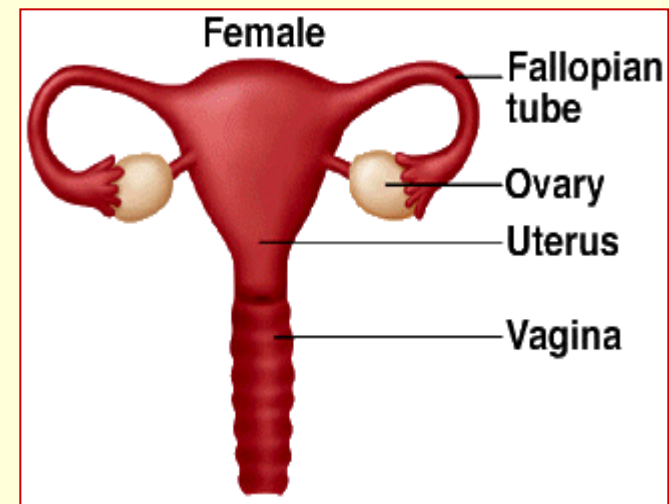
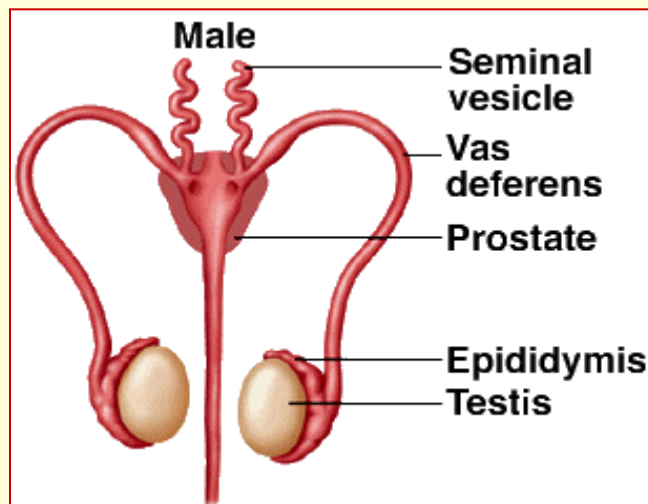
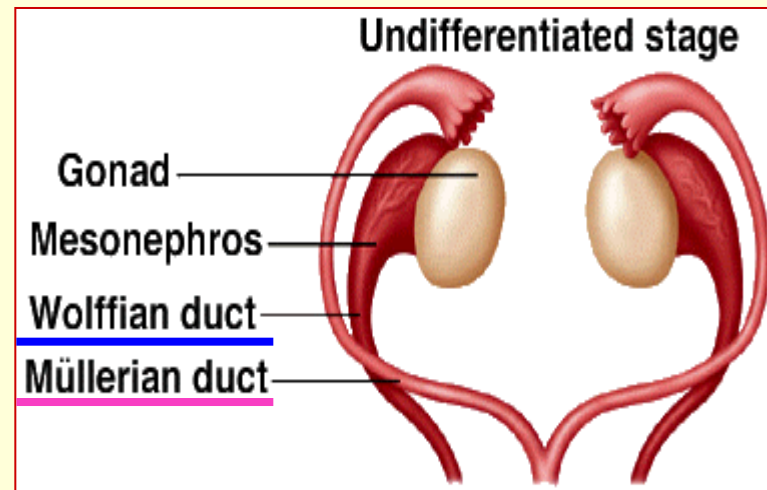


# Embryology /organogenesis/

## **Week 4**

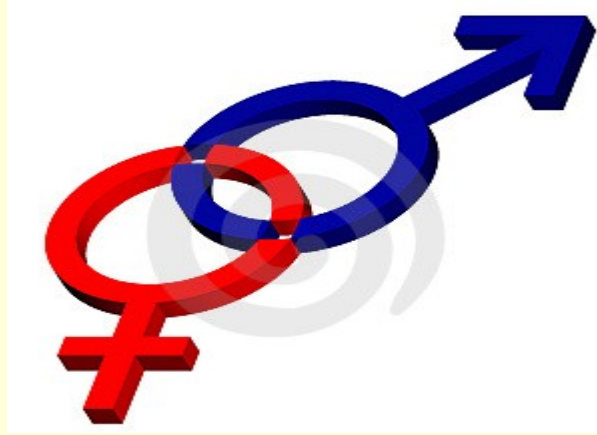
Development and teratology of reproductive system.

# 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 (*fallopian tubes, 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

1,2,3 - is studied independently, although everything relates to everything

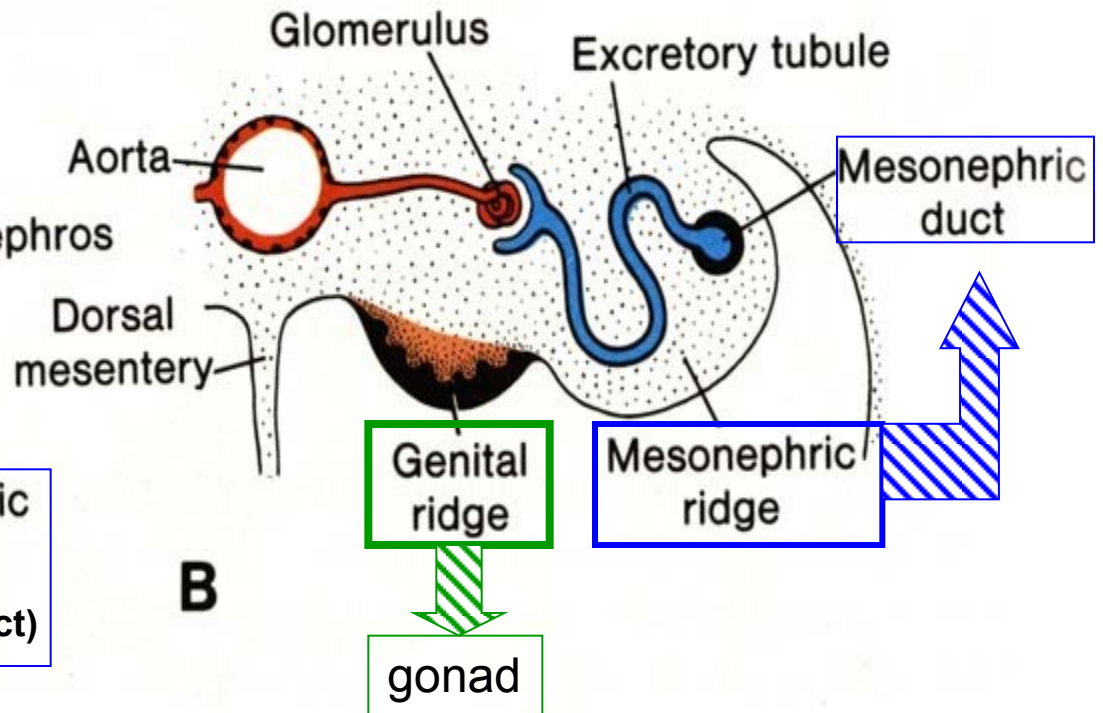
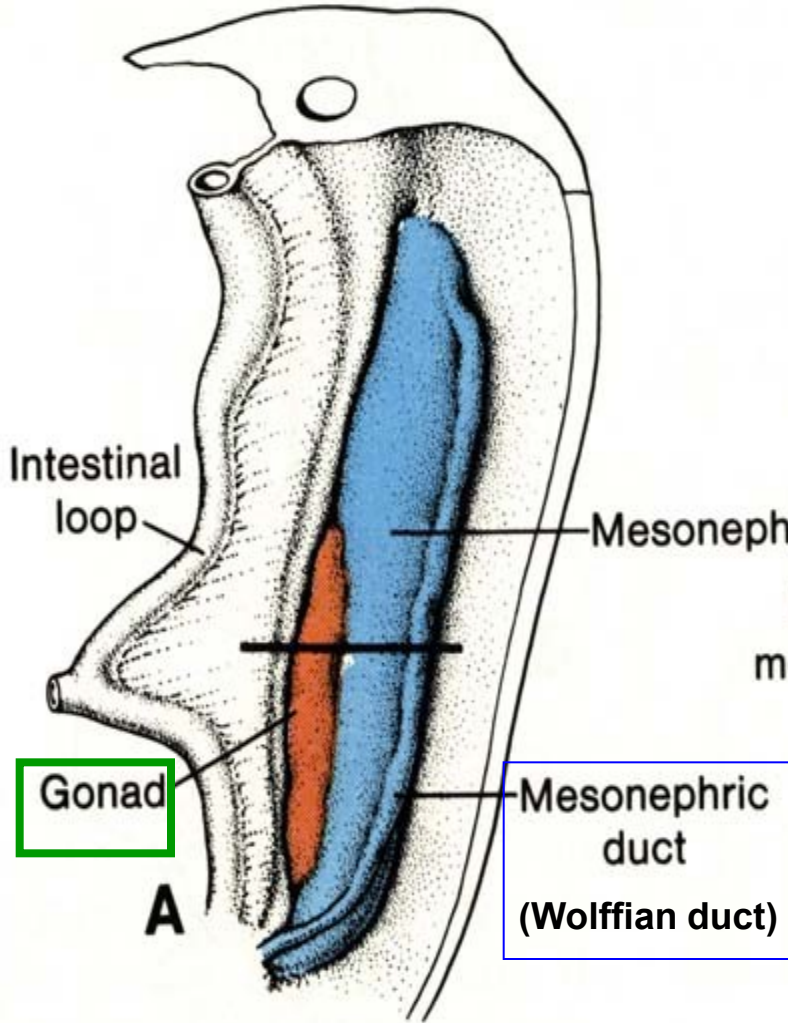
# Development of gonads

Dorsal wall of body: urogenital ridge

mesonephric ridge (laterally)

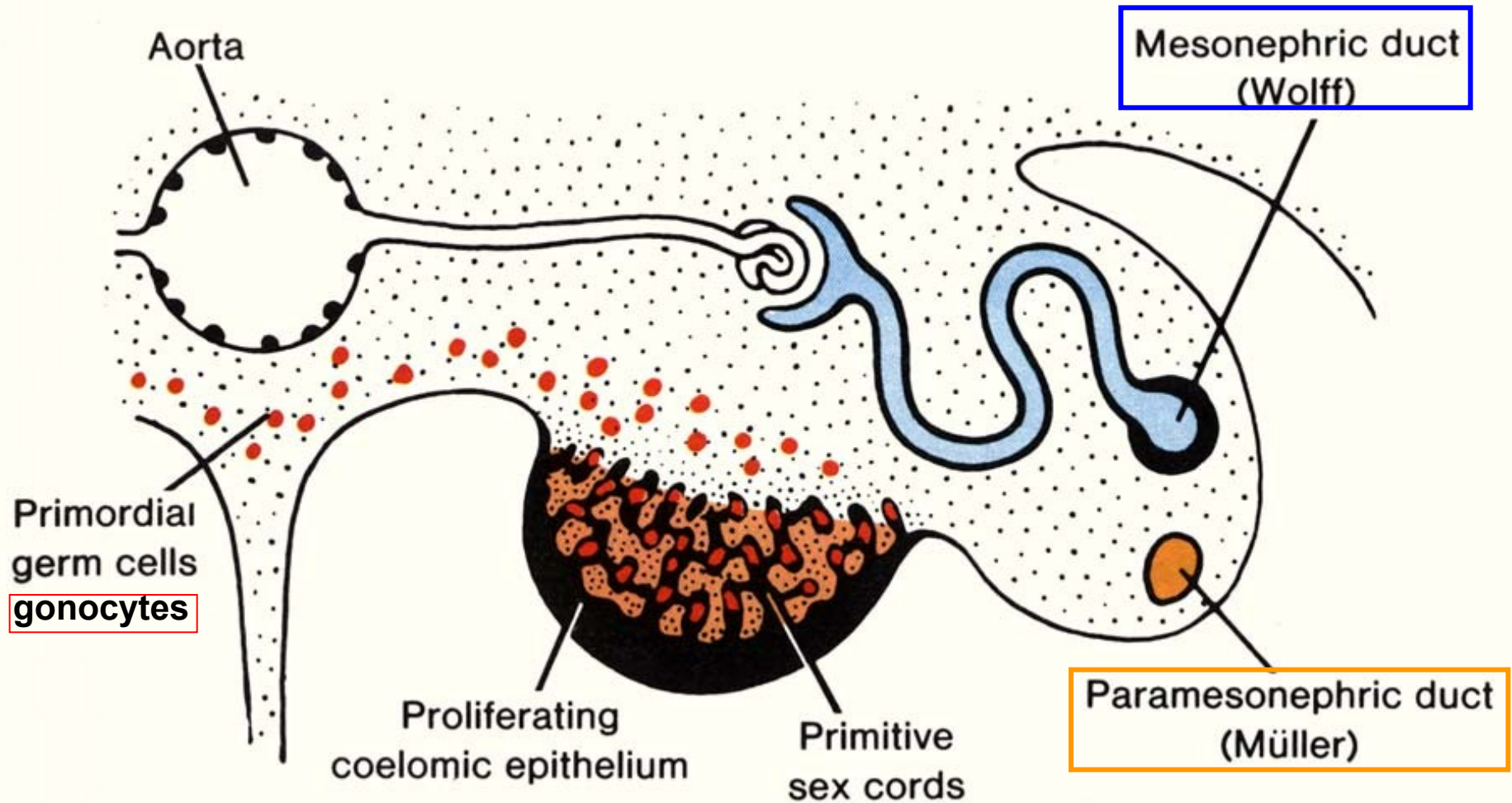
genital ridge (medially), consisting of

mesenchyme and coelomic epithelium

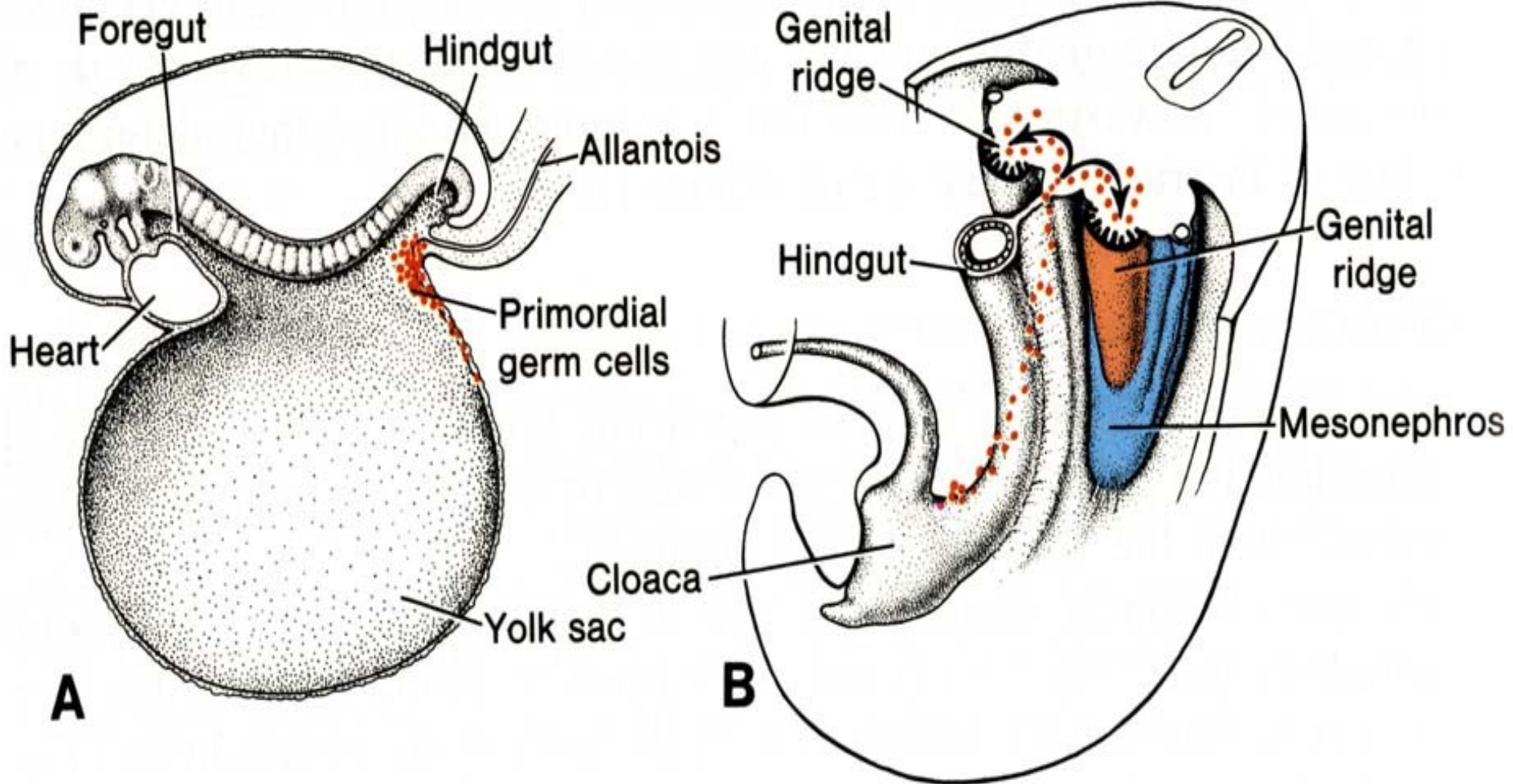


## Three sources of gonad development:

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

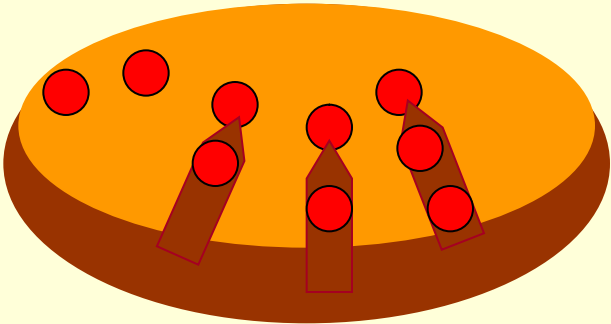


Primordial germ cells – **gonocytes** – in endoderm of dorsal wall of yolk sac. Gonocytes migrate along dorsal mesentery of hindgut into the gonadal ridges and induce (!) gonad development.

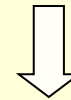


# Indifferent gonad development

- **Gonocytes** induce **coelomic epithelium** to proliferate



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



- **primary sex cords**

in indifferent gonad



Primary proliferation  
Secondary proliferation

TESTIS

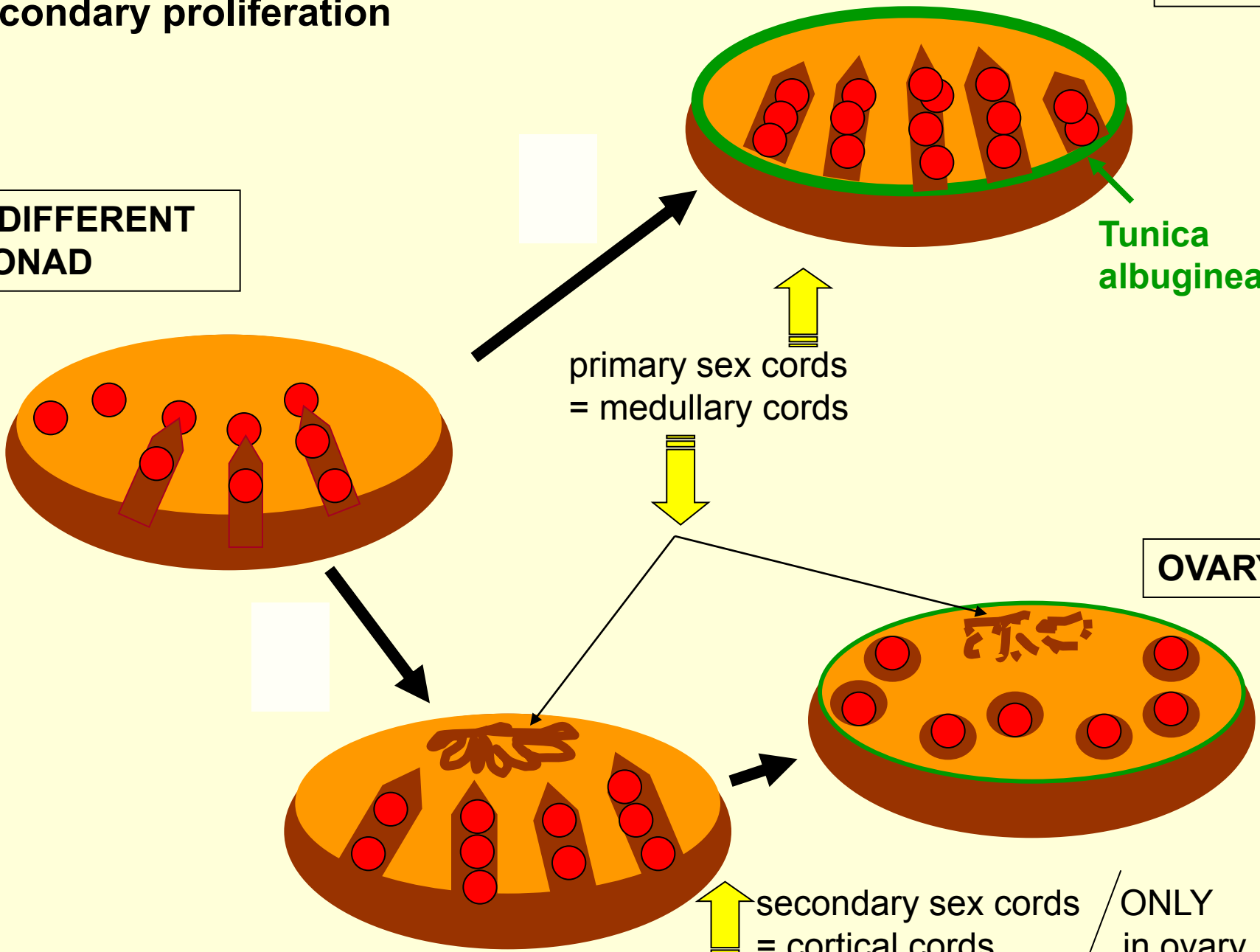
INDIFFERENT  
GONAD

Tunica  
albuginea

primary sex cords  
= medullary cords

OVARY

secondary sex cords  
= cortical cords  
ONLY  
in ovary



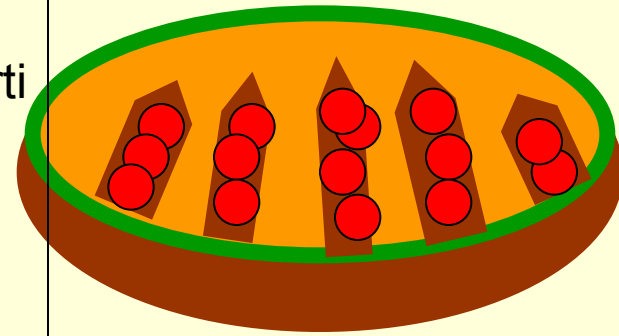
## TESTIS:

Primary sex cords ⇒ tubuli semuniferi contorti

Gonocytes ⇒ **spermatogonia**

Coelomic cells ⇒ **Sertoli cells**

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



Tunica albuginea

## OVARY:

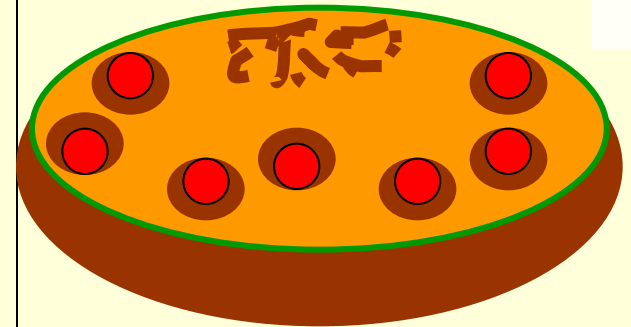
Primary sex cords ⇒ degenerate in ovarian medulla

