

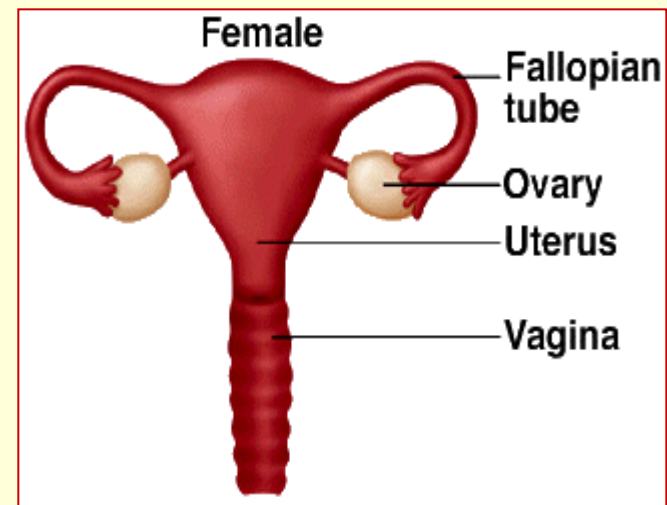
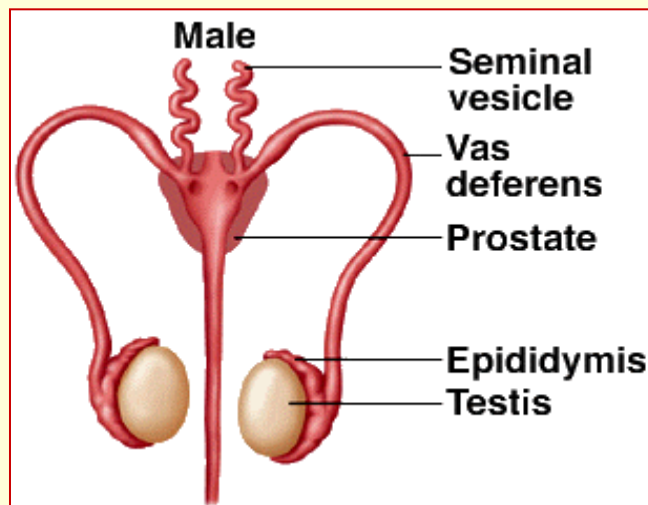
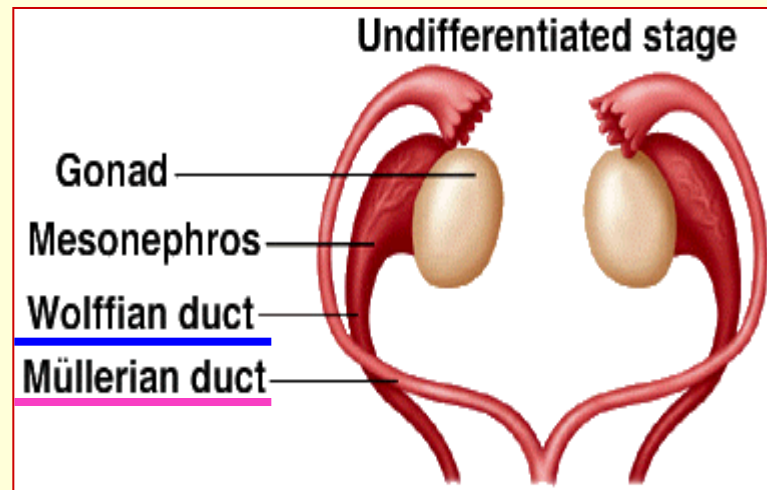


Embryology /organogenesis/

Week 4

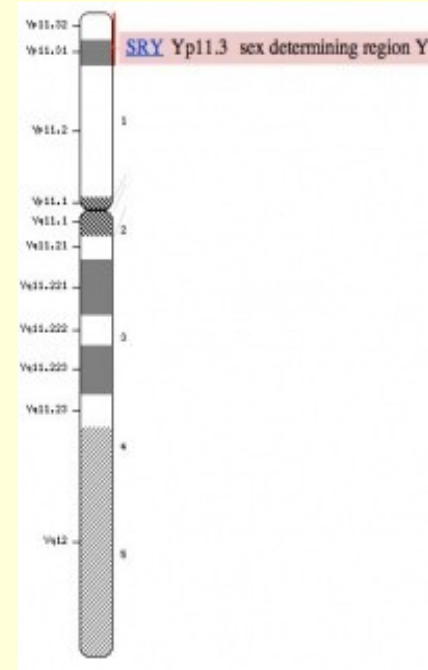
Development and teratology of reproductive system.

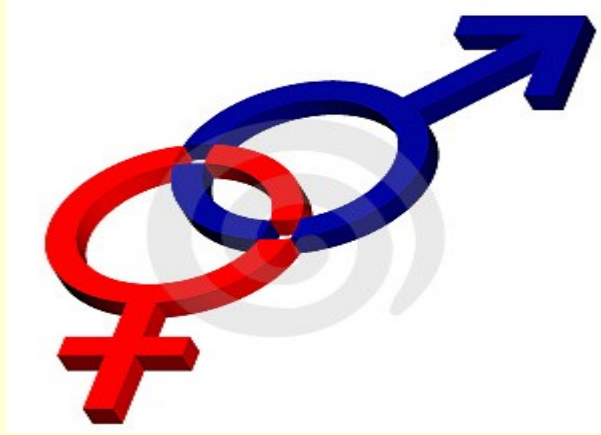
Male or female sex is determined by spermatozoon Y in the moment of fertilization



SRY gene, on the short arm of the Y chromosome, initiates male sexual differentiation.

- The **SRY** initiates transformation of indifferent gonads to form **testes**, which produce hormones supporting development of male reproductive organs.
 - Developed testes produce:
 - **testosterone** (T) - stimulates the Wolffian ducts development (*epididymis and deferent ducts*)
- and
- **anti-Müllerian hormone** (AMH) - suppresses the Mullerian ducts development (*oviduct, uterus, and upper vagina*).





- Indifferent stage – until the 7th week
- Differentiated stage
 - 1) Development of gonads
 - 2) Development of reproductive passages
 - 3) Development of external genitalia

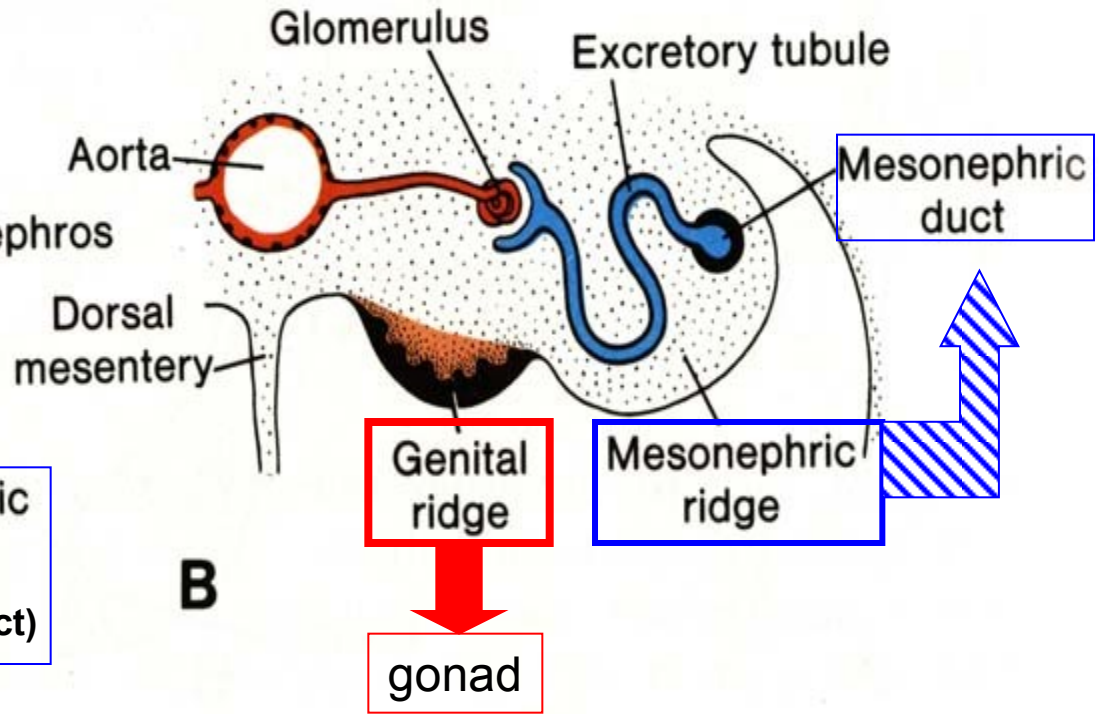
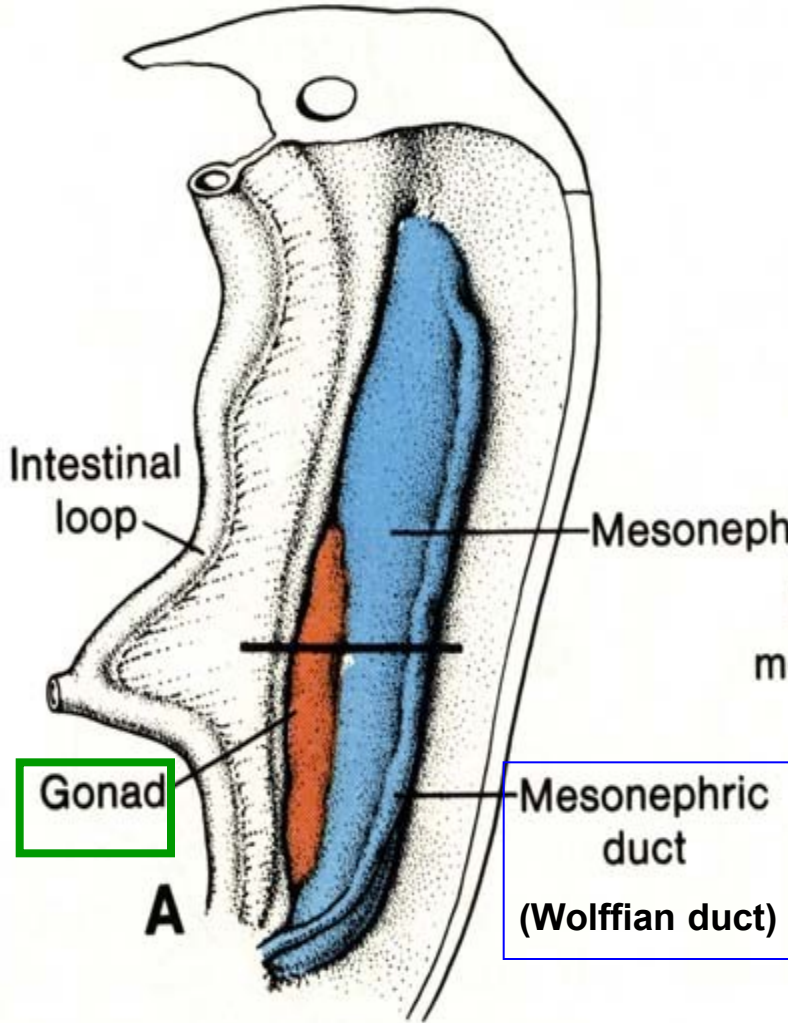
Development of gonads

Dorsal wall of body: urogenital ridge

mesonephric ridge (laterally)

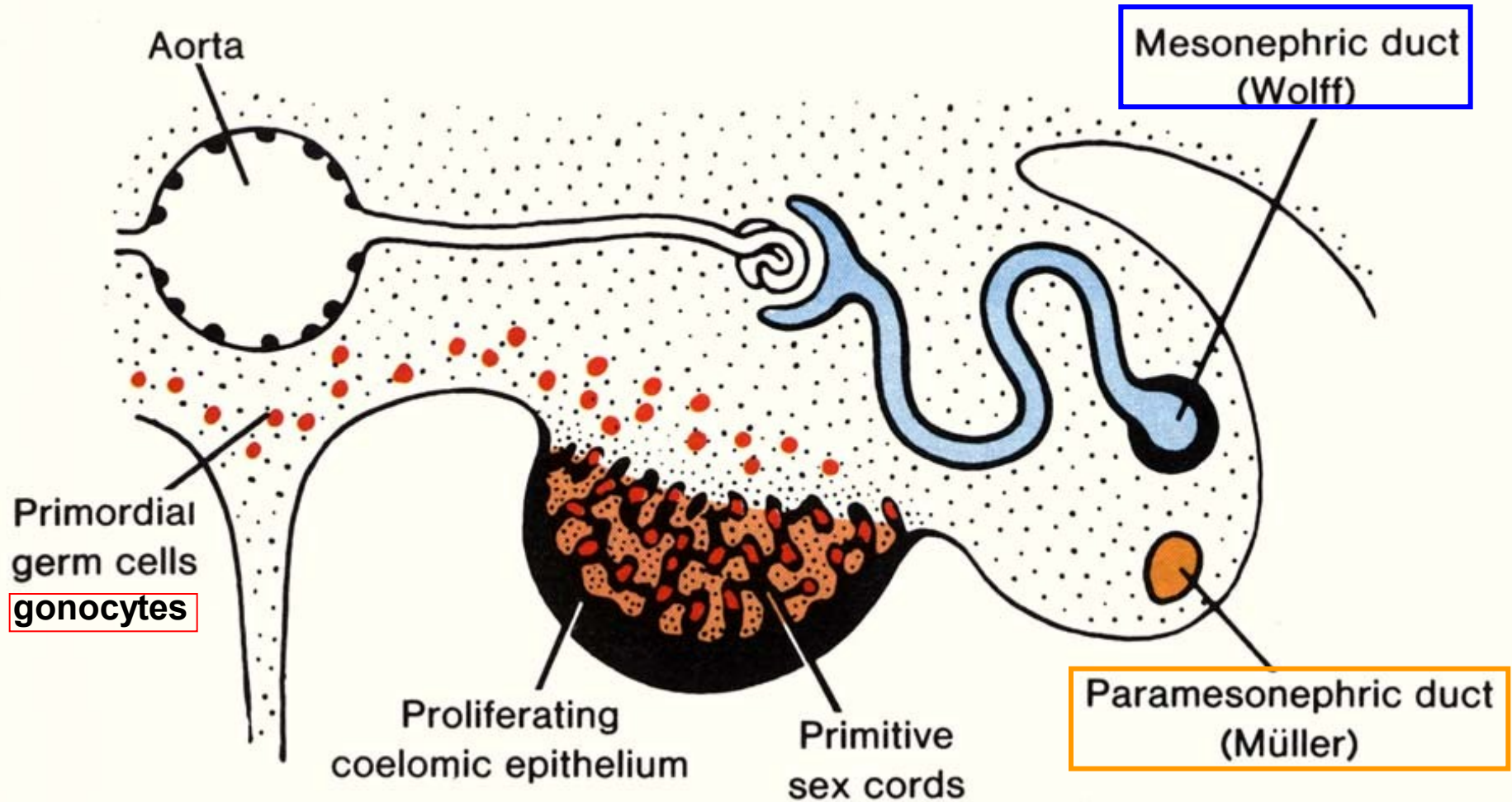
genital ridge (medially), consisting of

mesenchyme and coelomic epithelium

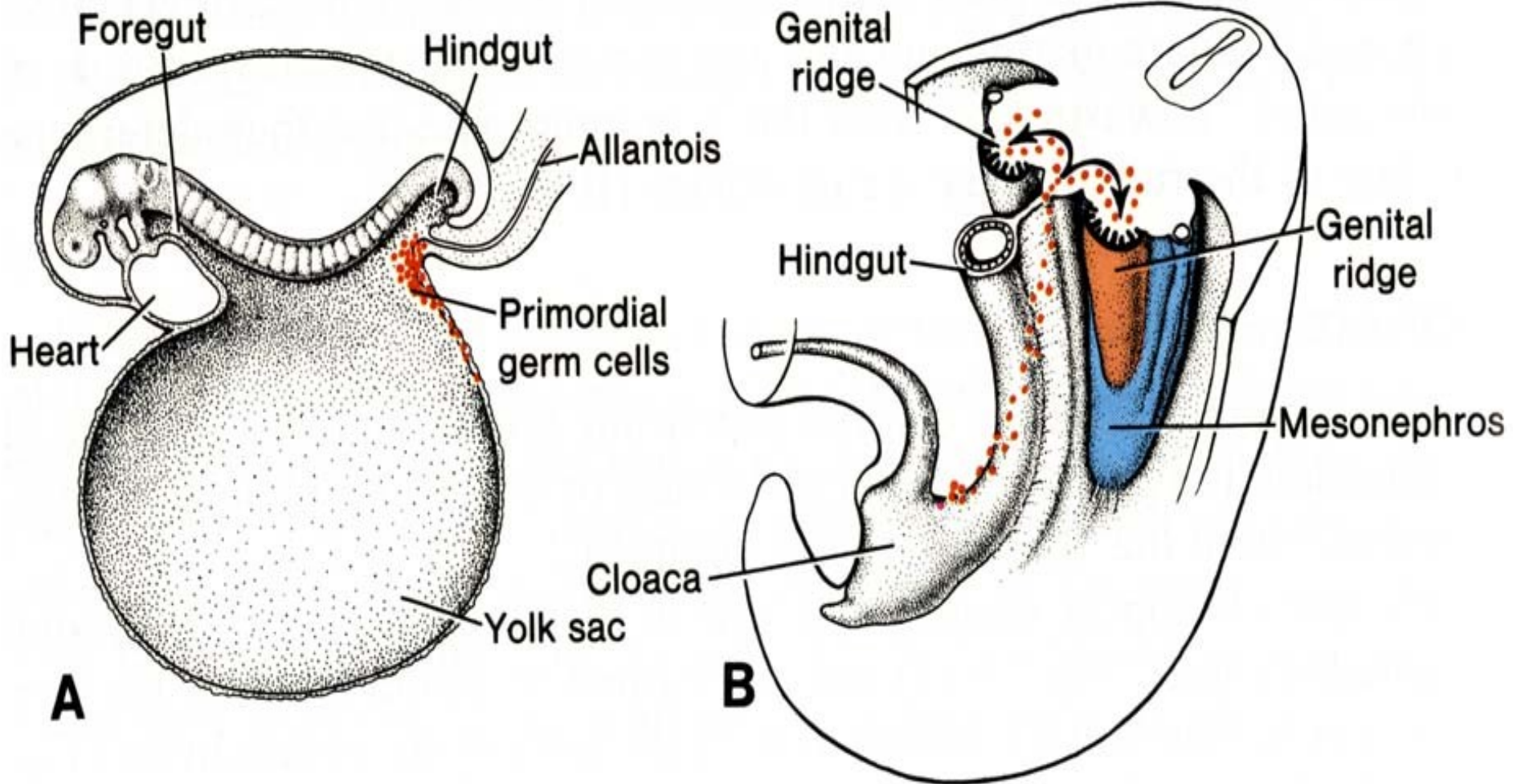


Three sources of gonad development:

- 1 – **mesenchyme** of gonadal ridges (plica genitalis)
- 2 – **coelomic epithelium** (mesodermal origin)
- 3 – **gonocytes** (primordial cells)

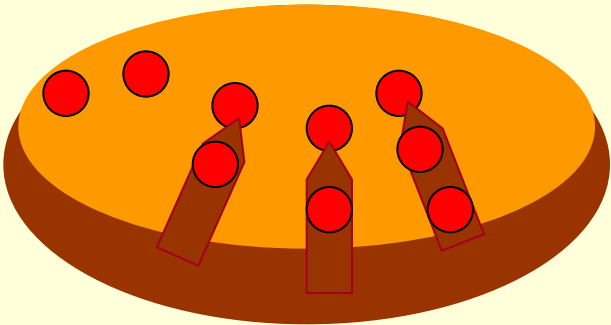


Primordial germ cells – **gonocytes** – in endoderm of dorsal wall of yolk sac.
Gonocytes migrate along dorsal mesentery of hindgut into the gonadal ridges and induce (!) gonad development.

