أهلا وسهلا

الأستاذ الدكتور يوسف حسين

أستاذ التشريح وعلم الأجنة - كلية الطب – جامعة الزقازيق – مصر

رئيس قسم التشريح و الأنسجة و الأجنة - كلية الطب - جامعة مؤتة - الأردن

دكتوراة من جامعة كولونيا المانيا

اليوتيوب **Prof. Dr. Youssef Hussein Anatomy**

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Development of Urinary bladder

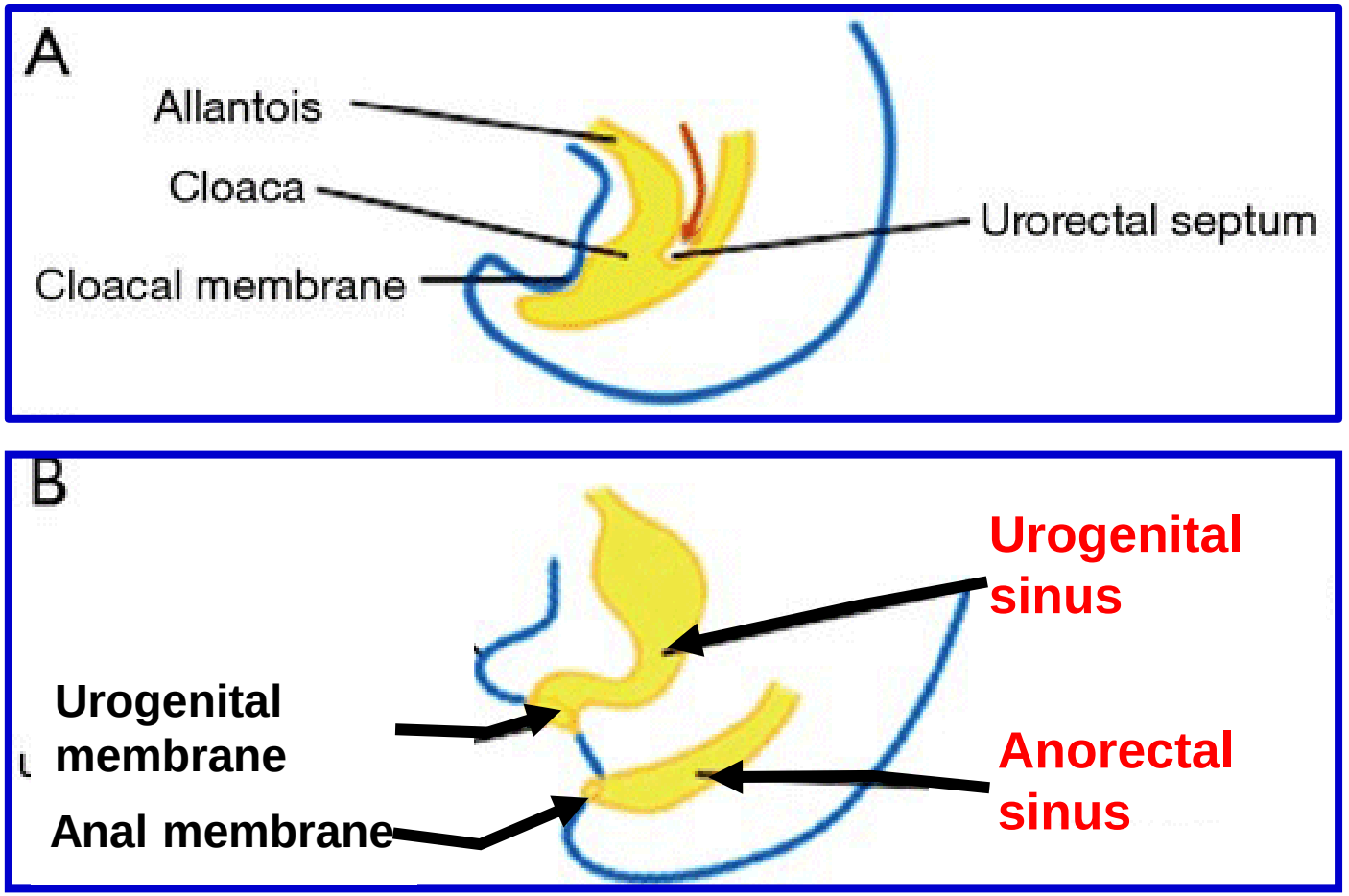
❖ Derivatives of cloaca

- The cloaca is the caudal dilated part of the **hindgut**, which is closed by the cloacal membrane and connected to umbilicus by **allantois (urachus)**.

- **Urorectal septum** divides the cloaca into **2 parts:**

1- Ventral part called **urogenital sinus**, **c**losed by urogenital membrane.

2- Dorsal part called **anorectal sinus**, closed by **anal membrane**.



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- **** Derivatives of the urogenital sinus:**

- It receives openings of allantois and 2 mesonephric ducts.

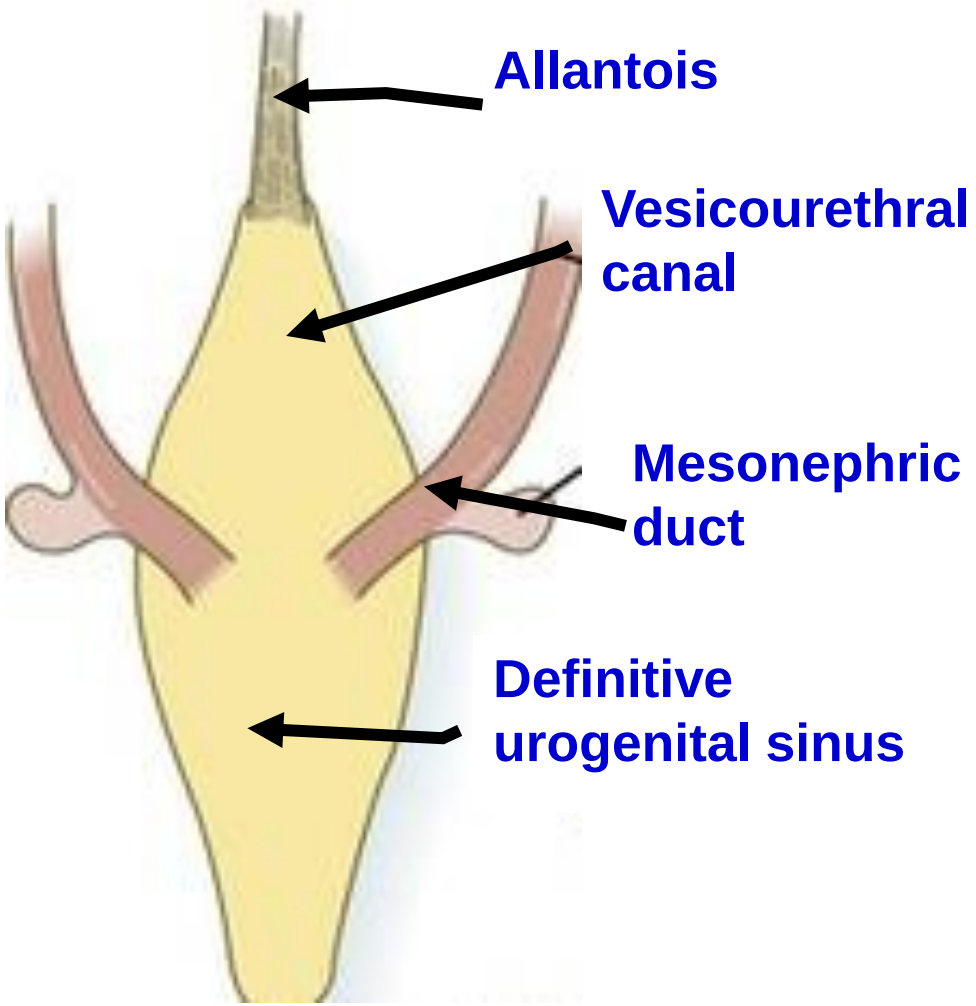
- The site of opening of mesonephric ducts into **urogenital sinus** dividing it into:

1- Cranial part called **vesicourethral canal** which forms mucous membrane of:

a) Urinary bladder.

b) Prostatic part of urethra above the utricle (in male) or Upper 4/5 of the **urethra** (in female).

2- Caudal part called definitive urogenital sinus.



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- **Development of the Urinary Bladder**

**** Development of the mucous membrane**

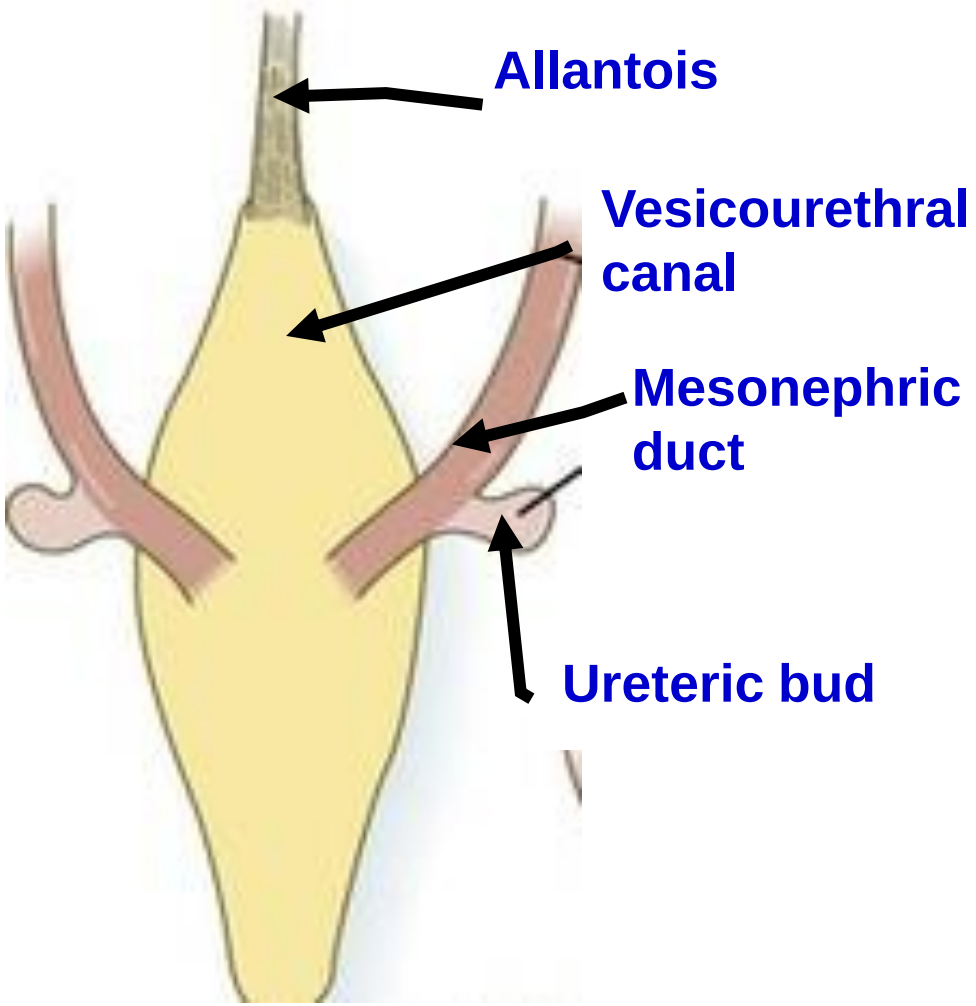
1- Proximal part of allantois (urachus), forms the apex of the urinary bladder (endodermal in origin).

