



# NEET - UG

NATIONAL TESTING AGENCY

## Zoology - 1



# NEET - UG

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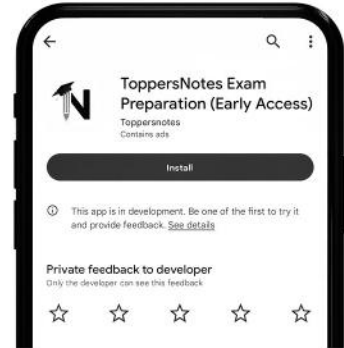
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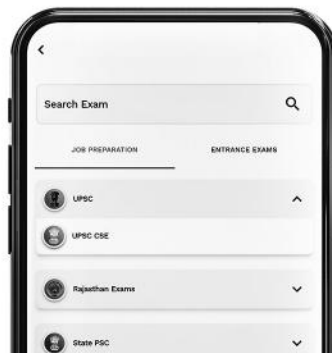
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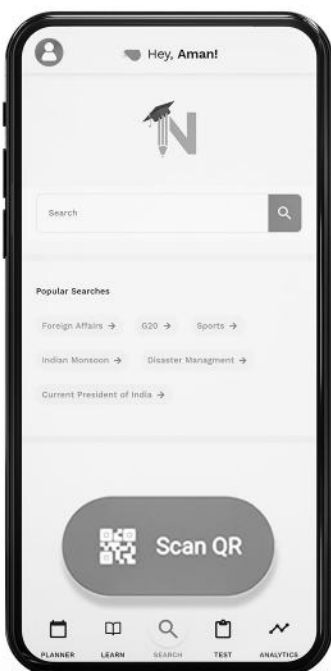
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# Human Reproduction

## CHAPTER OUTLINE

- Events in Human Reproduction
- Male Reproductive System
- Gametogenesis- Spermatogenesis and Oogenesis
- Fertilisation
- Pregnancy and Embryo Development
- Lactation
- Sexual Organ
- Female Reproductive System
- Menstrual Cycle
- Implantation
- Parturition
- Types of Egg

### INTRODUCTION

- Ability to produce offsprings similar to them or to self-reproduce

**Importance:**

- Reproduction is essential for continuity of species.
- Variation among the species.

### HUMAN

- Sexual dimorphism in human beings.



Externally male and female individuals are different

### Development Period

#### Embryonic/prenatal (natal = birth)

- In human being, this period is passed /spent in Mother's womb (Uterus).
- Includes events from formation of embryo to time of birth.

#### Post- embryonic / postnatal

- Period passed outside mother's womb.
- Includes events from birth to death of the individuals.

### EVENTS IN HUMAN REPRODUCTION

**Gametogenesis:** Gametes formation



**Spermatogenesis:** Sperm formation



**Oogenesis:** Egg formation



**Insemination:** Transfer of sperm by male into female genital tract



**Fertilisation:** Fusion of male and female gametes



**Zygote:** Single cell stage



**Cleavage:** Rapid mitotic divisions of zygote (Which converts single celled zygote into multi-cellular)



**Implantation:** Attachment of blastocyst to uterine wall



**Placentation:** Formation of placenta



**Gastrulation :** Process by which blastocyst gets converted to Gastrula



**Organogenesis:** Formation of specific tissue, organ, organ system from 3 germ layers



**Parturition (Child Birth):** Delivery of the baby

## SEXUAL ORGAN

Primary Sexual Organs	Secondary Sexual Organs
<ul style="list-style-type: none"> <li>• Organs which produces gametes and secretes sexual hormone</li> <li><u>Examples:</u> Gonads, Testis and Ovary</li> <li>Note: Development of primary sex organ depends on sex chromosome i.e. X and Y -Testis, X and X -Ovary</li> </ul>	<ul style="list-style-type: none"> <li>• Organ which help in reproduction but do not produce gametes or sex hormone</li> <li><u>Examples:</u> Male genital tract, female genital tract, Male accessory gland, female accessory gland</li> <li>• Development of 2° sexual organ depends upon sex hormone</li> </ul>

### Examples:

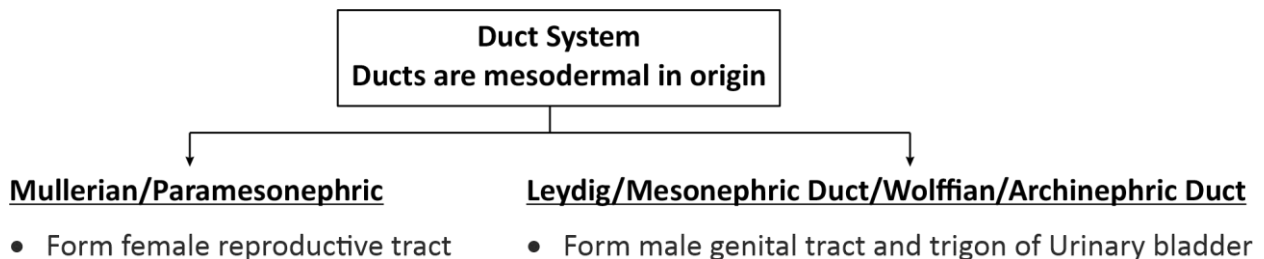
- **Body hair** → Facial hair in males.
- **Fat distribution** → Women > Males, in thighs & hips.
- **Muscle mass** → Men > Women (40%, 30%)
- **Pitch of voice** → Women > Men (women have short vocal cord)
- **Mammary gland** (sex organ) → in females
- **Breathing pattern** → Prothoracic in female Abdominal in male
- **Pattern of pelvic girdle** → Male - V shaped pubic arch  
Female - Wider pubic arch
- **Shoulder** → Broad in males

**Note:** Capacitation refers to the changes the sperm undergoes before fertilization. It occurs in female reproductive tract.

