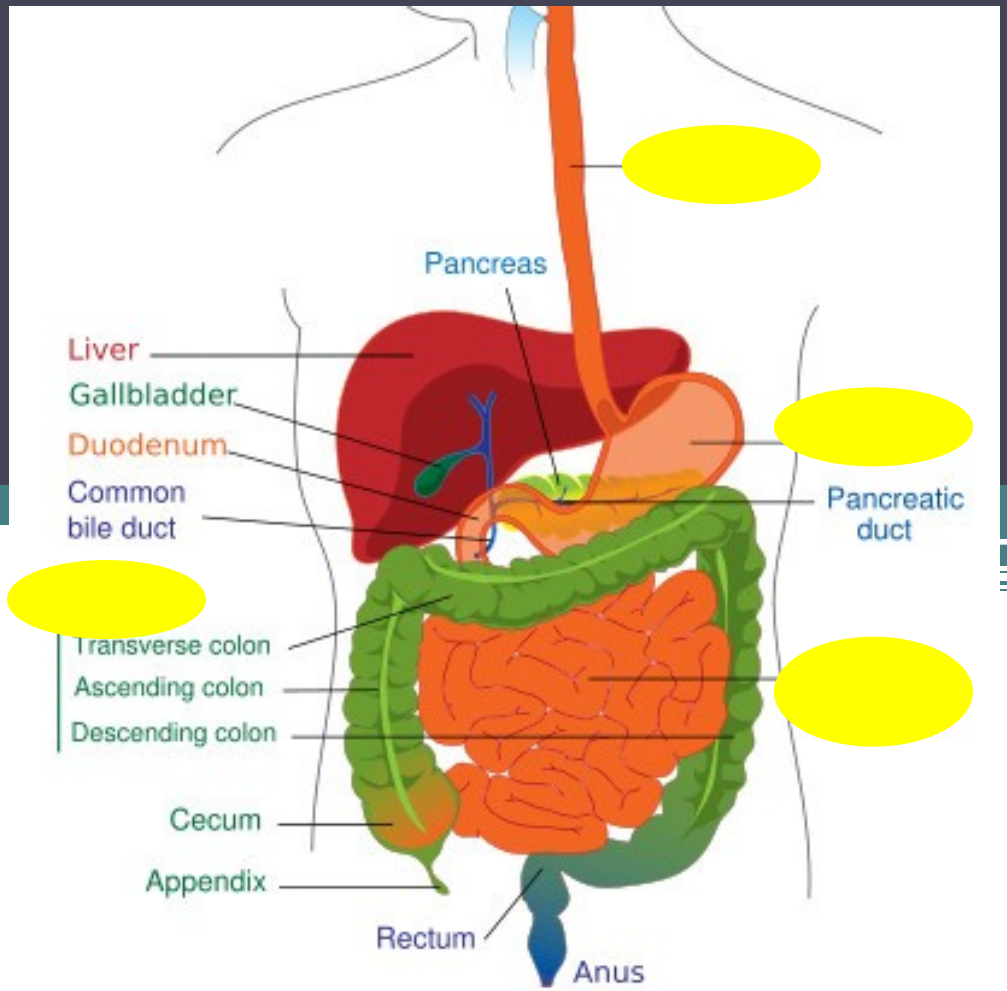
Gastrointenstinal system



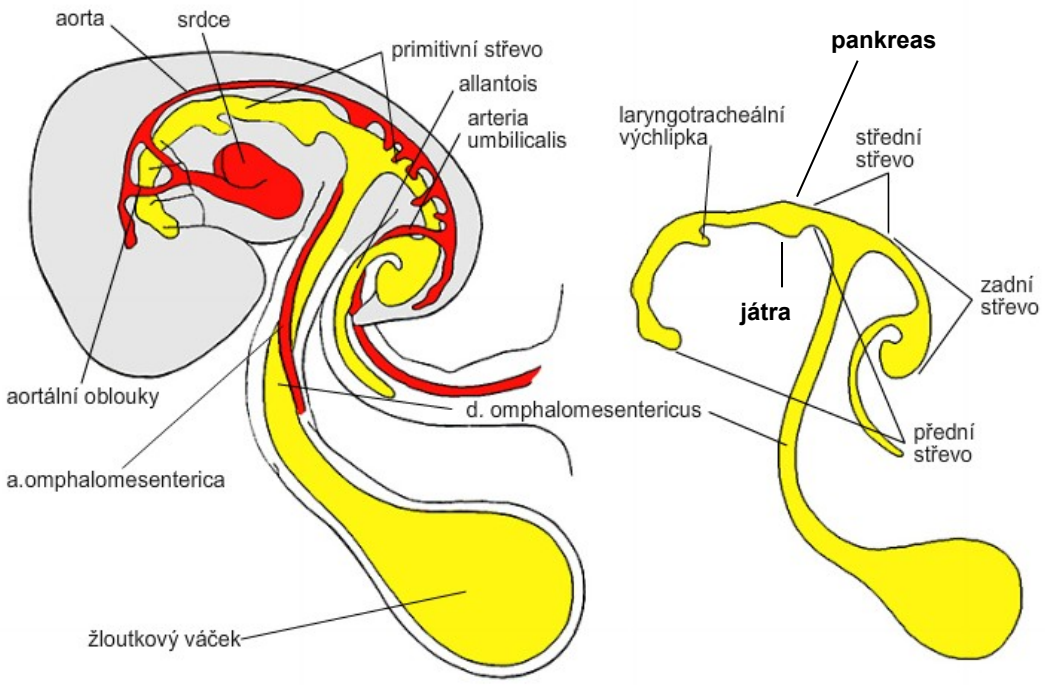
http://www.gistsupport.org/about-gist/what-is-gist.php

Endodermal origin – epithelium - mucose

Mezoderm of splanchnopleura – other layers

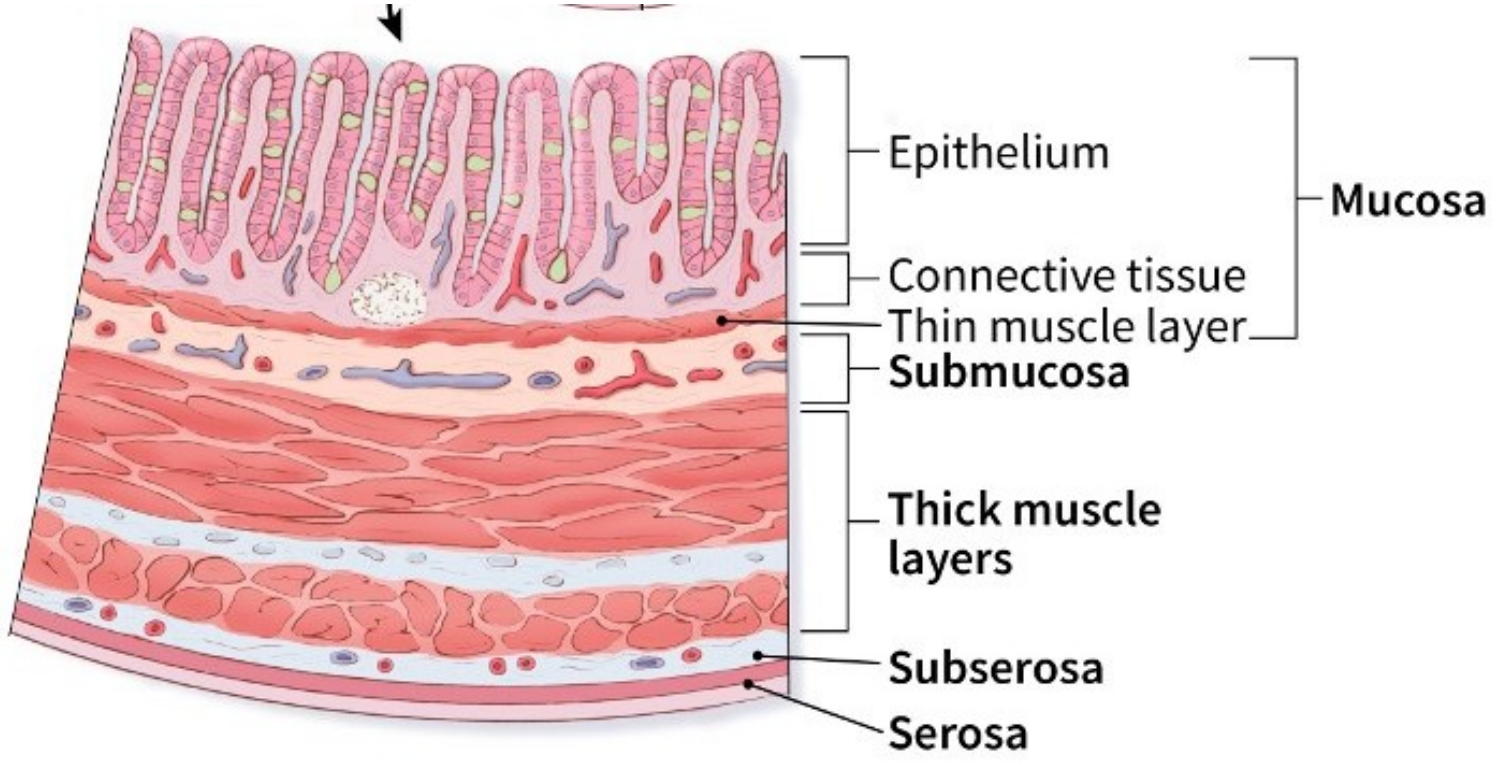
Origin of primitive intestine

http://www.youtube.com/watch?v=qMnpxP6EeIY&feature=related

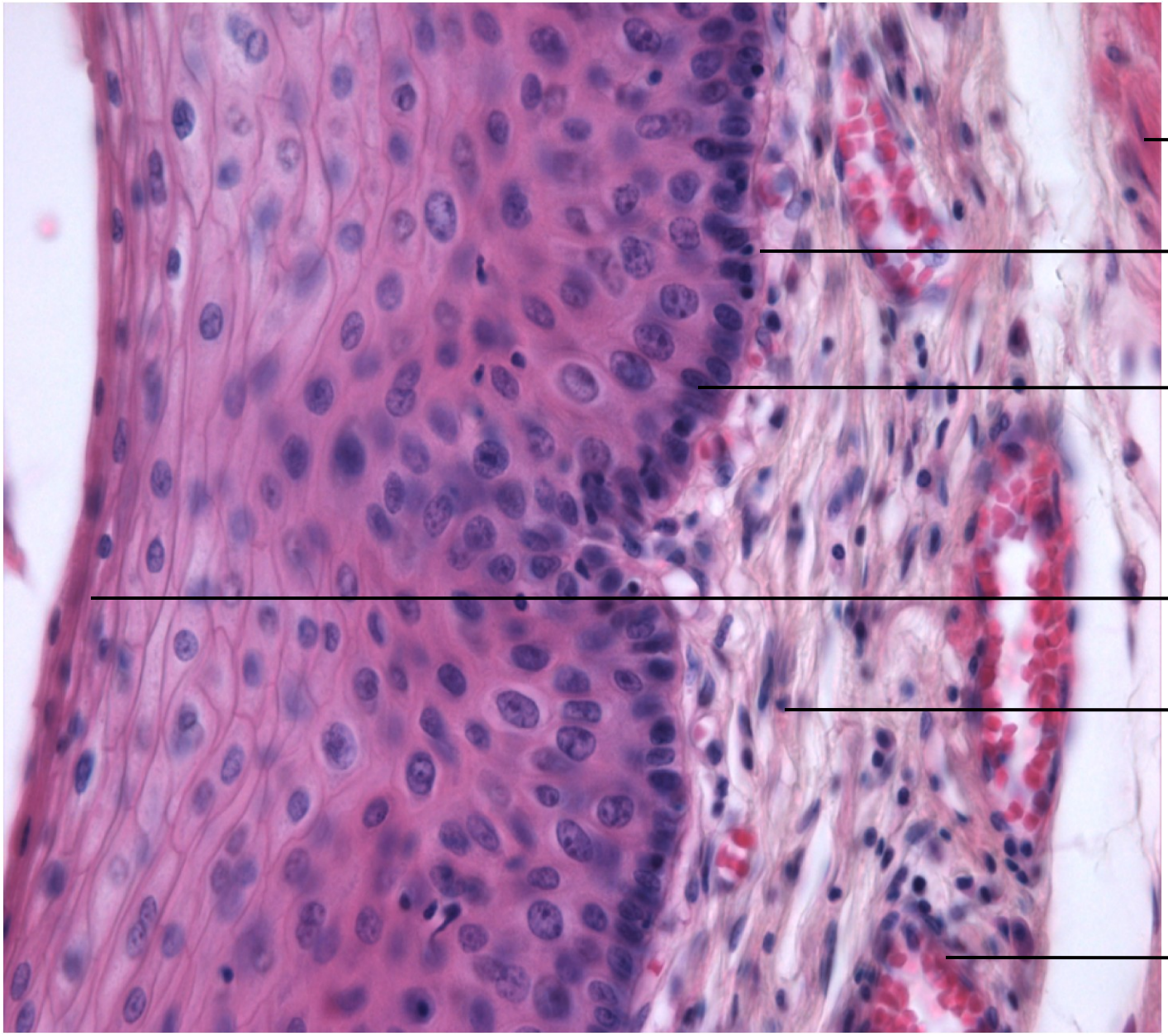


http://www.med.muni.cz/histol/MedAtlas_3/bin-release/MedAtlas.html#app=d8c4&92c7-selectedIndex=3&2b7a-selectedIndex=0

Intestinal layers

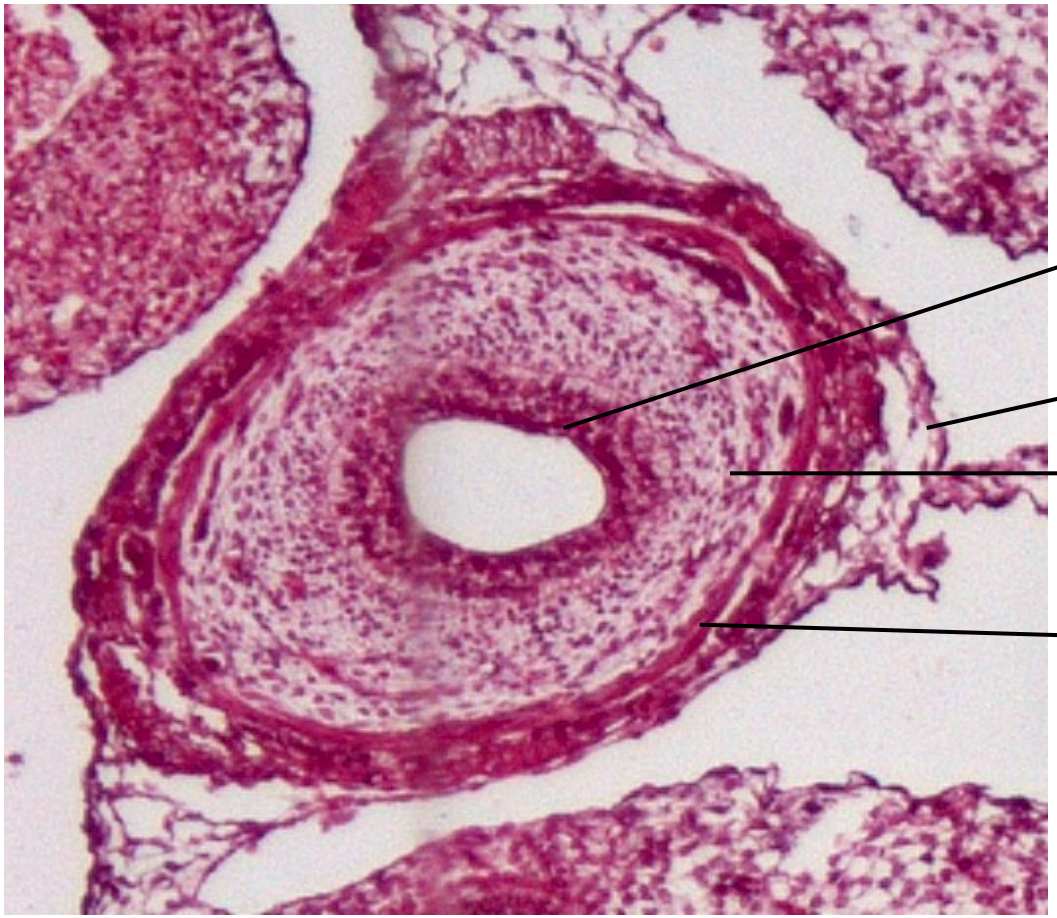


Oesophagus, adult



Magn. x40

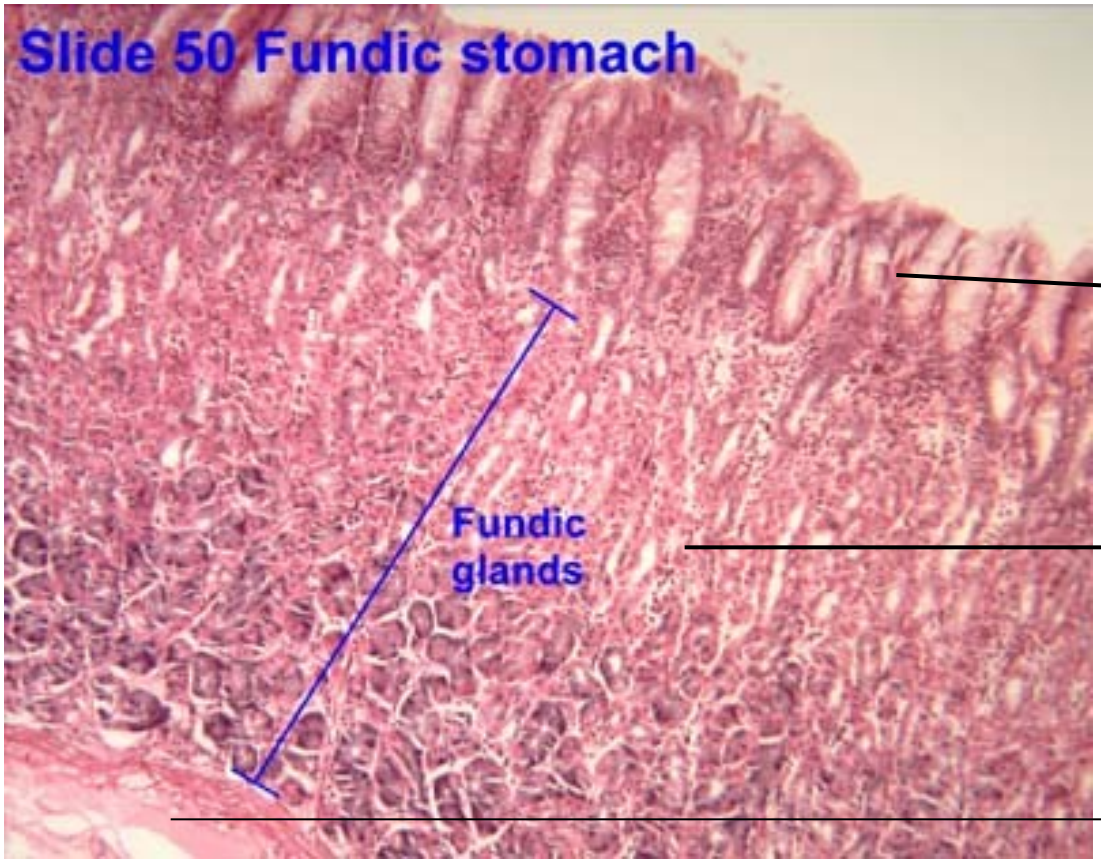
Embryonal oesophagus E2111/5 8th week iud



