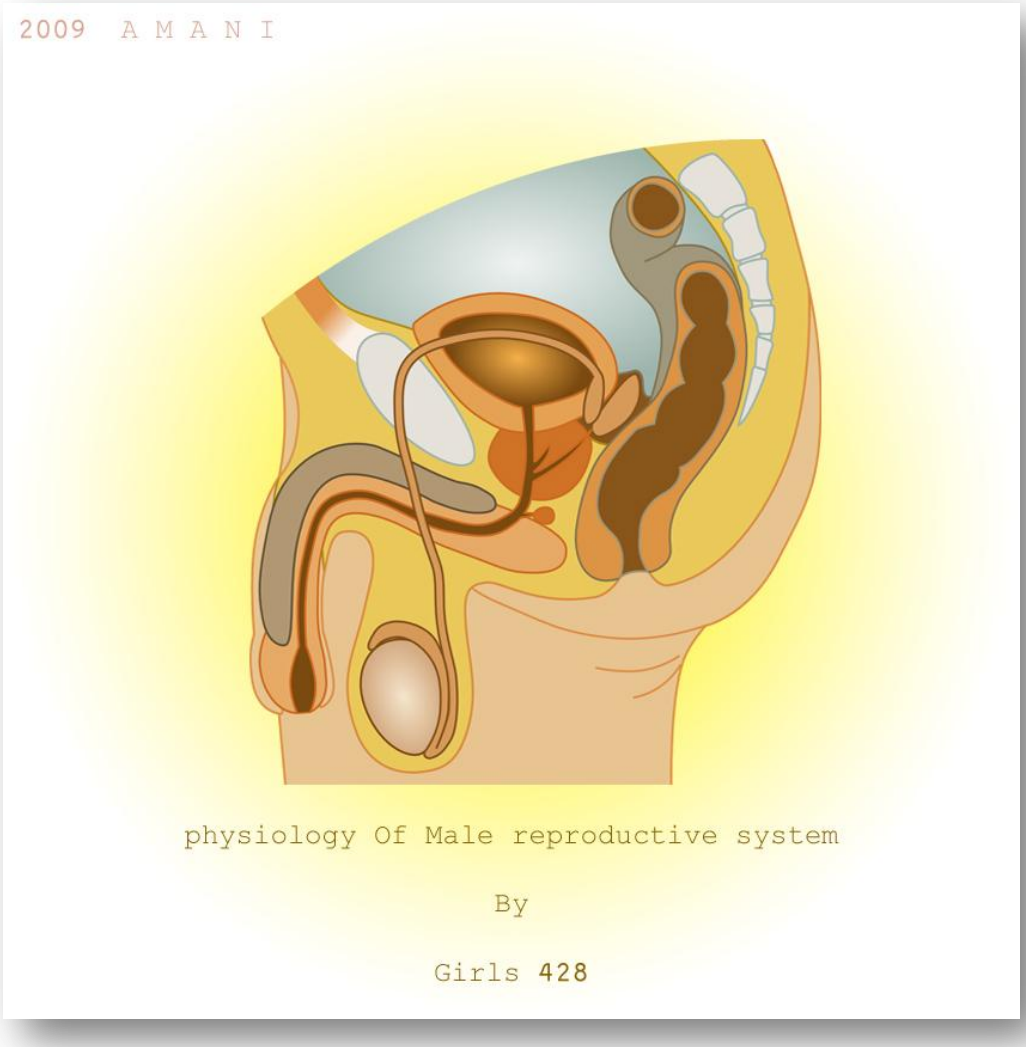

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Male Reproductive System

It formed by :