2- Vesicourethral canal, forms most of the urinary bladder (endodermal in origin).

3- Proximal parts of mesonephric ducts till the opening of ureteric buds form **trigone** (mesodermal in origin).

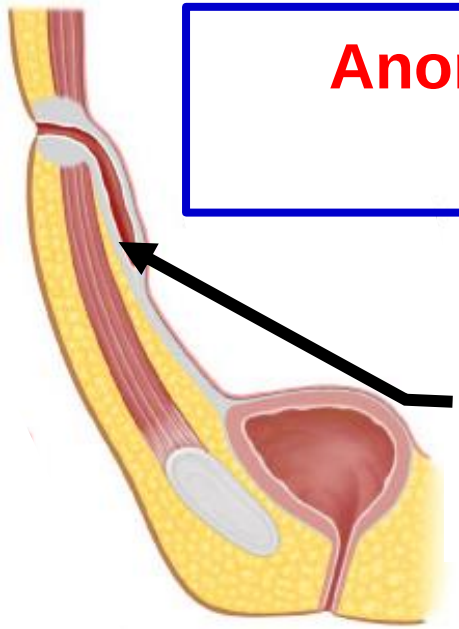
**** Development of muscles (**from the mesoderm surrounding the vesicourethral canal).

- Distal part of allantois (urachus) obliterated, fibrosed and formed **median umbilical ligament.**

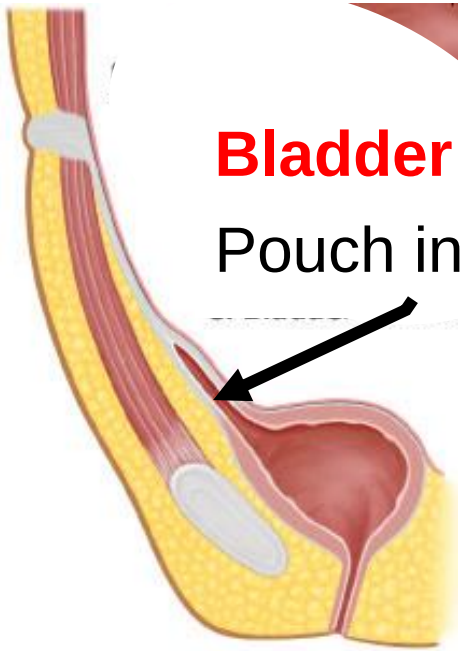


Anomalies of urachus (allantois):

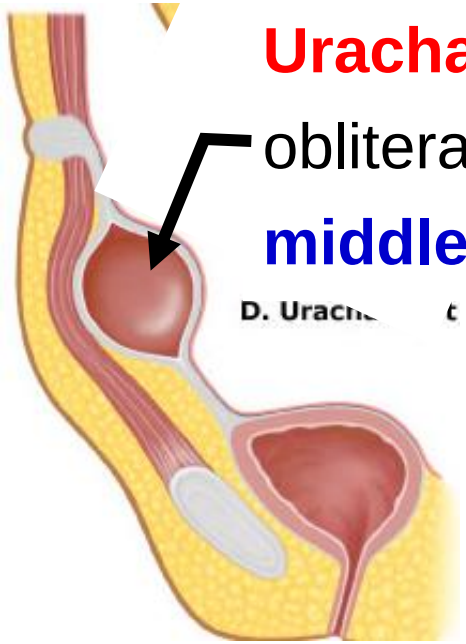
Urachal fistula: failure of obliteration of **urachus**. This will lead to discharge of urine from umbilicus.



Urachal sinus: failure of obliteration of **distal** part of urachus.



Bladder diverticulum: Pouch in the apex



Urachal cyst: failure of obliteration of the **middle** part of urachus.

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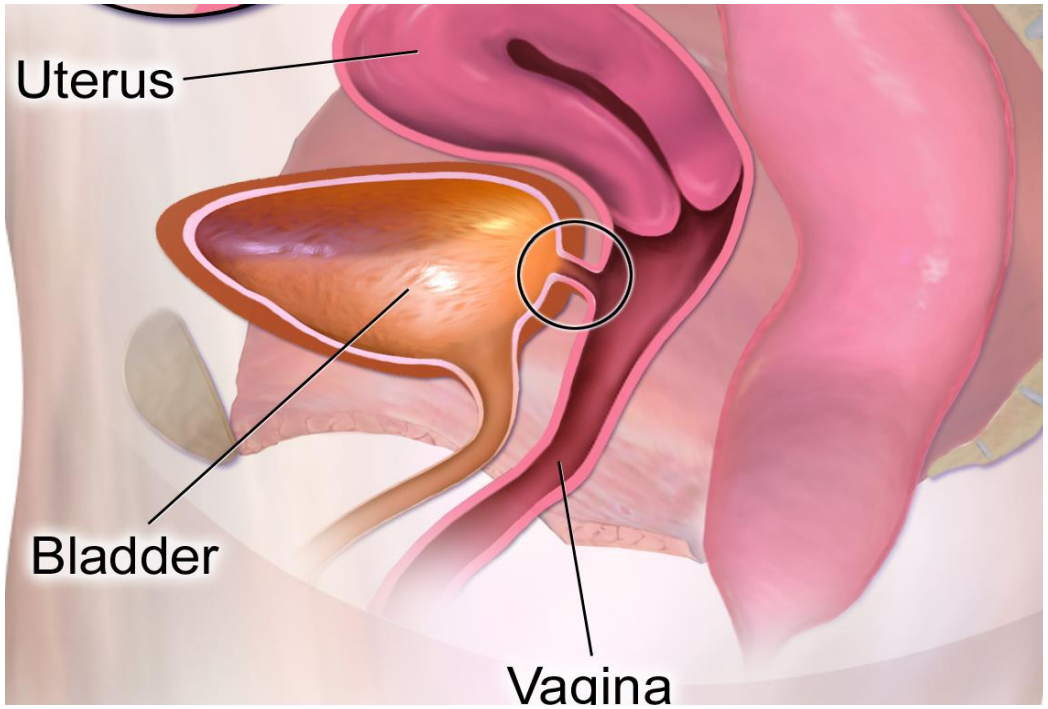

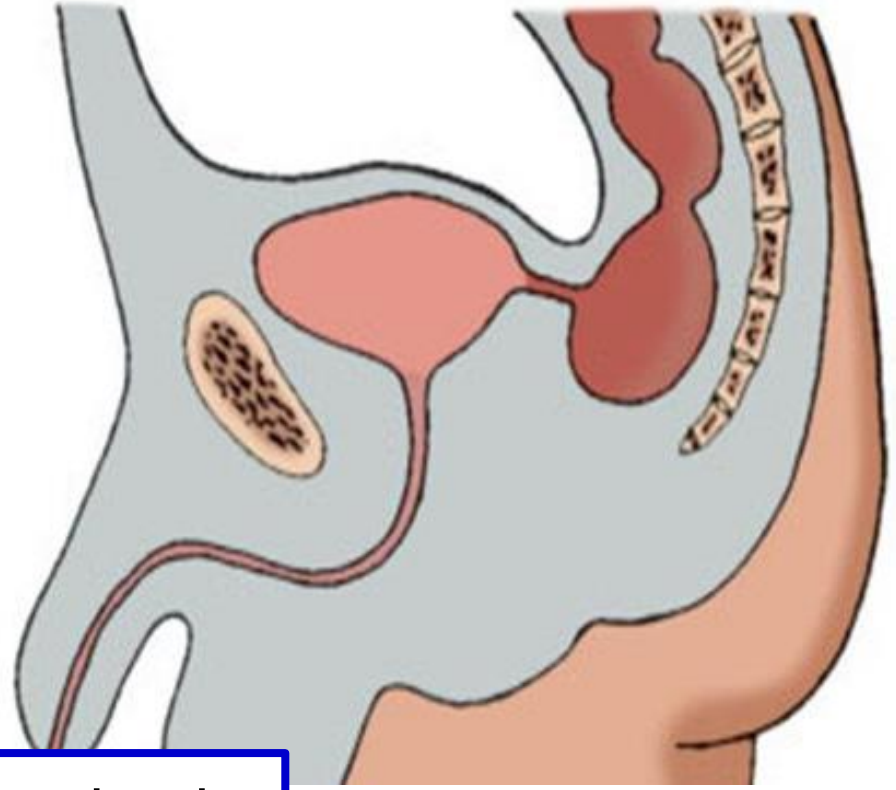

Fistulae of the urinary bladder: due to defect in the urorectal septum.

(a) Vesicovaginal fistula: communication between urinary bladder and vagina (**female**).

(b) Rectovesical fistula: communication between urinary bladder and rectum (**male**).

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- **Ectopia vesica:**

- The inner aspect of the urinary bladder is exposed below the umbilicus.

- This occurs due to failure of the formation of the anterior abdominal wall and anterior wall of the urinary bladder.

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Development of urethra

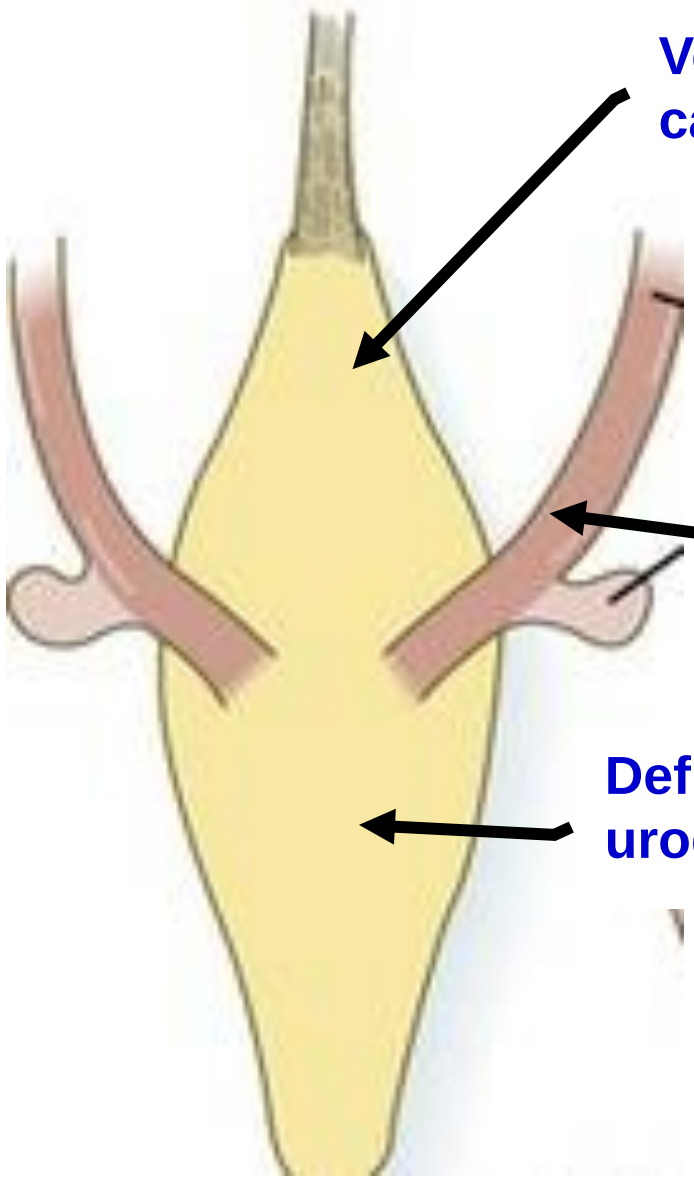
** Development of the female urethra

- The site of opening of mesonephric ducts into **urogenital sinus** dividing it into:

1- Cranial part called **vesicourethral canal** which forms mucous membrane of Upper 4/5 of the **urethra**.

