

Development of female genital systems

Reproductive block

Objectives :

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

Resources :

- ✓ 435 embryology (males & females) lectures.
- ✓ BRS embryology Book.
- ✓ The Developing Human Clinically Oriented Embryology book.

Color Index:

- ✓ EXTRA
- ✓ Important
- ✓ Day, Week, Month

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Helpful video



Focus on female genital system

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INTRODUCTION

Sex Determination

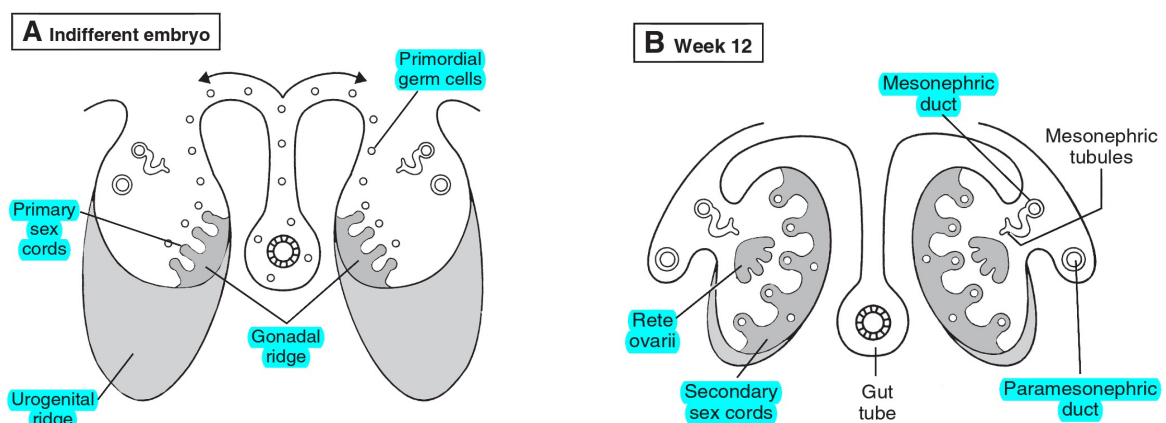
- Chromosomal and genetic sex is established at fertilization and depends upon the presence of Y or X chromosome of the sperm.
- Development of female phenotype requires two X chromosomes.
- The type of sex chromosomes complex established at fertilization determine the type of gonad differentiated from the indifferent gonad
- The Y chromosome has testis determining factor (TDF) **testis determining factor**.
One of the important result of fertilization is 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**.
- The type of gonad determines the type of sexual differentiation in the **Sexual Ducts and External Genitalia**.
- The Female reproductive system development comprises of : **Gonad (Ovary)** , **Genital Ducts** (Both male and female embryo have two pair of genital ducts , They do not depend on ovaries or hormones) and **External genitalia**.

DEVELOPMENT OF THE GONADS (ovaries)

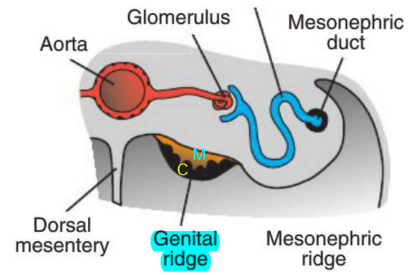
- Is Derived From Three Sources (Male Slides)

1. Mesothelium	2. Mesenchyme	3. Primordial Germ cells
(mesodermal epithelium) lining the posterior abdominal wall	underlying embryonic connective tissue	appear among the Endodermal cells in the wall of the yolk sac).