1- Testis and it's semineferous tubule

2- Epididymis

3- Vas deferens and ampulla

4- Seminal vesicle

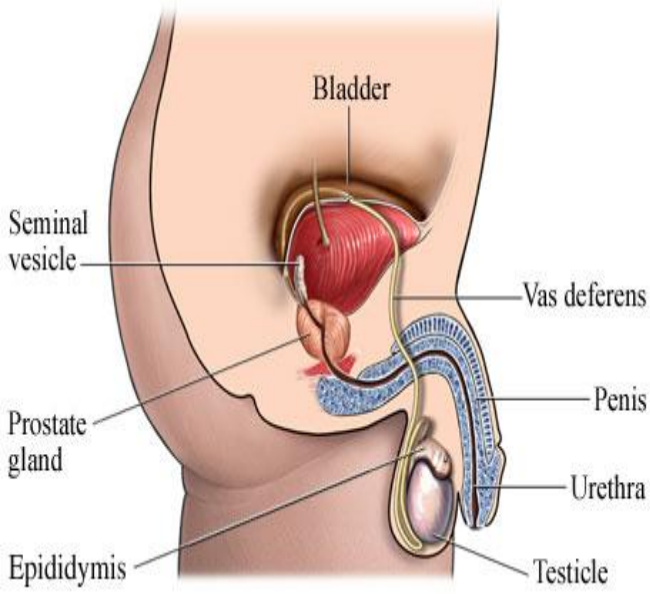
5- Prostate

6- Bulb urethral gland

7- Ejaculatory duct

8- Urethra

9- Penis



* The testis located in scrotum , and it is highly vascular (full of blood)

The Testis:

1- SEMINEFROUS TUBULE...

Contain spermatogonia stem (germ) , involved in spermatogenesis (storage of sperms)

2- SERTOLI CELL ...

- It is located inside the seminefrous tubule

- Large with cytoplasmic envelopes surround the developing spermatogeia around the central lumen of the seminefrous tubule

Function: sustain, promote and development of sperms

3- LEYDING CELL (INTERSTITIAL) …

Lies between the seminefrous tubules

Function: secrete testosterone

* they are found in newborn male to secrete testosterone for the first month in life

* they are absent in childhood

* active at puberty and through out of live

Spermatogenesis:

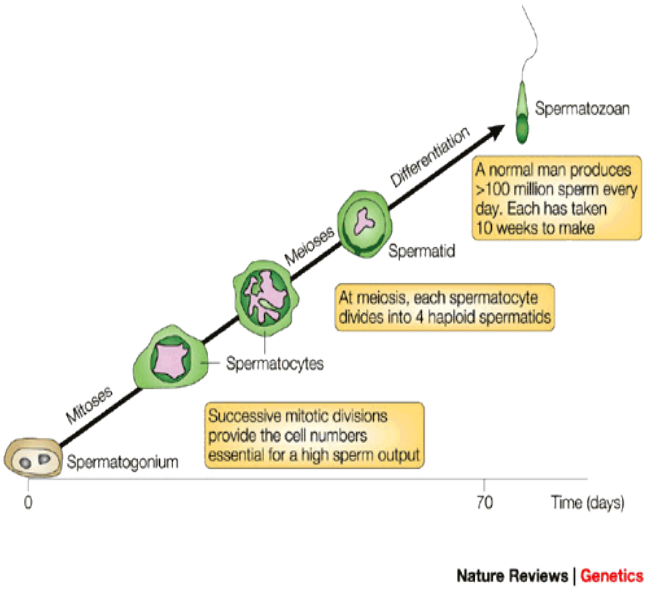
- Take 74 days

- Occur in **seminefrous tubule**

- Stimulate by FSH (maturation in sertoli sells) , testosterone (to growth and division of germ cells)

- Begin at age 13 and continue throughout life

- It decreases with the increase of the age



IN THE SPERMATOGENSIS :

- By mitosis division each spermatogonia will give us 2 primary spermatocytes (with diploid no. of chromosomes"46 2n"

- DNA replication will occur in each primary spermatocyte,and the result is a 92 chromosomes

- Then, by meiosis division each primary spermatocyte will give us 2 secondary spermatocytes (with diploid no. of chromosomes "46 2n"