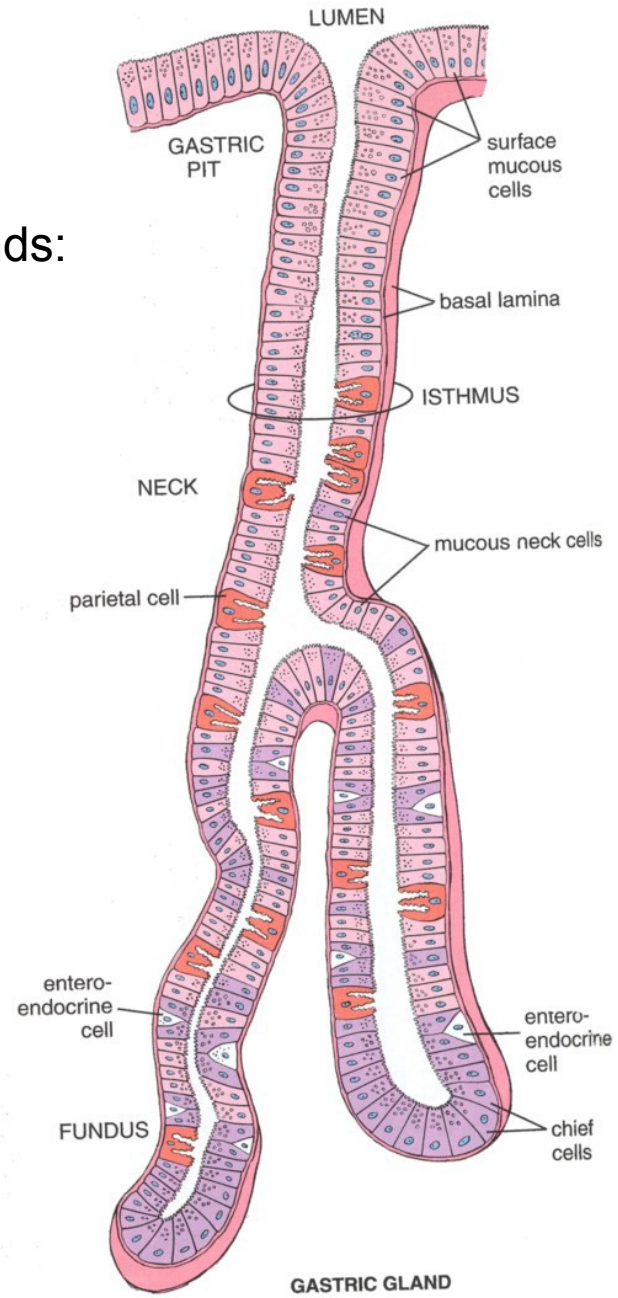
Magn. x5

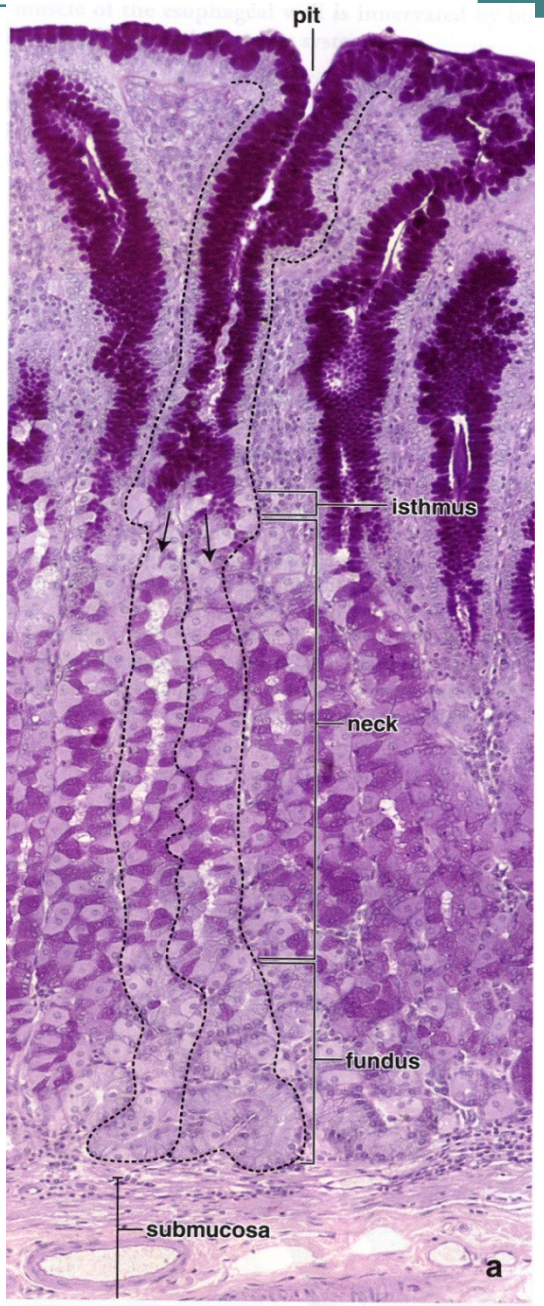
Stomach

- One layer columnar epithelium
- Many mucus and serose glands



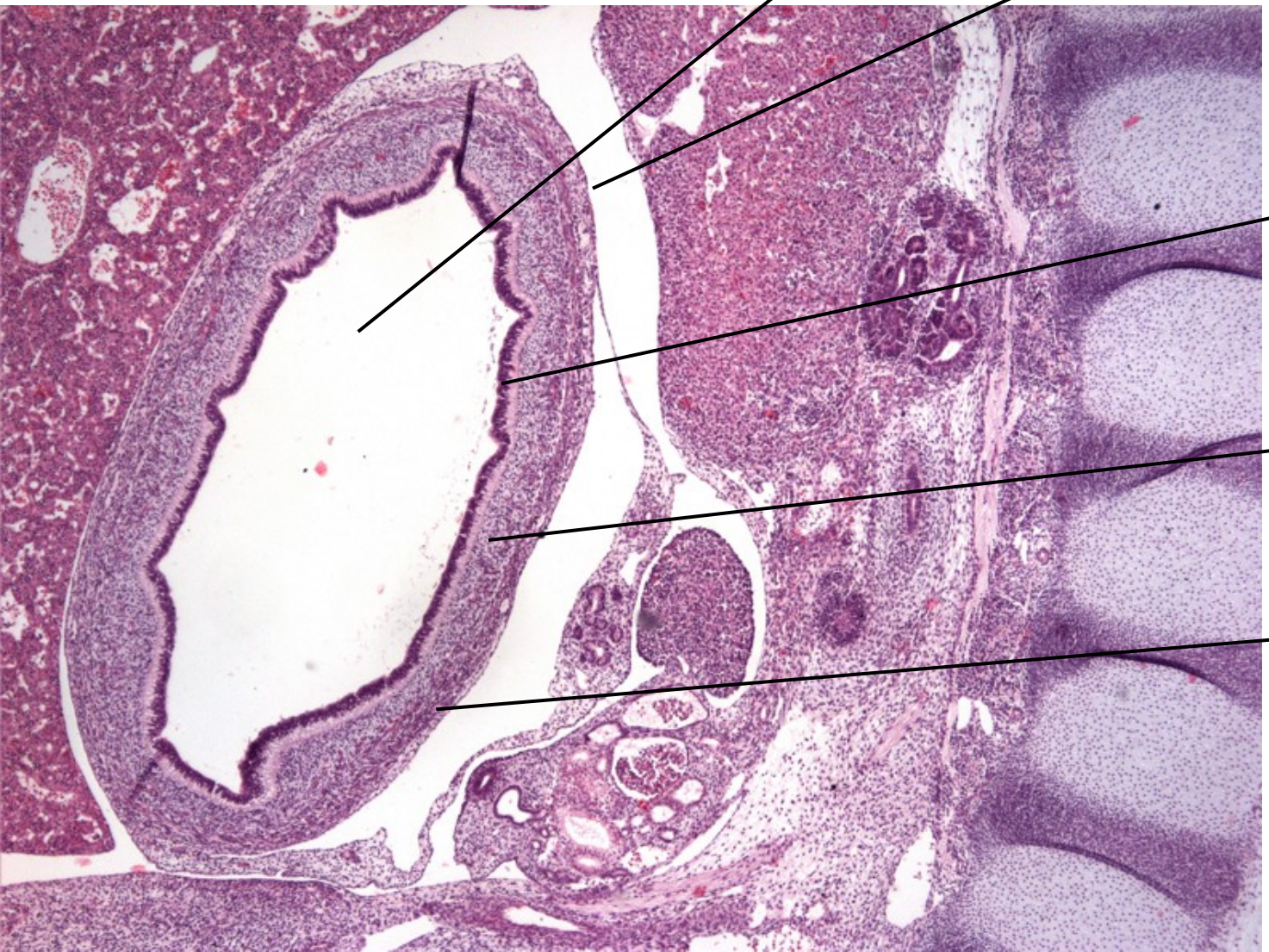
L. propria contains many glands:
- Gl. cardiacae
- Gl. pyloricae
- Gl. gastricae propriae



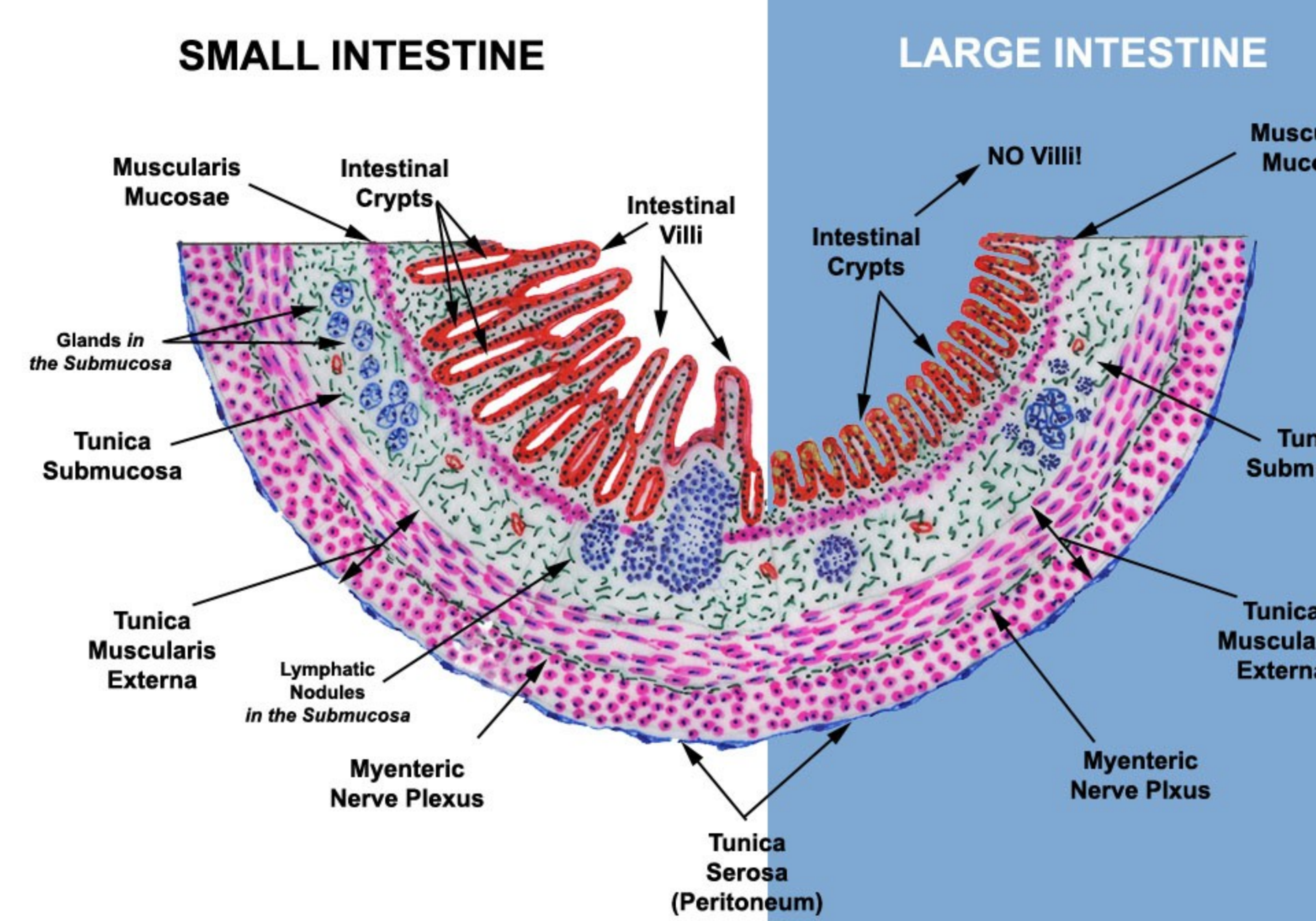


Embryo

6th week iud



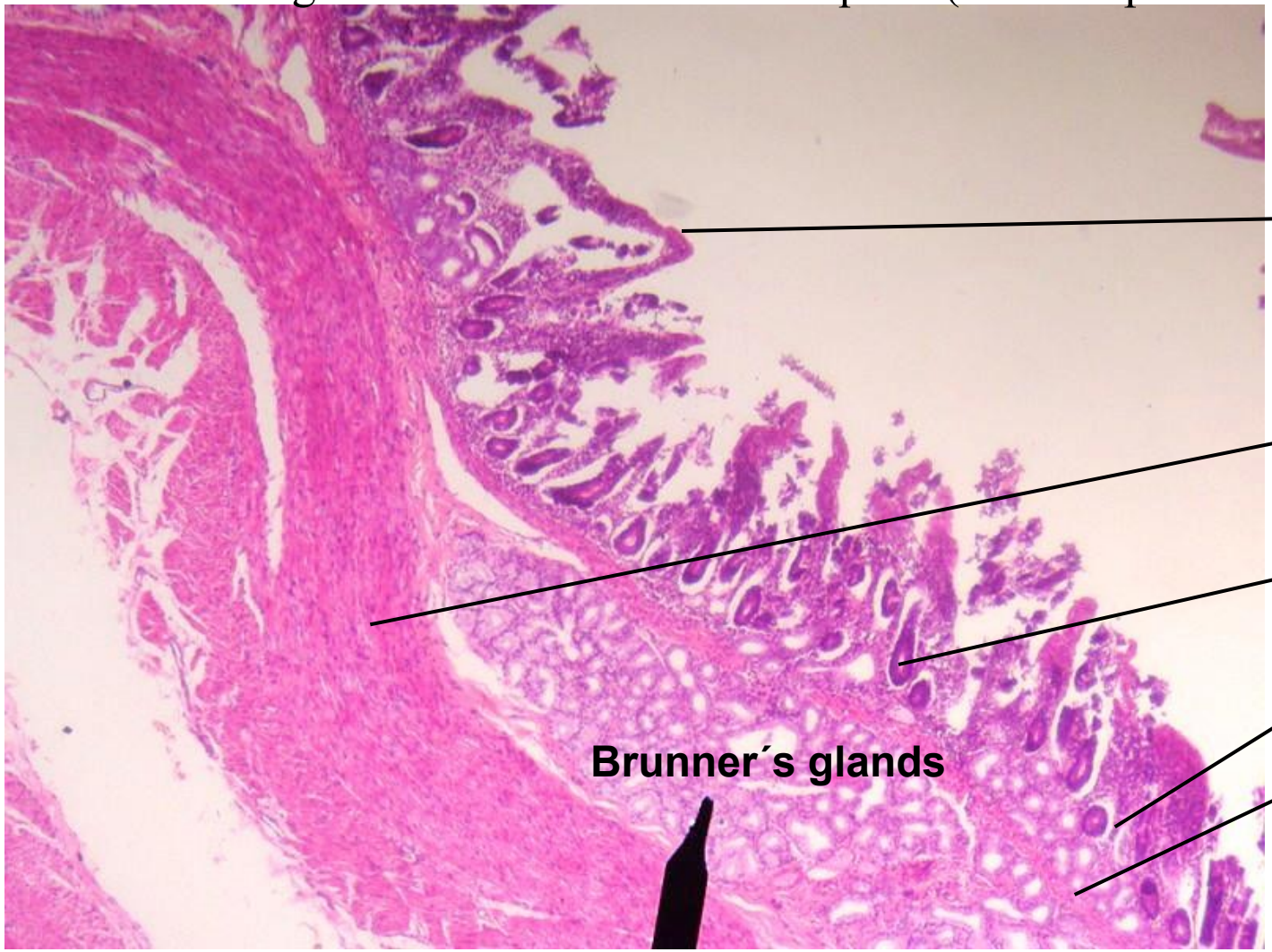
Magn. x40



http://education.vetmed.vt.edu

Small intestine

- One layer, columnar epithelium
- Enterocytes, undifferentiated cells, goblet cells, paneth cells., endocrine cells,
- Brunner´s glands – mucous and serous parts (increses pH of the food)



