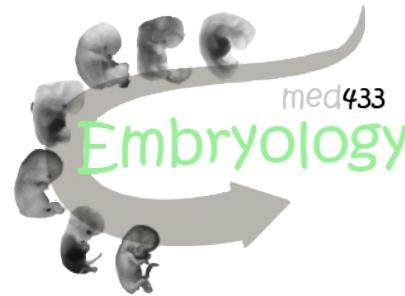


EMBRYOLOGY

DEVELOPMENT OF FEMALE GENITAL SYSTEM



Lecture Objectives:

1. Describe the development of gonads (indifferent & different stages)
2. Describe the development of the female gonad (ovary).
3. Describe the development of the internal genital organs (uterine tubes, uterus & vagina).
4. Describe the development of the external genitalia.
5. List the main congenital anomalies

MIND MAP

Sex Determination

The primary female sexual differentiation is **determined by the presence of the X chromosome**, and the absence of Y chromosome and does not depend on hormonal effect.

Gonadal Ridge → Appears during the 5th week

The primordial germ cells → appear early in the 4th week, have an Inductive Influence on the differentiation of the gonad into ovary or testis

Development of the Ovary → **Primitive (Primary) Sex cords:** dissociate into (Rete ovarii),
Cortical (Secondary) Sex Cords: break up into isolated cell clusters: Primordial Follicles (Primary Oocytes)

Development of the Female Duct system → In the **absence of MIS** (Müllerian Inhibiting Substance).▪

The Paramesonephric Ducts → **1. Uterine Tubes**
2. Uterovaginal Primordium → Uterus
Superior Portion of the Vagina.

Development of Lower Portion of Vagina and its differentiation

External Genitalia → Fully differentiated by the 12th week

Congenital Anomalies

Congenital Anomalies

External Genitalia → Fully differentiated by the 12th week

#SEX DETERMINATION

Chromosomal and genetic sex is established *at fertilization* and depends upon the presence of Y or X chromosome of the sperm.

*Development of female phenotype *requires two X chromosomes*.

*The type of sex chromosomes established at fertilization are responsible to determine the type of gonads in the subject (By Testis Determining factor)

The **primary** female sexual differentiation is determined by the presence of the X chromosome, and the absence of Y chromosome and **does not depend** on hormonal effect.

Depending on the type of gonads (Either testis or ovaries), specific genital ducts and external genitalia are developed



That means, when the gonads are developed it will produce hormones. These hormones will lead to the formation of *Specific genital ducts and external genitalia*.

#GENITAL (GONADAL) RIDGE

A pair of longitudinal ridge appear during the **5th week**



From the intermediate mesoderm of the celomic cavity and covering mesenchyme



On the medial side of the Mesonephros (nephrogenic cord)

#PRIMORDIAL GERM CELLS

In the **4th week**

- Primordial germ cells appear among the Endodermal cells in the wall of the yolk sac near the origin of the allantois.

