ANATOMY

☑ Sheet ○ Slide ○ Handout

Number

6

Subject

Male Reproductive System

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This sheet was written according to the lectures of sections 1 & 3 with some kind of different orientation.

This lecture was explained using handouts 2 and 3, but everything was mentioned here. This sheet is mostly histology with a final anatomy part.

Male Reproductive System

Our last lecture was about the way in which the male gametes become sperms in two processes called spermatogenesis and spermiogenesis.

The doctor focused on the function of the two most important cells in these processes, which were Sertoli cells and Interstitial cells.

In this lecture, the doctor added some new information about the two cells. And from here we start.

Quick Reminder:

Spermatogonia: stem cells of the sperms that have not gone through any processes yet.

Spermatozoa: gametes/ sperms that went through all the processes in the testis.

- **Sertoli Cell:**
  This essential cell works under the effect of FSH (Follicle-stimulating hormone) to produce a lot of molecules that play a major role in the spermatogenesis.

Figure 1: leydig under microscope

- **Interstitial Cell (Leydig cell):**
  - This cell works under the effect of LH (luteinizing hormone) which induces the production of the testosterone hormone. Also, this hormone has an important role in spermatogenesis (indirectly).
    Note: In the past, LH was named by a better name; "ICSH"= interstitial cell stimulating hormone.


Figure 2: leydig under microscope

- Where can you find these cells? They are found in groups and embedded in the loose connective tissue between the seminiferous tubules of the testis. (Figure-1,2)
- What do they look like under the microscope? They look large and polyhedral in shape with extensive eosinophilic cytoplasm and an eccentric nucleus.
- Where do they release their secretions? The Leydig cell secretes testosterone locally in a paracrine way of secretion, and like any other endocrine organ, it must be surrounded by blood capillaries (to compensate the absence of a duct).
- Ultrastructural features: these cells closely resemble the steroid-secreting cells of the adrenal cortex. Which means they look like some cells in the adrenal cortex. (from handout 2)

Let's take a closer look at the Leydig cell to explain what are the steps of testosterone synthesis, and how the LH hormone affects that.

As you can see in figure-3, these are the steps of synthesizing testosterone. What really matters in this chart are the 1st and the last steps.

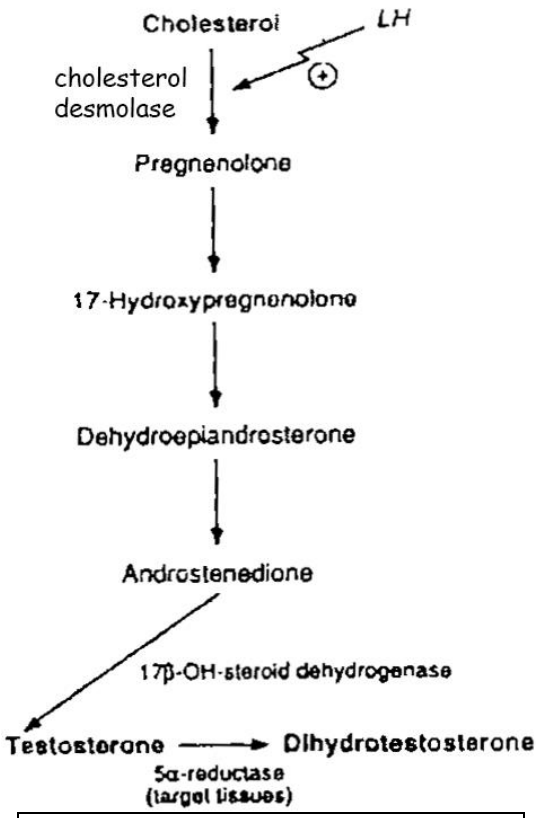


Figure 3: steps of testosterone synthesis

- In the 1st step: here is the step where LH takes its role. We know that all steroid hormones are made originally from cholesterol. So for converting cholesterol into the first intermediate product we need an enzyme called: "**Cholesterol Desmolase". LH will work on this enzyme to change cholesterol into Pregnenolone.**
- In the last step: here the testosterone is converted into another molecule called Dihydrotestosterone by a very essential enzyme called "**5α-reductase**", we will talk about its importance in few lines.

To understand this chart more, we need to know the functions of the previous hormones..

- Testosterone
  1) This man always calls Mr. **VES**; which means this hormone helps in the **differentiation** of three structures: the **V**as deferens, the **E**pididymis and the **S**eminal vesicle, which are the structures that have ducts (It's really important to know the exact structures).
  2) Pubertal growth spurt. It's not a seafood dish for sure :P The story begins with "Ogla" who -at the age of puberty and due to the magnificent increase in testosterone production- became taller, his muscle mass increased quickly, his voice turned rough and beard grew on his face. At the age of 18, due to testosterone secretions as well, he stopped growing in length due to the closure of the epiphyseal plates of his long bones. No matter how old he gets, he can no longer get any taller. (the epiphyseal plate in the bone is the part between the epiphysis and the diaphysis of the bone shaft. With age, this plate is closing and replaced by the epiphyseal line). So testosterone is responsible for both; the growth spurt at puberty as well as the stop in growing in length after that.
  3) The most important function of this hormone is that it has a major role in the spermatogenesis process. We mentioned before that FSH works on the sertoli cells, and in order for FSH to do its job, testosterone has to be concentrated there. In other words; testosterone mediates the effect of FSH on sertoli cells.
  4) It stimulates men's libido.
  5) It also works as a negative feedback signal that acts on the anterior pituitary gland to stop secreting more LH.
  6) This hormone has two close friends only; the Penis and the Seminal vesicles. This means testosterone helps in the **growth** of these two structures: the penis and the seminal vesicles.

So differentiation of VES, and growth of Penis and Seminal vesicle

❖ Dihydrotestosterone

1) This guy plays on **PSP**. Which means it differentiates the three structures: the **P**enis, the **S**crotum and the **P**rostate gland.
2) This hormone is your barber. This means it's responsible for the male pattern of baldness.
3) When a man has acne on his face, the reason is probably the secretion of this hormone.
4) The most important function of the dihydrotestosterone hormone is being a close friend to only one structure → the prostate. Whenever you hear the word **dihydrotestosterone**, remember that it **increases the growth of prostate** and that might cause benign prostatic enlargement after the age of 50. This might compress the urethra and block urination.

The master of this game is neither any of these two hormones, but the connection between them; of course we're talking about our famous **5α- reductase**. If we block the work of this enzyme by giving a blocker drug called Finasteride, you treat your patient from his benign prostatic enlargement

➢ The testis can't synthesize glucocorticoids or mineralocorticoids because it doesn't have the enzymes needed for their synthesis. These enzymes are 21β-hydroxylase and 11β-hydroxylase. They are found in the adrenal cortex of the adrenal gland where the synthesis of glucocorticoids and mineralocorticoids occurs.

Let's take a look on the way our worth-telling story heroes are being released (follow figures-4,5).

From the master gland in our body "the hypothalamus" –from the arcuate nucleus to be precise- a solider called GnRH (gonadotropin releasing hormone) is released into the tunnel "the pituitary stalk" through the portal veins to send a message to the gonadotropic cells of the anterior pituitary so that they release another two heroes.