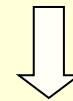


Indifferent gonad development

- **Gonocytes** induce **coelomic epithelium** to proliferate (primary proliferation)



Together with **gonocytes**, cells of **coelomic epithelium** in **mesenchyme** form -



- **primary sex cords**

in indifferent gonad

Primary proliferation (male)
Secondary proliferation (female)

TESTIS

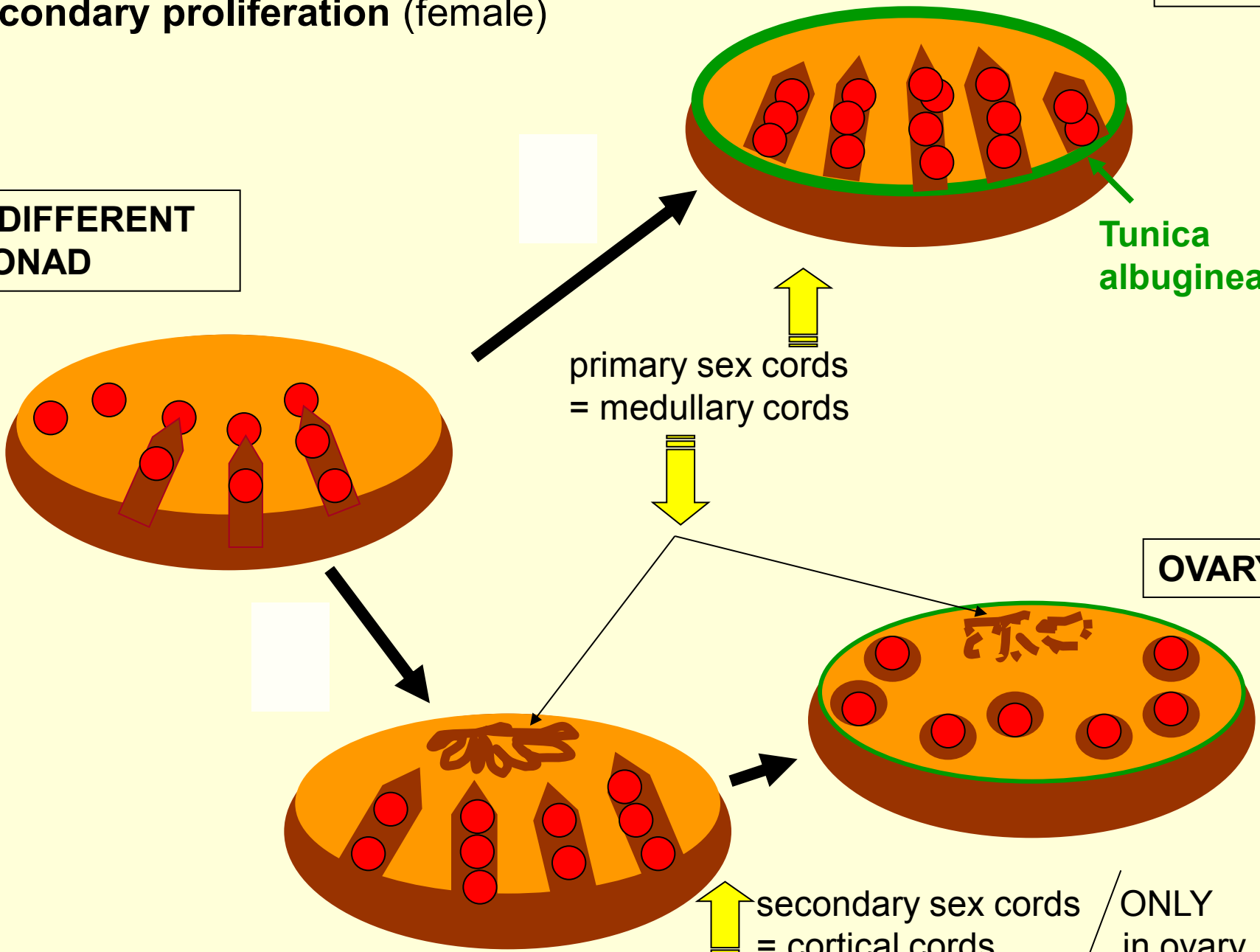
INDIFFERENT GONAD

Tunica albuginea

primary sex cords
= medullary cords

OVARY

secondary sex cords
= cortical cords
ONLY in ovary



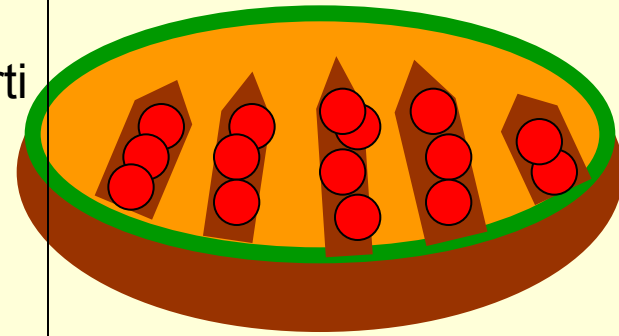
TESTIS:

Primary sex cords ⇒ tubuli semuniferi contorti

Gonocytes ⇒ **spermatogonia**

Coelomic cells ⇒ **Sertoli cells**

Mesenchyme ⇒ **Leydig cells**, interstitial
connective tissue



Tunica albuginea

OVARY:

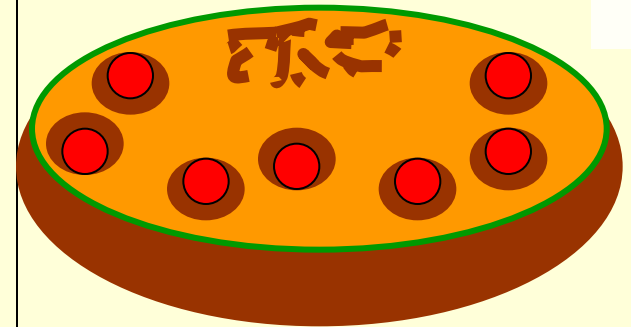
Primary sex cords ⇒ degenerate in ovarian medulla

Secondary sex cords ⇒ disintegrate into the
follicles:

Gonocytes ⇒ **oogonia**

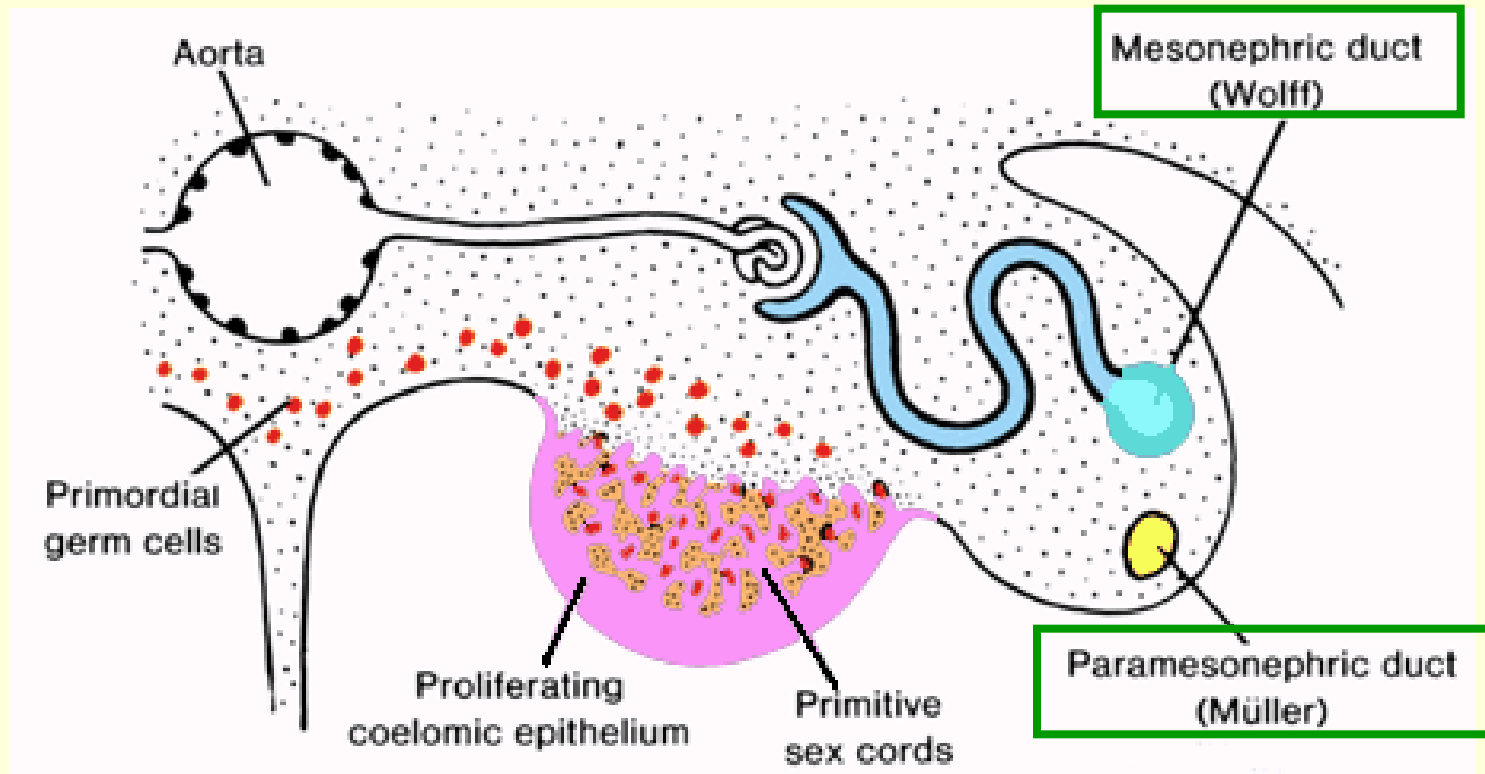
Coelomic cells ⇒ **follicular cells**

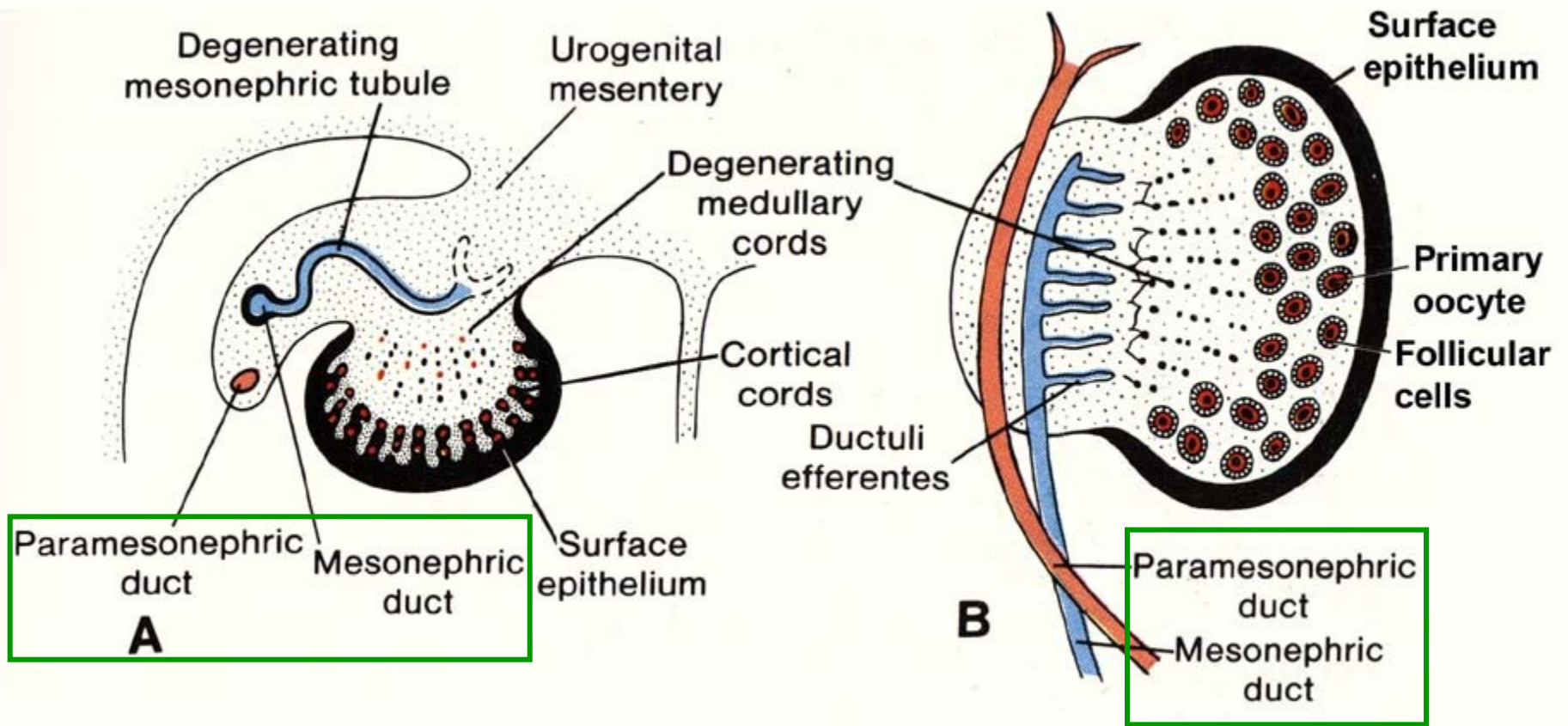
Mesenchyme ⇒ **ovarian stroma**

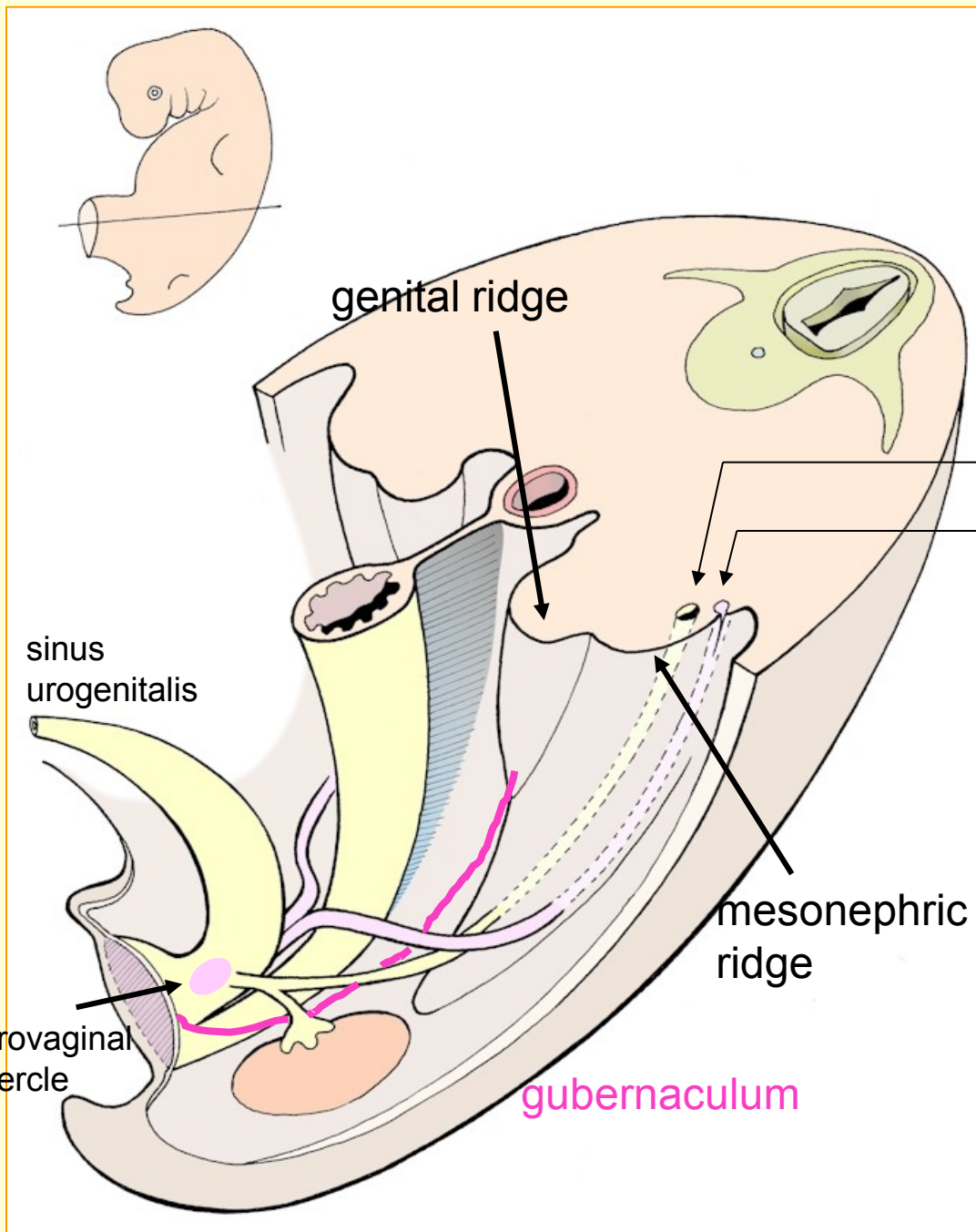


Development of reproductive passages (indifferent – differentiated stage)