**(2015, 2017)**

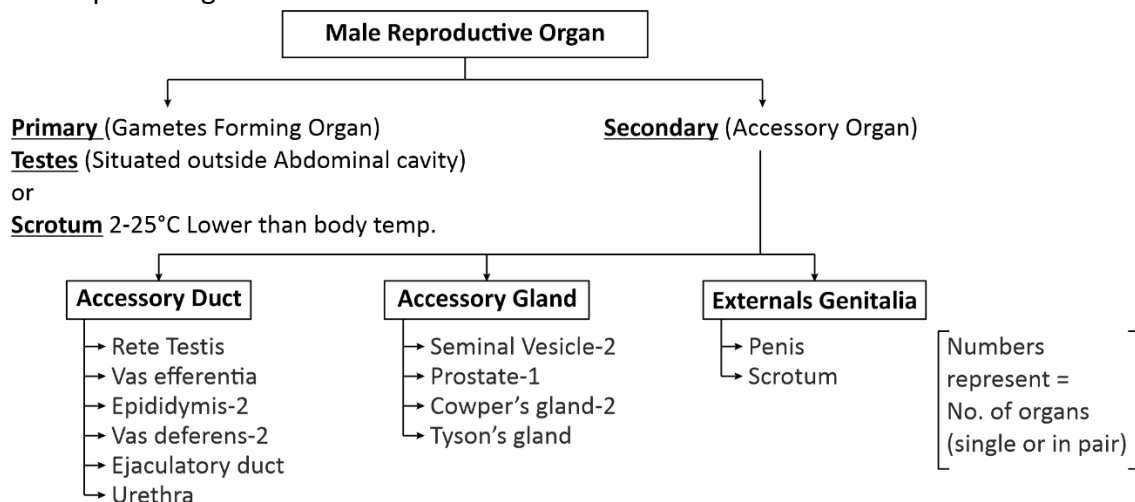
### External Sexual Character:

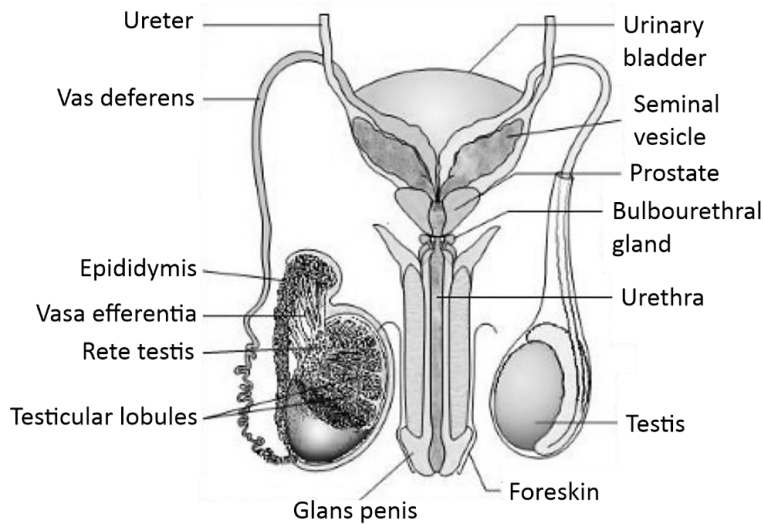
- Characters which differentiate male and female are termed as external sexual characters.



## THE MALE REPRODUCTIVE SYSTEM

- Located in pelvis region





Labelling type question. (2009)

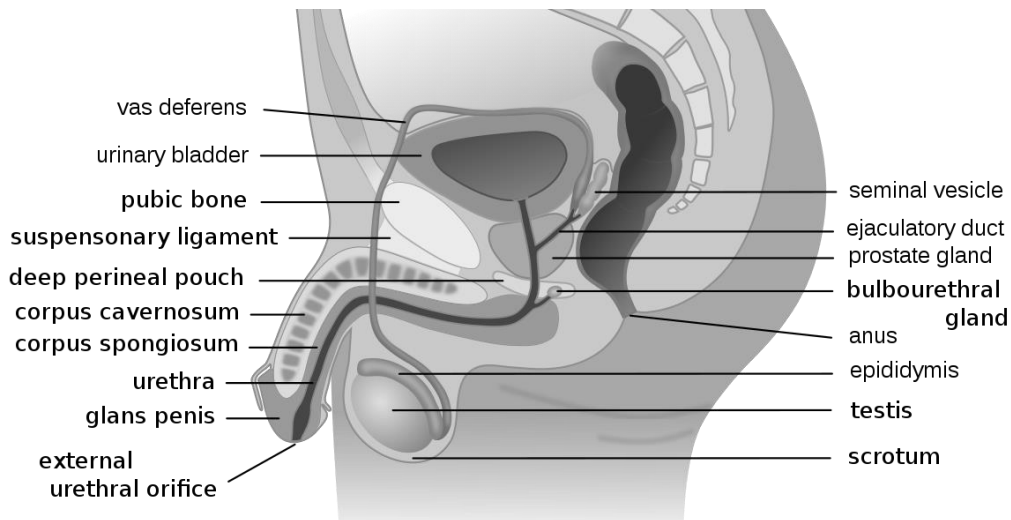


Figure: Male Reproductive system

### Primary Sex Organs: Testis

- **One Pair** → 2 in number
- **Mesodermal** → Origin
- **Situated** → Outside abdominal cavity → within pouch called-**scrotum**.
- **Scrotum** → To maintain 2-2.5°C less than body temperature for normal spermatogenesis
- **Development** → Testis develop in abdominal cavity, but in 7th month, it descends into scrotum through inguinal canal → under the influence of testosterone.
- In adults, each testis is
  - Oval in shape

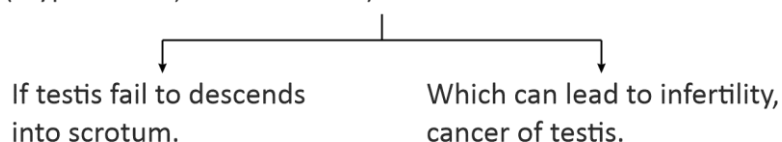
- Length of about 4 to 5 cm
- Width of about 2 to 3 cm
- The testis is covered by a dense covering.
- Each testis has about 250 compartments called **testicular lobules**.

#### Important concepts

- Animals in which testis always remains in abdominal cavity  
**Examples:** Cetacean, Elephant, Prototheria, dolphin, whales.
- Animals in which testis descends into scrotum during only breeding seasons  
**Examples:** Rodent (Rat), Chiroptera (Bat)