2- Caudal part called definitive urogenital sinus forms Lower 1/5 of the urethra.

- The urethral sphincters are developed from the surrounding mesoderm.



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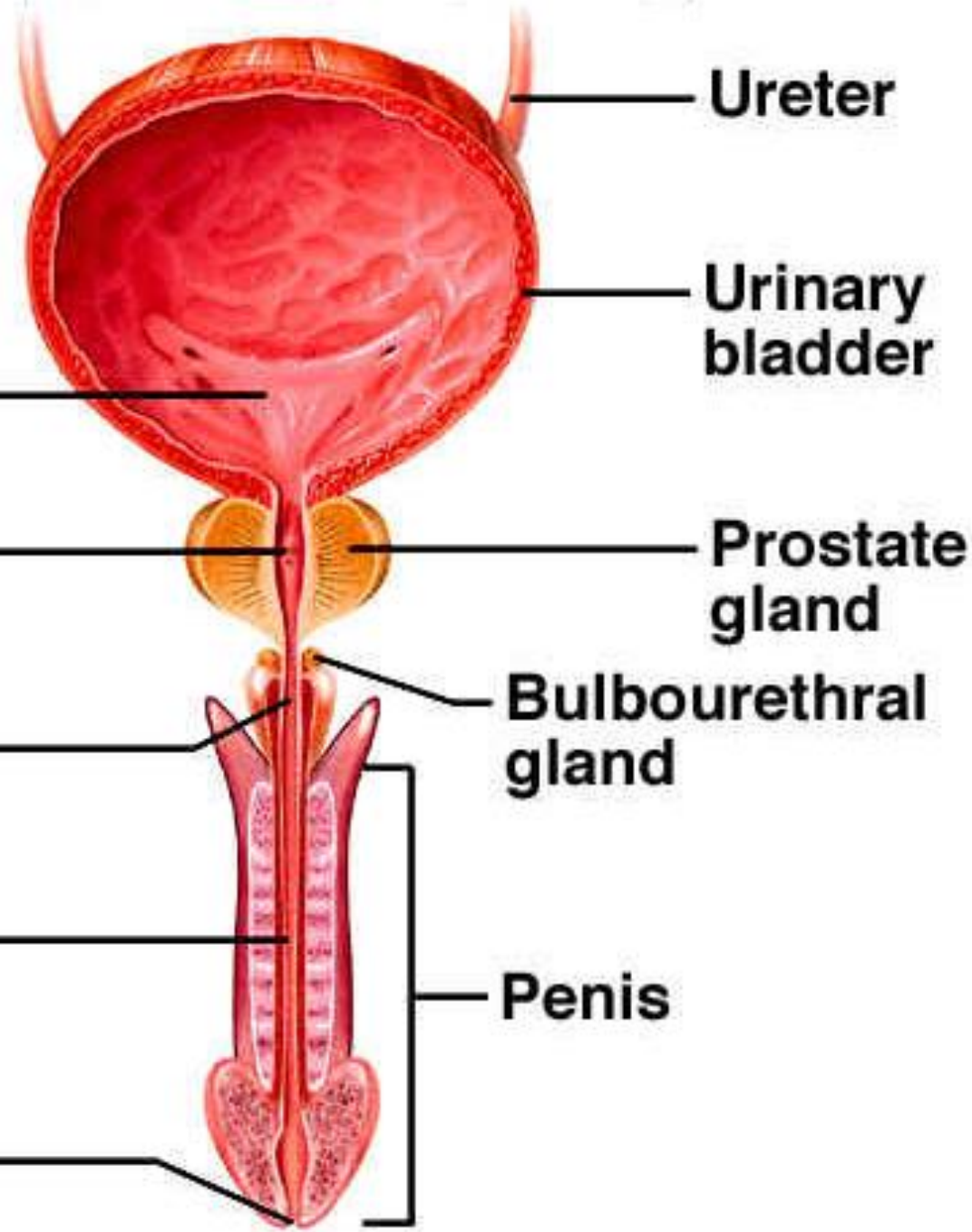
Male Urinary Bladder and Urethra



** Development of male urethra

A- Vesicourethral canal forms Prostatic part of the urethra above the utricle .

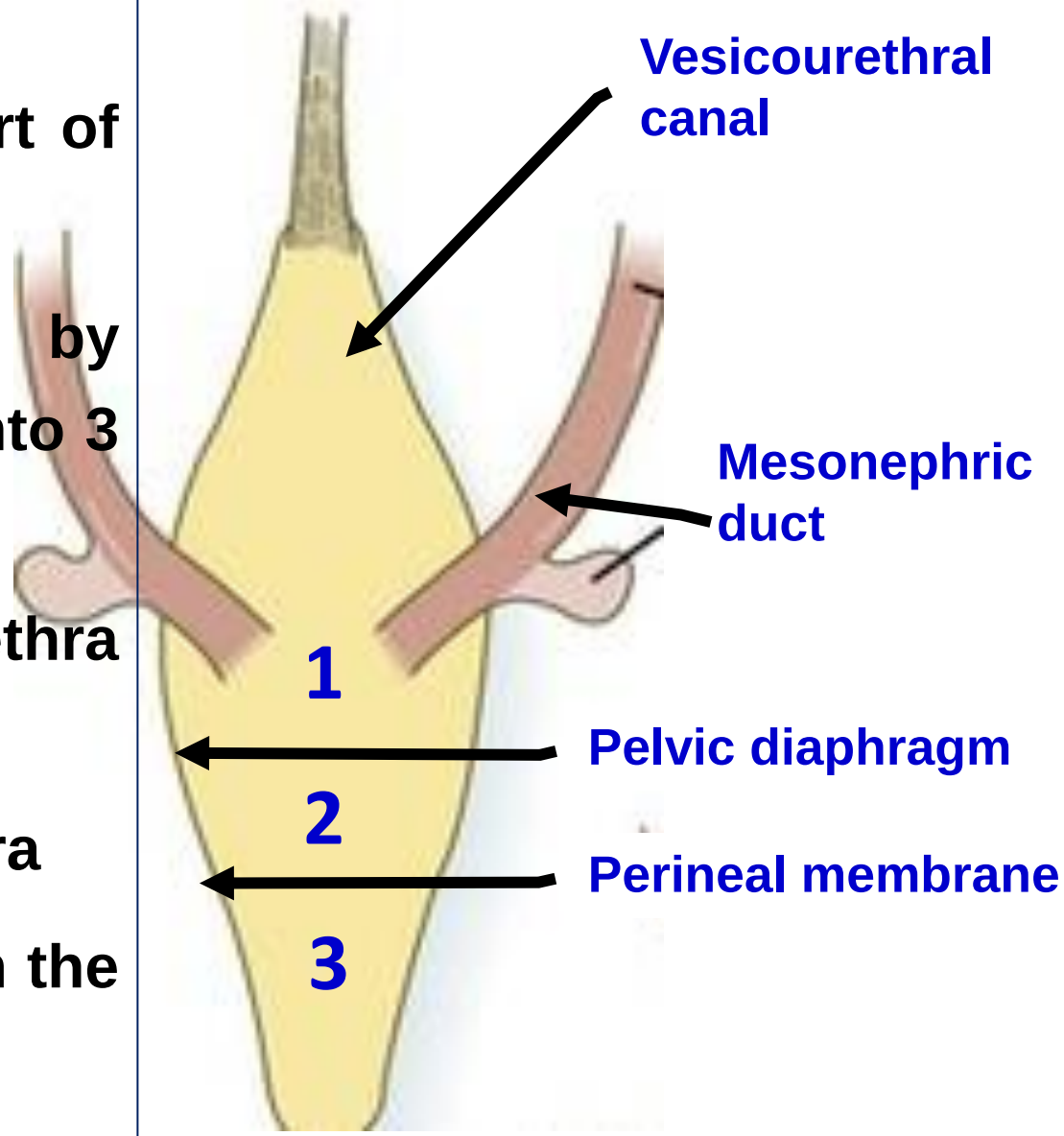
A- Definitive urogenital sinus is divided by pelvic diaphragm and perineal membrane into 3 parts:

1- Cranial part form Prostatic part of the urethra below the utricle

2- Middle part forms the membranous urethra

3- Caudal part forms forms penile urethra in the root of the penis

- The urethral sphincters are developed from the surrounding mesoderm.