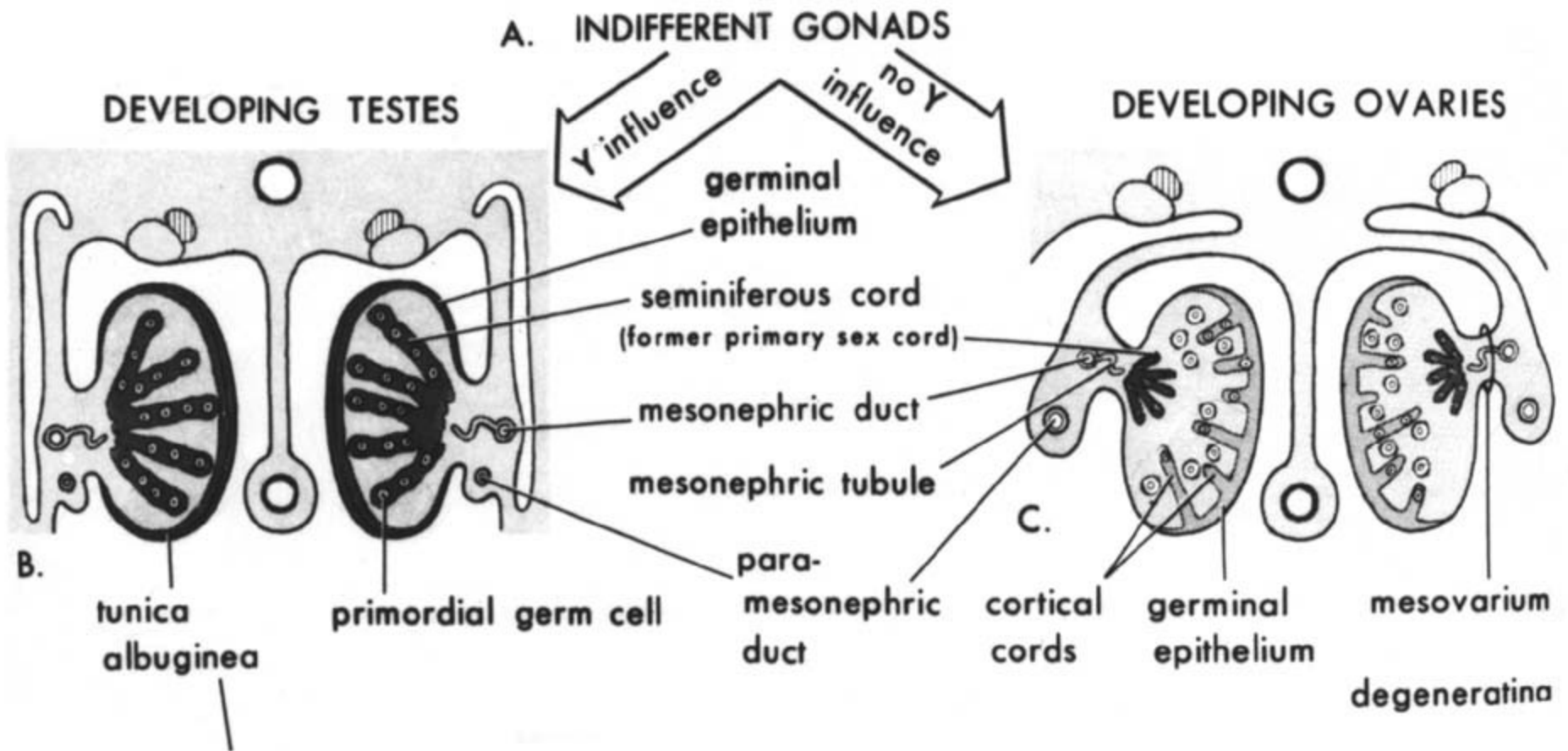
Secondary sex cords ⇒ disintegrate into the  
follicles:

Gonocytes ⇒ **oogonia**

Coelomic cells ⇒ **follicular cells**

Mesenchyme ⇒ **ovarian stroma**

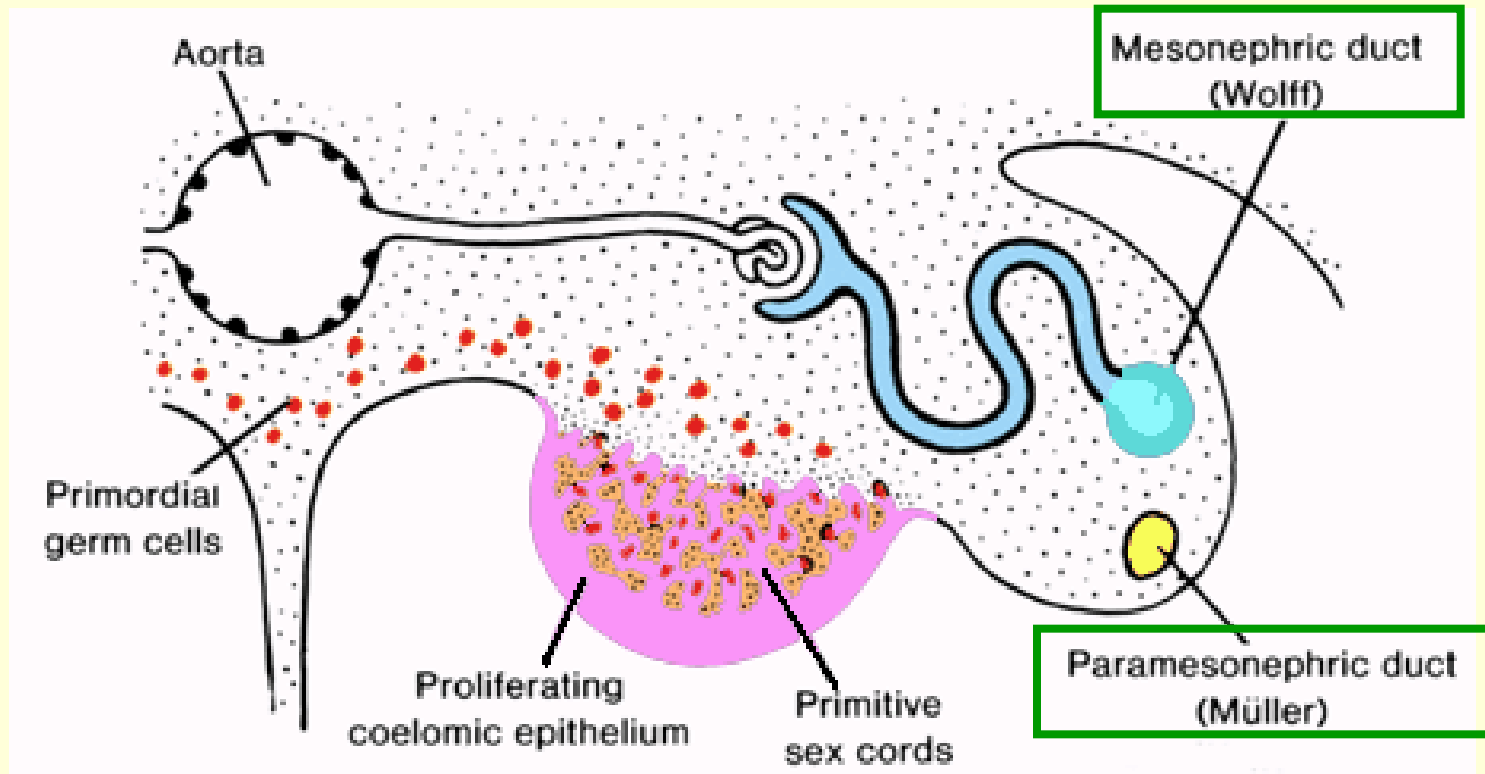


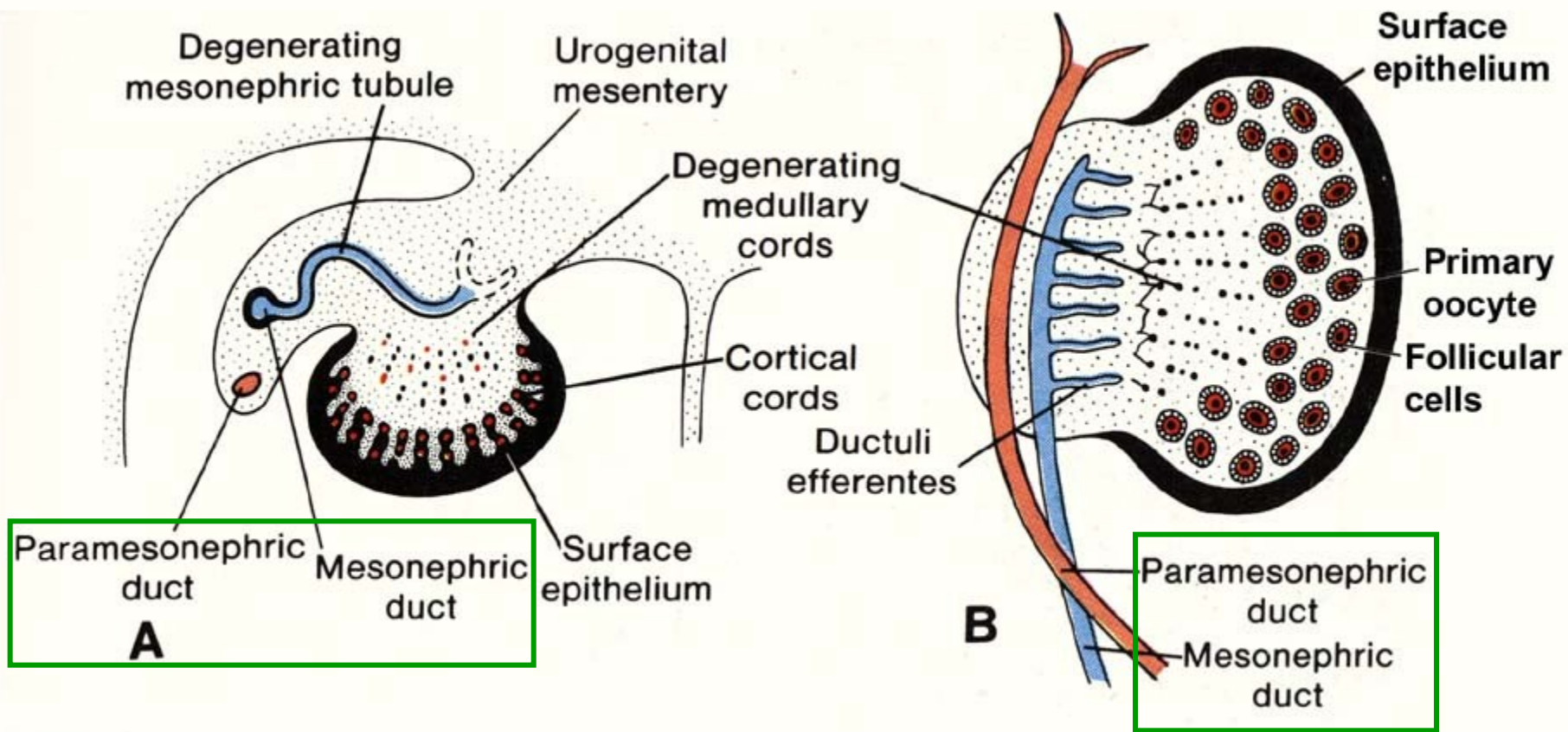


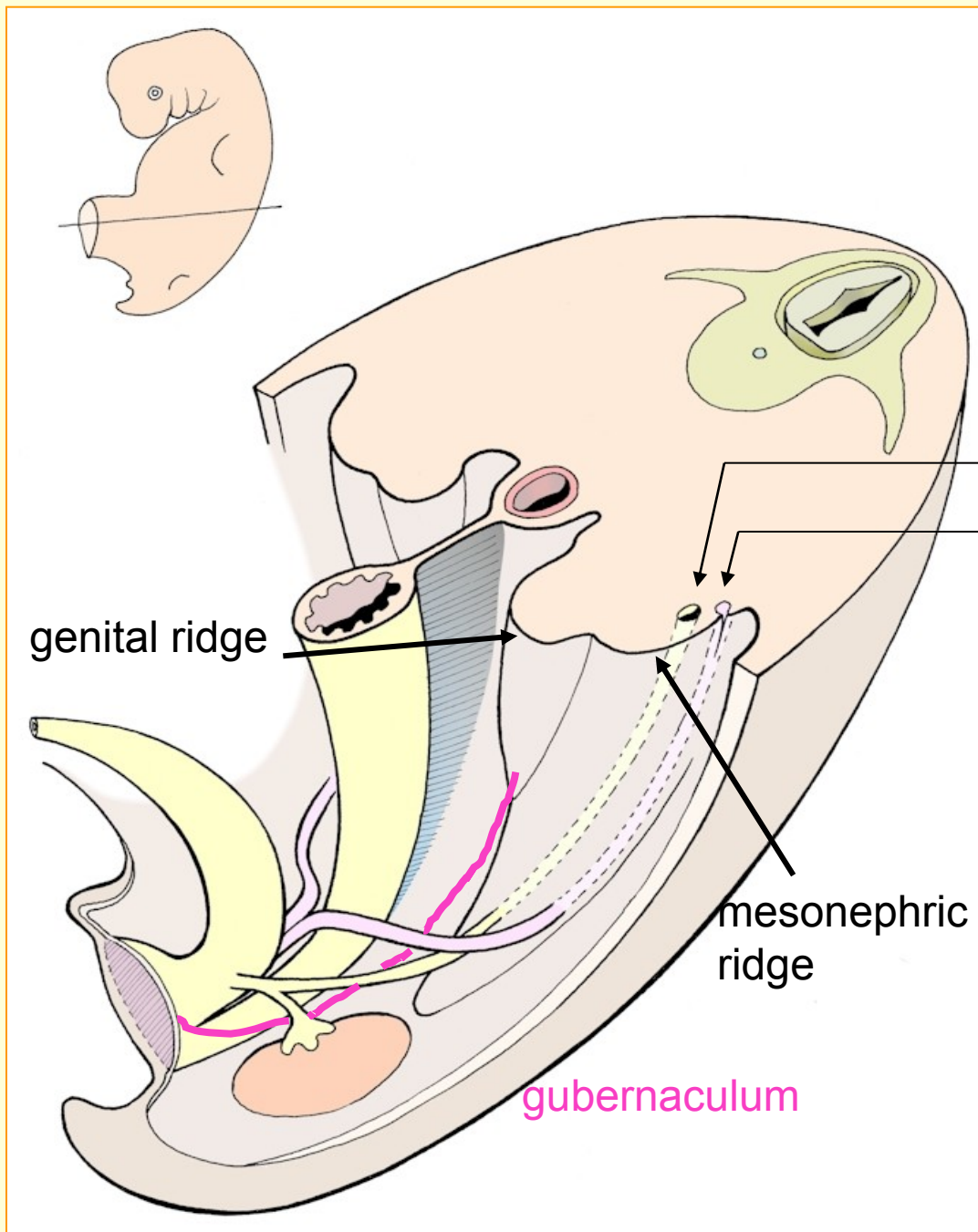
# Development of reproductive passages

(indifferent – differentiated stage)

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

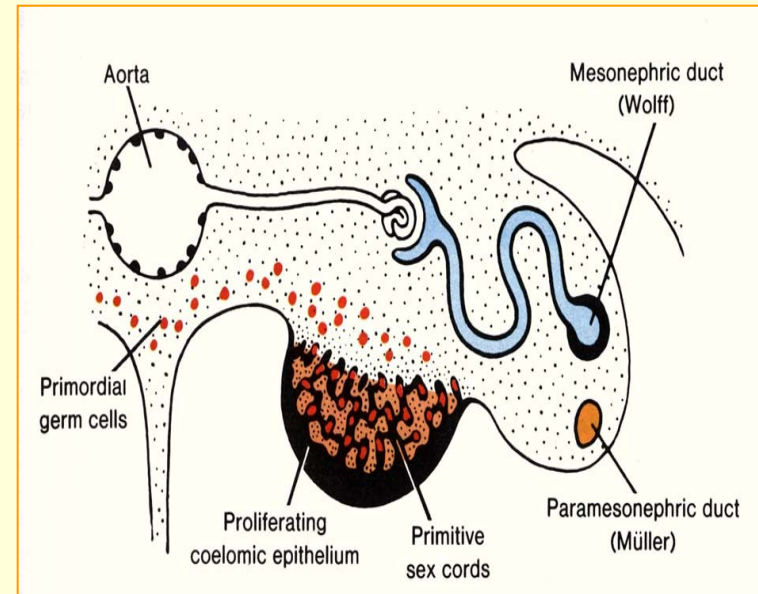






Indifferent stage:

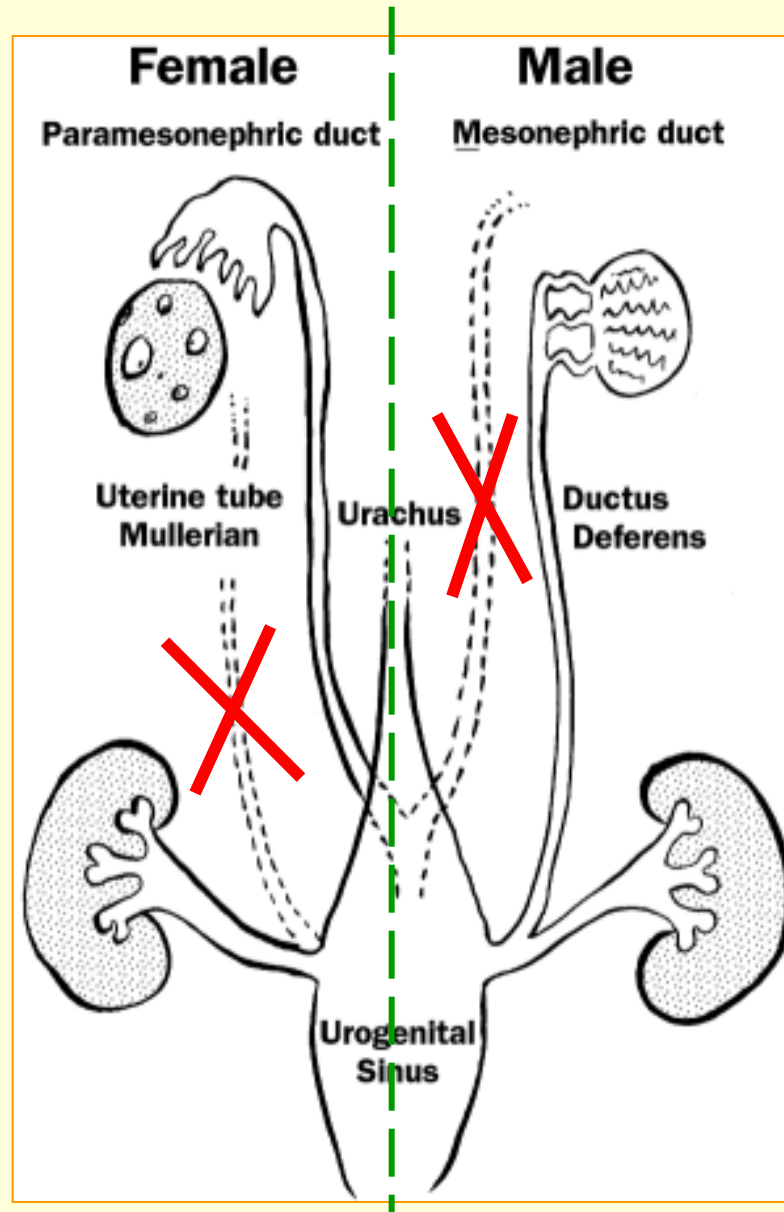
**Wolffian duct**  
**Müllerian duct**



# Differentiated stage of development:

## Müllerian duct:

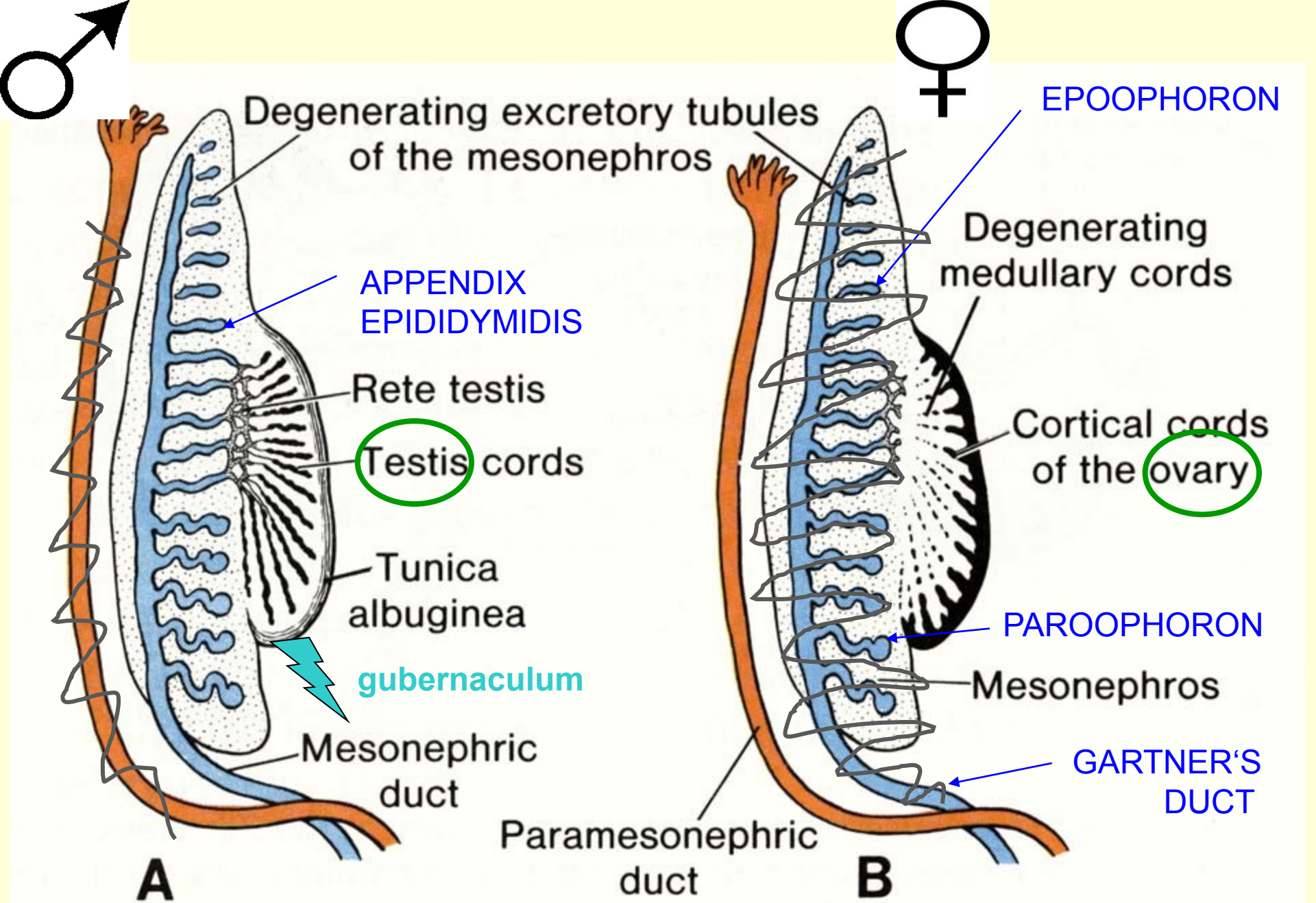
Oviduct  
Uterus  
Cranial part of  
vagina