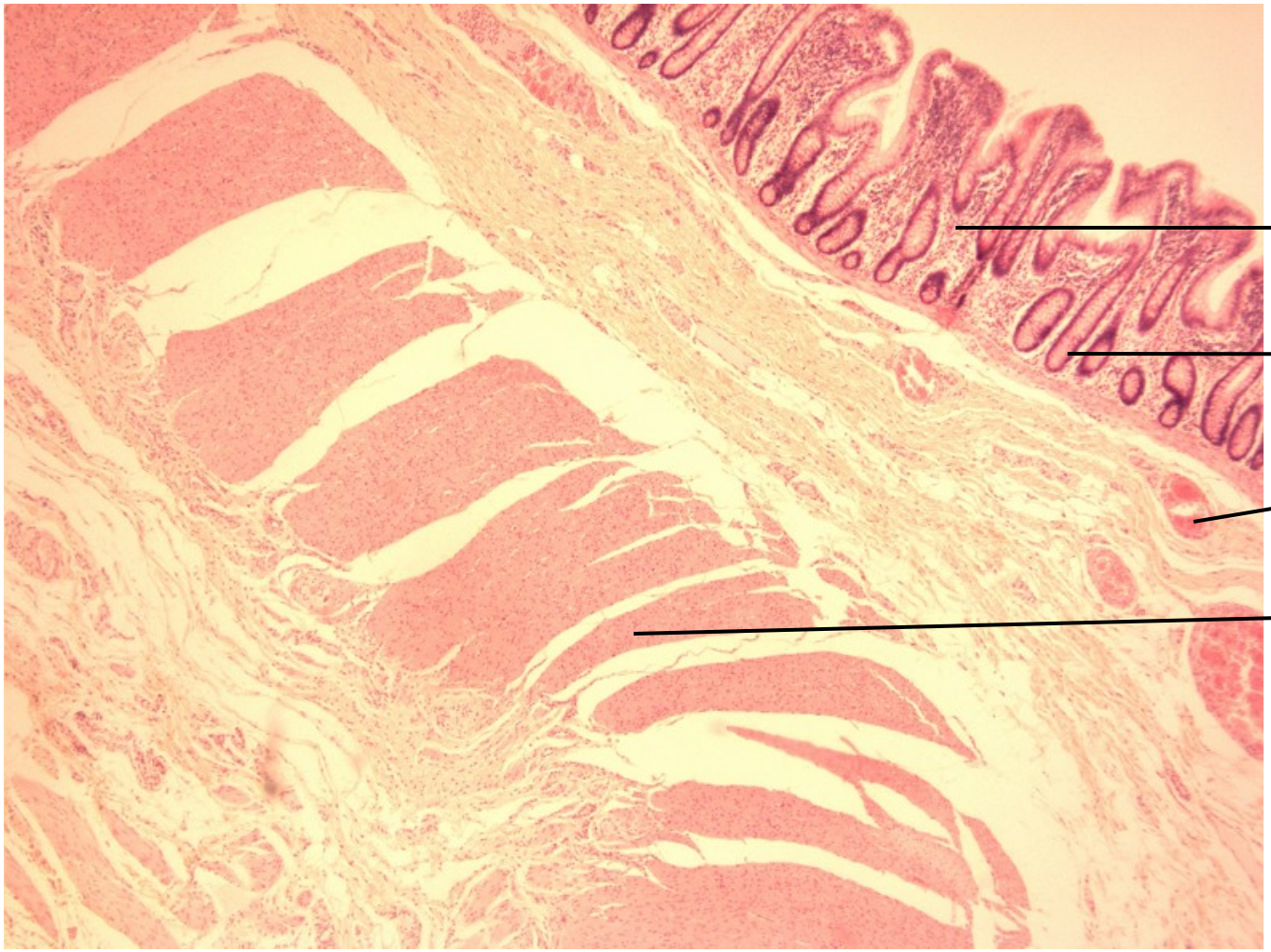
11 week iud

Proliferation of mucose of primitive gut is followed by recanalization

Magn. x5

Large intestine

- One layer columnar epithelium – absence of villi
- goblet cells are more numerous than in small intestine



Magn. x5

Embryo

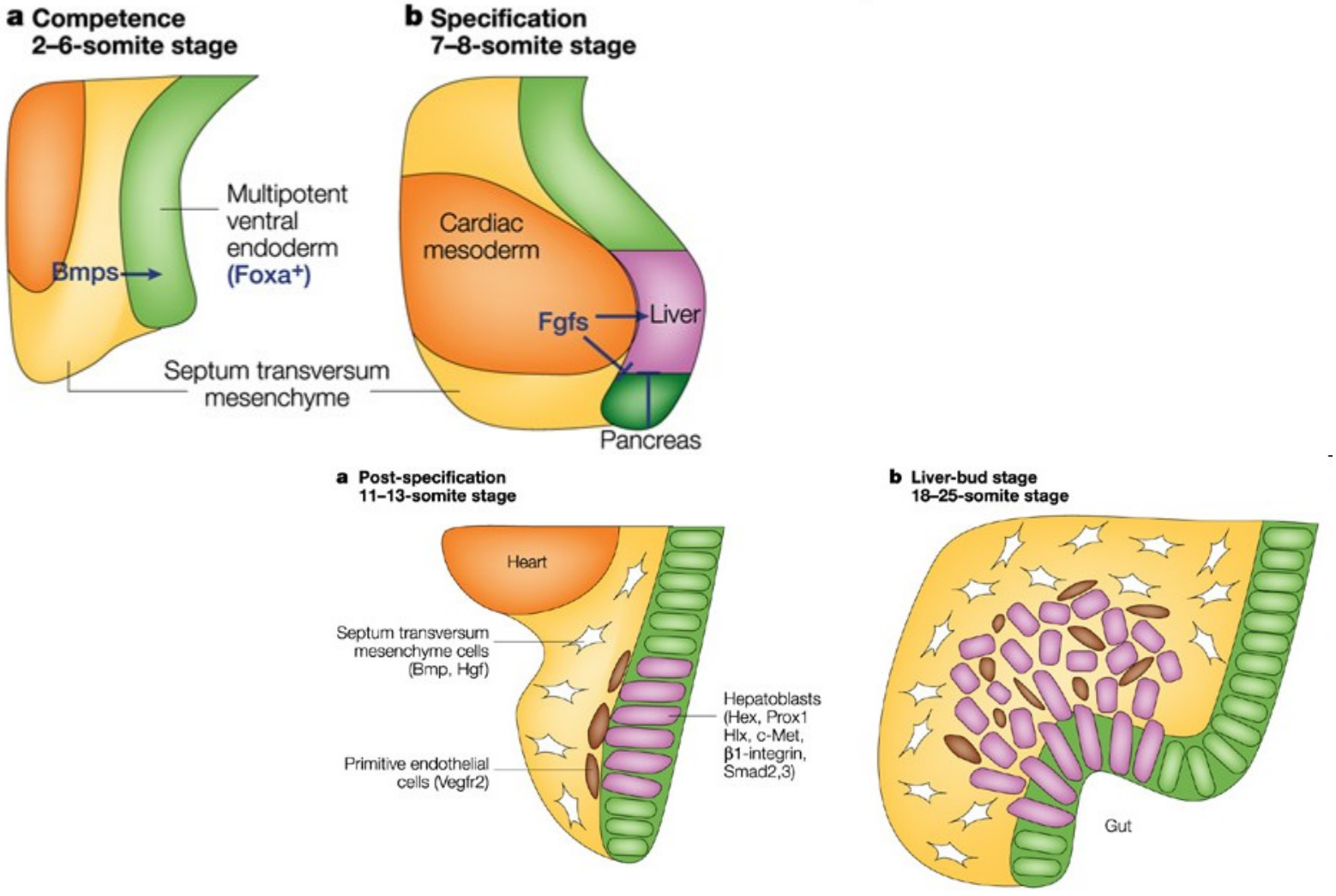
10th week iud

Magn. x5

Liver

Endodermal origin

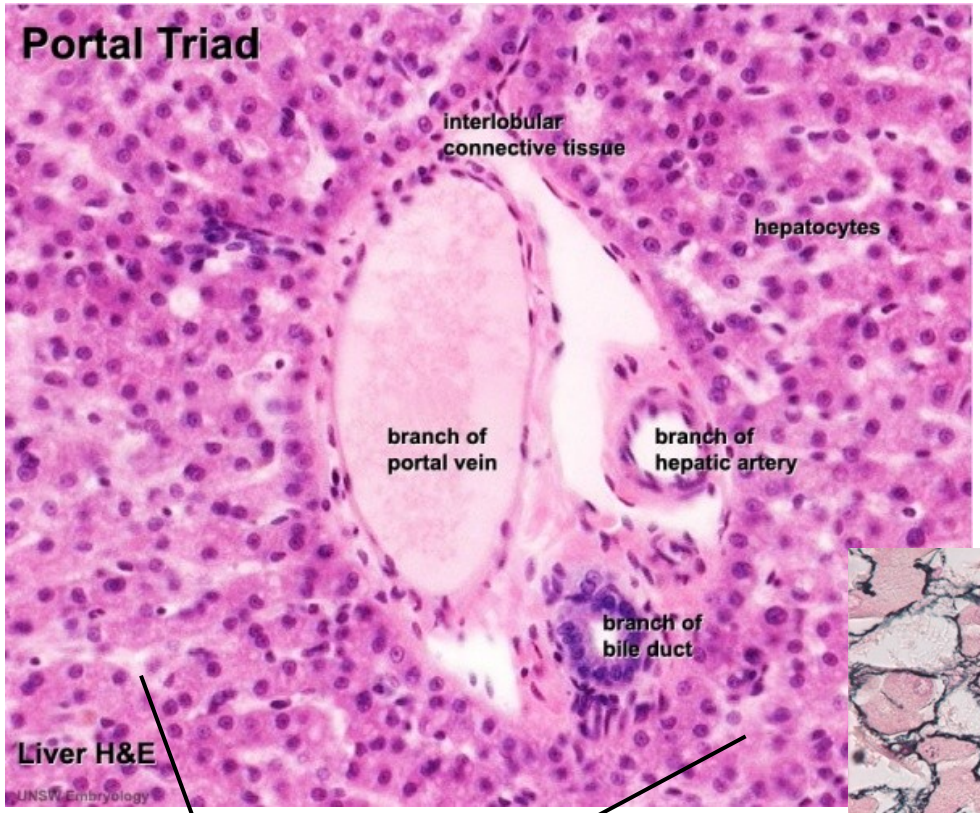
Mezodermal origin



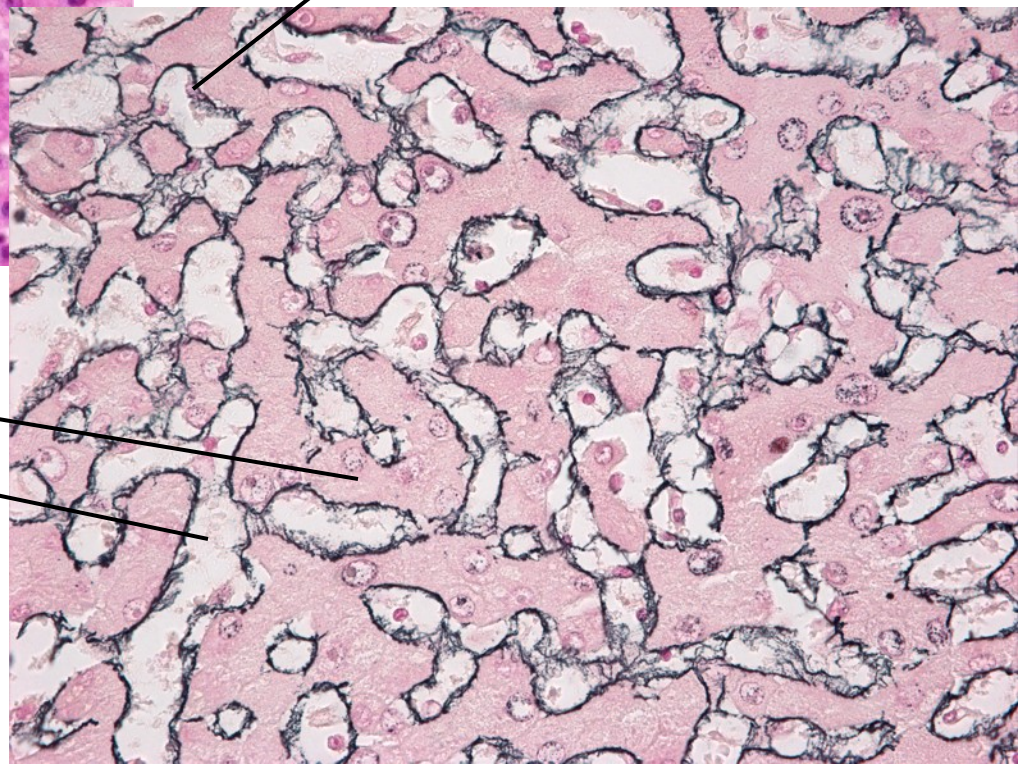
K.S. Zaret, Nature Reviews Genetics 3, 499-512, 2002

Liver - adult

Magn. x40



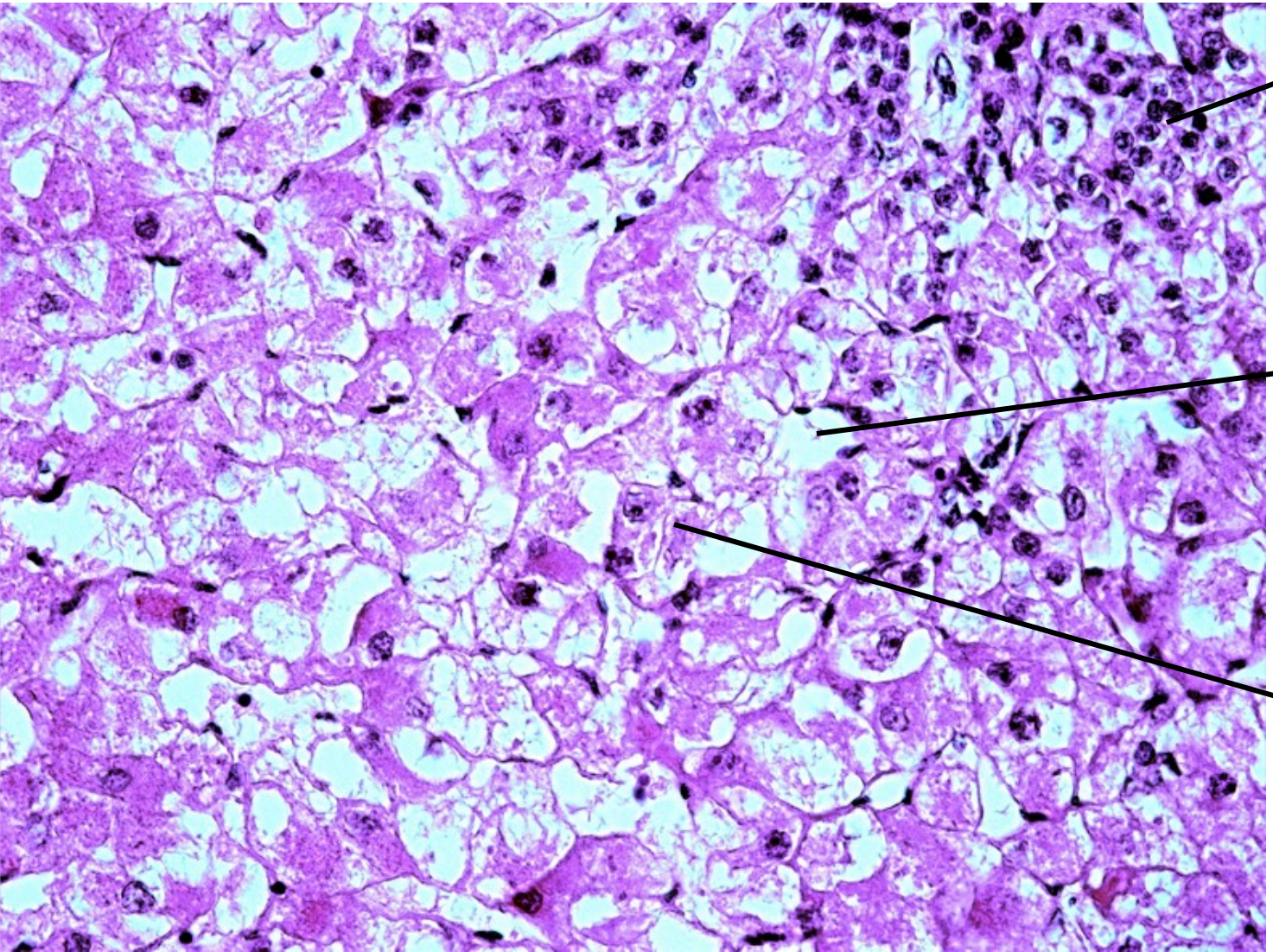
Gomori stain -
Reticular fibres
(colagen type III, mesh which is the „backbone“ of soft tissues)



