Development of female Genital System

Prof. Musaed Al-Fayez

Development of Genital System

- Y chromosome
- Testis-determining factor (TDF) gene
- TDF = Male
- No TDF = Female

Gonads

- Sex of the embryo is determined genetically at the time of fertilization
- Gonads do not acquire male or female morphological characteristics until 7^{th} week of development.

Gonads

- Genital system are developed from two longitudinal ridges of mesoderm which run down the entire length of the dorsal body wall. These ridges are called urogenital ridges. The medial region of this ridge differentiates into the gential ridge where the gonads develop.

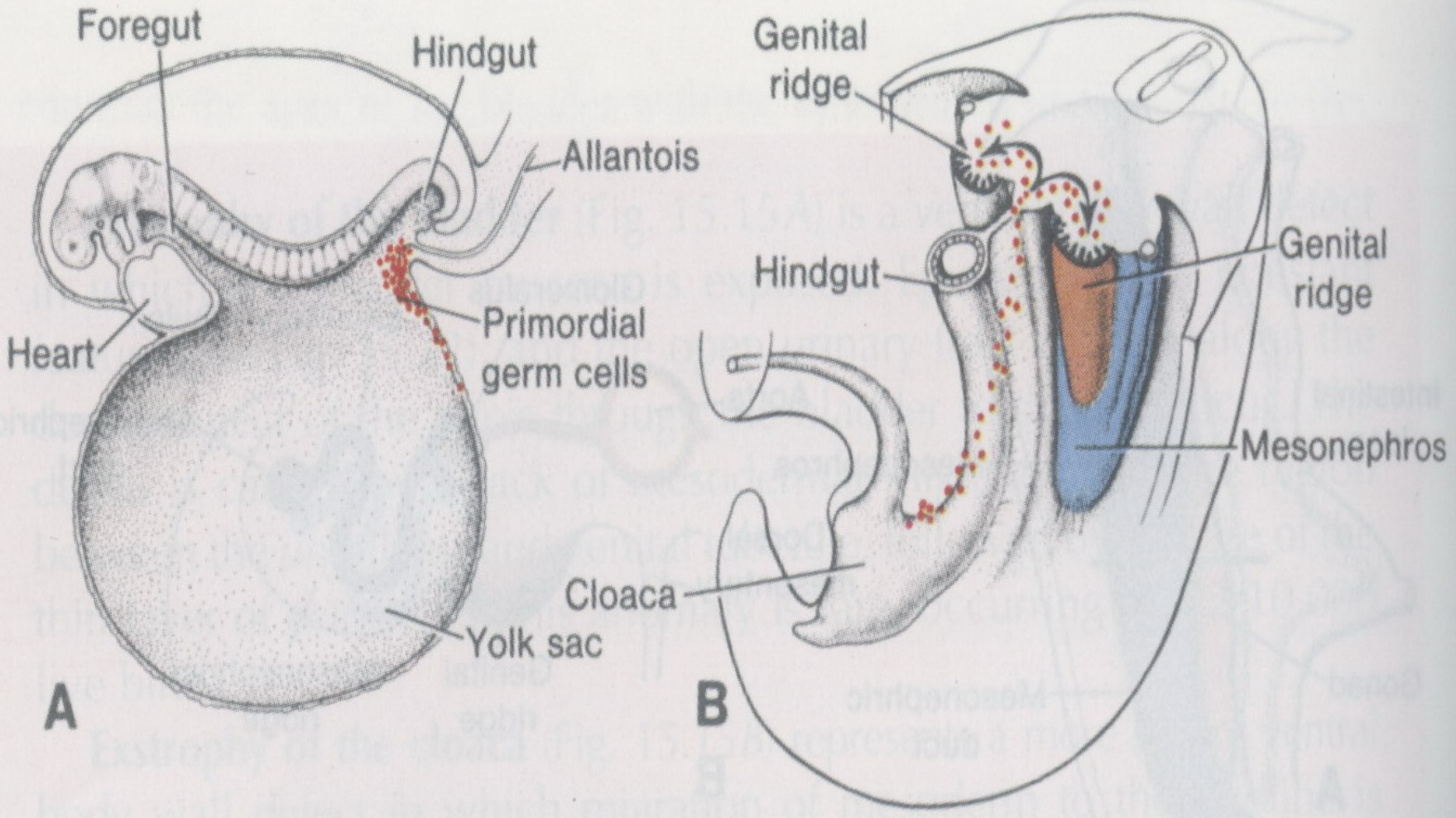


Figure 15.17. **A.** Schematic drawing of a 3-week-old embryo, showing the primordial germ cells in the wall of the yolk sac, close to the attachment of the allantois. **B.** Drawing to show the migrational path of the primordial germ cells along the wall of the hindgut and the dorsal mesentery into the genital ridge.

- The gonads begin to develop during the fifth week in the **genital ridge**. The gonads are first undifferentiated and have only a cortex and a medulla.

- In embryos with an XX chromosome complex, the cortex normally differentiates into an ovary, and the medulla regresses. In embryos with an XY complex, the medulla differentiates into a testis and the cortex regresses.

- Large primitive cells, called **primordial sex cells**, form in the yolk sac during the fourth week. They migrate along the dorsal mesentery of the hindgut to the genital ridges where they become incorporated into the developing gonads