- **Steps of development of penile (spongy) urethra**

• 2 folds develop on each side of the urogenital membrane

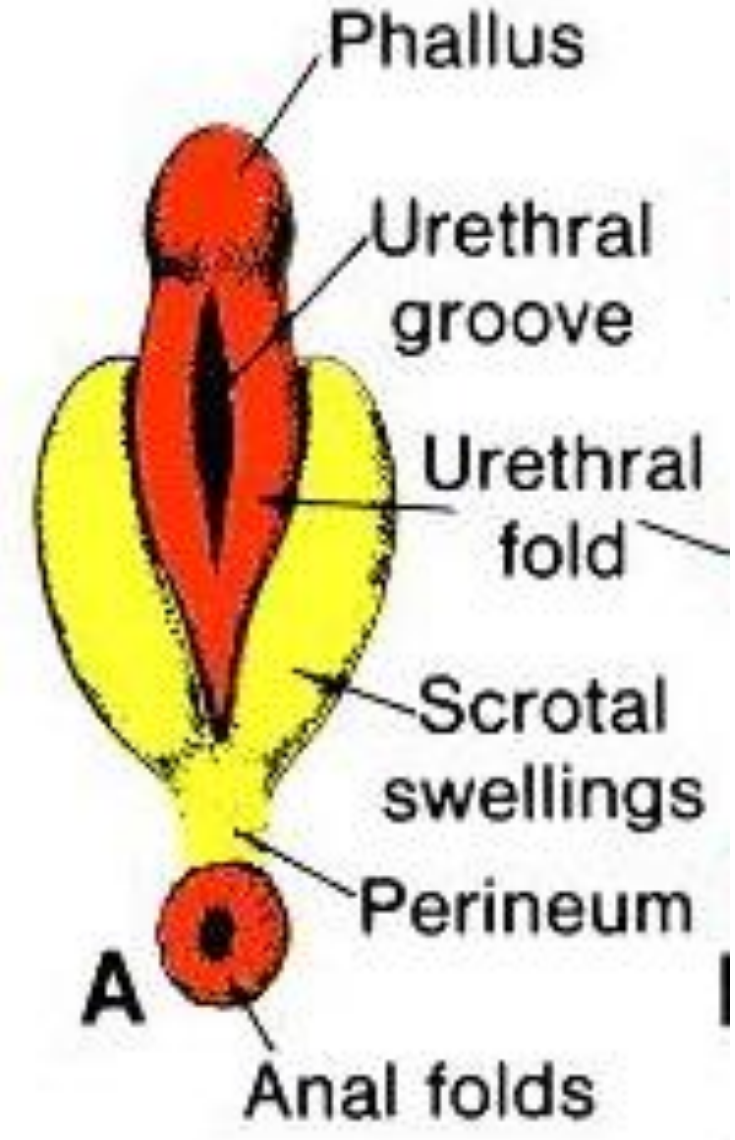
a. Inner fold called urethral fold.

b. Outer fold called genital fold (scrotal).

• The 2 genital fold meet each other **cranial to the urogenital membrane** to form **genital tubercle** (**phallus) that forms body of the penis**.

- The 2 urethral folds fuse with each other to form **urethral tube --- solidified** --- **urethral plate --- canalized ---urethral groove** -- edges of the urethral groove fuse with each other --- **penile urethra in body of the penis**.

• Mesoderm around the urethra forms erectile tissues and blood vessels of the penis.



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• Hypospadias

- External meatus is found on the lower surface of the penis.
- It is caused by failure in fusion of the urethral groove.

A- Complete: groove extends from the head of the penis till the scrotum (resembles labia majora).

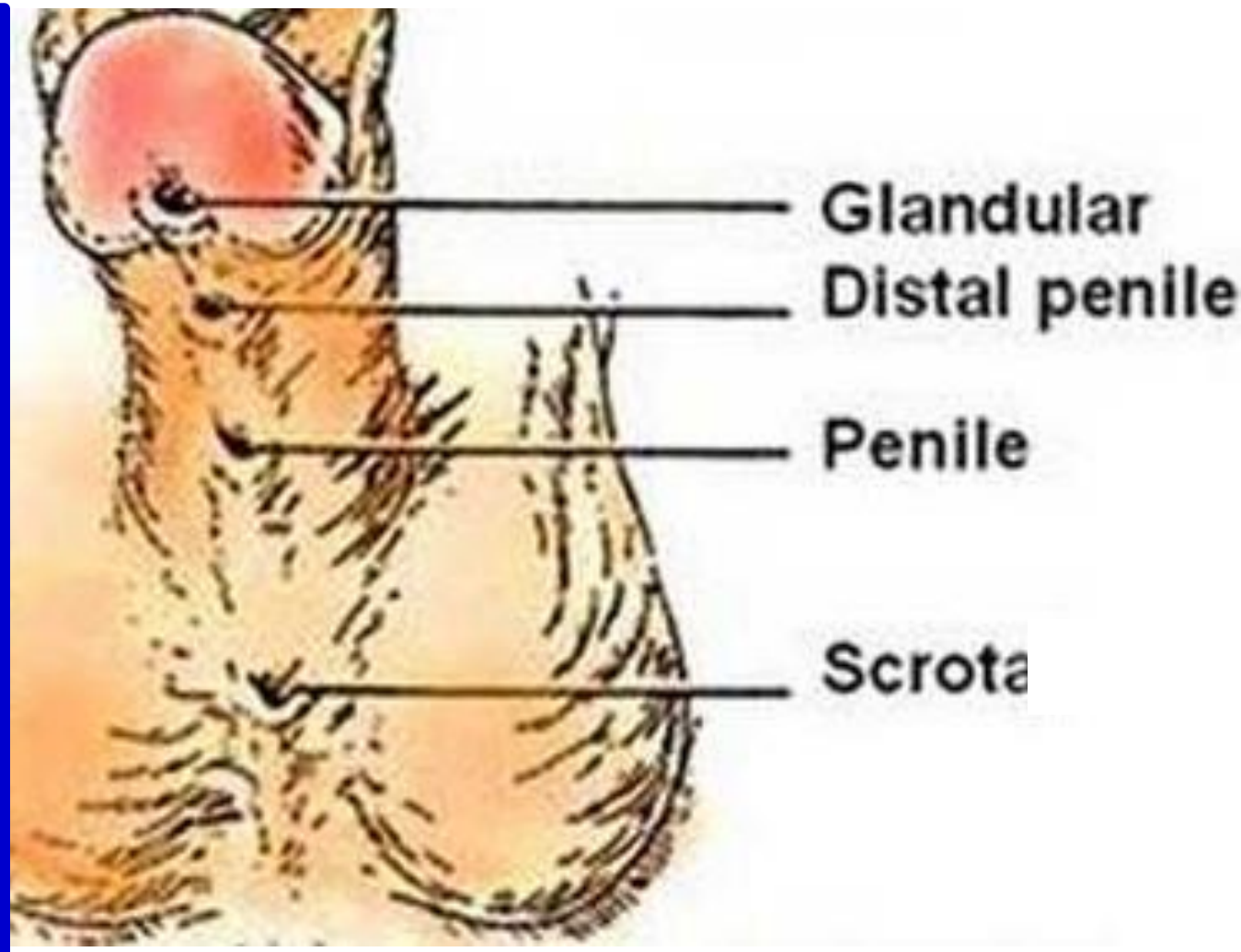
B- Incomplete:

a- Scrotal: at the root of the penis.

b- Penile: at any site along the inferior surface of the penis

c- Distal at the terminal of body

d- Glandular: at glans penis (The best one for man, can not be repair).



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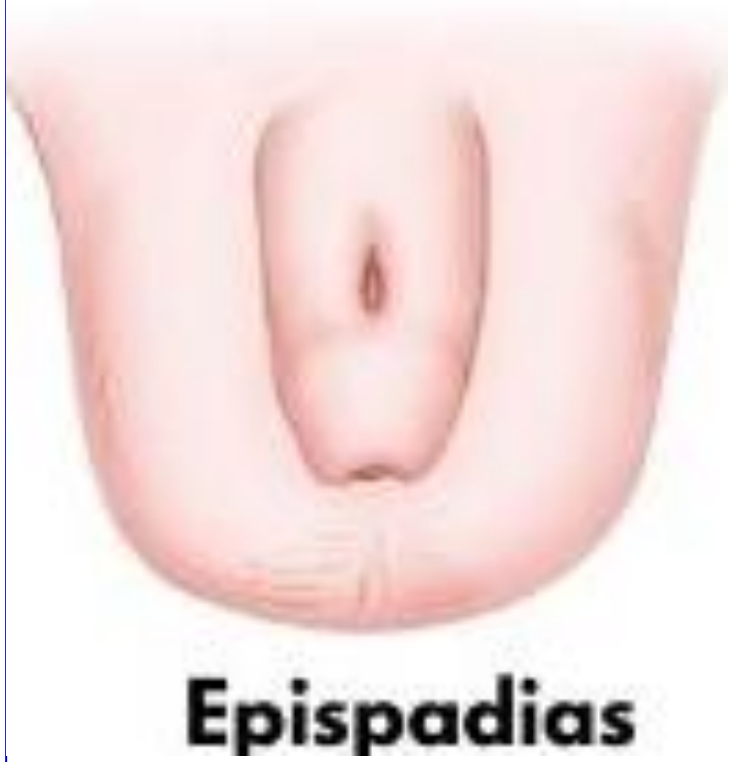
• Epispadias

- The opening of urethra lies on the upper surface of the penis.

- It is either occurred alone or with ectopia vesica.

- **Glandular**: at glans penis.
- **Penile**: at any site along the superior surface of the penis
- **Penopubic:** at the base of the penis.



Epispadias

• Urethral fistula

• (defect in urorectal septum)

- **Recto-urethral fistula:** communication between rectum and urethra.
- **Urethrovaginal fistula:** communication between vagina and urethra.

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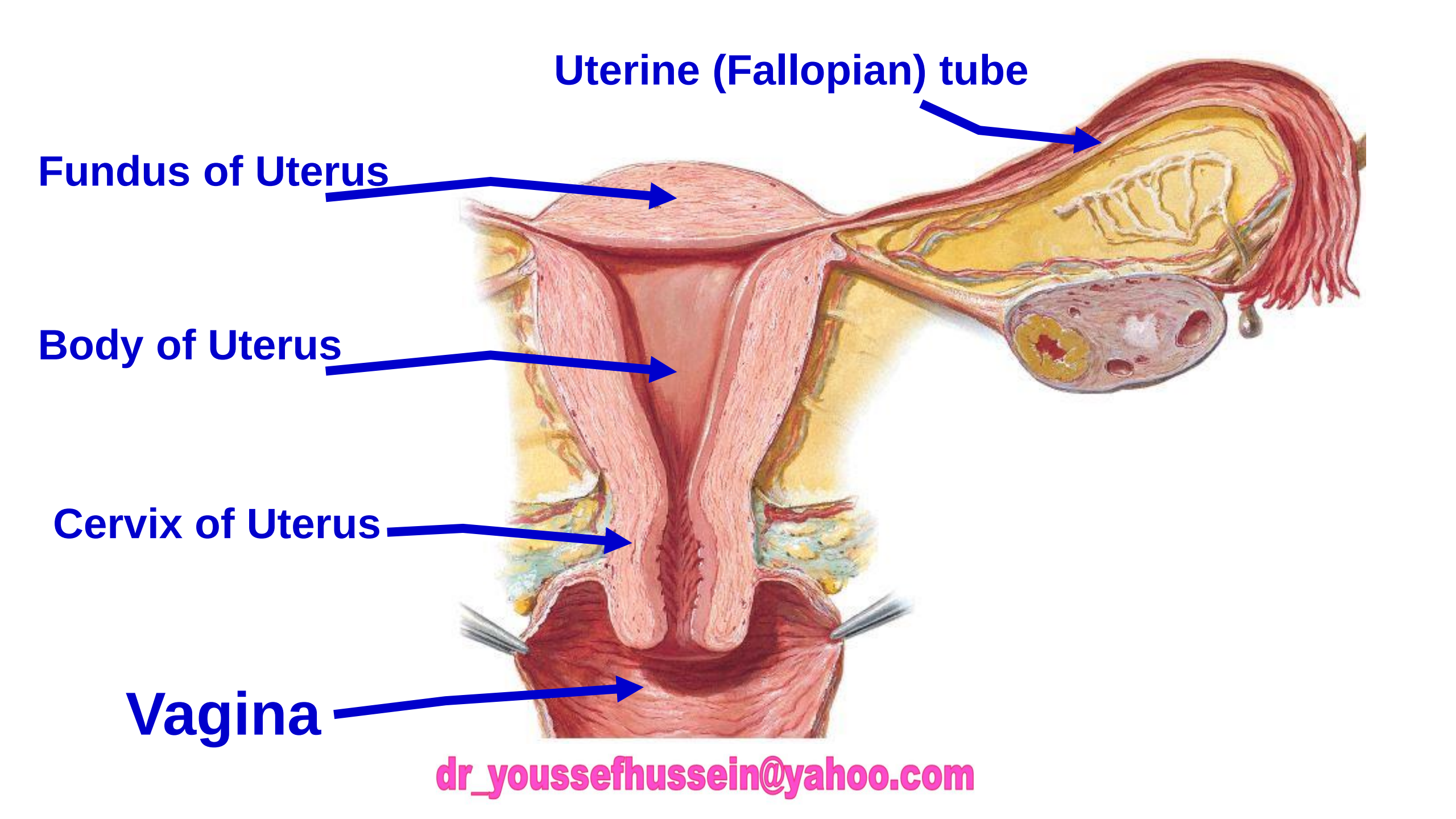
Development of Female genital system



