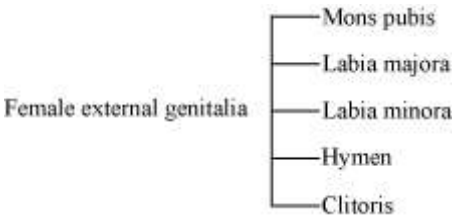
Structure and Function of Female Reproductive System

Female reproductive system: Consists of

1. A pair of ovaries
2. A pair of oviducts (fallopian tube)
3. Uterus
4. Vagina
5. External genitalia
6. A pair of mammary glands

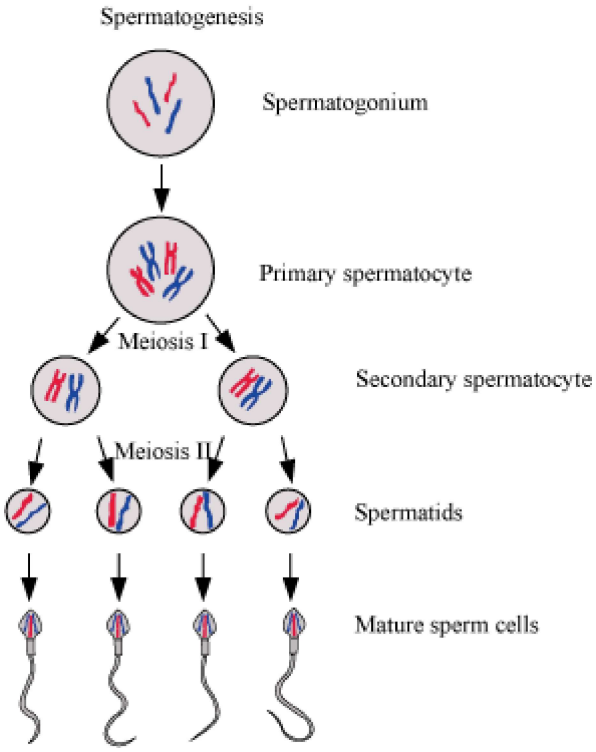
- Female accessory ducts are oviduct, uterus and vagina.
- The fallopian tube is divided into isthmus, ampulla and infundibulum.
- Ovaries are the primary female sex organ. The ovarian stroma is made up of peripheral cortex and inner medulla.



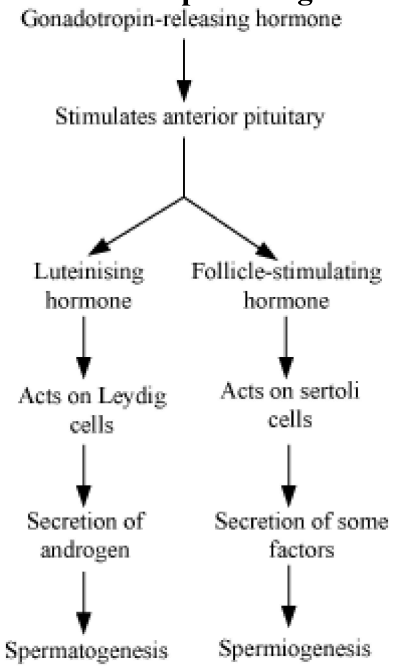


Gametogenesis

- It involves the formation of the male and female gametes in the male and female genital organs respectively. It involves two processes: spermatogenesis and oogenesis.
    - **Spermatogenesis**
        - It is the process of formation of the haploid sperm from the diploid spermatogonia.



