

VÝVOJ MOČOVÉHO A POHLAVNÍHO SYSTÉMU

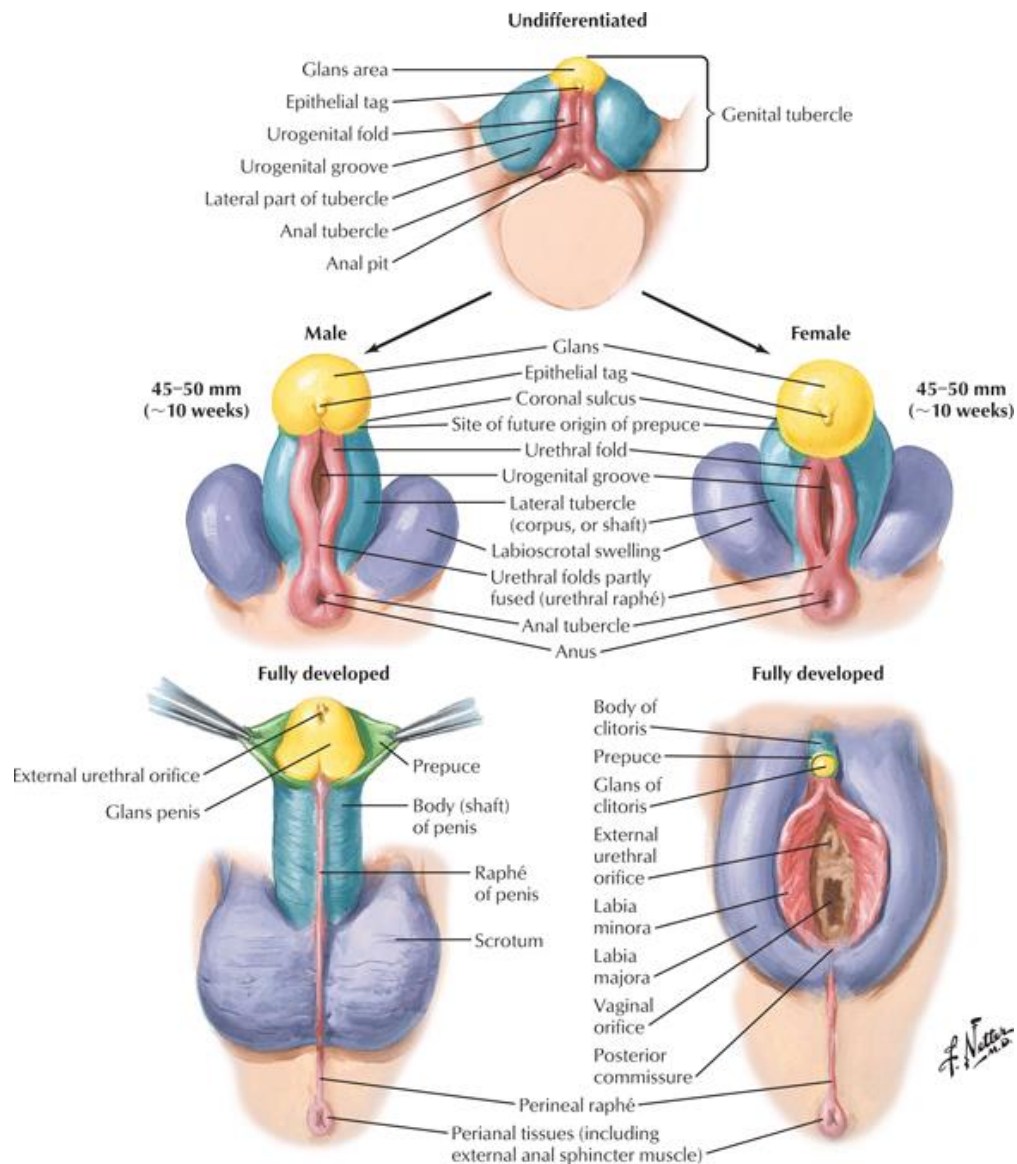
ANATOMIE, HISTOLOGIE,

EMBRYOLOGIE

14. 3. 2024

MUDr. Anna Malečková, Ph.D.