## Wolffian duct:

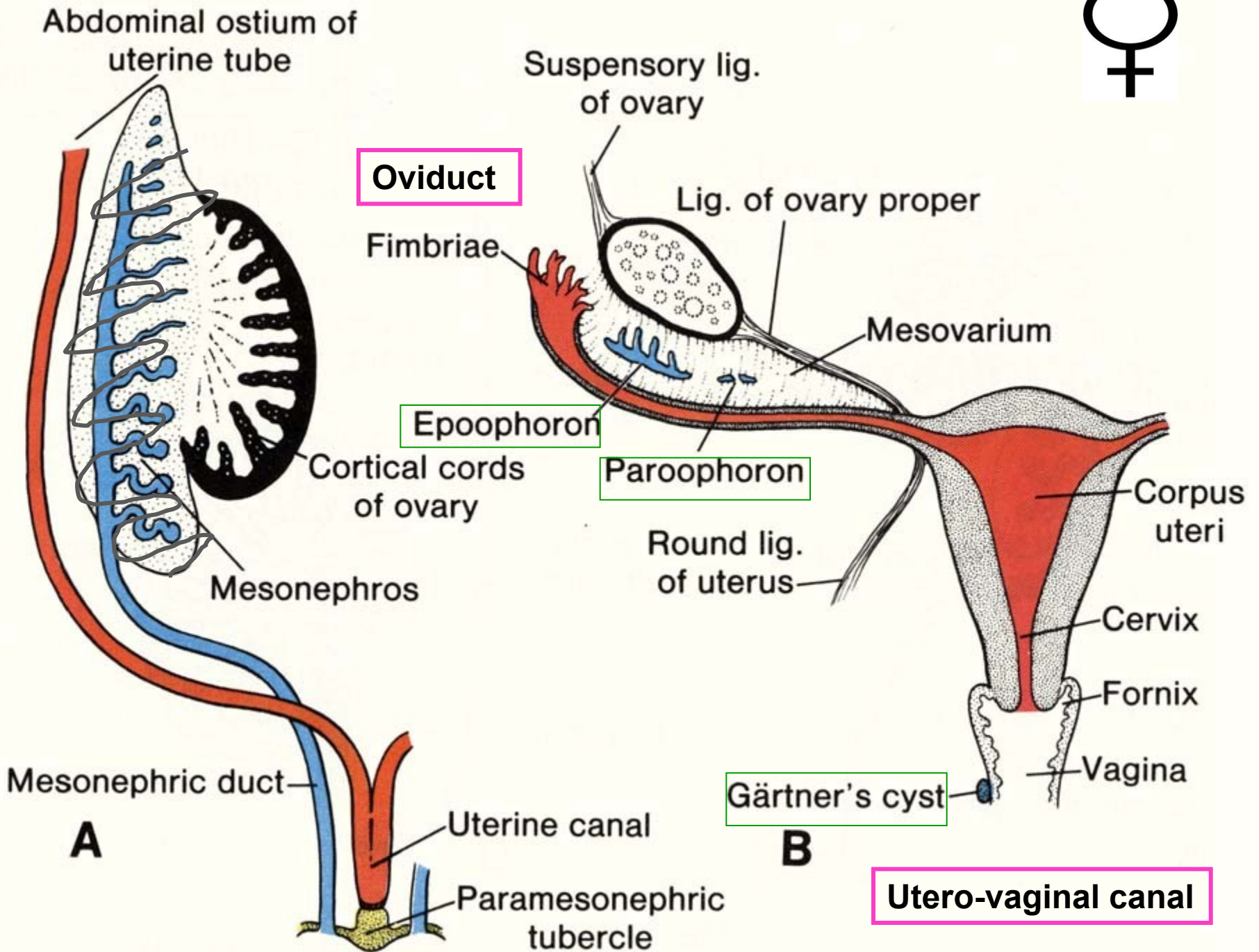
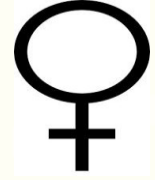
Ductus epididymidis  
Ductus deferens  
Ductus ejaculatorius

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

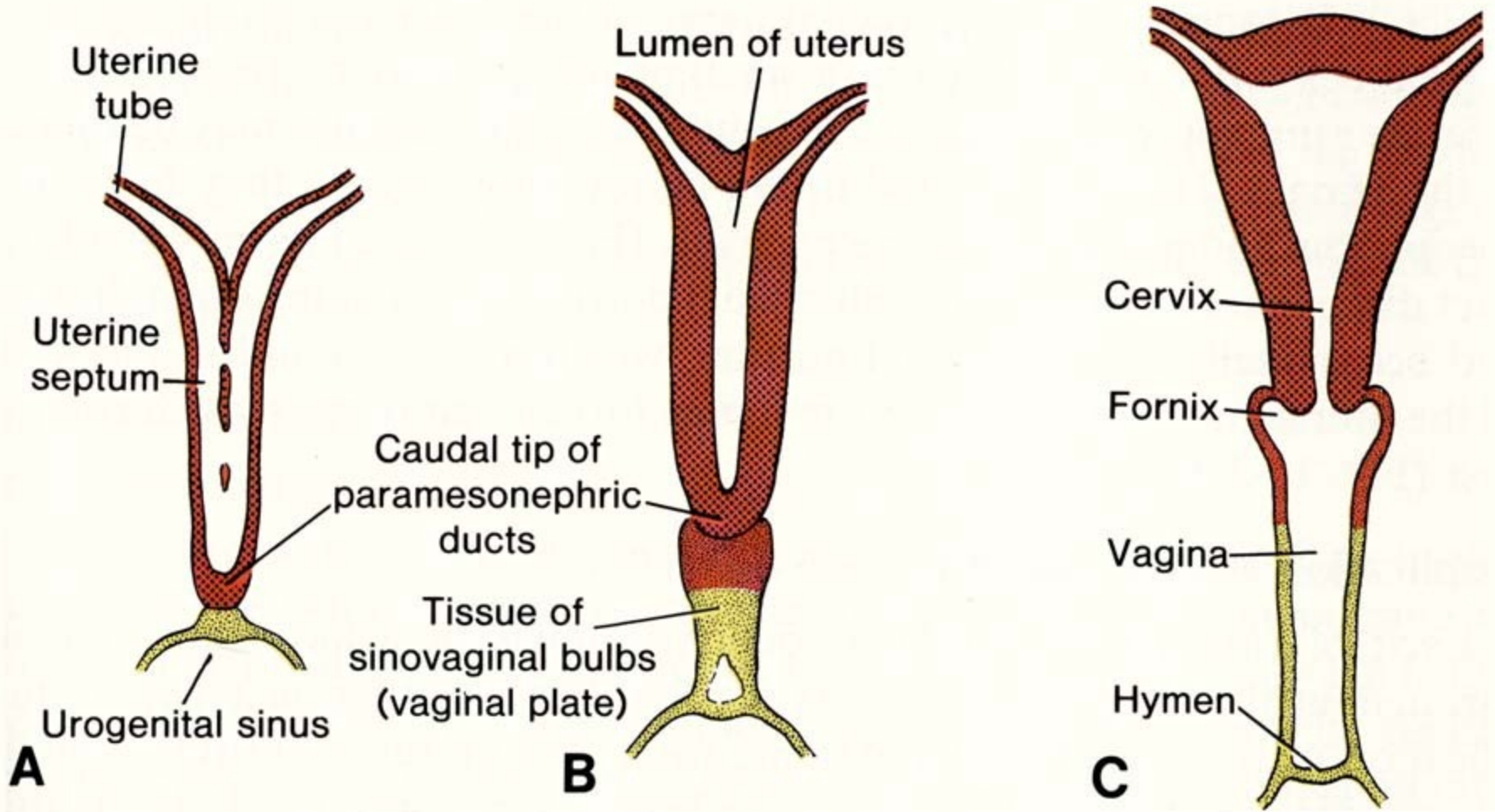


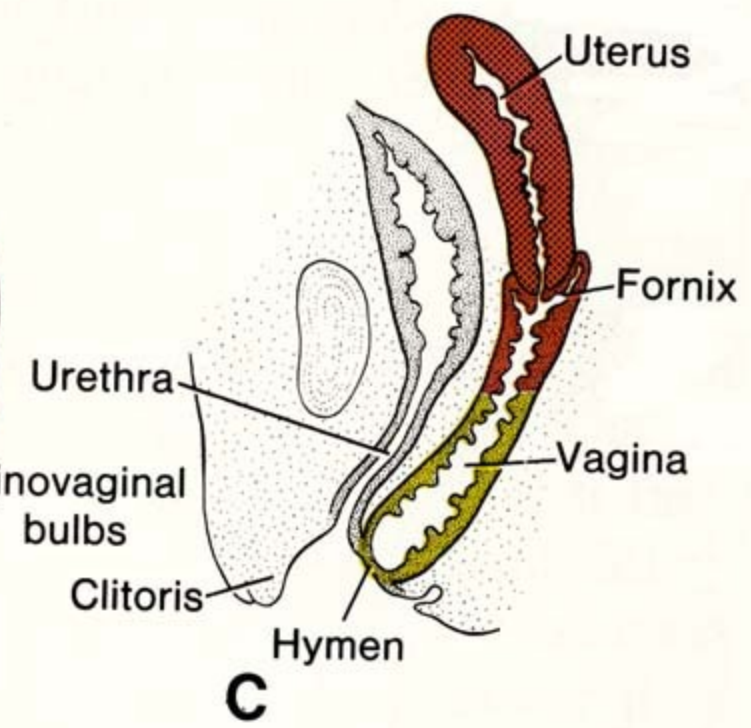
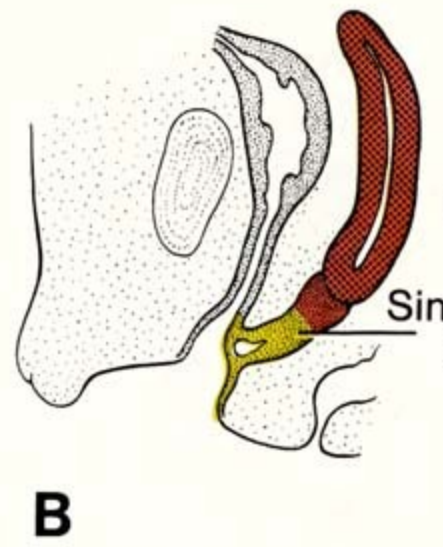
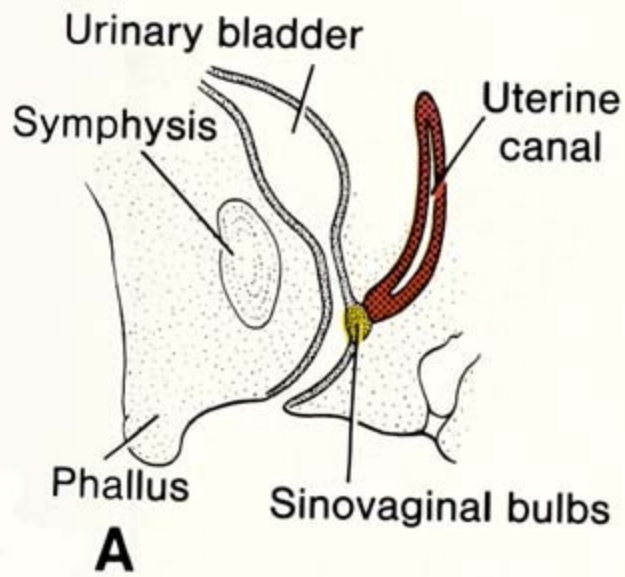
+ RUDIMENTARY STRUCTURES





# UTEROVAGINAL CANAL





# Development of external genitalia

(indifferent – differentiated stage)

## Genital tubercle

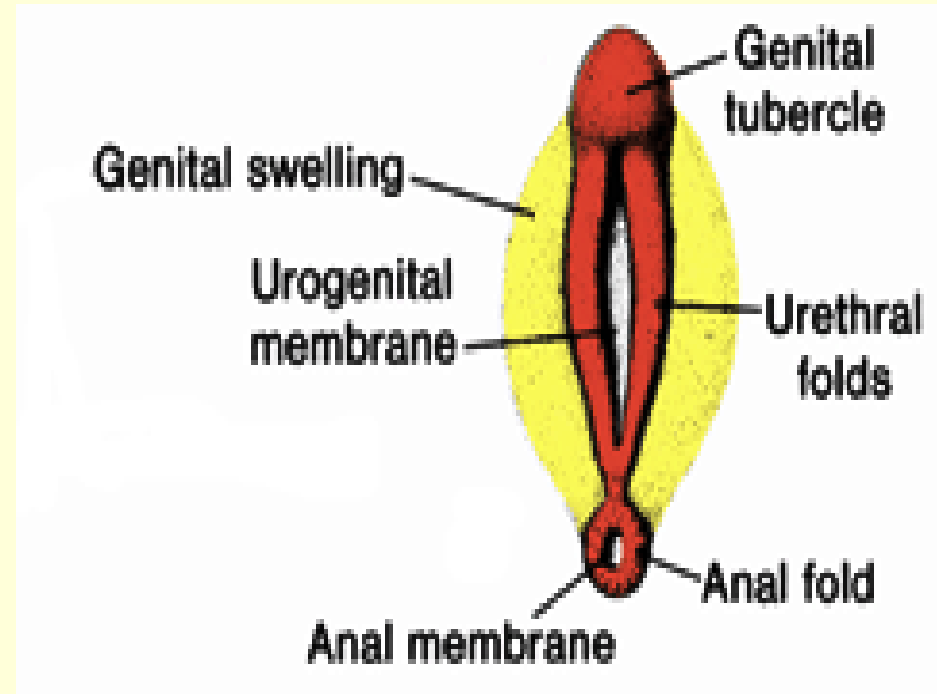
[tuberculum genitale]

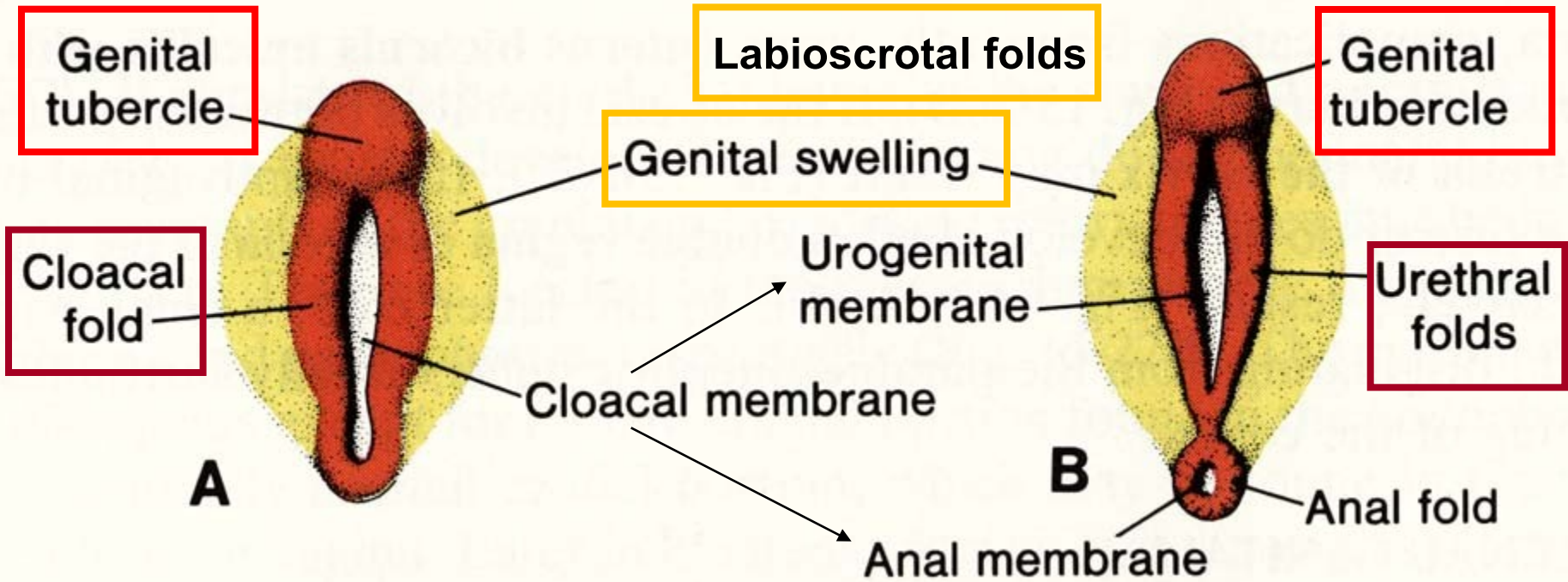
## Urethral (cloacal) folds

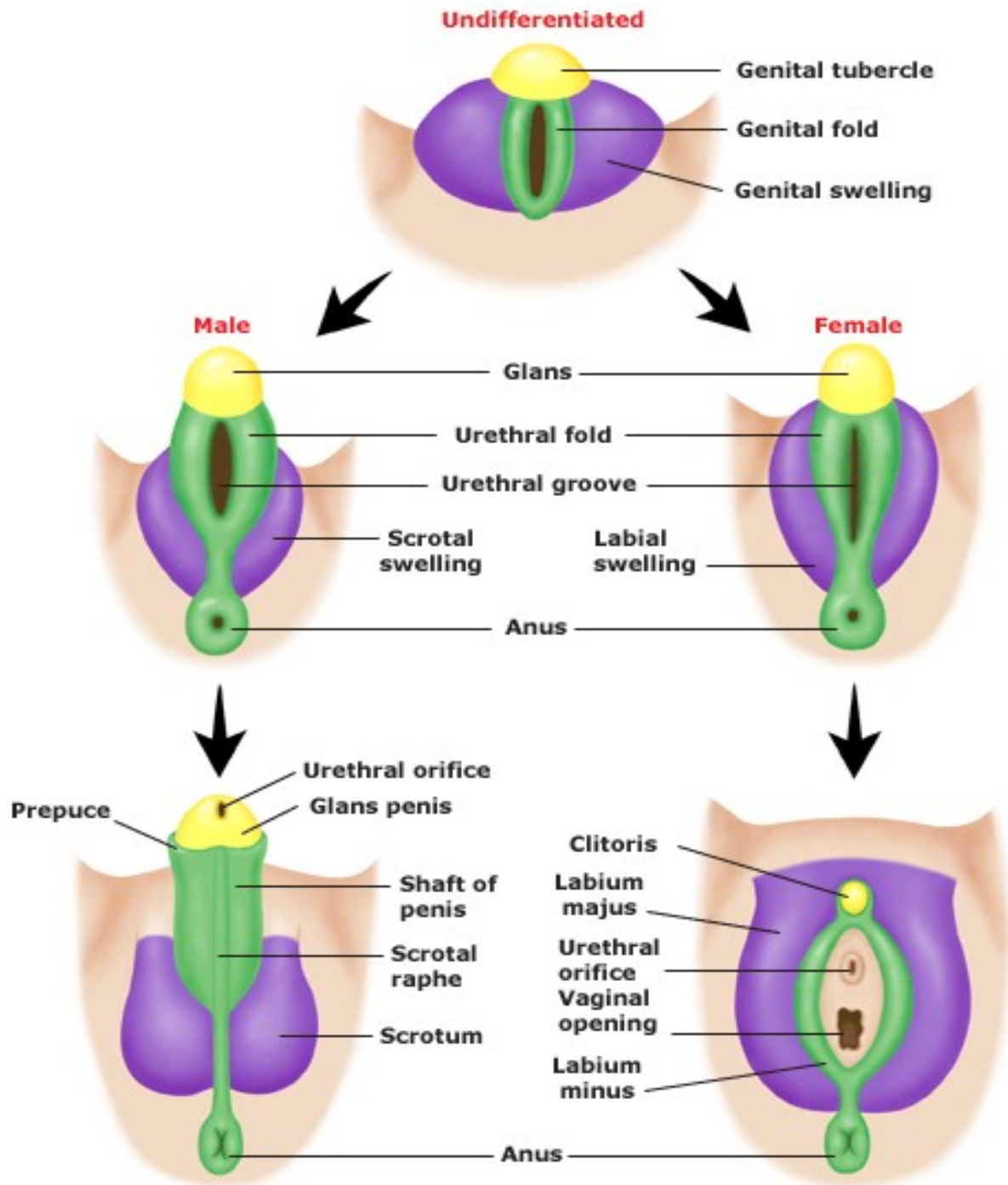
[plicae genitales]

## Labio-scrotal swellings

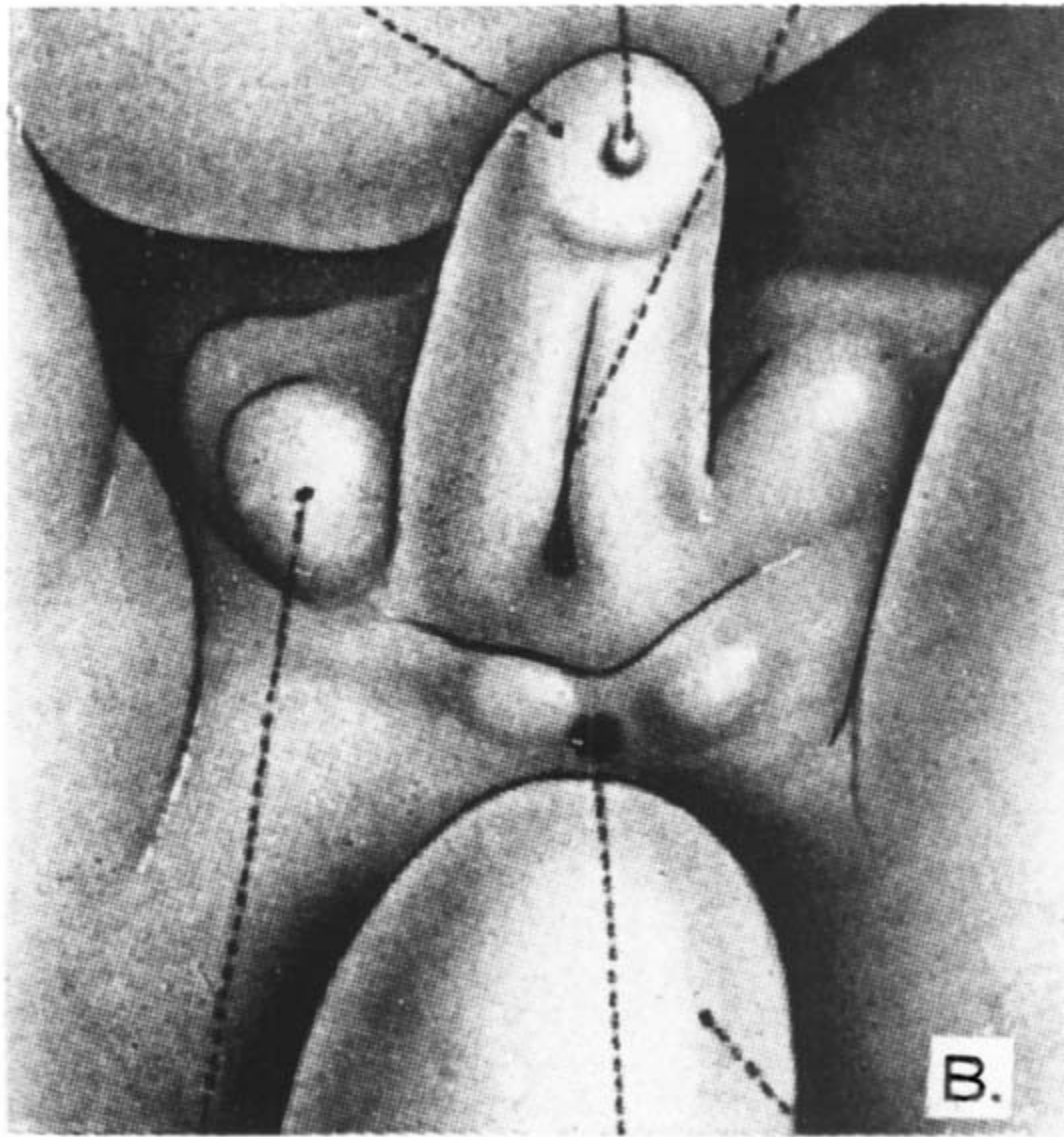
[tori genitales]







GLANS PENIS      EPITHELIAL TAG      URETHRAL GROOVE



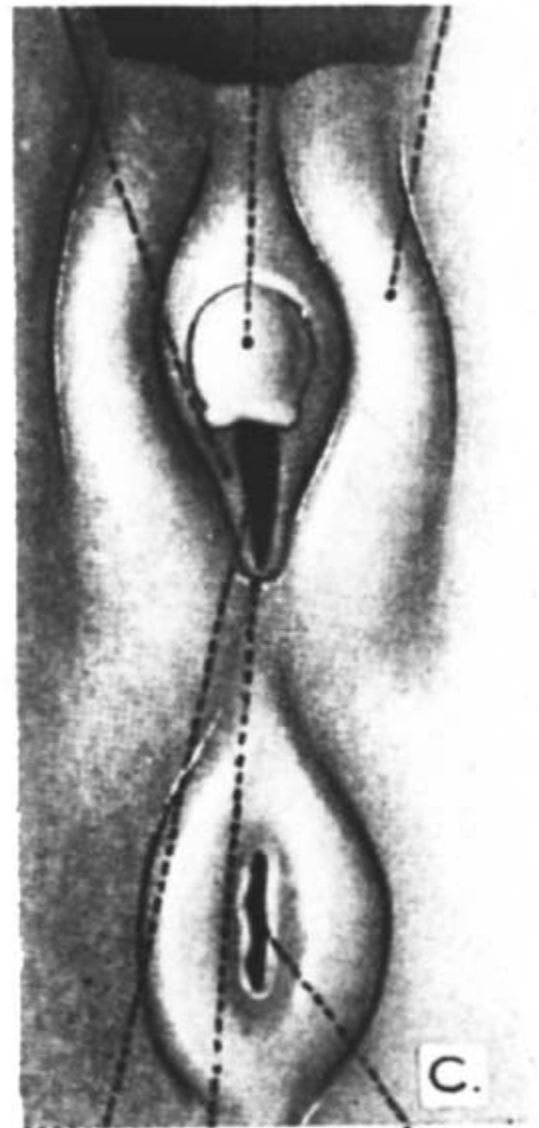
SCROTAL SWELLING

ANUS

TAIL

B.