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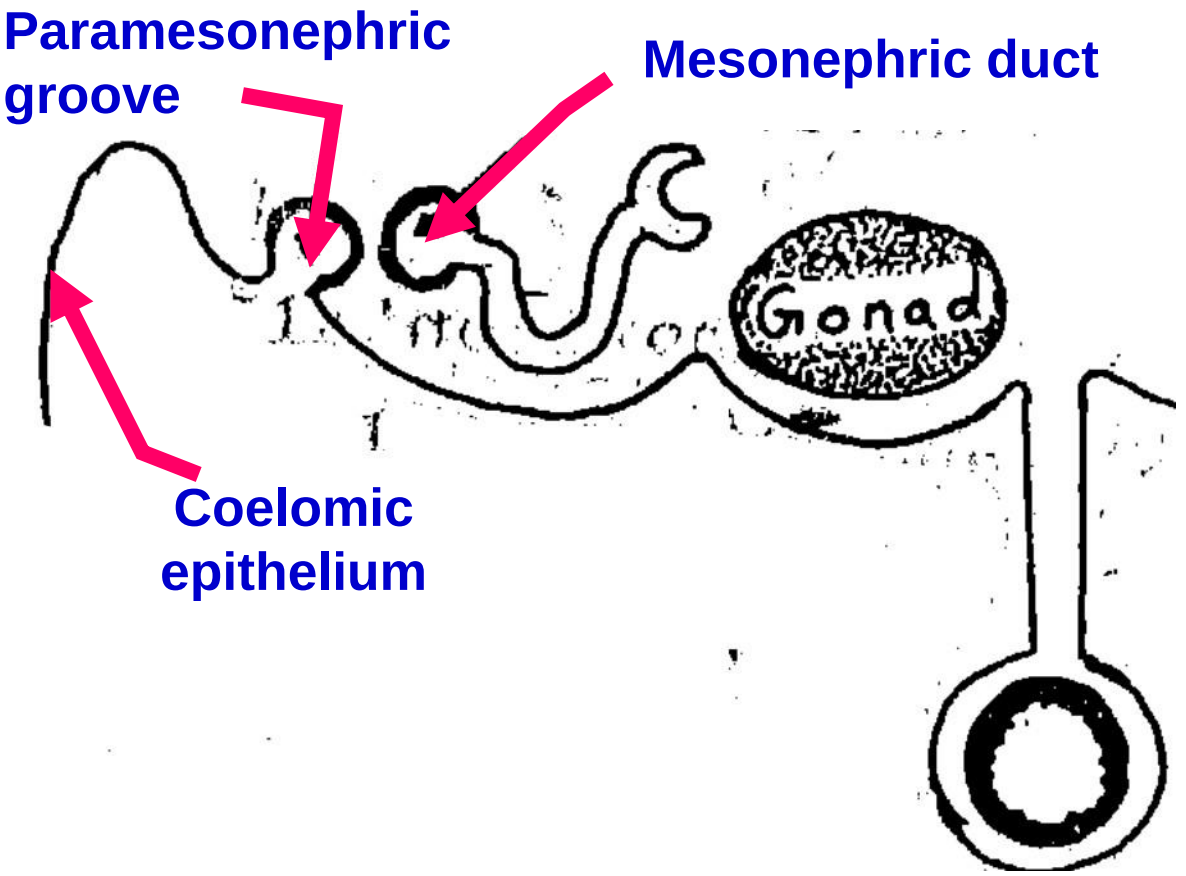
- **Development of paramesonephric**
  - **(Mullerian duct)**
  - **Indifferentiation Stage:**

(in male and female embryos)

* **Paramesonephric groove** developed **from coelomic epithelium covering intermediate mesoderm**, lateral to mesonephric duct (**Wolffian duct**).
* This groove transformed into **paramesonephric duct** (**Mullerian duct**).



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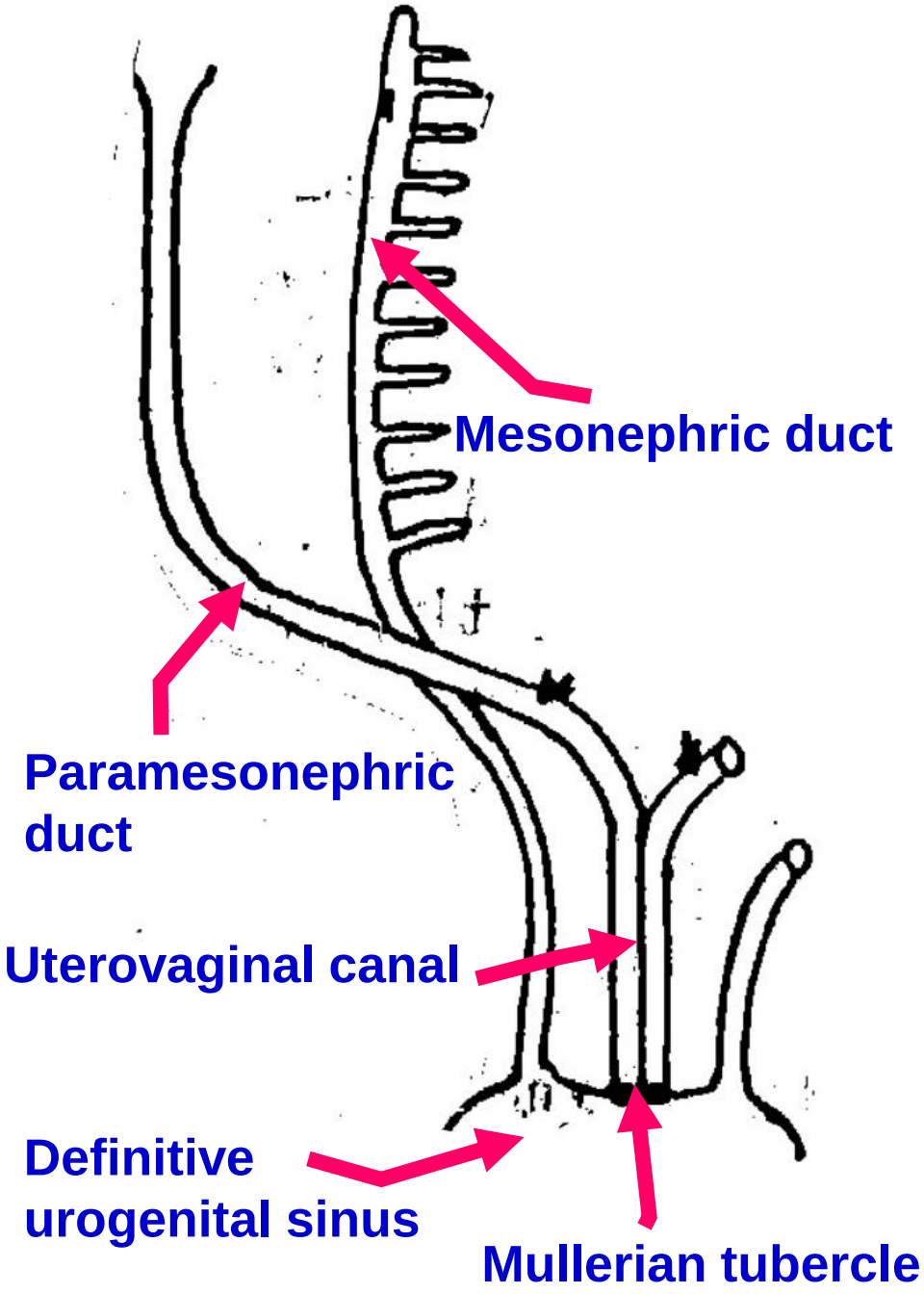


* **The cranial end** of each paramesonephric duct opens into the peritoneal (coelomic) cavity.
* **Caudal end** remains blind.
* **After lateral folding** of the embryo the duct crosses ventral to mesonephric duct **till reaching the back** of the definitive urogenital sinus.

**** Paramesonephric duct is now formed of 3 parts:**

1- Cranial vertical part: lateral to mesonephric duct.

2- Intermediate transverse part: ventral to duct.

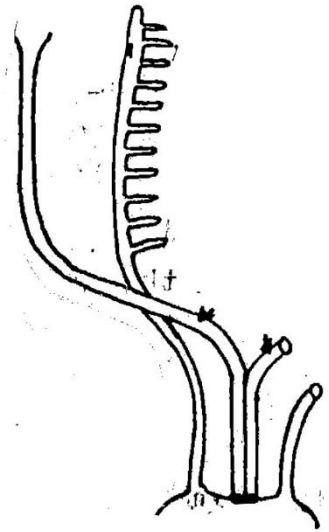
3- Caudal vertical part: medial to duct.

- The caudal parts of 2 ducts **unite with each other** forming the **uterovaginal canal, separated by septum**.

- The tip of the caudal end of the uterovaginal canal project into the posterior wall of the definitive urogenital sinus producing an elevation called **Mullerian tubercle.**

1- Development of uterine (Fallopian) tubes from cranial vertical part.

2- Development of the uterus from horizontal part of 2 paramesonephric ducts and cranial part of the uterovaginal canal **after degeneration of the septum**.



3- Development of the vagina:

* Upper 4/5 from the caudal part of uterovaginal canal (mesodermal).
* The lower 1/5 from the definitive urogenital sinus (endodermal).

N.B; The muscles formed from the mesoderm of the genital ridge.