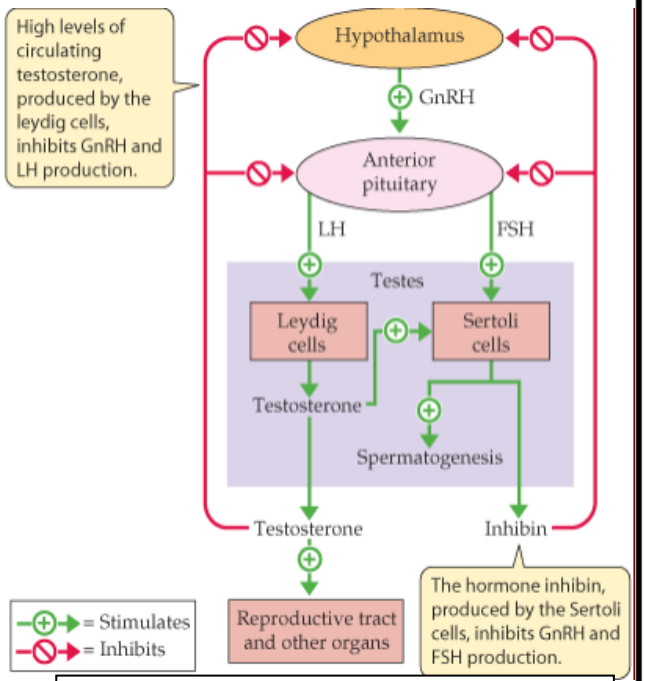


Figure 4: release of male reproductive hormones

1- The first one is LH, which goes through the blood to target Leydig cells which will secrete the hero testosterone that acts locally to mediate the job of the other hero "FSH".

2- FSH, which will do its job (spermatogenesis) but only after testosterone stimulates Sertoli cells, so that it can sense the effect of FSH on it.

(FSH and testosterone together are superheroes, which means FSH can't produce an effect on Sertoli without its assistant testosterone.) مليون مرة حكينا الكلام هادا

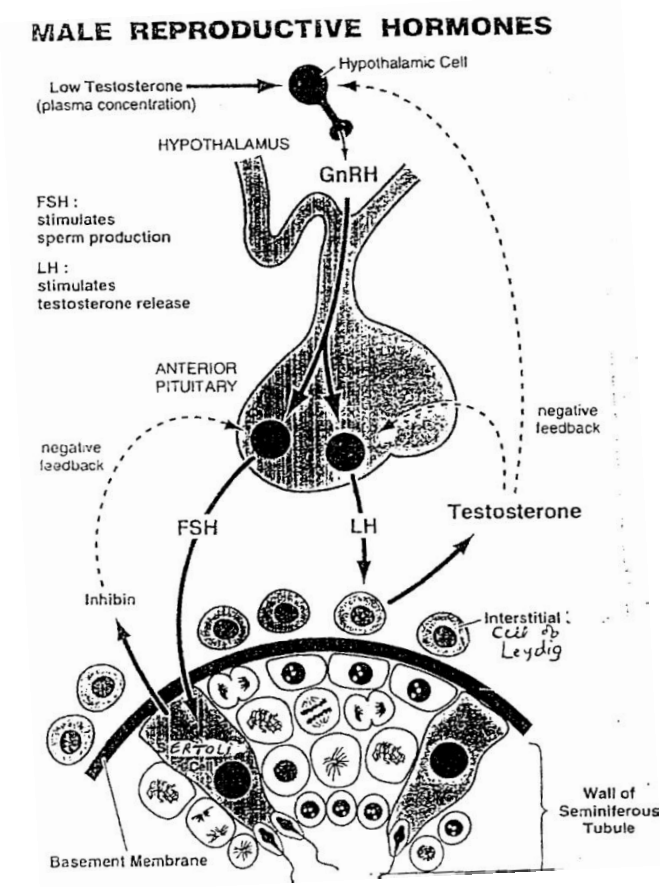


Figure 5: release of male reproductive hormones

The story of the assistant hero isn't over yet for sure.

Testosterone is smart enough to send negative feedback signals not only to one but two major glands; the anterior pituitary and the hypothalamus.

Testosterone inhibits the release of LH **indirectly** by inhibiting the release of GnRH

from the hypothalamus. It also inhibits the release of LH **directly** by inhibiting its release from the anterior pituitary itself.

We should also have something to decrease the release of the 3rd hero, FSH. That's why Sertoli cells are going to produce the protein **inhibin** that travels to the anterior pituitary to stop the secretion of FSH.

❖ *Sertoli & FSH*

Most of this part was mentioned before, but the doctor repeated it with adding few new information. (during the lecture, this part was explained after the histology part).

- FSH is a steroid hormone produced by the anterior pituitary, then it reaches the testes to work on Sertoli cells. **FSH stimulates Sertoli to produce:**
  a. Stem cell factor: From its name you can guess that it interacts with a specific receptor on the surface of spermatogonia. What does this factor do? It increases the number of stem cells (spermatogonia) by increasing mitosis and inhibiting apoptosis (programmed cell death).
  b. Activin: This protein hormone also stimulates spermatogonia in order for the cells to mature into primary spermatocytes.
  c. Estradiol: One of our previous heroes, testosterone, after being produced by Leydig cells, it will go to Sertoli to be converted into Estradiol.
  d. Androgen Binging Protein (ABP). Before we get to know more about this guy, let's explain some interesting things first…
     - Three of the sex hormones -Testosterone, dihydrotestosterone and estrogen- their job in spermatogenesis requires them to work on the stem cells themselves. The problem here is that germ cells lack androgen receptors. So, there must be something that is helping sex steroids to do their job. Our friend ABP comes to save the critical situation; it has a high affinity towards these steroids, it binds to one of them and **the ABP-hormone complex** enters the germ cells by endocytosis.

- Another specific deal the ABP holds with testosterone is that it highly concentrates testosterone –inside and outside the sertoli cells- in order to help the other famous steroid FSH to do its job as mentioned earlier.

- For every hormone that is released there must be a mechanism that regulates its amount of production. And by that, we won't have too much of that hormone "معلومات سنة أولى".

We are now going to mention some local feedback loops that operate within and between Sertoli, Leydig and peritubular cells (epithelial cells in testis).

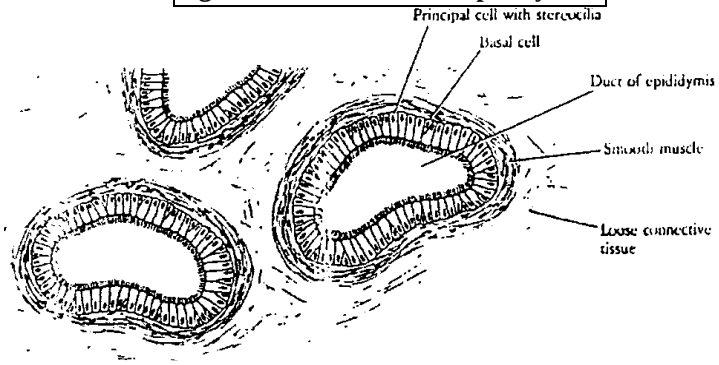
Loops of feedback in the male reproductive system are done by:

1. Inhibin B: This protein hormone is also secreted from sertoli -under the effect of FSH and testosterone- at the same time with Estradiol (which makes it number e. in the previous part). It's released as a negative feedback mechanism to block the **aromatase** enzyme that's necessary for estrogen synthesis.
2. Activin and Estradiol: Together they block the testosterone synthesis in Leydig cells as a negative feedback mechanism.
3. Testosterone stimulates the differentiation of peritubular cells which secrete proteins similar to the ones produced by Sertoli.
4. Estradiol and testosterone: The two steroids are enemies and they always work against each other in a balanced miraculous way;
   Till middle age, testosterone is the one that owns the victory which means it's more synthesized and secreted than estradiol. But after middle age, Estrogen is the one who is in charge. Estrogen increases the expression of DHT receptors, this means that the prostate will be stimulated by more dihydrotestosterone (DHT). And that explains why the prostate gets enlarged after the middle age (also explains why the high estrogen amounts have bad effects on males). The evidence to prove that is the drug that's used in such cases, which is Finasteride.

❖ Epididymis البربَخ

Now it's time to start talking about the histology of the rest of the male reproductive system.

Figure 6: cross section of epididymis

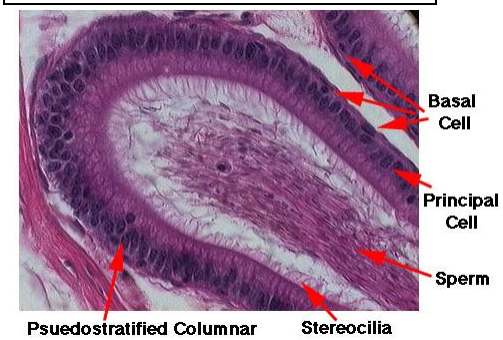


- Starting with the Epididymis:

We are now behind the testis where this beautiful large lady is lying as the main site for **storing sperms**. And it's made of: head, body and tail.