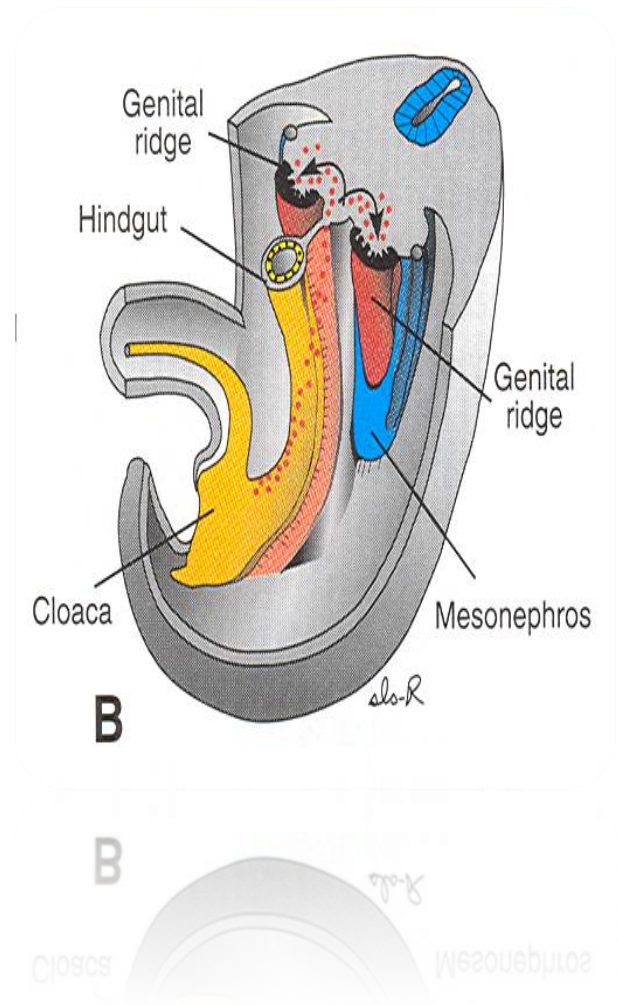
In the **6th week**

- these Primordial germ cells will migrate to the Gonadal Ridges.

Function?

- The primordial germ cells have an **Inductive Influence** on the differentiation of the gonad into ovary or testis.

If these cells fail to reach the ridges, the gonad **remains Indifferent or Absent.**



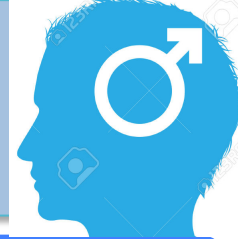
#STRUCTURE OF INDIFFERENT GONAD

Generally, The indifferent gonad consists of an External Cortex (C) and Internal Medulla (M)

Embryos with **XX** chromosomes



Embryos with **XY** chromosomes



- the Cortex differentiates into the **Ovary** and the medulla regresses.

- the Medulla differentiates into Testis and the cortex regresses.

The gonad acquires the Female or Male morphological characteristics **at about the 7th week.**

#DEVELOPMENT OF THE OVARY

The development of the ovaries has 2 stages ; 1st / primitive primary sex cord

Fingerlike epithelial cords grow from cortex of the indifferent gonad and extend into the medulla.

The Primary (Medullary) sex cords dissociate into (Rete ovarii)
تنفصل عن الكورتكس

Both the primary sex cords and rete ovarii degenerate and disappear

Second/ Cortical Secondary sex cords

They extend from the surface epithelium into the underlying mesenchyme to replace the primary cords.

*The primordial germ cells are incorporated into them

the ovary is identifiable histologically at the 10th week

At the 16 weeks The cortical cords break up into isolated cell clusters: Primordial Follicles containing (Oogonia)

#Primary Oocyte (Oogonia)

1.Oogonium	Derived from the Primitive Germ Cell.
2.Follicular Cells	A single layer of cells derived from the surface epithelium and surrounds the primordial follicle.

Active Mitosis of Oogonia occurs during fetal period producing thousands of **primordial follicles**

*(**No** New Oogonia Are Formed Postnatally)

*Two millions Oogonia (or so) enlarge to become Primary Oocytes (Before Birth).

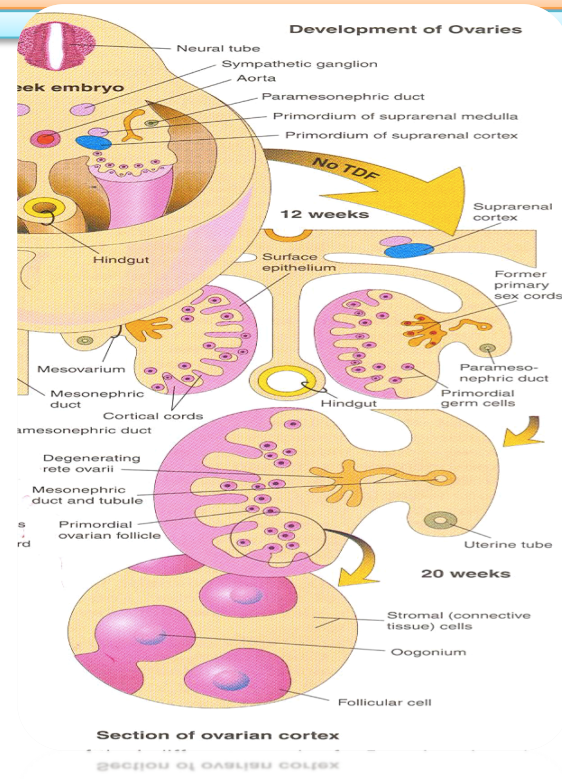
POSTNATAL CHANGES OF THE OVARY

1. Surface Epithelium:

- Flattened into a single layer and separated from follicles in the cortex by a thin tunica albuginea

2. The ovaries descend:

- from the posterior abdominal wall into the pelvis; just inferior to the pelvic brim.