Sinusoid

Hepatocytes

Embryonal liver 14th week iud

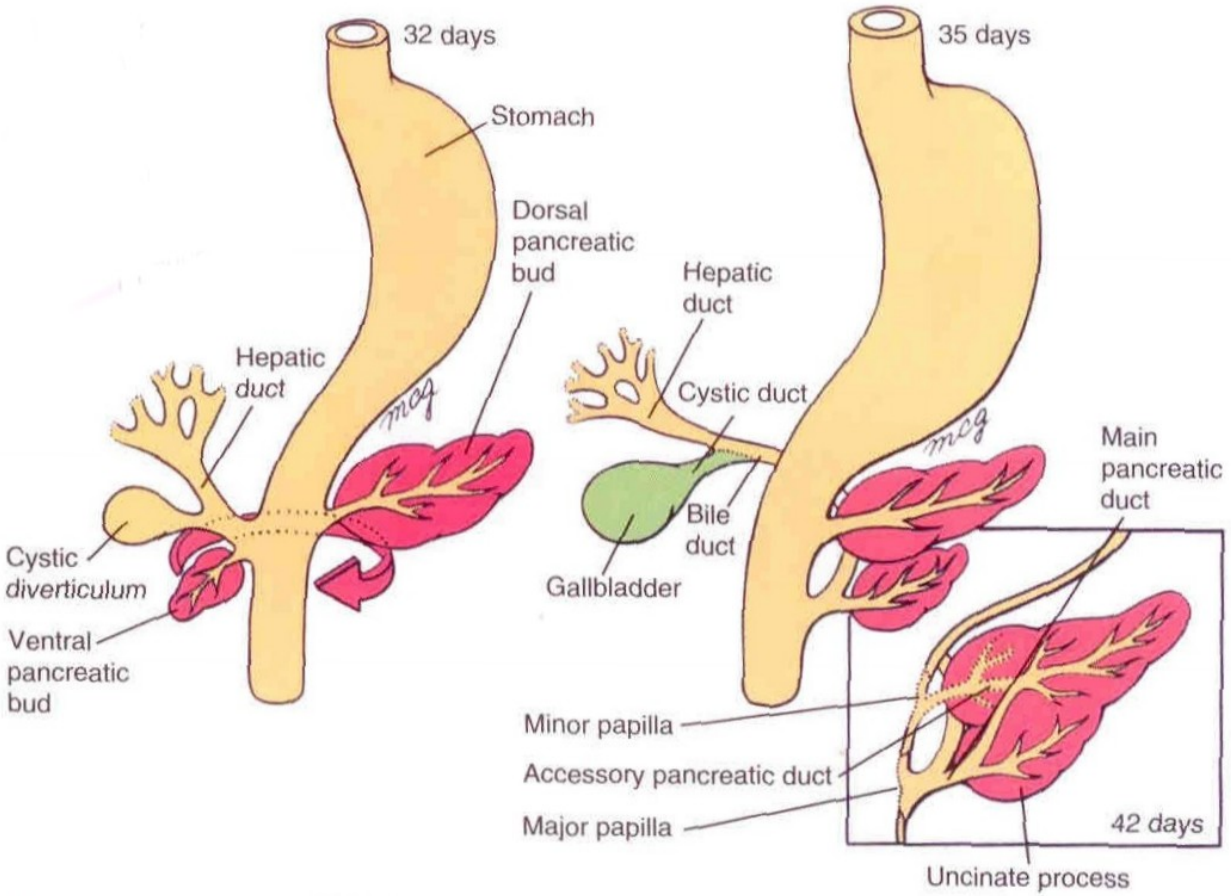


Magn. x40

Pancreas

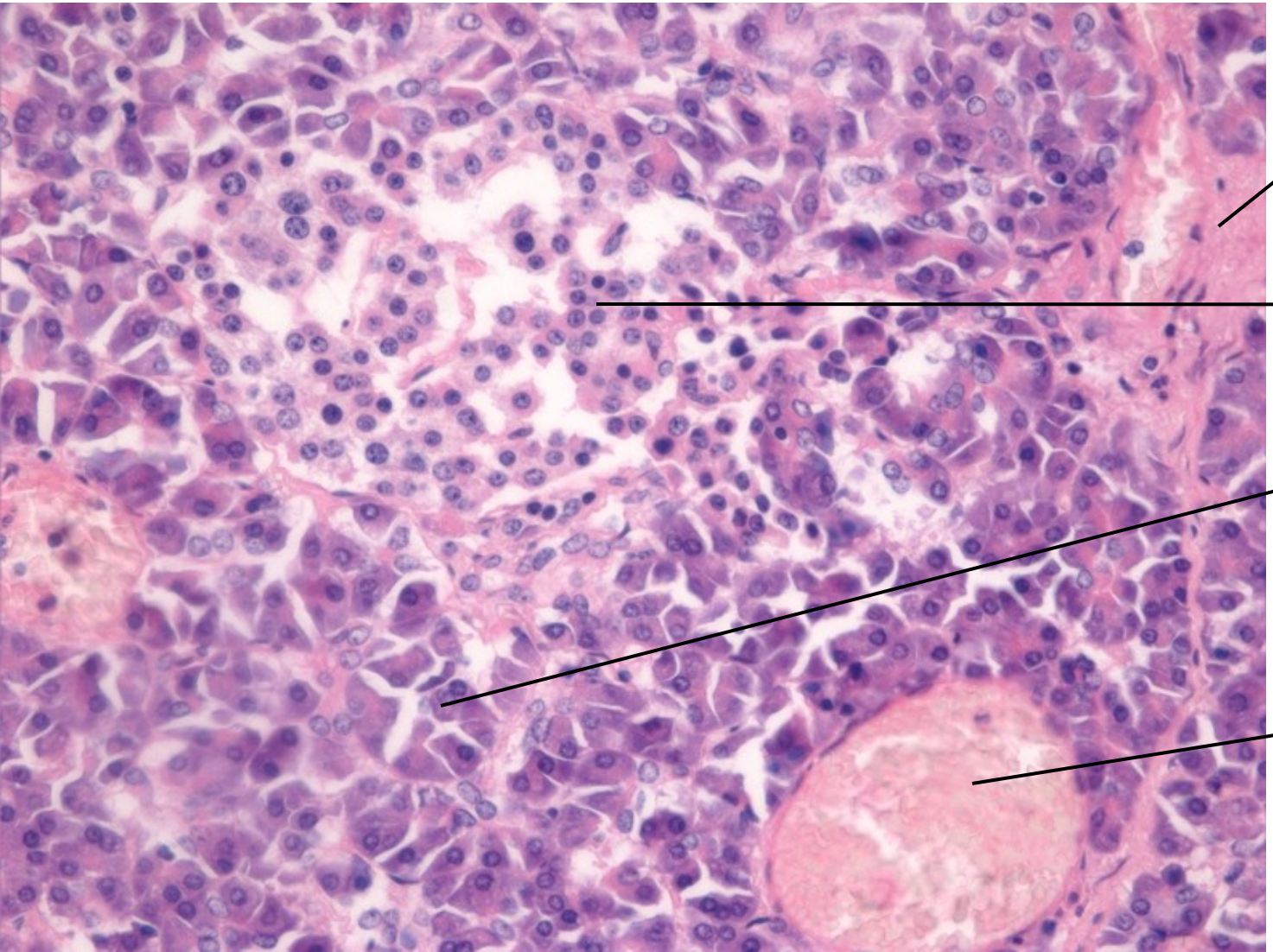
Endodermal origin

1. Turn of **ventr**al anglage – the head of **pancreas**
2. Ventral a. encloses the **dorsa**l anlage – the tail of **pankreas**
3. Ducts fusing