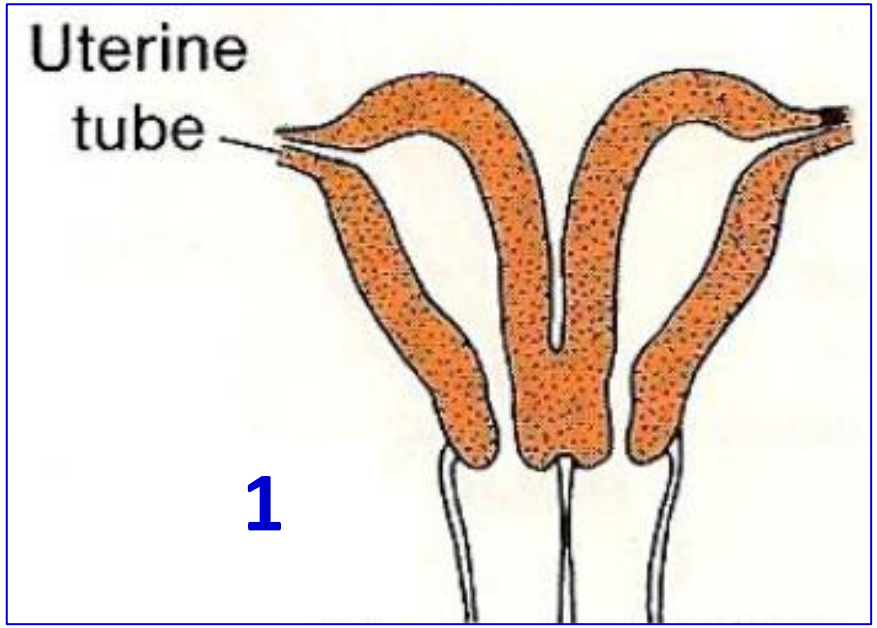
- **Development of the hymen**

- It is a thin membrane separate definitive urogenital sinus from uterovaginal canal
- **Hymen about 1.5 cm from the opening of vagina.**
- The central part of the hymen degenerate forming an opening.

- **Variations of the hymen**;

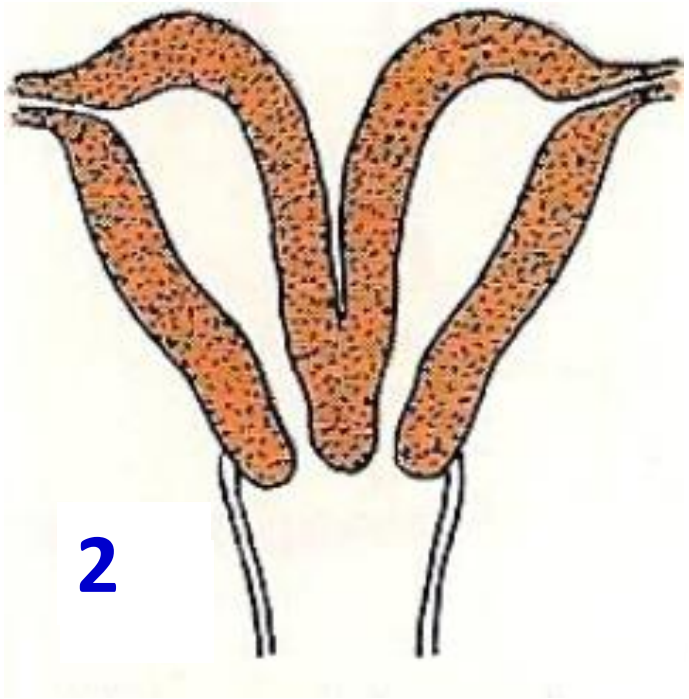
1- Thin membrane with central opening. **2-** Ring.
3- Semilunar. **4-** Cribriform. **5-** Completely absent. **6-** Imperforate.

Congenital anomalies of the uterus



❖1- Uterus didelphys:

- Uterus with 2 bodies, 2 cervices and double vagina.
- It occurs due to complete failure of degeneration of the uterovaginal septum.



❖ 2- Uterus bicornis bicollis

(cornis= horn=cavity) (collis=cervix):

- Uterus with 2 bodies, 2 cervices and one vagina.
- It occurs due to incomplete degeneration of the uterovaginal septum.

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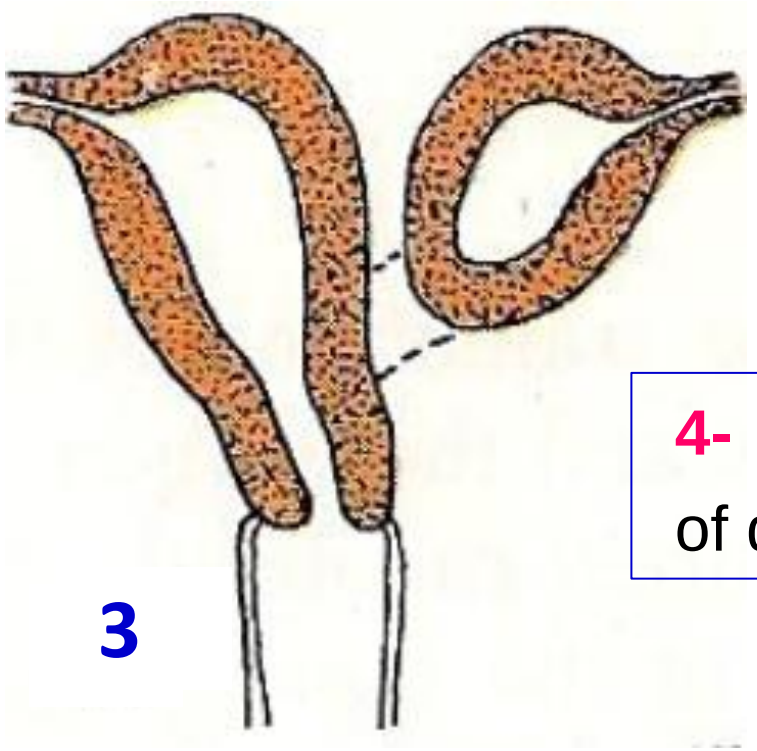
Congenital anomalies of the uterus



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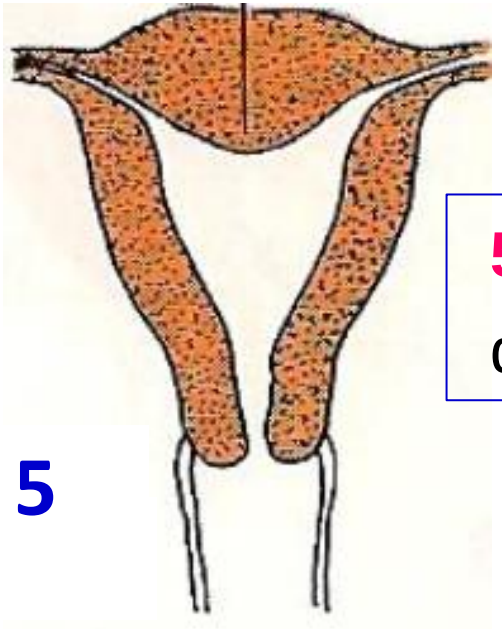
3- Uterus bicornis unicollis

- Uterus with 2 bodies and one cervix.

4- Uterus unicornis with rudimentary horn, failure of development of one para-mesonephric duct.



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5- Uterus arcuatus: uterus with a depressed fundus.

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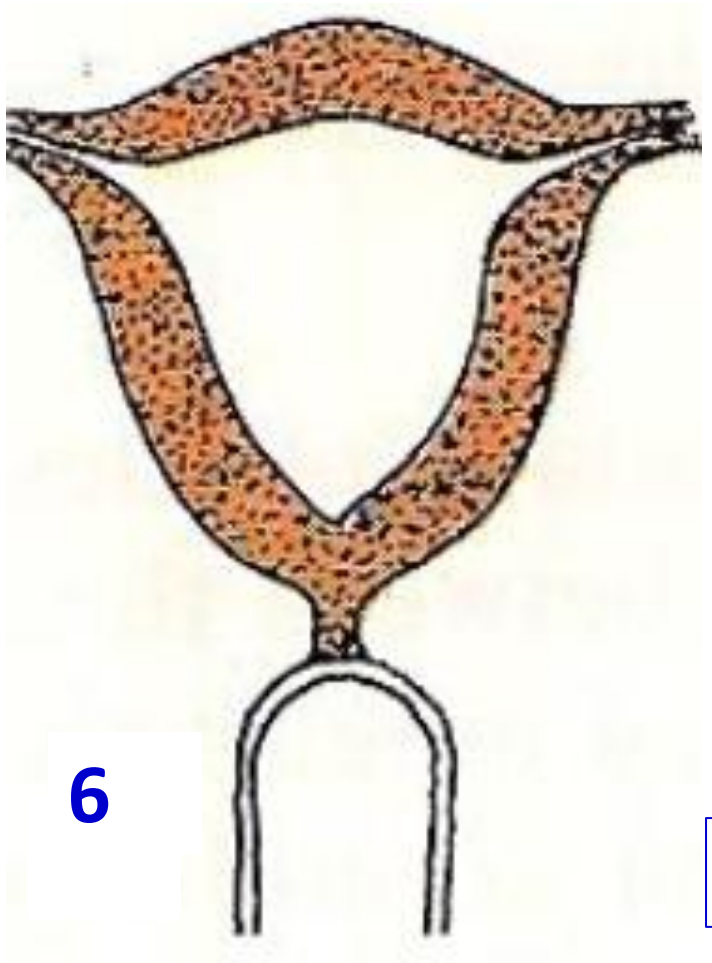
Congenital anomalies of the uterus



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6- Cervical atresia

7- Infantile uterus, small uterus.

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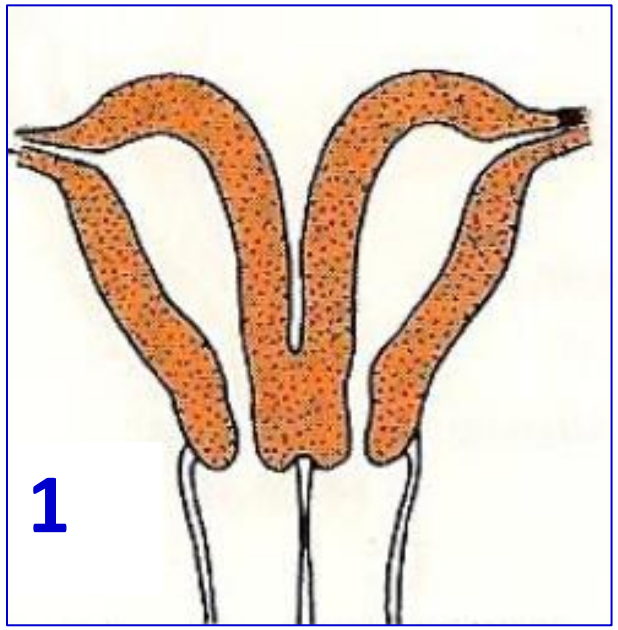
Congenital anomalies of the vagina



1

❖1- Double vagina:

- It occurs due to complete failure of degeneration of the uterovaginal septum.