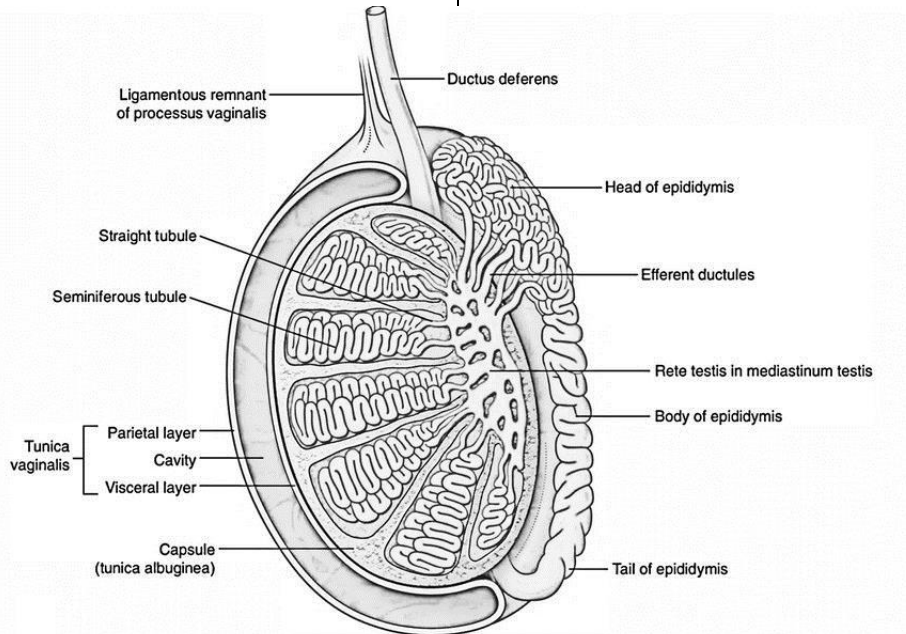
#### **Cryptorchidism**

(crypt-hidden, orchid = testis) → Failure of testis to descend



- **Orchiopexy** : Surgical transfer of testis into scrotum from abdominal cavity.
- **Castration**: Destruction of testis to make aggressive animal calm and obedient.
- **Orchiectomy**: Surgical removal of one or both testis.
- **Orchitis**: Inflammation of testis which can occur in mumps/bacterial infection.

- **Hernia**: Protrusion of viscous (soft tissue) through orifice  
**For ex. inguinal hernia**-intestine protrudes into Scrotum.  
 Wall of testis consist of following –  
 Protective layer:  
 A. T. vaginalis  
 B. T. Albuginea/fibrosa  
 C. Tunica Vasculosa



**A. Tunica Vaginalis:**

- Outer most double layer
- Collection of fluid or blood in T. Vaginalis.

**B. Tunica Albuginea-Middle Layer/Tunica fibrosa**

- Which divides testis into 250 compartments called testicular lobules
- Each testicular lobule contains 1-3 seminiferous tubule that produce sperms.
- Each testis contain 750 seminiferous tubules.

**C. Tunica Vasculosa:**

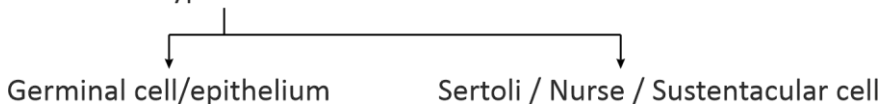
- Highly vascularised **inner most** layer

- Testis remain suspended into scrotum with the help of spermatic cord which connect testis to abdominal cavity.
- Spermatic cord consists of:
  - Vas deferens
  - Gonadal artery
  - Vein Lymphatic + Nerves
  - Cremaster muscle

**Seminiferous Tubules:**

- Each lobule contains one to three highly coiled seminiferous tubule in which sperms are produced.
- Around **750 seminiferous tubules** in each testis which was considered as unit of Reproductive system

- It contain 2 type of cells



**A. Germinal Cell/Epithelium (Single Layered):**

- **Simple cuboidal** cell-Male germ cell → undergo meiosis (SPERMATOGONIA) → Produce sperm

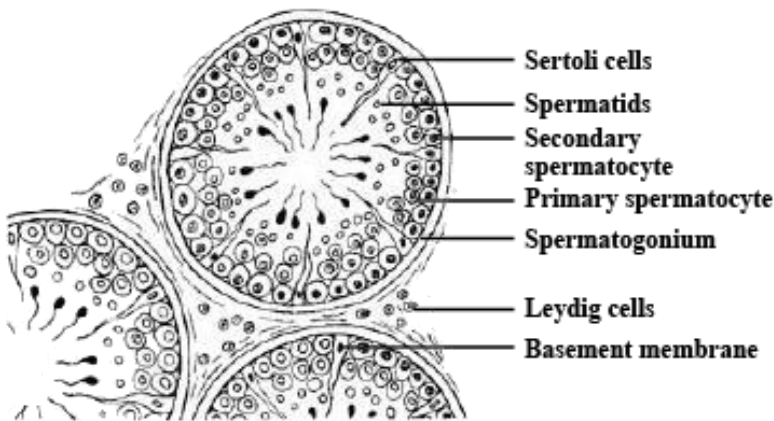
**B. Sertoli/Sustentacular/Nurse Cell: Columnar Cell (2006/2010)**

**Functions:**

1. Sertoli cell supports developing germ cell.
2. Provide nutrition to developing spermatids. **(2010)**
3. Involved in phagocytosis of dead cells.
4. It secretes ABP (Androgen binding protein), that maintain normal

testosterone concentration in seminiferous tubule.

5. Secrete **INHIBIN HORMONE (IH)** that suppresses FSH secretion. **(2016)**
6. It produces **Blood Testis Barrier (BTB)**. Because sperm being the haploid cells are immune non competent cell.
7. Secrete factor essential for **spermatogenesis**.
8. Secrete MRF (**Mullerian Regression Factor**) or MIS (**Mullerian Inhibitory Substance**).



**Note:**  
Sertoli cells are regulated by a pituitary hormone known as FSH **(2006)**

**Note:**

- In female, inhibin hormone is secreted by granulosa cells
- MIS - Mullerian inhibitory substance plays a role to destroy Mullerian duct

- So if embryo is male then Mullerian duct is destroyed by MRF secreted by sertoli cells.

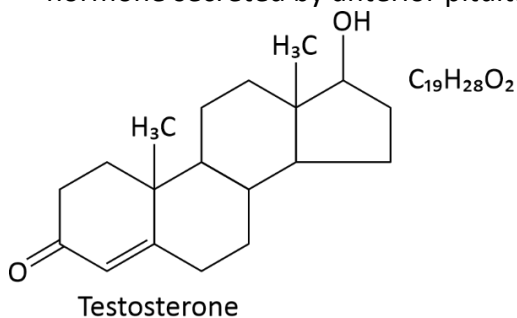
**C. Leydig's Cell or Interstitial Cells-Endocrine Part of Testis:**

- Present around the S tubule in connective tissue.
- Secrete: Androgen-eg. Testosterone and DHT. **(2012)** (Di-hydroxy testosterone) or Male sex hormone.
- Under the influence of Luteinizing hormone /interstitial cell stimulating hormone secreted by anterior pituitary.

**Testosterone** (19 carbons structure) Derived from steroid.

**Function of Testosterone Hormone:**

- Responsible for transfer of testis in scrotum.
- Spermatogenesis after puberty.
- Development of secondary sexual character at the age of puberty which includes:
  - Development of beard, moustache
  - Broadening of shoulder
  - Deepening of voice
  - Aggressive nature
  - Musculature
- Promote Ca<sup>+2</sup> deposition in bones.
- Promote cholesterol deposition in blood vessel which can lead to atherosclerosis or CAD (Coronary artery disease) more in male than female, as estrogen inhibits it.
- Promote protein anabolism and healing.
- Can cause baldness.
- Highest **thermogenic** effect.