LABIUM MINUS      GLANS CLITORIDIS      LABIUM MAJUS



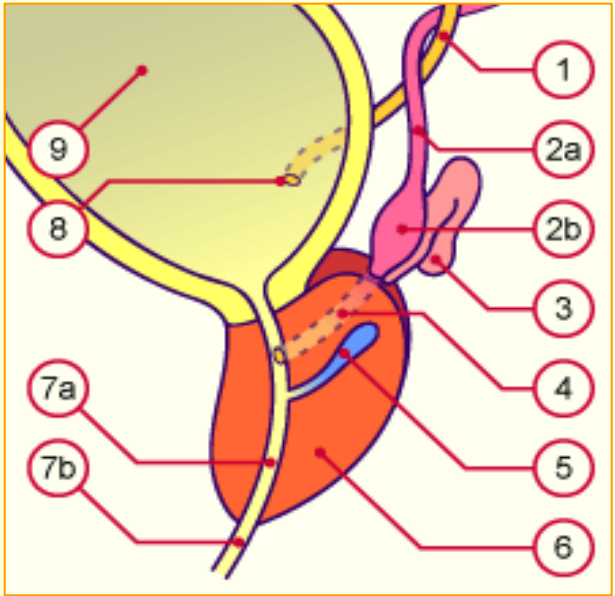
VESTIBULE

POSTERIOR COMMISSURE

ANUS

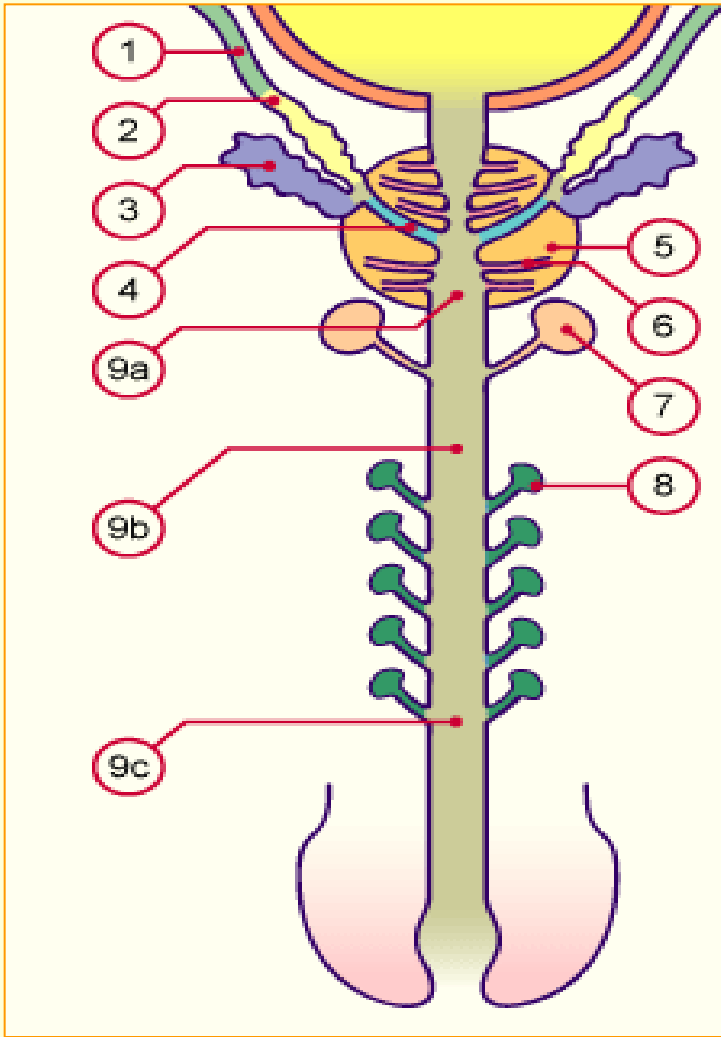
C.

# 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)

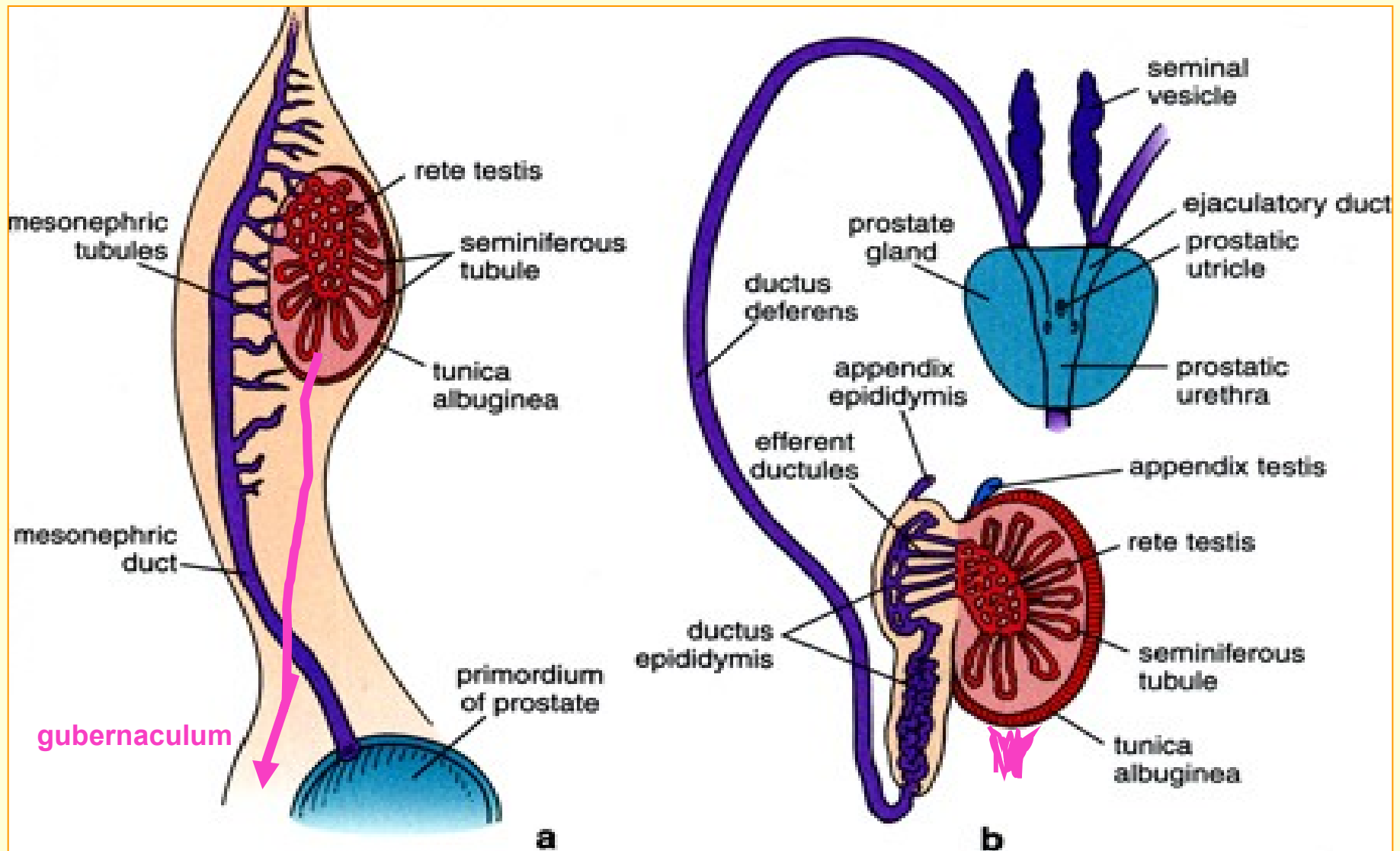


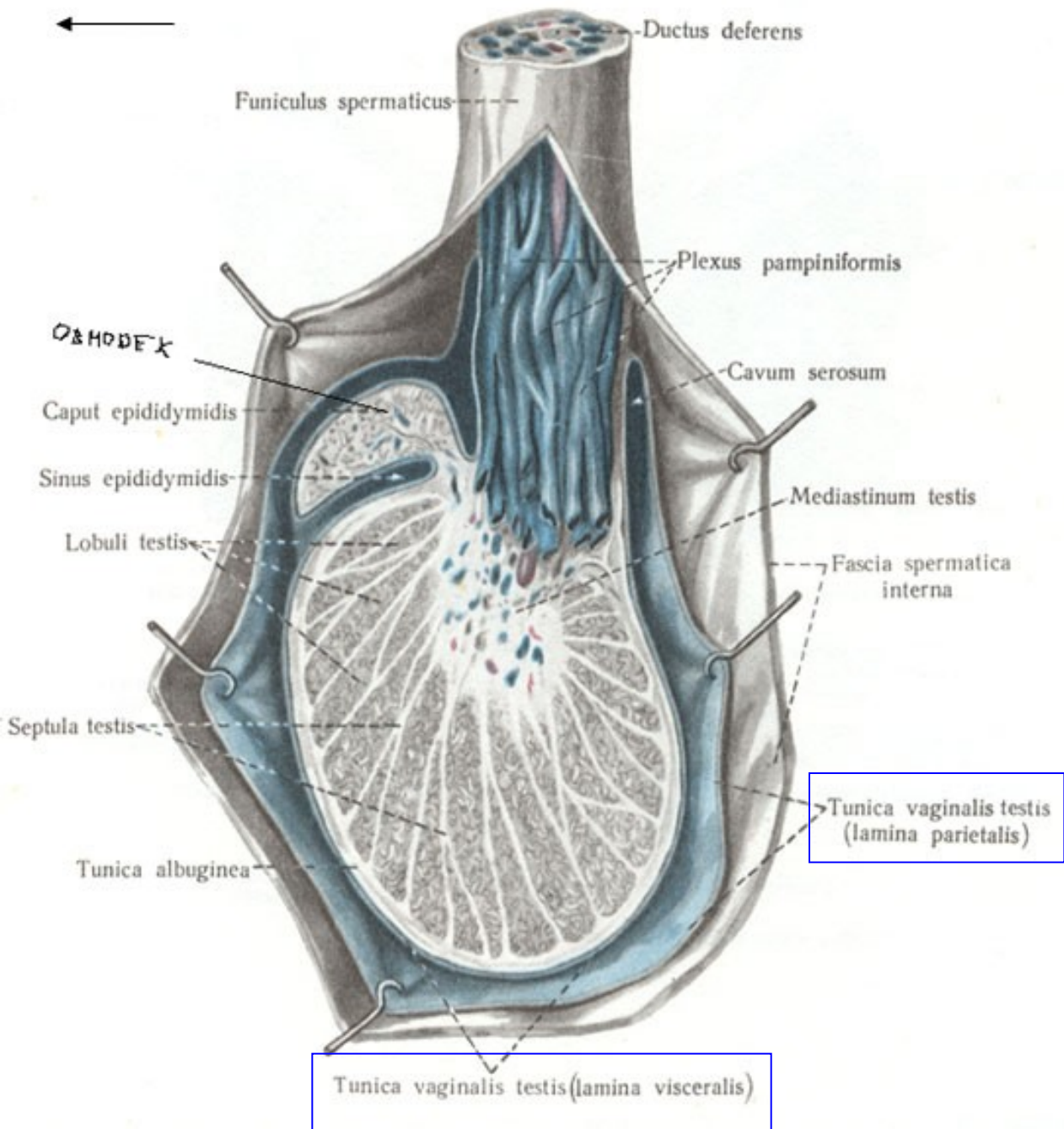


# Position of gonads during development

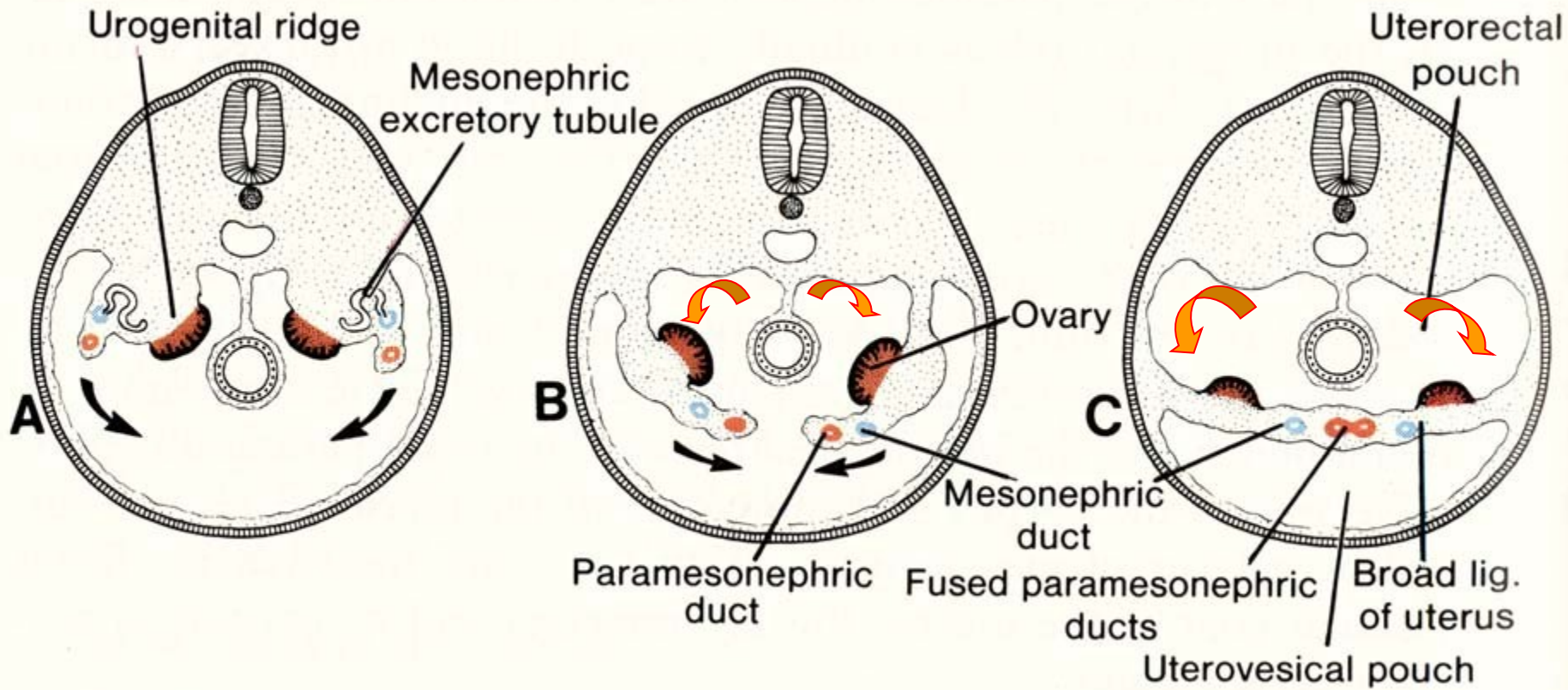
- Gonad develops in only short, lumbal part of genital (gonadal) ridge (Th6 – S2)
- Cranial part - disappears
- Caudal part transforms into **gubernaculum**
  
- **Testes – descensus into the scrotum**
- **Ovaries – change also their position** due to fusion of Müllerian ducts and formation of broad ligament (lig. latum uteri)

# Testis – descends into the scrotum





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

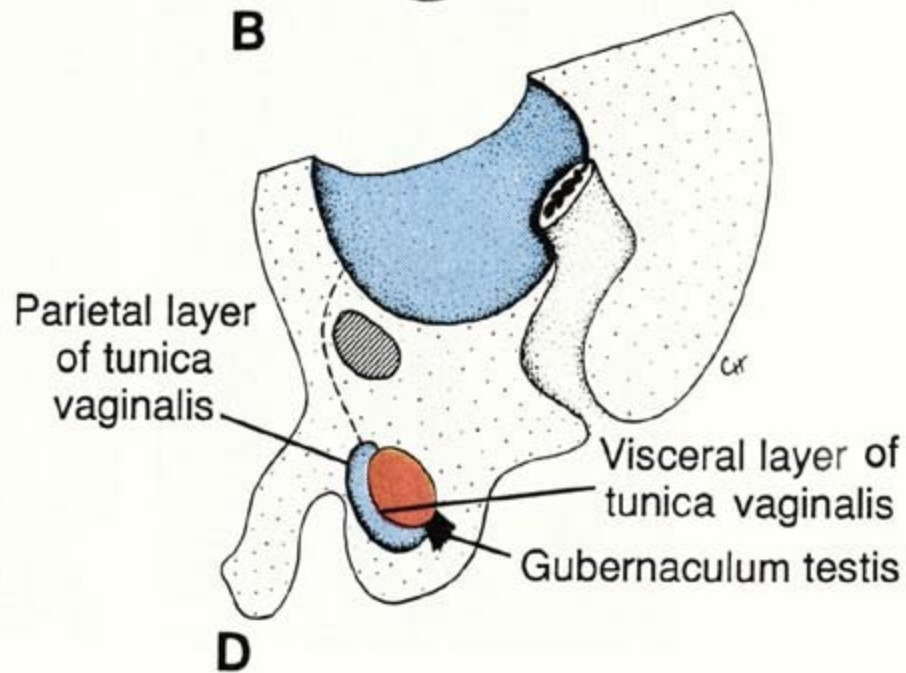
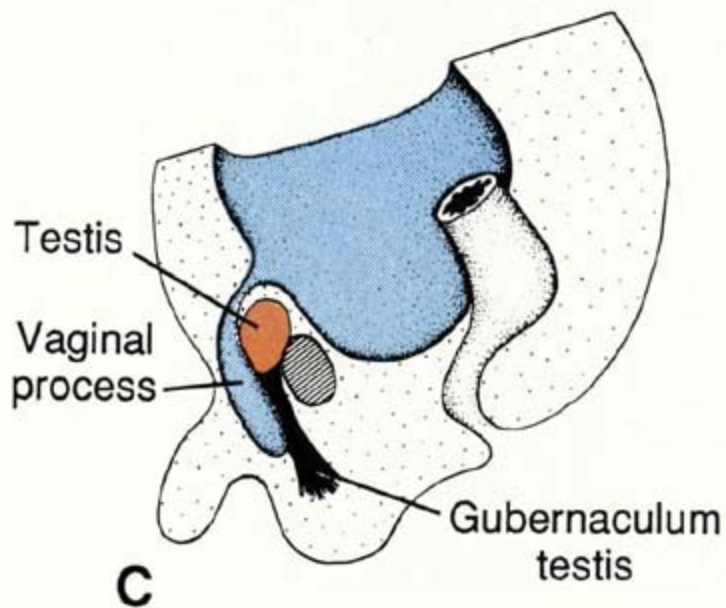
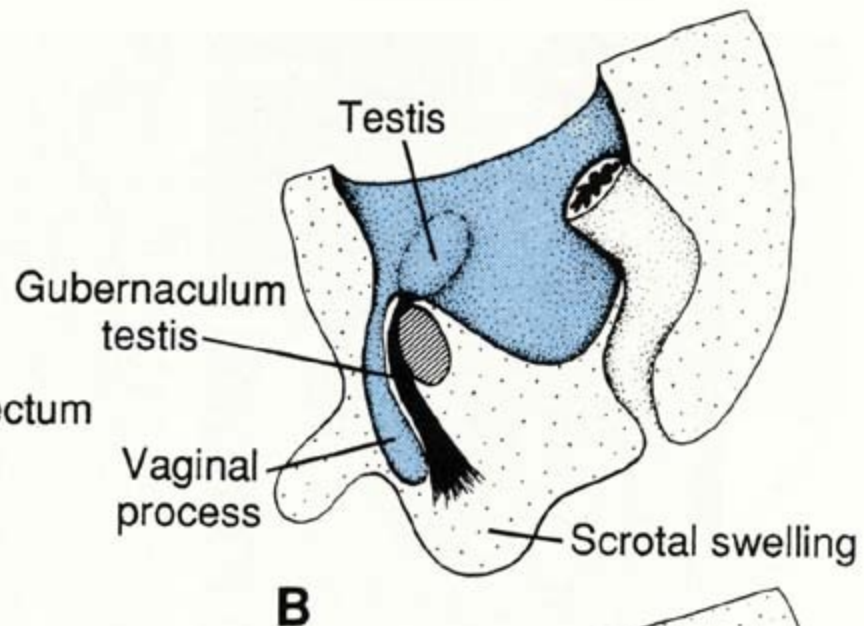
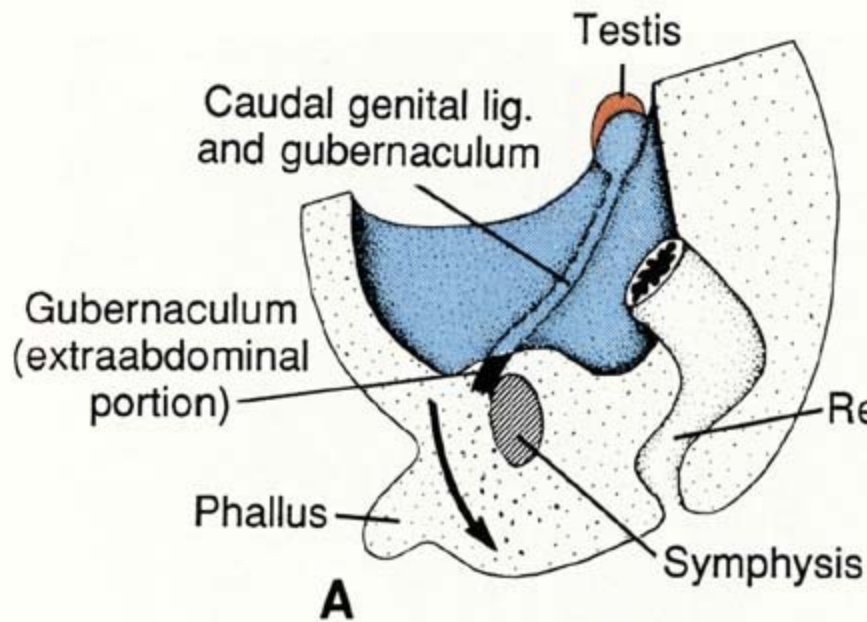