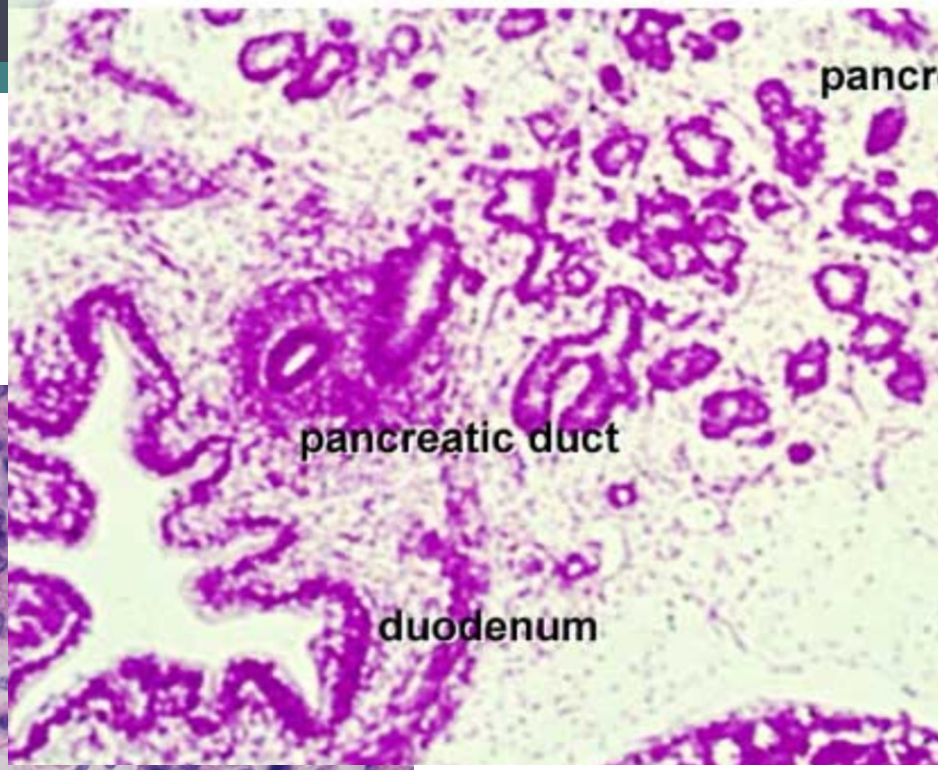
W.J. Larsen Human Embryology 2001

Pancreas

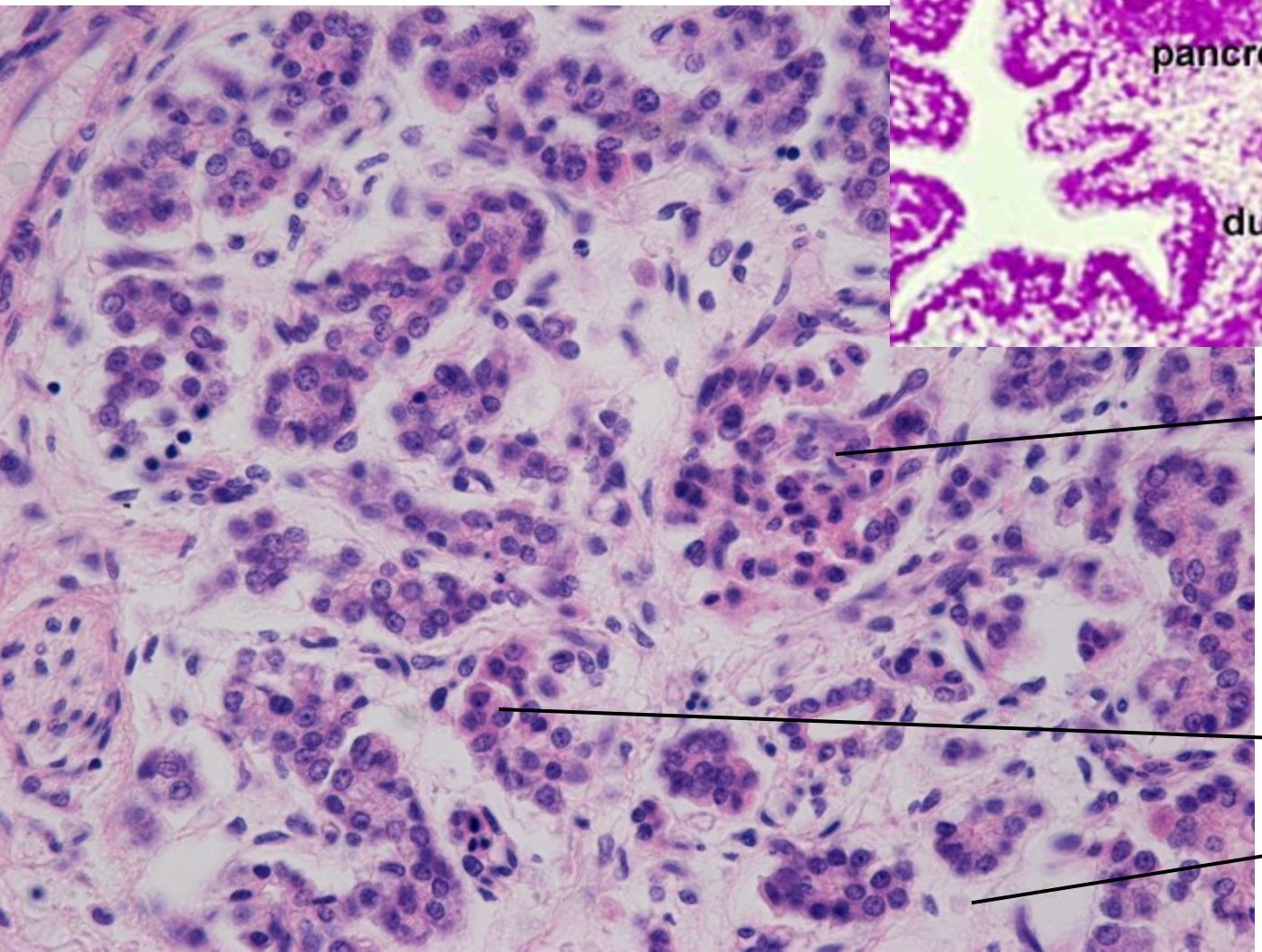


Magn. x40

Embryonal pancreas 8th week iud



Embryonal pancreas 22th week iud



Langer. isle

Tubulus/acinus

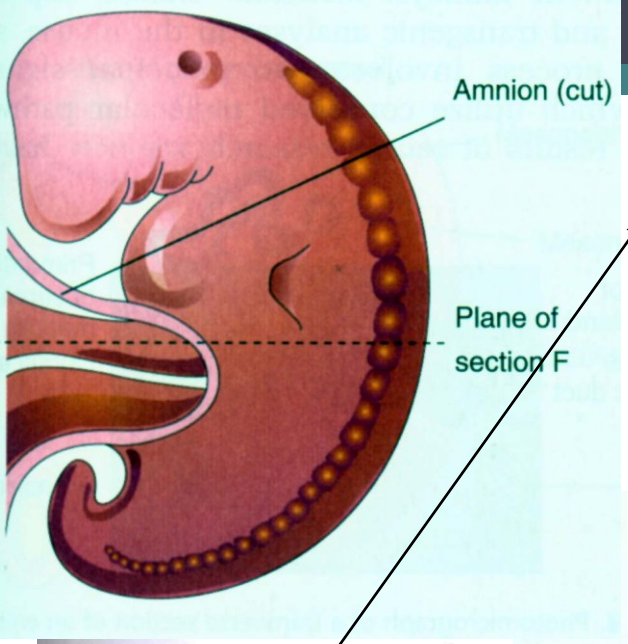
Mezenchyme

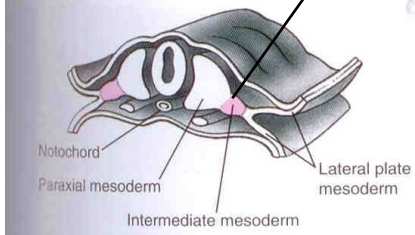
Magn. x40

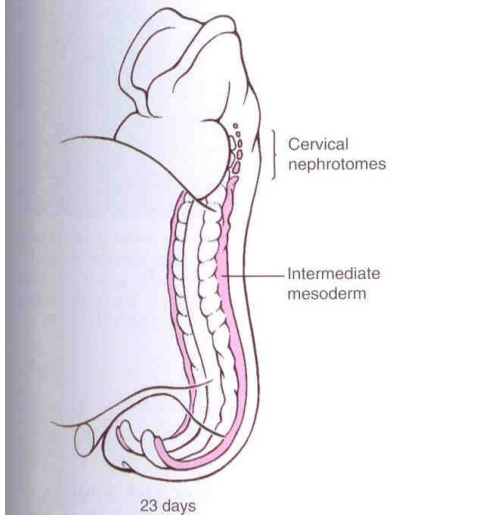
Kidney

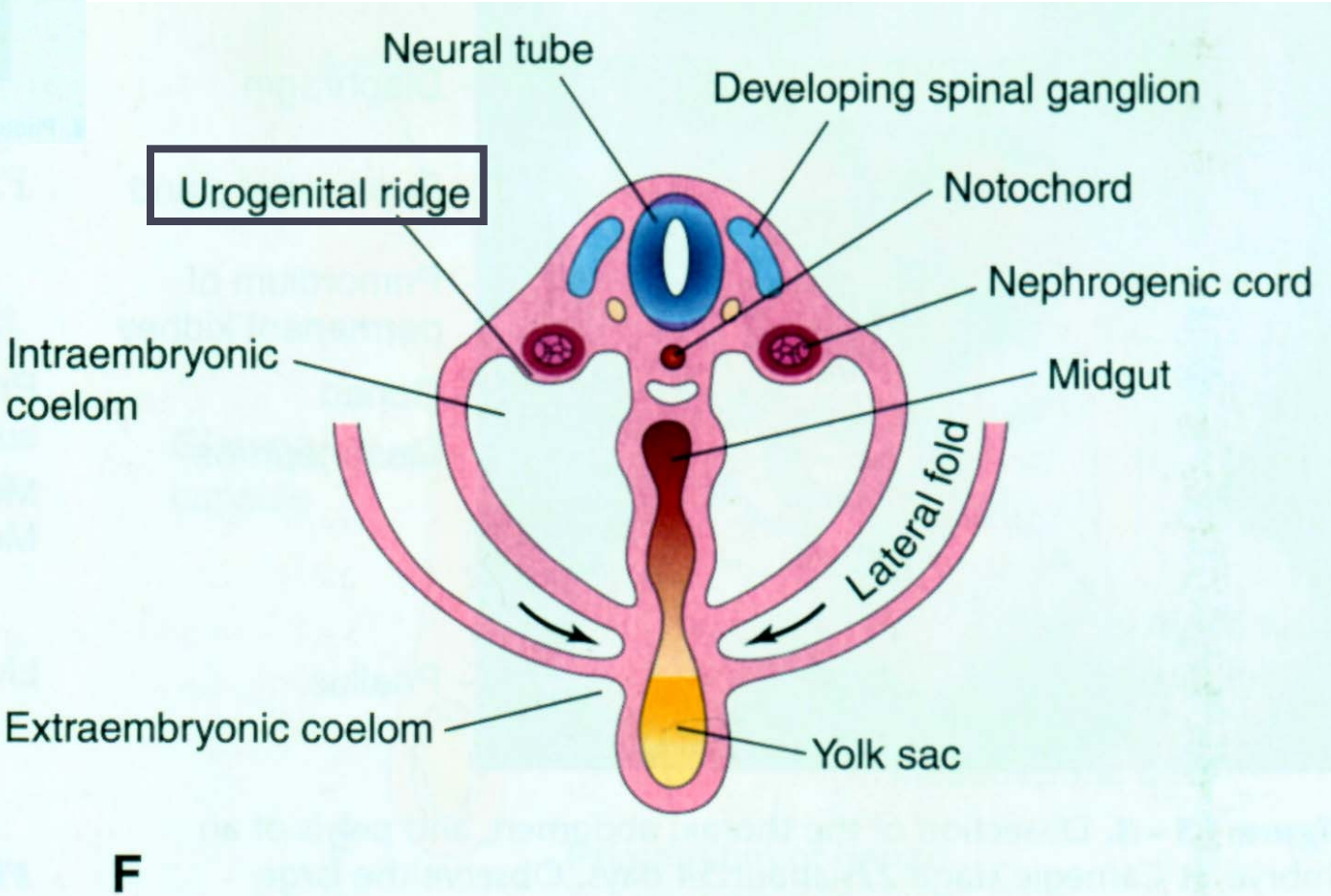
Intermediální mezoderm

Urogenital ridge – anlage of kidney and gonads (6th week iud)









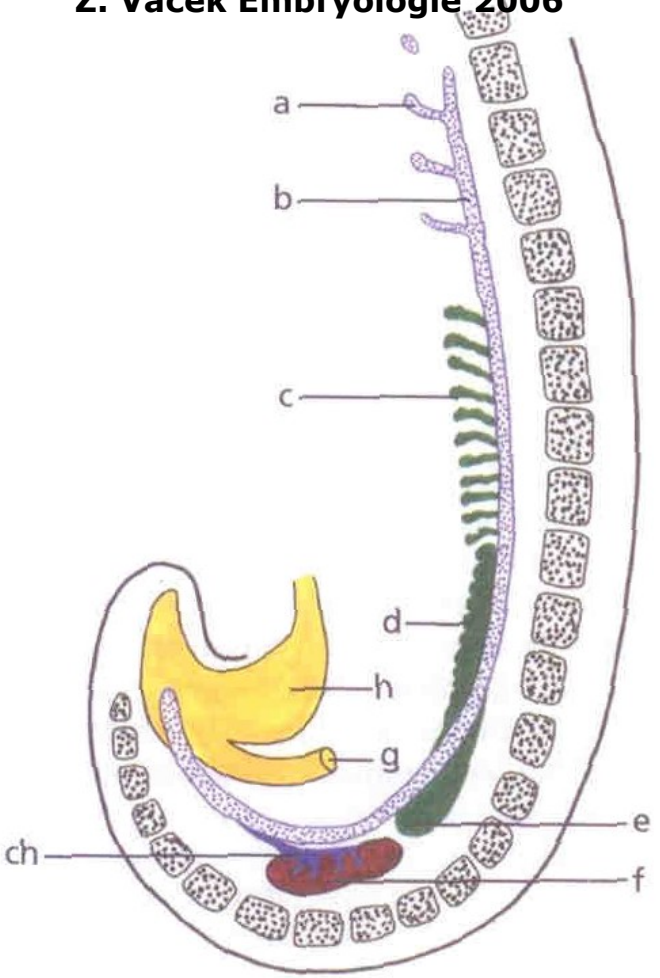
3 stages of development

Beginning of 4th week iud
Pronefros – pronefric duct
(base of Wolffi duct)

End of 4th week iud
Mezonefros – mesonefric duct (Wolffi)
- ureter bud

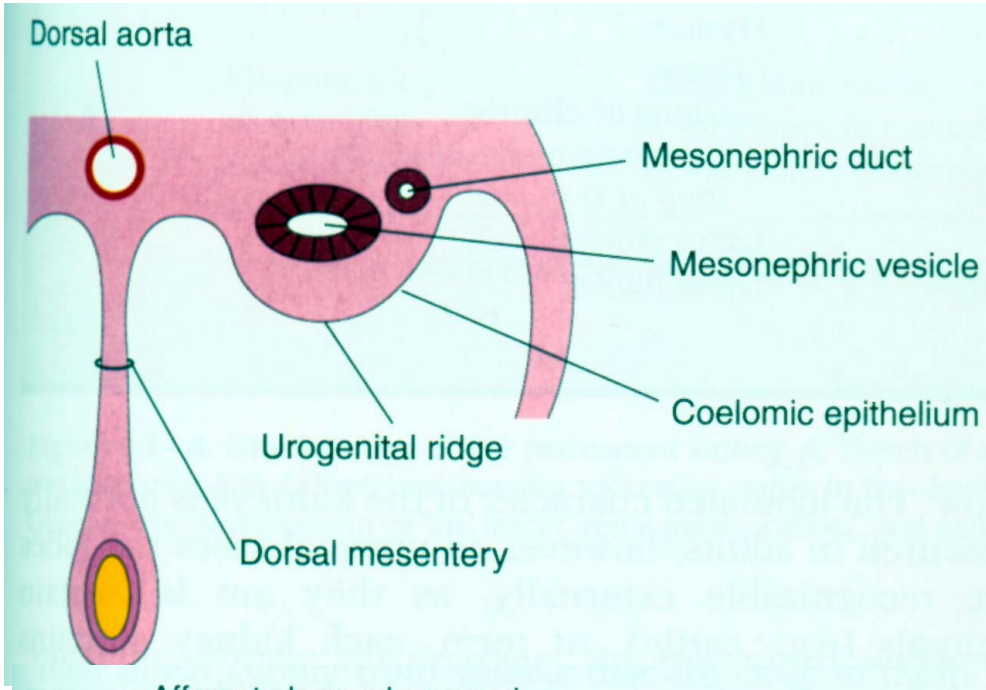
Beginning of 5th weeek iud
Metanefros – definitive kidney

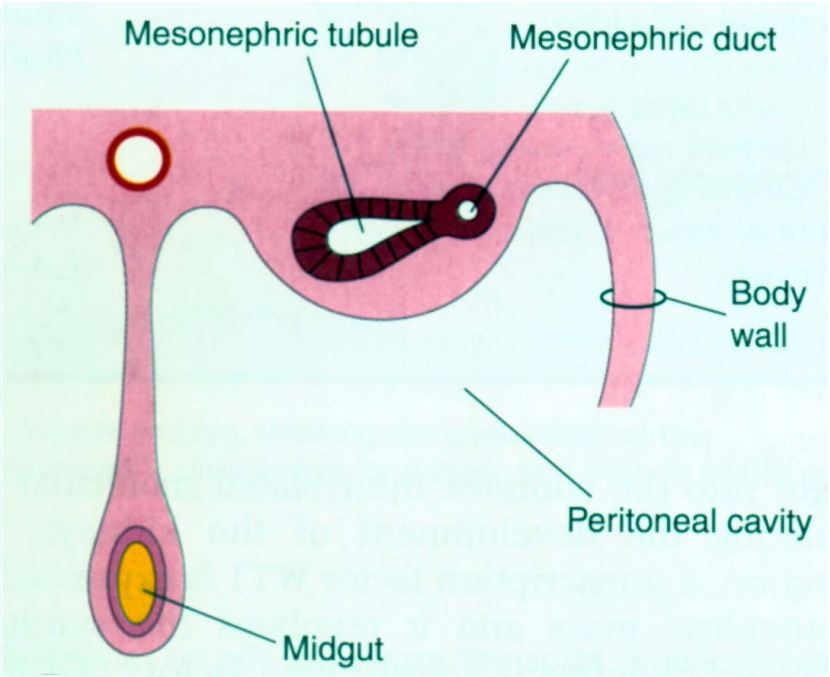
Z. Vacek Embryologie 2006

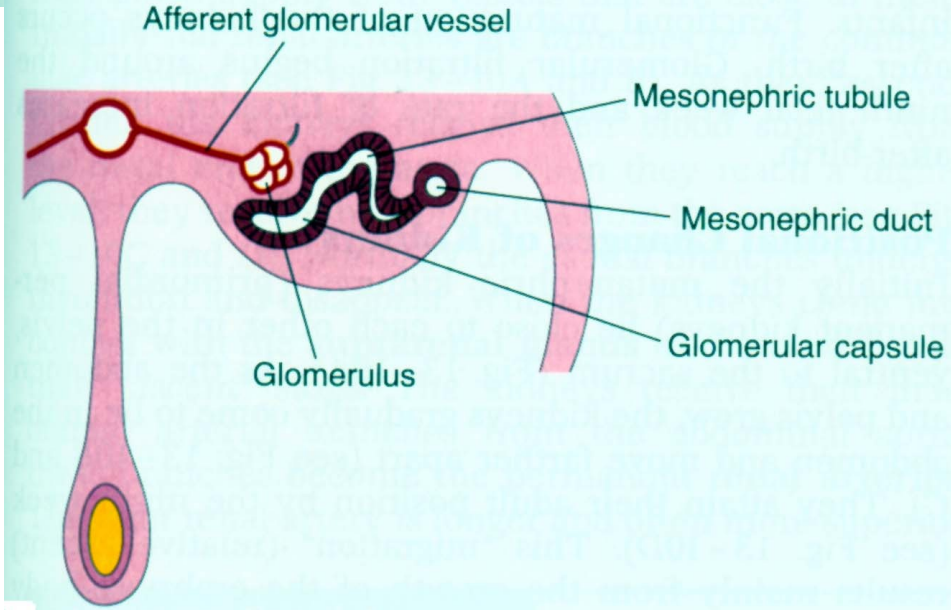


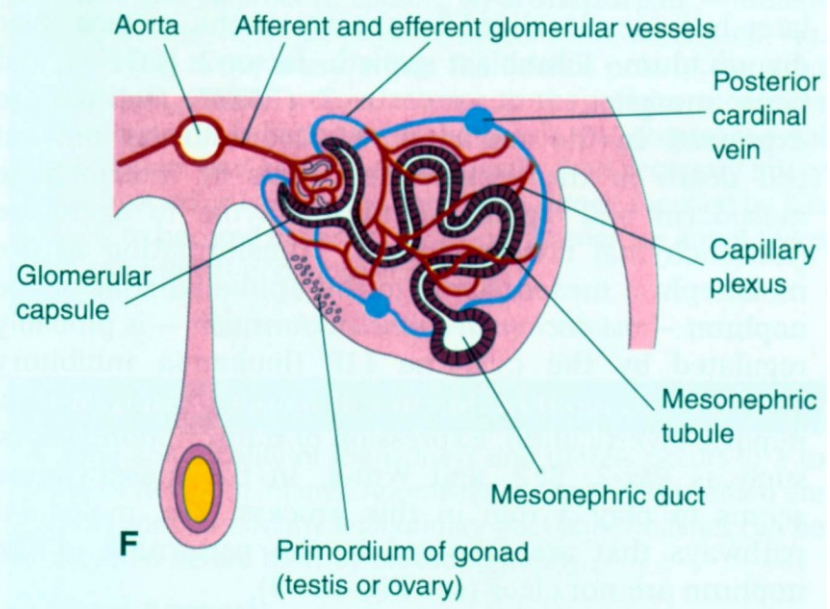
Obr. 8.98 *Schéma vývoje pronefros, mezonefros a metanefros u embrya 5 mm dlouhého, asi 4 týdny starého.*
a – kanálek pronefros, b – ductus mesonephricus (Wolffi), c – kanálek mezonefros, d – mezonefrogenní blastém, e – dolní hranice mezonefrogenního blastému, f – metanefros, g – zadní střevo, h – močový měchýř, ch – základy sběracích kanálků.

Mesonefros


Dorsal aorta
Mesonephric duct
Mesonephric vesicle
Coelomic epithelium
Urogenital ridge
Dorsal mesentery


Mesonephric tubule
Mesonephric duct
Body wall
Peritoneal cavity
Midgut


Afferent glomerular vessel
Mesonephric tubule
Mesonephric duct
Glomerular capsule
Glomerulus

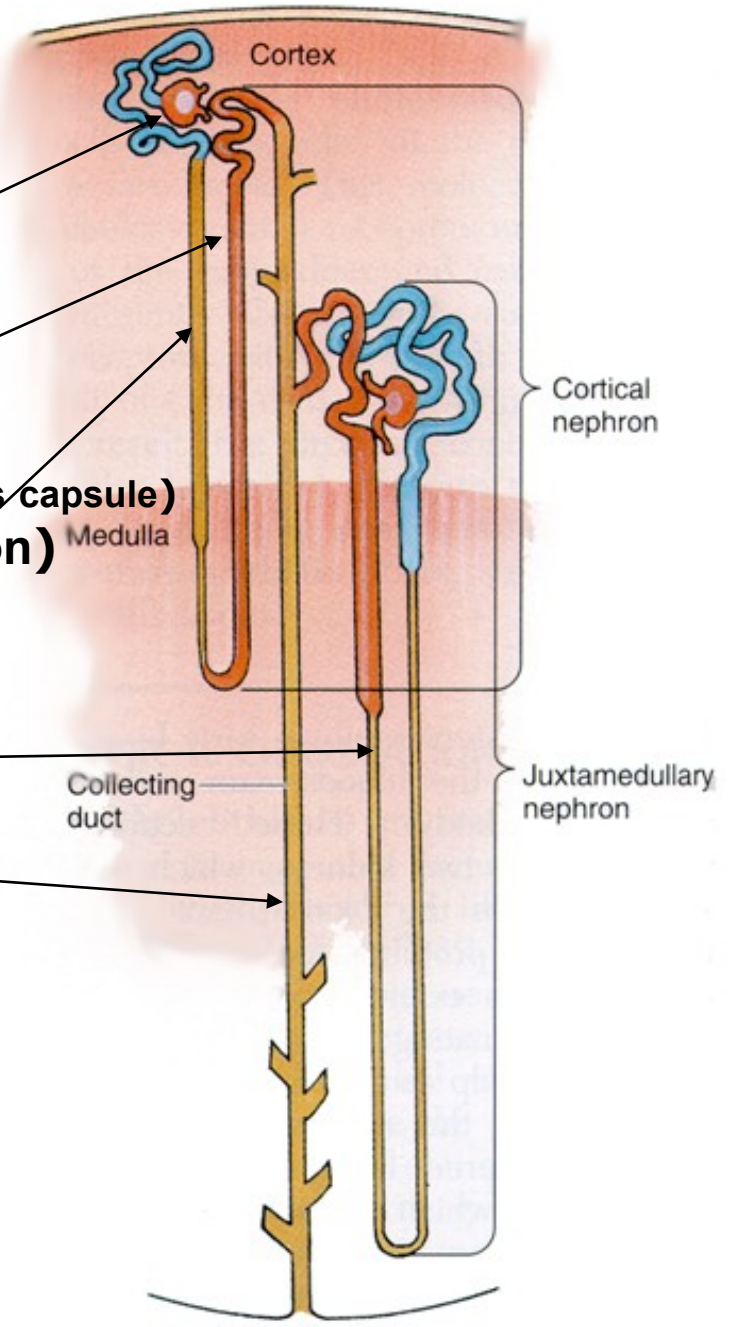

Aorta
Afferent and efferent glomerular vessels
Posterior cardinal vein
Capillary plexus
Glomerular capsule
Mesonephric tubule
Mesonephric duct
F
Primordium of gonad (testis or ovary)