**Question: Which hormone can be used in female contraceptive pills**

- (i) Estrogen                      (ii) Progesterone  
 (iii) Testosterone              (iv) Estradiol

**Ans. (i)**

**Accessory Gland**

- A. Seminal vesicle- 1 pair  
 B. A Prostate gland  
 C. Bulbourethral Gland- 1 pair / Cowper's gland.

- Their secretion is **Seminal Plasma**
- **Contains:** Fructose, Prostaglandin, citric acid, Ca<sup>2+</sup>, and certain enzymes.

**(2009, 2010)**

- Semen: Seminal plasma (40%) + sperm (10% vas deferens) **(2010)**

**A. Seminal Vesicle:**

One pair

- It is misnomer (name does not fit its function): i.e. it does not store sperm.
- Situated behind urinary bladders in front of rectum.
- It accounts for 60-70% of semen.

**Its secretion**

1. **Fructose:** Provide nutrition to sperm.

**Note:**  
 Seminal vesicle is **only gland of body which secretes fructose**, so in **rape cases**, presence of fructose is detected in female genitalia.

2. **Prostaglandin:** Local hormone causes contraction of smooth muscle in female genital tract so, sperm can reach to ovum.
3. **Citrate:** Directly used in aerobic sperm nutrition.
4. Ca<sup>++</sup>: Sperm motility.
5. Inositol
6. **Clotting Factor (Fibrinogen):** Form clots of semen to adhere in female genital-tract.

**B. Prostate Gland:**

- Chestnut sized, walnut or golf ball shaped.
- One in number-collection of 30-40 tubules-alveolar glands.
- Lies at the base of bladder, Surrounds the first part of Urethra.
- Its secretion accounts for 25-30% of semen.
- Specific milky white color and odour of semen due to prostate gland's secretion.

**Note :**  
**Prostatitis** → Inflammation of prostate gland

- Its secretion contain: - Ca<sup>++</sup>, Zn, Citric Acid, Fibrinolysin, proteolytic enzyme.
- Fibrinolysin: Causes release of sperm by dissolving the sperm clot as semen when deposited in female genital tract.

**C. Cowper's Gland or Bulbourethral Gland:**

- Pea sized, laying adjacent to urethra at the base of penis
- Its secretion is part of pre ejaculation (alkaline in nature) which release before ejaculation/emission. (5% semen).
- and neutralizes the activity of urethra.
- Functions as lubrication of the penis.

**Note:** Sperm is active in alkaline medium

- Inactive in **neutral medium**
- Dead in acidic medium
- pH of female genital tract is **acidic**.

**Accessory Duct**

Accessory duct includes

- (1) Rete testis
- (2) Vasa efferentia
- (3) Epididymis
- (4) Vas deferens
- (5) Ejaculatory duct

### 1. Rete Testis: (Tubuli Recti)

- Ducts situated in testis (Intra testicular)
- All seminiferous tubules first opens into tubuli recti, which ultimately open into rete testis
- **Function:** It causes forward movement of sperm and transfer sperm from seminiferous tubules into vas efferentia.

### 2. Vasa Efferentia (Ductuli Efferentia): (2011)

- 10-12 small ducts arise from rete testis
- It transfers sperm from rete testis to epididymis
- Vasa efferentia leaves testis and open into epididymis located along posterior surface of each testis.

**Note:**

Intra testicular duct system	Extra testicular duct System
Includes: Tubules Recta, Rete testis and Vas efferentia (Ductuli efferentia)	it consist of tubes which conduct sperm <b>from testis to the outside</b>

### 3. Epididymis:

- 10-12 vasa efferentia combined to form folded and coiled tube structure.
- Length-6 meter (20 feet), highly coiled structure.
- Consists of 3 part:
  - (i) **Caput or Head or Globus Major:** Initial part
  - (ii) **Body or Globus Normal:** Middle part.
  - (iii) **Tail or Caudal or Globus Minus:** gives rise to vas deferens
- The epididymis leads to vas deferens that ascends to the abdomen and loops over the urinary bladder.
- It receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct.
- These ducts store and transport the sperms from the testis to the outside through urethra.

- The urethra originates from the urinary bladder and extends through the penis to its external opening called **urethral meatus**.

**Note:**

If for some reason, vasa efferentia get blocked, the gamete will not be transported from testis to epididymis. **(2011)**

**Functions:**

- Temporary storage of sperm up to one month. → mature: **Capacitation**
- Transfer of sperm from vasa efferentia → Vas deferens.
- **Functional maturation of sperm take place in it**, in which activation of **CETSPER protein** present in tail, so tail wagging movement starts.
- Sperm transferred from S. tubules in epididymis by rhythmic contraction of smooth muscle present in rete testis and vasa efferentia.

**Note:**

In frogs, vas deferens is absent & sperms pass through bidder's canal

### 4. Vas Deferens:

- Partially coiled tubes
- 45 cm long tube which **comes out into abdominal cavity, through inguinal canal**
- Vas deferens fuses with duct of seminal to form ejaculatory duct.
- Contains dilated part called **ampulla** where sperms are stored.

**Note:**

After **vasectomy** up to two month sperm can release from this ampulla, that's because vasectomy does not provide immediate benefits of contraception

### 5. Ejaculatory Duct:

- Small duct which get opened into urethra
- Two tube each formed by union of duct from seminal vesicle and vas deferens.
- Passes through prostate and empties in urethra.

**Urethra:**

1. In male, it is called **urinogenital duct:** (Provides common pathway for urine and semen) (2014)
2. Get opened outside the body through urethral meatus situated at glans penis

3. It is divided into 3 parts :-

**A. Prostatic Urethra:**

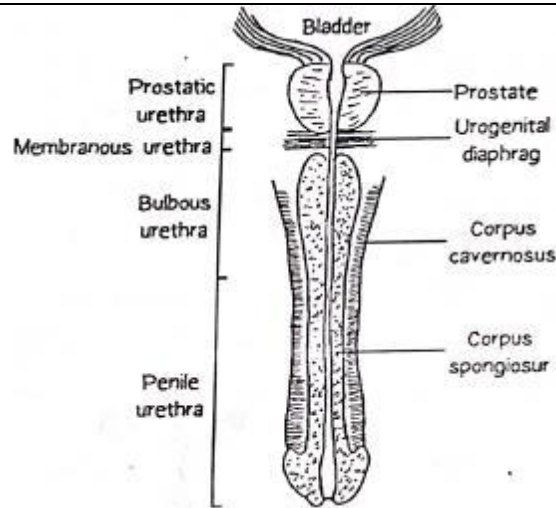
- 3-4 cm long
- Surrounded by prostate gland

**B. Membranous Urethra:**

- Smallest part
- 1 to 1.5 cm in length
- Cowper's gland open in this

**C. Penile or Spongy Urethra:**

- Longest part 12-14 cm
- Situated in corpora/ corpus spongiosum of penis



**External Genitalia:**

Consists: Scrotum and Penis

**A. Scrotum:**

- Pouch-like structure situated outside lower abdominal part.
- Testis are situated in Scrotum.
- Scrotum involved in **thermoregulation** of testis for spermatogenesis. (2011)
- **During summer** – Cremaster and Dart muscle remain relaxed and temperature

of testis is lowered by counter heat exchange.