- **Genital (Gonadal) Ridge** pic.A : Appears during the **5th week** as a pair of longitudinal ridges (from the **intermediate mesoderm**), on the medial side of the **Mesonephros** pic.B (nephrogenic cord).
- In the **6th week**, the **Primordial germ cells** pic.A (which appear early in the **4th week** among the **Endodermal** cell in the wall of the yolk sac near origin of the allantois) **migrate** to the Gonadal Ridges. The primordial germ cells have an



Inductive Influence on the differentiation of the gonad into ovary or testis. **If they fail to reach the ridges, the gonad remains Indifferent or Absent.**

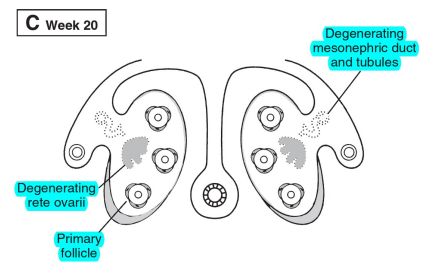


- **Structure of Indifferent Gonad** : The **indifferent gonad** consists of an **External Cortex (C)** and **Internal Medulla (M)**.

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.

لازم تختفي وحده منهم سواء الكورتكس او الميدولا وما يصير ابدًا انهم يظلون التثني بنفس الوقت ، بهذا الوقت ما نقدر نحدد جنس الجنين.

- The **gonad acquires the Female or Male morphological characteristics** at about the **7th week**.
- **Primitive (primary) sex cords** : **Fingerlike** epithelial cords grow from cortex of the indifferent gonad and extend into the medulla. The Primary sex cords dissociate into (**Rete ovarii**) (بيتقطع لقطع صغيرة نسميها بهذا الاسم). Both the primary sex cords and rete ovarii **degenerate and disappear** pic.C.
- **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 (**Primary Oocytes**) pic.C



Primary Oocyte Composed of :

Oogonium	Follicular Cells
derived from the Primitive Germ Cell.	They are a single layer of flattened cells surrounding the oogonium , derived from the surface epithelium (Sex Cord)

- Active Mitosis of Oogonia occurs during **fetal period** producing thousands of primordial follicles. **No New Oogonia Are Formed Postnatally.** Two million 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 DUCT SYSTEM

In female embryo :

mesonephric ducts Wolffian's ducts

paramesonephric ducts Müllerian's ducts

regress due to **absence of the testosterone** hormone.

for development of male reproductive system

develop due to **absence of MIS** (Müllerian Inhibiting Substance).

for development of female reproductive system.

The Paramesonephric Ducts

- They form most of the female genital tract.

- Derivatives Of Paramesonephric Ducts :

1- Uterine Tubes:

develop from the **cranial**

unfused parts of the ducts.

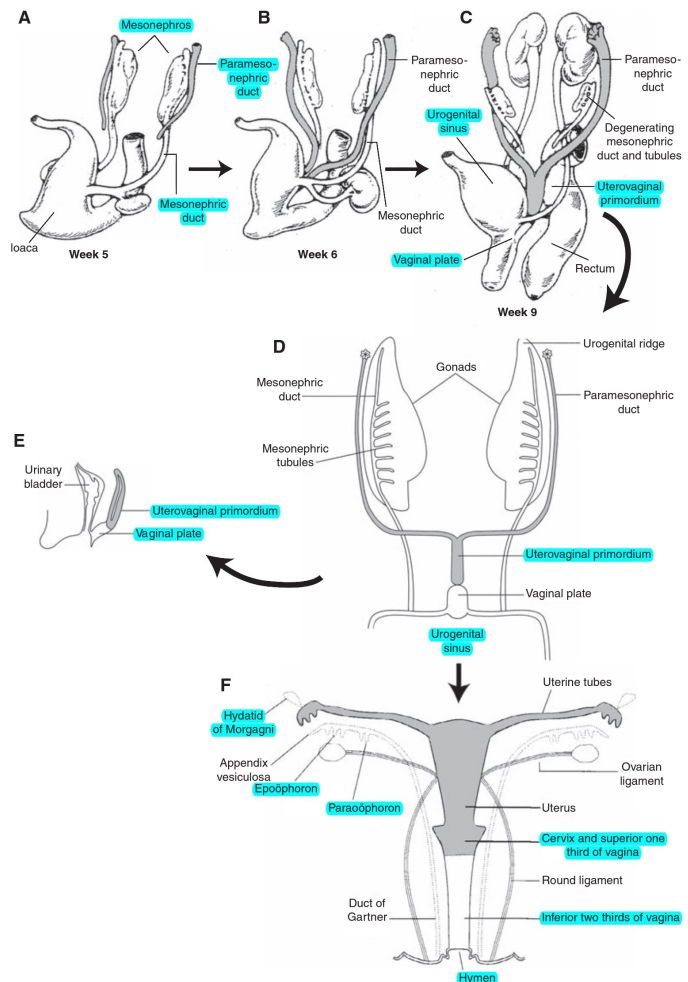
2. Uterovaginal Primordium:

It differentiates into:

Uterus (Body and Cervix)

Superior Portion of Vagina.