- In mesonephric ridge) – 2 ducts:
Ductus mesonephricus (Wolffi)
Ductus paramesonephricus (Mülleri)

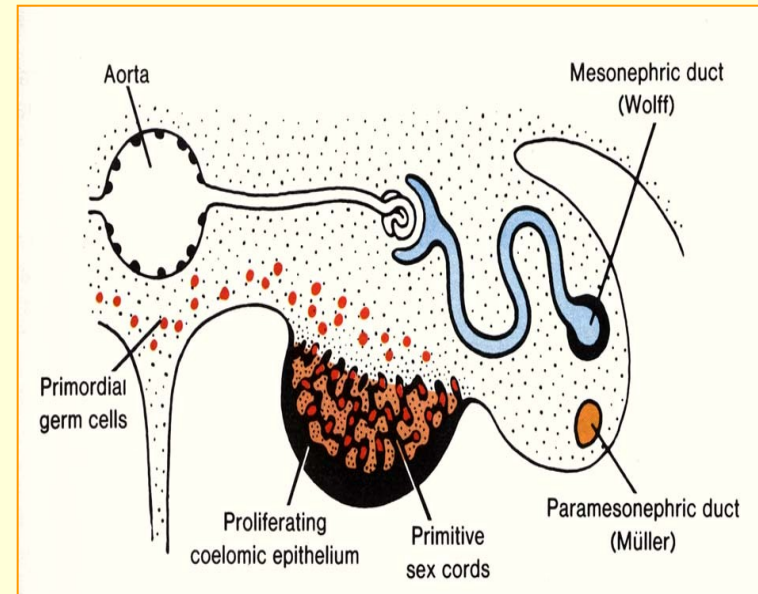






Indifferent stage:

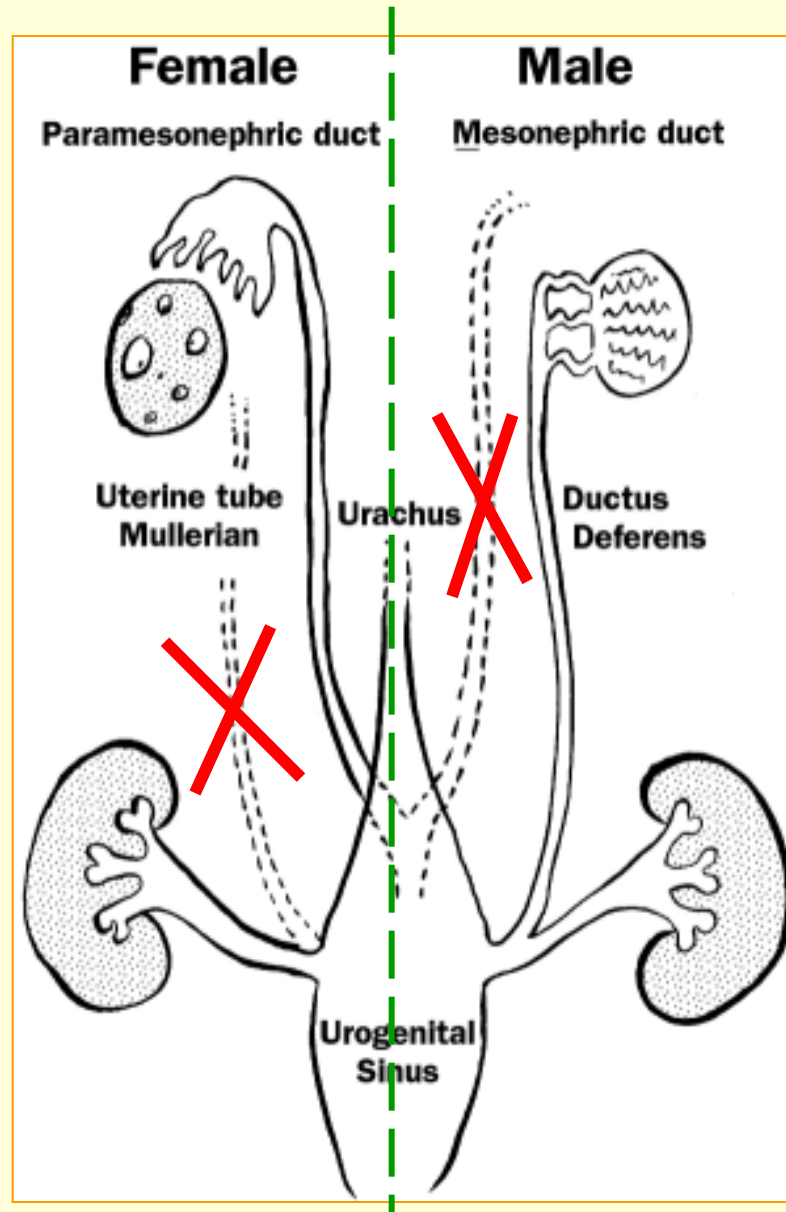
Wolffian duct
Müllerian duct



Differentiated stage of development:

Müllerian duct:

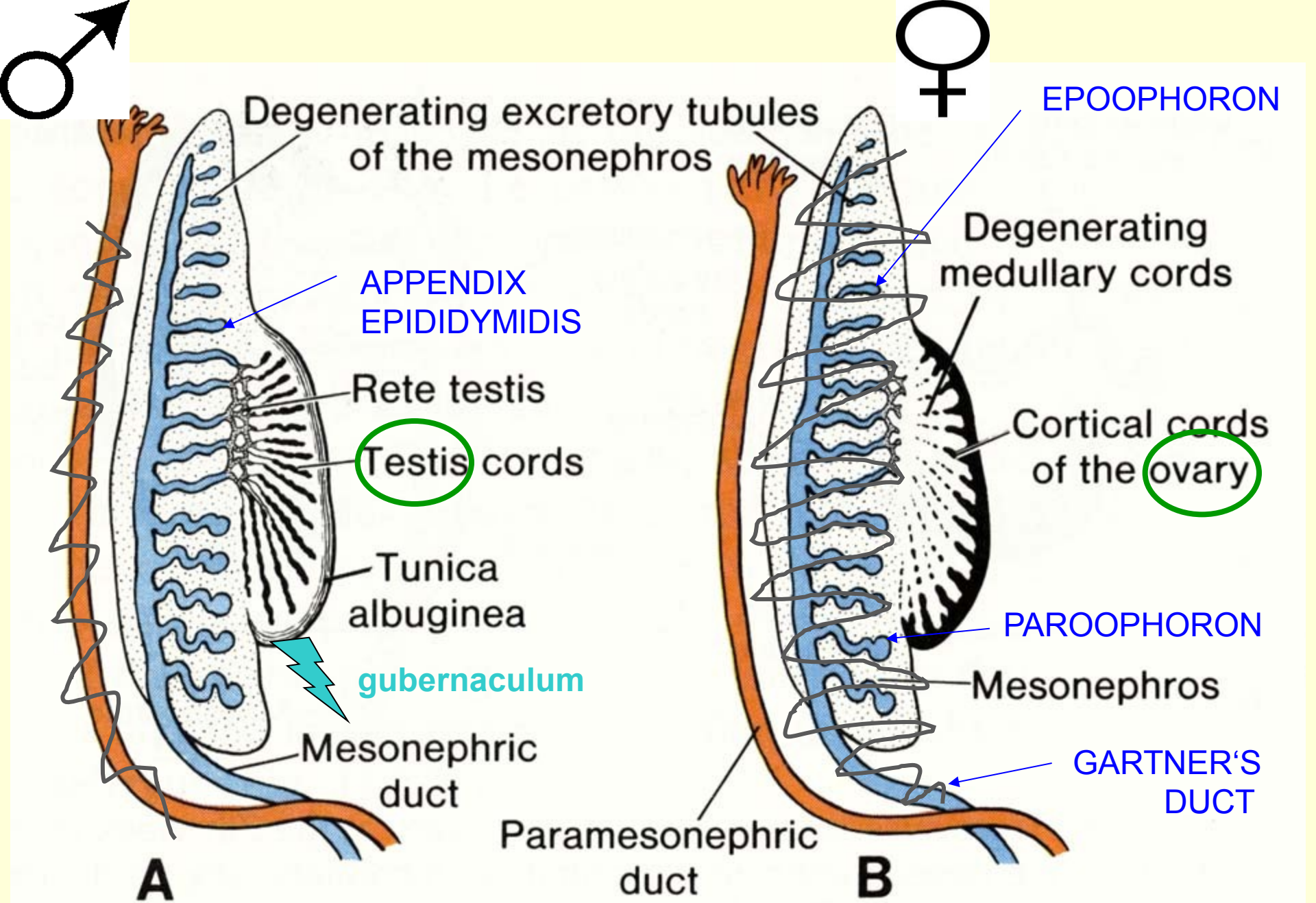
Oviduct
Uterus
Cranial part of
vagina



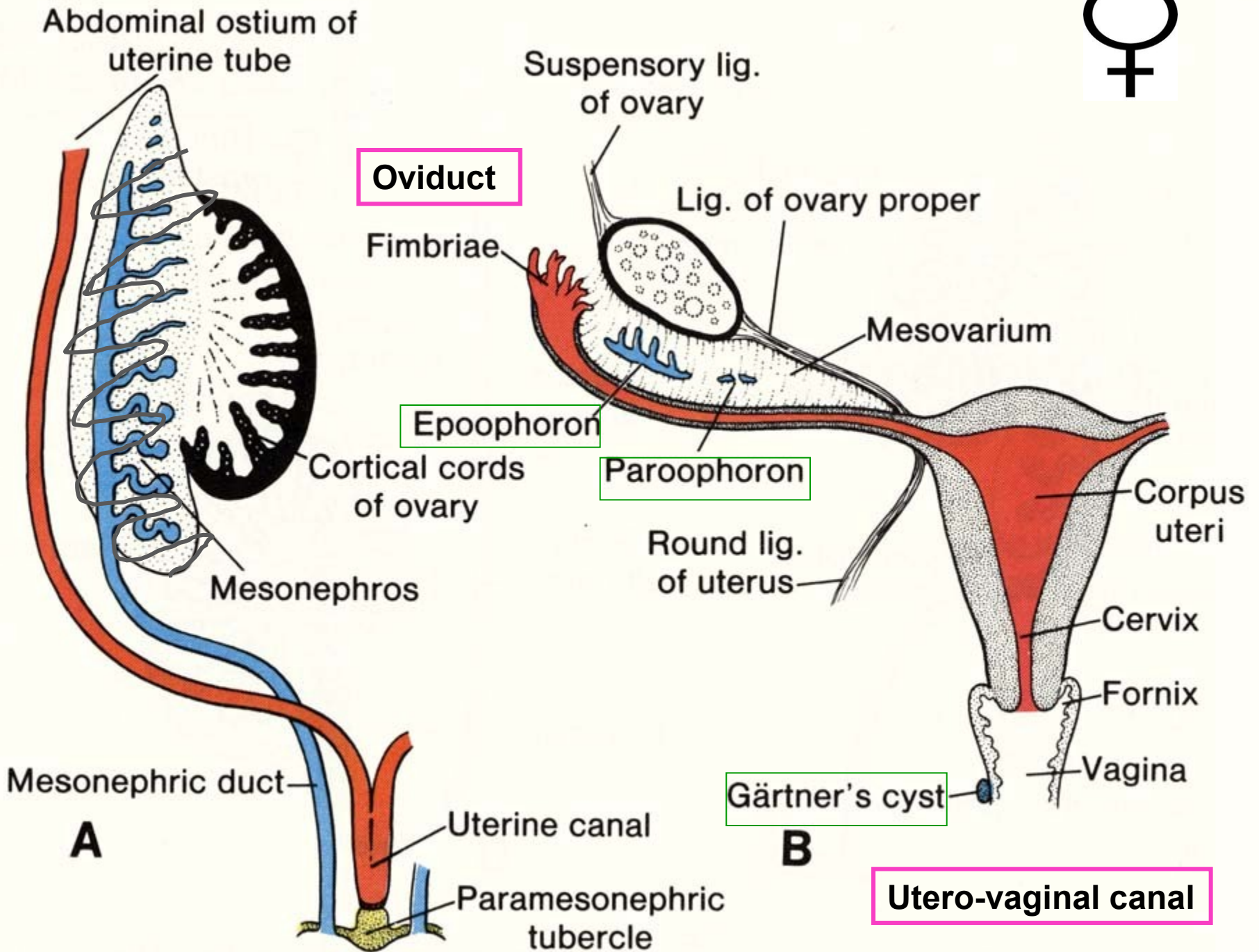
Wolffian duct:

Ductus epididymidis
Ductus deferens
Ductus ejaculatorius

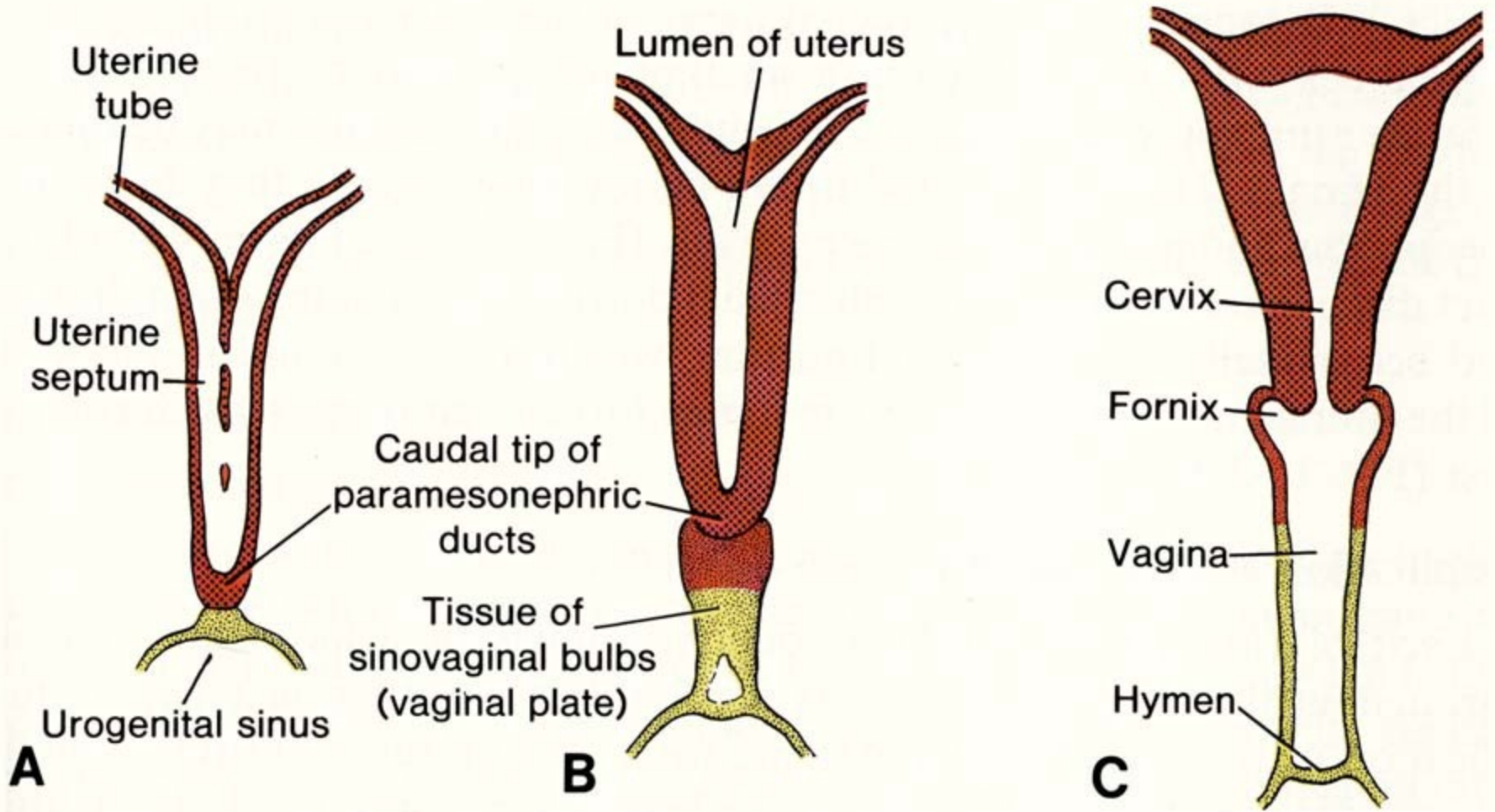
Ductuli efferentes in epididymis and rete testis originate from mesonephric tubules (see mesonephros)