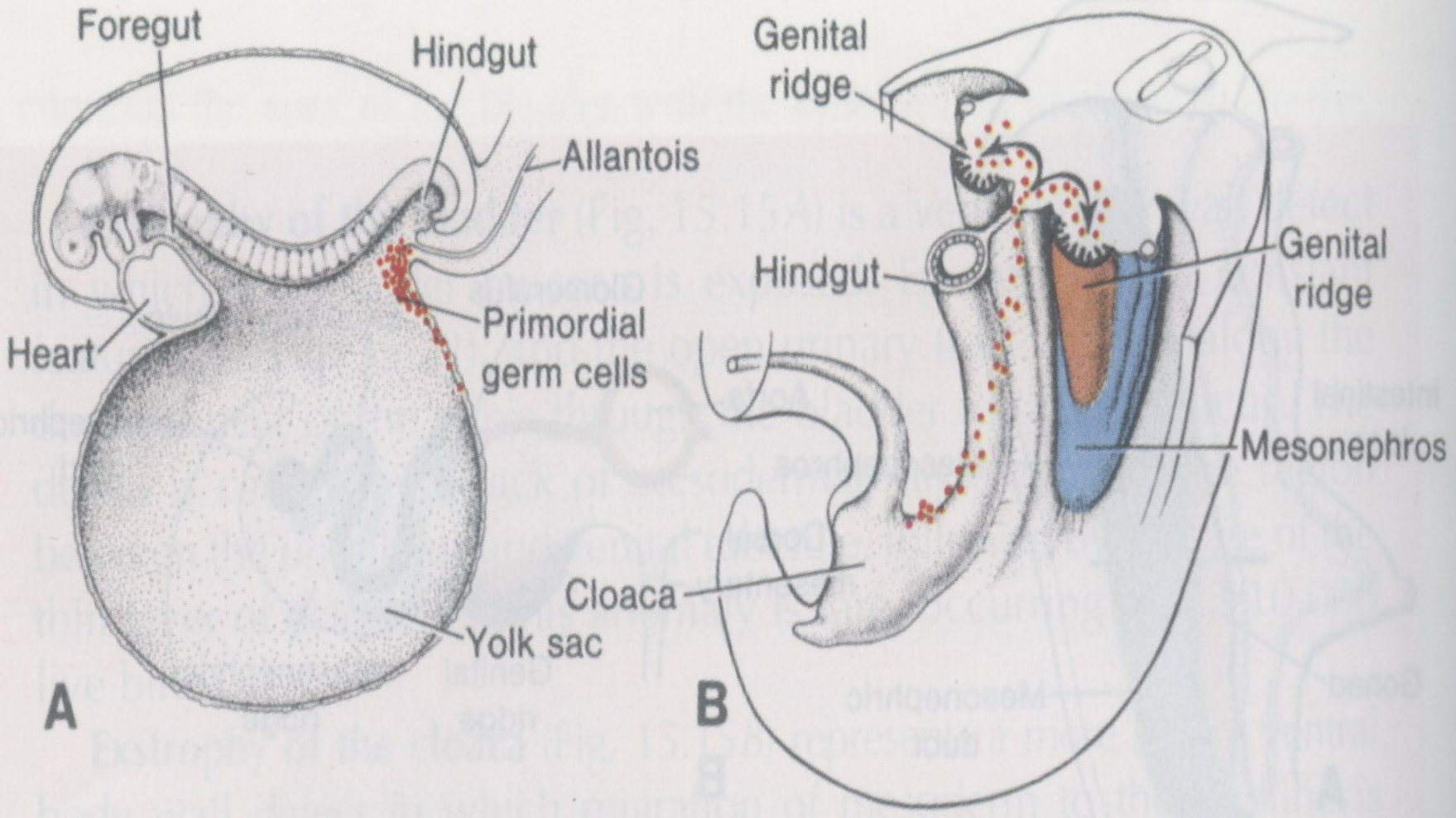


Figure 15.17. **A.** Schematic drawing of a 3-week-old embryo, showing the primordial germ cells in the wall of the yolk sac, close to the attachment of the allantois. **B.** Drawing to show the migrational path of the primordial germ cells along the wall of the hindgut and the dorsal mesentery into the genital ridge.

- Germ Cells arriving at 5th week & invading the genital ridge in the 6th week.
- During arrival of Germ cells, the epitheluim of the genital ridge proliferates, and epithelial cells penetrate the underlying mesenchyme
- Forming irregular shaped cord primitive sex cord indifferent gonad

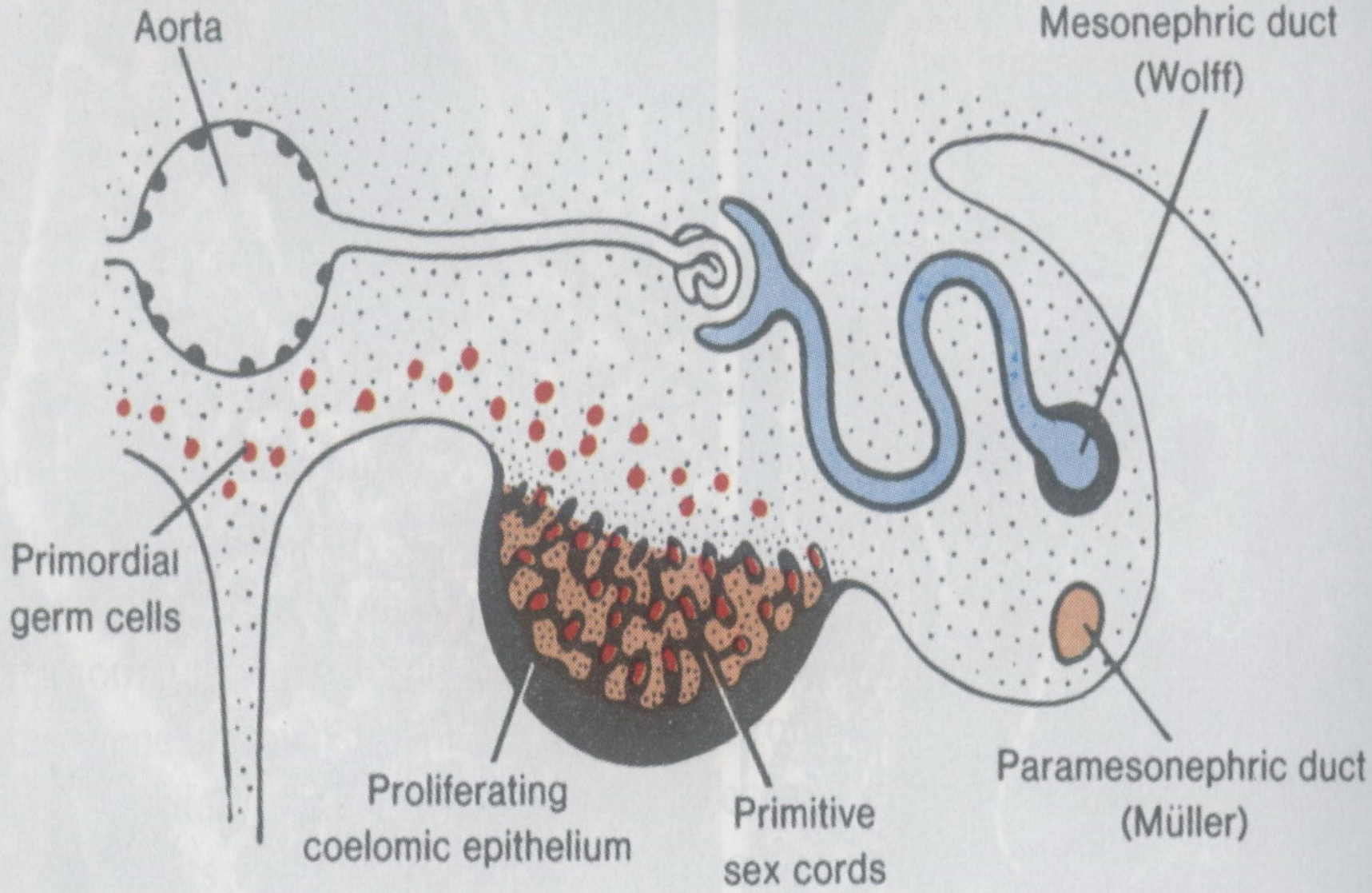


Figure 15.18. Schematic transverse section through the lumbar region of a 6-week embryo, showing the indifferent gonad with the primitive sex cords. Some of the primordial germ cells are surrounded by cells of the primitive sex cords.