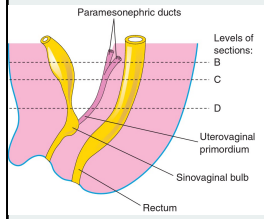
- The endometrial stroma and myometrium are derived from the **splanchnic mesoderm**.



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صفحة

Paramesonephric Ducts develop lateral to the gonads and mesonephric ducts.	Pic. A
Their funnel-shaped cranial ends open into the peritoneal cavity.	Forms FALLOPIAN TUBES
They pass caudally parallel to mesonephric ducts to reach the future pelvic region .	Pic. B
They Cross ventral to the mesonephric ducts & approach each other in the median plane and fuse to form the Y shaped Uterovaginal Primordial (which opens into the dorsal wall of the urogenital sinus and produces Paramesonephric (müllerian) Tubercle).	Pic. C

Development of Lower Portion of Vagina

It is derived from the Urogenital Sinus	Pic.C
The contact of the uterovaginal primordium with the urogenital sinus induces formation of SinoVaginal Bulbs .	
The bulbs proliferate and fuse to form a solid Vaginal Plate .	Pic.C&D
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. **Pic.F**
- **Paramesonephric Ducts** → Upper part of vagina
- **urogenital sinus** → lower part of vagina

EXTERNAL GENITALIA (NEED HORMONE)

External Genitalia		
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.
		نقدر نحدد جنس الجنين

Development of Female External Genitalia In 7th week in both (female & male)

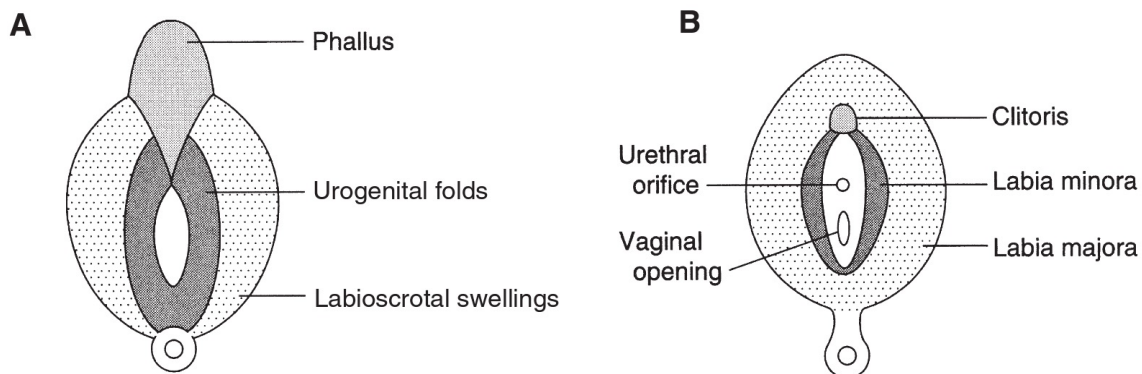
- Proliferation of Mesenchyme at the Cranial end and Sides of the **Cloacal Membrane**, forms:

1. Genital Tubercle.
2. Urogenital Folds (Urethral Folds)
3. Labioscrotal Swellings (Genital Swellings)

Feminization of External Genitalia (in 9th week in female)