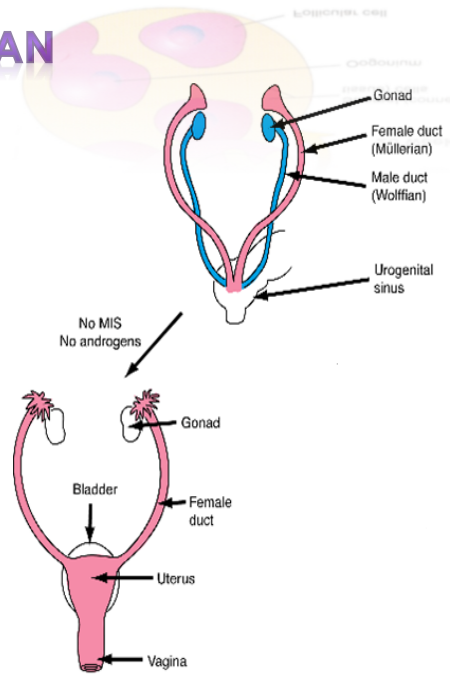
DEVELOPMENT OF THE FEMALE DUCTAL SYSTEM (FALLOPIAN TUBES, UTERUS AND VAGINA)

mesonephric ducts

- it will regress due to **absence of the testosterone hormone.**

The paramesonephric ducts

- it will develop due to absence of **MIS (Müllerian Inhibiting Substance)**



The development of female ductal system is hormonal dependent, and these hormones are secreted by **placenta and ovaries.**

THE PARAMESONEPHRIC DUCTS

*They form most of the female genital tract.

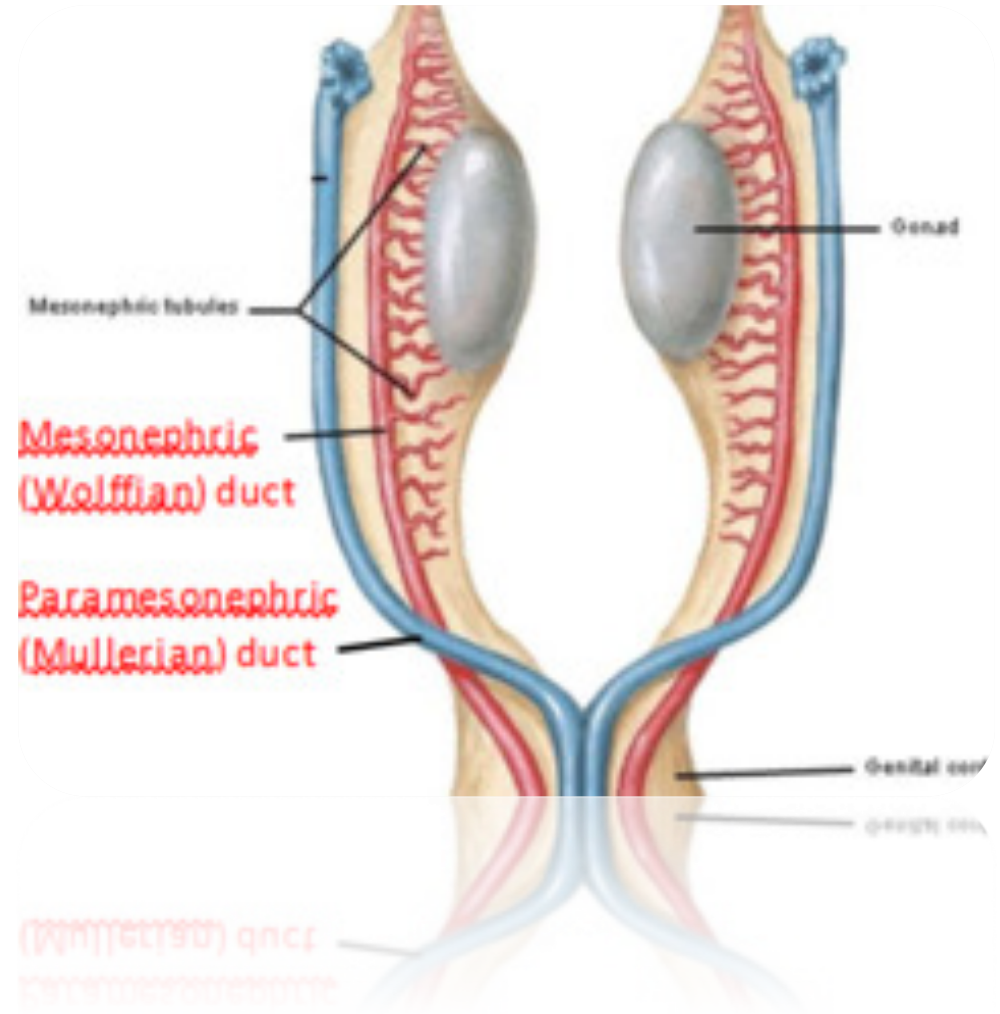
**They develop lateral to the gonads and mesonephric ducts.*