The head of this lady is formed by the combination of more than one efferent ductules (12-20 ductules), that later will join together as a single duct "the duct of the epididymis". This duct is too coiled that its length may reach 6 meters, and it represents the body and the tail.

Figure 7: cross section of epididymis



We should learn some more stuff about this lady. (figures-6,7)

1. Its lining epithelium is made of basement membrane and 2 types of cells, both of them are pseudostratified columnar:
   A. Basal cell; this cell has a rounded nucleus and is resting on the basement membrane.

   B. Principal cell; its nucleus is oval in shape. This cell processes magical structures into the lumen of the duct and that would be the famous long microvilli, or their tricky nickname which is Stereocilia. These stereocilia are not similar to other stereocilia in the rest of our bodies; it does not move. Stereocilia of the principal cells are magical as they absorb the fluids once released from the Sertoli cells along with the sperms into the lumen (Sertoli send the sperms with fluids to help them move since they are still immotile).

2. It must have some smooth muscle cells supplied by sympathetic neurons to eject the sperms into the vas deferens on peristalsis. The duct of the Epididymis has thin layers of smooth muscle cells: a circular layer in the head and three multidirectional layers in the body and the tail.
3. The lumen of the duct is full of immature sperms that the testis has sent. And here is the perfect place to **store and to induce maturation of the sperms**. They will stay here for weeks or maybe months. Maturation of the sperms in the lumen will give them the ability to be motile but yet not ready to fertilize.

Extra information: The lamina propria, containing underlying small blood vessels and lymphatics. Together with the epithelia, this is called the mucosa, and is arranged into convoluted folds, increasing the overall surface area**. Wikipedia**

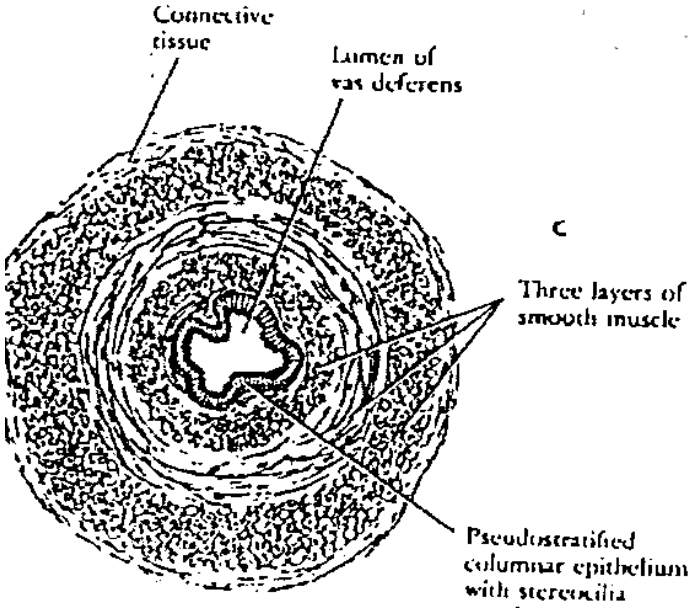
   - A sperm becomes capable of fertilizing an ovum only when it reaches the female genitalia. When a sperm reaches the uterus it will face the mucosa of the uterus which contains specific enzymes that change the properties of the acrosomal head of the sperm allowing it to penetrate the ovum. And that's the meaning of "Capacitation".

4. One more tiny note about the Epididymis; it might have a phagocytic activity.

❖ Vas deferens قناة الخِصية، أوالأسهر

- The next stop in our journey is the Vas Deferens. The sperm now is in this long tube that starts as a continuation of the tail of the epididymis. And it ends its road up in the last station of the deferens which is the "Ampulla", where some sperms are stored temporarily. And when the sperm wants to leave the vas deferens,

Figure 8: cross section of vas deferance



the Ampulla must join the duct of the Seminal vesicle and they form together the ejaculatory duct.

- As you can see in figure-8, the vas deferens has **long folds of mucosa** in its very narrow lumen, but has a **very thick wall.** Apparently, the wall is composed of three layers of smooth muscle cells and they are involved in the powerful peristalsis we need to transport sperms to the seminal vesicle. The layers of s.m.c are:
    1) Outer layer with longitudinal fibers.
    2) Middle layer with circular fibers.
    3) Inner layer with also longitudinal fibers.

Since the vas deferens is a continuation of the epididymis, they must have some common features. The lining epithelium of the vas deferens is also pseudostratified columnar but instead it is resting on lamina propria.

- ✪ To leave this tube station, we should notice one more thing; The adventitia of the vas deferens, that's made of blood vessels and nerves embedded in a connective tissue (from handout 3).

❖ The spermatic cord الحبل المنوي

This wonderful structure is composed of a collection of many stuff. Let's find out what is it hiding for us..(figure-9).

The doctor explained this picture and pointed at it each of its components. As It's explained in the next two pages.

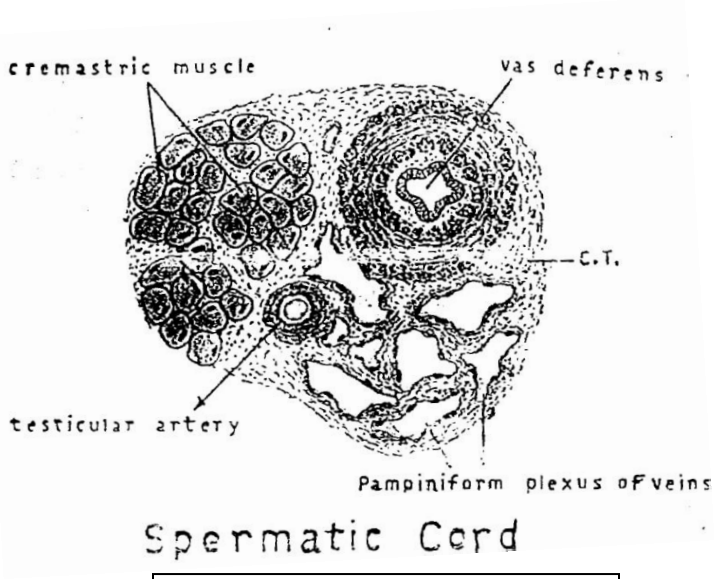
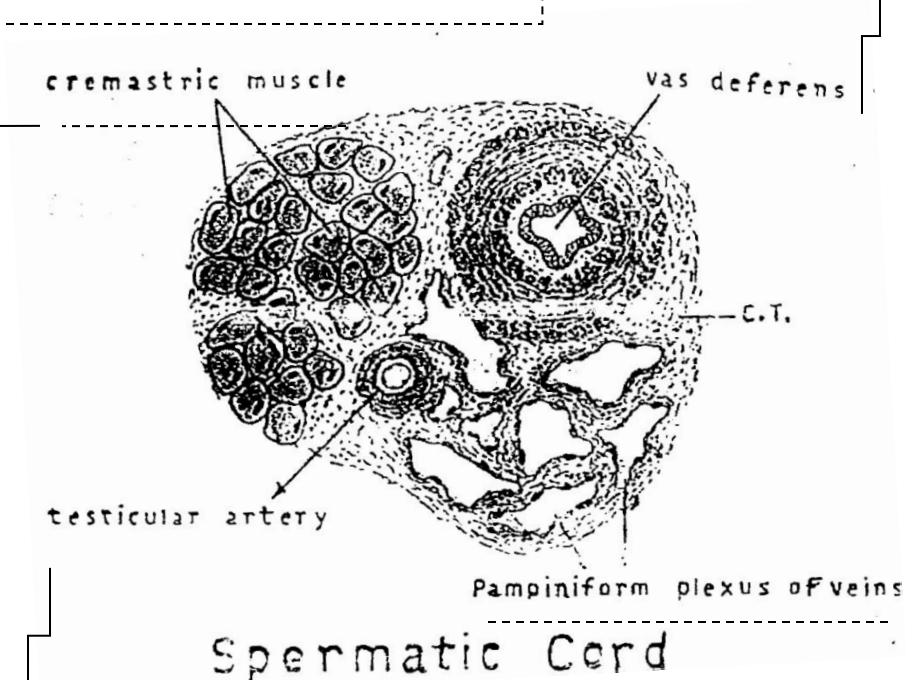


Figure 9: cross section of spermatic cord

This muscle covers the testis and the spermatic cord with its three layers of fibers. This reminds us of the cremasteric reflex we took before in the CNS. This reflex is composed of the afferent nerve: femoral branch of genitofemoral nerve. And the efferent nerve: genital branch of genitofemoral nerve (the nerve that supplies the cremasteric muscle). We test this reflex when we suspect an U.M.N lesion. How? If you scratch the thigh of your patient, normally this muscle will elevate his testis at the same side. But if there was a lesion, the cremasteric reflex would be absent.