NEPHROS

NEPHRON – functional unit

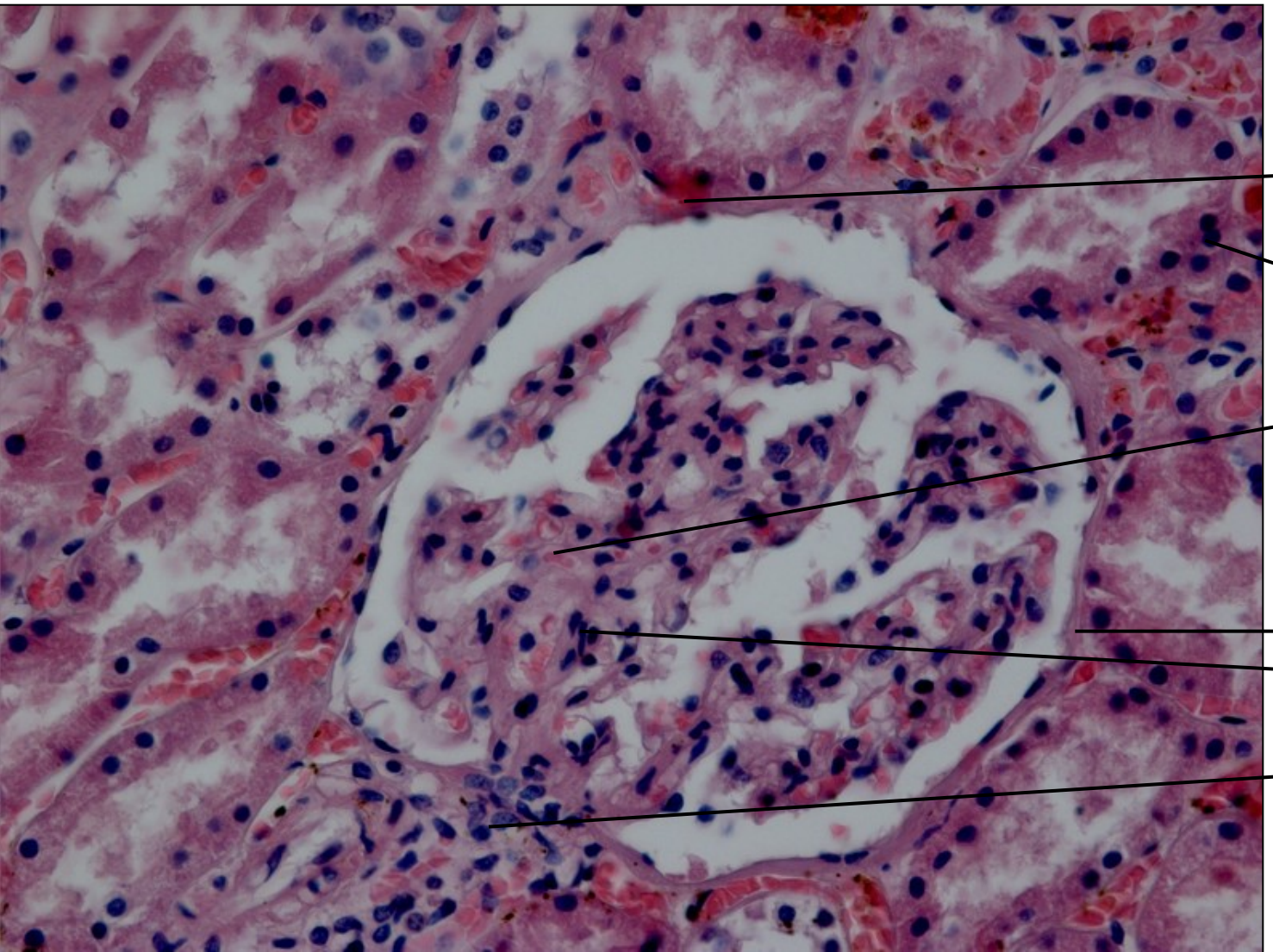
Cortex – renal corpuscle (glomerulus + Bowman´s capsule)
- proximal tubulus (backward absorption)
- distal tubulus