OVARY

- Primitive sex cords dissociate into irregular cell cluster. Later they will disappear and are replaced by vascular stroma forming ovarian medulla.
- Surface epithelium of the female gonad proliferate.
- In 7^{th} week give rise to 2^{nd} generation of cords, cortical cords

- Penetrate the unerlying mesenchyme
- In 4^{th} month these cords split into isolated cell clusters which surrounding one or more primitive germ cells.
- GS will develop into oogonia and surrounding epithelial cells form follicular cells.

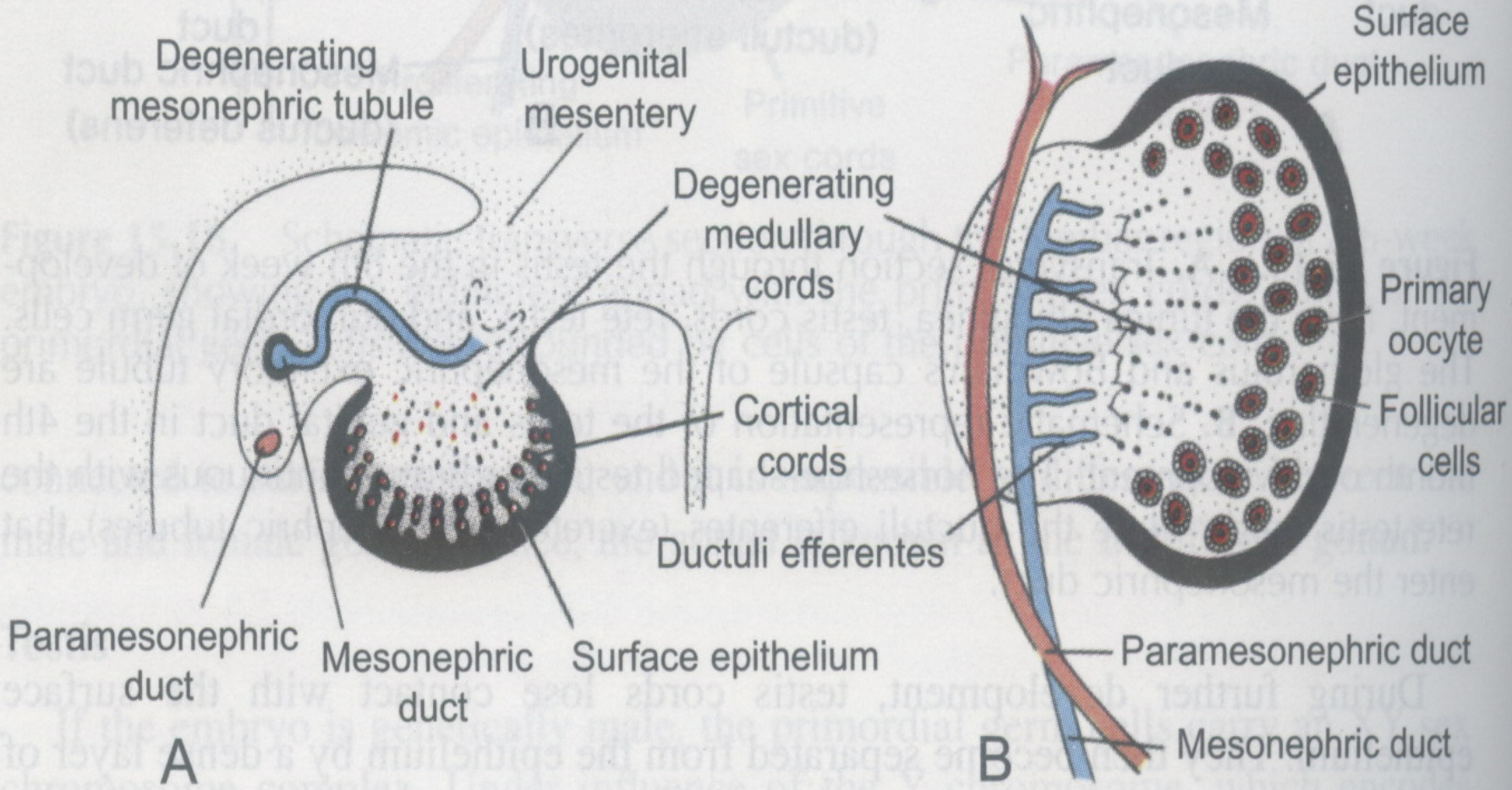


Figure 15.20. **A.** Transverse section of the ovary at the 7th week of development, showing degeneration of the primitive (medullary) sex cords and formation of the cortical cords. **B.** Drawing of the ovary and genital ducts in the 5th month of development. Note degeneration of the medullary cords. The excretory mesonephric tubules (efferent ductules) do not communicate with the rete. The cortical zone of the ovary contains groups of oogonia surrounded by follicular cells.

- Two pairs of **genital ducts** develop in both sexes; Mesonephric (Wolffian) Ducts and Paramesonephric (Mullerian) Ducts.

- In female embryos, **mesonephric ducts** regress and paramesonephric ducts develop into uterine tubes, uterus, and upper vagina.

- If the embryo is to become a male, the mesonephric duct system remains to form efferent ductules, epididymis, vas deferens and ejaculatory duct. The seminal vesicle develops as a diverticulum from the developing vas.