The most important structure in the cord. With its blood vessels.



Spermatic Cord

Originates from the abdominal aorta and descends to supply the spermatic cord and the testis. (the testis developed in the abdomen then moved down to the scrotum)

Group of veins that form the testicular vein above. If we follow where this vein goes we'll find that(figure-10):-The right testicular vein drains into the IVC. -The left testicular vein drains into the left renal vein at right angle. This prearranges for varicose veins in the left testis more than in the right one. So, the reasons for that to happen are:

1) The left testis commonly is lower in position than the right >> longer blood column>> higher blood pressure.
2) The left testicular vein drains into the left renal vein at right angle.
3) The left adrenal vein also drains into the left renal vein, with its large content of catecholamines >> vasoconstriction of the testicular vein>> higher BP.

And this is bad for the testis because varicose veins will increase its temperature which means the function of the sperms in it will be disrupted.

There are still two essential structures that can't be seen in the figure above:

- **Lymphatics**: they come from the testes and the epididymis to drain into the paraaortic lymph nodes (since its origin's from the abdomen); around the aorta at the same level where the renal artery branches from the abdomen. (this point is extremely important)
- **Coverings of the spermatic cord**: what covers the cord are layers derived from the abdomen. Coverings of the spermatic cord(figure-11):
    1) Internal spermatic fascia, derived from fascia transversalis.
    2) Cremasteric fascia, made up of cremasteric muscle loops connected together by areolar tissue (loose connective tissue). It's derived from the internal oblique and transversus abdominis muscles.
    3) External spermatic fascia, derived from the external oblique aponeurosis.
        - The internal spermatic fascia and the cremasteric fascia cover the whole cord, while the external one only covers it below the superficial inguinal ring (only the lower part).

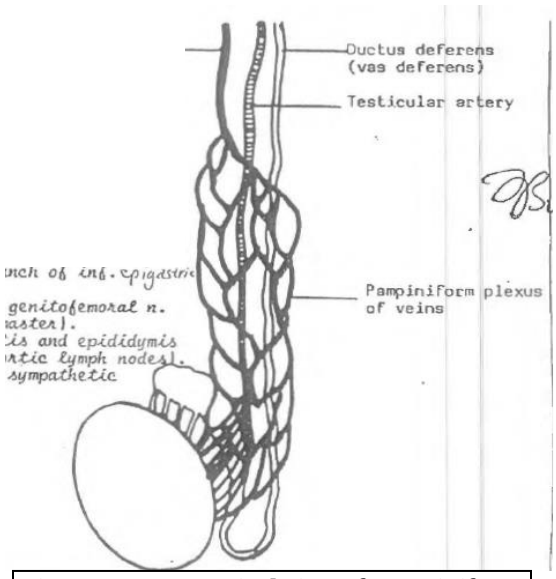


Figure 10: anatomical view of pampiniform plexus of veins

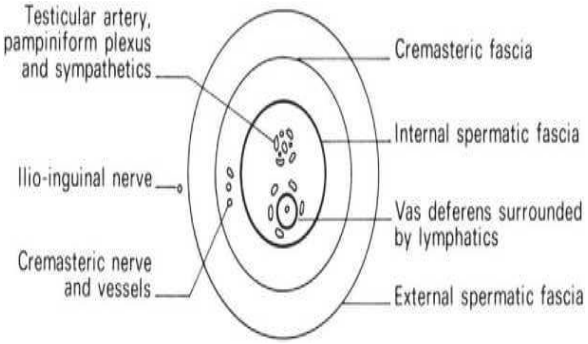


Figure 11: cross section of spermatic cord

✪ **Clinical application: Inguinal Hernia.(figure-12)**

Last year we studied the direct and the indirect inguinal hernias in details. What matters here is the **indirect hernia**; as it would be **inside** the spermatic cord and lies lateral to inferior epigastric artery. (It will be explained in the next lectures, so don't worry).

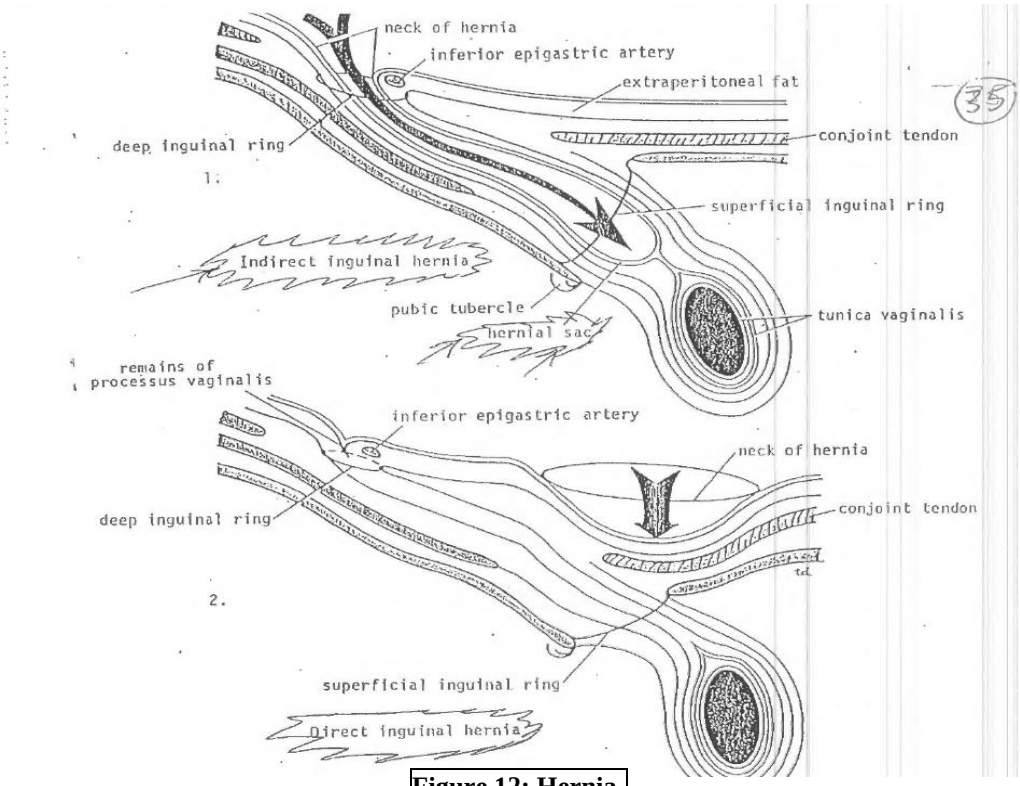


Figure 12: Hernia

★ Prostate

We always hear in the news about the greatest serial killer in men which is "the carcinoma of the prostate gland". So let's take a look at its top secret profile to find out what is making it so great.

- ★ The prostate is located in **the true pelvis** of the human skeleton where it's below the neck of the bladder, anterior to the rectum, posterior to the symphysis pubis and the pubic arch and above the levator ani (inferolateral surfaces).
- ★ Since the prostate is a gland, we must point at its two main structures: stroma and glands (parenchyma):
  - ✪ The *stroma* or "هيكل الغدة" is composed of a fibrous capsule and muscles, which make it firm (not soft).