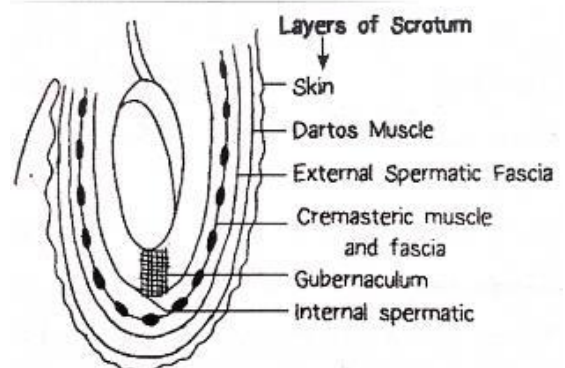
• **During winter –**

- **Contraction of Dartos Muscle** increases wrinkle in scrotum, reducing surface area for heat.
- **Contraction of Cremaster muscle** causes elevation of testis, comes near abdominal cavity thus temperature of testis in maintained.

**(Important)** Its wall having 5 layers: **Skin, Dartos, Ext. Spermatic fascia, cremaster muscle and internal spermatic fascia.**

- Tricks to remember: Some Desi Engineer created it.

**Some** = Skin, **Desi** = Dartos, **Engineer** = External spermatic fascia, **Created** = Cremaster muscle, **It** = Internal spermatic fascia.



**Note : Gubernaculum :** Thick fibrous cord that connect testis to scrotum

- Two lobes of scrotum is connected through Raphae.

## B. Penis:

Male copulatory organ

- It is made up of special tissue that helps in erection of the penis to facilitate insemination.
- The enlarged end of penis called the **glans penis** is covered by a loose fold of skin called **foreskin**.
- Consist of 3 erectile columns of tissue:
  - 2 situated at – Dorso – lateral region → Called - **corpora cavernosa** (Paired)
  - 1 situated at – ventro – medial part → Called **corpora /corpus spongiosum** → Surrounds urethra.
- These erectile tissues are separated by **Tunica Albuginea**
- Terminal dilated part called **glans penis**, consists of **corpus spongiosum**.
- Glans Penis consists of **slit-like external urethral orifice or meatus** -for release of semen and urine.

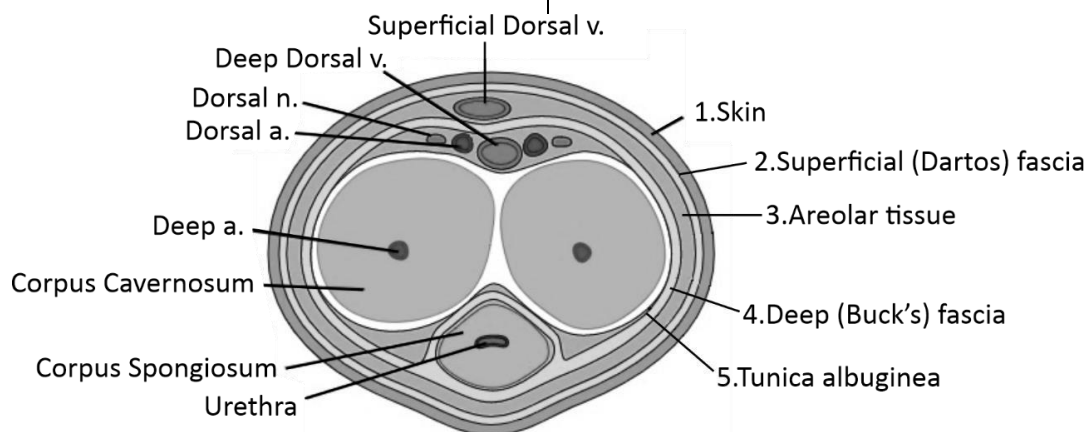
- Glans is covered **by loose fold of skin called prepuce or fore skin** which contains **perputical or Tyson's gland**

**Note: Circumcision** - surgical removal of prepuce/fore skin

- These gland secretes white sebaceous substance, called - **smegma**
- Erection of penis occurs under the **control of parasympathetic nerve**. Penis is supplied with nerves containing VIP (Vasoactive Intestinal Polypeptide) and NO (Nitric Oxide).

**Note:**  
(Nitric Oxide) in penis, due to which blood vessel of penis get filled with blood causing erection.

- **Ejaculation of semen** under the control of **sympathetic nervous system**.
- Semen is ejaculated due to contraction of **Bulbocavernosus muscle**.



## Semen:

- Mixture of sperm (10%) and seminal fluids (90%)
- Liquid part consist of secretion from
  - Seminiferous tubule
  - Seminal Vesicle
  - Prostate gland
  - Bulbourethral gland
- **Ejaculation contain average of 2.5-5 ml** with sperm count (Concentration) of 200-525 million sperm

**Note:**  
Path of sperm through male body. **(2016), (2019)**

- **Out of these sperm** For normal fertility:
  - at least **60% sperm** must have normal shape and size
  - at least **40%** of the show **vigorous motility**.
- **When sperm falls below- 20 million/Person** is infertile
- **Slightly alkaline -7.2 to 7.7 pH**

**Note:**

Seminiferous Tubules → Rete testis → Vasa efferentia → Epididymis → vas - deferens → Ejaculatory duct → Urethra

**DISORDER**

- **Varicocele** - Enlargement of veins within loose bag of skin that holds testis (scrotum)
- **BPH (Benign Prostate Hypertrophy):** Enlargement of Prostate → common condition in old age

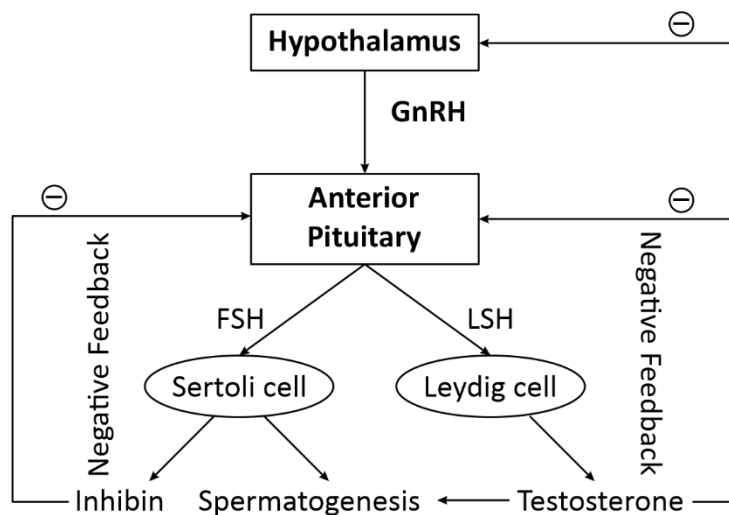
• **Prostate Cancer- PSA**

- It is the most common cancer in male worldwide but in India, mouth cancer is the most common cancer in male.