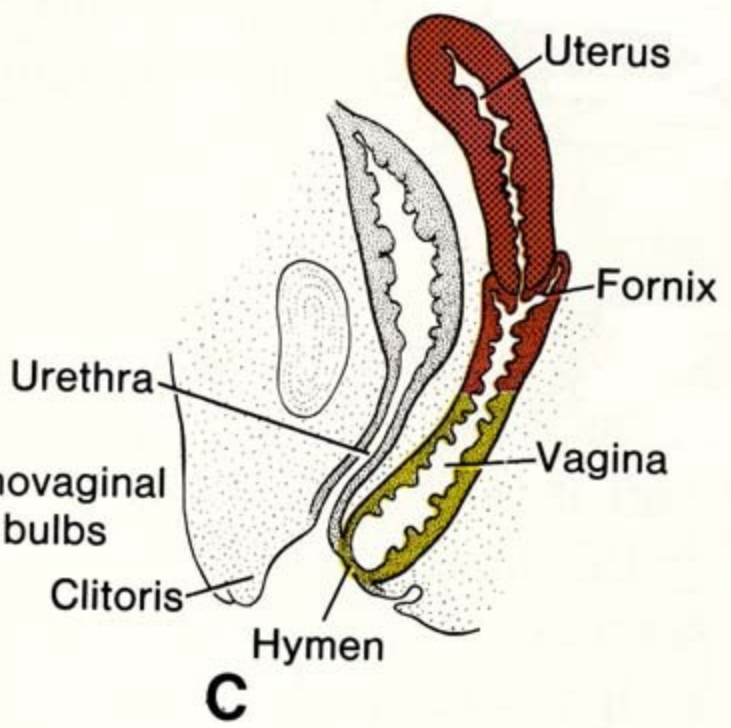
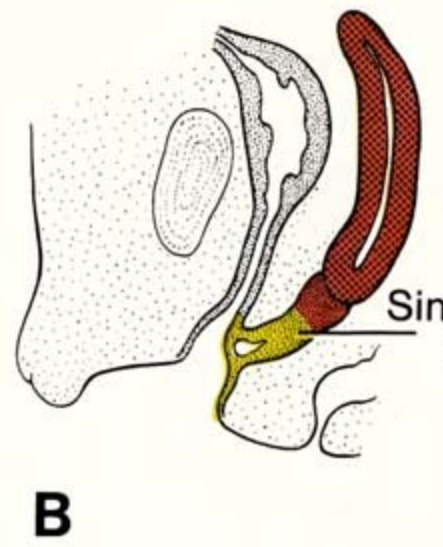
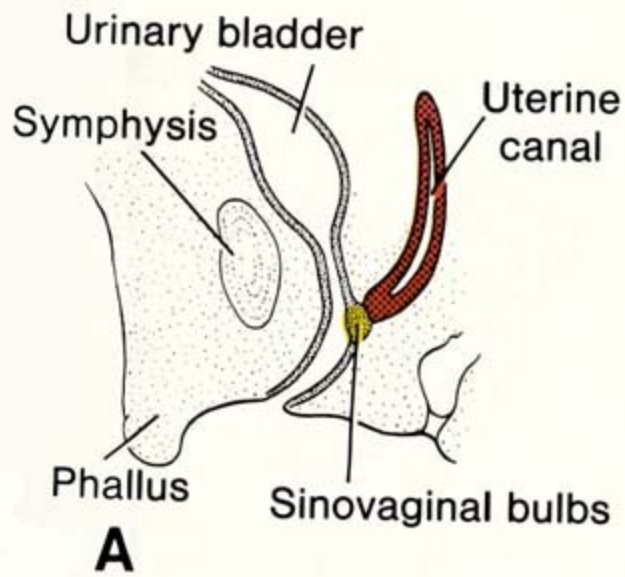


+ RUDIMENTARY STRUCTURES



UTEROVAGINAL CANAL





Development of external genitalia

(indifferent – differentiated stage)

Genital tubercle

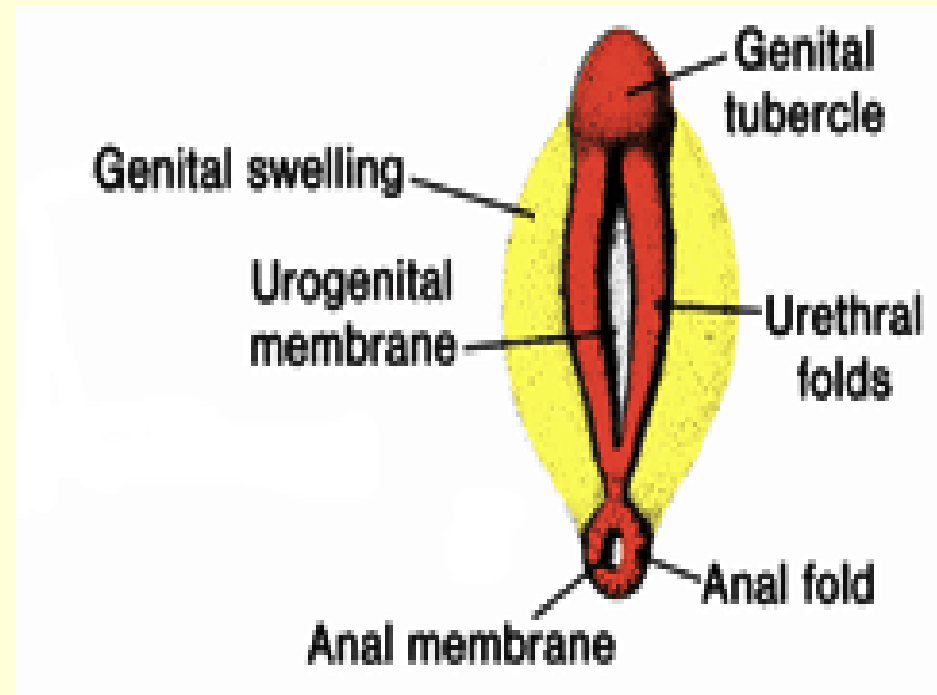
[tuberculum genitale]

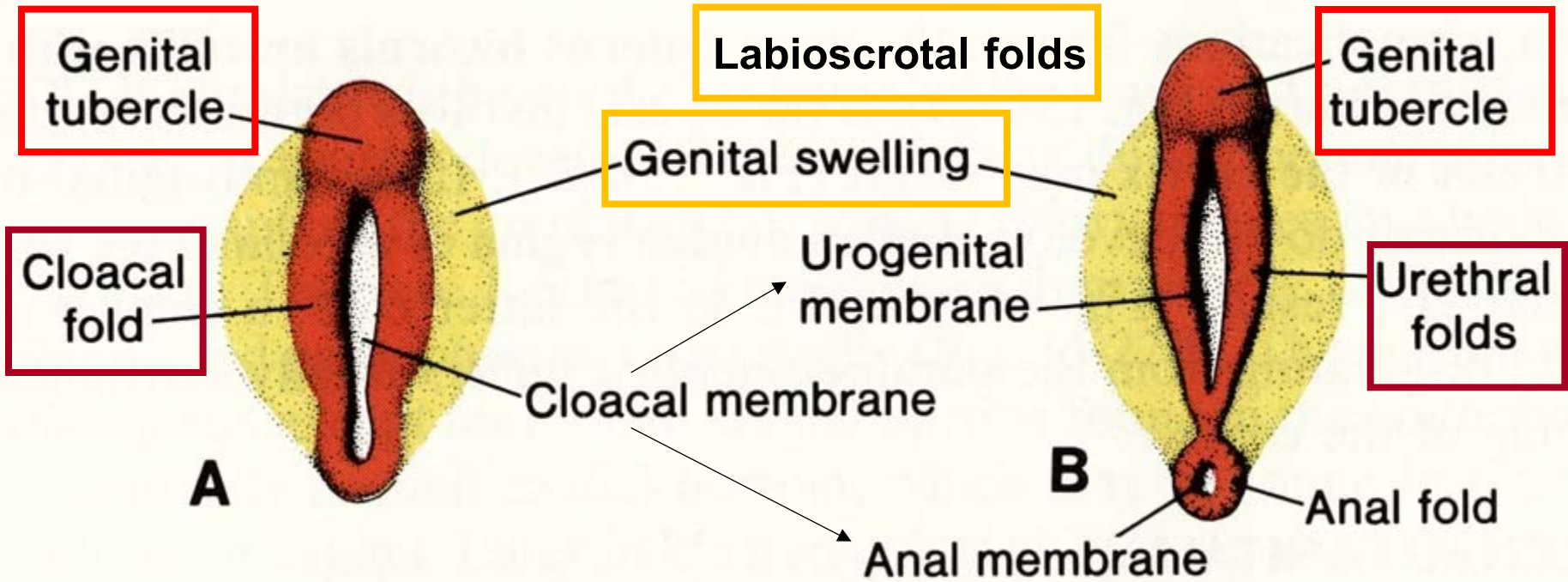
Urethral (cloacal) folds

[plicae genitales]

Labio-scrotal swellings

[tori genitales]





Genital tubercle

Cloacal fold

A

Labioscrotal folds

Genital swelling

Urogenital membrane

Cloacal membrane

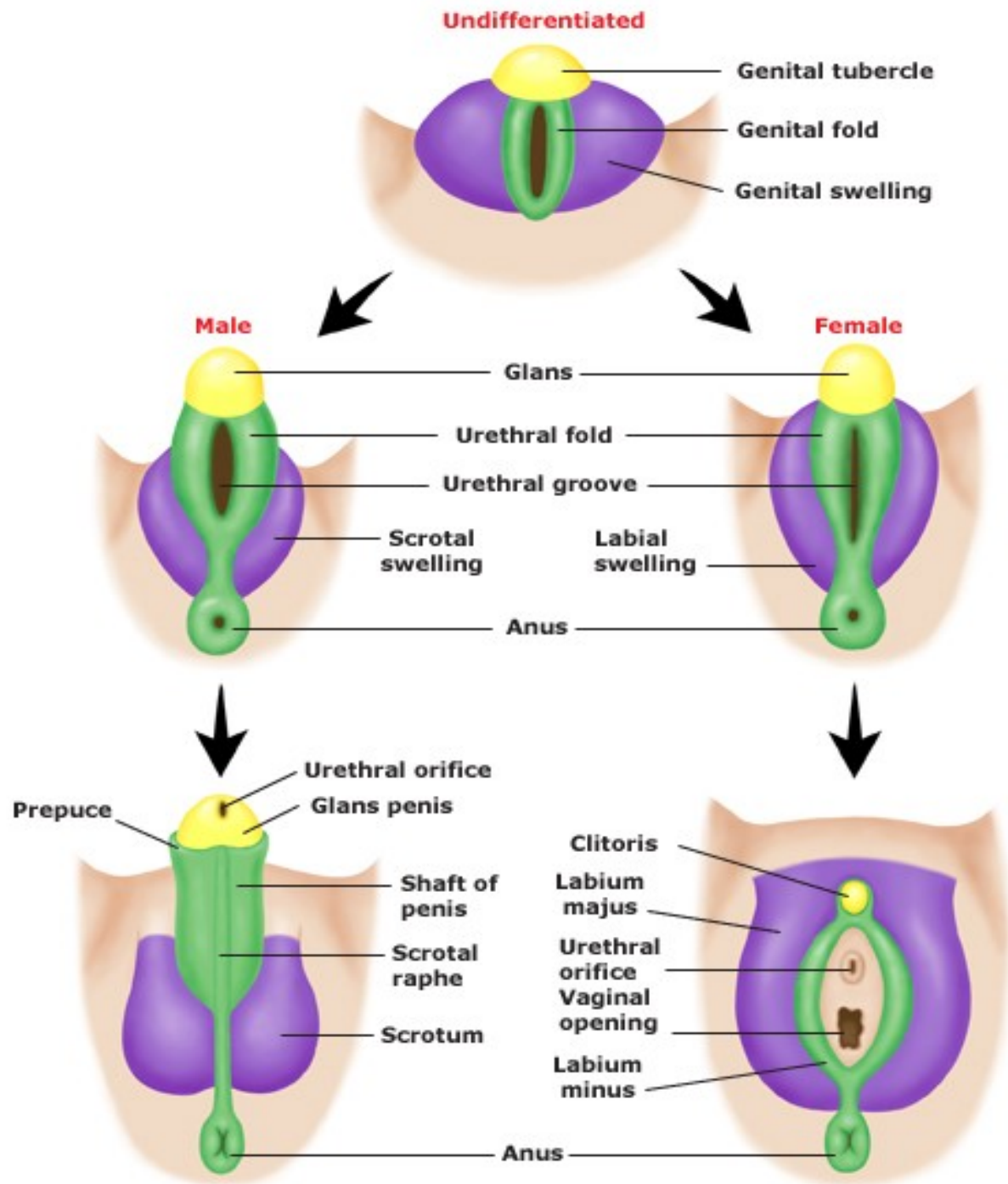
Anal membrane

B

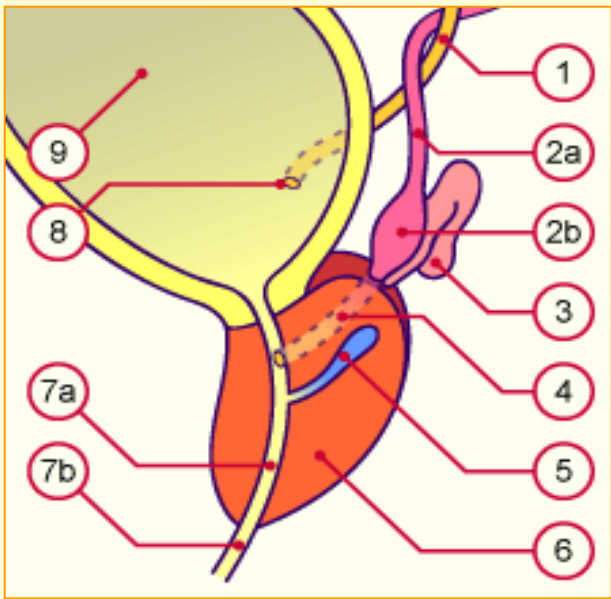
Genital tubercle

Urethral folds

Anal fold



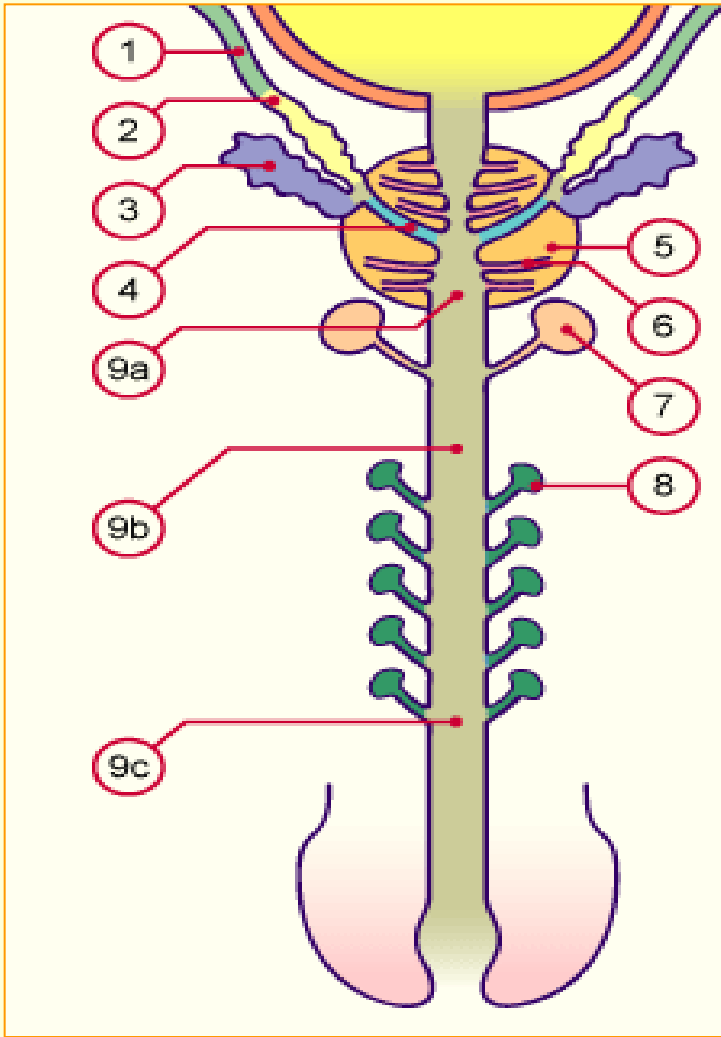
Accessory glands development



Seminal vesicles – develop as diverticles of ductus deferens (from Wolffian duct)

Prostate – develops around urethra as numerous diverticles (from pelvic part of sinus urogenitalis)