✪ The glands are in the shape of alveoli and tubules. Most of these glands open into the prostatic sinuses on either side of the urethral crest.

But where do you find these glands? The prostate glands are either:

1) At the periphery**,** where they have enough space to get large, branched and able to **produce carcinoma**. How can we treat the prostate and remove the tumor? What would we do? The only solution here is to remove the whole prostate gland.(figure-13)

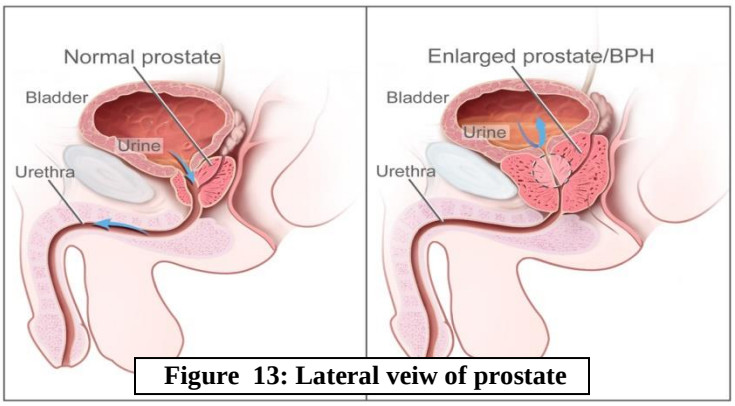


Figure 13: Lateral veiw of prostate

2) In the inner zone next to the urethra, where they are small, mucosal or submucosal glands. But here only hyperplasia of stroma and glands could cause benign enlargement, and it's easy to fix that if you approached from the urethra. As mentioned before, the direct reason for the enlargement is the excess production of DHT(dihydrotetosterone).

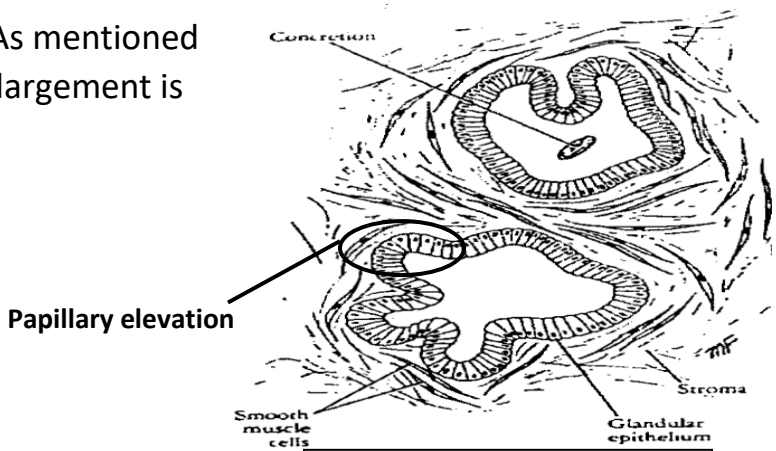


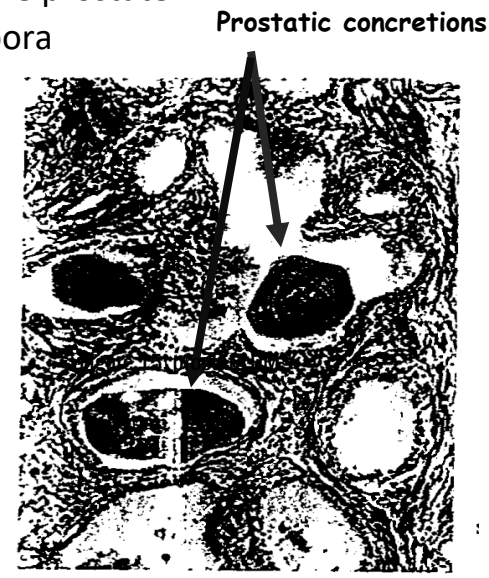
Figure 14: cross section of prostate

★ The **lining epithelium** of the prostate:

The lining epithelial cells of the prostate are **variable**; in childhood the cells will be in the shape of inactive low cuboidal cells, they become gradually active **pseudostratified columnar cells in adulthood**.

A very specific feature of the lining epithelium of the prostate is that you can clearly see –under the microscope- **papillary elevations**.(figure-14)

★ Lumen of prostate: the lumen of the glands in the prostate becomes full of amorphous masses called “corpora amylacea” that increase in amount with age to form prostatic concretions or prostatic salts.



- Prostatic concretions are also very specific to the prostate and are clearly seen under the microscope (figure-15). But what are these secretions/concretions/salts?
  The prostate gland secretes alkaline fluid and it makes up about 25% of the volume of the seminal fluid. So the secretions contain:
  a. **Citric acid**, used by sperms for ATP production via Krebs cycle.
  b. Several **proteolytic enzymes** such as prostate specific antigen, amylase and hyaluronidase which break down the clotting proteins from the seminal vesicle.
  c. **Acid phosphatase** which has an unknown function.

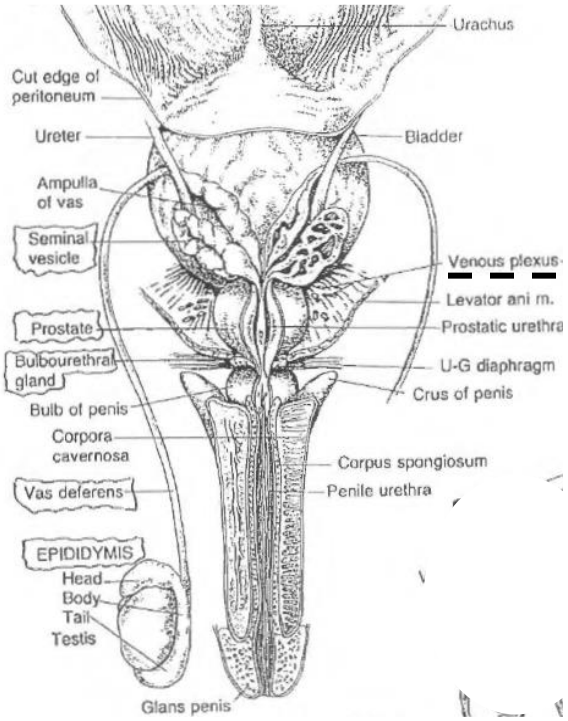


Figure 16: male reproductive organs from behind

★ In the capsule of the prostate –in the false and not the true capsule- on the sides of prostate we find the prostatic venous plexus; which is in a continuation with the venous plexus of the spinal cord (figure-16).

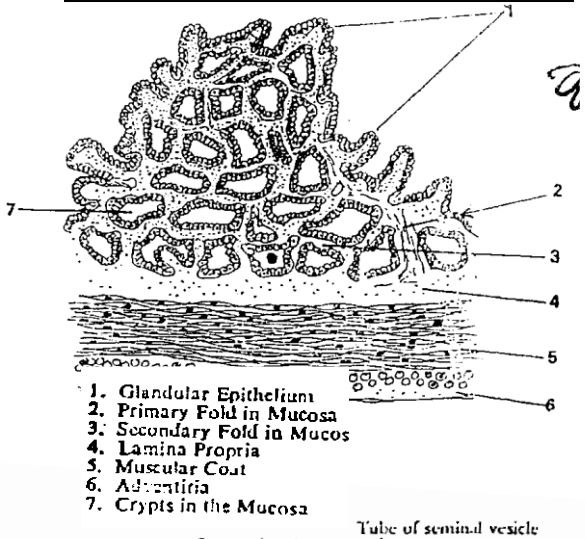
This connection makes it easier for prostate carcinoma to metastasize in early stages (like breast and lung carcinomas) to the vertebral column.

The doctor said that everything about the prostate is very important so before you go to the next part read this part well again "وبدون شلفقة".