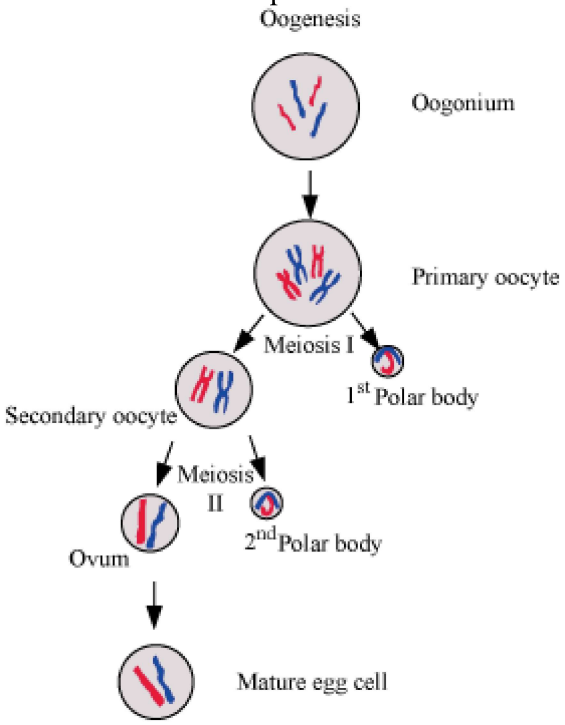
- **Spermiogenesis:** It is the process of transformation of the spermatids into the matured spermatozoa or sperm cell.
- **Spermiation:** It is the process of release of the matured spermatozoa into the lumen of the seminiferous tubules.
- **Hormones involved in spermatogenesis are : –**



- Sperm is made up of three parts –
  - **Head:** Anterior portion is covered by the acrosome (cap-like structure), which helps in the fertilisation of the ovum.
  - **Middle piece:** Contains the mitochondria and provides energy
  - **Tail:** Helps in the movement of the sperm

- **Oogenesis**

- It is the process of formation of the haploid ovum from the diploid oogonium.



- **Various stages of primary oocyte –**

  Primary follicle → Secondary follicle → Tertiary follicle → Matured Graafian follicle

- **Ovulation:** Process of release of the ovum from the ovary

Menstrual cycle

- **Menarche:** First occurrence of menstruation at puberty
- **Menopause**: End of the menstrual cycle, at around 50 years of age
- Events during the menstrual cycle –
  - **Menstruation phase:** It involves the process of menstruation. If the egg does not get fertilised, the endometrium breaks down and is released out from the vagina in the form of blood.
  - Follicular/proliferative phase: It involves increase in levels of FSH and LH hormones.
    - Release of the FSH hormone stimulates the primary follicle to change into the matured Graafian follicle.
    - Release of the LH hormone induces release of the ovum.
  - **Ovulatory phase:** It is characterised by ovulation or release of the ovum from the Graafian follicle due to high level of LH hormone.

- Luteal phase: It is characterised by the rupture of the Graafian follicle in the corpus luteum.

- In the absence of fertilisation, the corpus luteum degenerates.
- The corpus luteum secretes progesterone.
- Progesterone is important during pregnancy as it prepares the endometrial wall of the uterus for implantation.

Fertilisation and implantation

- Fertilisation takes place in the ampullary–isthmic junction.
- Binding of the sperm with the zona pellucida layer of the ovum changes the membrane permeability and blocks the entry of any other sperm.
- Sex of the baby is determined by the type of the male gamete (X or Y) that fuses with the female gamete (X).
- A diploid zygote undergoes several mitotic divisions to form the blastocyst.

Zygote →Blastula →Morula (8 to 16 cell stages) →Blastocyst

- The blastocyst is implanted in the endometrium of the uterus.

- **Pregnancy**
- After implantation, the trophoblast forms finger-like projections called chorionic villi, surrounded by the uterine tissue and maternal blood.
- The chorionic villi and the uterine tissue get integrated to form the placenta.
- **Placenta:** It is the structural and functional unit between the embryo and the maternal body. It is connected to the embryo through the umbilical cord.**Placenta** acts as a permeable membrane and allows diffusion of substances through it. Moreover it does not allow the germs to pass through.
- Substances that passes through placenta:
- From Mother to Foetus
  - Oxygen
  - Nutrients(gucose, amino acids, vitamins, mineral ions)
- From Foetus to Mother
  - CO_2
  - Urea and other wastes

- **Functions of the placenta:**

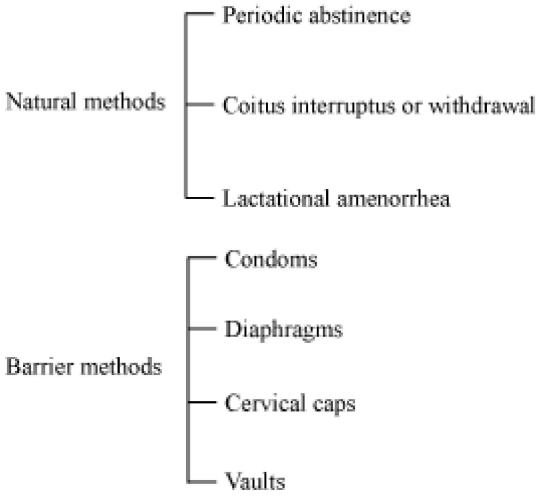
  - Umbilical cord helps in transportation of substances between the mother and the foetus.
  - Provides nutrients to the embryo
  - Removes waste products produced by the foetus
  - It releases several hormones that are essential for pregnancy –
    -