Bulbourethral and Litré’s glands

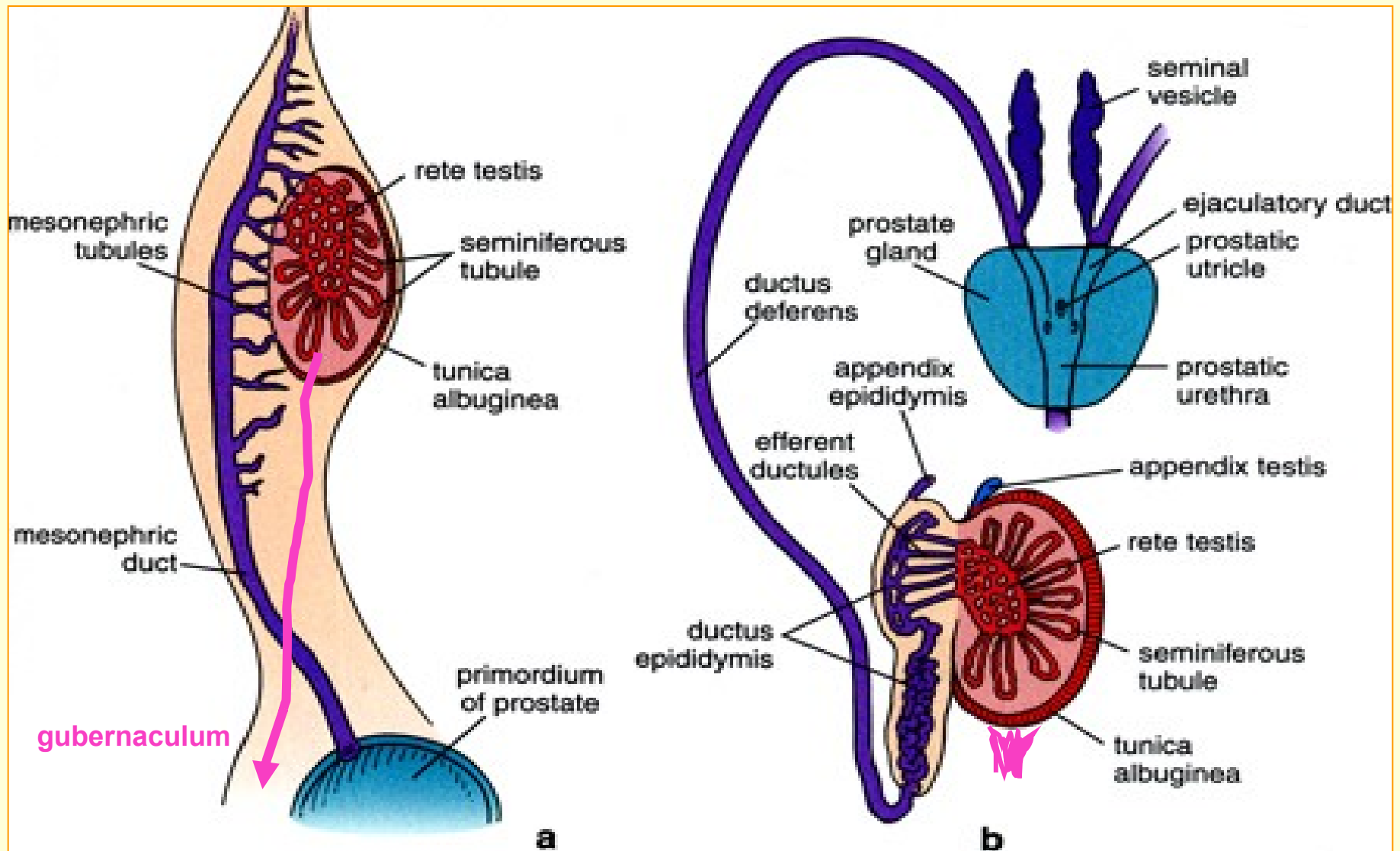


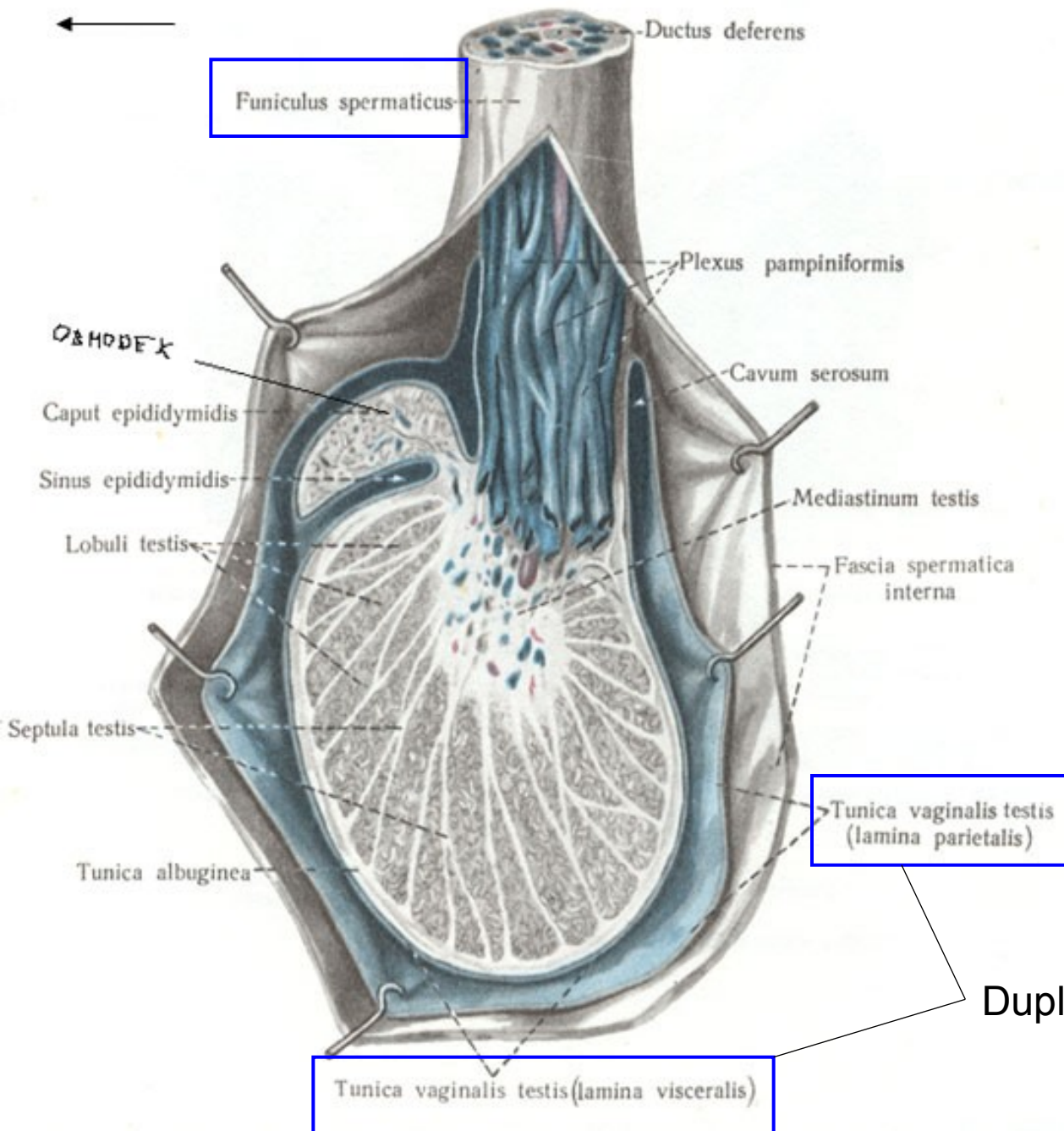
Position of gonads during development

- Gonad develops in only short, lumbal part of genital (gonadal) ridge (Th6 – S2)
- Cranial part - disappears
- Caudal part transforms into **gubernaculum**

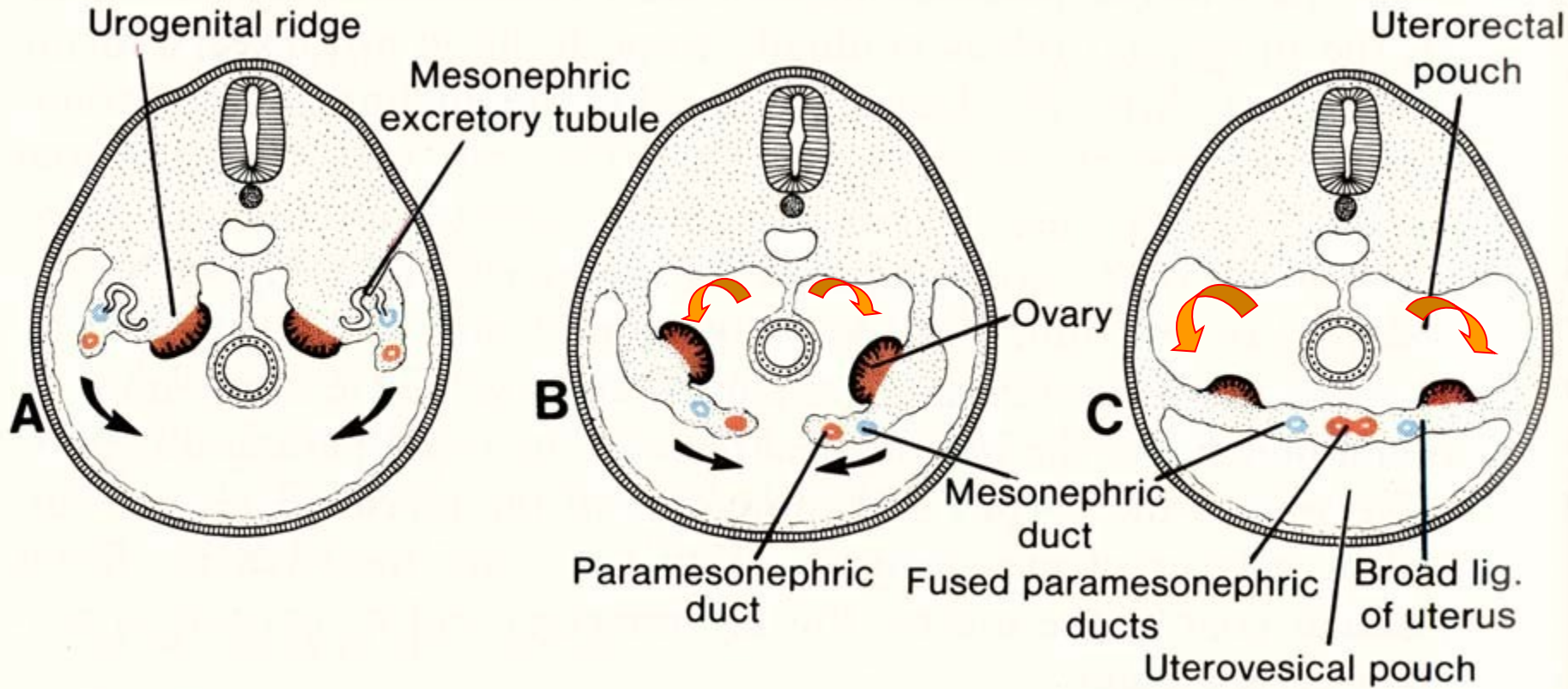
- **Testes – descensus into the scrotum**
- **Ovaries – change also their position** due to fusion of Müllerian ducts and formation of broad ligament (lig. latum uteri)

Testis – descends into the scrotum





Ovaries – change their position due to fusion of Müllerian ducts and formation of broad ligament



Congenital malformations - 1

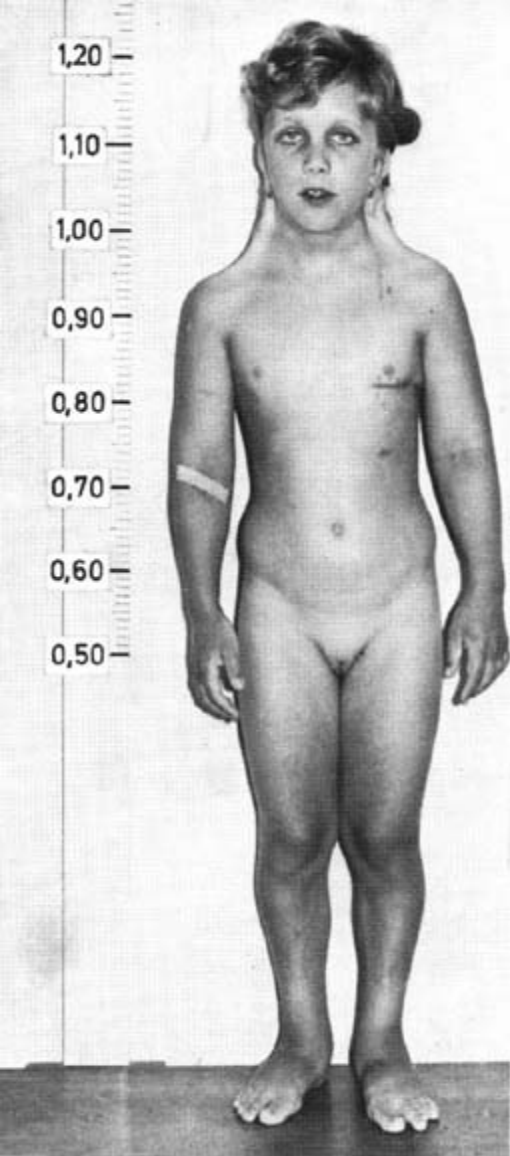
- **Genetic anomalies**: total manifestation
- Gonad(s) agenesis – gonocytes did not reach genital ridge
- Hermafroditism (ovotestes, ovary+testis) + chromosomal aberrations (45X/46XX, 45X/46XY, 47XXY/46X, etc.)
- Pseudohermafroditism – karyotype and gonads do not correspond to external genitalia
- Gonadal hypoplasia (dysgenesis) – Turner sy. (45X0), Klinefelter sy. (47XXY)



Turner syndrom
45/X0 – absent X chr.

(girl - 15 years, 150 cm)

pterygium coli ↙



Turner syndrom

Before and after hormonal and surgical therapy



Klinefelter syndrom (47/XXY) – X more

19 years, 180 cm

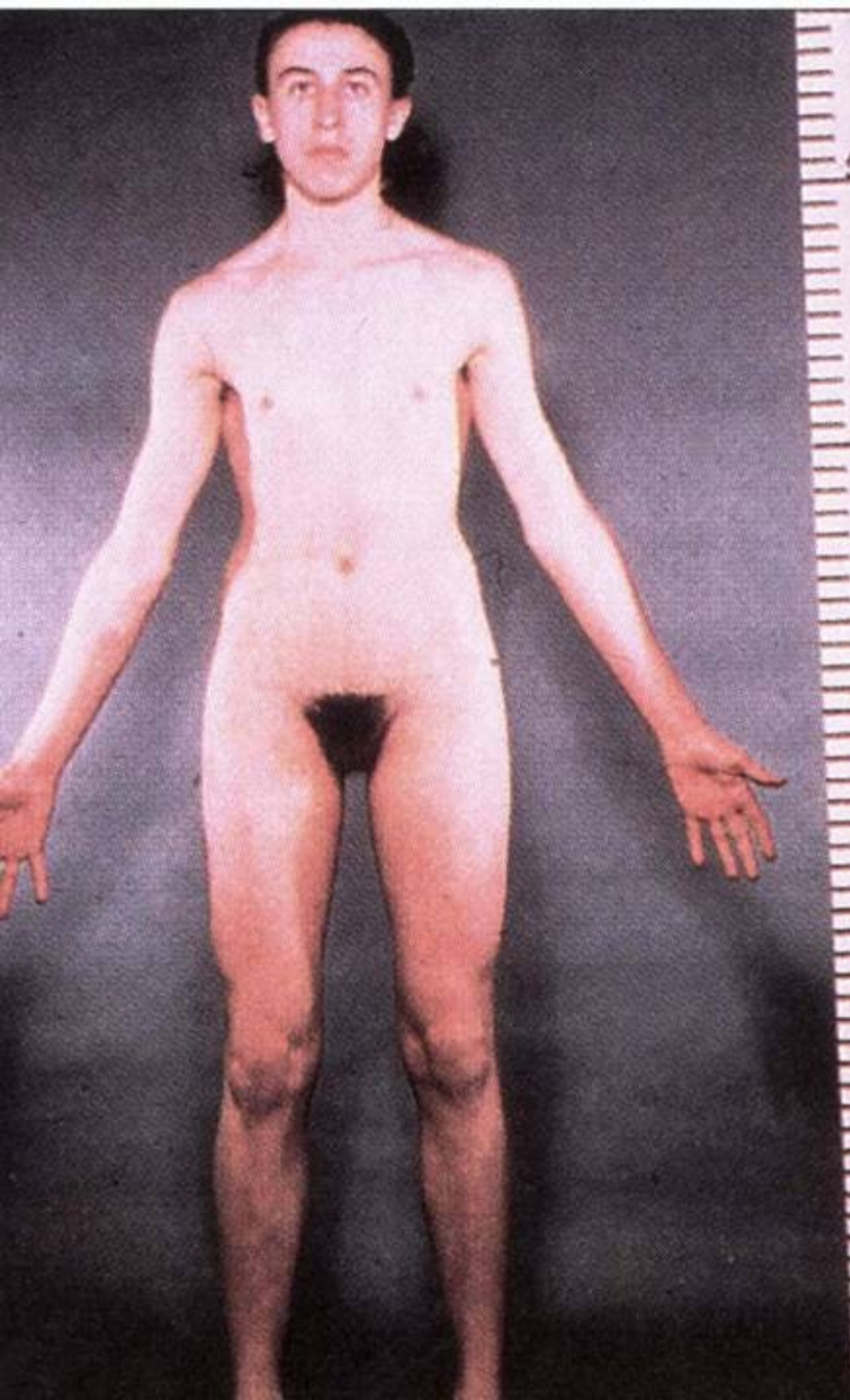
infertility
gynecomastia,

Pseudohermafroditismus femininus

(girl, 12 years)

ovaries, fenotype rather male





Pseudohermafroditismus masculinus

(17 years)