❖ Seminal Vesicles الحويصلة المنوية

The seminal vesicles are composed of two lobulated sacs and are situated between the urinary bladder and the rectum. Each vesicle is about 2 inches long and is directed upwards and laterally. The highly convoluted mucus membrane that projects into the wall forms cavities which take a honeycomb appearance.(figure -17)

Figure 17: cross section of Seminal vesicle.



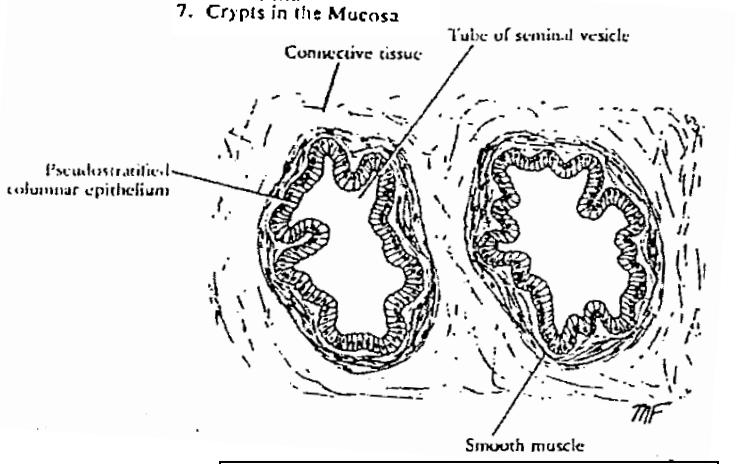


Figure 18: cross section of Seminal Vesicle

- Their mucous membrane is very specific; thrown into **<u>many complex folds</u>** and usually lined by pseudostratified columnar cells (but maybe just columnar). Look at figure-18 to easily recognize the cross section of the vesicles.
- Since we need the seminal vesicles in the process of ejaculation, they must have smooth muscle cells to do peristalsis. According to that; the vesicles have one inner circular layer of s.m.c and an outer longitudinal one.
- What about their lumen? The sperm enjoys its time around here since it gets most of its supply from the seminal vesicles. As we mentioned before, they don't store the sperms but they secrete 60% of the seminal fluid to benefit sperms. The contents of their secretions are:

1- Fructose
2- Ascorbic acid
3- Amino acids

→ The three of them give nourishment to the sperm to form ATP.

4- Prostaglandins (extremely important): They assist in the fertilization process in 2 main ways: Firstly, they react with the cervical nucleus to make it more penetrable by the sperm(at the sexual arousal). Secondly, they induce peristaltic contractions in the female reproductive tract (uterus and fallopian tubes) to propel the sperm up the tract.
    - The neck of the uterus is full of mucous to protect the female from bacterial infections. But at the same time, this mucous forms a barrier for the sperm and holds it from any penetrations. At the sexual intercourse, prostaglandins will be carried to the uterus by the seminal fluid and try to decrease the mucous viscosity in order to make an easier way for the sperm to reach and penetrate the ovum.
5- Fibrinogen: When the seminal fluid reaches the vagina, we need to hold the sperms temporarily to buy some time for capacitation. So fibrinogen induces clotting, until capacitation is done, then other enzymes from the **prostate** like fibrinolysin come to lyse the clot.

(كأنه في قوة بتعمل على إيقاف الحيوان المنوي ومنعه من الحركة و قوتين بتسهل عملية اختراقه، القوة الي ضده بتيجي من التخثر والقوتين الي بتلعب لصالحه هي ال PGs& NOT MENTIONED BY THE DOCTOR(Capicitation

Again, the seminal vesicles need the testosterone for differentiation and growth.

- Also, if the seminal vesicles got inflamed, they become firm and for that they can be felt by PR examination (digital rectal examination).

☑ And by that, the sperm has ended its journey in the male reproductive system, all it has to do now is to use the urethra to enter to the vagina.

Map of our previous journey:

❖ Male external Genitalia: Penis

We are now going to learn about the urethra. It's a membranous canal for the external discharge of urine and seminal fluid. And to understand it well, we will start with the penis in male. The doctor pointed at each structure in figures-15, 16. The rest of the figures are helpful as well.

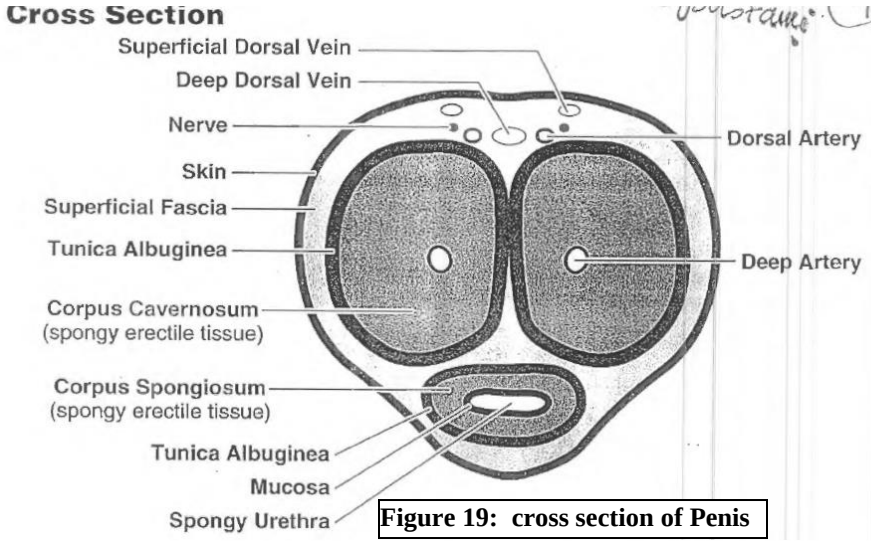


Figure 19: cross section of Penis

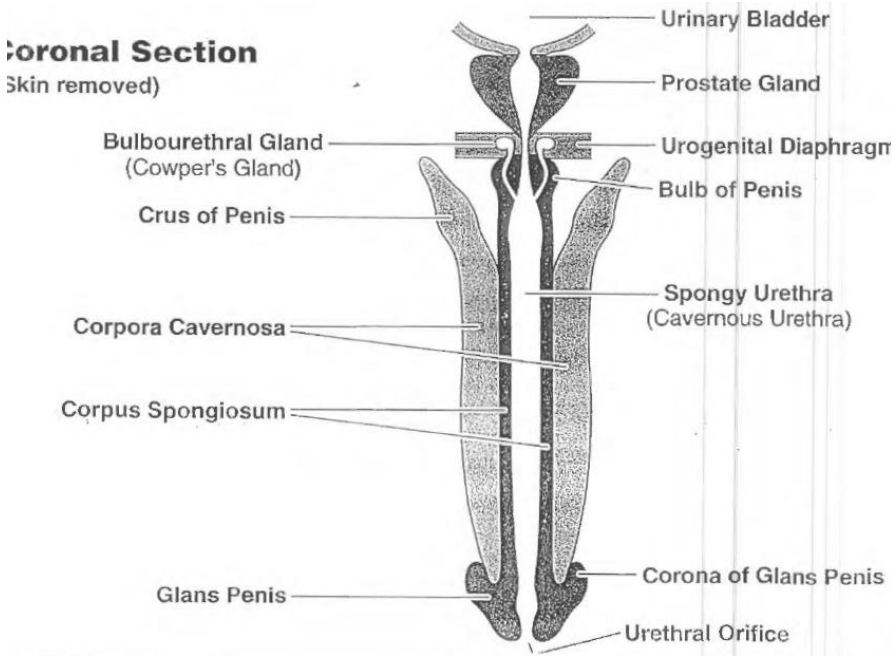


Figure 20: coronal section of Penis.

1. The outer coverings of the penis -as most parts in our bodies- are skin and under it you will find superficial fascia then deep fascia that's called Tunica Albuginea.
2. On the back of penis at the dorsal surface there is Corpus Cavernosum. Related to this erectile tissue two arteries: one deep artery passing through it and another one on the surface. The two arteries come from a major artery called **pudendal artery** which is a branch of the internal iliac artery. The pudendal artery with its branches represent the blood supply of the penis.