**Their funnel-shaped cranial ends open into the peritoneal cavity.*

**They pass caudally parallel to mesonephric ducts to reach the future pelvic region.*

*They Cross ventral to the mesonephric ducts & approach each other in the median plane and fuse to form the Y shaped **Uterovaginal Primordium**.

*Which opens into the dorsal wall of the urogenital sinus and produces Paramesonephric (müllerian) Tubercle.



DERIVATIVES OF PARAMESONEPHRIC DUCTS

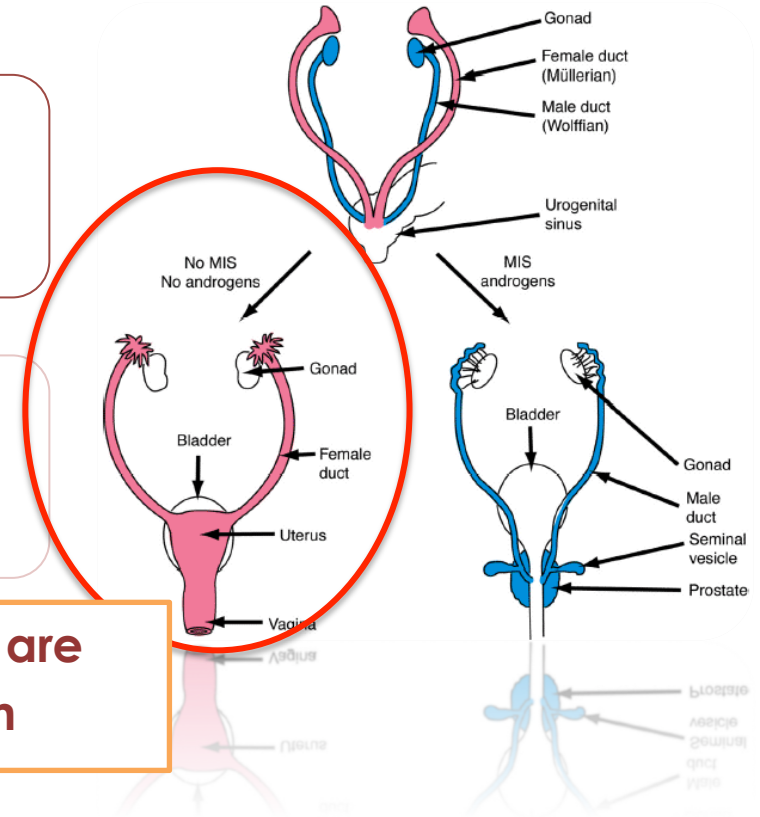
1. Uterine Tubes:

- develop from the cranial unfused parts of the ducts.

2. Uterovaginal Primordium THE Y SHAPE

- It differentiates into:
- 1.Uterus (Body and Cervix)
- 2.Superior Portion of the Vagina.