    - Human chorionic gonadotropin (hCG).
    - Human placental lactogen (hPL)
    - Oestrogens
    - Progestogens
- Relaxin is secreted by the ovary.
- Relaxin, hCG and hPL are released only during pregnancy.
- After nine months of pregnancy, the foetus is ready for delivery.
- **Parturition:** It is the process of expulsion of the full term foetus out of the uterus. It is induced by the hormone oxytocin.
- **Lactation:** It the process of producing milk after the birth of the baby. The hormone involved in lactation is prolactin.

Reproductive Health and Population Explosion

- Reproductive health refers to the total well being in all aspects of reproduction – physical, emotional, behavioural and social.
- Aspects of reproductive and child health care (RCH):
    - Creating awareness among people regarding reproductive organs, adolescence and sexually transmitted diseases (STDs).
    - Provision of medical facilities and care regarding problems like pregnancy, abortions, infertility, menstrual cycle, etc.
- Population of our country is increasing exponentially. A decreased death rate, maternal mortality rate and infant mortality rate are the probable causes for the population explosion.
- Amniocentesis (foetal sex determination) has been banned to check female foeticide.

- **Need for adopting control measures as it creates a lot of problems:**
- Per capita income is decreasing
- Health of population is affected
- Over utilisation of natural resouces
- **Contraceptive methods include**



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    - **Intrauterine devices:** Non-medicated IUDs (e.g., Lippes loop), Copper-releasing IUDs (e.g., CuT, Cu7), and hormone-releasing IUDs (e.g., LNG 20).
    - **Oral administration:** Mainly used in the form of pills. Example: saheli
    - **Sterilisation technique:** It includes surgical methods.
    - **Tubectomy:** It involves the cutting and tying of the fallopian tube in females.
    - **Vasectomy:** It involves the cutting and tying of the vas deferens in males.

- It is essential to educate the people about populatiuon explosion and its adverse effects by creating awareness and educating people about advantages of small families.

- **Medical termination of pregnancy (MTP)**
    - It is the voluntary termination of pregnancy during the first trimester.
    - Also known as induced abortion
    - Advantage of MTP: Helps to get rid of unwanted pregnancies
    - Disadvantage: Misuse of amniocentesis to determine the sex of the baby, which is then followed by MTP, if it is female
- **Sexually transmitted diseases (STDs)**
    - Diseases transmitted through sexual intercourse are known as sexually transmitted diseases.
    - Example: gonorrhoea, syphilis, chlamydiasis, trichomoniasis, AIDS.
- **Prevention of STD:**
    - Safe sexual intercourse
    - Early detection and control

Infertility

- Inability of the female uterus to conceive baby, even after unprotected coitus.
- For the treatment of infertility, couples adopt certain techniques which are known as **assisted reproductive technologies**.They include –

1. **In vitro fertilisation:** It is the process where the fusion of the egg occurs outside the mother's womb.
2. **Test tube baby:** It involves in vitro fertilisation of the ovum, followed by embryo transfer in the uterus of the mother for further development of the embryo.
3. **Gamete intra-fallopian transfer (GIFT):** It involves the transfer of the ovum from a donor into the fallopian tube of the recipient.
4. **Zygote intra-fallopian transfer (ZIFT):** It involves the transfer of the zygote (at the stage up to 8 blastomeres) into the fallopian tube of the recipient.
5. **Intra-uterine transfer:** It involves the transfer of the zygote (at the stage of more than 8 blastomeres) into the uterus of the recipient for further development.
6. **Intra-cytoplasmic sperm injection (ICSI):** It involves the injection of the sperm directly into the ovum.
7. **Intra-uterine insemination:** It is the method of introducing the semen from a healthy donor into the uterus of the recipient.