- By the second meiosis each secondary spermatocyte will give us 2 spermatids (with haploid no. of chromosomes "23 1n")

- each spermatid will convert to sperm

- SO, the net result is 8 sperms from one spermatogonia

* all these events occur under effect of the testosterone inside the semniferous tubule

* we need FSH (in sertoile cells) to shaping and phagocytosis of the cytoplasm

Formation of sperm:

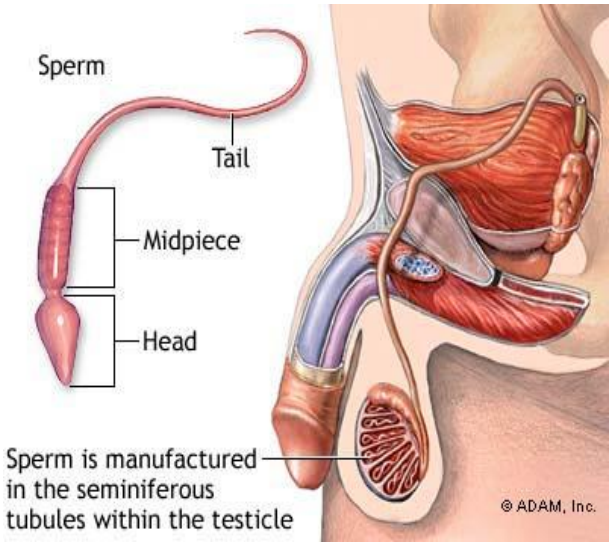
- THE HEAD : contains nucleus, cytoplasm , cell membrane and Golgi apparatus witch form the acrosomal enzymes

"the acrosome enzyme (acrosome reaction) " :

The sperm store large quantities of **hyaluronidase** and **proteolytic** enzymes

- **hyaluronidase** depolarize hydorin acid in the intracellular eenet that hold the ceuaria cells together

- **proteolytic enzymes** digest the protein



- THE MIDPIECE : contains the centrioles and microtubule

- THE TAIL: contains mitochondria (synthesize ATP)

Functions of Sertoli cell:

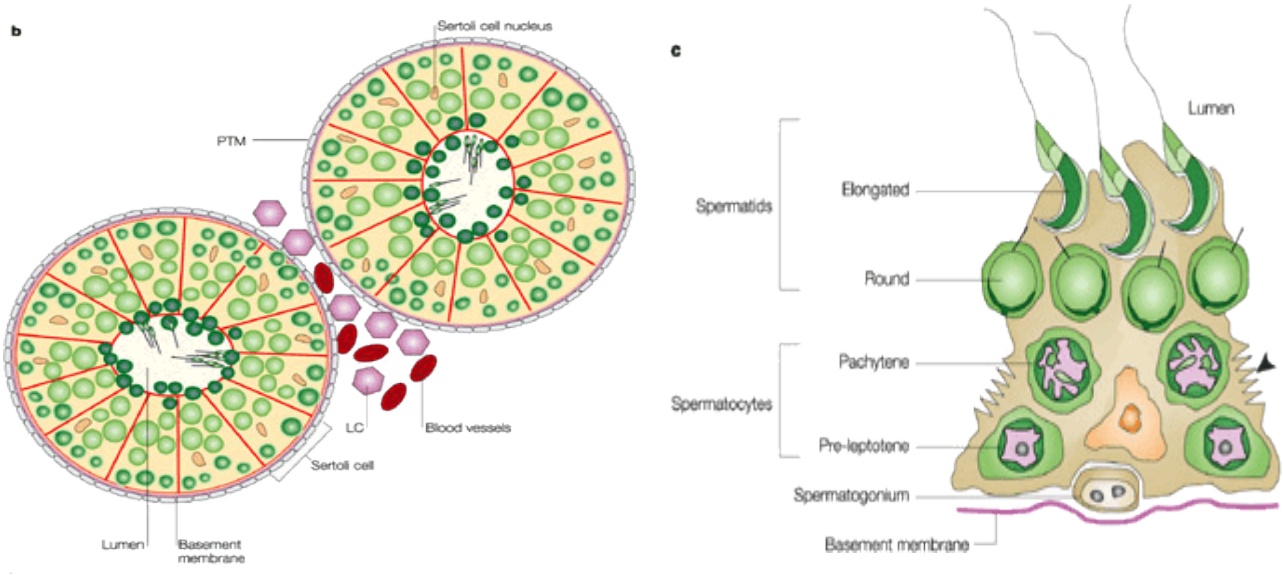
1- **Form blood-testis barrier** to prevent foreign bodies and bacteria from invading testis and any blood components pass through it before it enters the testis