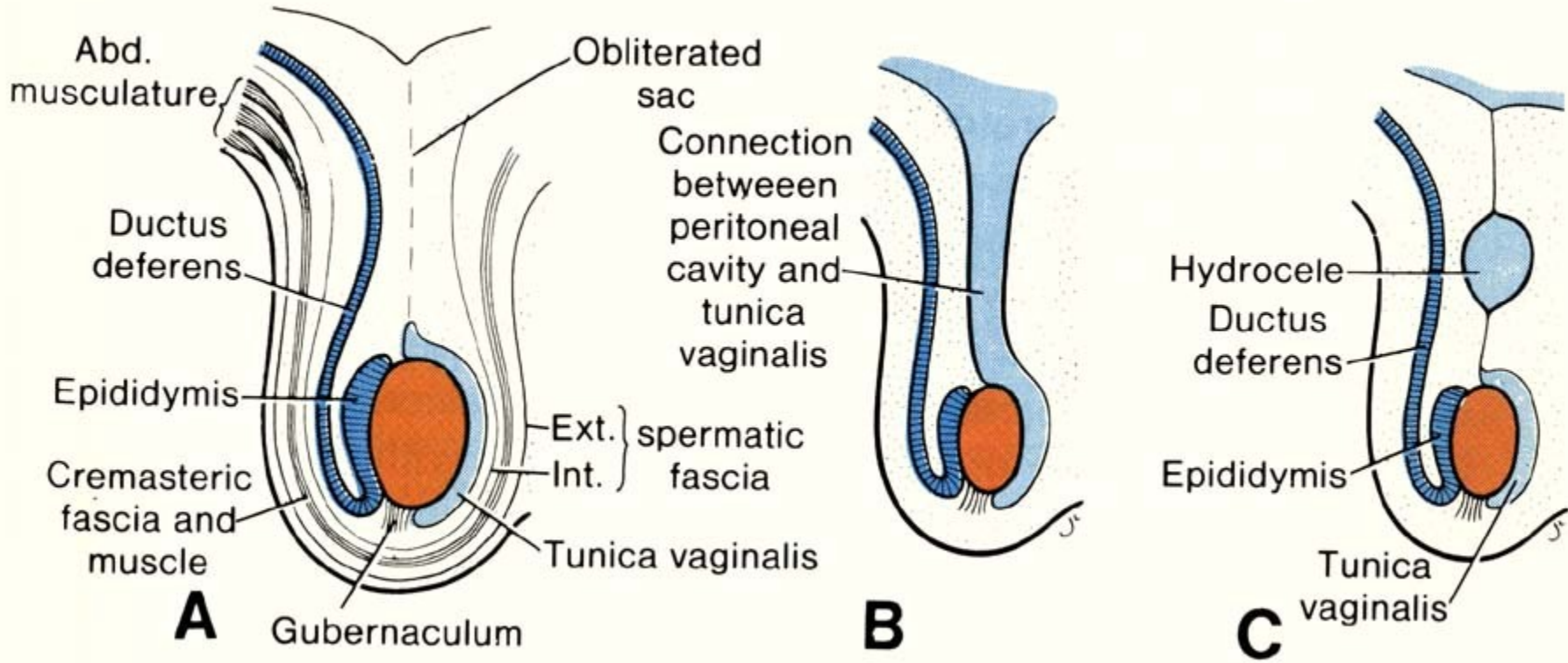
# Congenital malformations - 1

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

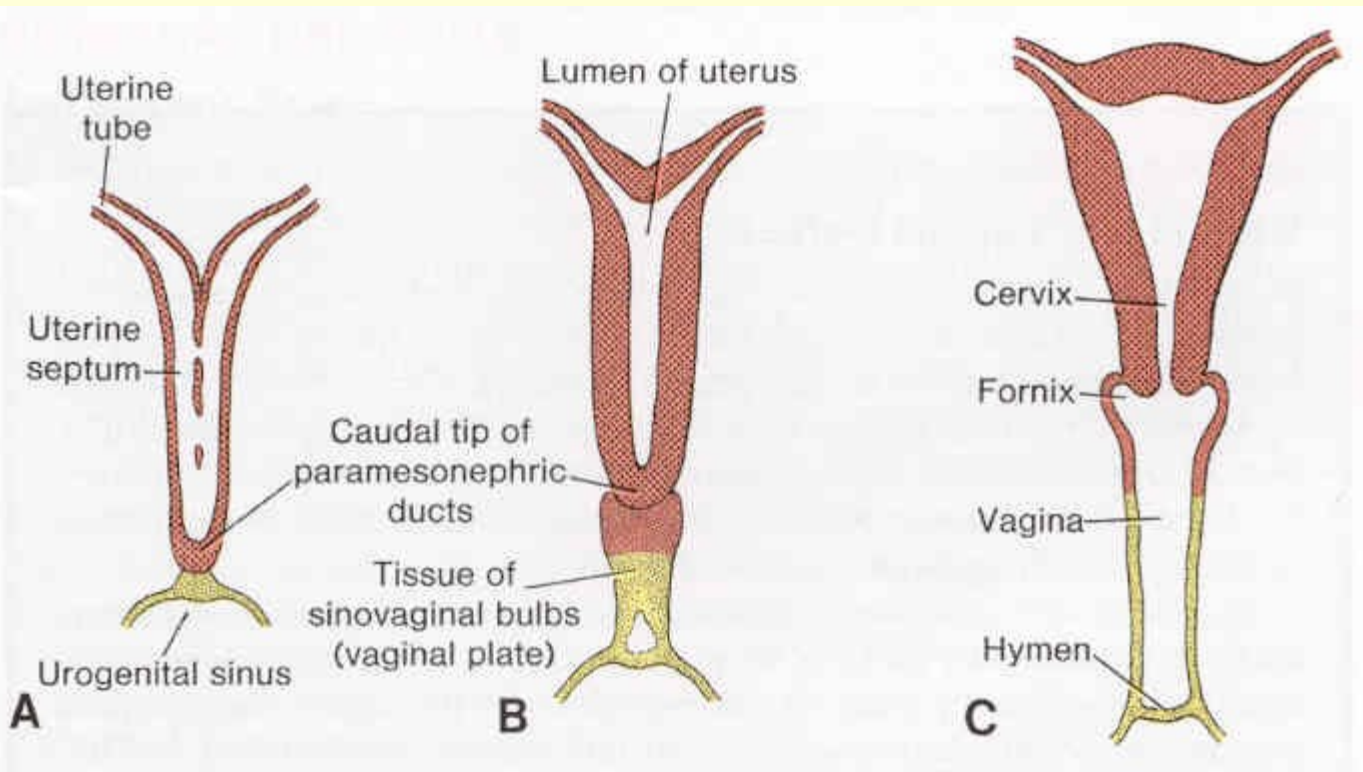
# Congenital malformations - 2

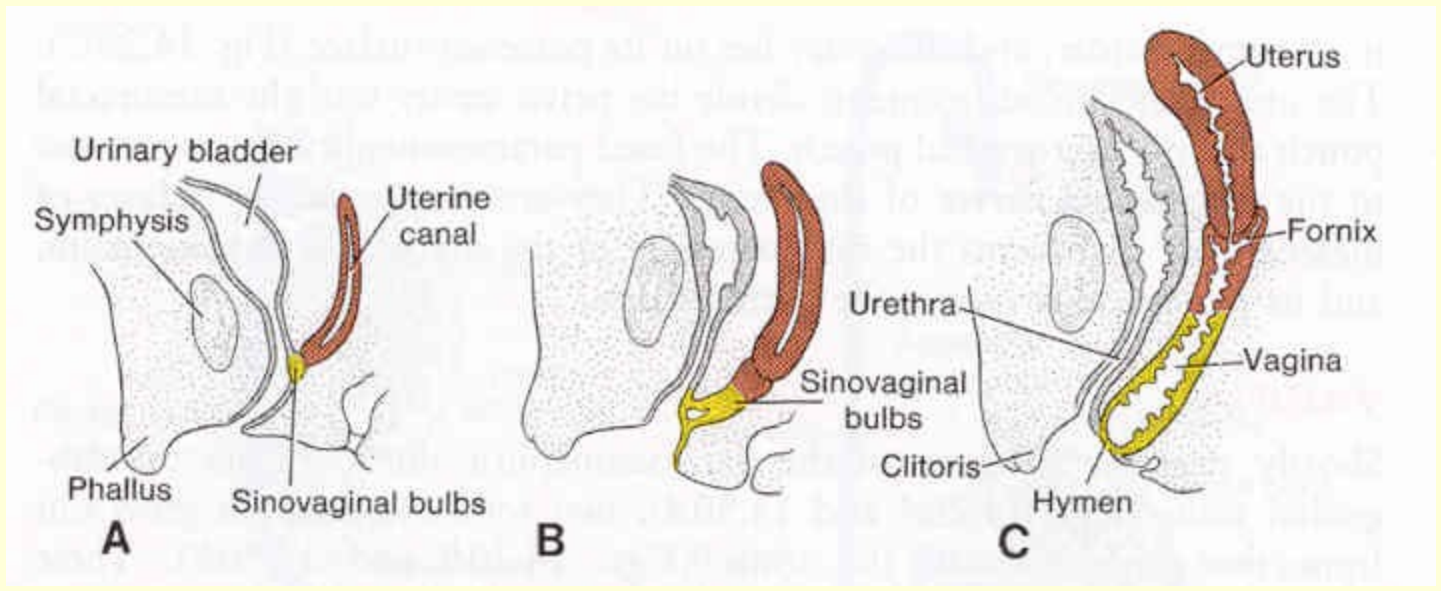
- Kryptorchism
- Hydrocele testis
- Hypospadias, epispadias
- ---
- Developmental defect of uterus (and vagina)  
uterus et vagina separatus, uterus bicornis, uterus septus or subseptus, uterus unicornis etc.

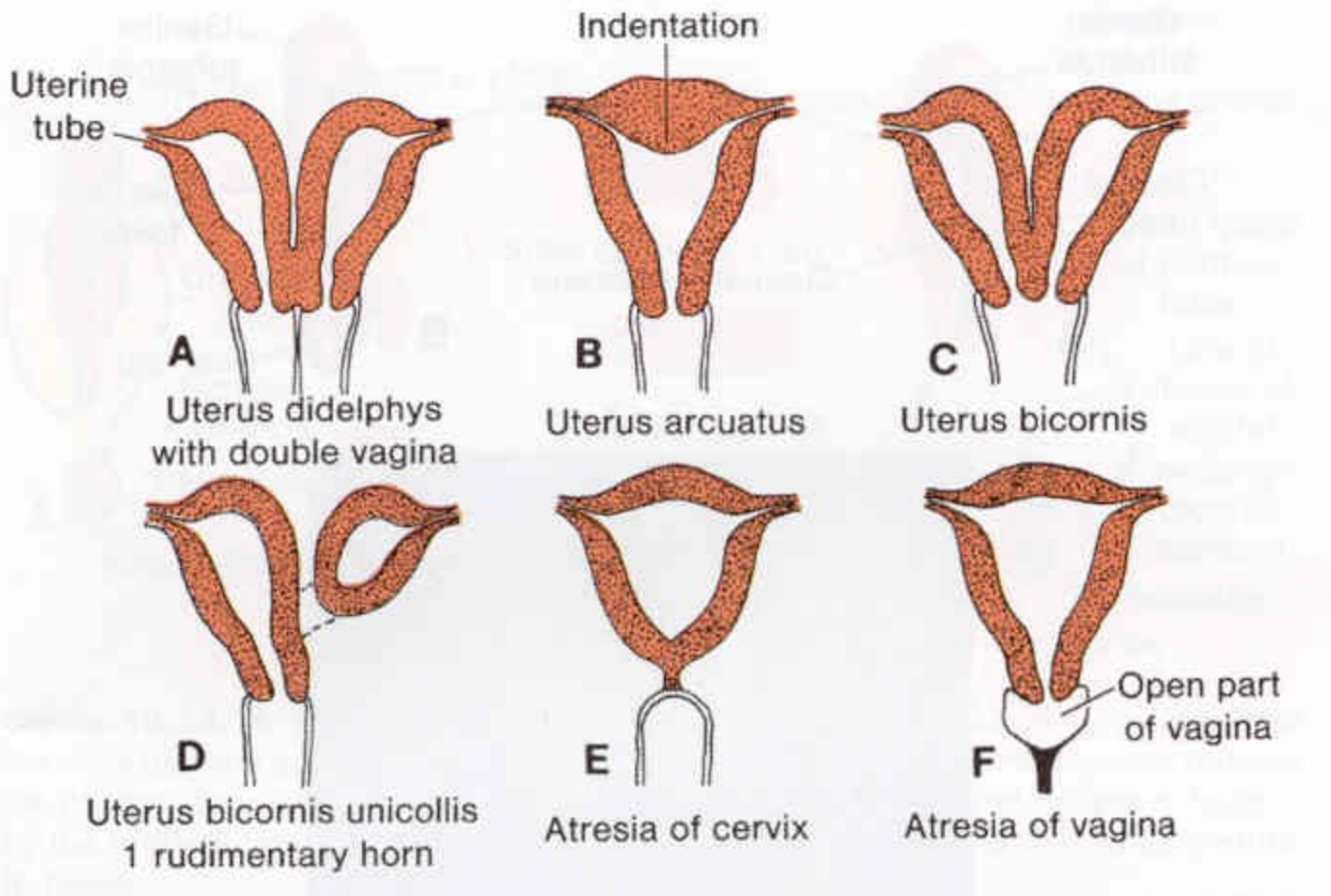














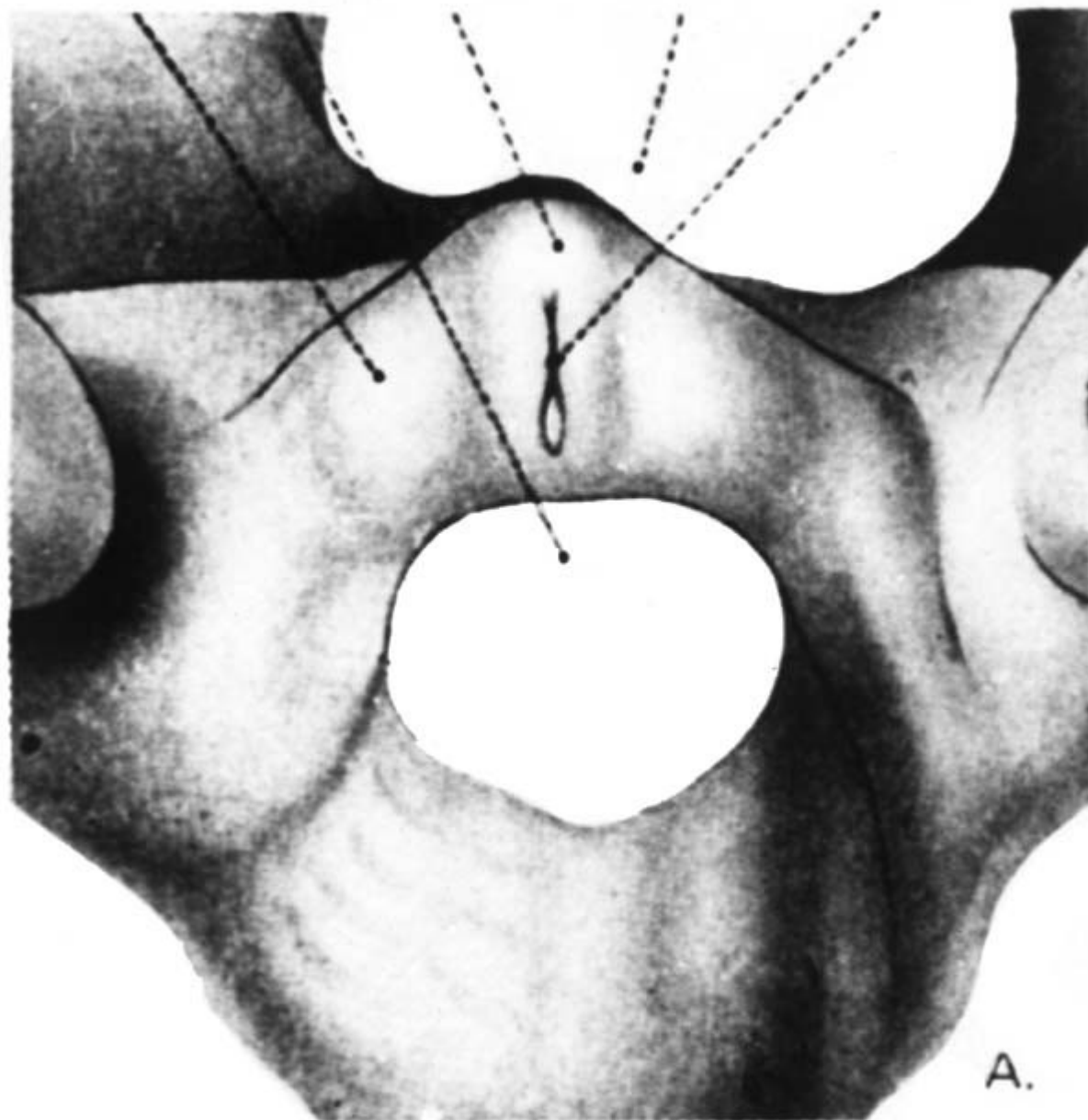
19. Indifferent stage in development of reproductive system.
20. Development of male and female gonad.
21. An overview of development of male and female genital duct.
22. Development of external genital organs.
23. Developmental malformations of urogenital system.

GENITAL  
SWELLING TAIL

GENITAL  
TUBERCLE

UMBILICAL  
CORD

URETHRAL  
GROOVE



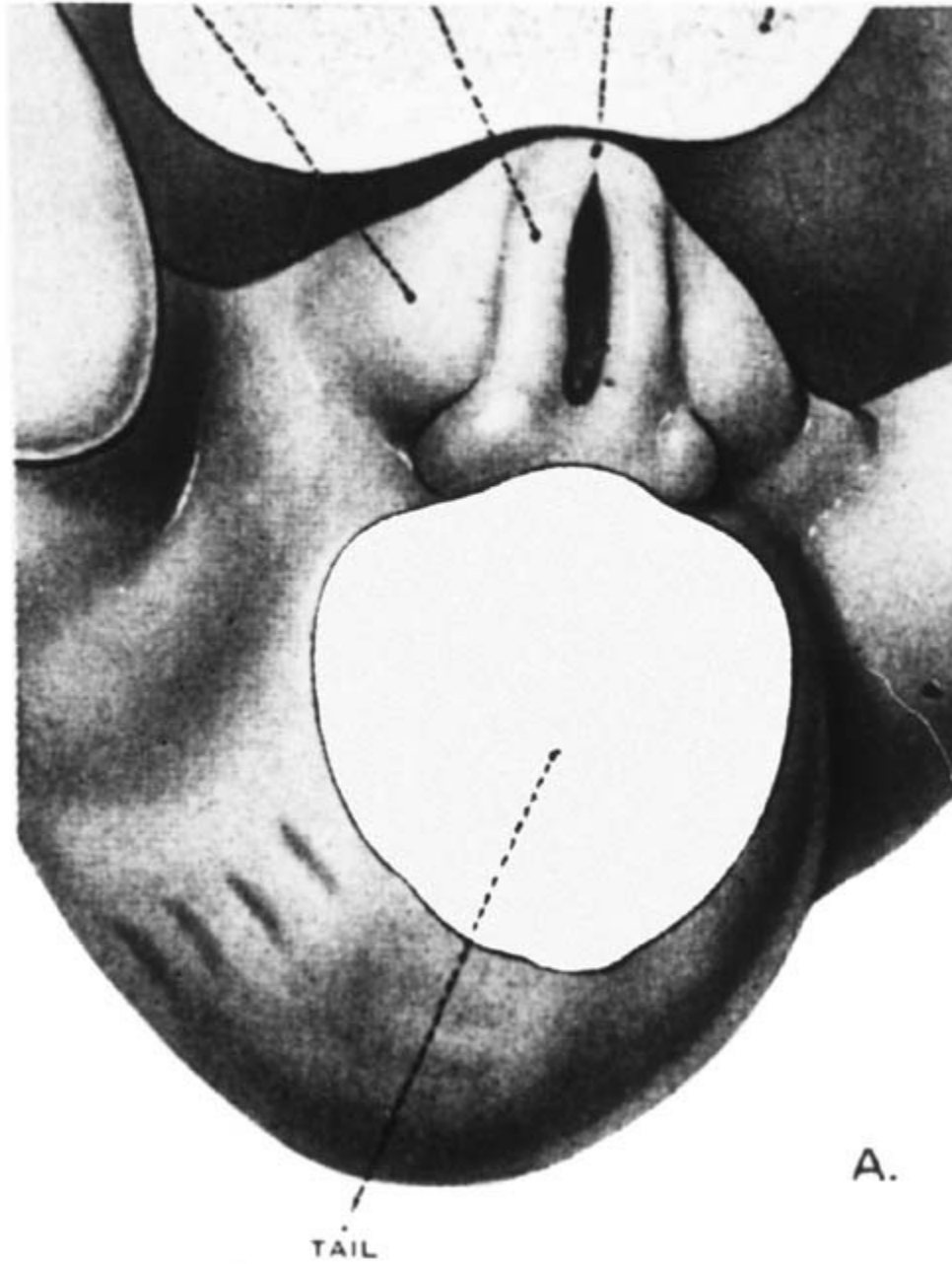
A.

GENITAL  
SWELLING

URETHRAL  
FOLD

GENITAL  
TUBERCLE

UMBILICAL  
CORD



A.

TAIL

# Repetition of blood

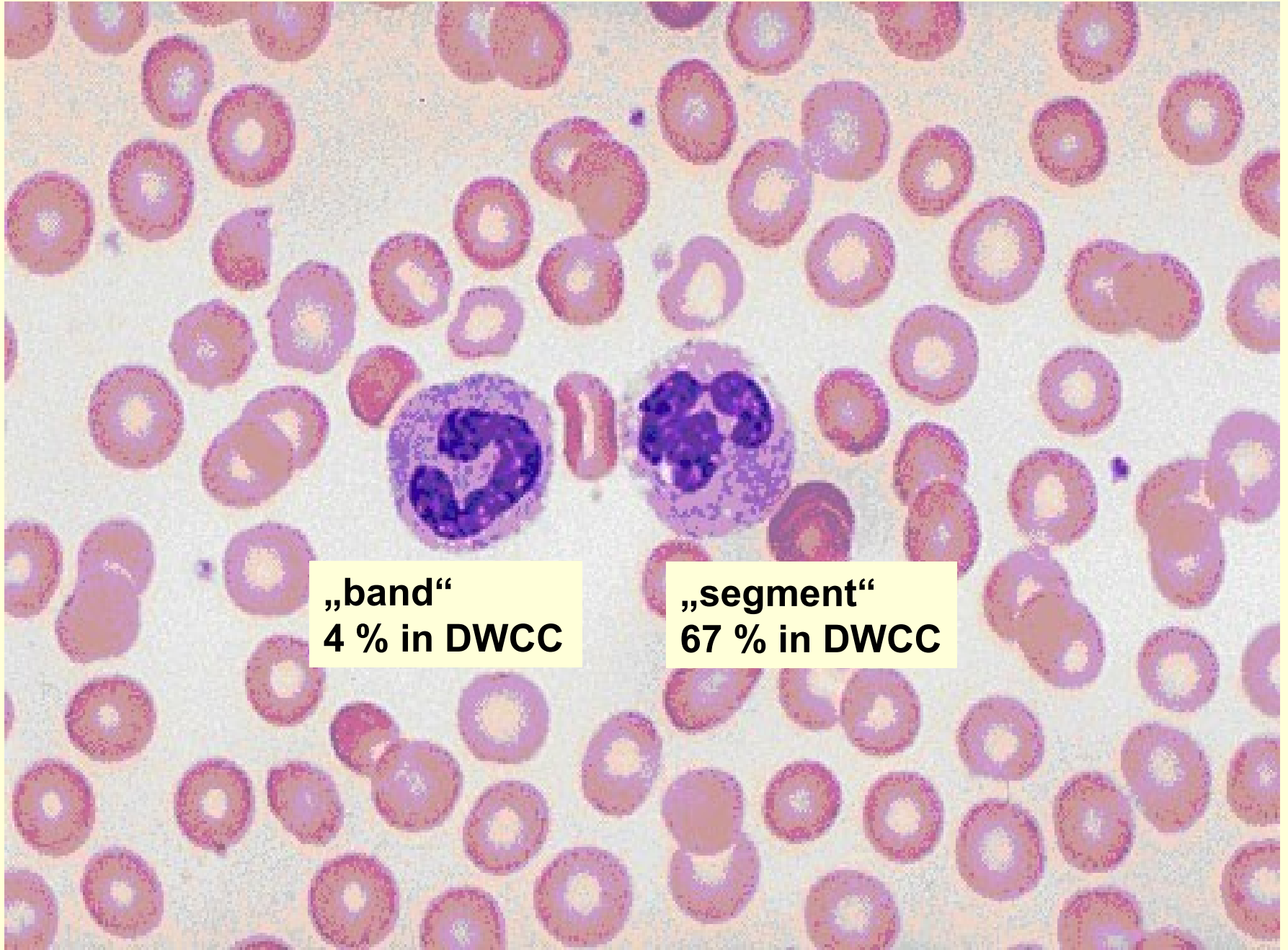
- Composition of the blood
- Hematocrit
- Hemoglobin
- Erythrocytes – shape, size, density per 1  $\mu\text{l}$
- Reticulocytes
- Anisocytosis
- Poikilocytosis
- Polycythemia (= polyglobulia)



- 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) !!!
- Shift to the left or to the right