The endometrial stroma and myometrium are derived from the splanchnic mesoderm



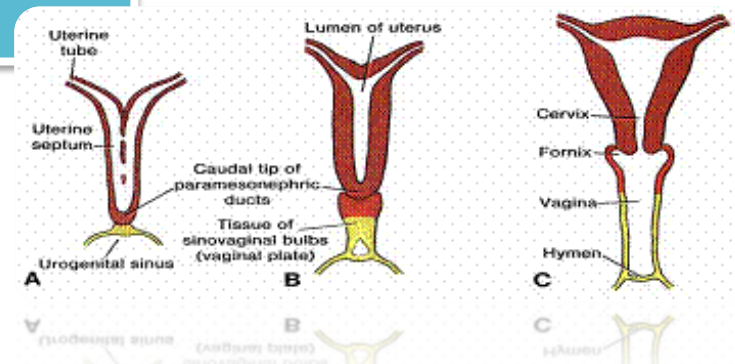
DEVELOPMENT OF THE LOWER PORTION OF VAGINA

It is derived from the **Urogenital Sinus**

*The contact of the **Uterovaginal primordium** with the **urogenital sinus** induces **formation of SinoVaginal Bulbs (elevation).**

*The bulbs proliferate and fuse to form a solid **Vaginal Plate.**

The central cells of the vaginal plate break down to form the **lumen of the vagina.**



DIFFERENTIATION OF VAGINA

The lining of the entire vagina is derived from the **Vaginal Plate (urogenital sinus)**

The lumen of vagina is separated from the urogenital sinus by the **Hymen** which remains as a thin fold of mucous membrane just within the vaginal orifice.

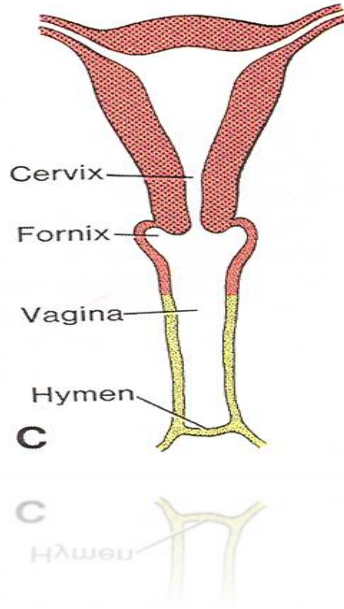
DEVELOPMENT OF FEMALE EXTERNAL GENITALIA

Proliferation of **Mesenchyme at the cranial end, and Sides of the Cloacal Membrane**, forms:

1. **Genital Tubercle.**

2. **Urogenital Folds (Urethral Folds)-inner folds**

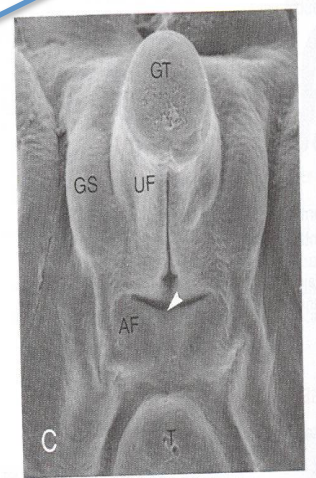
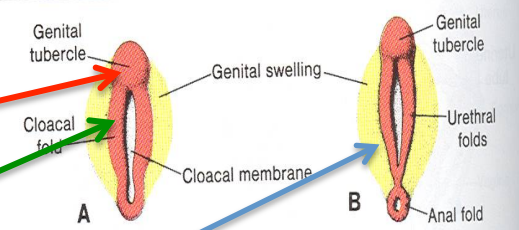
3. **Labioscrotal Swellings (Genital Swellings)-outer folds**