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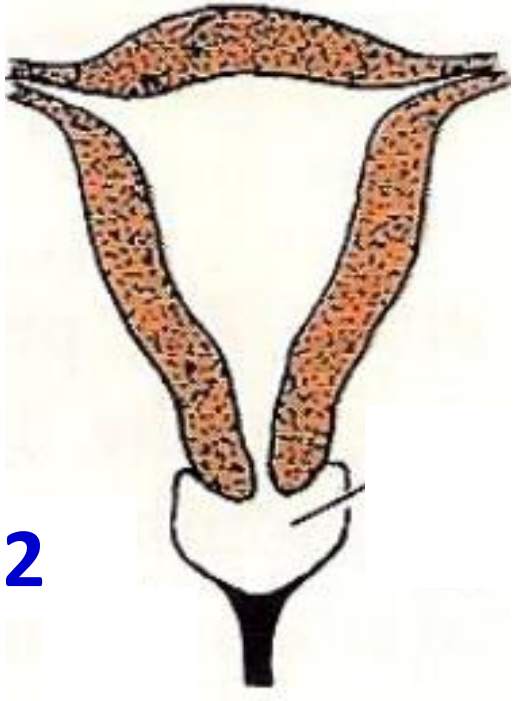
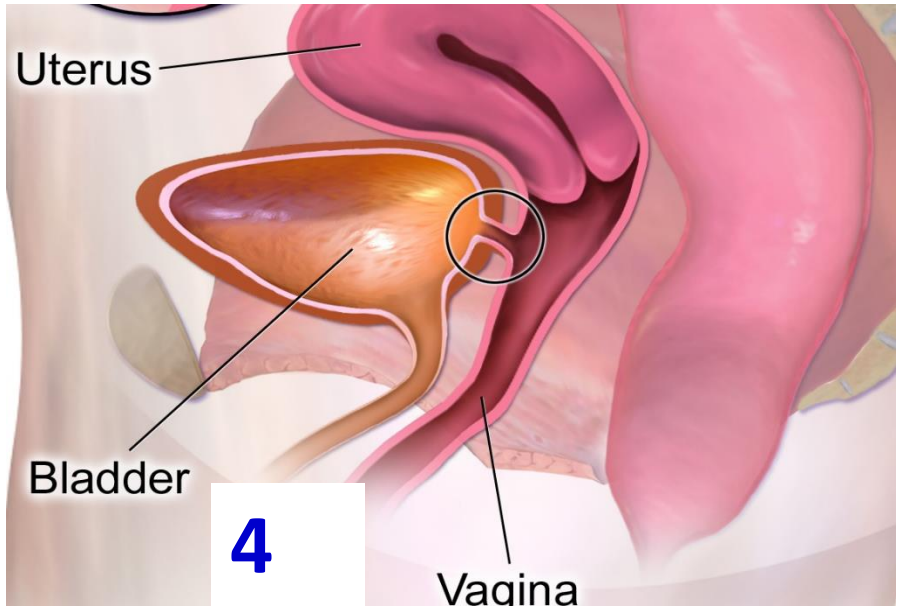


2

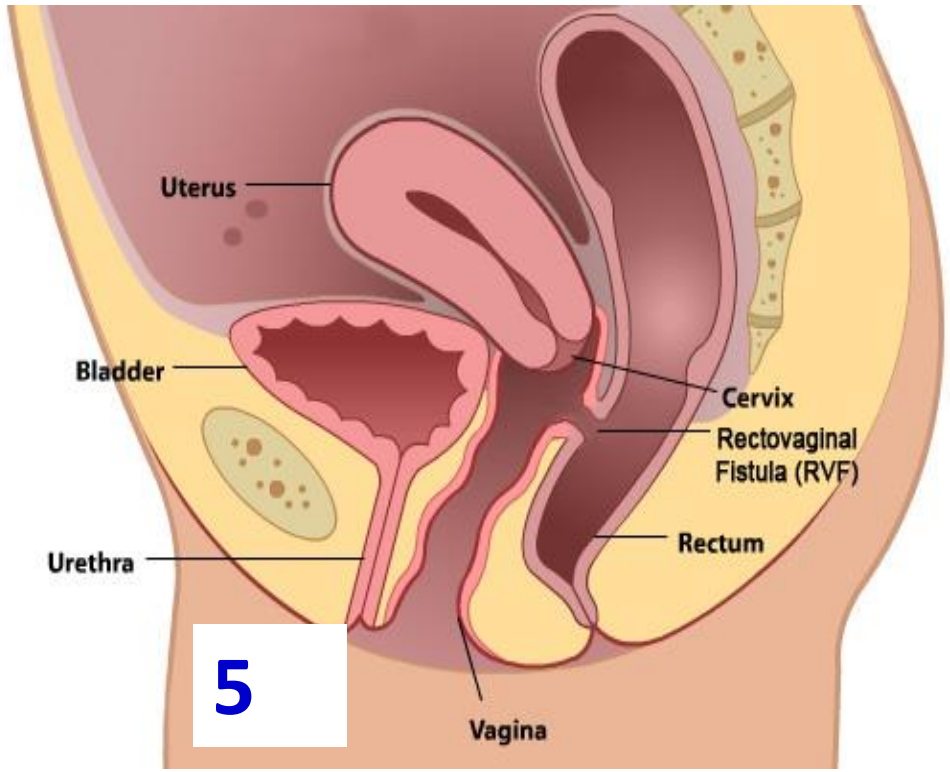
2- Atresia of the vagina: failure of canalization.

3- Imperforate hymen: occurs due to failure of breakdown of the hymen. It leads to collection of the blood in the vagina and uterus after puberty.

Congenital anomalies of the vagina



4- Vesicovaginal fistula: connection between vagina and urinary bladder.



5- Rectovaginal fistula: connection between vagina and rectum.

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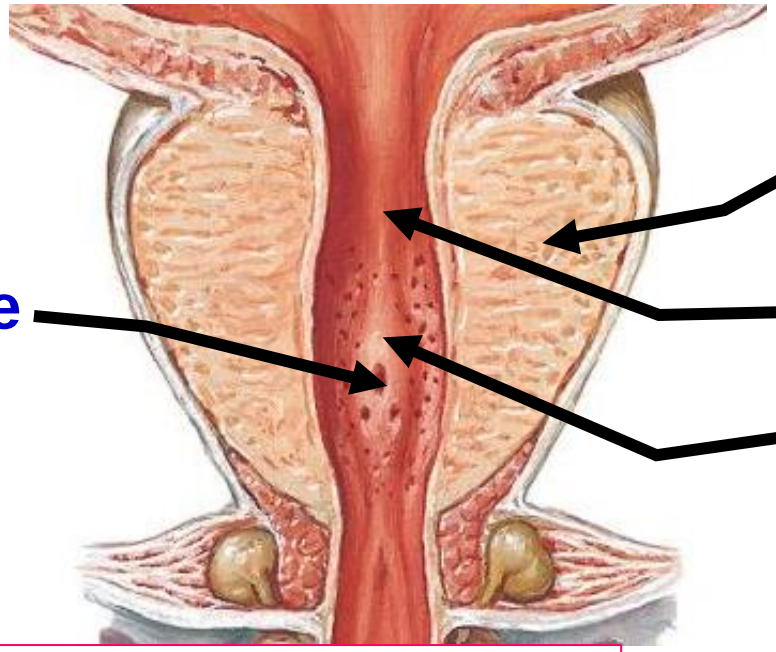
Paramesonephric duct in Male



A- In male:

- The paramesonephric duct disappears leaving remnants

a. The cranial part forms the **appendix of the testis**.

b. The uterovaginal canal forms the **prostatic utricle**.

c. The Mullerian tubercle forms the **seminal colliculus**.

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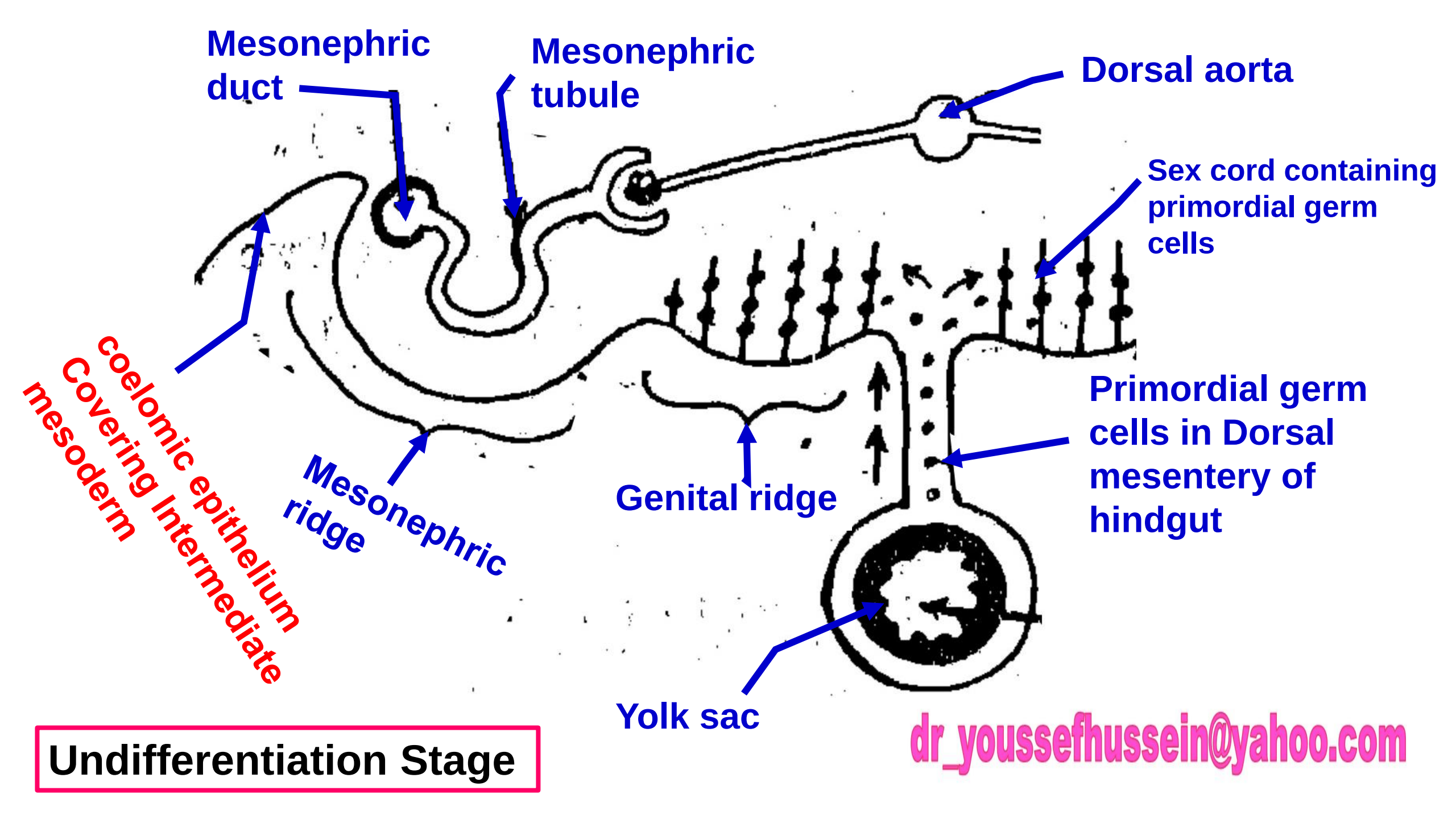
Development of gonads (Testis & Ovary)



Undifferentiation Stage

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• DEVELOPMENT OF THE GONADS

* The gonads, in both sexes, pass into 2 stages of development:

A- Undifferentiation Stage:

* In the first stage of gonadal development, it is impossible to distinguish between testis and ovary.