2- Secretion **inhibin**

3- **Help spermatogenesis in phagocytosis** cytoplasm around spermatid to be free sperm

4- **Prevents antigen from developing spermatozoa to reach blood**, so prevent immunize against sperms

5- **Provide nutrients for sperm**



Maturation of sperm in Epididymis:

- After formation in the seminiferous tubules, transport to the lumen of S.T.
- The sperm require several days to pass trough the epididymis (still non-motile)
- After 18-24 hours, they develop capability of motility (inhibitory protein in the epididymal fluid prevent final motility until after ejaculation)
- Sertoli cells and epithelium of epididymis secrete nutrient fluid which contains hormones (testosterone & estrogens), enzymes & nutrients essential for sperm maturation.
- Activity of a sperm is greatly enhanced in neutral to slightly alkaline medium and depressed in acidic medium

Storage of sperm:

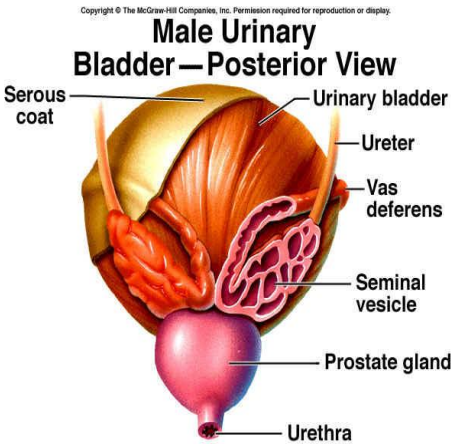
- The 2 testis of adult human formed up to **120** million sperm each **day**.

- the storage of sperm are mainly stored in the vas deferens, maintaining their fertility for at least a month

-Small amount stored in the epididymis

- The sperm are kept inactive state by multiple inhibitory substances in the secretion of the genital tract.

After ejaculation, the sperm become motile & capable of fertilizing the ovum **called maturation.**



Function of the seminal vesicles:

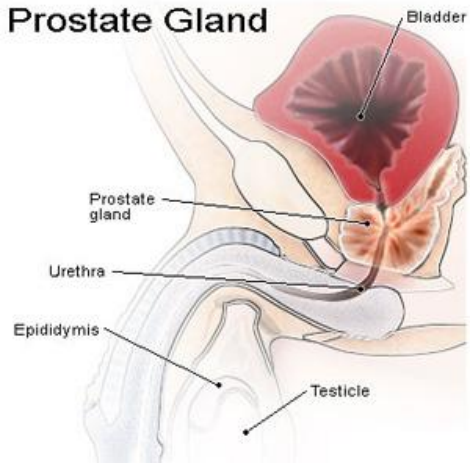
- secrete mucoid material containing fructose, citric acid & nutrient substances & large quantities of prostaglandins & fibrinogen.

- The prostaglandins are important help in fertilization:

1- By reacting with the female cervical mucus making it more receptive to sperm movement.

2- By causing backward reverse peristaltic contractions of the uterus & fallopian tubes to move the ejaculated sperm toward the ovaries.