Medulla – Henle´s loop
- collecting duct



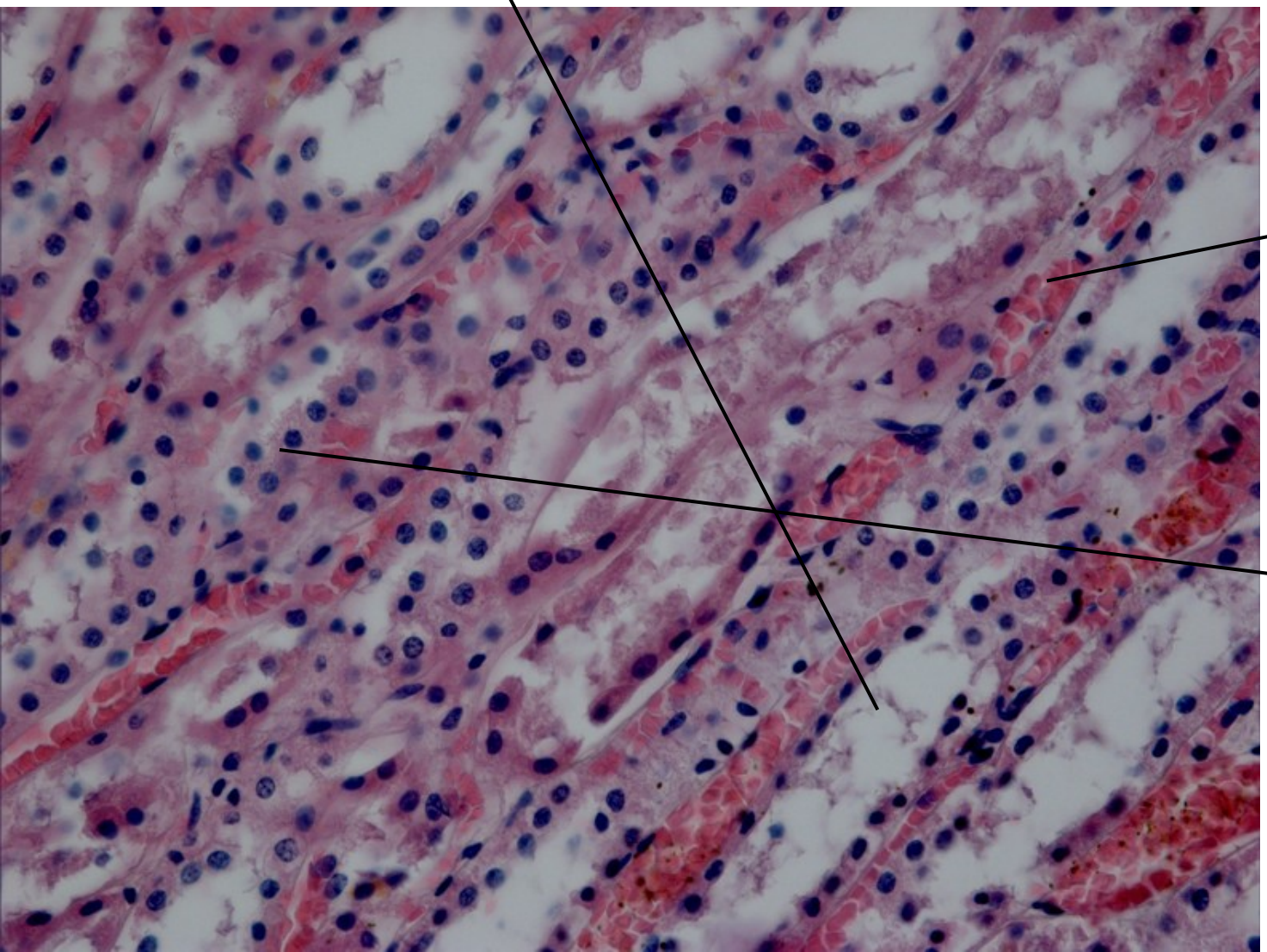
Metanephros - cortex

Nephron



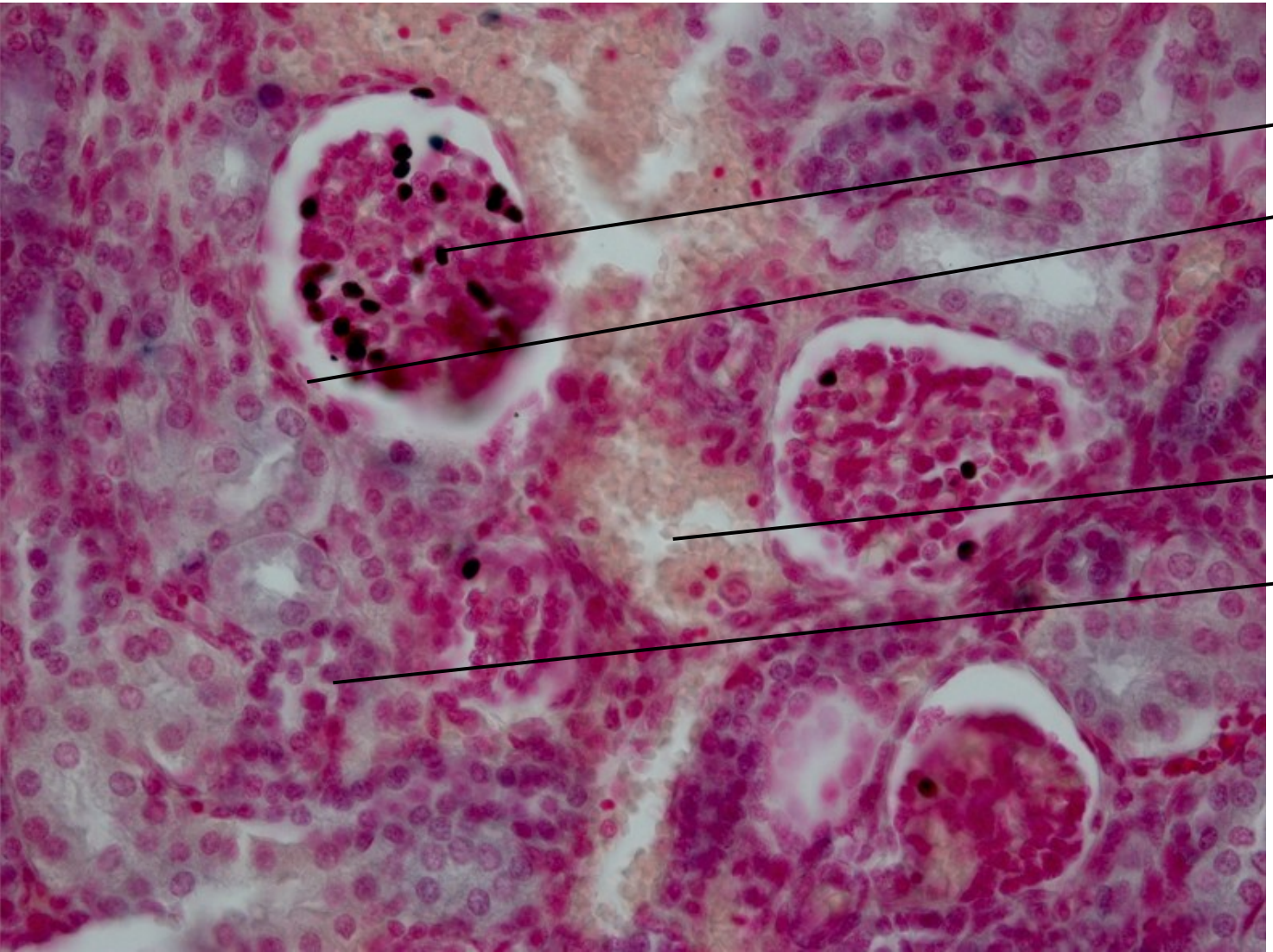
Magn. x40

Metanephros - medulla



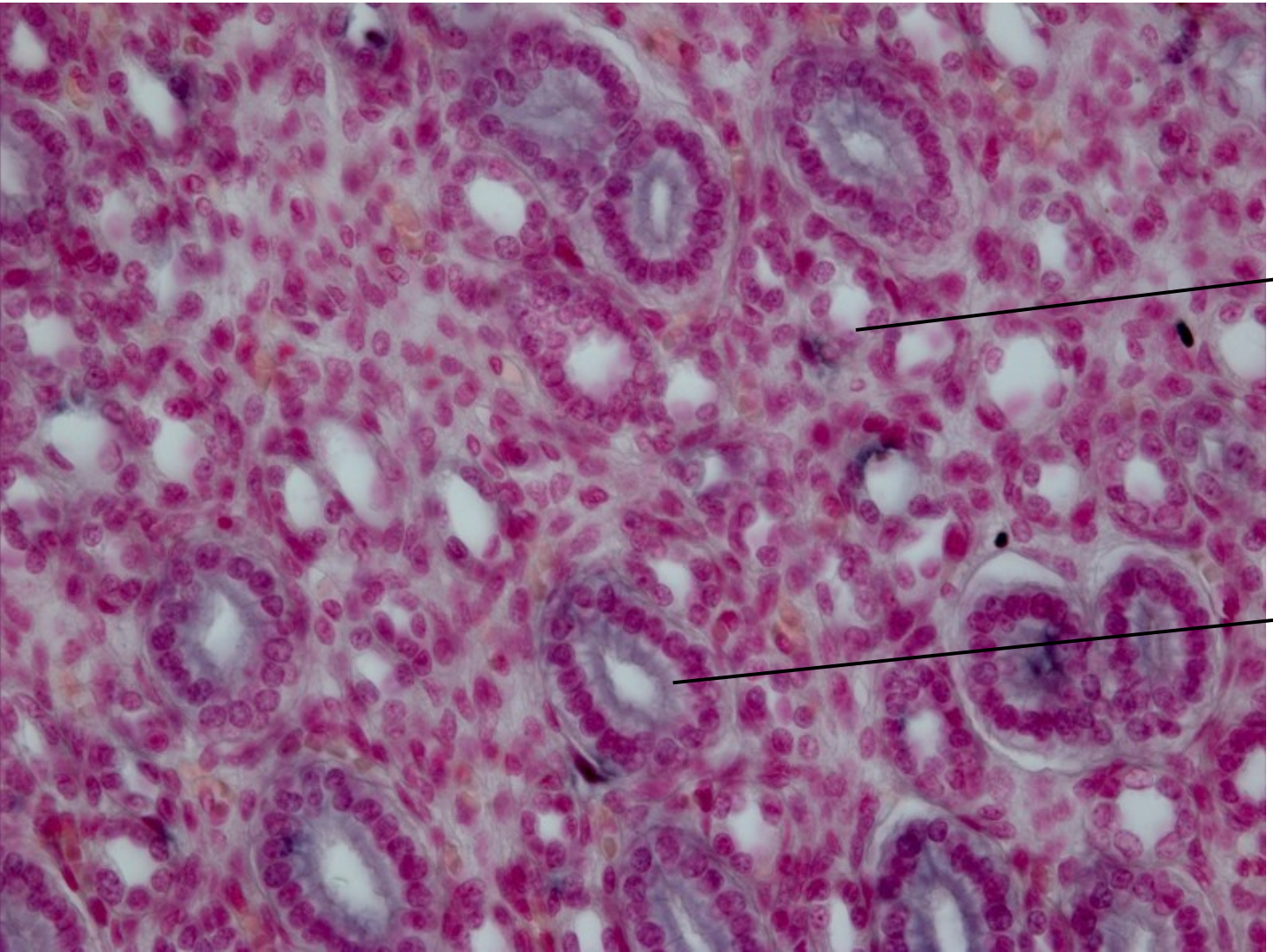
Magn. x40

Embryo metanephros cortex **21st week of iud**



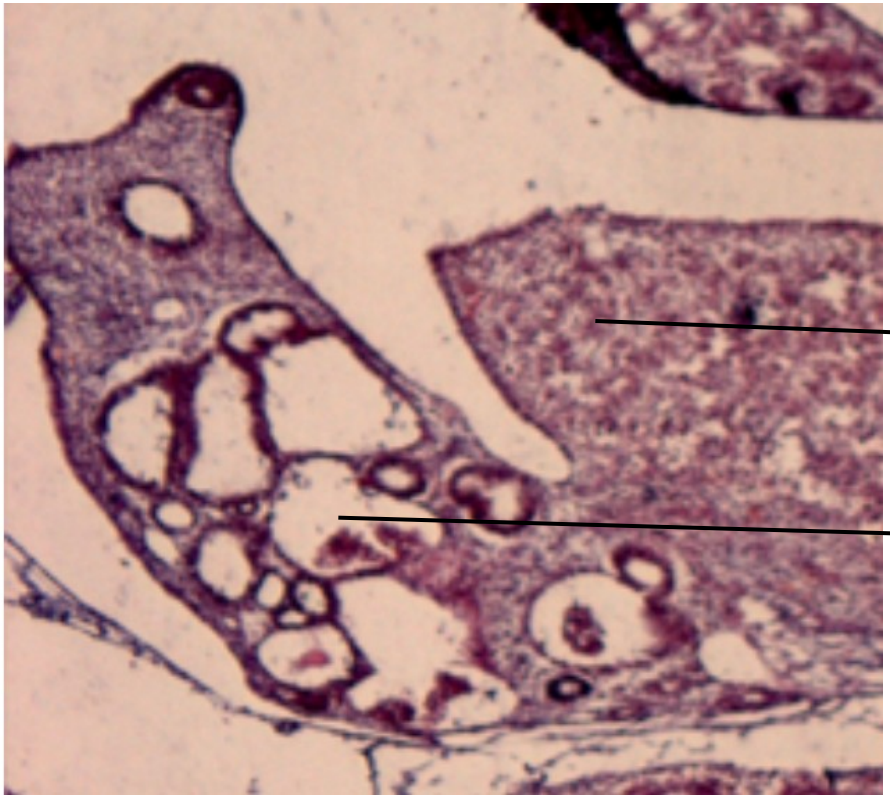
Magn. x40

Embryo metanephros medulla 21st week of iud



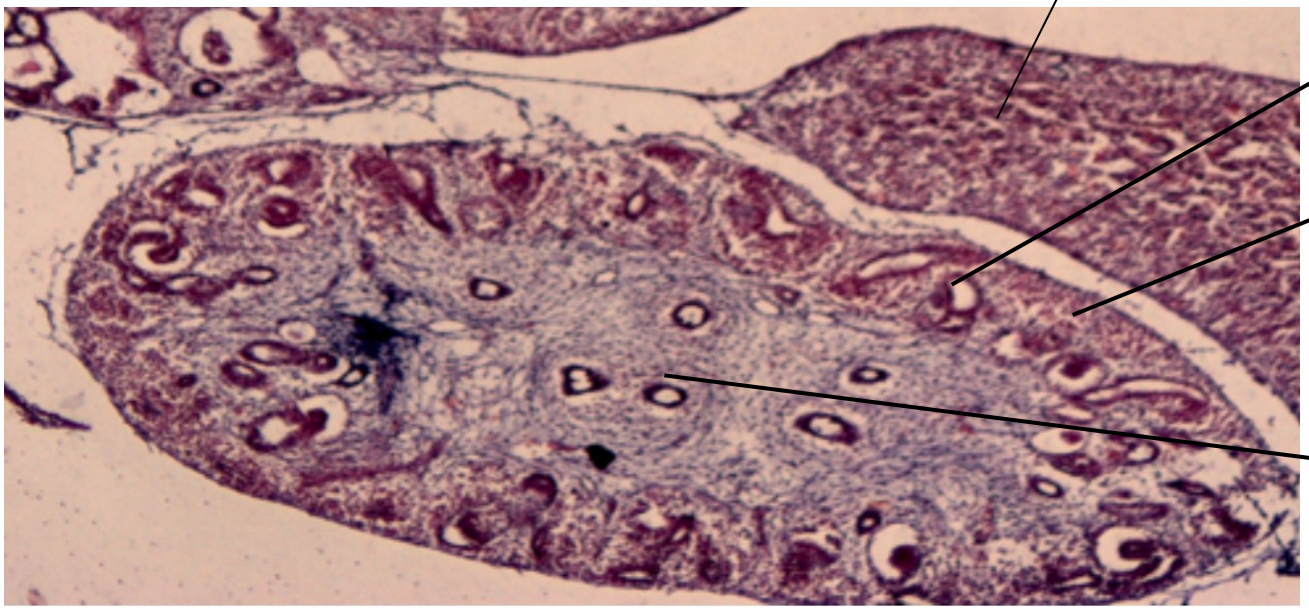
Magn. x40

Mesonephros E1208T 7th week iud



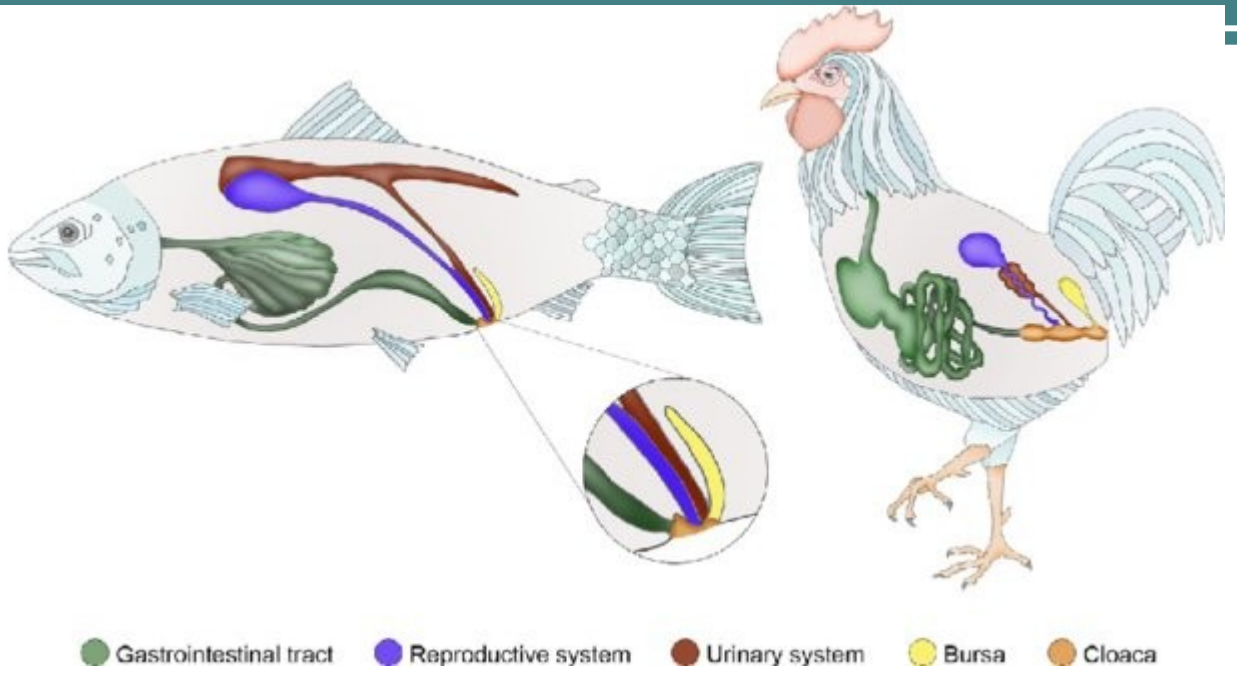
Magn. x10

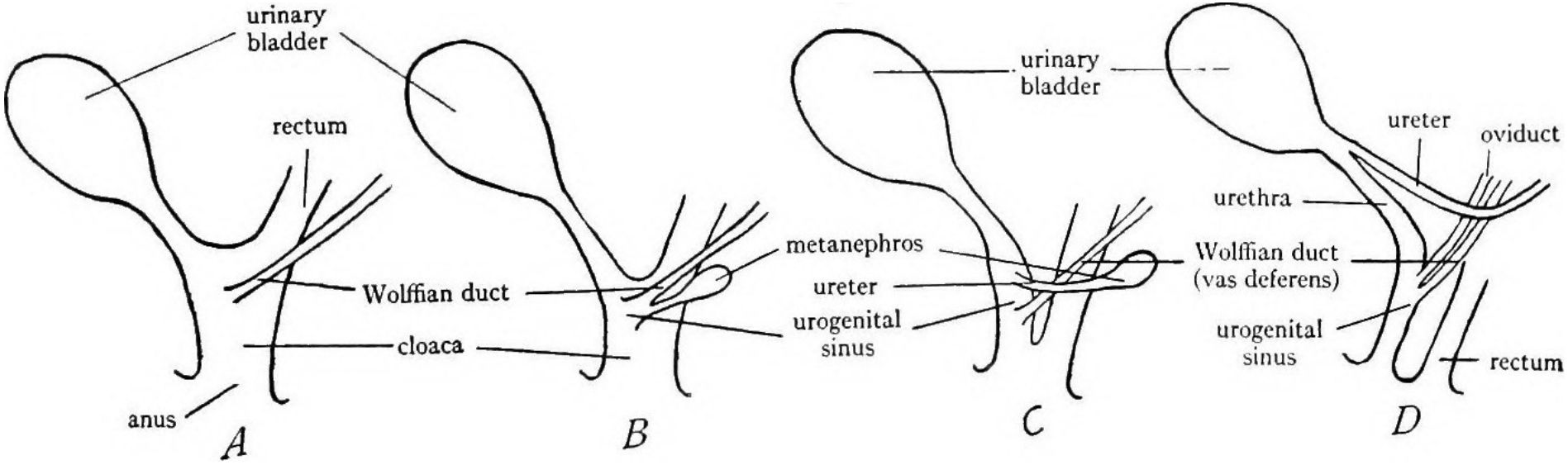
Metanephros E 1208T 7th week iud



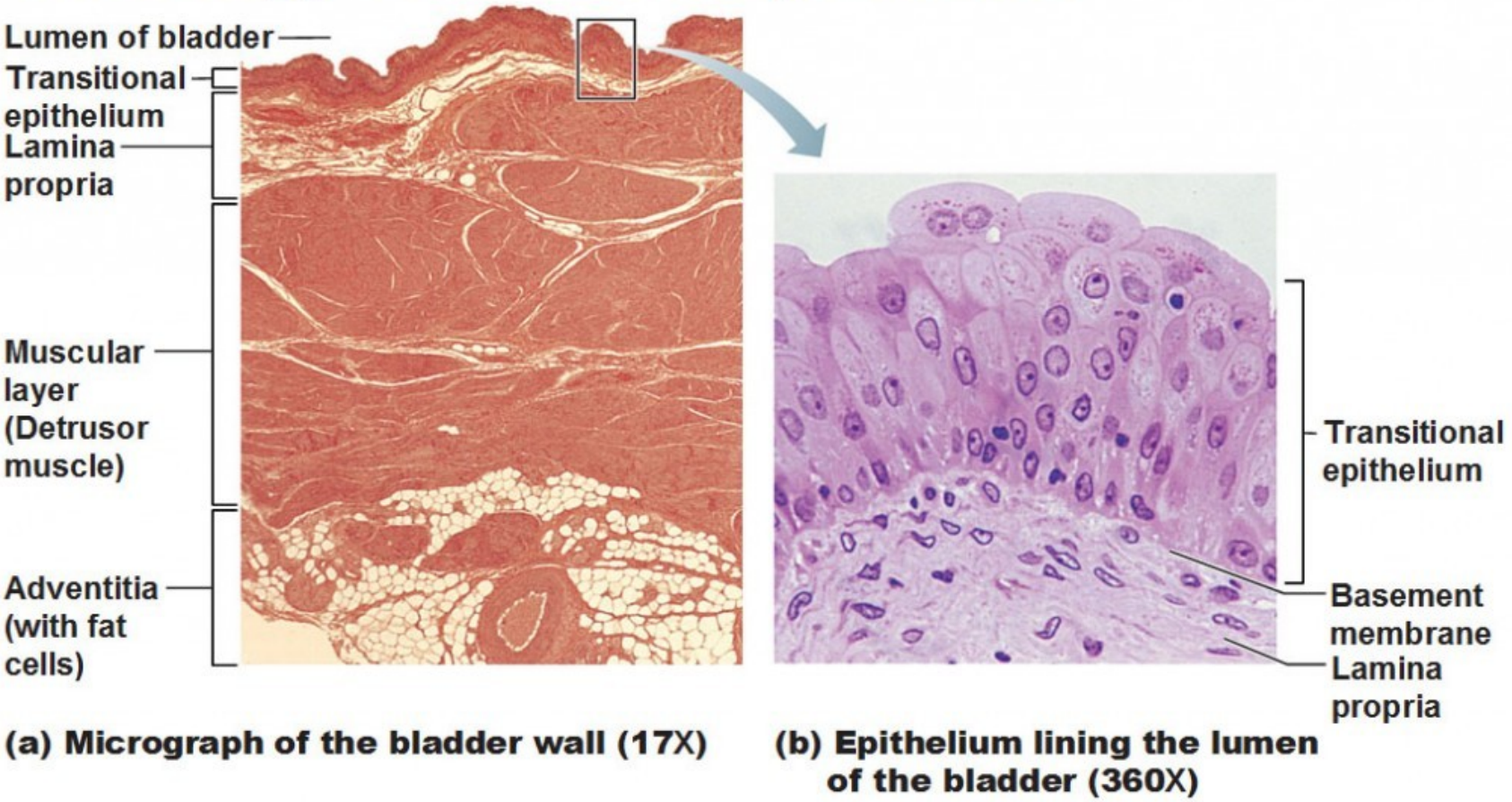
Magn. x10

Cloaca


Gastrointestinal tract
Reproductive system
Urinary system
Bursa
Cloaca


urinary bladder
rectum
Wolffian duct
cloaca
anus
A
B
urinary bladder
metanephros
ureter
urogenital sinus
C
ureter
oviduct
urethra
Wolffian duct (vas deferens)
urogenital sinus
rectum
D

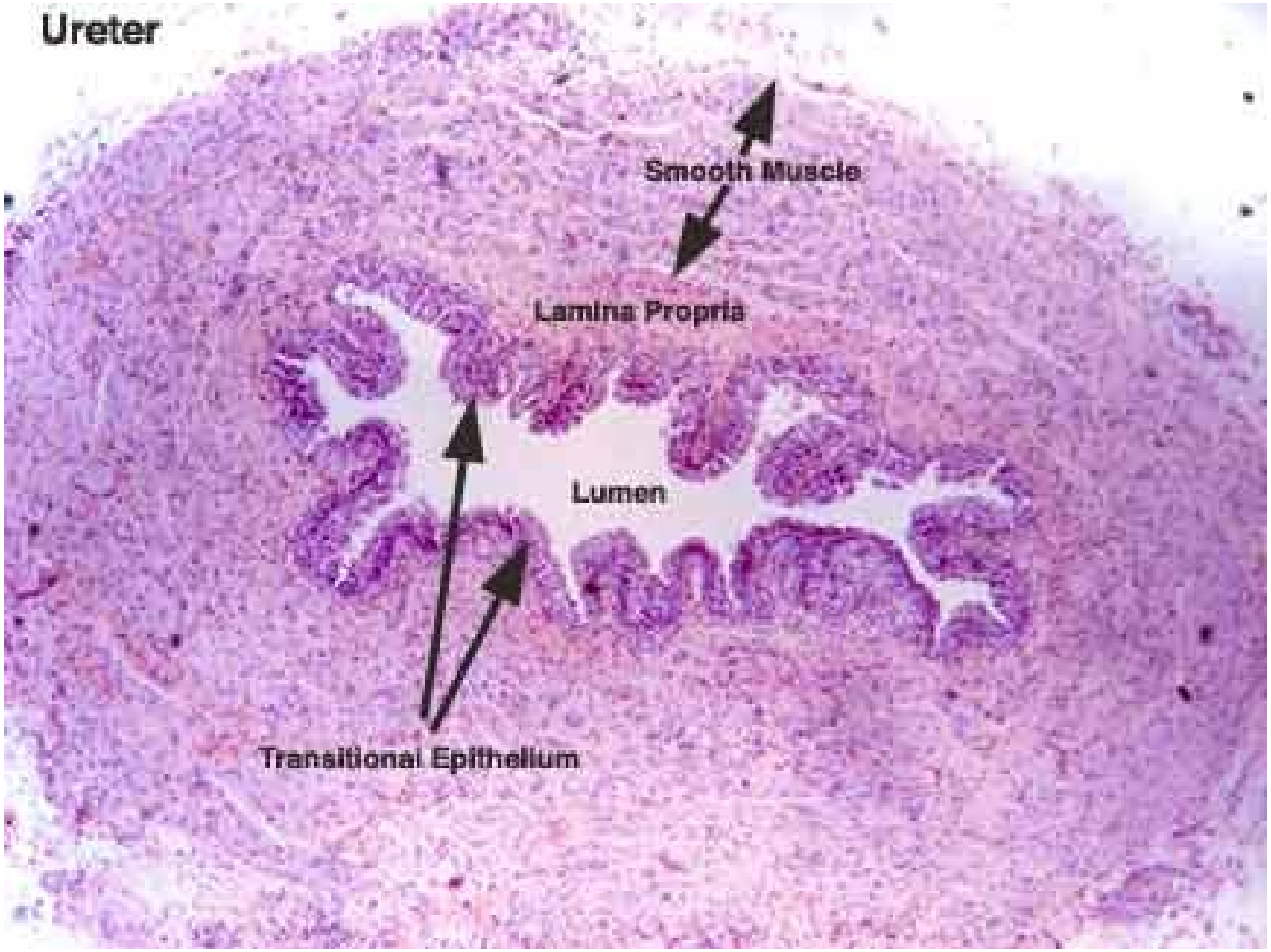
Histology of the Urinary Bladder



(a) Micrograph of the bladder wall (17X)

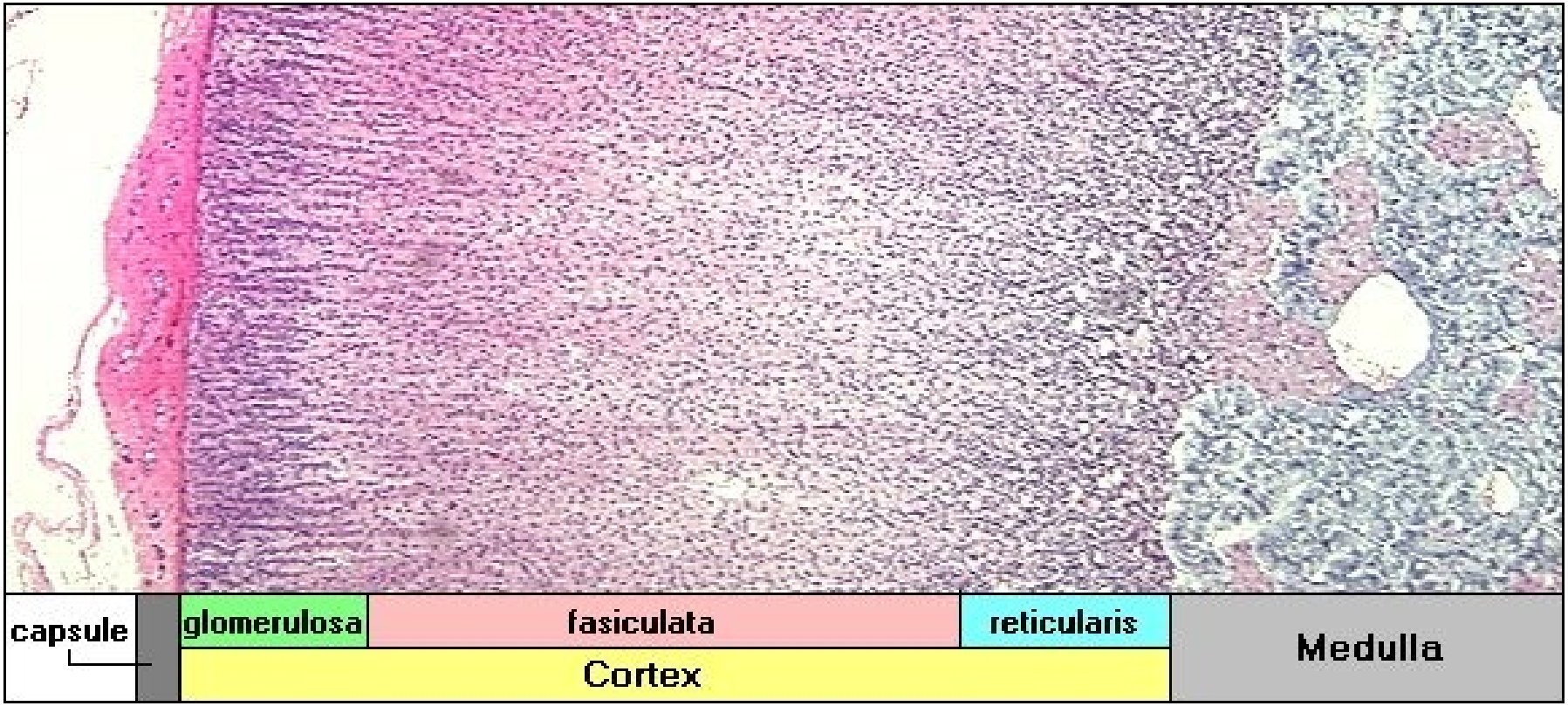
(b) Epithelium lining the lumen of the bladder (360X)