anna.maleckova@lfp.cuni.cz



O čem dnes budeme mluvit

Vývoj močového systému

Nefrogenní lišta, urogenitální lišta

Pronephros

Mesonephros

Metanephros

Kloaka, močový měchýř a močovody

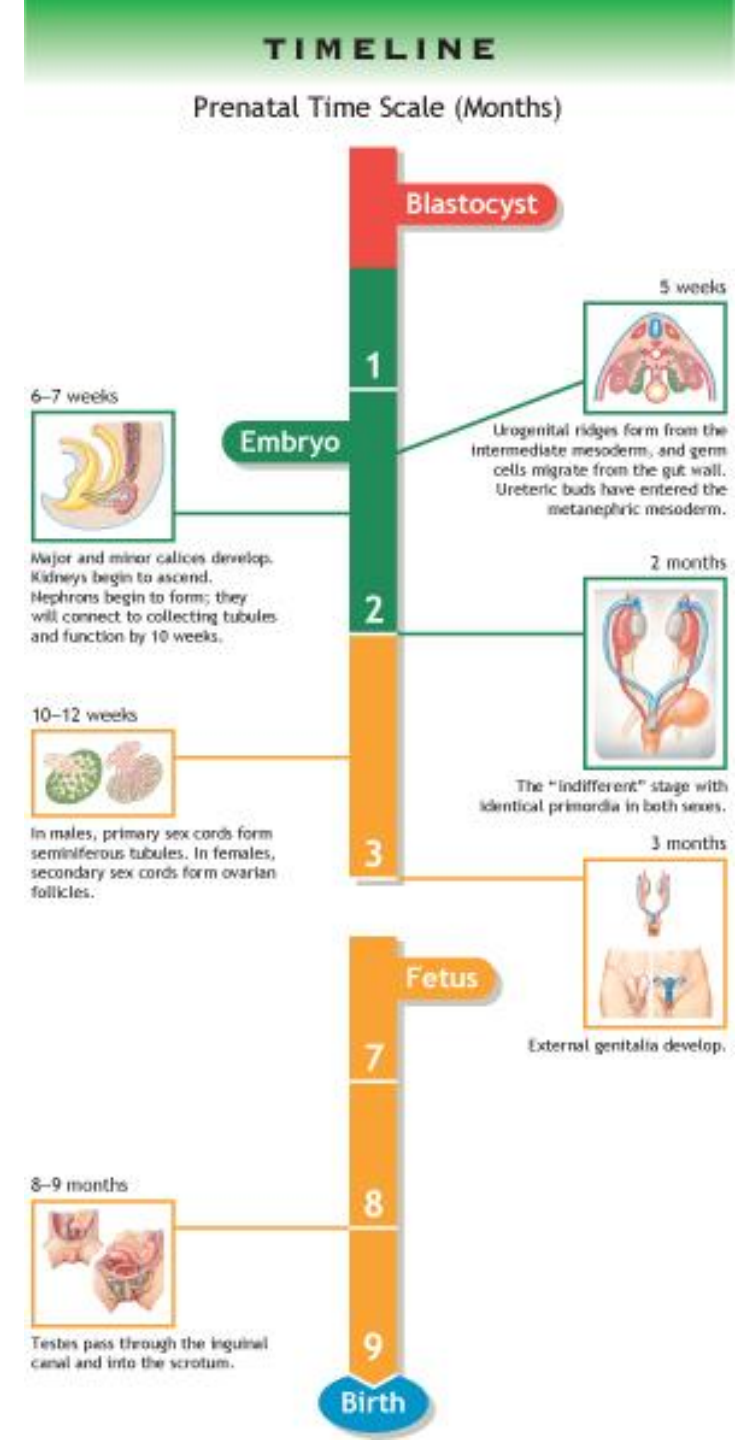
Vývoj pohlavního systému

Indiferentní stádium gonád a vývodných cest pohlavních

Varle a nadvarle