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

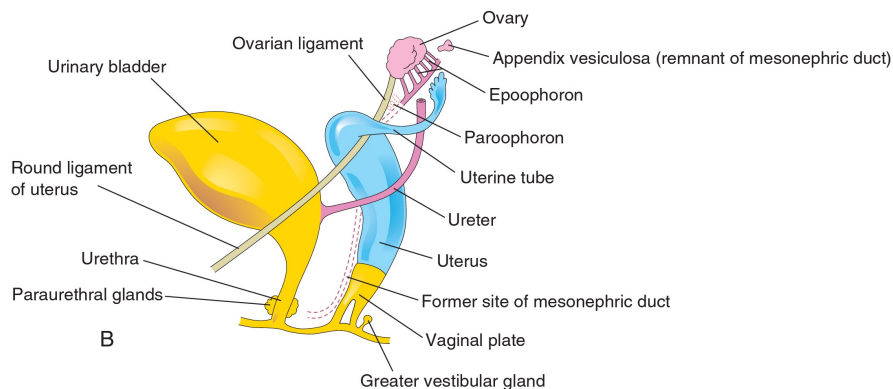
1-The Genital Tubercle	2- Urethral Folds	3-Labioscrotal Folds
proliferates to form the Primordial Phalls → The phalls elongates slightly to form the Clitoris .	do not fuse and form the Labia Minora .	form the Labia Majora , they fuse to form the Posterior& the Anterior Labial Commissures .



In females, the genital tubercle becomes the clitoris, the genital swellings become the labia majora, and the genital folds become the labia minora. In males, the genital tubercle becomes the glans penis, the genital swellings fuse to become the scrotum, the genital folds elongate and fuse to form the shaft of the penis and the penile urethra, and the prostate forms in the wall of the urogenital sinus.

Female Sex Glands

1- Urethral & Paraurethral Glands:	2. Greater Vestibular Glands (Bartholin glands)
grow as buds from the urethra, they are corresponding to the Prostate Gland of the male.	outgrowths of the urogenital sinus, they are corresponding to the Bulbourethral Glands of the male.



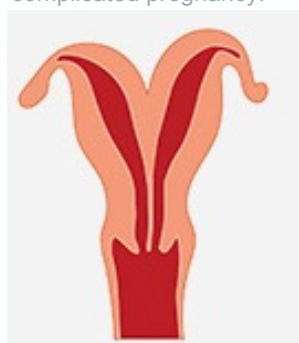
Congenital Anomalies

Various types of anomalies can result due to:

1. Arrest of development of the uterovaginal primordium 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.

Uterine Malformations

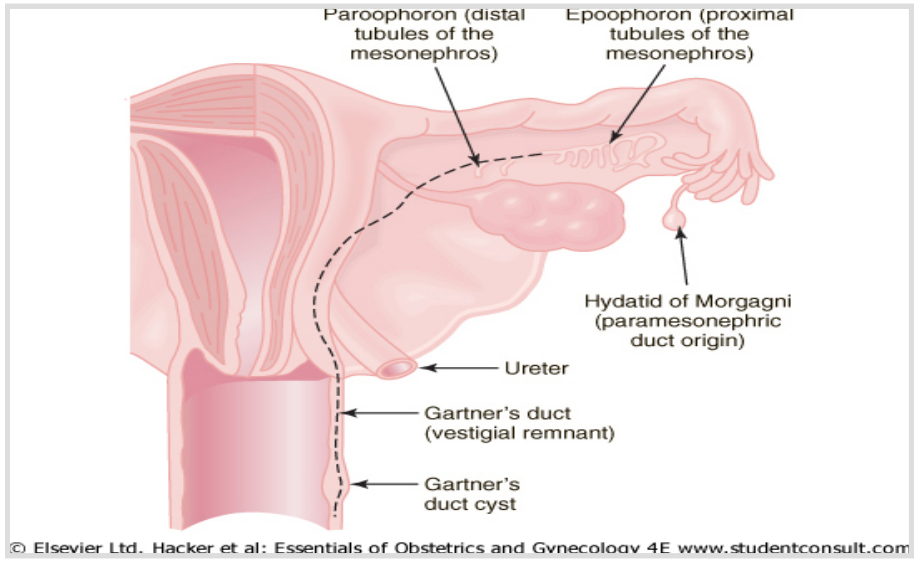
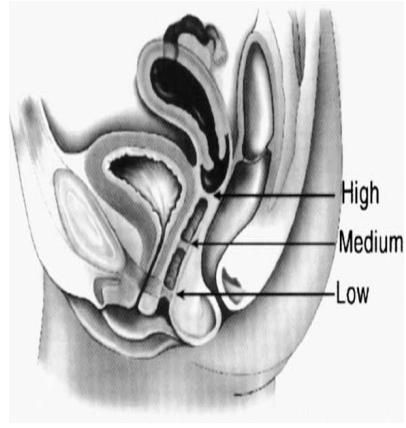
Double uterus (Uterus Didelphys)	Bicornuate uterus	Unicornuate Uterus:	Arcuate Uterus.
Due to failure of fusion of inferior parts of the paramesonephric ducts . May be associated with a double or single vagina.	The duplication involves the superior segment . Incomplete fusion of Müllerian ducts, risk of complicated pregnancy.	One paramesonephric duct fails to develop.	the uterine cavity displays a concave contour towards the fundus.