Are Similar in both sexes up to **the 7th week (indifferent stage).**

Begin to differentiate in the **9th week**

Fully differentiated by the **12th week (4th month)**



FEMINIZATION OF EXTERNAL GENITALIA

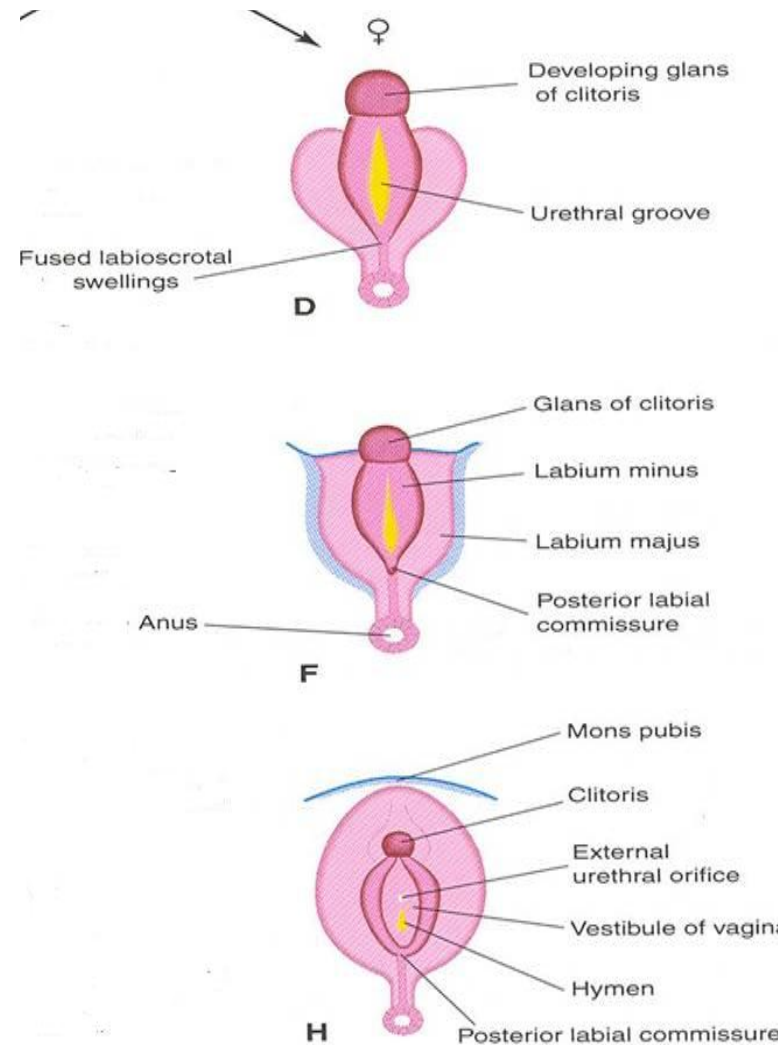
Estrogen produced by both the **placenta** and the **fetal ovaries** has a role in feminization of the external genitalia.

*The **Genital Tubercle** proliferates to form the Primordial **Phalls**

*The phalls elongates slightly to form the **Clitoris**.- not as the size of the penis.

The Urethral Folds **do not fuse** and form the **Labia Minora**.

The **Labioscrotal Folds** form the **Labia Majora**, they fuse to form the Posterior & the Anterior Labial Commissures



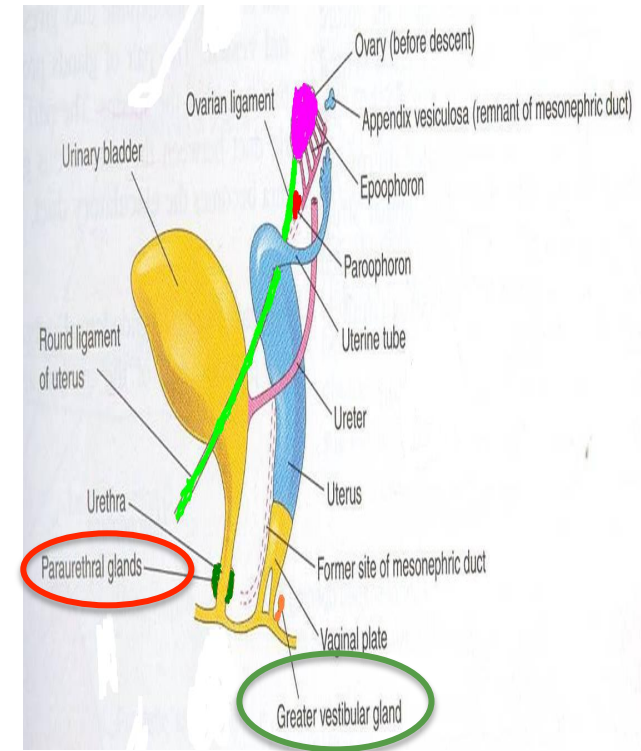
FEMALE SEX GLANDS

1. Urethral & Paraurethral Glands:

grow as buds from the urethra, they are corresponding to the Prostate Gland of the male.