Function of prostate gland:



- Secrete slightly alkaline milky fluids helps in neutralization seminal fluid & vaginal fluid
- Secretion contains Ca2+ ion, citrate ion, phosphate ion, a clotting enzyme & profibrinolysin.
- The alkaline prostatic fluid is important for successful fertilization of the ovum.
- Neutralized acidic fluid of the vas deferens due to presence of citric acid & metabolism end product of the sperm that inhibit sperm fertility
- Help to neutralize acidity of seminal & vaginal fluid
- Enhance of motility & fertility of sperm

Semen:

Milky white, sticky, mixture of:

1- Sperm & fluid from vas deferens (10%)
2- Seminal plasma (70% seminal vesicle , 20% prostate + small amounts from the bluburethral gland)

- PH is 7.5 alkaline, the alkaline prostate fluid help to neutralize the mild acidity of other portion of the male tract.
- Prostatic fluid gives the semen a milky appearance

- Fluid from the seminal vesicles & mucous glands give the semen mucoid consistency.

Function of semen:

1- Provides a transport medium & facilities sperm move
2- Protect & actives the sperm
3- Nutrients (fructose) for sperm
4- Fibrinogen → clotting → prevent the sperm from back (prostate)
5- Fibrinolysis → remove clotting

***Prostaglandin in semen** → seminal vesicle

1. •Decrease viscosity of mucous in cervical
2. •Stimulate reverse prostalsis in the uterus
3. •Facilities the movement of sperm through the level reproductive tract

***Clotting factor** – coagulate semen after ejaculation

1. •The fibrinlysin ……. The sticky mass during the next 15 – 30 min.
2. •After ejaculating, sperm can live 24 – 48 hr. (1-2 days)
3. Only 2-5 ml of semen are ejaculation, each milliter contains about 120 million sperm • (normal male count vary between 35 million to 200 million sperm

*** Fertility:**

(***Semen analysis***)

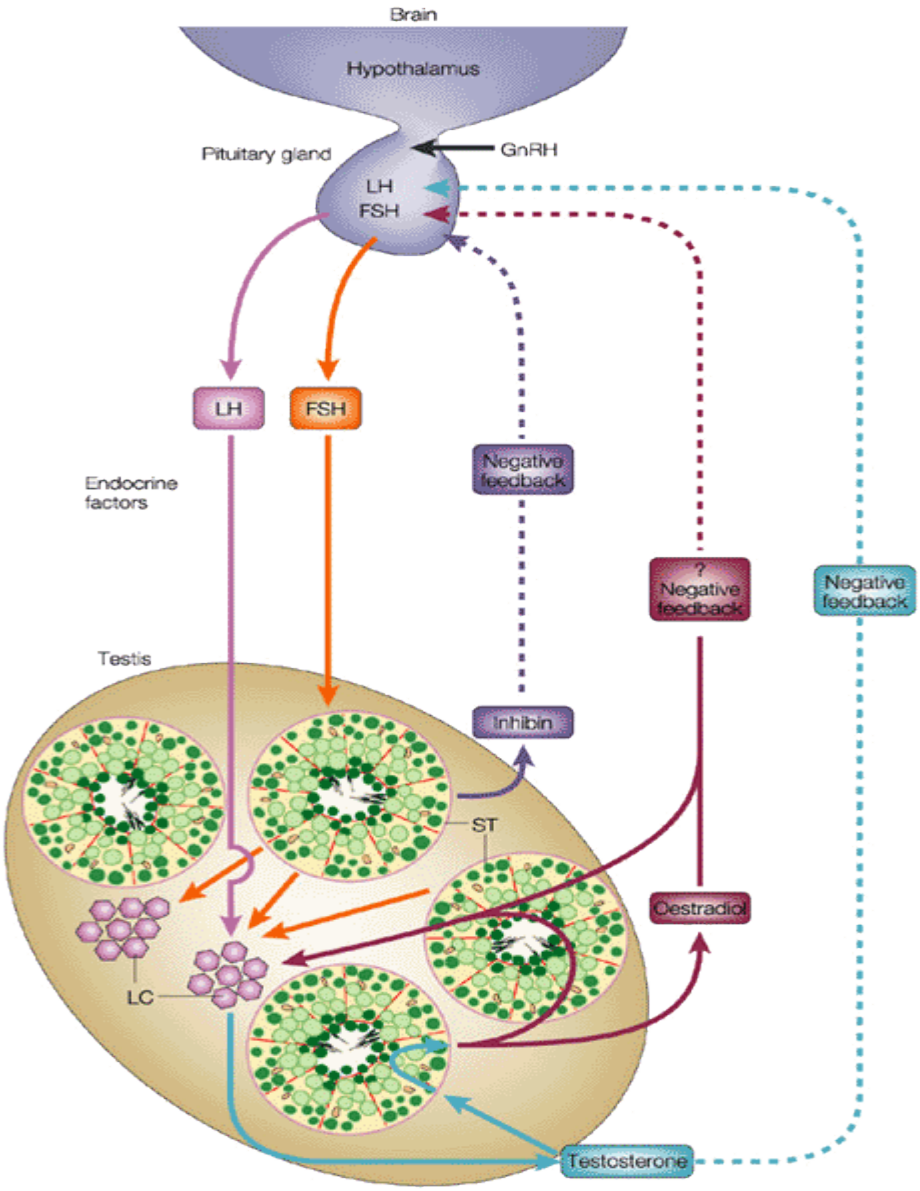
1- Sperm count below 20 million leads to infertility.
2- If the majority of sperm are morphology abnormal on non-motile.