Cervical Atresia: It may be combined with **incomplete development of the upper vagina or lower uterus.**

Vaginal Anomalies:

Atresia	Double vagina	Transversely septate vagina
(Partial or complete).	-	Results from faulty canalization of the fused müllerian ducts.



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

433 notes:

- If the remnant mesonephric duct was in the **PROXIMAL** part we call it **epoophoron** (within the broad ligament).
- 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 vagina).

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Summary

4th week	Appearance of the Primordial germ cells
5th week	Appearance of the Gonadal Ridge
6th week	Migration of the Primordial germ cells to the Gonadal Ridge
7th week	The gonad acquires Female or Male morphological characteristics.
	The external genitalia are similar in both sexes.
9th week	The external genitalia begin to differentiate
10th week	The ovary is identifiable histologically
12th week	The external genitalia are fully differentiated
16th 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
Mullerian ducts (Paramesonephric Ducts)	Female internal genital Organs → Upper Vagina , Cervix, Uterus & Fallopian Tubes.
Urogenital sinus	Female external genitalia → Lower vagina.
Genital Tubercle	Primordial Phalls → Clitoris.
Urethral Folds	Labia Minora.
Labioscrotal Folds	Labia Majora .
SinoVaginal Bulbs.	Vaginal Plate.
splanchnic mesoderm.	endometrial stroma and myometrium .
intermediate mesoderm	Genital (Gonadal) Ridge.
Primitive Germ Cell.	Oogonium
surface epithelium (Sex Cord)	Follicular Cells
Vaginal Plate	The lining of the entire vagina
Uterus Didelphys	Due to failure of fusion of inferior parts of the paramesonephric ducts.
Bicornuate uterus	The duplication involves the superior segment.
Unicornuate Uterus:	One paramesonephric duct fails to develop.
Cervical Atresia	incomplete development of the upper vagina or lower uterus.
Transversely septate vagina	Results from faulty canalization of the fused müllerian ducts.

MCQ's

- 1-The external genitalia begin to differentiate during
- A. week 3 of development
 - B. week 5 of development
 - C. week 7 of development
 - D. week 9 of development
 - E. week 12 of development
- 2- The external genitalia are fully differentiated during
- A. week 3 of development
 - B. week 5 of development
 - C. week 7 of development
 - D. week 12 of development
 - E. week 20 of development
- 3- which of the following is a correct answer about Uterus Didelphys ?
- A. failure of fusion of inferior parts of the paramesonephric ducts.
 - B. One paramesonephric duct fails to develop.
 - C. Only associated with a double vagina
 - D. Only associated with a single vagina
- 4- The labia minora arise embryologically from which of the following structures?
- A. Phallus
 - B. Labioscrotal swellings
 - C. Sinovaginal bulbs
 - D. Urogenital folds
 - E. Paramesonephric duct
- 5- which one of the following duct will regress in the absence of testosterone ?
- A. paramesonephric duct
 - B. mesonephric duct
 - C. nephric duct
- 6- Phallus elongated to form which one of the following ?
- A. labia minora
 - B. labia majora
 - C. clitoris

1

D

2

D

3

A

4

D

5

B

6

C