Genital duct in the female

- Paramesonephric ducts develop into the main genital ducts of the female
- Initially, 3 parts can be recognized in each duct:
- A) A cranial vertical portion opens into abdominal cavity
- B) A horizontal part that crosses the mesonephric duct

- C) A caudal vertical part that fuses with its partner from the opposite side
- A&B develop into the uterine tube
- C fuse to form uterine canal
- Fused give rise to the body and cervix of the uterus.
- Mesenchyme will form muscular coat of the uterus myometrium & perimetrium

Vagina

- After solid tip of paramesonephric ducts reaches the urogenital sinus, 2 solid evagination grow out
- These evagination (sinovaginal bulbs), proliferate and form vaginal plate.
- By 5^{th} week outgrowth is entirely canalized

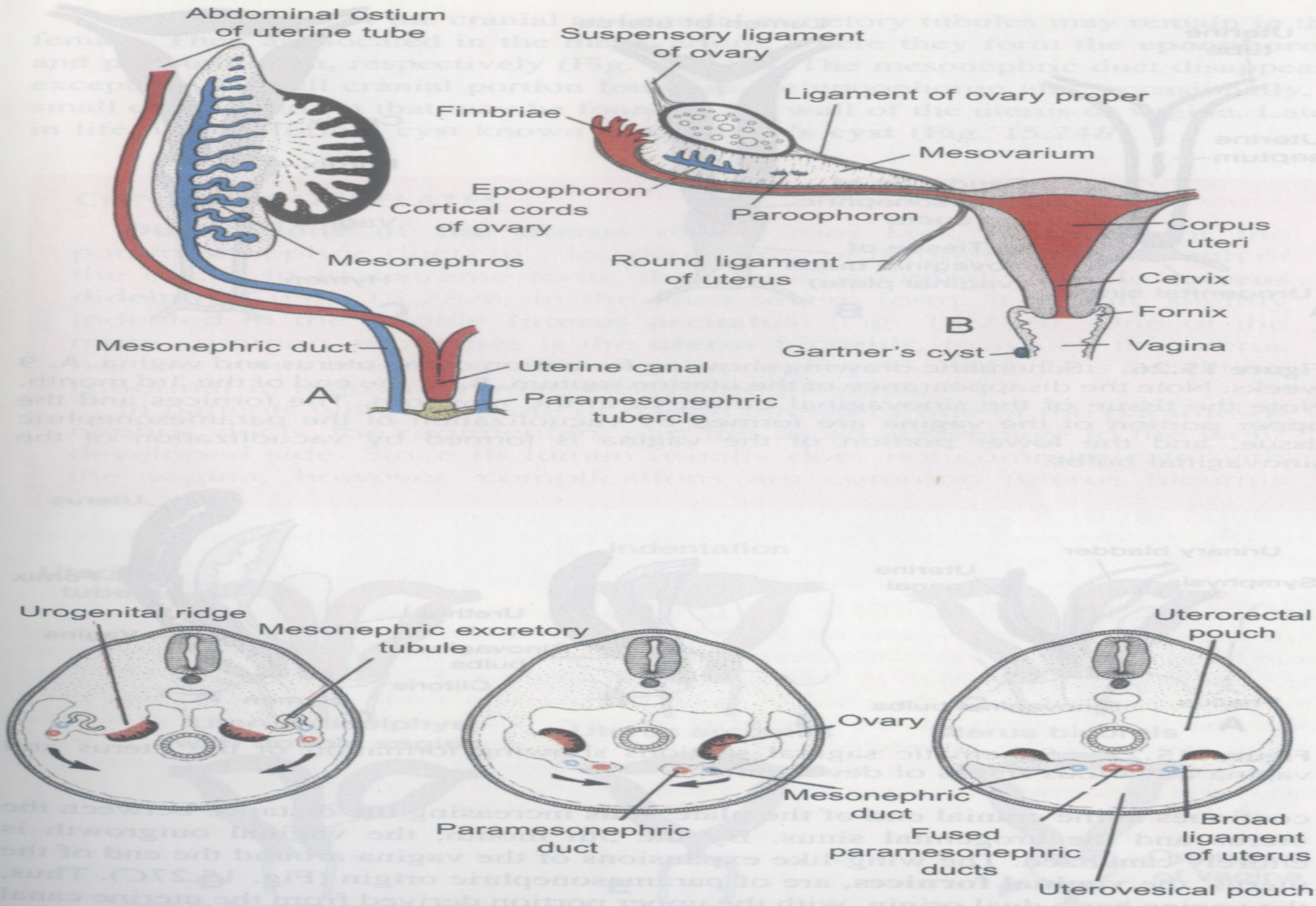


Figure 15.25. Transverse sections through the urogenital ridge at progressively lower levels. Note that the paramesonephric ducts approach each other in the midline to fuse. As a result of fusion, a transverse fold, the broad ligament of the uterus, is formed in the pelvis. The gonads come to lie at the posterior aspect of the transverse fold.