**Important**

- **Impotence:** Failure of erection of penis
- **Sterility:** Inability to produce offspring
- **Azospemia:** No sperm formation

**Hormonal Control:**

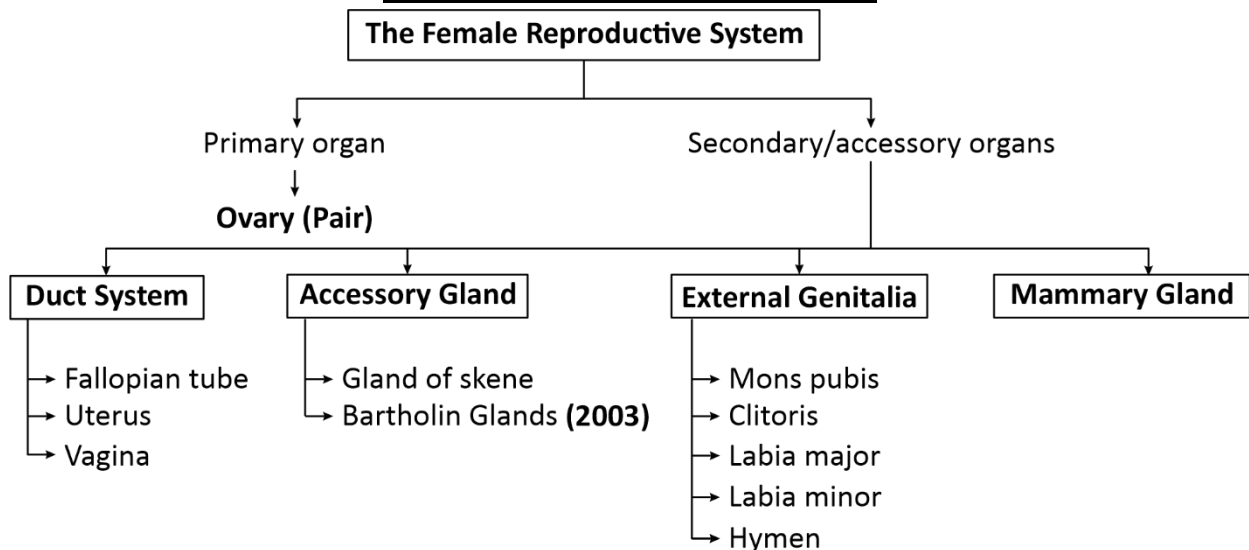


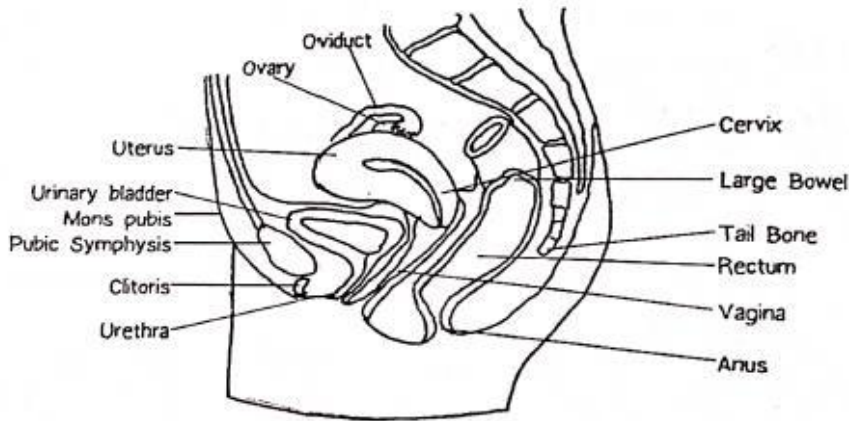
**Sperm pathway**

Testis → Epididymis → Vas deferens → Ejaculatory duct → Urethra

(2019)

**THE FEMALE REPRODUCTIVE SYSTEM**



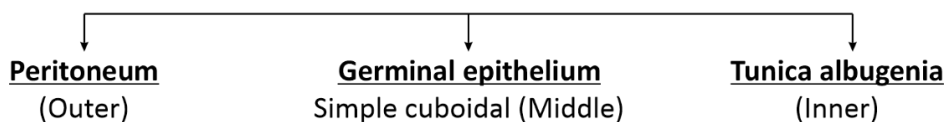


### Primary Sex Organ: Ovary

- Each ovary is about 2 to 4 cm in length and is connected to the pelvic wall and uterus by ligaments.
- Each ovary is covered by a thin epithelium which encloses the ovarian stroma.
- **Produces-ova/female gamete and sex hormone:** Estrogen and progesterone.

- Shape-small, almond like and flattened body.
- **Location** - near kidney, one on each side of the lower abdomen through mesovarium.
- Connected to pelvic wall one either side of uterus by ligament.
- Remain attached to lower abdominal cavity through mesovarium.

#### Wall of ovary consist of



- Internal tissue of ovary is called **stroma**.
- Stroma is divided into two zone:
  - Peripheral Cortex - Contains follicle in different developmental stage
  - Inner medulla – Blood vessels

### Accessory Duct System

- Formed by mullerian **duct system**.
- Consist of following structures:  
1. Oviducts    2. Uterus    3. Vagina
- 1. **Fallopian Tube/Uterine-Tube/Oviducts**
  - Length 10-12cm & extends from periphery of each ovary to the uterus.
  - **Mesosalpinx** (membrane which support the fallopian tube)
  - It consists of following parts.
    - (a) **Infundibulum (2010):**
      - Funnel-shaped structure situated near ovaries.

- Its edges possess finger like process called fimbriae.
- Fimbriae causes **transfer of ovum** from coelom into fallopian tube.