2. Greater Vestibular glands:

outgrowths of the urogenital sinus, they are corresponding to the Bulbourethral Glands of the male.



CONGENITAL ANOMALIES

Various types of anomalies can result due to

1. Arrest of development of the **Uterovaginal primordium** (THE Y SHAPED STRUCTURE) during the **8th week**

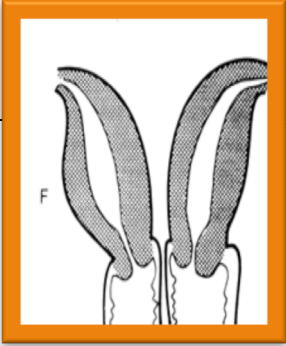
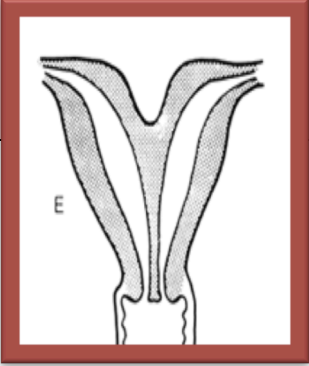
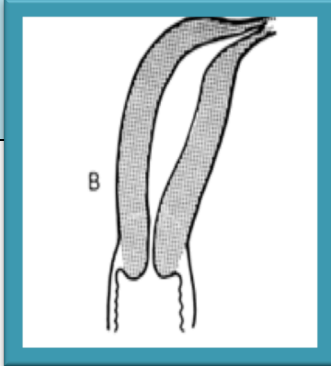
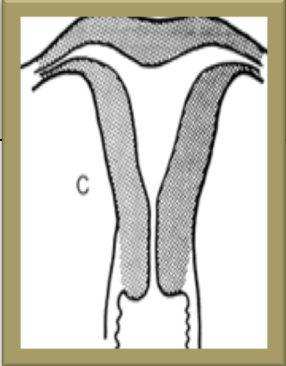
2. Incomplete development of the paramesonephric ducts.

3. Incomplete fusion of the paramesonephric ducts.

4. Failure of parts of one or both paramesonephric ducts to develop.

5. Incomplete canalization of vaginal plate.

UTERINE MALFORMATIONS

Double uterus (Uterus didelphys)	Bicornuate uterus	Unicornuate Uterus	Arcuate Uterus
<p>*Due to failure of fusion of inferior parts of the paramesonephric ducts.</p> <p>*May be associated with a double or single vagina.</p>	<p>The duplication involves the superior segment.</p>	<p>One paramesonephric duct fails to develop.</p>	<p>An arch appears on the upper part of the uterus.</p>
			

CERVICAL ATRESIA

It may be combined with incomplete development of the upper vagina or lower uterus.

VAGINAL ANOMALIES:

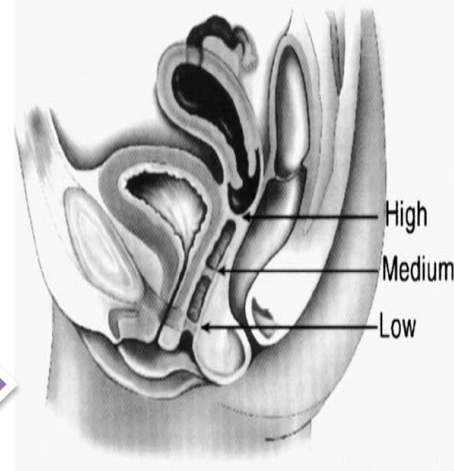
Atresia

- Partial or complete

Double vagina.

- Results from faulty canalization of the fused müllerian ducts.