3. On the ventral surface of the penis we will find another spongy erectile tissue called Corpus Spongiosum. But why is it called spongy? It contains cavities that become full of blood during erection"انتصاب أو استقامة القضيب". Part of the urethra passes through the corpus spongiosum and here it's called penile urethra.

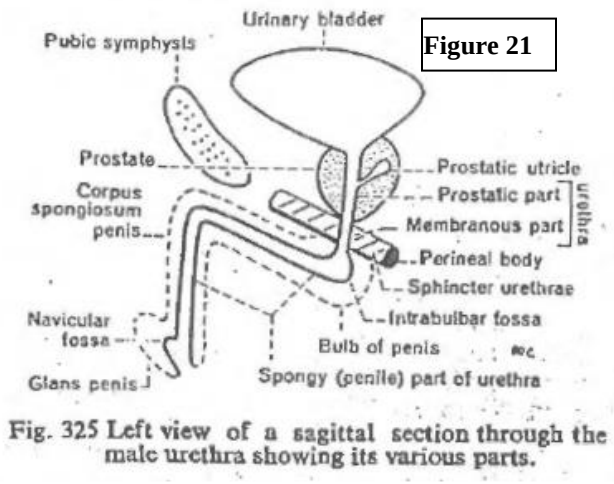


Figure 21

Fig. 325 Left view of a sagittal section through the male urethra showing its various parts.

4. At the terminal end of corpus spongiosum there is a part called Glans Penis. This end is covered by a fold of skin that is cut and removed in newborns in a procedure called circumcision" الختان، أو الطهارة" (in Islam, this procedure is sunnah ☺)
5. The corpus spongiosum and the corpora cavernosa represent the free part of the penis, while the root of the penis is attached.
6. The root of penis is composed of one bulb and two crura. If you follow one **c**rus of penis, you will notice that it's turning into corpus **c**avernosum. And the <u>bulb</u> of the penis will be turning into <u>corpus spongiosum</u>. The urethra passing through the bulb is called bulbourethra. The root of the penis is attached to the lower surface of perineal membrane, which is anatomically a horizontal plate extending between the two pubic arches and the pelvic outlet (remember the angle between the arches is smaller in men).
7. The prostatic urethra is 3cm long and it's the widest urethra.(figure-21)
8. Then comes the part where the urethra is at its **narrowest** while passing through the **urogenital diaphragm** where its 1.5-2 cm in length. We call it the **membranous urethra**.(figure-21)
9. The **external urethral sphincter** (أهم عضلة في جسمك مع خبطة إيده عالطاولة) is another part of the diaphragm rather than the membranous urethra. This sphincter urethrae is **voluntary** in nature because it's made up of striated muscle fibers and supplied by perineal branch of pudendal nerve (somatic not sympathetic). It narrows the membranous urethra and therefore responsible for the voluntary holding of urine. <u>Initiation of micturition</u>"التبول" is attributed

to the relaxation of the pelvic floor, including the sphincter urethrae (others accord it to the detrusor muscle)(from H.O.2). If the external urethral sphincter was damaged, the patient would suffer from urinary incontinence " سلس البول"(figure-21).

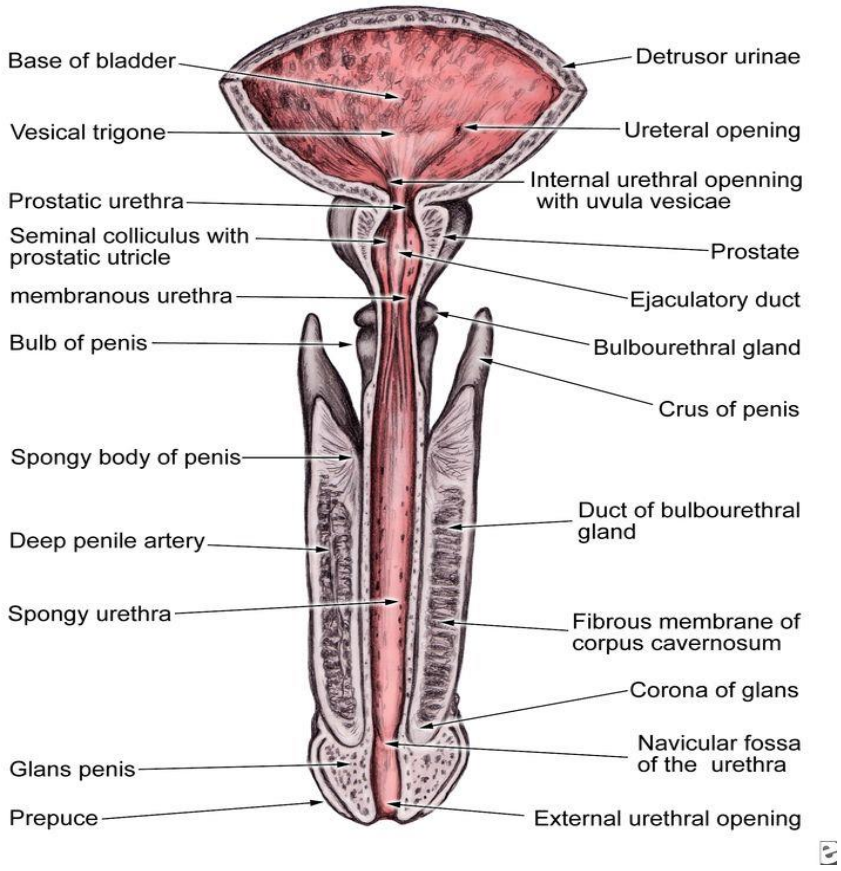
- Since it's called external urethral sphincter then there must be an internal one. The *internal urethral sphincter* (aka sphincter vesicae) is simply the neck of the urinary bladder which is a smooth muscle. The internal sphincter controls the neck of the bladder and the prostatic urethra above the opening of the ejaculatory duct. Its *involuntary* in nature so must be supplied by sympathetic nerves (lower thoracic and upper lumber).

10. There is still a third part of the diaphragm (that was mentioned in the lab) which is the bulbourethral gland. The two bulbourethral glands are found around the MEMBRANOUS urethra but their ducts penetrate the perineal membrane and open in the PENILE urethra (the longest urethra) in the spongy part of penis. These glands secrete alkaline fluid into the urethra that protects the passing sperms by neutralizing acids from urine in urethra (from H.O.2), it adds to the seminal fluid.
11. The urogenital diaphragm is inferior to the anterior fibers of levator ani muscles. So these muscles elevate the prostate (levator prostatae).
12. The prostate's inferolateral surfaces rest on the pelvic diaphragm, and it also lies on the urogenital diaphragm where its apex is connected.
13. In the flaccid state penis, the long axis of urethra shows 2 curvatures, and therefore is S-shaped. Its 18-20 cm long as whole.(figure-21)
14. You can now identify the extension of the urethra; starting from the internal urethral orifice to the external urethral orifice at the tip of penis.

* The urethra in females is commonly exposed to urinary tract infections (UTI) for 2 reasons:

1) It's 4 cm long (short).
2) The urethra is close to the vagina.