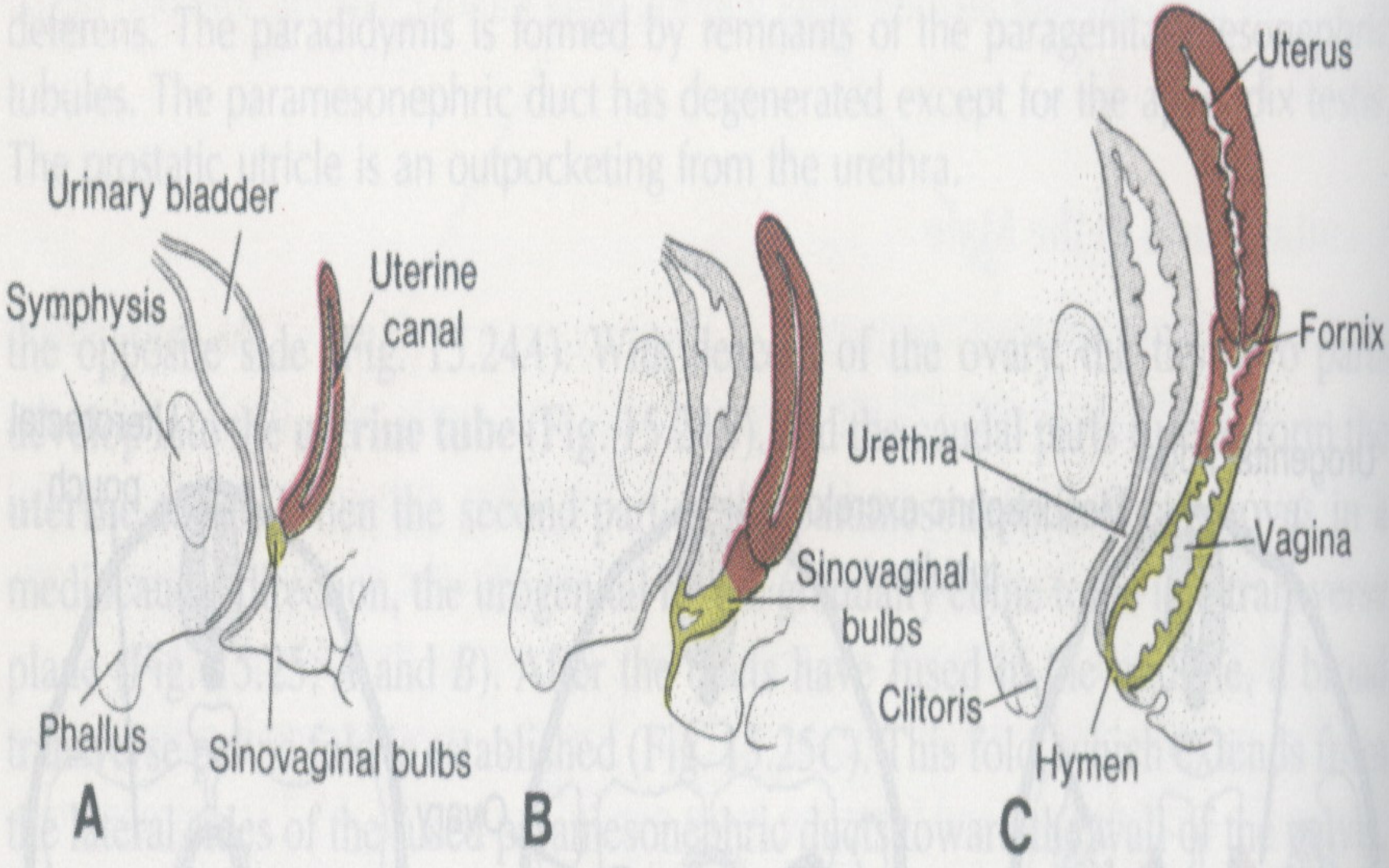


Figure 15.27. Schematic sagittal sections showing formation of the uterus and vagina at various stages of development.

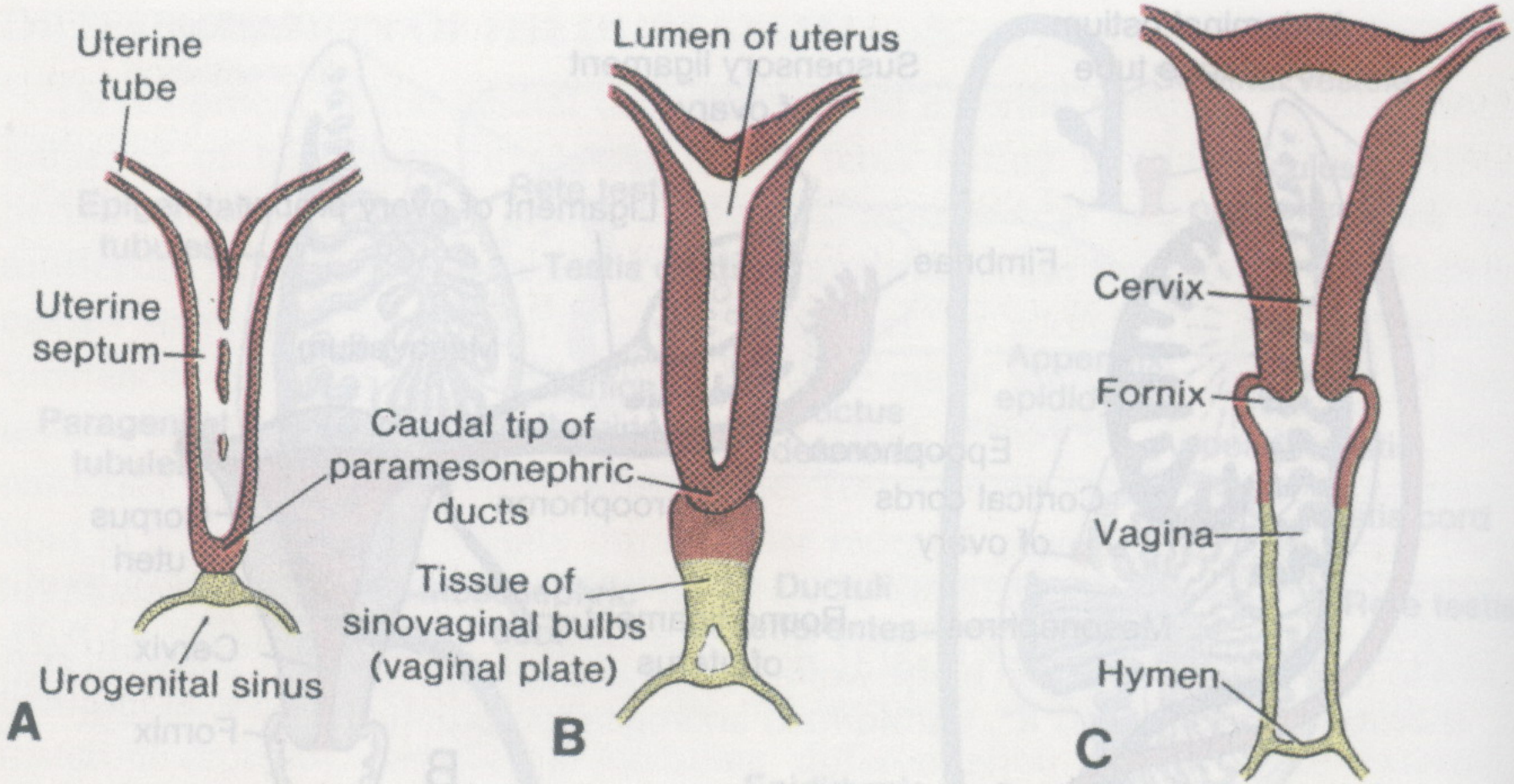


Figure 15.26. Schematic drawing showing formation of the uterus and vagina. **A.** 9 weeks. Note the disappearance of the uterine septum. **B.** At the end of the 3rd month. Note the tissue of the sinovaginal bulbs. **C.** In the newborn. The fornices and the upper portion of the vagina are formed by vacuolization of the paramesonephric tissue, and the lower portion of the vagina is formed by vacuolization of the sinovaginal bulbs.