testes, fenotype rather female

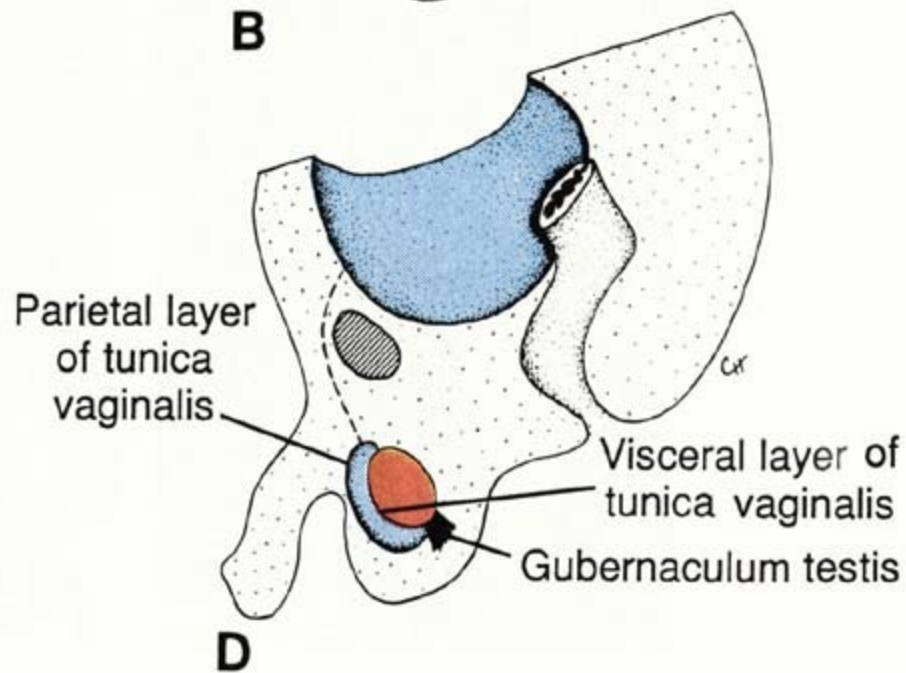
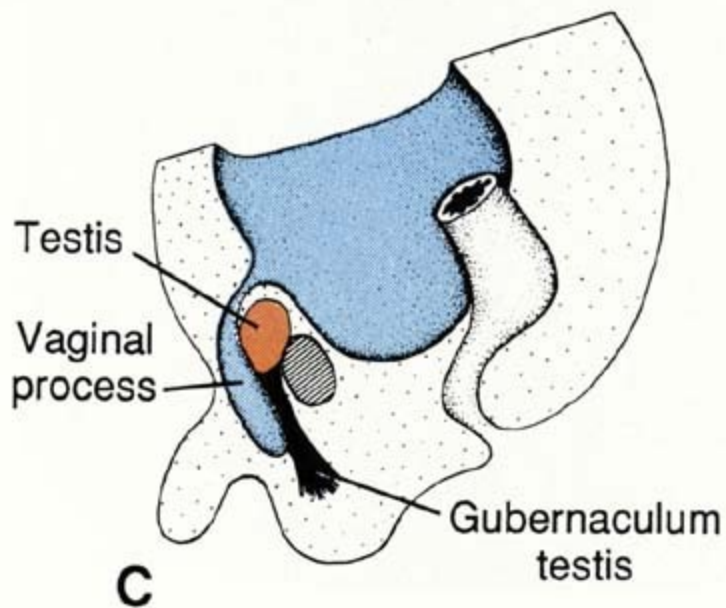
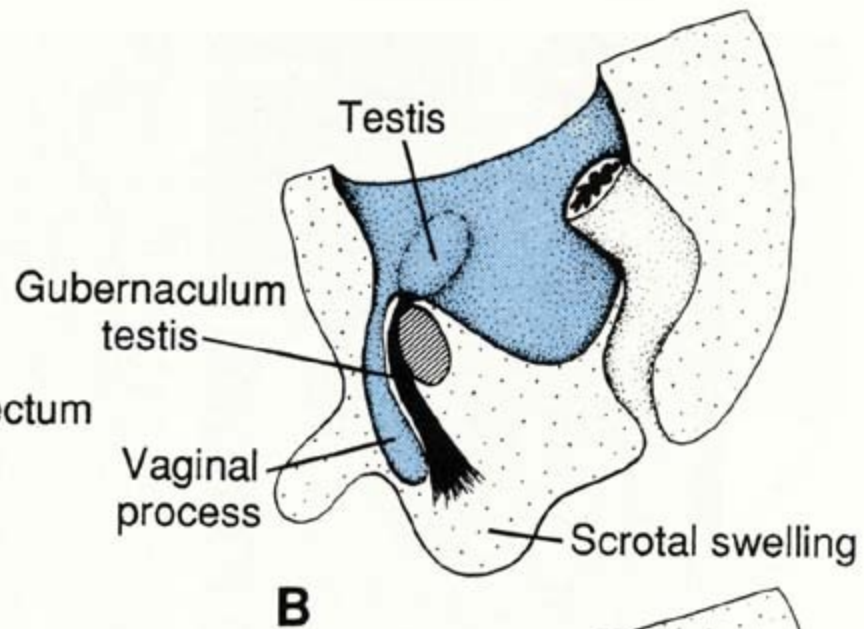
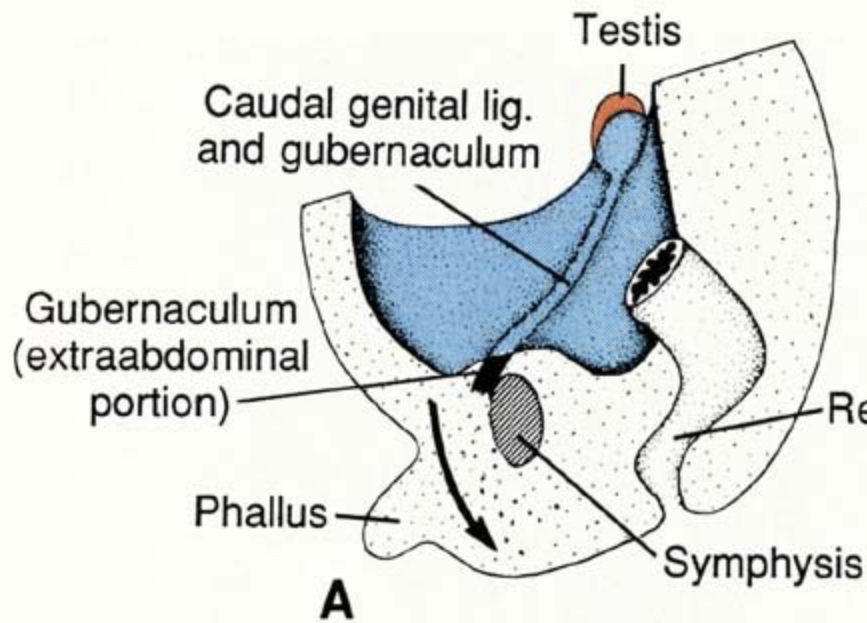


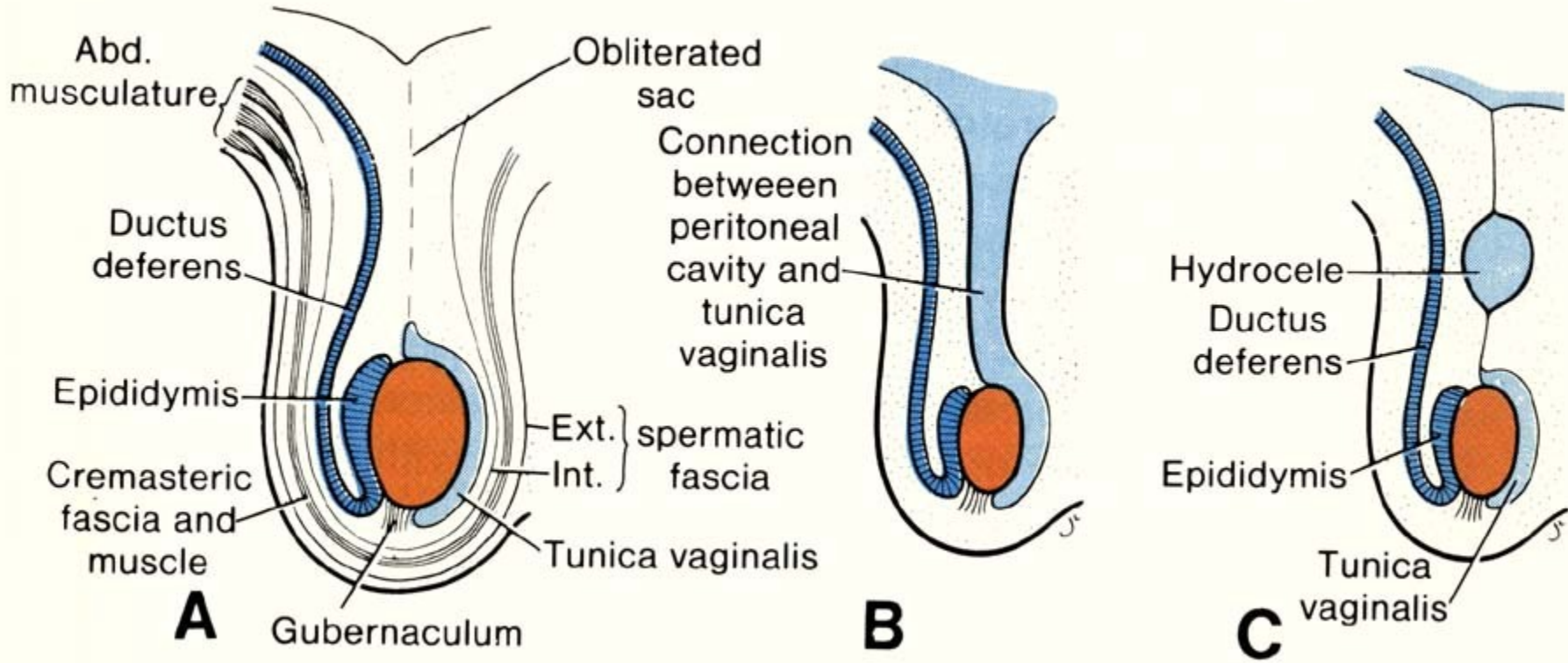
Congenital malformations – 2

defects of growth, position or cleft

local manifestation

- Kryptorchidism
- Hydrocele testis
- Hypospadias, epispadias
- ---
- **Developmental defect of uterus (and vagina)**
uterus et vagina separatus, uterus bicornis, uterus septus or subseptus, uterus unicornis etc.





Obstruction in way of descensus

CRYPTORCHID

ECTOPIC

Defect insertion of gubernaculum

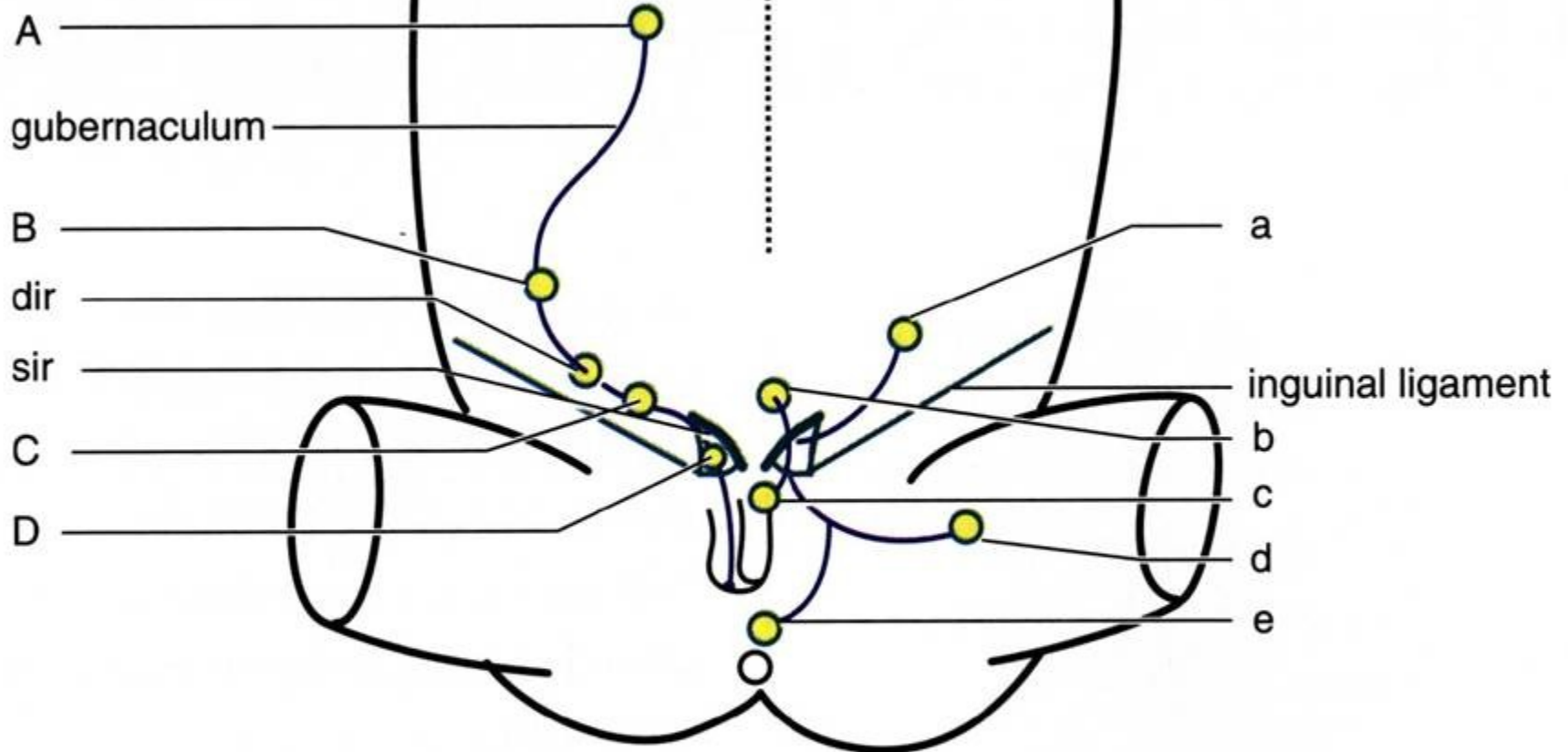
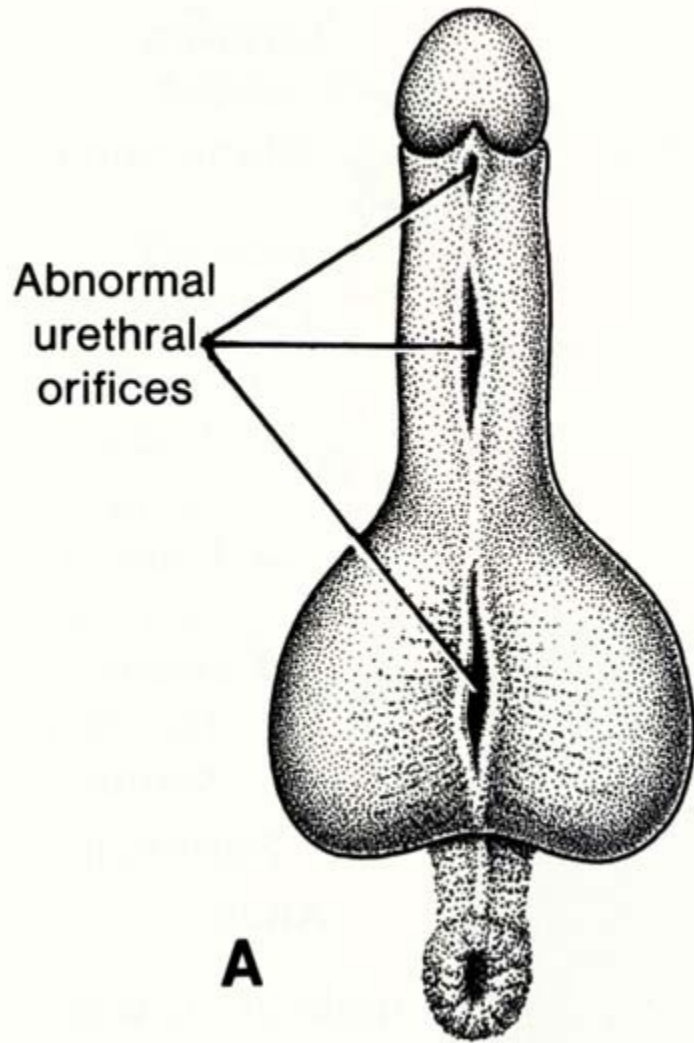


FIGURE 3 Abnormal descent of the testis. On the left, cryptorchid sites of arrest are shown: **A**, abdominal; **B**, pelvic; **C**, inguinal; **D**, at the superficial inguinal ring. **dir**, **sir**, deep and superficial inguinal rings. On the right, ectopic sites are shown: **a**, supra-inguinal; **b**, hypogastric; **c**, pubo-penile; **d**, femoral; **e**, perineal.