Having a trouble memorizing all of that? Here's a quick summary:

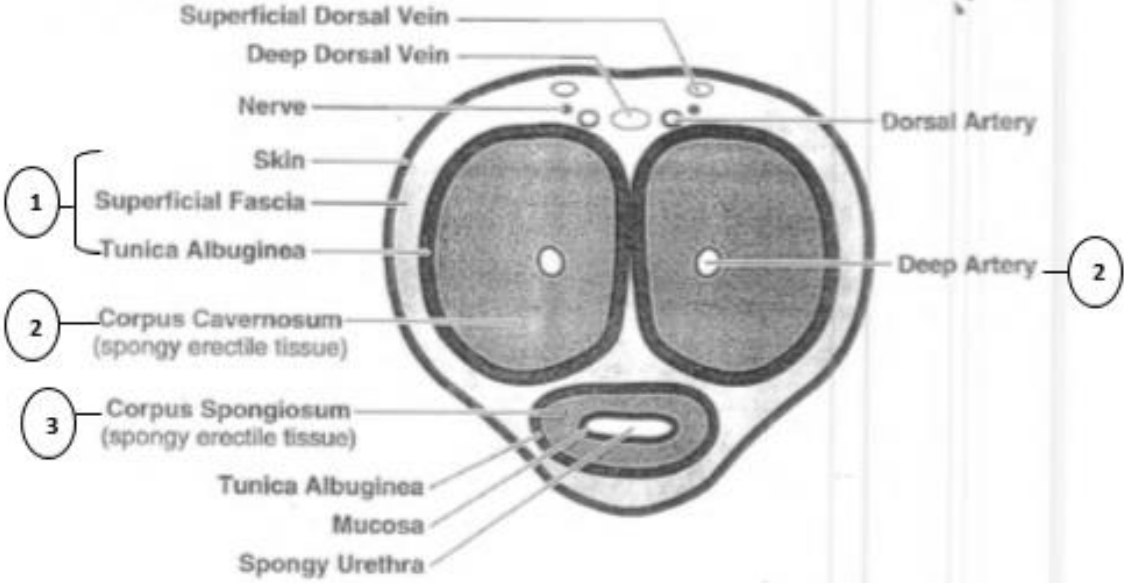


☑ **Urogenital diaphragm** is composed of: (16)

a) <u>Sphincter urethrae</u> (aka external urethral sphincter), which narrows the lumen of the membranous urethra <u>voluntarily</u> to prevent incontinence of urine.
b) Superior fascia of urogenital diaphragm
c) Inferior fascia of urogenital diaphragm, aka perineal membrane. This membrane is horizontal and attached to the pelvic outlet and the pubic arches. What's attached to its lower surface is the root of penis.
d) the membranous urethra is found inside it.
e) Two bulbourethral glands around the urethra.

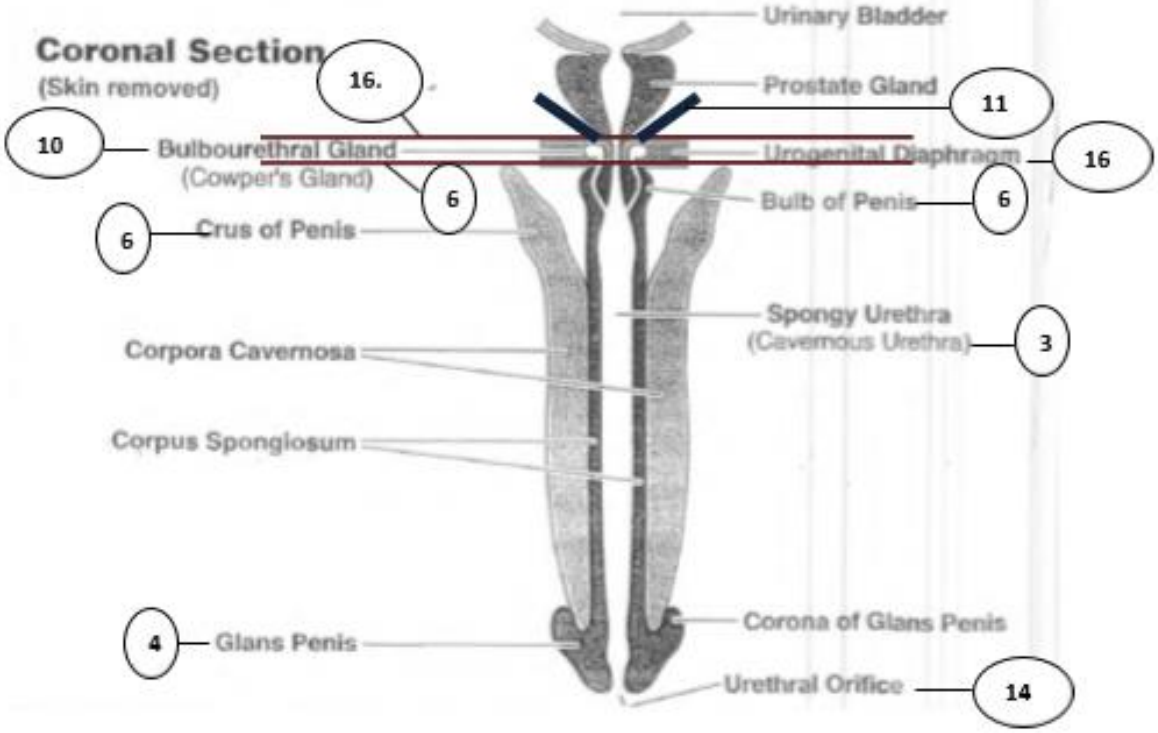
PENIS

Cross Section

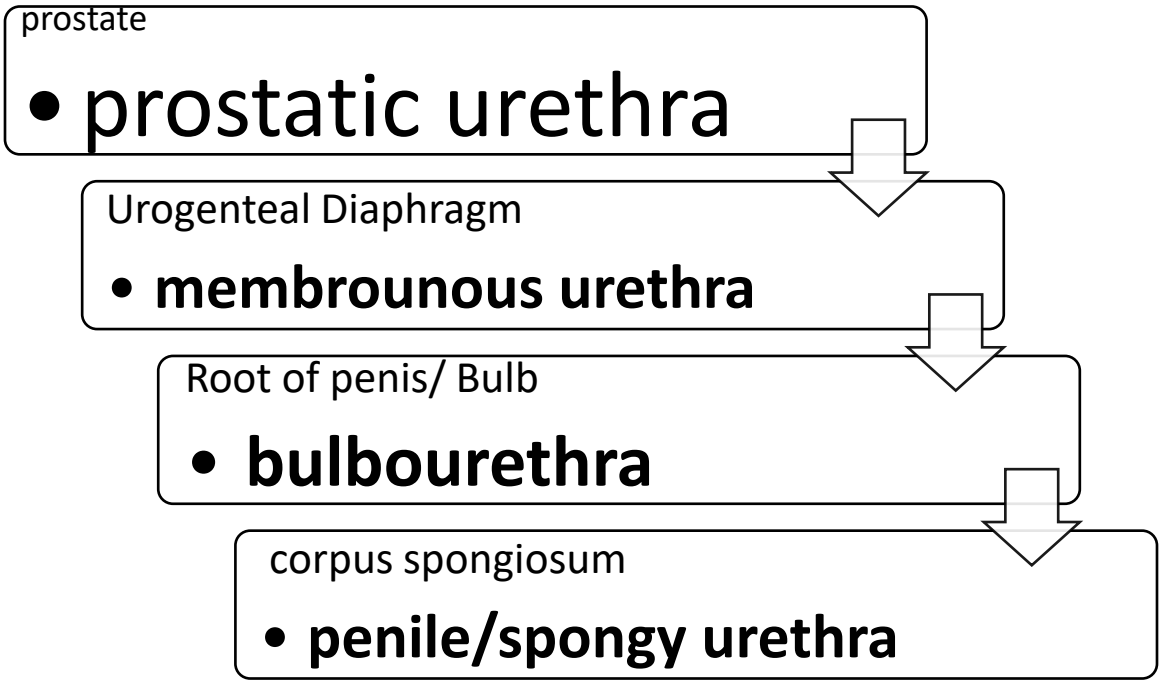


Coronal Section

(Skin removed)



☑ The parts of **Urethra** are:



I tried to put everything that's related to the lecture and was only written in handouts. Some slides weren't explained and if they were copied here, some people من طول الشيت رح يخلصوا علي.

So these slides (29-46) are explained in lecture anatomy 7.

الحمد لله الذي بنعمته تتم الصالحات

I'm greatly thankful to all who helped me; especially: queen of motivation Raghad Bataineh, queen of sheets Reem Al-Akiely and the one and only YANES.

وتذكّر دوما: أنّنا لا نكبر حقًّا إلّا بقدر ما نضيف، بقدر ما نقدّم من إضافة.

Sorry for any mistakes