Capacitation of the spermatozoa: (Making them to penetrate the ovum:

- Sperms in epididymis is inactive by inhibitory factors they exposed to floating vesicle from semineferous tubule containing large amount of cholesterol
- Cholesterol is added to the membrane converting the acrosome and moving it more roughly preventing the release of it's enzyme
- Sperms activate in female genital tract by it's capacitation

After ejaculation: the sperm removed from the cholesterol vesicles and this make the membrane of sperm acrosome and head become weaker
The sperm membrane become more permeable to ca+2
Which increase their movement and help to release the protyeltic enzyme which aid in penetration of the ovum
Uterine and fallopian fluid wash away the inhibitory factor which suppers the seminal vesicle activity in the male genital ducts

Hormonal factor control of spermatogenesis:



- Both FSH and testosterone necessary to initiate spermatogenesis

LH stimulate the leyding sell to secrete testosterone

- Estrogen: formed from testosterone by sertoli cell under FSH stimulation also essential for spermatogenesis
- FSH bind with FSH receptor at sertoli sell to grow and secrete spermatogenesis substance stimulates conversion of spermatids to sperm
- Testosterone and dihydrotestosterone :

Diffuse into the somniferous tubule from the leyding cell is essential for the growth and division of testicular gremial cell (spermatogonia)

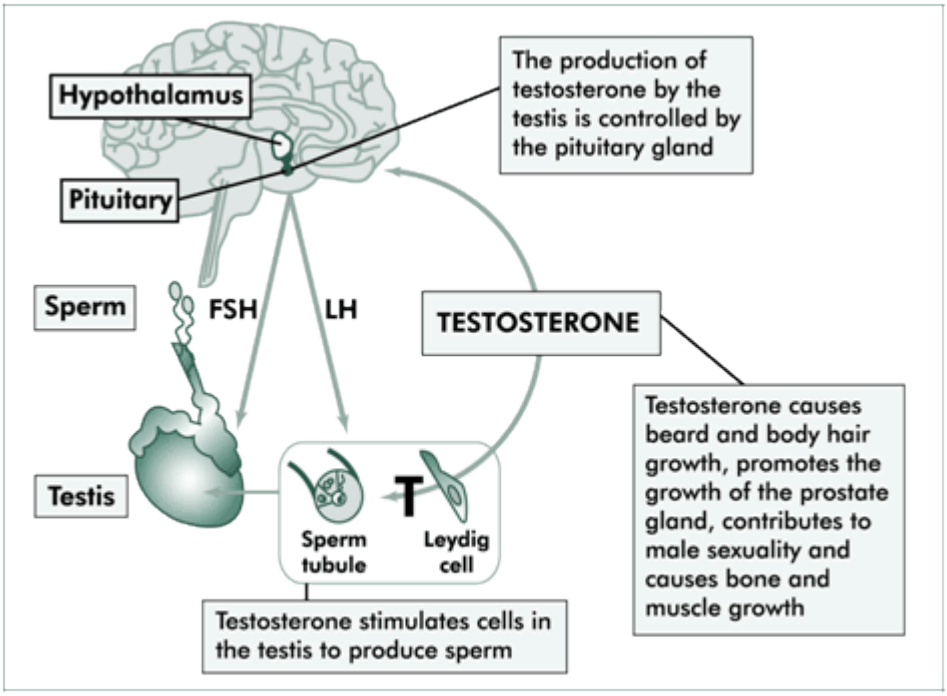
- Growth hormone : is necessary for controlling metabolic function of testis and promote early division of spermatogenesis