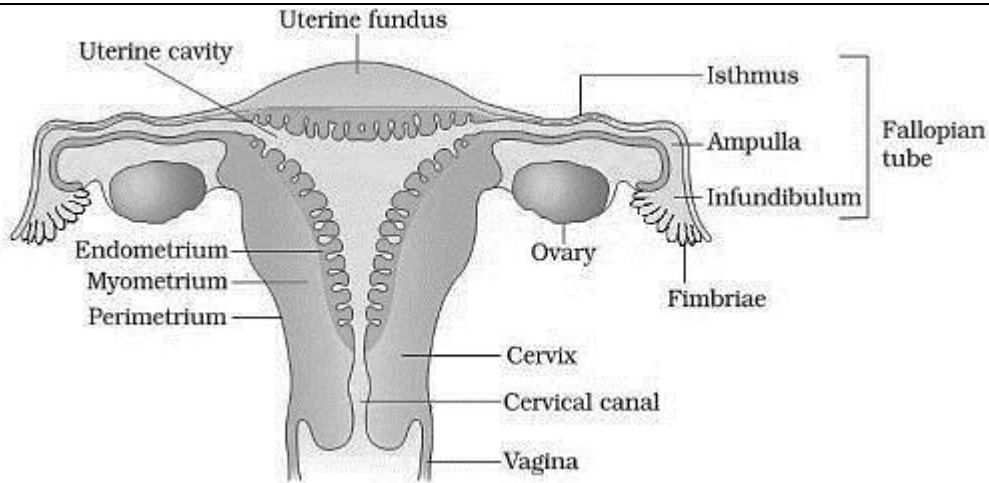
**Note:**

After evolution, ovum enter into coelom so human egg is coelomic egg.

**The part of fallopian tube closest to ovary is infundibulum.**

**(b) Ampulla:**

- Most dilated, wider part of fallopian tube
- The ampullary region, where fertilisation takes place.



(2011)

**(c) Isthmus:**

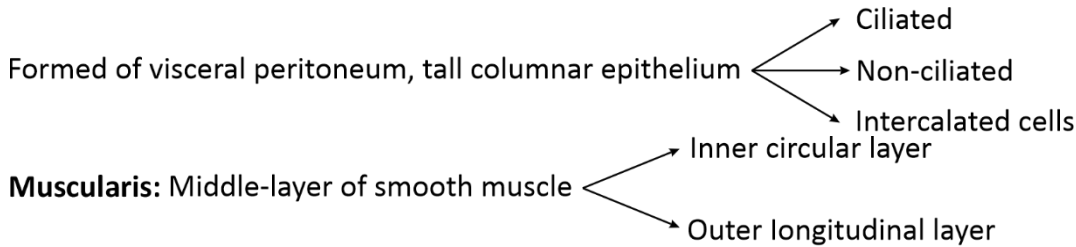
- Has narrow lumen & joins uterus.
- It is tube which connects ampulla to the uterus.

- It is lined by **ciliated simple columnar epithelium**.

**Wall of Fallopian tubes:**

It has three layers:

**(i) Serosa:** Outer – most



**(iii) Mucosa:** Inner- most luminal surface, has two types cell.

- (a) Ciliated** → Create slow current inside lumen.
- (b) Secretary** → Provide nourishment & protective secretion.

- Present in pelvis between bladders and rectum
- Supported by **myometrium**.

Some time uterus come out through vagina, condition called **prolapse of uterus**.

**Function of Fallopian Tube:**

- To convey the ovum from the ovary to uterus.
- It is done by peristalsis movement called ciliary action.
- Site of fertilisation is **ampullary region**.

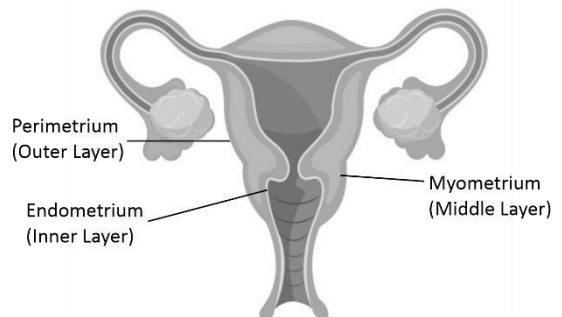
**Note:**

- **Tubectomy:** Surgical process of contraception in female.
- **Salpingectomy:** Surgical removal of fallopian tube

**2. Uterus (Hystera/Womb/Metra):**

- Large hollow, muscular, highly vascular and inverted pear shaped structure.

**Uterine Wall Consists of 3 Layers:**



- **Perimetrium** - outer most, thin peritoneal layer.
- **Myometrium** - middle, thick muscular-smooth muscle
  - This contain **receptor for oxytocin**
- **Endometrium** - inner-highly vascular and glandular, Consist of:

## Endometrium

### Stratum basalis

It gives rise to stratum functionale

- Endometrium undergoes cyclical changes during menstrual cycle while myometrium exhibits strong contraction during delivery of the baby.
- Endometrium contains **receptor for estrogen and progesterone**.
  - **Estrogen responsible for** → repairing of endometrium
  - **Progesterone for** → maintaining of endometrium.

### Stratum functionale

Innermost layer

It contains glandular and ciliated epithelium

This layer participates in **menstruation and implantation**.

#### Note:

- **Endometriosis** - presence of endometrium outside the uterus
- **Ectopic pregnancy** - implantation of embryo outside the uterus is called ectopic pregnancy
- **Hysterectomy** - surgical removal of uterus. **(2015)**

## Functions of uterus

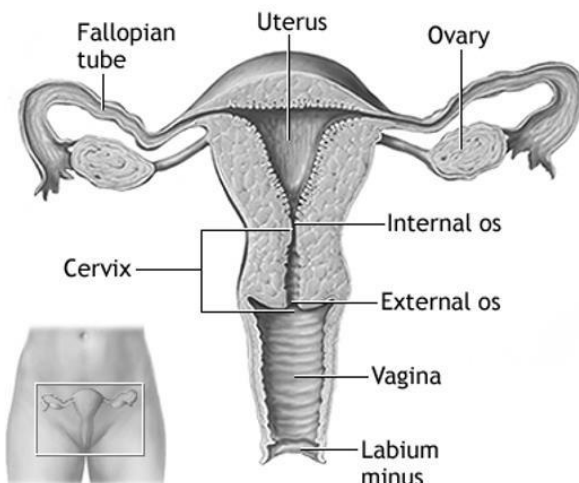
Site of foetal growth during pregnancy

Take part in placenta formation

Expulsion the body during parturition

### Parts of Uterus:

- 1. Fundus:** Upper dome-shaped parts, above the opening fallopian tube. Chance of implantation is maximum (labour)
- 2. Body/Corpus:** Middle, large and main part of uterus
- 3. Cervix:** lower narrow tube like part, which is connected to **body of uterus** through **internal os**. Connected to **Vagina** through **external os**.