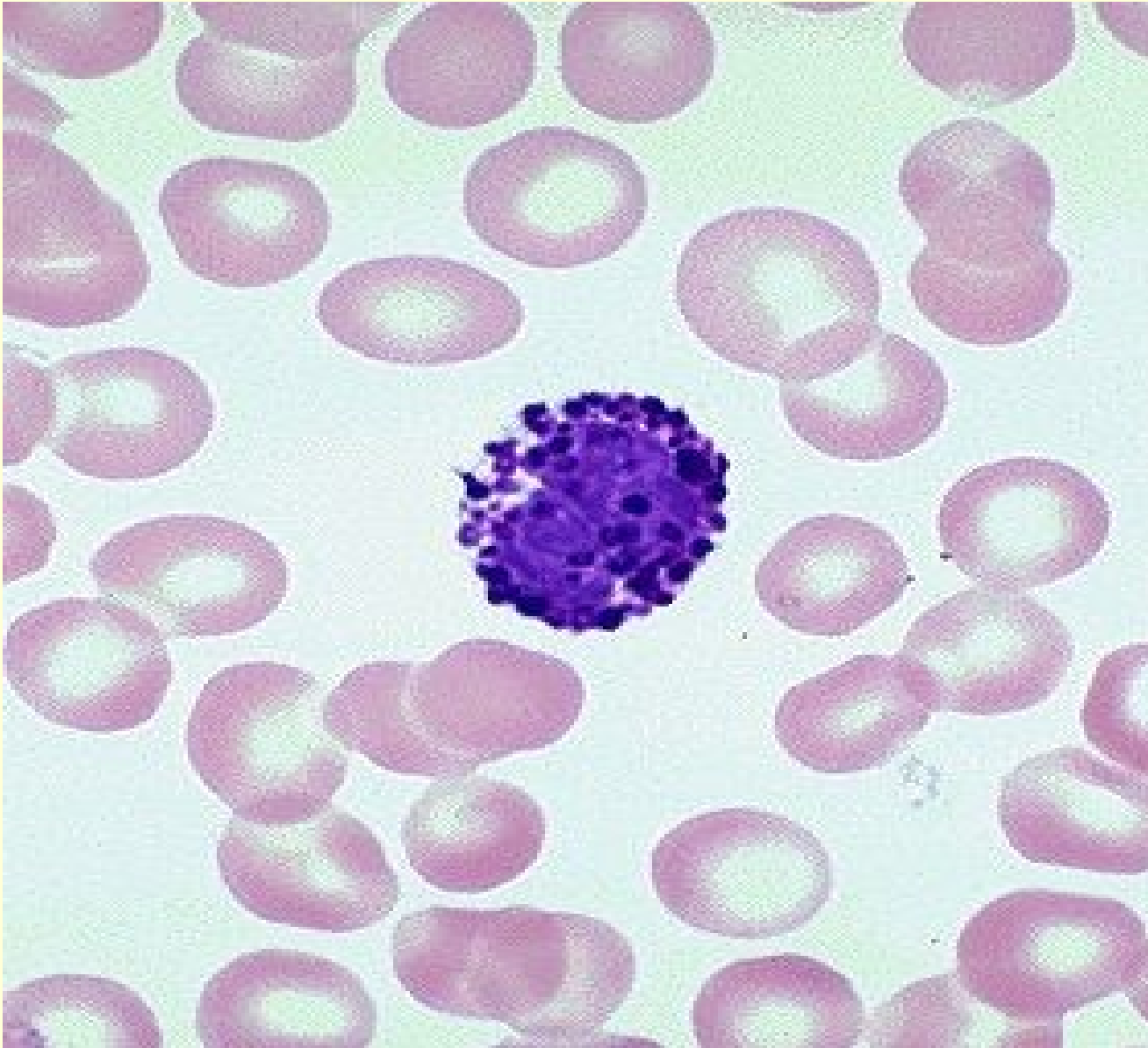
**Neutrophilic granulocytes: 10-12  $\mu\text{m}$  in  $\emptyset$**



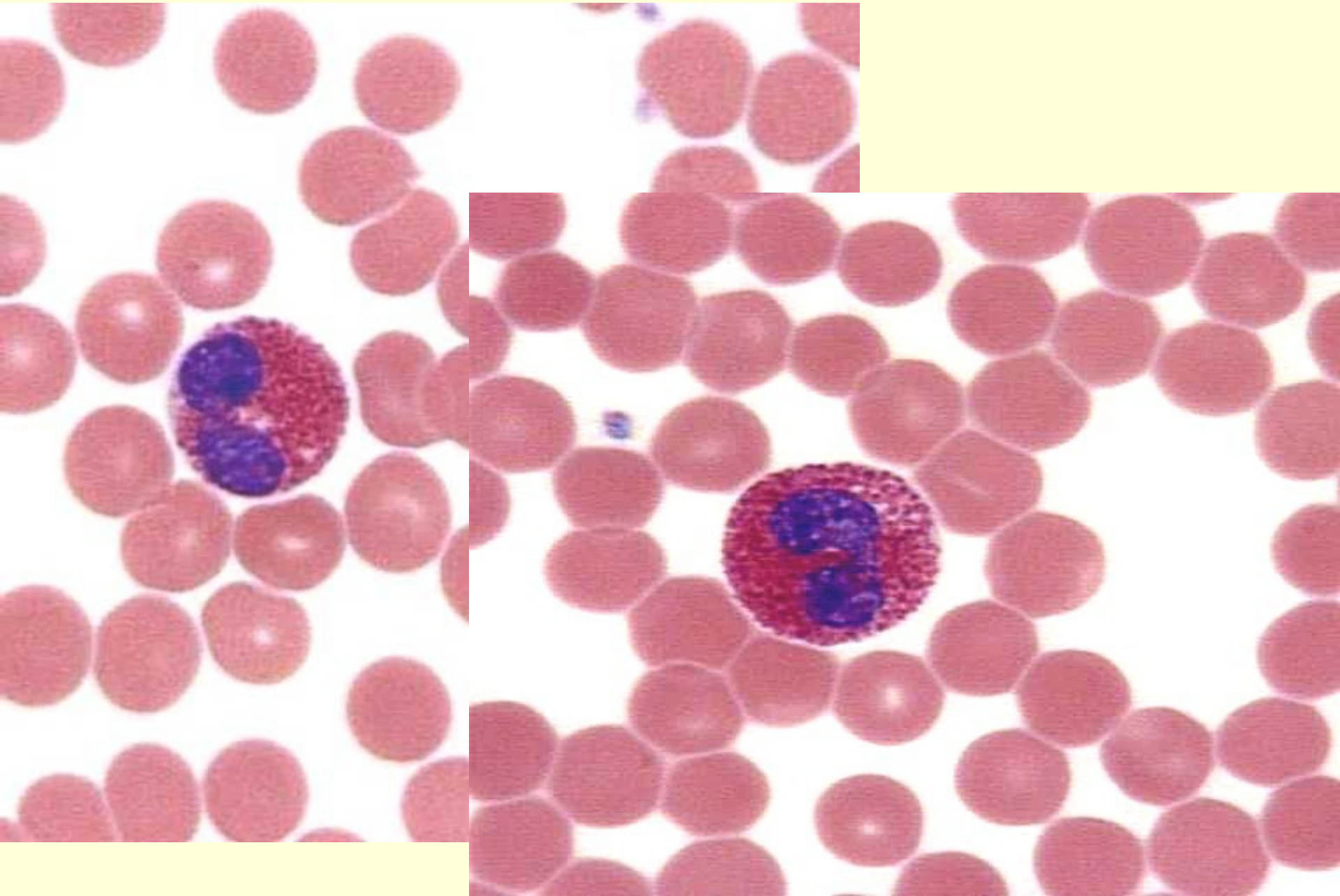
**„band“  
4 % in DWCC**

**„segment“  
67 % in DWCC**

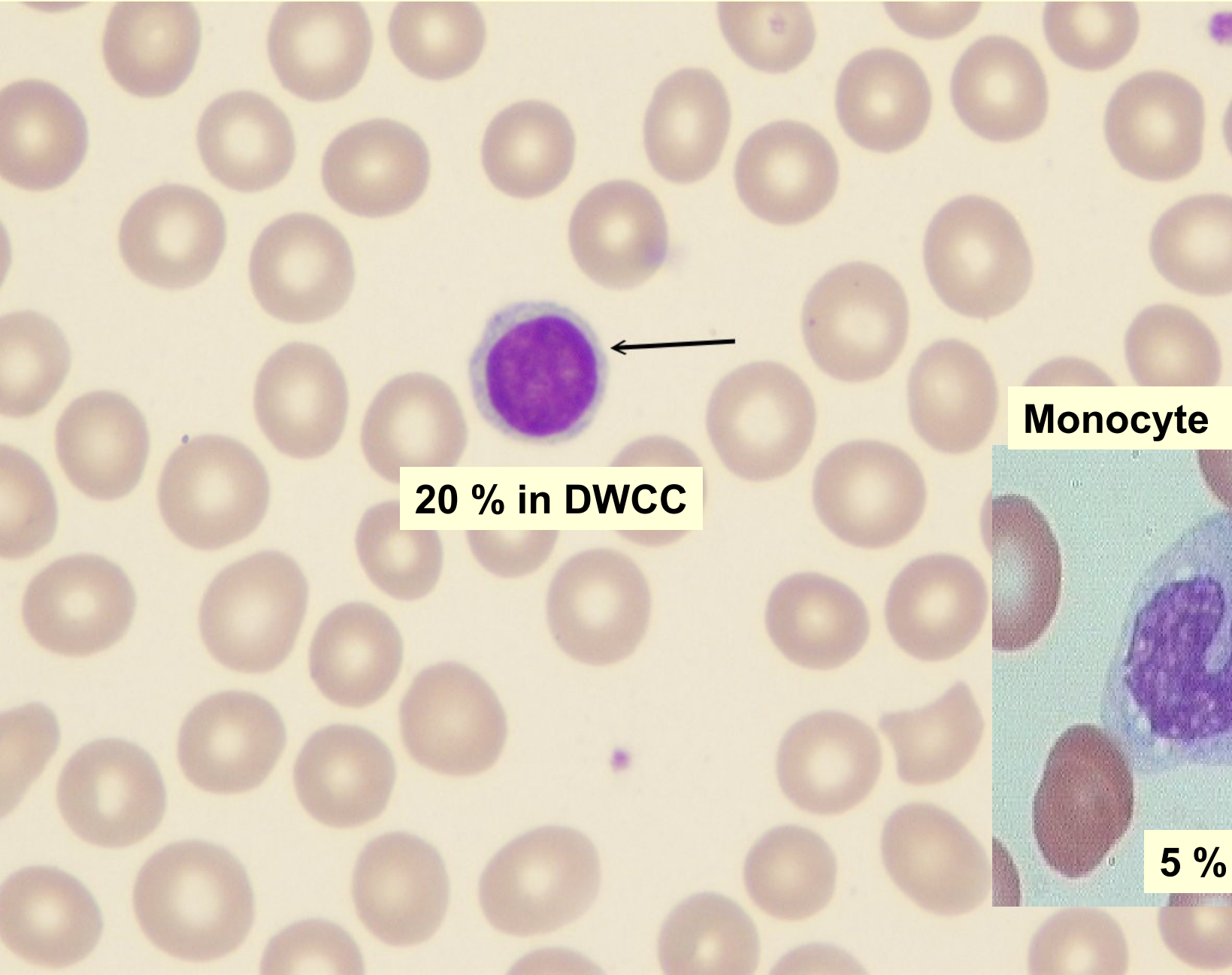
**Basophilic granulocyte: 8  $\mu\text{m}$  in  $\varnothing$ , only 1 % in DWCC**



**Eosinophilic granulocyte: up to 14  $\mu\text{m}$  in  $\varnothing$ , 3 % in DWCC**

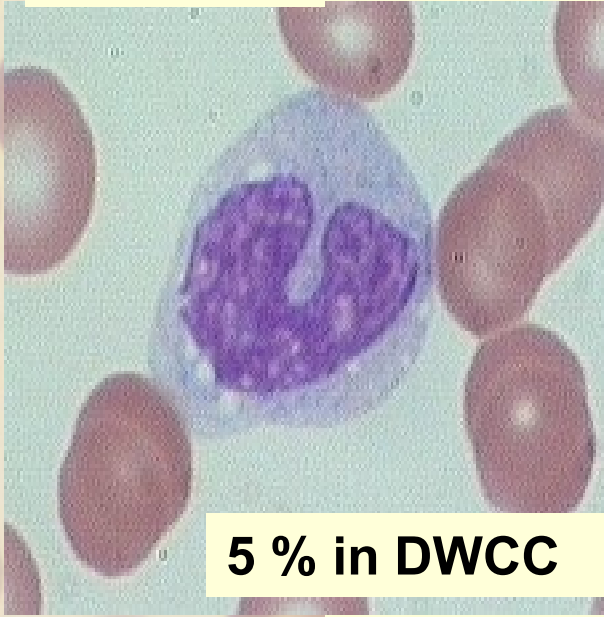


# Lymphocyte



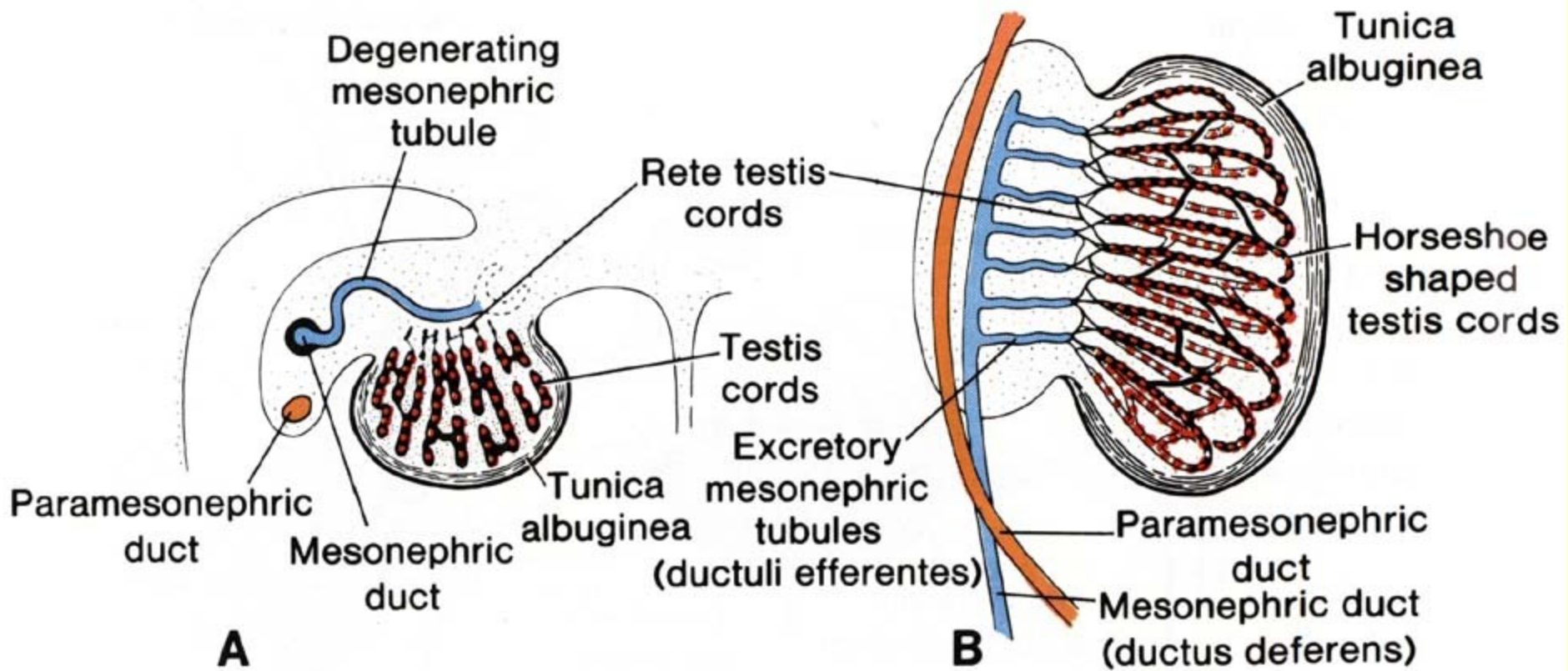
**20 % in DWCC**

# Monocyte

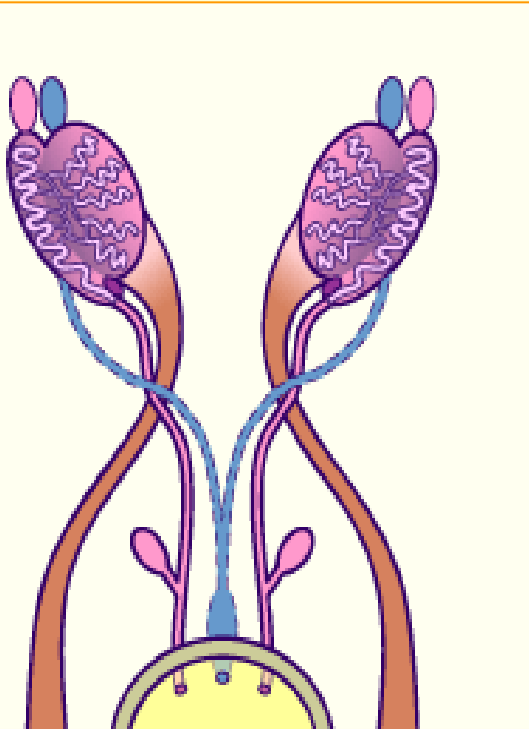
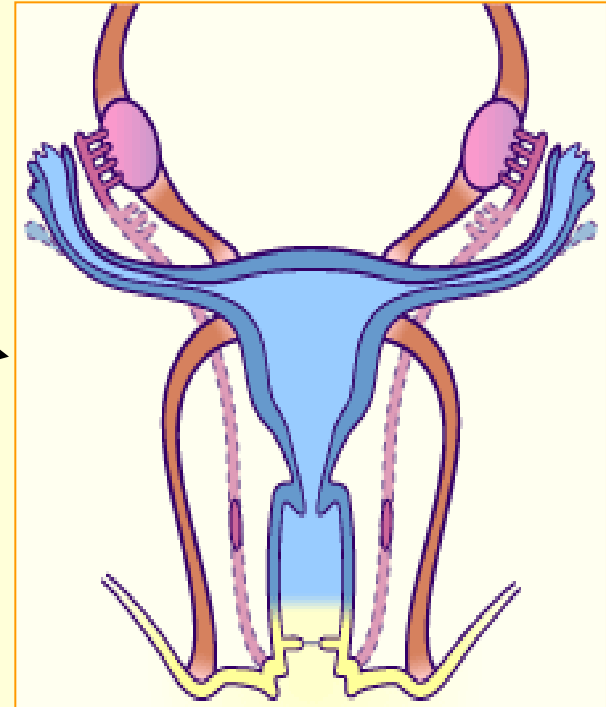
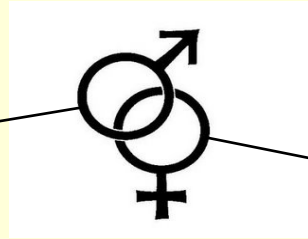
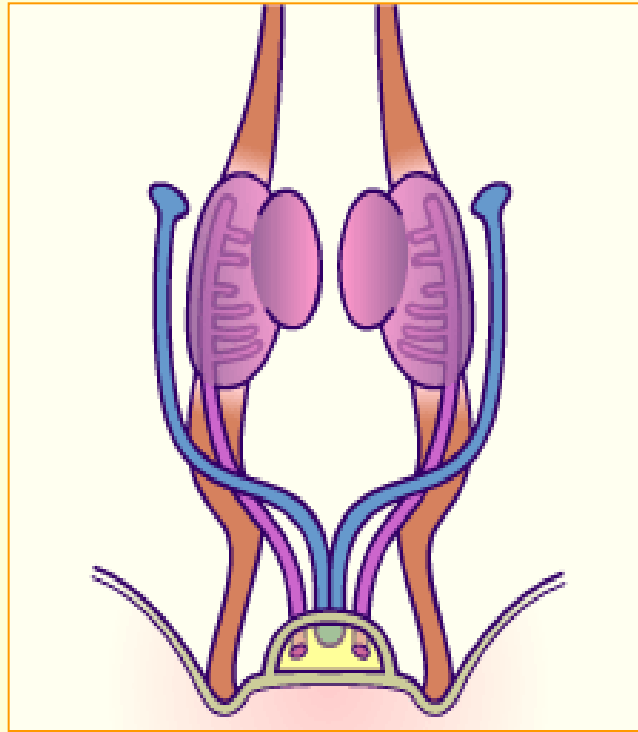


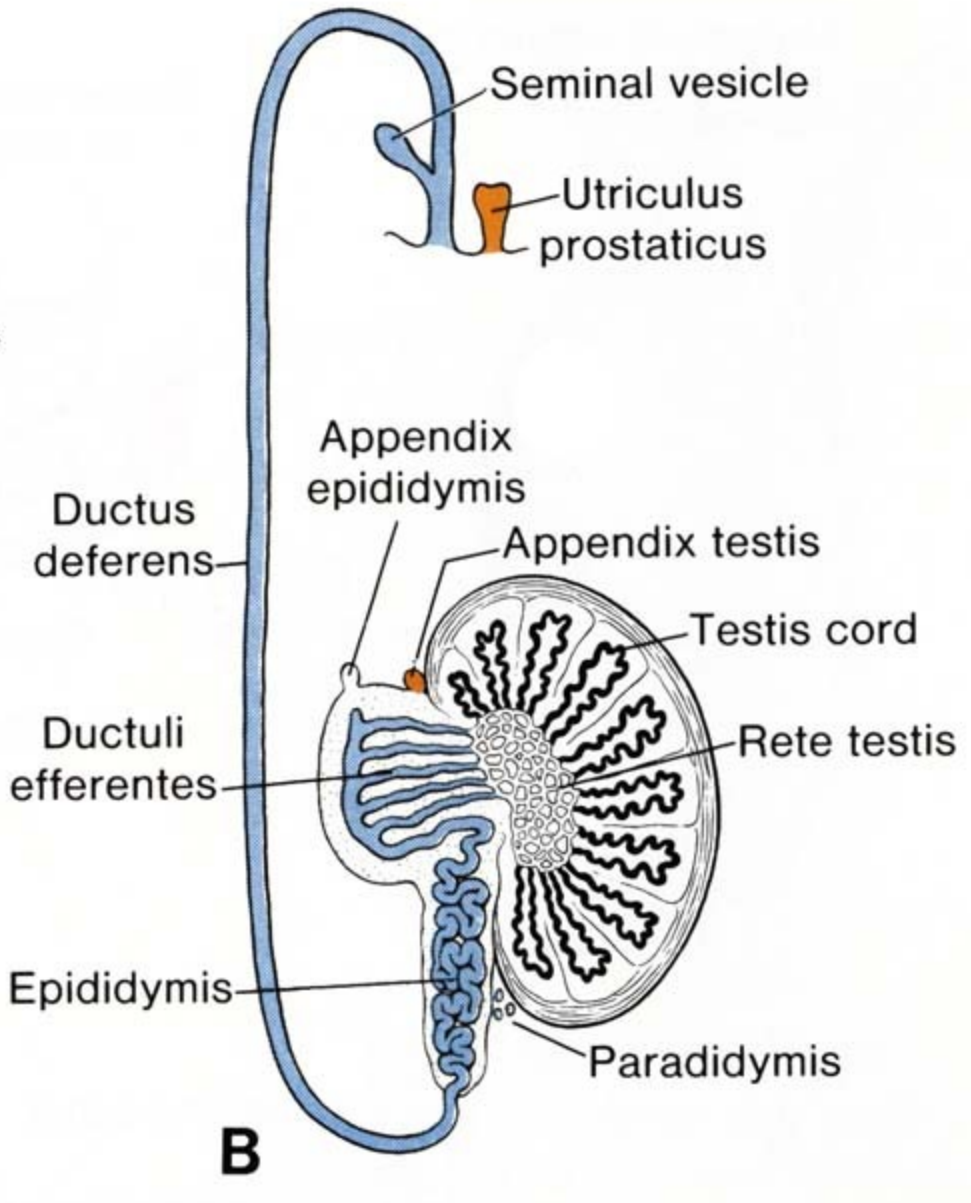
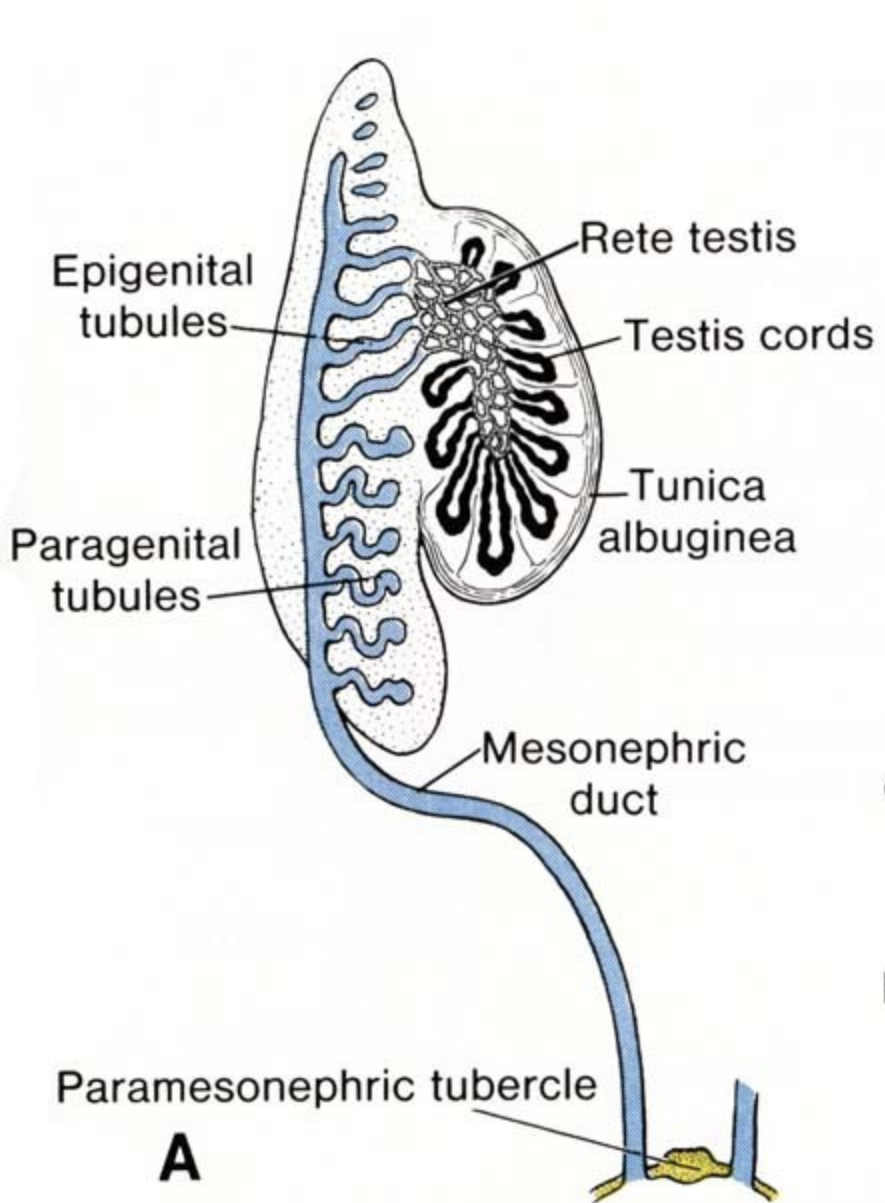
**5 % in DWCC**