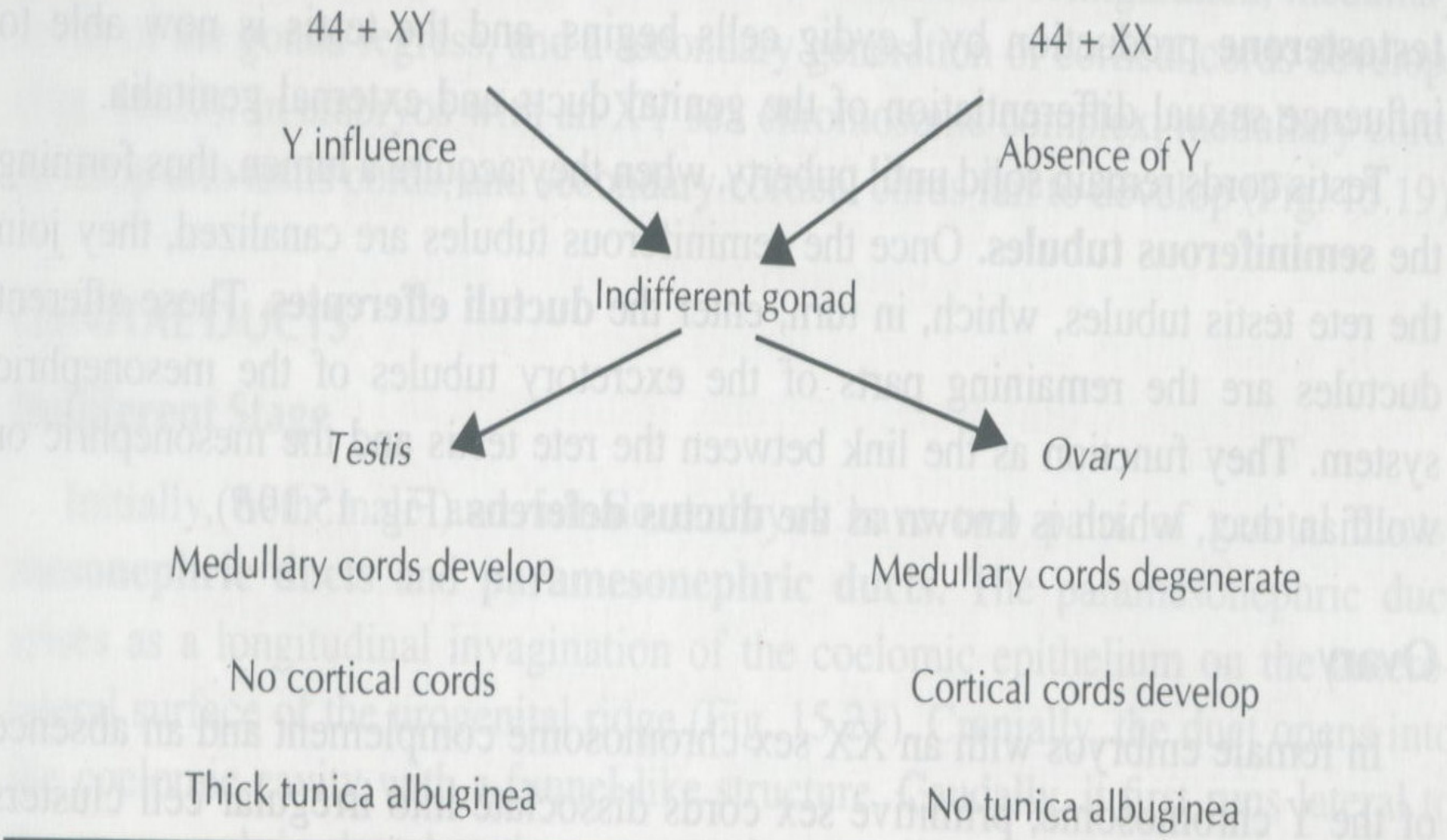
External genitalia

- 3rd week, mesenchyme cells originated from primitive streak migrate around the clocal membrane to form a pair of cloacal folds.
- Crainal to cloacal membrane the folds unite to form the genital tubercle.
- Caudally the folds are subdivided into urethral folds anterior & anal folds poste

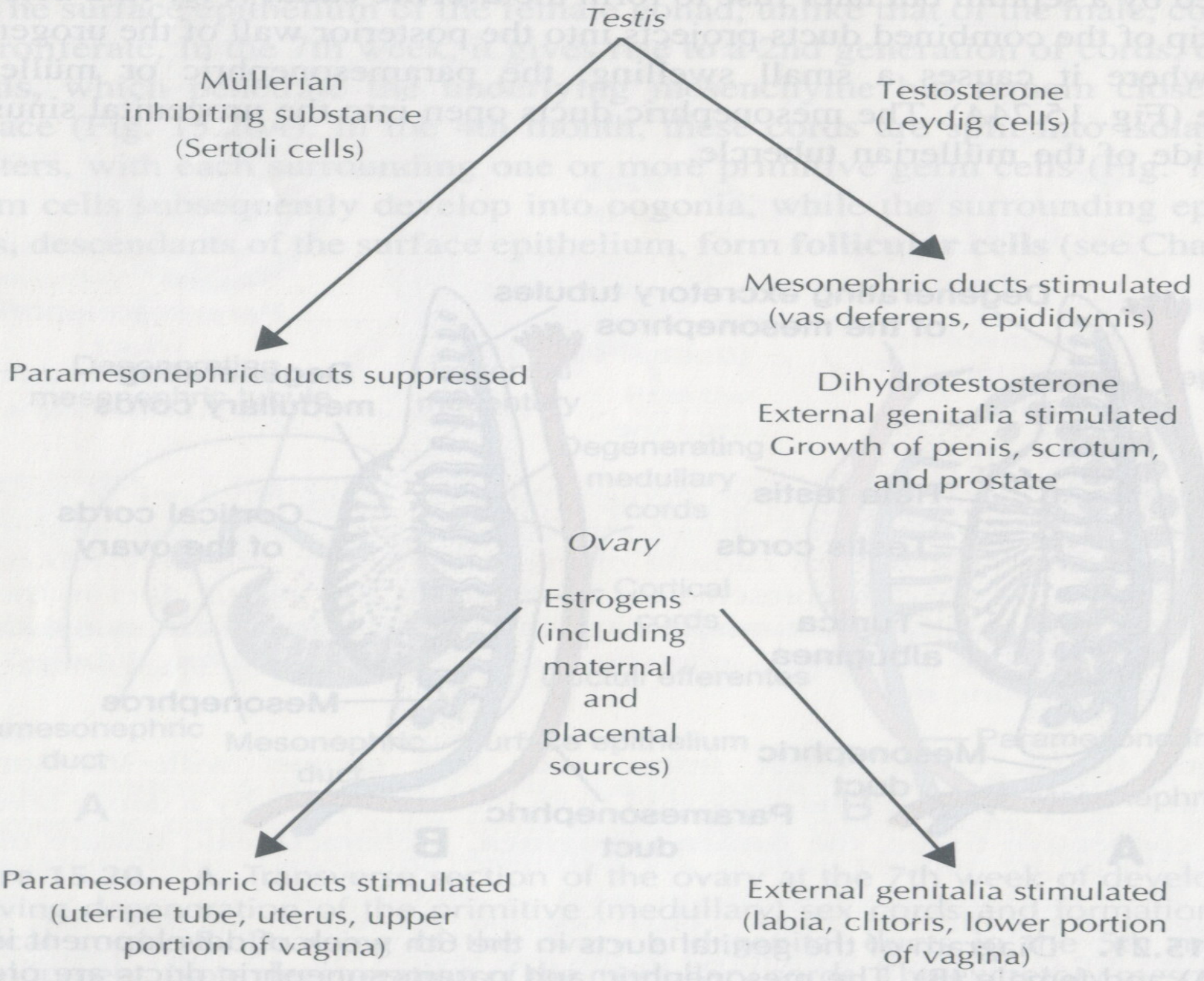
- In the meantime, another pair of elevation, genital swelling become visible on each side of the urethral folds
- These will form labia majora
- Estrogens stimulate development of the external genitalia of the female
- The genital tubercle elongates slightly to form clitoris;

- Urethral folds do not fuse to form labia minora
- Urogenital groove is open and forms the vestibule.