It's absence = infertility (dwarf)

-ve feed back control of seminiferous tubule activity – role of inhibin :

- when semniferous tubule fail to produce sperm: secretion FSH from the AP(anterior pituitary) increase
- when spermatogenesis proceeds rapidly pituitary secretion of FSH diminishes >> due to secretion of inhibin hormone from the sertoli cell >> inhibit AP-FSH >> decrease spermatogenesis >> inhibitory effect on the hypothalamus to inhibit GnRH

Hormonal regulation of testicular function :



- The hypothalamus release gonadotropin Releasing hormone (GnRH) – peptide hormone- in pulses for few min every 1-3hrs (not continuous)
- Pass through the hypothalamus –hypophysial portalsys.- to anterior pituitary , stimulates the release of gondotopin LH and FSH , the secretion of LH is also cyclic flowing in to pulsation release of GnRH
  - ☒ FSH causes sertoli cell to release ABP- and help in spermatozoa maturation
  - ☒ LH stimulate interstitial (leyding) cell to release testosterone binding of testosterone to ABP to enhance spermatogenesis and growth and division of germ cell
  - ☒ GH promotes early division of spermatogonia , improve testicular process

Feed back inhibition on the hypothalamus and pituitary results form

1- Rising level of testosterone : it has direct affection in the hypothalamus to decrease secretion of GnRH which causes decrease secretion of both LH and FSH it has minor affection AP

2- Increased inhibin

Secretion, metabolism and chemistry of the male sex hormone :

- testosterone is synthesized from cholesterol
- The testis secrete several male sex hormone called androgen including testosterone ,dihydrotestosterone
- testosterone is due most abundant forms , dihydrotestosterone is most active (**testosterone converted into dihydrotestosterone into target cell**

<Imp. Qs >

- When is diffused to cell it either bind to endogen receptor or converted to dihydrotestosterone

Metabolism of testosterone:

Testosterone bound with beta globulin and circulates in the blood for 30 minutes to several hours and converted to estrogen in the liver and excreted either into the gut through liver bile or into the urine through the kidneys.

Function of Testosterone:

During Fetal life the Testis are stimulated by placenta choronic gonadotropin to produce Testosterone throughout Fetal life and the 10 week after birth then no more Testosterone production during childhood

At puperty under anterior pituitary gonadotropic hormones stimulation testeron produced and remain throughout life

Then decline beyond 80 years to 50%

Function of testosterone during fetal development:

Testosterone secreted by fetal testis as responsible for development at male child body characteristic

1\ formation of penis , scrotum , prostategland and seminal vesicle

2\ suppressing the formation of Female genital organe

3\ the testis descend into the scrotum at last 2-3 month

Effect of testosterone on development of adult primary gestation testosterone and secondary sexual character:

1\ Adult primary sexual character:

After puberty, testosterone cause enlargement of penis , scrotum and testis and secondary sexual character

2\ Effect on the distribution of body hair:

Cause growth of hair over the penis up ward along the lina alba, on the face and on the chest.