Transverse y septate vagina

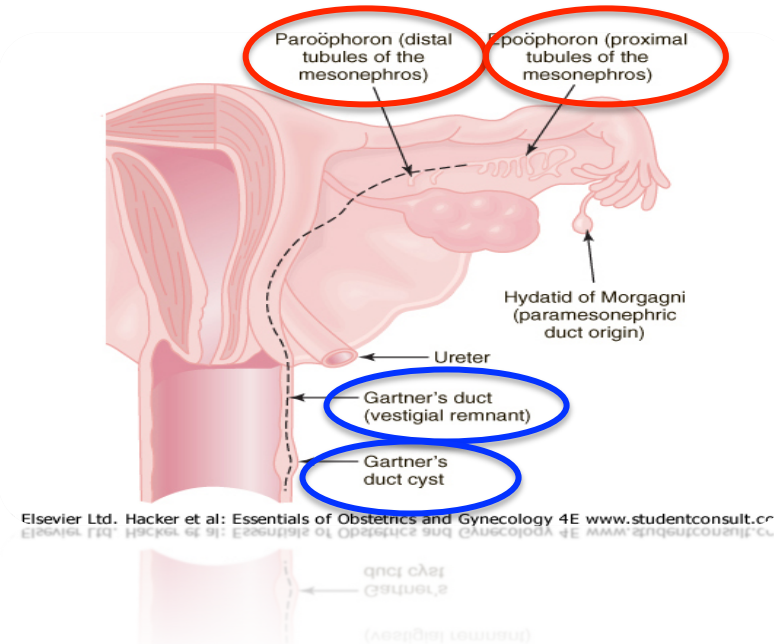


Remnants of the mesonephric (Wolffian) ducts may persist in the anterolateral wall of vagina or adjacent to the uterus within the broad ligament or mesosalpinx

1.If the remnant mesonephric duct was in the **proximal** part we call it **epoophoron (within the broad ligament)**.

2.If the remnant mesonephric duct was in the **distal** part we call it **paroophoron (within the broad ligament)**.

Sometimes, the mesonephric duct might remain open at the lower part of the vagina and form a **duct called Gartner's duct**. And it might form a **cyst called Gartner's duct cyst (close to the lower part of the vagina)**



SUMMARY

4 th week	Appearance of the Primordial germ cells
5 th week	Appearance of the Gonadal Ridge
6 th week	Migration of the Primordial germ cells to the Gonadal Ridge
7 th week	* The gonad acquires the Female or Male morphological characteristics. *The external genitalia are similar in both sexes.
9 th week	The external genitalia begin to differentiate
10 th week	The ovary is identifiable histologically
12 th week	The external genitalia are fully differentiated
16 th week	The cortical cords break up into isolated cell clusters: Primordial Follicles (Primary Oocytes)
Before Birth	About two million oogonia enlarge to become Primary Oocytes



The development of both male and female reproductive systems

<https://www.youtube.com/watch?v=MureNA-RSZM>

QUIZ YOURSELF

Q1: The primary female sexual differentiation is determined by the :

- A. absence of the X chromosome
- B. absence of Y chromosome
- C. does not depend on hormonal effect.
- D. B&C

Q2: In the, the Primordial germ cells migrate to the Gonadal Ridges:

- A. 1 month
- B. 1-1/2 month
- C. 12 week
- D. 6 month

Q 3: if the Embryos with XX chromosomes :

- A. the Medulla differentiates into ovary and the cortex regresses.
- B. the Cortex differentiates into the Ovary and the medulla regresses.
- C. Will remain cortex and medulla
- D. not above

Q 4: The ovary is identifiable histologically at the:

- A. 2 month
- B. 4 month
- C. 10th week
- D. 6 week

Q5: New Oogonia Are Formed Postnatally :

- A. True
- B. False

Q 6 : The paramesonephric ducts develop due to presence of MIS:

- A. True
- B. False

Q7:are derived from the splanchnic mesoderm:

- A. Uterine Tubes & Uterus only fundus
- B. Uterus (fundus -body -cervix) & uterine
- C. Inferior Portion of the Vagina & uterine tube
- D. All

Ans;

1.D 2.B 3.B 4.C 5.B 6.B 7.B

Good Luck

Done By

Rawan Alotaibi

Amani Alotaibi

Barah alqarni

Noura alnajashi