Table 15.1.
Influence of Primordial Germ Cells on Indifferent Gonad



Influence of the Sex Glands on Further Sex Differentiation



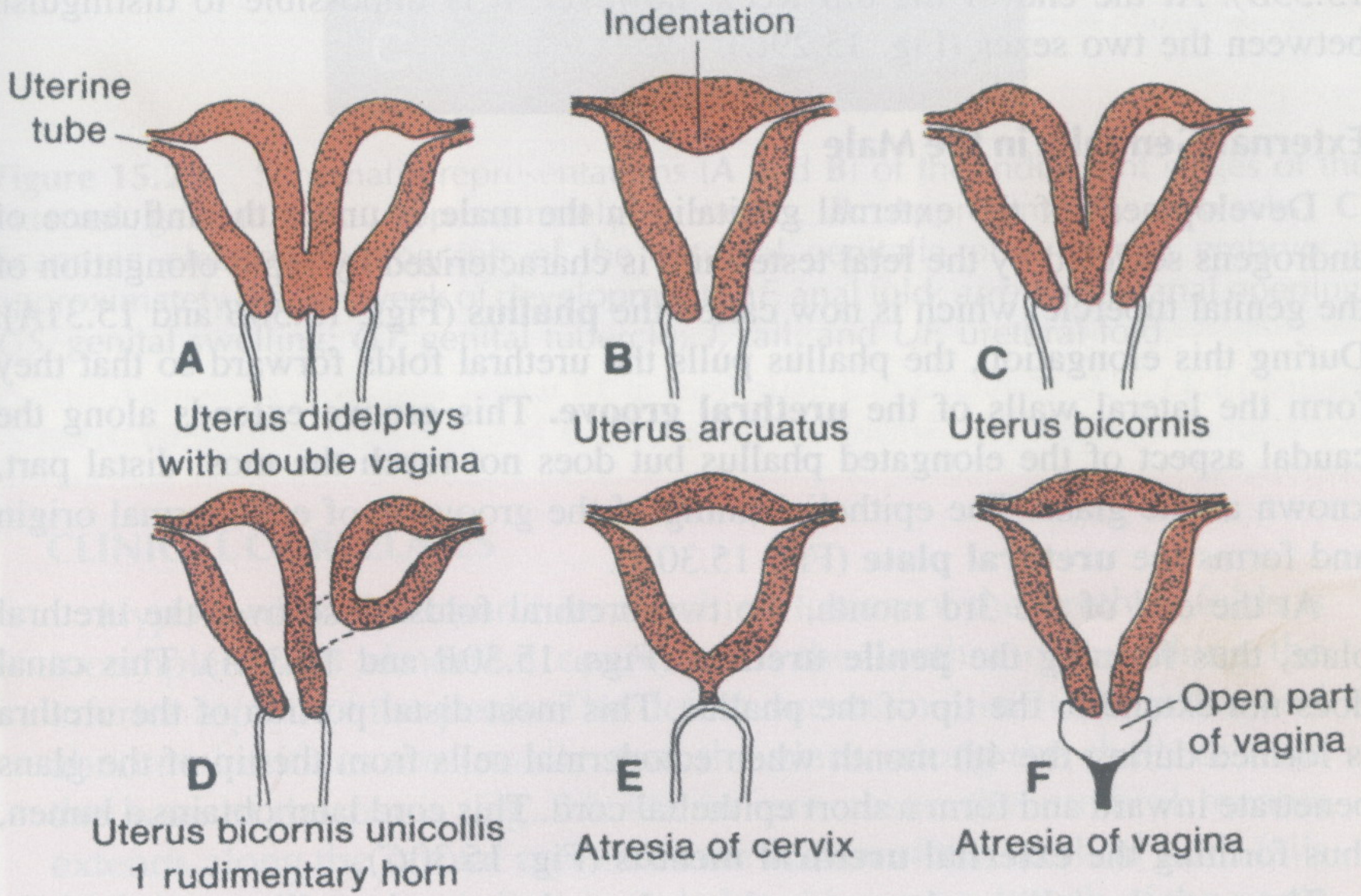


Figure 15.28. Schematic representation of the main abnormalities of the uterus and vagina, caused by persistence of the uterine septum or obliteration of the lumen of the uterine canal.