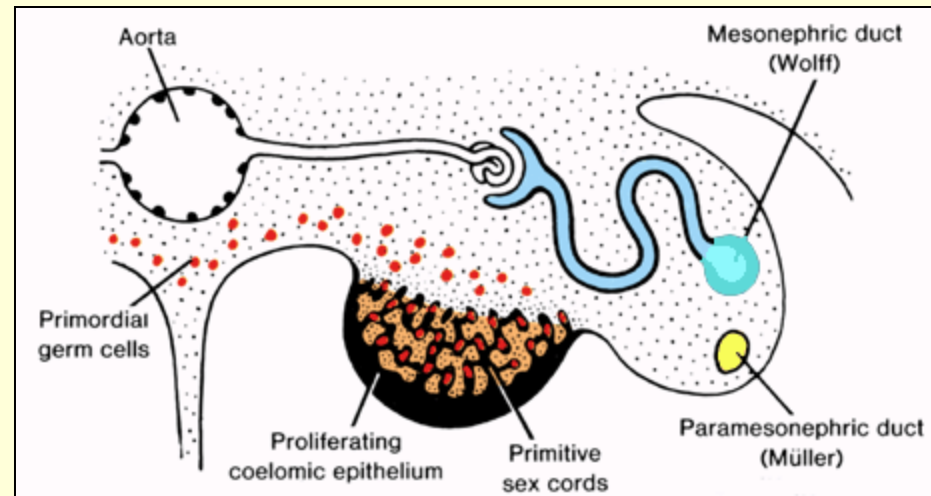
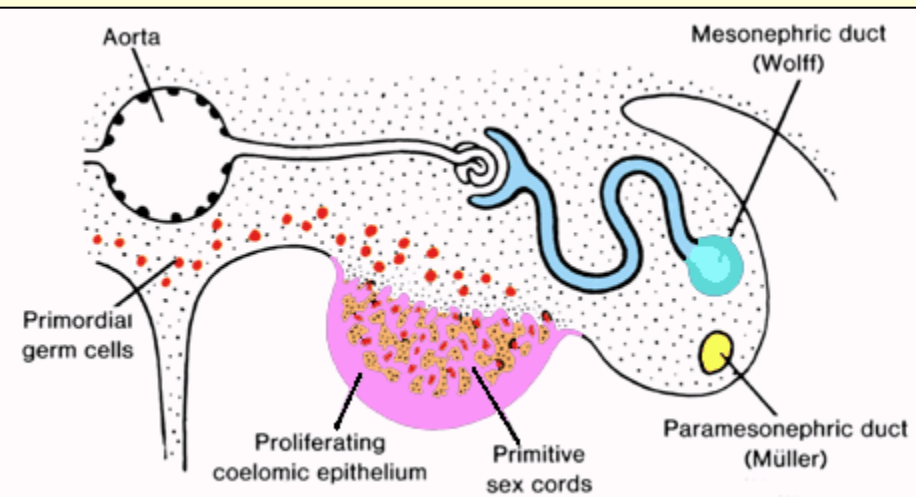
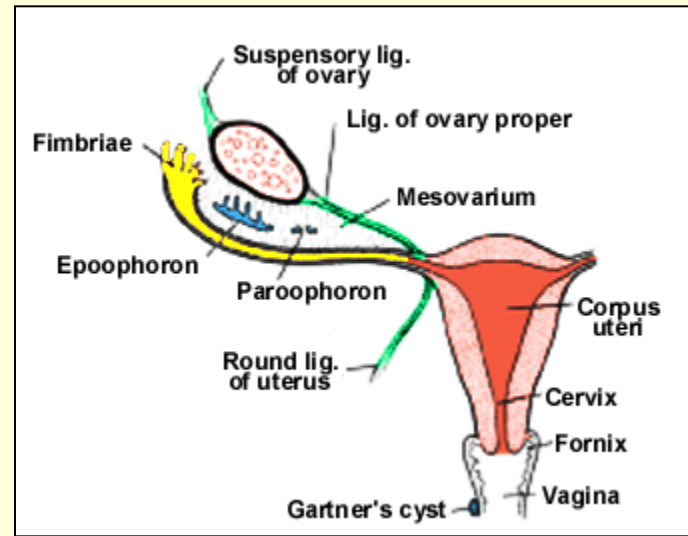
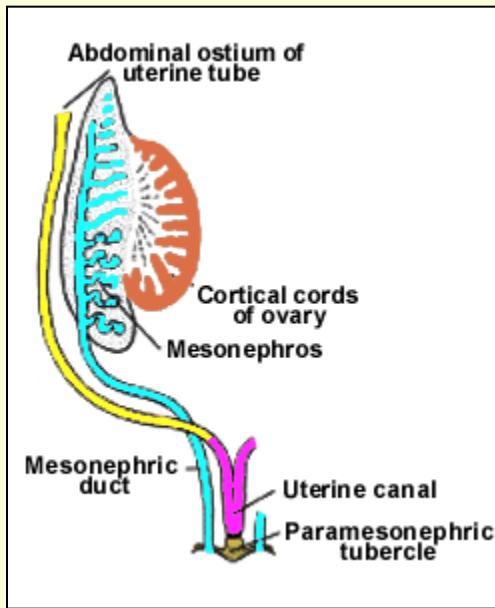


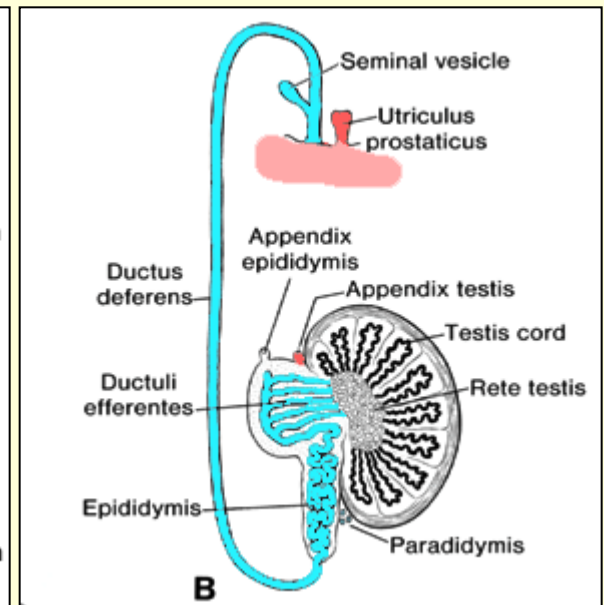
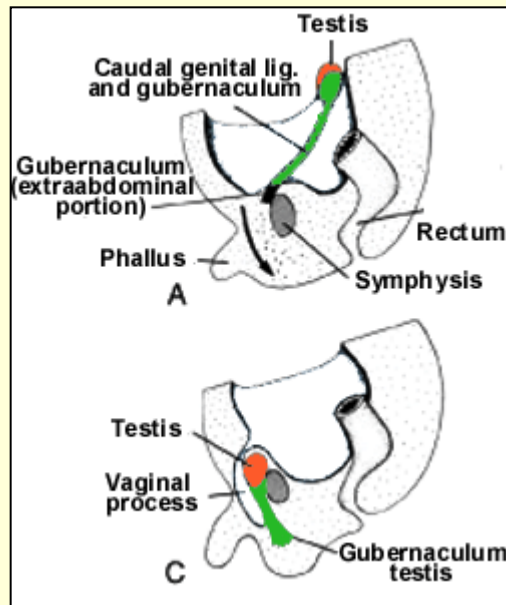
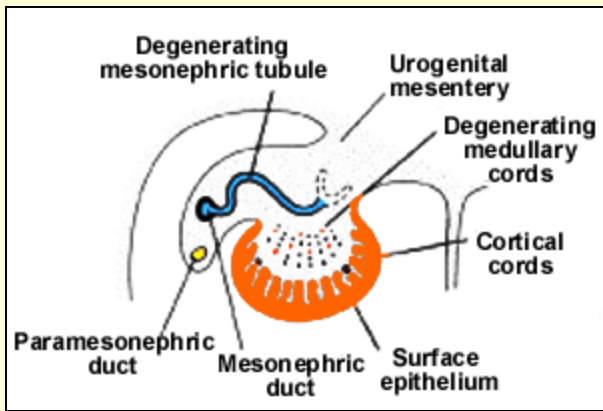
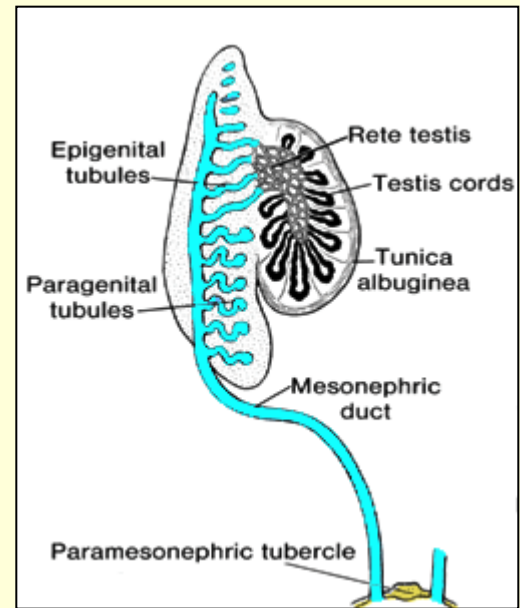
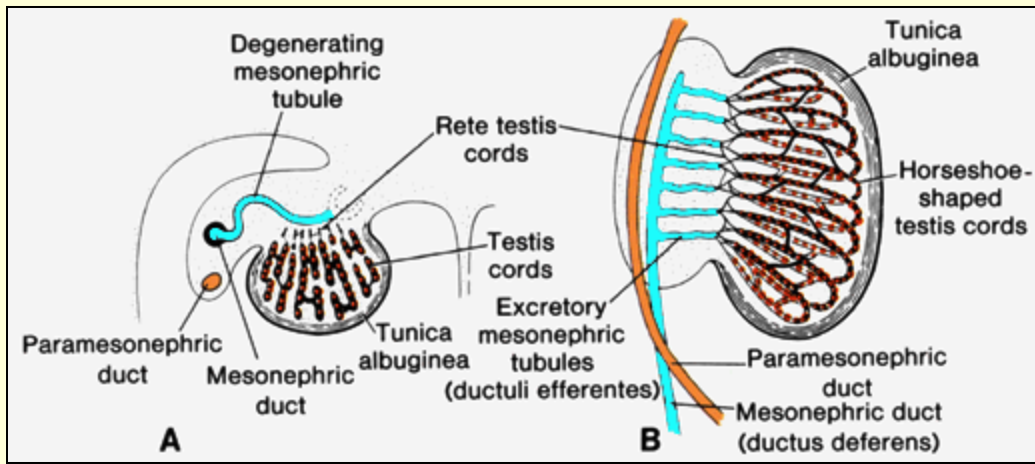


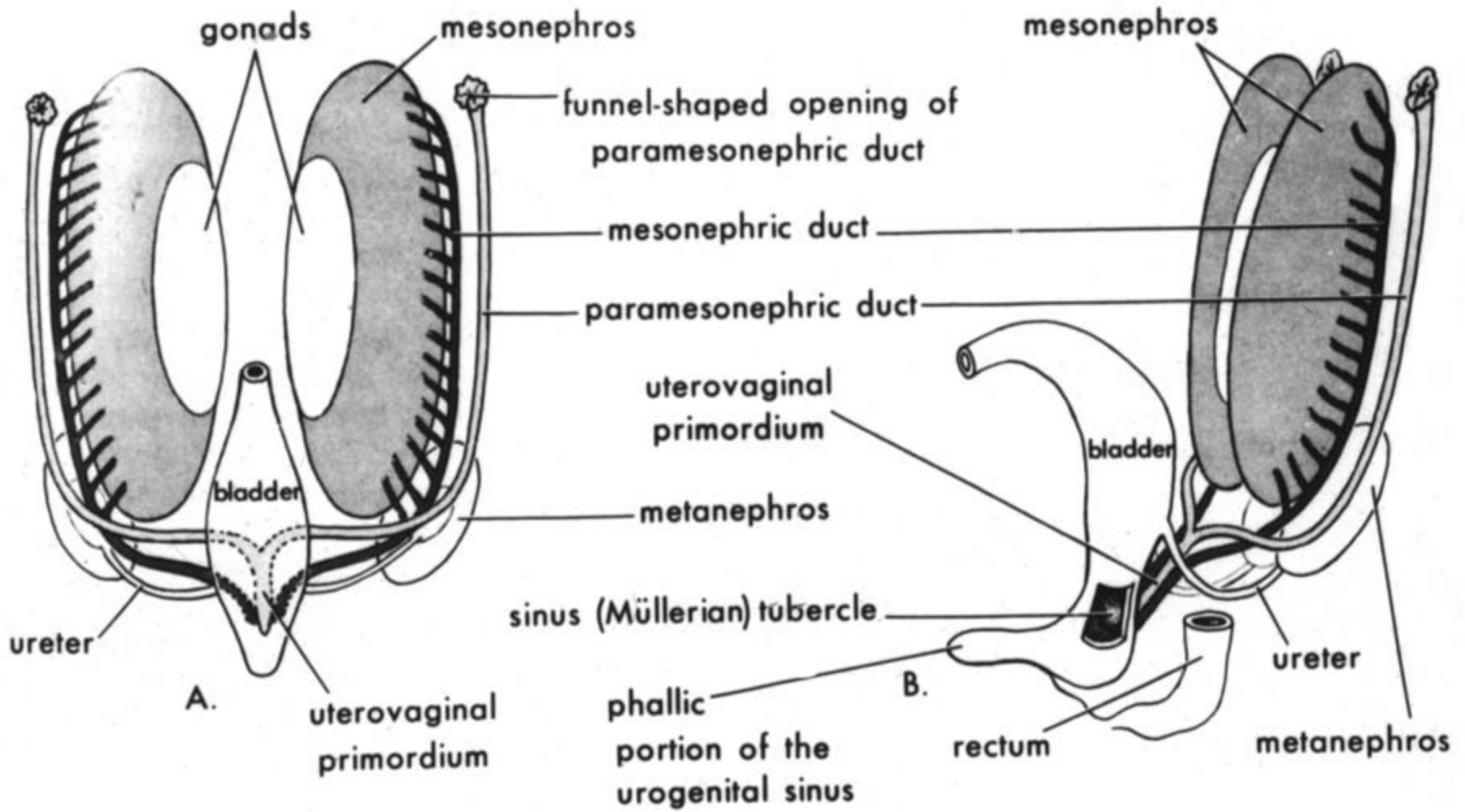


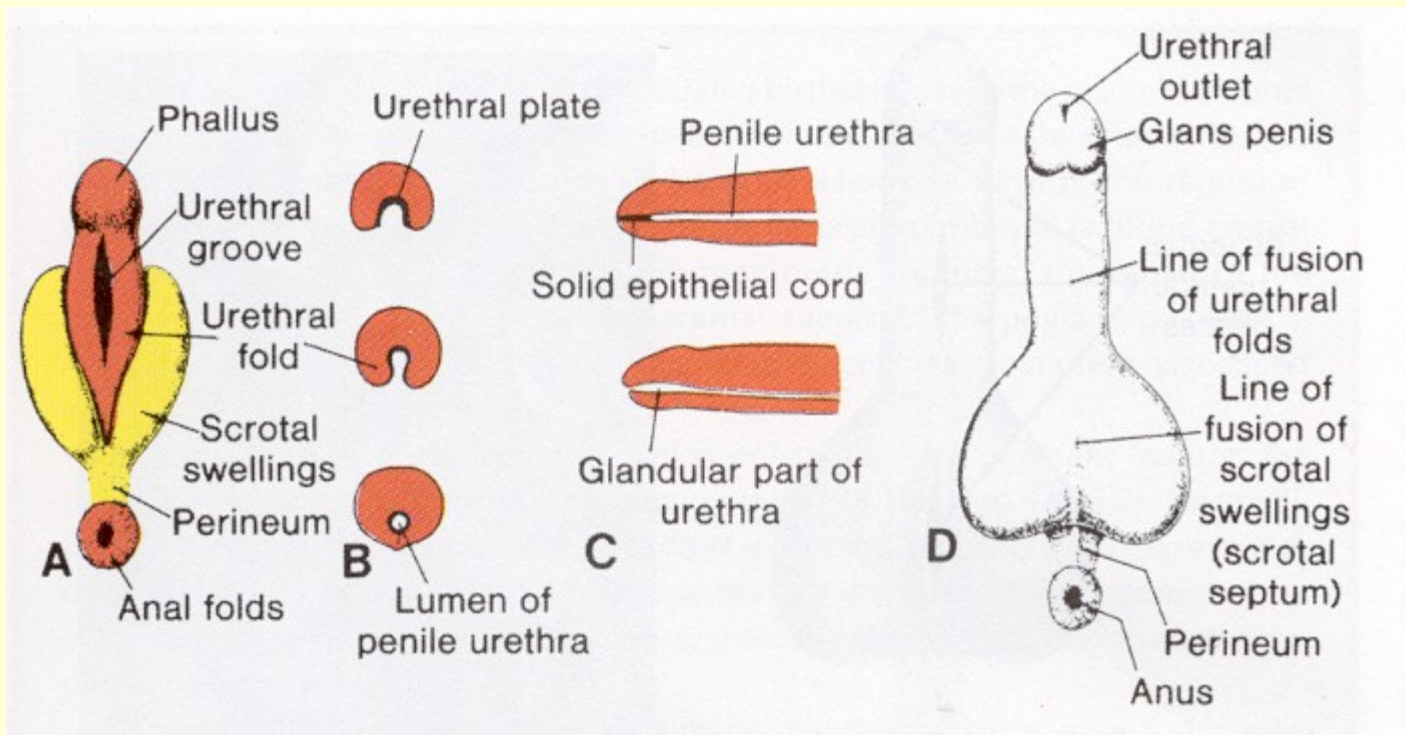
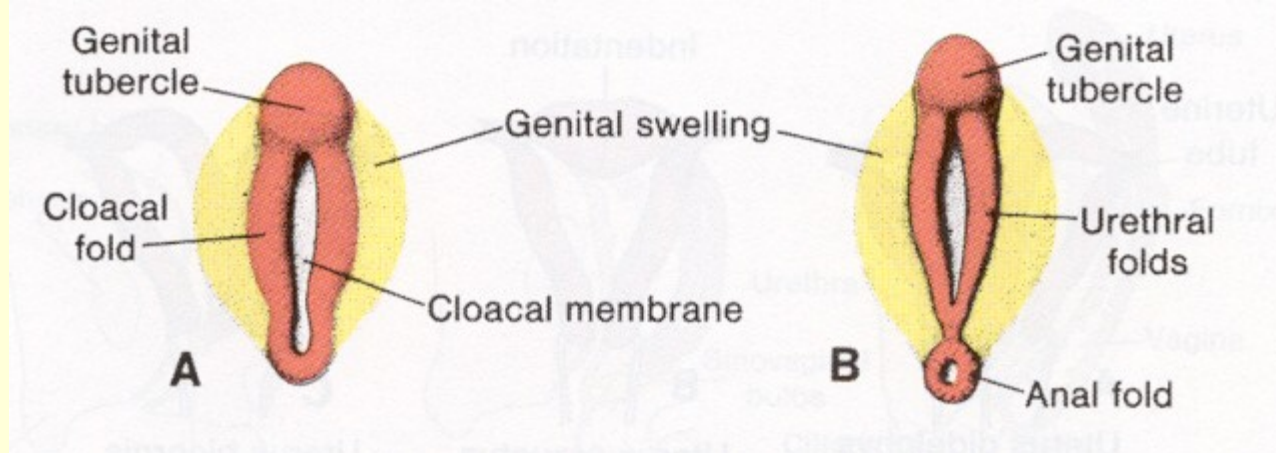