* **Paired Genital ridges** arise from the **coelomic epithelium covering** intermediate **mesoderm** **medial** to the mesonephric ridge, (on each side).
* In the **4th week**, **primordial gem cells** begins to **migrate** from the endoderm lining **yolk sac** to the **genital ridges** via dorsal mesentery of hindgut
* Simultaneously, the **epithelium of genital ridge** proliferate
  and form **sex cords** opposite
  the **middle part** of the mesonephric tubules

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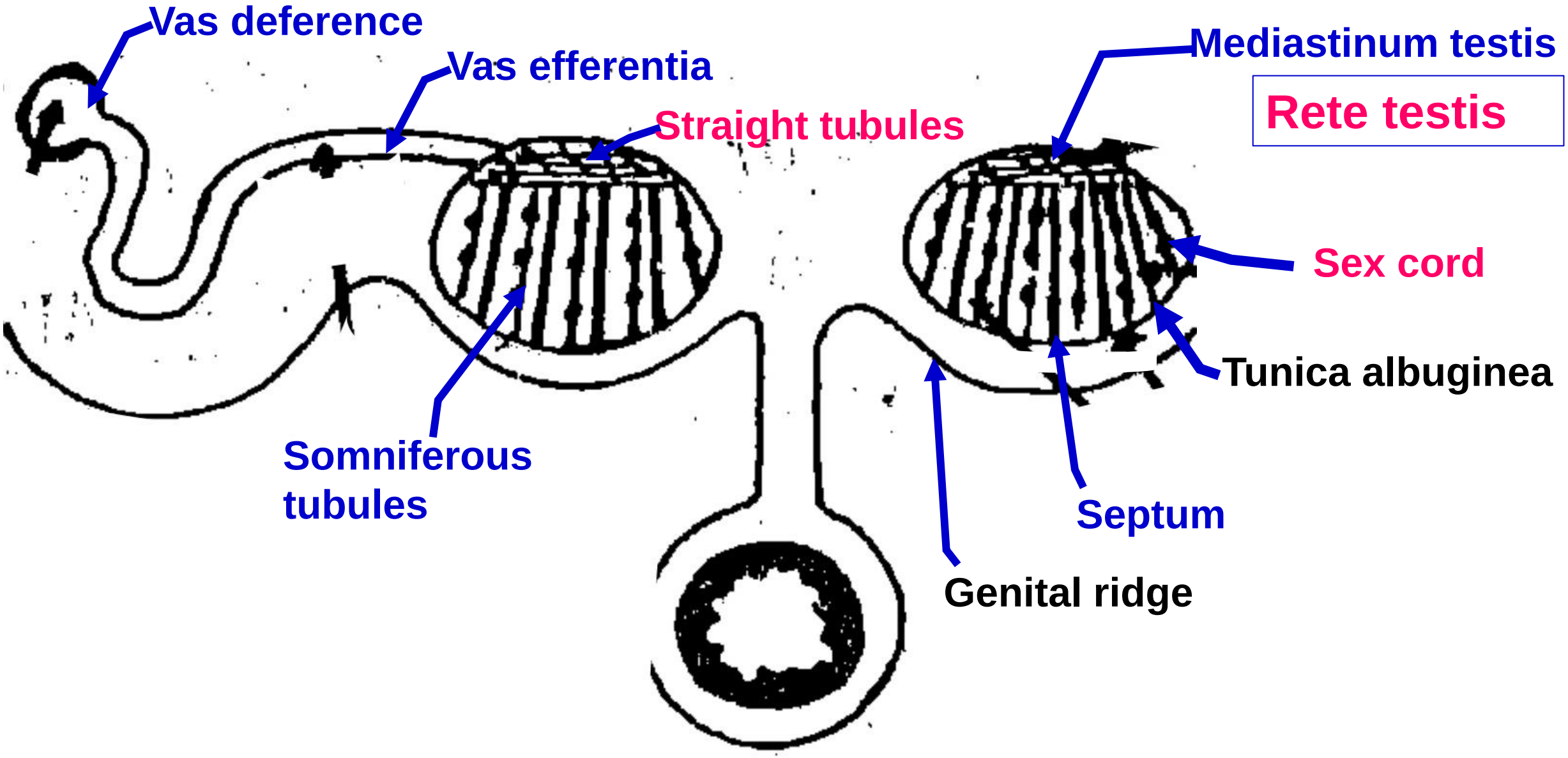
Development of Testis



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* DEVELOPMENT OF THE TESTIS

* At the **6th week** of intrauterine life under the effect of Y-chromosome that has **testis detecting factor** (**SRY gene (Sex-determing region Y protein**).

* The **sex cords** will be separated from genital ridge by a fibrous capsule (**tunica albuginea**).
* The tunica albuginea send connective tissue **septa** dividing the testis into 200-300 compartments.
* Each compartment contains **2-3 cords.**
* The **septa fuse** at the dorsal border of the testis to form the **mediastinum testis**.
* The **sex cords** communicate with each other at mediastinum testis forming **rete testis**.
* The **sex cords** canalize to form **seminiferous tubules**.
* The **rete testis** will be canalized forming **straight tubules**. These straight tubules will join with the **vasa efferentia** (**remnant of middle of mesonephric tubule**).

- **Descent of the Testis**

- **Aim of descend:** Because the process of spermatogenesis requires degree of temperature lower than that of the abdomen
- The testes descend through inguinal canal into the scrotum **by age 3 months** of pregnancy, In most cases, the testes pass down by **age 6 months without any treatment**.

- **Factors controlling the descent:**

- **Gubernaculum (**after mesonephros has atrophied) Cranially it has its **origin** at the testis and **inserts** in the region of the genital swelling (future scrotum).
- **Formation of the processes vaginalis** on which testes will slide through inguinal canal.
- Human chorionic gonadotrophin hormone from placenta, testosterone and Anti Mullerin Hormone.
- **Increasing intra-abdominal pressure** due to organ growth.

- **Developing of the cells:**

1- Primordial germ cells give the spermatogonia.

2- Coelomic epithelium gives rise the supporting cells of Sertoli.

3- Mesenchymal cells, give rise the interstitial cells of Leydig.

- **Congenital anomalies of the Testis:**

1- Agenesis of one or both testis. Bilateral agenesis resulted in sterility.

2- Primordial Germ cell aplasia (No spermatogonia) either degeneration or failure of migration

3- Abnormality in the descent of the testis:

a- Cryptorchidism (Undescended testis**)** remains in the abdomen. It causes sterility due to atrophy of spermatogenic cells or malignancy.

b- Incomplete descent: It may be found in inguinal canal or superficial inguinal ring.

c- Ectopic testis: the testis descends to an abnormal site.

4- Klinefelter syndrome (44+ XXY) leads to sterility

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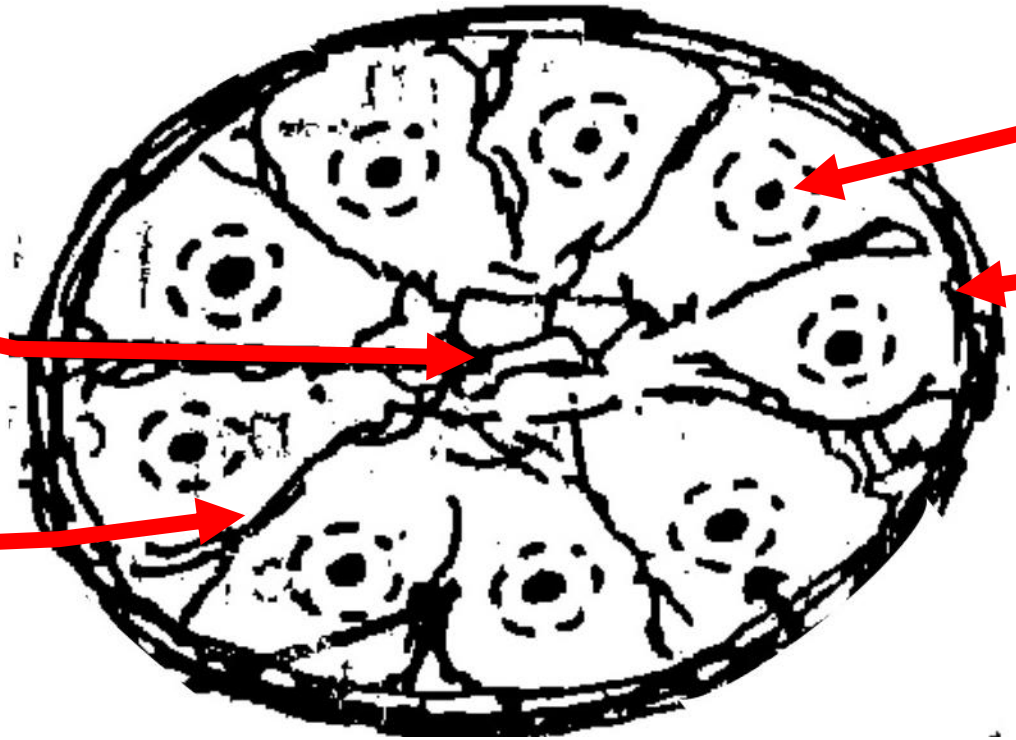
Development of Ovary

• DEVELOPMENT OF THE OVARY

* The sex cords will be separated by a fibrous capsule (**tunica albuginea**).
* The sex cords in the **medulla (**center**) degenerated** and replaced by **a vascular connective tissue.**
* **In the 3rd month,** the **sex cords in the cortex** (peripheral): flat cells surrounding each primordial germ cells (oogonia) forming **primary follicle.**



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- **Congenital Anomalies of the Ovary:**

1- Agenesis of one or both ovaries.

2. Primordial Germ cell aplasia (No oogonia) either degeneration or failure of migration

3. Ovarian hypoplasia (Turner's syndrome): (44+x0).

4. Ectopic ovary: It may be found in abnormal site.

5. Hermaphrodism (rare):

a- True hermaphrodism (Ovo-testis): both ovarian and testicular tissues are present.

b- Pseudo hermaphrodism:

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- **Male Pseudo hermaphrodism (**44+XY)**:** fetus has testis and female external genital organs.
- **Female Pseudo hermaphrodism (**44+XX)**:** fetus has ovaries and male external genital organs

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