Ureter = močovod



Magn. x4

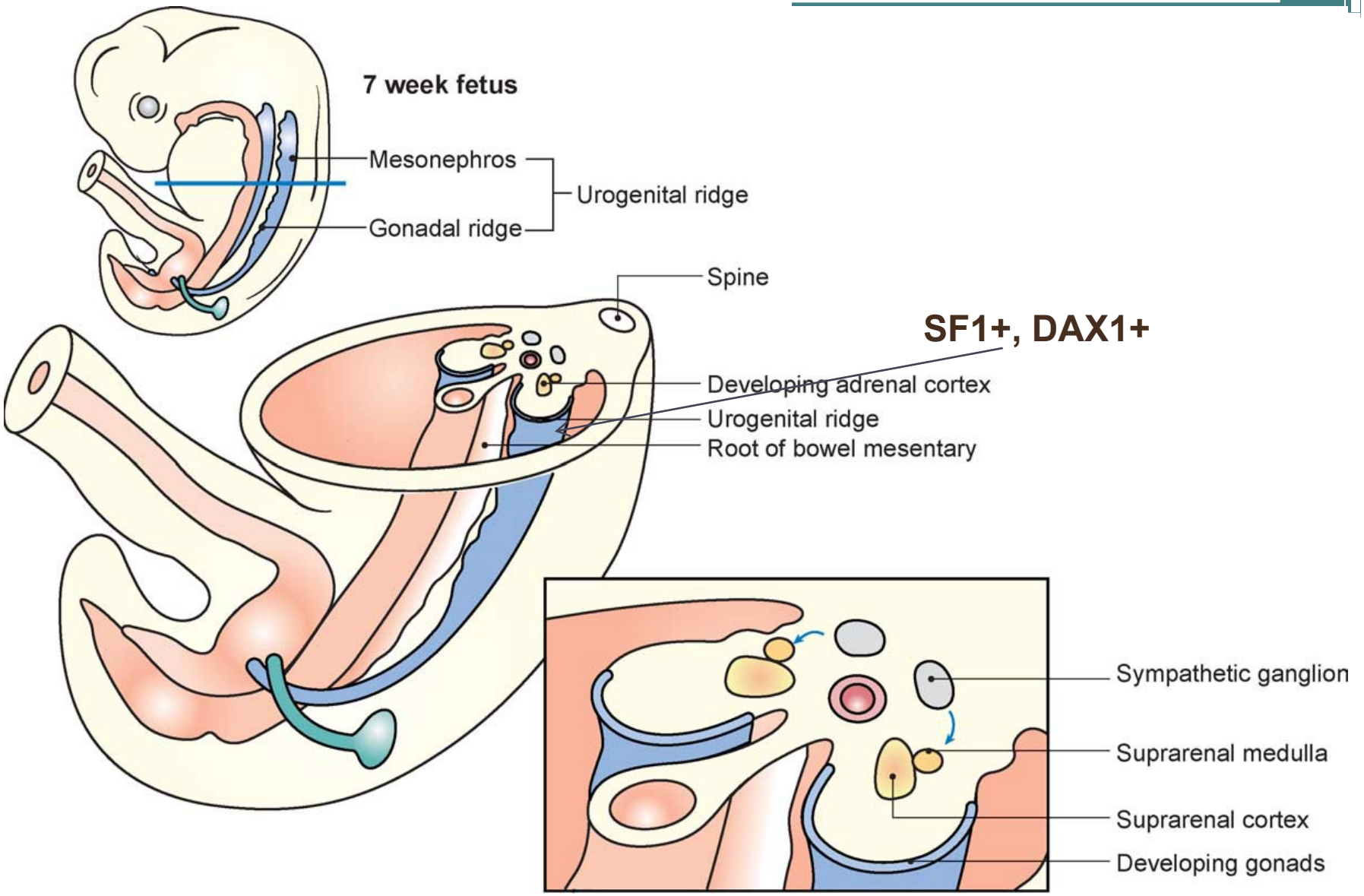
Nadledvina



Cortex	zona Glomerulosa	Mineralocorticoids (aldosteron)
	zona Fasiculata	Glucocorticoidy (cortisol)
	zona Reticularis	Sex hormons - androgens
Medulla		Catecholamins - (nor)adrenalin

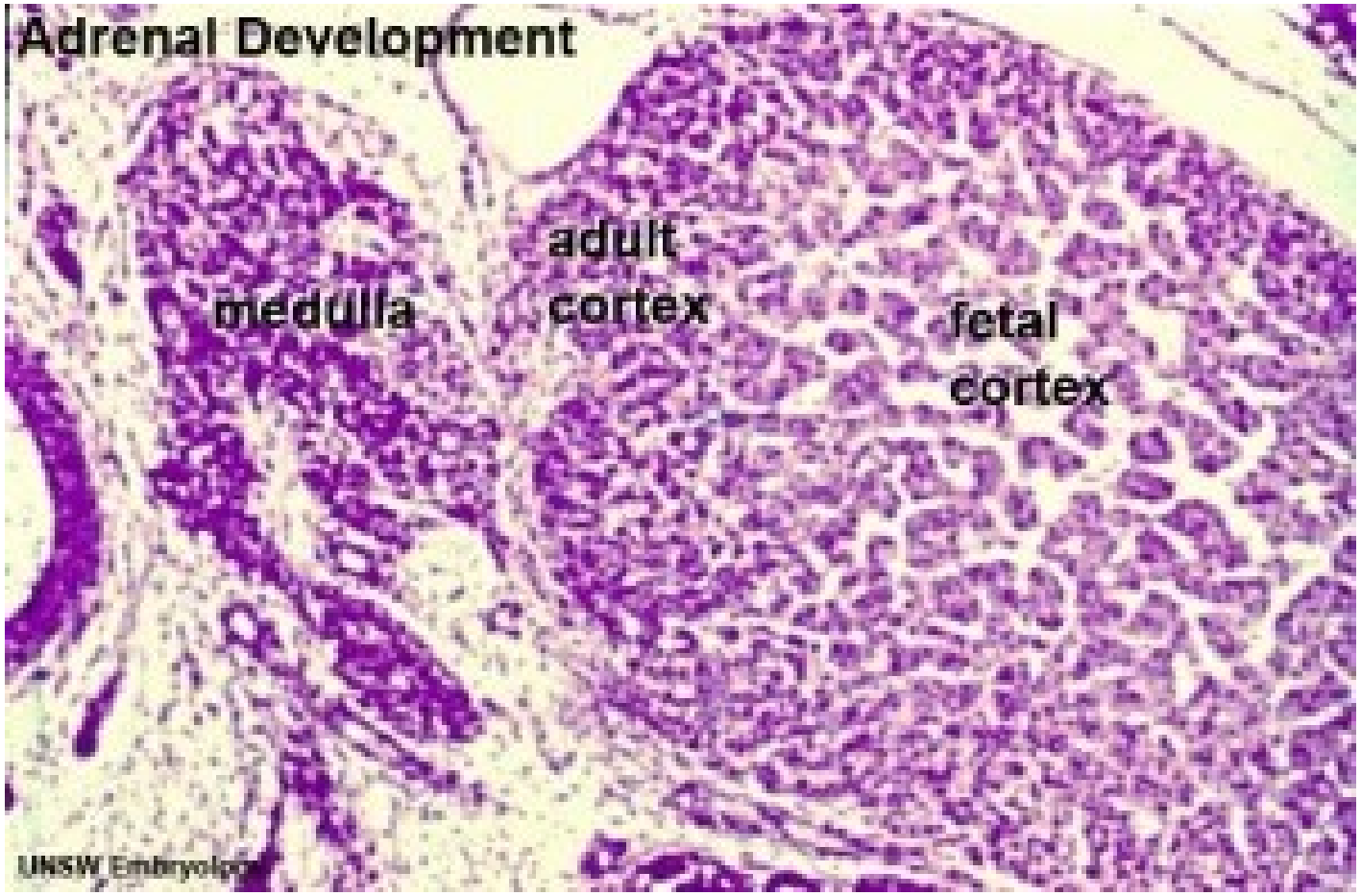
Double origin of Adrenals

- Medulla – neuroectoderm
  - Neural crest cells form sympathetic ganglion in solar plexus = chromafinne cells + primitive sympathetic cells (noduli)
  - Travel to cortex (7^{th} week iud) and along main vein get to its center
- Cortex - intermediate mezoderm
  - Cluster of cells in urogenital ridge (5^{th} week iud) – primitive cortex
  - Second wave of differentiation of mesotel cells (6^{th} w iud) – definitive cortex
  - 8th w iud – separation from other organs by connective tissue
  - Zona reticulata appears after 3rd year of life
  - Proliferation and apoptosis reshape primitive cortex in definitive c.



Barwick et al. Clinical Radiology (2005) 60, 953–959

Adrenals - fetus



8th week iud - medulla is not surrounded by cortex

https://embryology.med.unsw.edu.au/embryology/index.php/Endocrine_-_Adrenal_Development

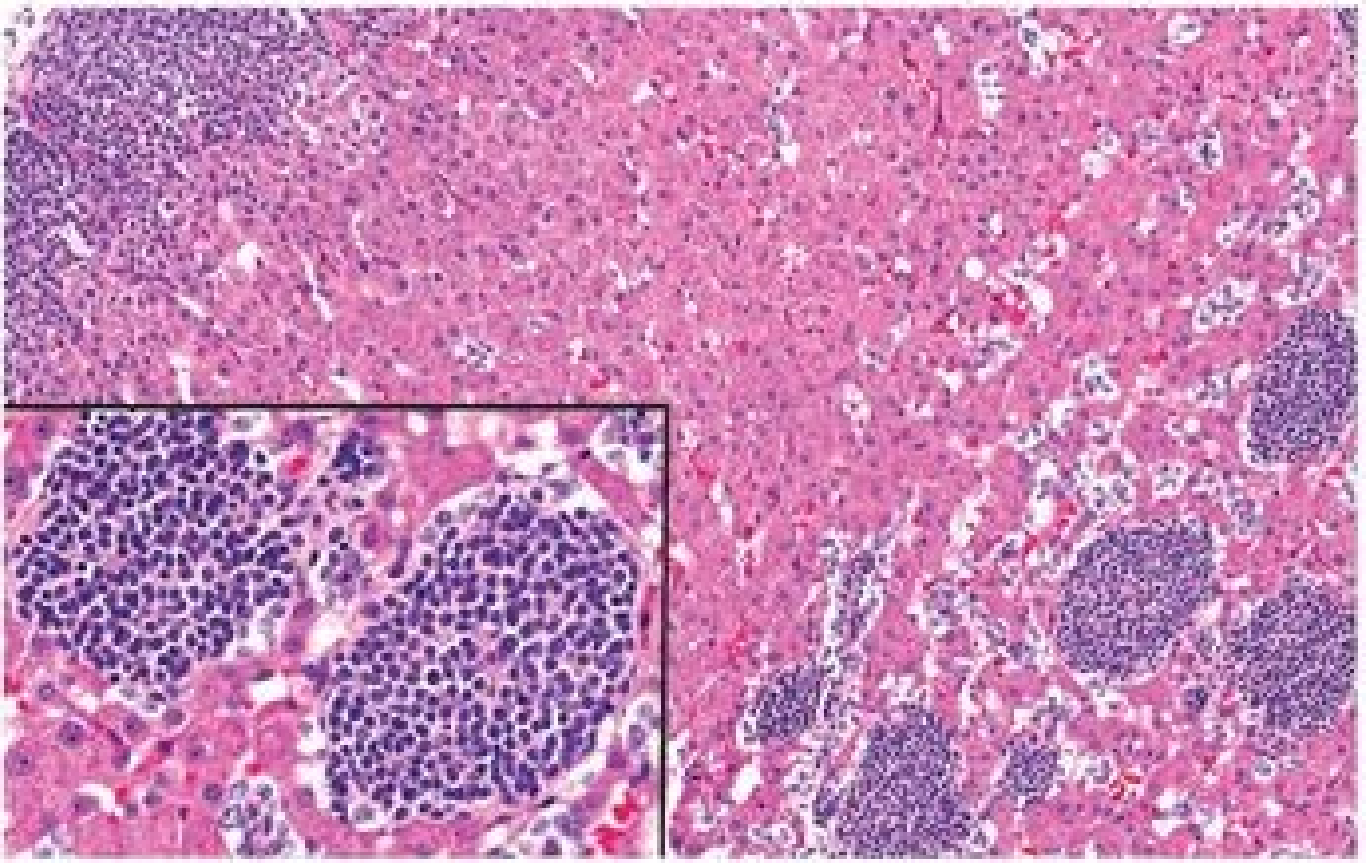


FIGURE 14.3 Nests of primitive sympathetic cells are present within the fetal cortex and at higher magnification (*inset*) in a 14-week fetus. The definitive cortex is seen in the *upper left*.

https://basicmedicalkey.com/adrenal-glands-2/

Models

- H.S.S. embrya 6. – 22. týden iuv (46 TÝDNŮ)

- M.M. E12 = 5-6. týden iuv H.S.S. (16 DNŮ)
- M.M. E14,5 = 7.-8. týden iuv H.S.S.

- G.G. HH10 (1,5 d) = 3. týden iuv H.S.S. (10d)
- G.G. HH20 (3,5 d) = 5. týden iuv H.S.S.
- G.G. HH24 (4,5 d) = 6. týden iuv H.S.S.
- G.G. HH26 (5D) = 6,5. týden IUV H.S.S.
- G.G. Hh28 (5,5-6D) = 7. týden iuv H.S.S.

- T.E. 16D = počátek organogeneze (29d)
- T.E. 27d = těsně před porodem

- M.A. 13,5D= 6. týden iuv H.S.S. (17d)
- M.A. 15D= před porodem

- Zebrafish 5D – larvální stádium (vyklubání embrya ve 3D)

Samples

- H.S.S. embryos 6th – 22nd week iud (46 weeks)

- M.M. E12 = 5-6th week iud H.S.S. (21 days)
- M.M. E14,5 = 7.-8. Ttýden iuv H.S.S.

- G.G. HH10 (1,5 d) = 3. týden iuv H.S.S. (21 d)
- G.G. HH20 (3,5 d) = 5. týden iuv H.S.S.
- G.G. HH24 (4,5 d) = 6. týden iuv H.S.S.
- G.G. HH26 (5D) = 6,5. týden IUV H.S.S.
- G.G. Hh28 (5,5-6D) = 7. týden iuv H.S.S.

- T.E. 16D = beginning of organogenesis (29 d)
- T.E. 27d = just before the birth

- M.A. 13,5D= 6. týden iuv H.S.S. (17d)
- M.A. 15D= just before the birth

- Zebrafish 5D – larval stage (embryo hatching at 3D)

Carnegie Stage	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Human Days	1	2-3	4-5	5-6	7-12	13-15	15-17	17-19	20	22	24	28	30	33	36	40	42	44	48	52	54	55	58
Mouse Days	1	2	3	E4.5	E5.0	E6.0	E7.0	E8.0	E9.0	E9.5	E10	E10.5	E11	E11.5	E12	E12.5	E13	E13.5	E14	E14.5	E15	E15.5	E16
Rat Days	1	3.5	4-5	5	6	7.5	8.5	9	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15	15.5	16	16.5	17	17.5

Note these Carnegie stages are only approximate day timings for average of embryos. **Links:** Carnegie Stage Comparison

Srovnání vývoje lidského a myšího embrya Vývoj trvá 21 dní
https://embryology.med.unsw.edu.au/embryology/index.php/Category:Mouse_E12

Atlas myšího embrya
http://www.emouseatlas.org/eAtlasViewer_ema/application/ema/kaufman/plate_25a.php

Stádia vývoje kuřecího embrya
https://embryology.med.unsw.edu.au/embryology/index.php/Hamburger_Hamilton_Stages
Vývoj trvá 21 dní

Stádia vývoje krtka evropského (talpa europea)
https://www.researchgate.net/publication/250068036_Developmental_Stages_and_Growth_Rate_of_the_Mole_Talpa_occidentals_Insectivora_Mammalia
Vývoj trvá 28 dní