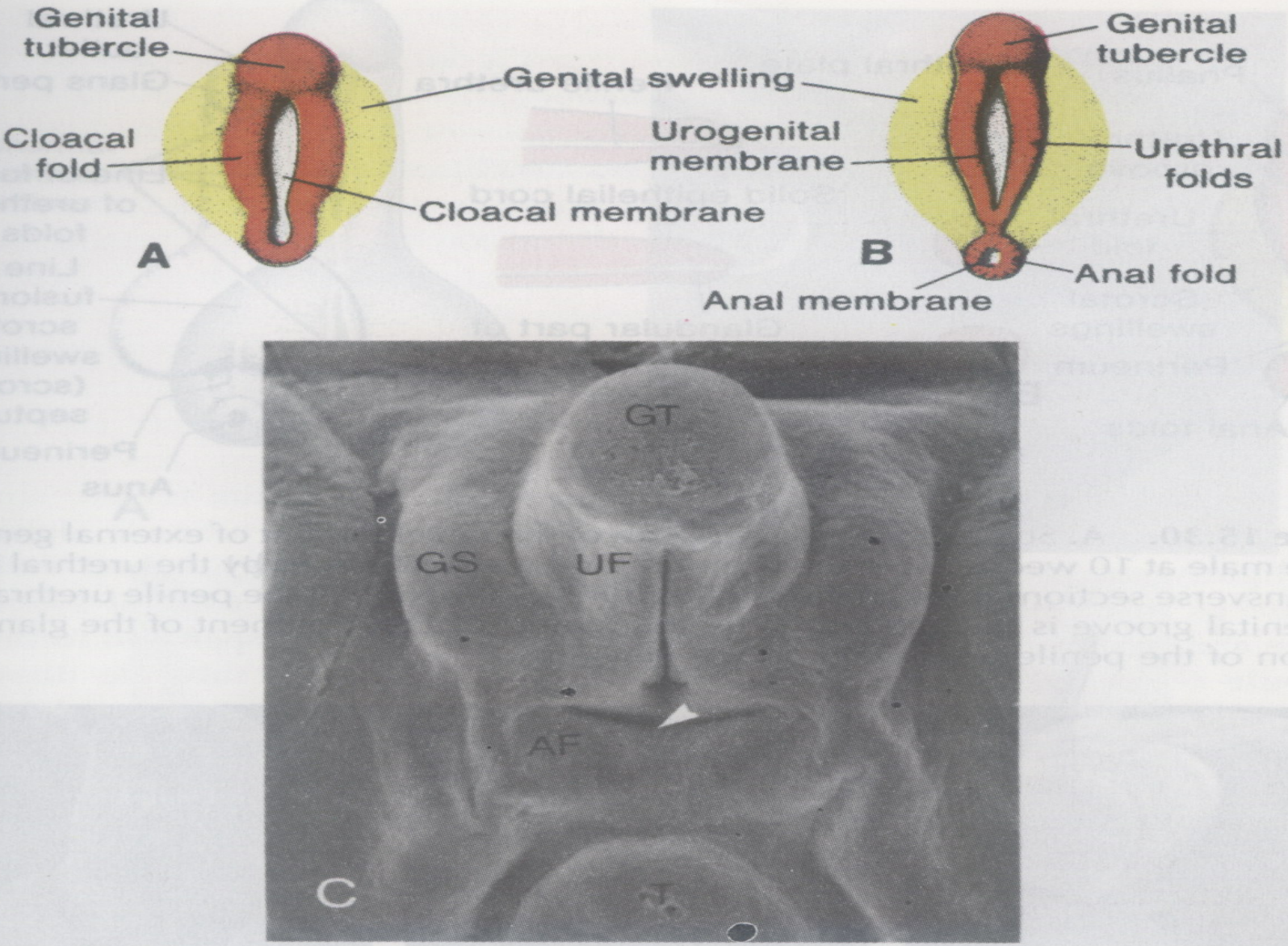


Figure 15.29. Schematic representations (**A** and **B**) of the indifferent stages of the external genitalia. **A.** Approximately 4 weeks. **B.** Approximately 6 weeks. **C.** Scanning electron micrograph of the external genitalia of a human embryo at approximately the 7th week of development. *AF,* anal fold; *arrowhead,* anal opening; *GS,* genital swelling; *GT,* genital tubercle; *T,* tail; and *UF,* urethral fold.

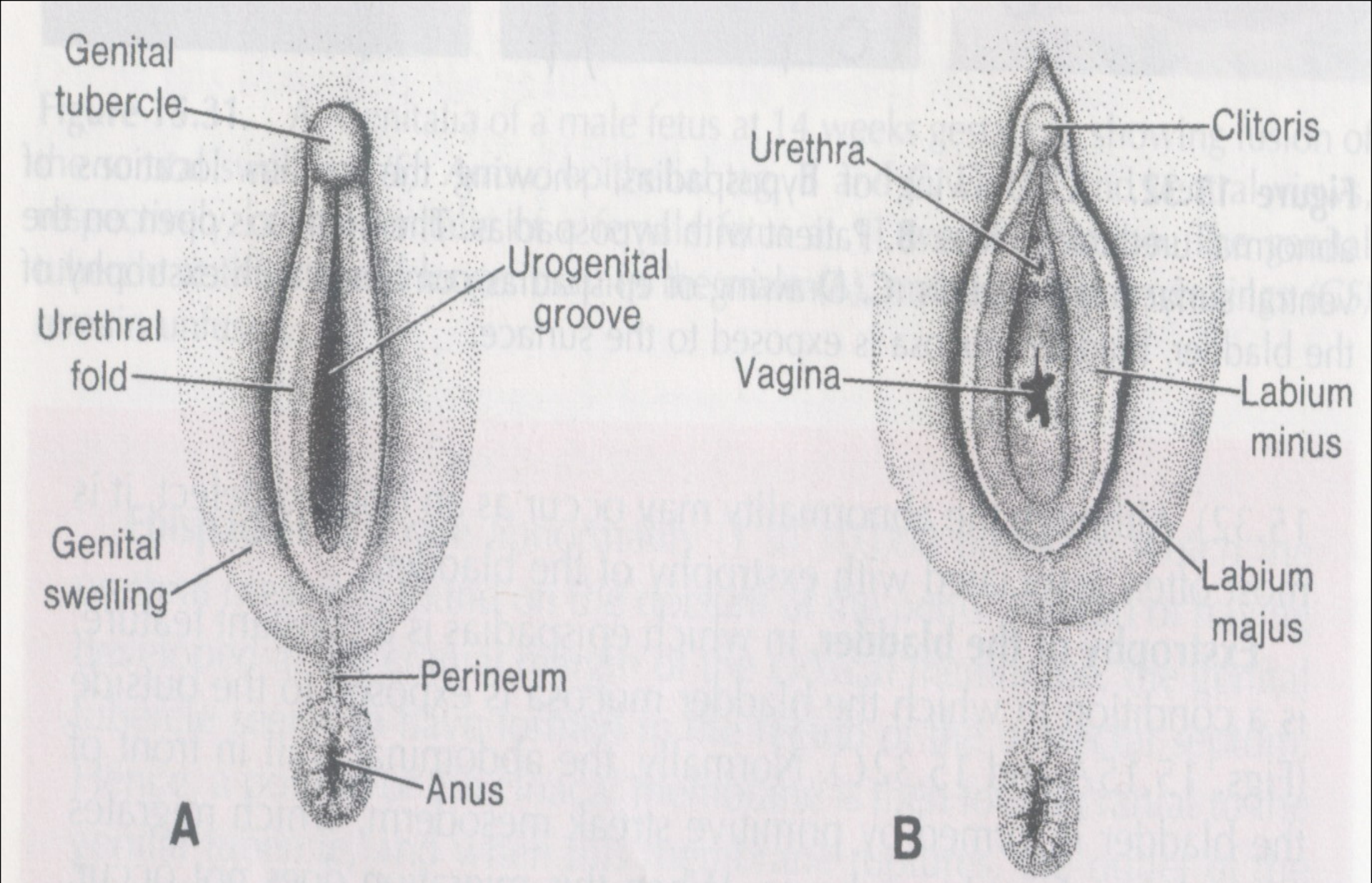


Figure 15.33. Development of the external genitalia in the female at 5 months gestation (**A**) and in the newborn (**B**).