Kryptorchidism

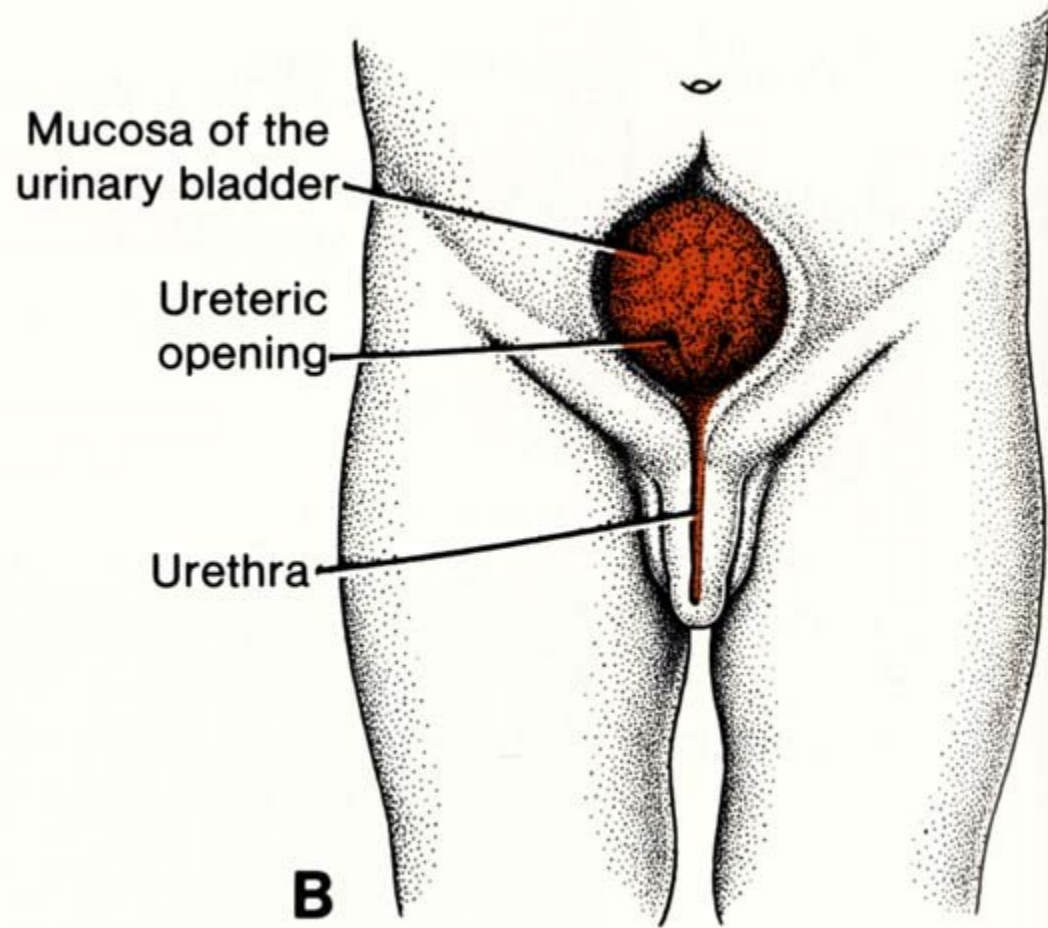


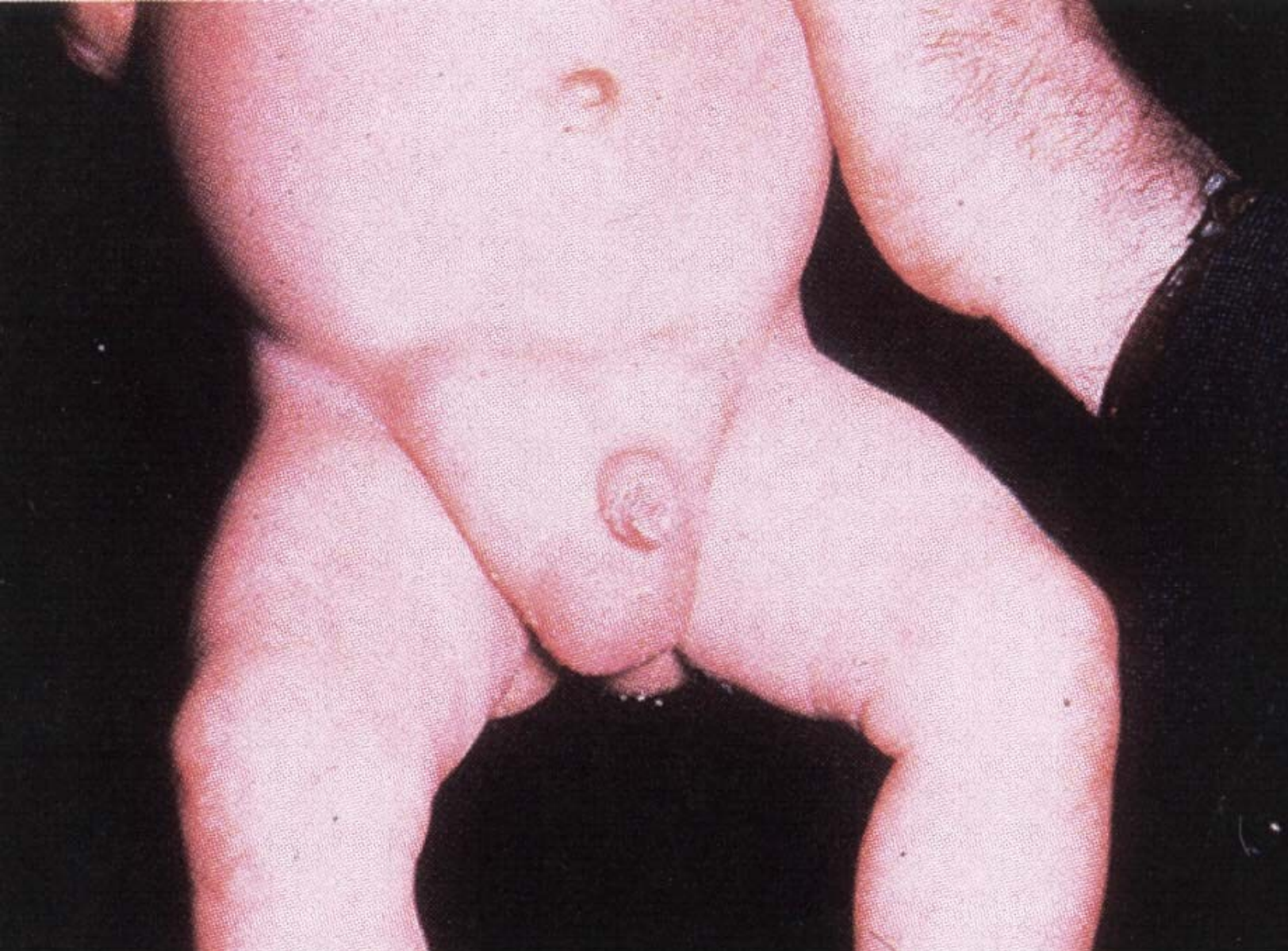
HYPOSPADIAS



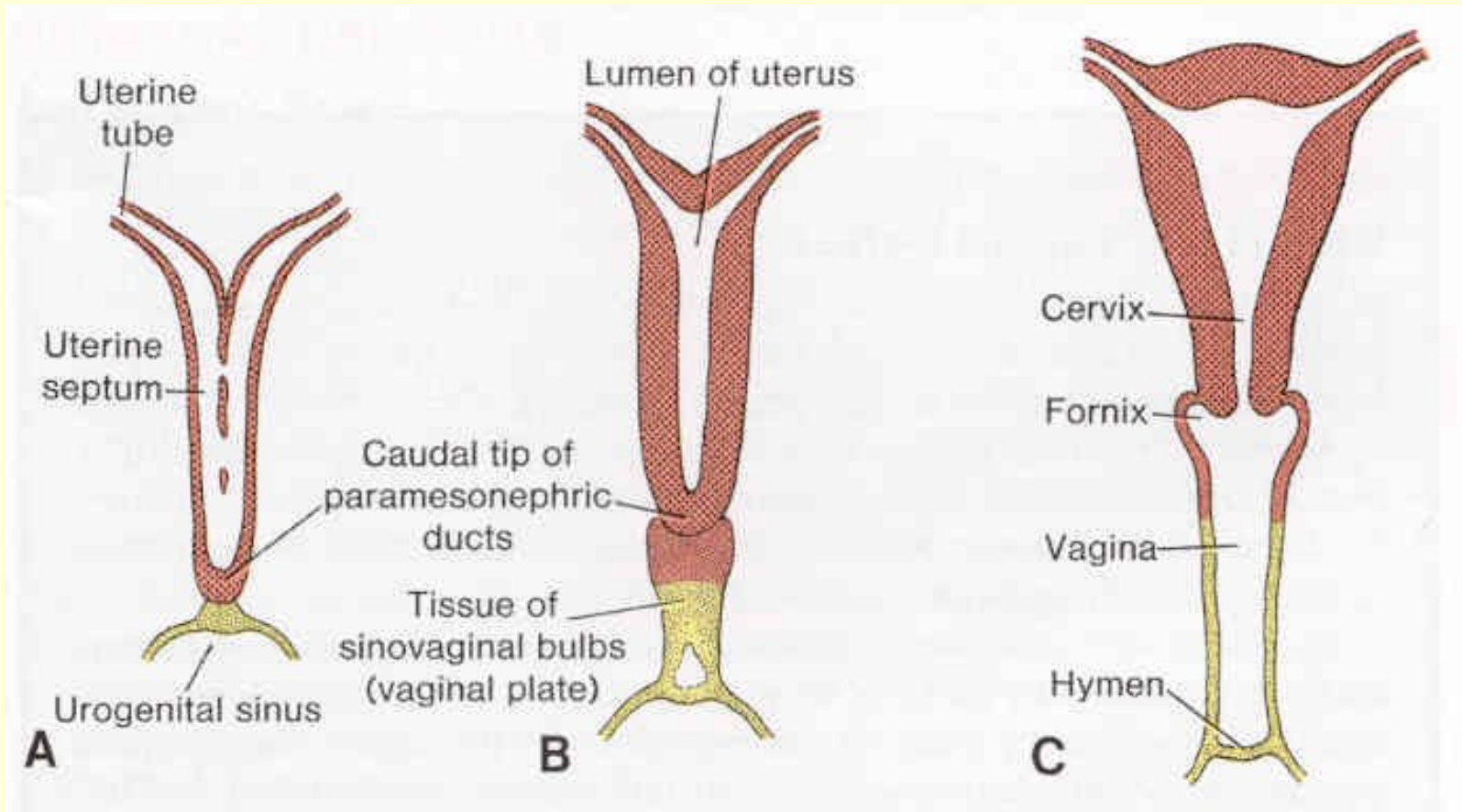
EPISPADIAS

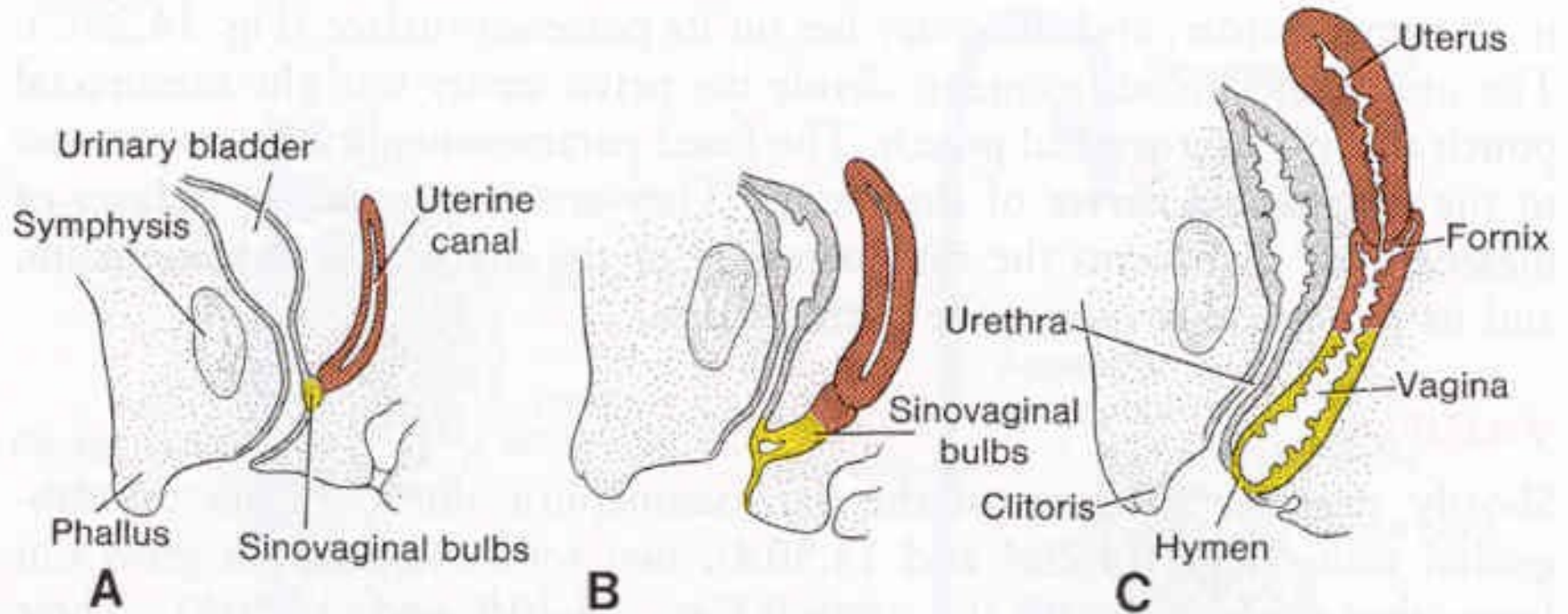
+ extrophia vesicae urinariae

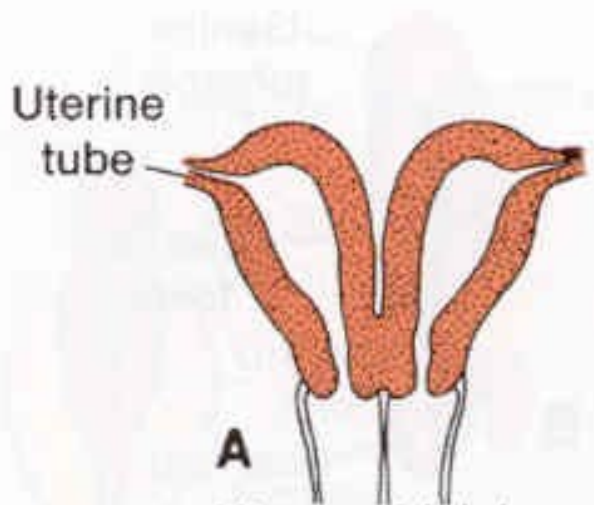




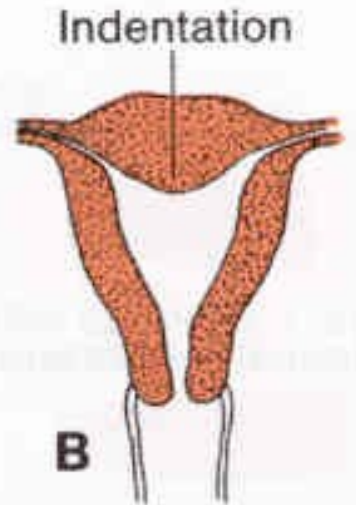
Congnital bilateral inguinal hernia



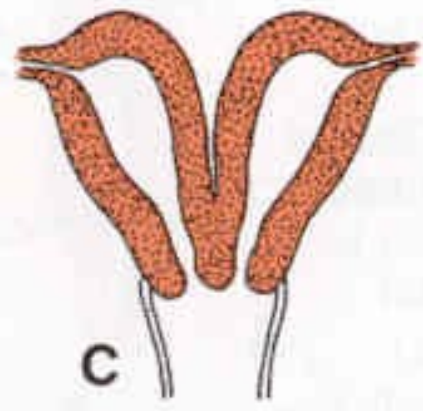




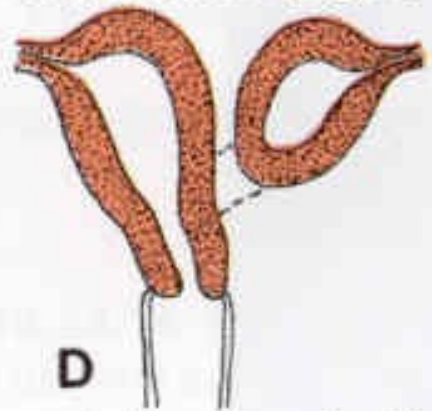
A
Uterus didelphys
with double vagina



B
Uterus arcuatus



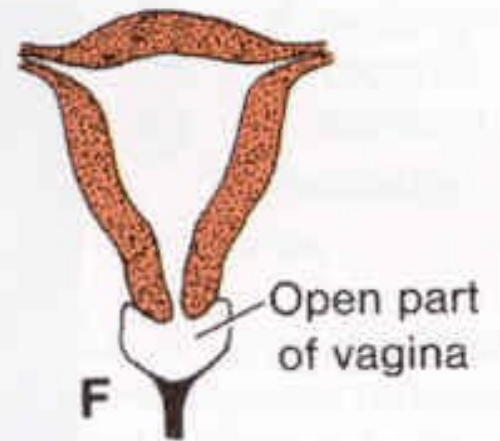
C
Uterus bicornis



D
Uterus bicornis unicollis
1 rudimentary horn



E
Atresia of cervix



F
Atresia of vagina

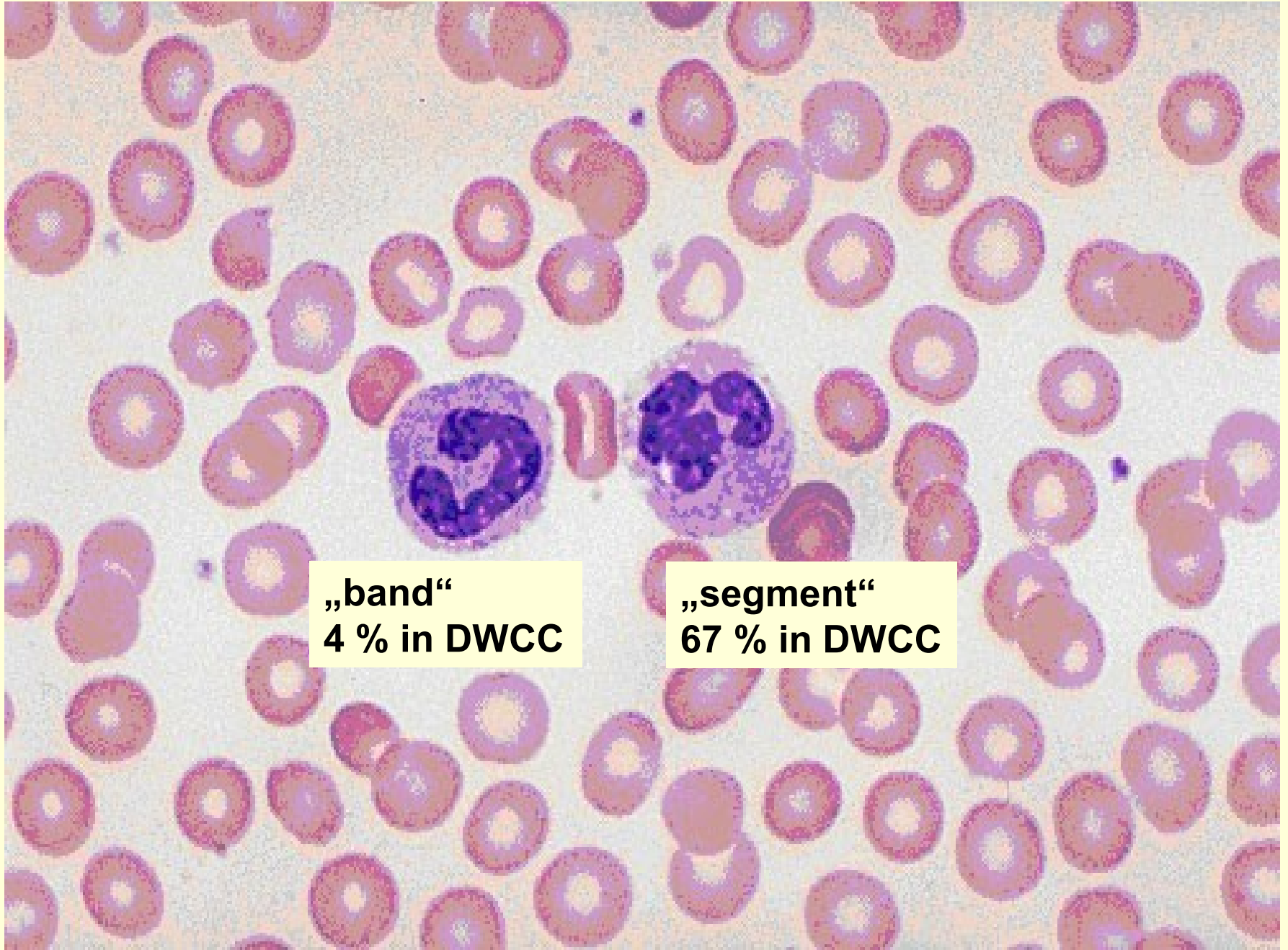
Repetition of blood

- Composition of the blood
- Hematocrit
- Hemoglobin
- Erythrocytes – shape, size, density per 1 μl
- Reticulocytes
- Anisocytosis
- Poikilocytosis
- Polycythemia (= polyglobulia)