3\ baldness: testosterone decreased growth of hair on the top of the head

(2 factor cause baldness)

* Genetic background

* Large quantities of androgenic hormone

4\ effect on voice:

It cause hypertrophy of the laryngeal mucosa, enlargement of larynx (typical adult masculine voice)

5\ testosterone increase thickness of the skin and can contribute to development of acne

By increase the secretion of sebaceous gland

6\ testosterone increase protein formation and muscle development

* Increase muscular development after puberty

* Increase protein in non-muscular parts of the body

* These effect due to anabolic effect

7\ testosterone increase the bone matrix and causes Ca+2 retention

* Increase the total quantity of the bone matrix, so bone is **thicker**

* Causes Ca+2 retention (anabolic effect)

* Causes the epiphyses of the long bones to unite with the shafts of the bones & early closure of the epiphyses.

* Testosterone has specific effect on the pelvis 1) narrow the pelvic outlet; 2) lengthen it; 3) cause the funnel-like shape instead of the broad ovoid shape of the female pelvis

8\ testosterone increase basal metabolism

* increase basal metabolic rate by 15% (indirectly as a result of anabolic effect)

9\ effect on RBC

*increase RBC \ ml (due to increase metabolic rate)

10\ effect on electrolyte and water balance

* increase the reabsorption of Na+ in distal tubules of the kidney

*** The basic intracellular mechanism of action of testosterone increase the rate of protein synthesis in target cell

Abnormalities of male sexual function:

- ***Prostate gland and its abnormalities***

Benign prostatic fibroadenoma in older age due to overgrowth of prostate tissue (not caused by testosterone).

Cancer of the prostate gland caused by stimulation of cancerous cells by testosterone.

- **Hypogonadism in male**:

1-During fetal life when the testis are non-functional, none of the male sexual characteristics develop in the fetus. Instead female organs are formed.

2-If the boy loses his testis before puberty, a state eunuchism (he have infantile sex organs & infantile sexual characteristics) & the height of an adult eunuch is slightly greater than normal because of slow union of the epiphyses.

3-If a man is castrated after puberty, sexual organ regress in size and voice regress - loss of the thick musculine bones- loss of masculine hair production -loss of musculature of the virile male.

Adiposogenitial syndrome, Frohlich's syndrome or hypothalamic eunuchism: -

hypogonadism due to genetic inability of the *hypothalamus* to secrete normal amount of *GnRH* & abnormality of the feeding center of the hypothalamus result in obesity with eunuchism.

- **Testicular tumors and hypergonadism in male:**

Interstitial leydig cell tumors (rare), over production of testosterone. In children, causes rapid growth of the musculature and bones and early uniting of the epiphyses and causes excessive development of male sexual organs.

Tumor of the germinal epithelium (more common).

Stages of male sexual act:

1-Penile erection. Erection is caused by parasympathetic impulses that pass from the sacral portion of the spinal cord through the pelvic nerves to the penis.

2-Expansion of corpora covernosa : compress their drainage vein of Retards blood outflow and maintains engorgement

3-Lubrication, Parasympathetic impulses cause the urethral glands &bulbourethral glands to secrete mucous.

4-Emission and ejaculation. Function of the sympathetic nerves. Emission begins by contraction of the vas deferens & ampulla to cause expulsion of the sperm in the internal urethra. Contraction of the prostate &seminal vesicles to expel their fluid in the urethra. All these fluid mix in the internal urethra with the mucous secreted by the bulburethral glands to form the semen. This process at this point is called emission.

5- Filling of the internal urethra with semen causes sensory impulses through pudendal nerves to the sacral region of the cord. Fullness of the internal urethra causes rhythmical contractions of the internal genital organs which increases their pressure to ejaculate the semen to the outside called ejaculation.