#### Note:

- Cervix contain strongest sphincter to body
- Cavity of cervix is called **cervical canal**.
- **Cervix + vagina = Birth canal**

#### Note:

- Most common cancer in **female worldwide** breast cancer
  - Investigation of **breast cancer** is **mammography**
- Most common cancer in **Indian female** is cervical cancer or cancer of uterine cervix.
  - Investigation is **pap smear test**

### 3. Vagina:

- 8.5cm long fibro-muscular tube
- Lined by-**stratified squamous, non-keratinized epithelium**
- It contain transverse fold called **vaginal rouge**.
- Muscular non glandular structure, which open into **vestibule**



- It is covered partially by a fibrous Tissue called **hymen**.
- Hymen gets-torned during 1<sup>st</sup> coitous, sports or during physical exercise.
  - **So presence of hymen is not a test for virginity**

- It contain acid producing bacteria, like *Leuconostoc*, *lactobacillus* and *Darderleins* bacteria due to which pH of vagina remains acidic (4-5) that prevent growth of infections pathogens.

### Function of Vagina

Function as birth canal along with cervix

- At the top of vestibule opening and above junction of labia minora → there is a structure clitoris

Homologous to glans penis ↓

### Accessory glands

#### 1. Glands of Skene (many in number)

- Lesser vestibular gland = paraurethral glands.
- **Homologous to prostate gland.**
- These glands open around urethral opening
- Help to neutralized acidic medium. i.e. **antimicrobial**

#### 2. Greater vestibule or bartholin glands

- One pair
- **Homologous to Cowper's glands**
- Helps to neutralizing acidic medium of vagina, lubricate the passage of coitus.
- Bartholin's glands are situated on either side of vagina in female.

### External Genitalia

- Collectively called **Vulva**
- It consist of following parts:

Mons Pubis	Labia majora	Labia minora	Clitoris
Cushion of fatty tissue covered by skin and pubic hair	Fleshy folds of tissue and surrounds the vaginal opening	Paired folds of tissue under the Labia majora	Tiny finger-like structure which lies upper junction of two labia minora above the urethral opening

### Mammary Glands/Breasts

- **Functional mammary glands** are the characteristic feature of all mammalian female, which consist of glandular tissue.
- Variable amount of fat, covered by skin.

#### Position:

- Pair of rounded prominences over the pectoralis major muscle.
- Remain **rudimentary** in male.

- In female-remain underdeveloped **till puberty.**
- At puberty start developing **under influence of Oestrogen and progesterone hormone.**
- Breast supported by **Cowper's Ligaments.**

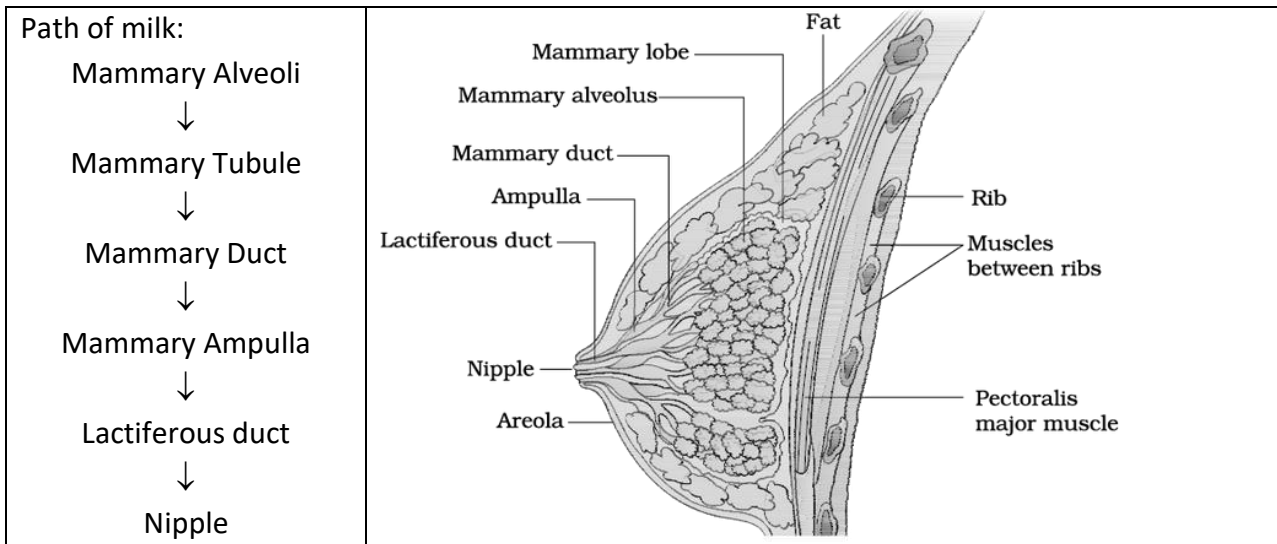
#### Structure:

- Externally has projection called **nipple.**
- Nipples are surrounded by round hyper pigmented are called **Areola.**
- On surface of areola, numerous sebaceous glands called **areolar glands.**

**Internally Consist of:**

- Glandular tissue forming mammary glands.
- Fibrous tissue (Connective tissue)

- Fatty or adipose tissue - amount decide the size of mammary glands.



- Internally mammary glands consist of 15-20 mammary lobes, having milk producing gland called **alveoli**, which give rise to mammary tubules.
- Mammary tubules fuse to form mammary duct, which open into **Mammary ampulla**
- Mammary sinuses open into lactiferous duct, which ultimately open outside to body through nipple.

**Function of mammary gland:**

- Main function is secretion and ejection of milk.
- **Lactation** - associated with pregnancy and child birth.
- **Milk production** is stimulated by **Prolactine of Anterior Pituitary**.
- **Milk ejection** is stimulated by - **Oxytocin of Posterior Pituitary**.
- **Tubular growth** of breast is promoted by **Estrogen hormone**, which is also called **Growth hormone of breast**.
- **Alveolar/Glandular growth** of breast promoted by **Progesterone**.

**Human Milk:**

- 1-2 lit/ day.
- First milk after child birth called **COLOSTRUM**.

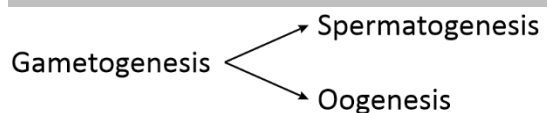
**Milk Contains:**

- Water
- Protein-Casein (Milk protein)
- Sugar-Lactose
- Mineral salt- (Na, Ca, K, P) Vitamins- (Vit.C negligible)
- Ig-A
- Poor in **iron** contents.

**Note:**

**Mastectomy:** Surgical removal of breast in breast cancer.

**Gametogenesis**



- ★ Gametos = Gamete, Genesis = Production
- Formation of haploid gametes or sex cells (n) from diploid gamete mother is called **gametogenesis**.