- Granulocytes
- Agranulocytes
- Number of leukocytes per $1\mu\text{l}$
- Anemia
- Leukocytopenia
- Thrombocyte
- Number of thrombocytes per $1\mu\text{l}$
- Hyalomere, granulomere

- Bone marrow structure
 - Erythropoiesis
 - Granulocytopoiesis
 - Megakaryocyte
 - Endomitosis
-
- Differential white cell count (DWCC)
 - Anomalies of DWCC
 - Shift to the left or to the right

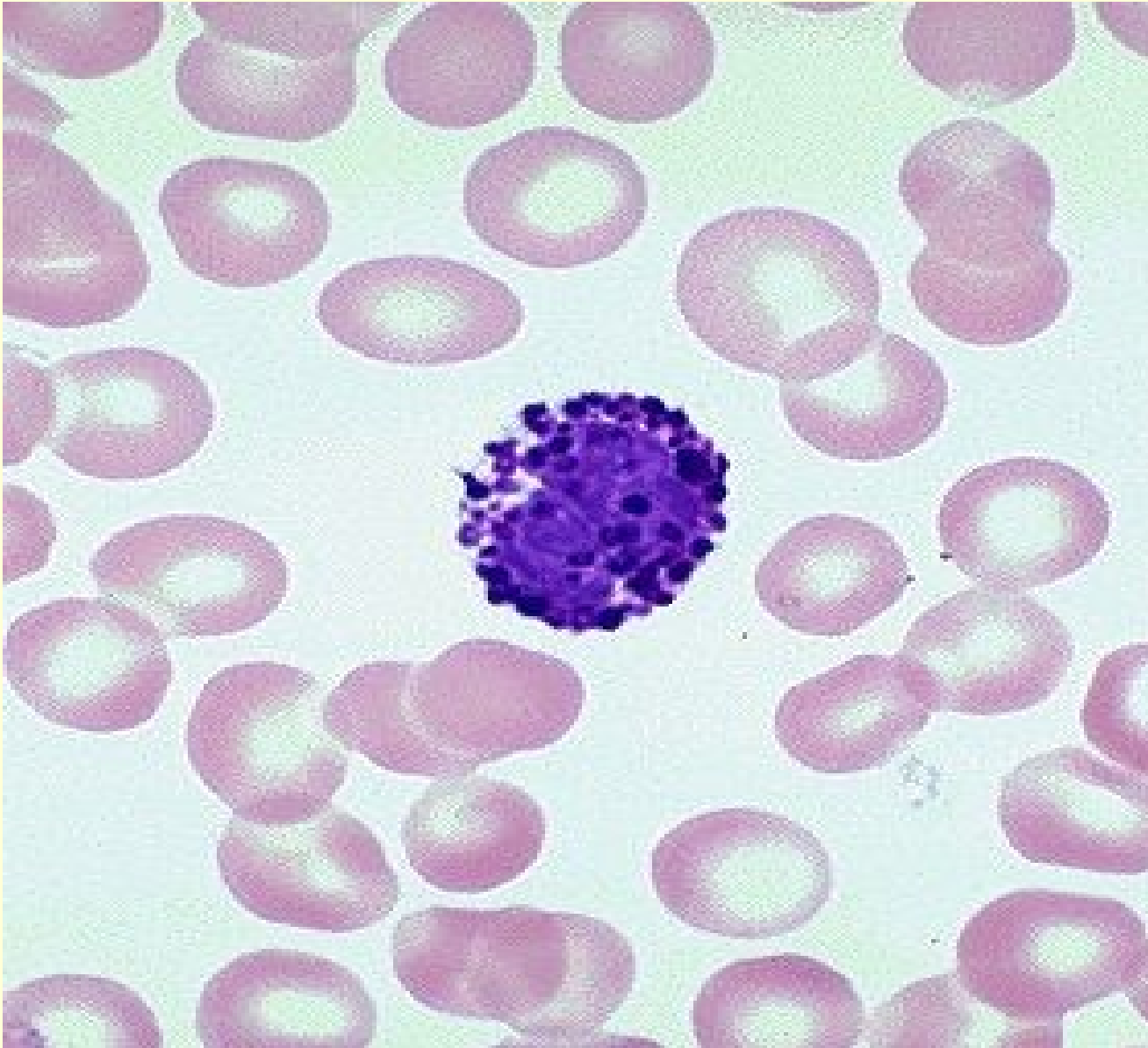
Neutrophilic granulocytes: 10-12 μm in \varnothing



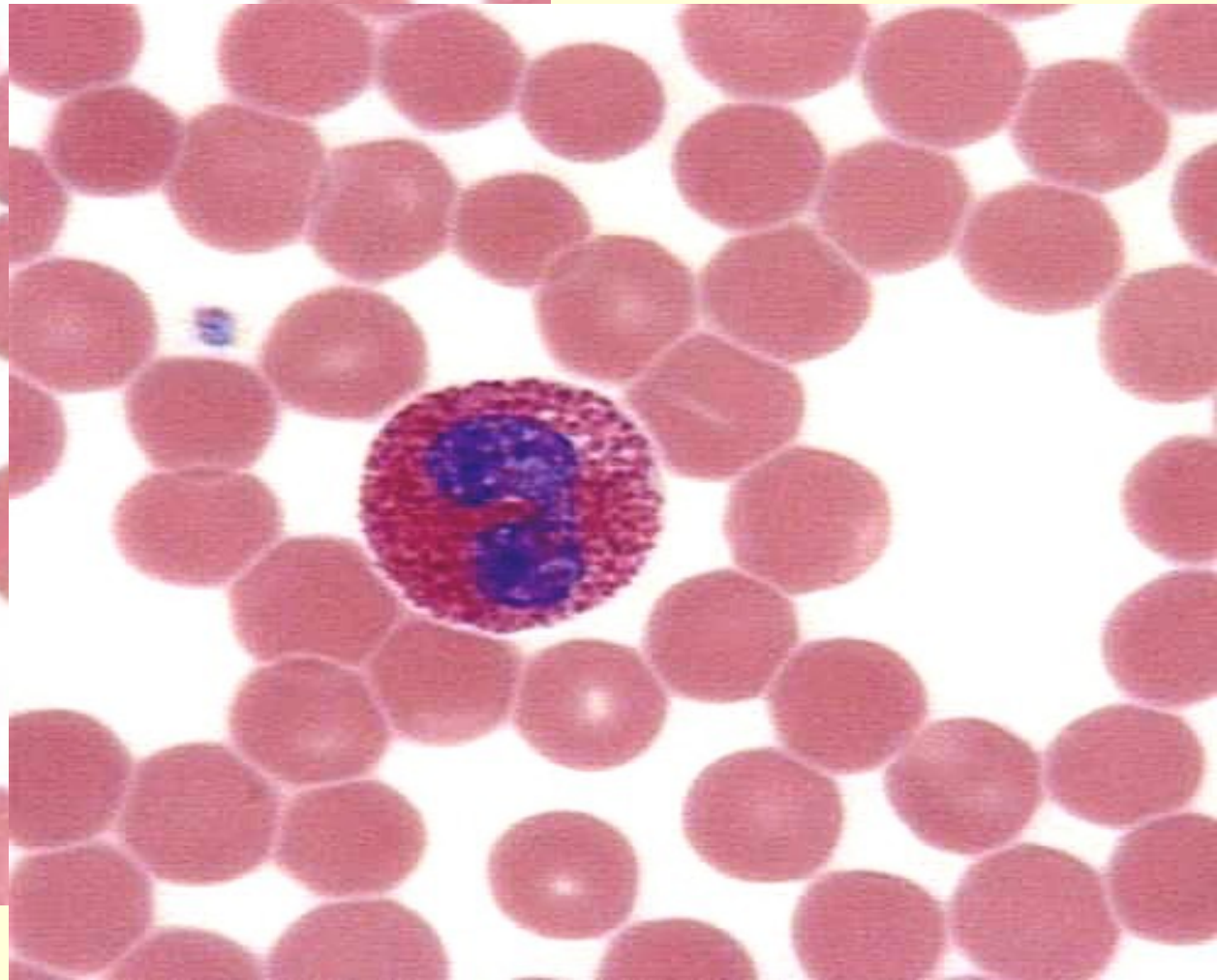
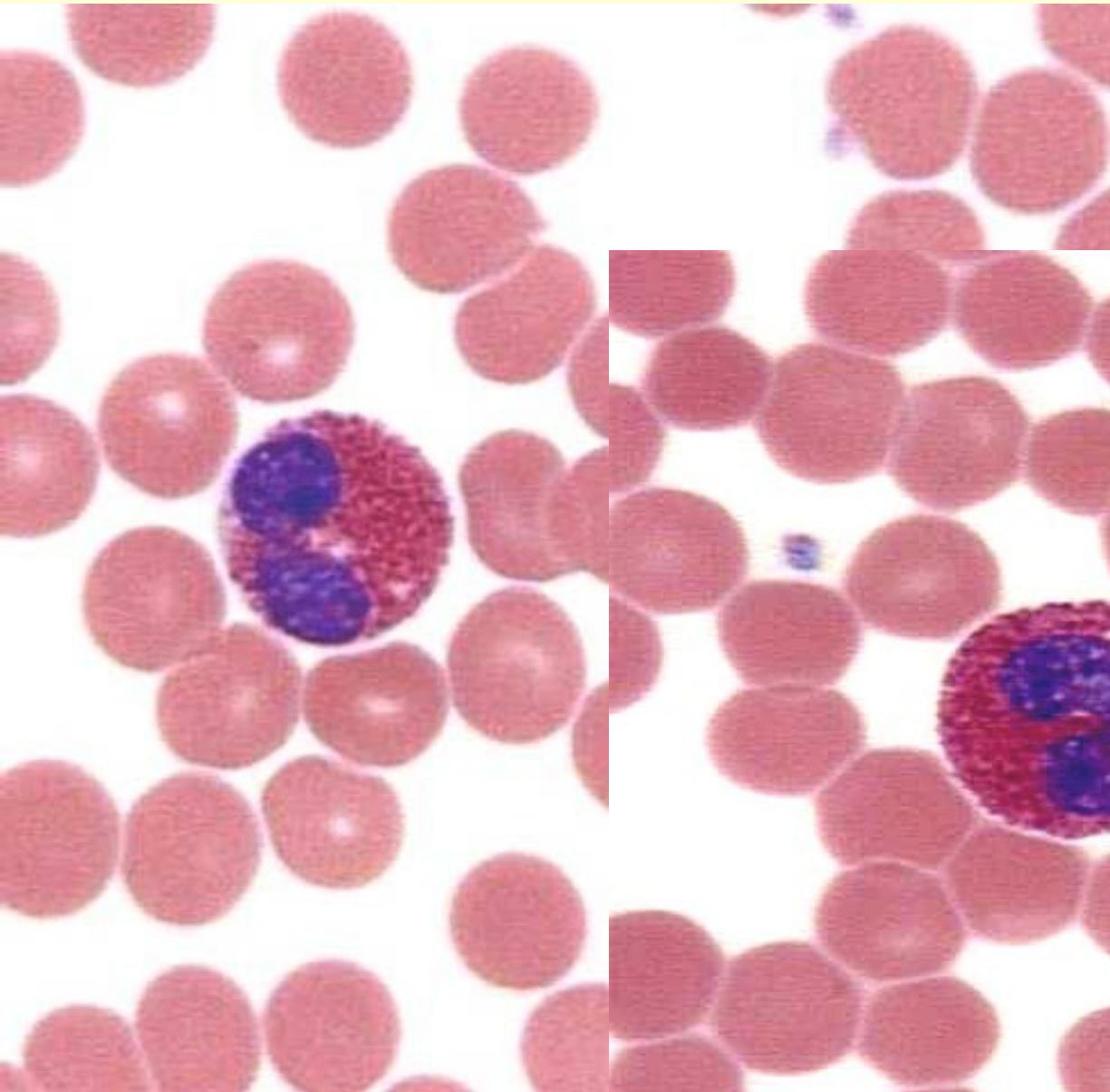
„band“
4 % in DWCC

„segment“
67 % in DWCC

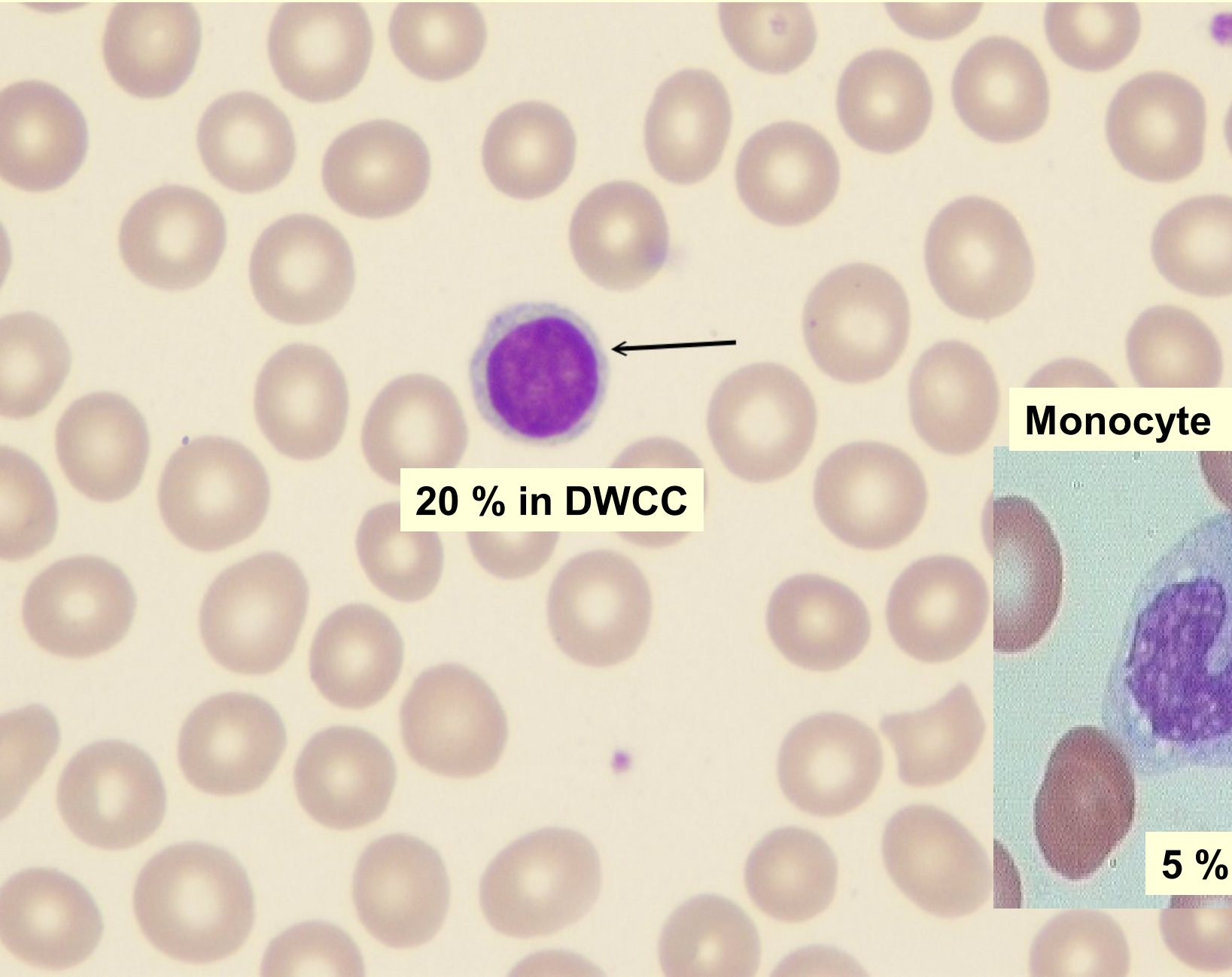
Basophilic granulocyte: 8 μm in \emptyset , only 1 % in DWCC



Eosinophilic granulocyte: up to 14 μm in \varnothing , 3 % in DWCC

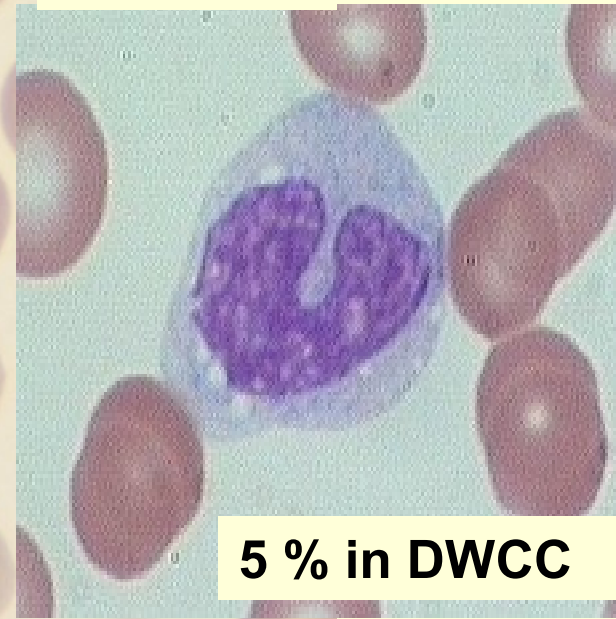


Lymphocyte



20 % in DWCC

Monocyte



5 % in DWCC

Thank for your attention