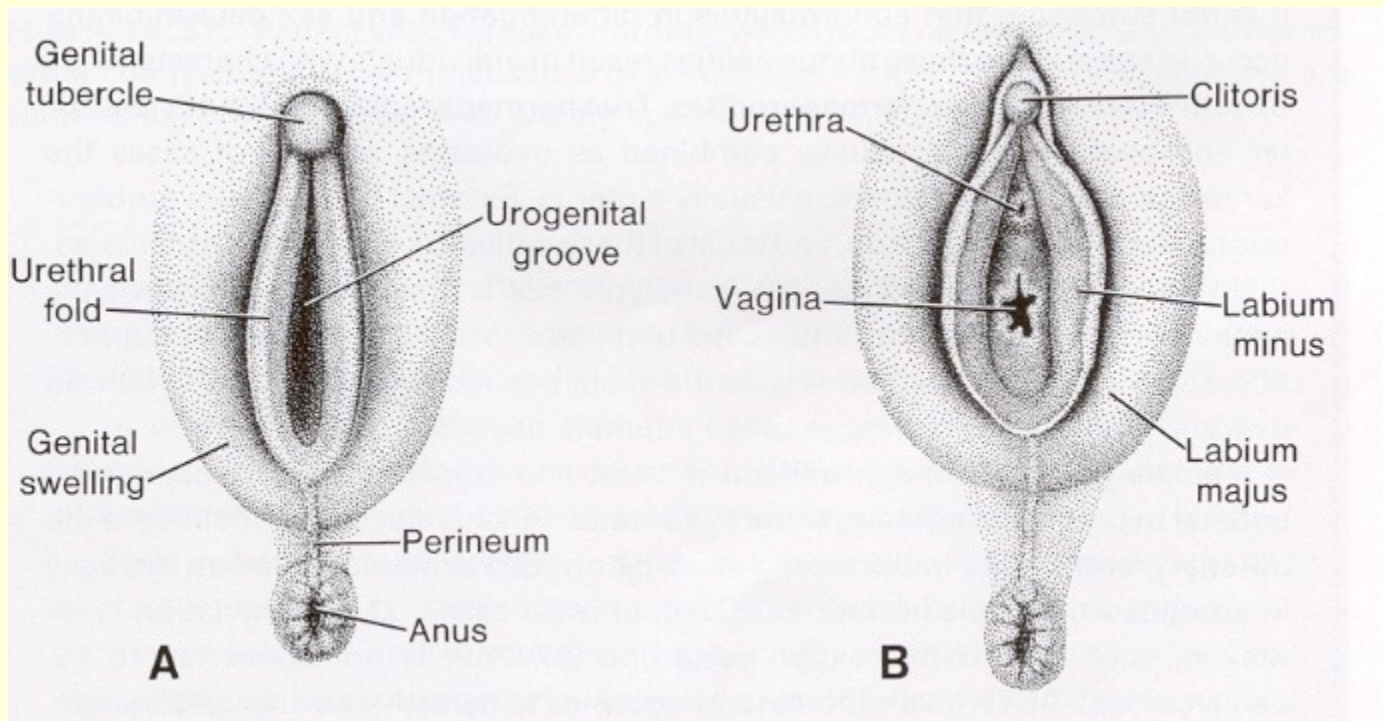










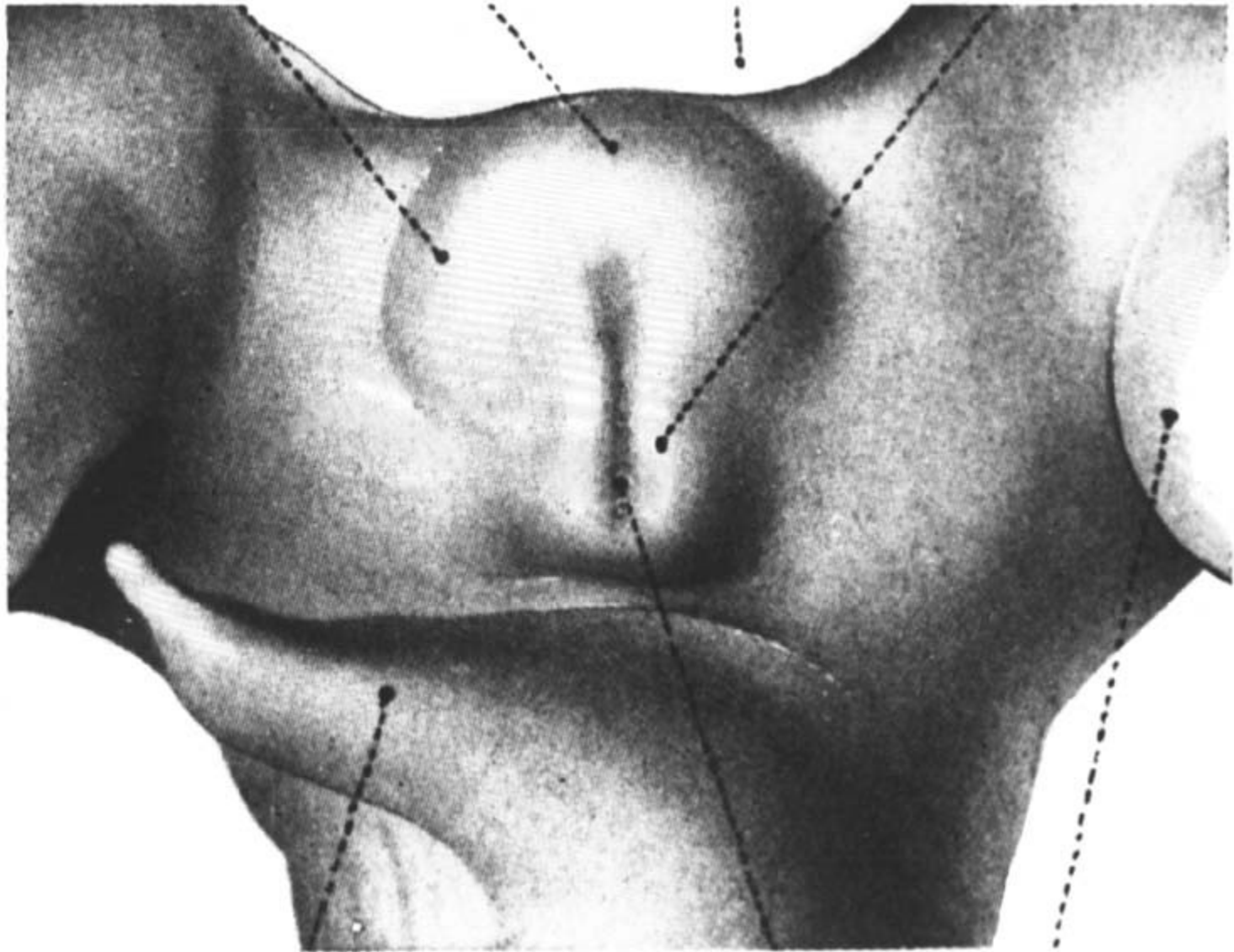


GENITAL  
SWELLING

GENITAL  
TUBERCLE

UMBILICAL  
CORD

URETHRAL  
FOLD

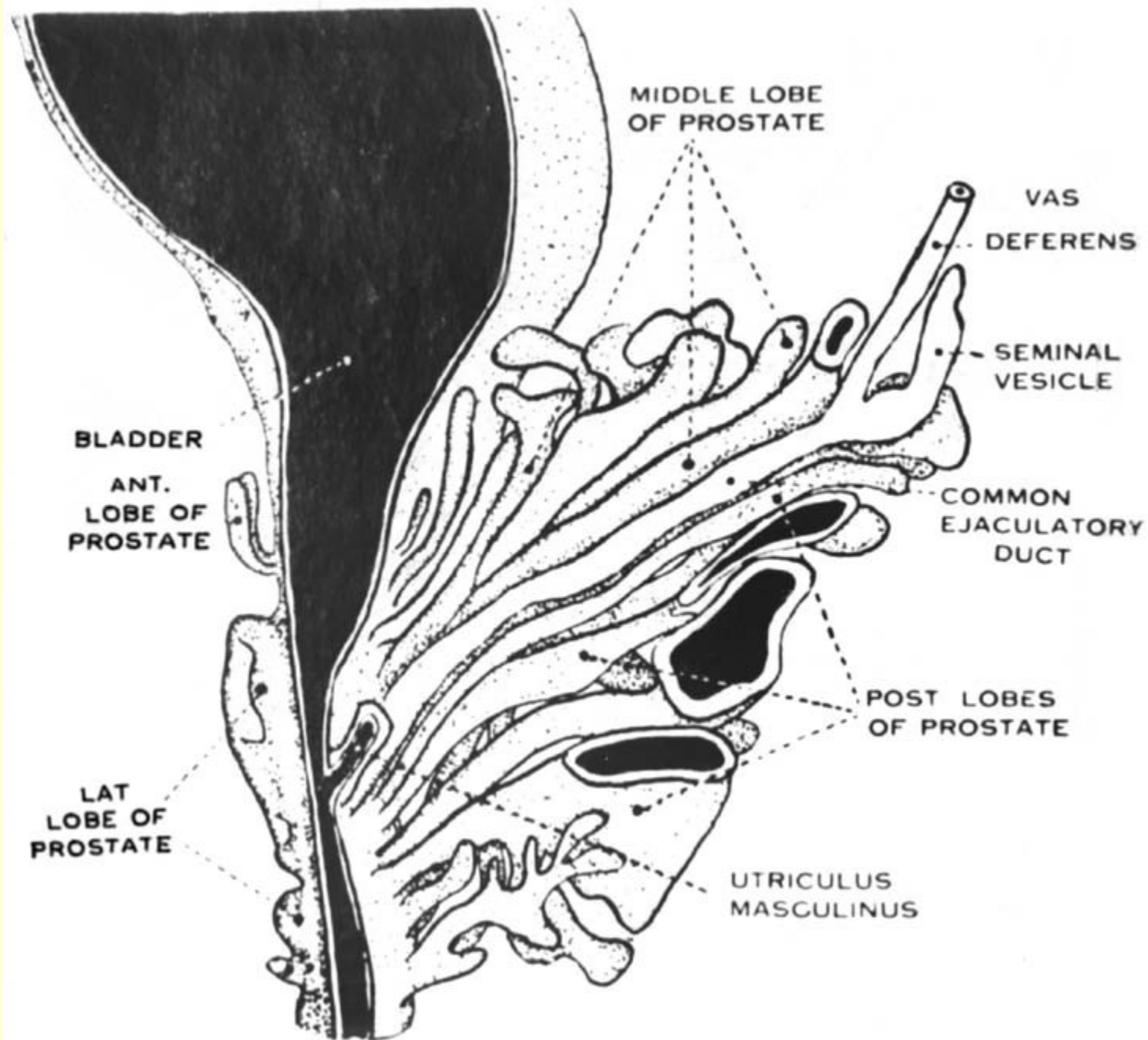


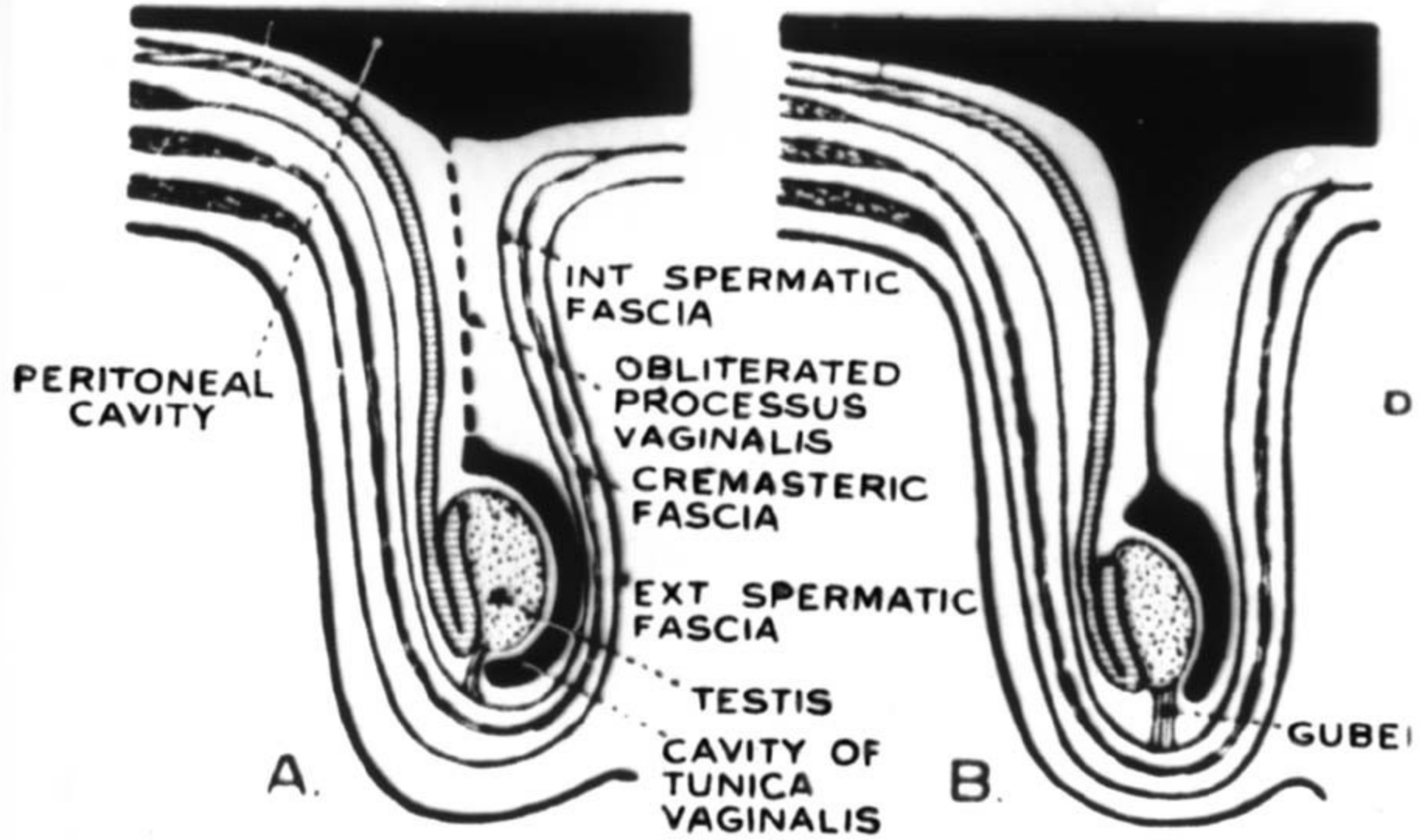
TAIL

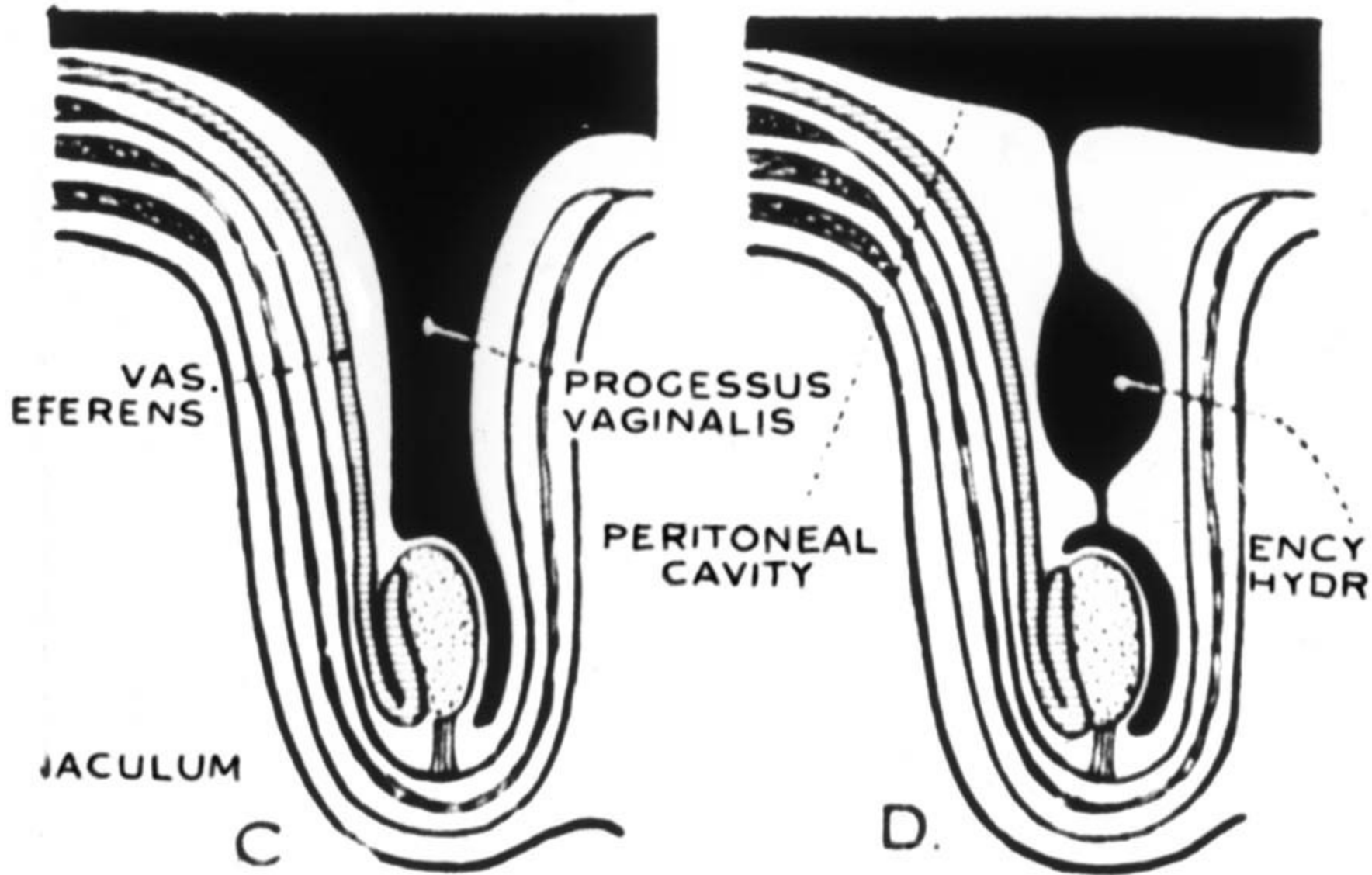
CLOACAL  
MEMBRANE

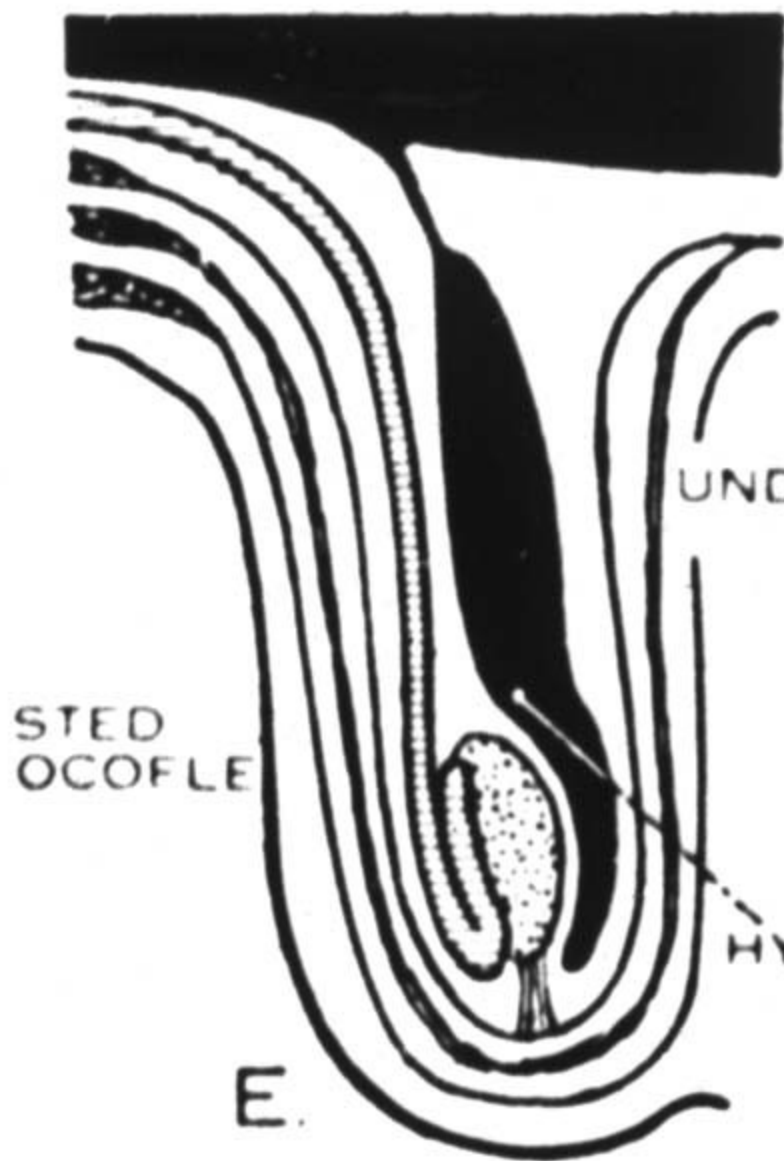
HIND  
LIMB





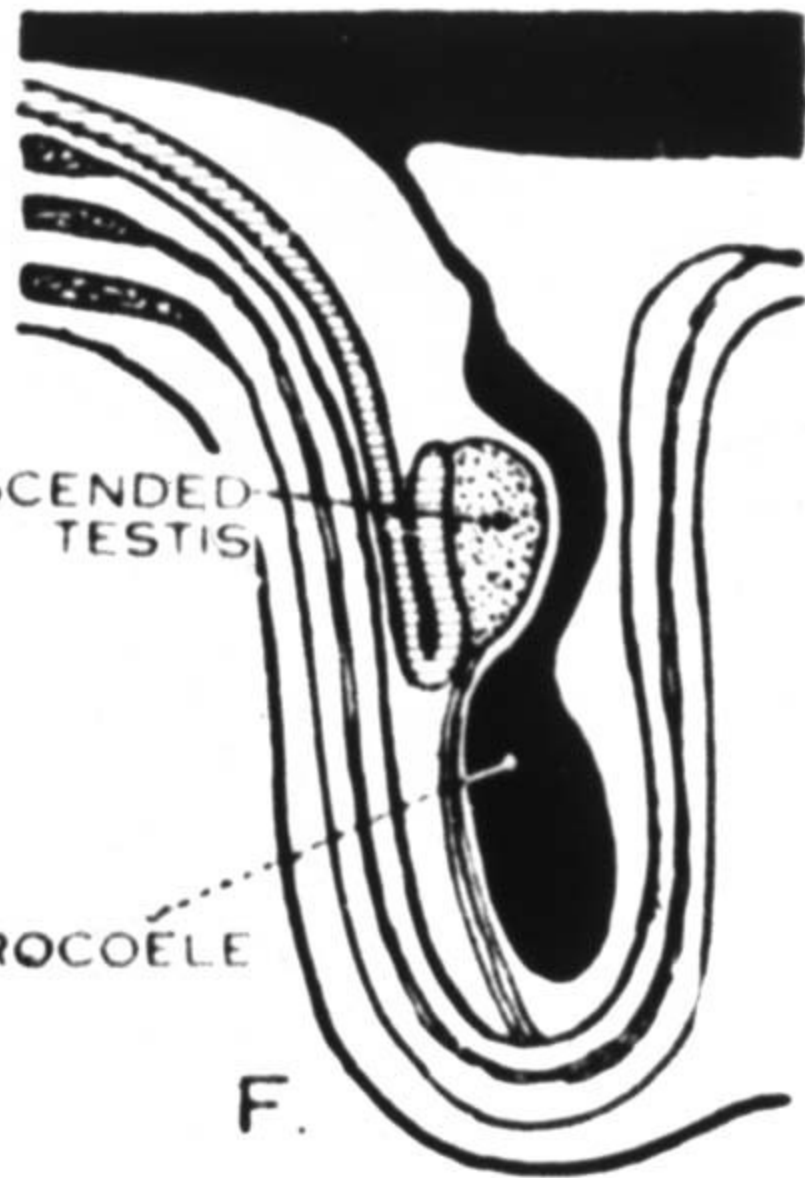






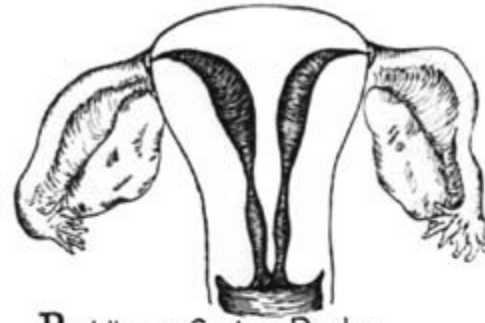
UNDESCENDED  
TESTIS

HYDROCOELE





A. Uterus Subseptus Unicollis



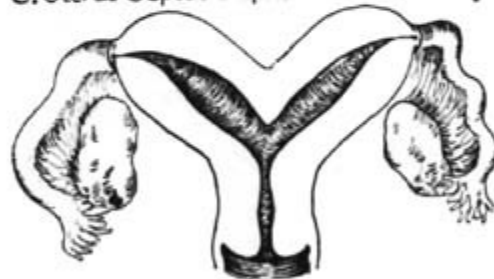
B. Uterus Septus Duplex



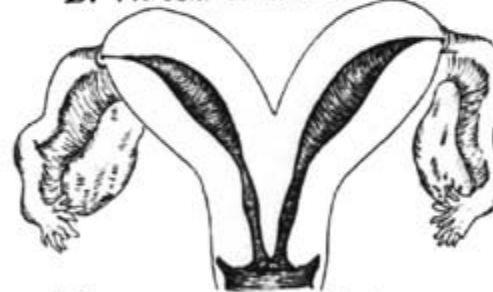
C. Uterus Septus Duplex with Double Vagina



D. Atresia at Level of Cervix



E. Uterus Bicornis Unicollis



F. Uterus Bicornis Septus