Vaječník, děloha, pochva

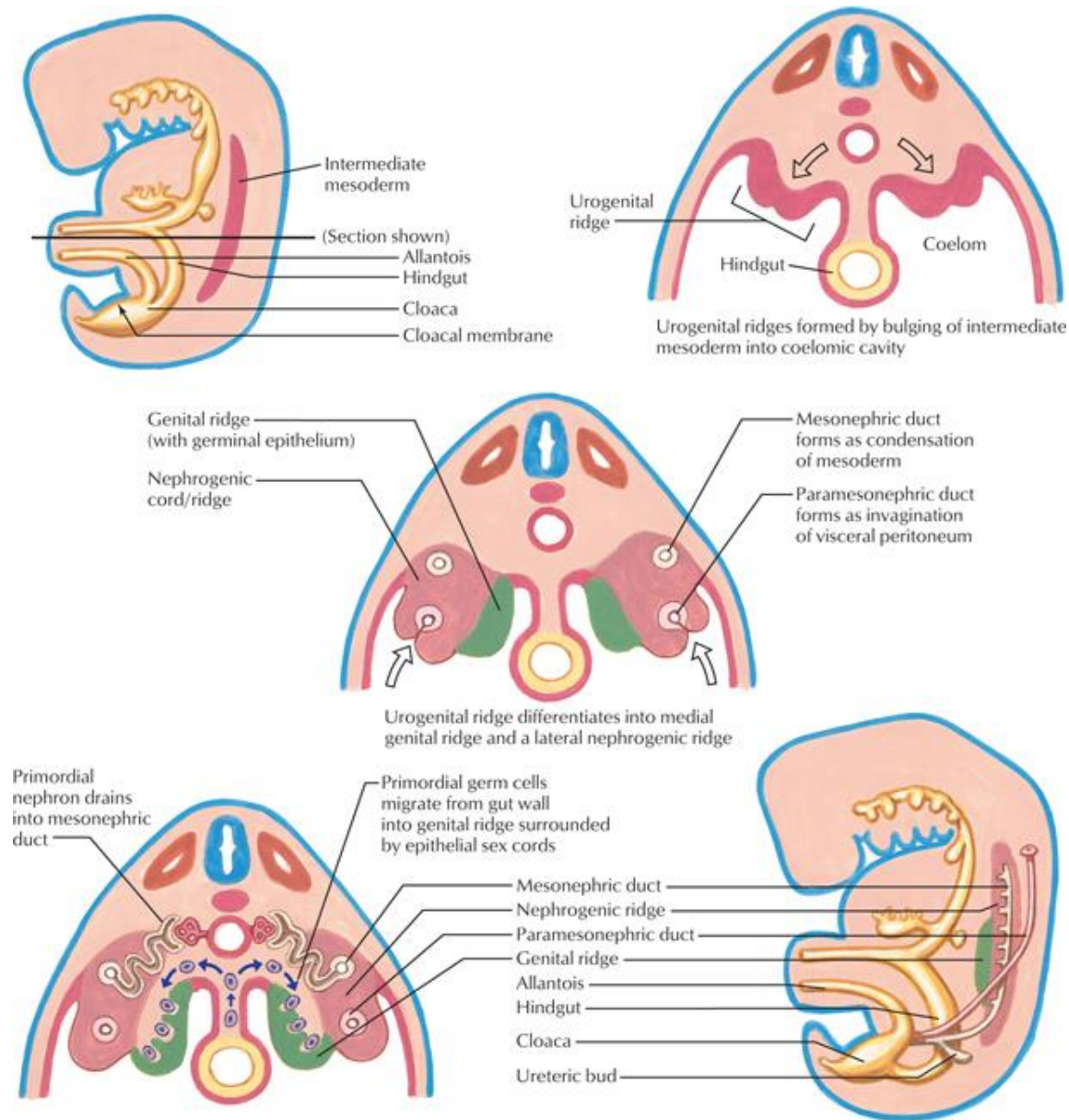
Vnější genitál



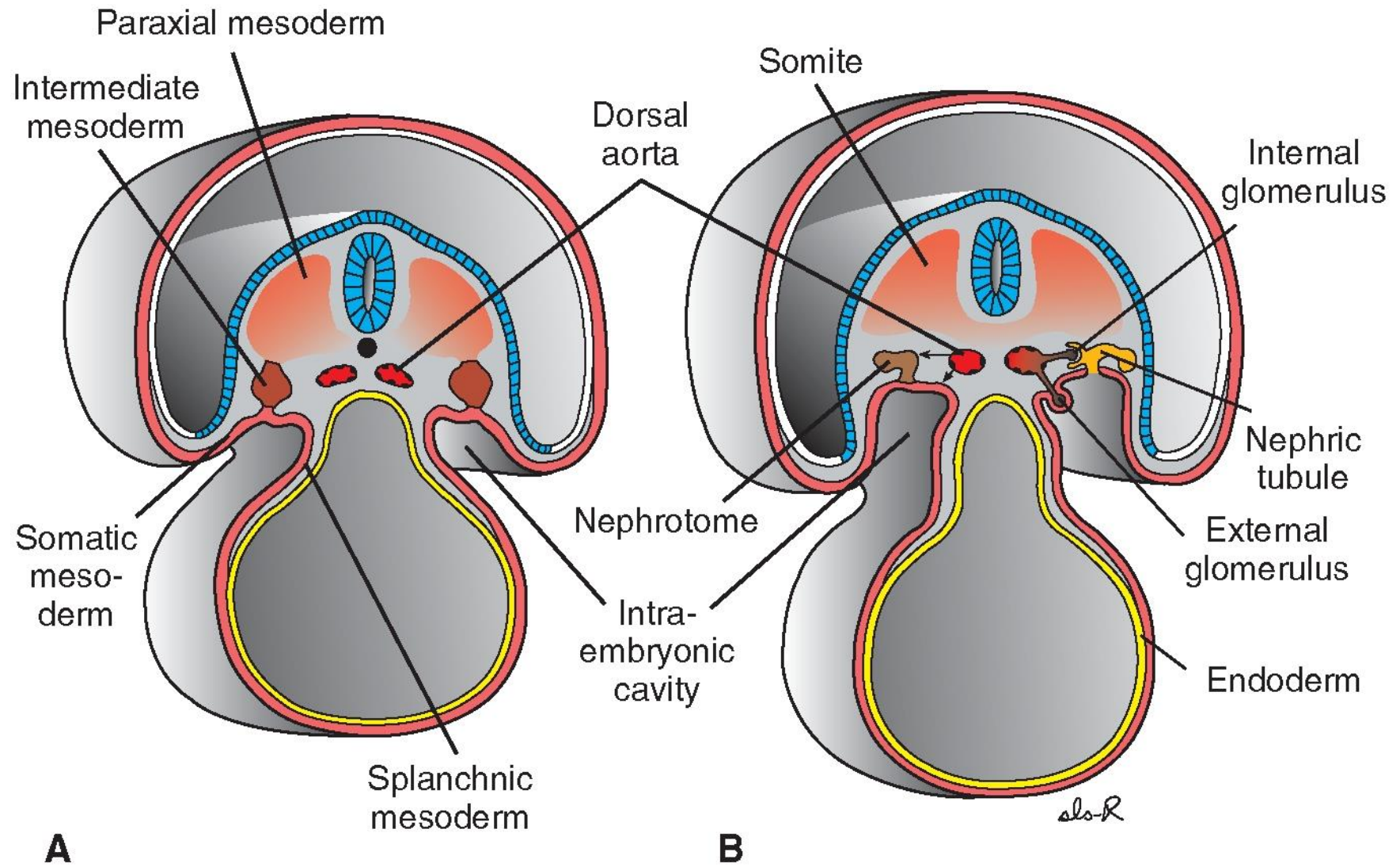
Močový a pohlavní systém

– principy vývoje

- Původ z intermediárního mezodermu = mezodermový val
- Ústí do společné dutiny = kloaky
- Časné struktury jednoho systému jsou následně součástí systému druhého
- Přítomnost struktur typických pro nižší obratlovce
- Interakce mezi epitelem a mezenchymem
- Indiferentní orgány se přemění v závislosti na pohlaví



Intermediární mezoderm, nefrogenní lišta



Intermediární mezoderm, nefrogenní lišta



System tří vylučovacích orgánů

- **PRONEPHROS: 3. – 4. týden**

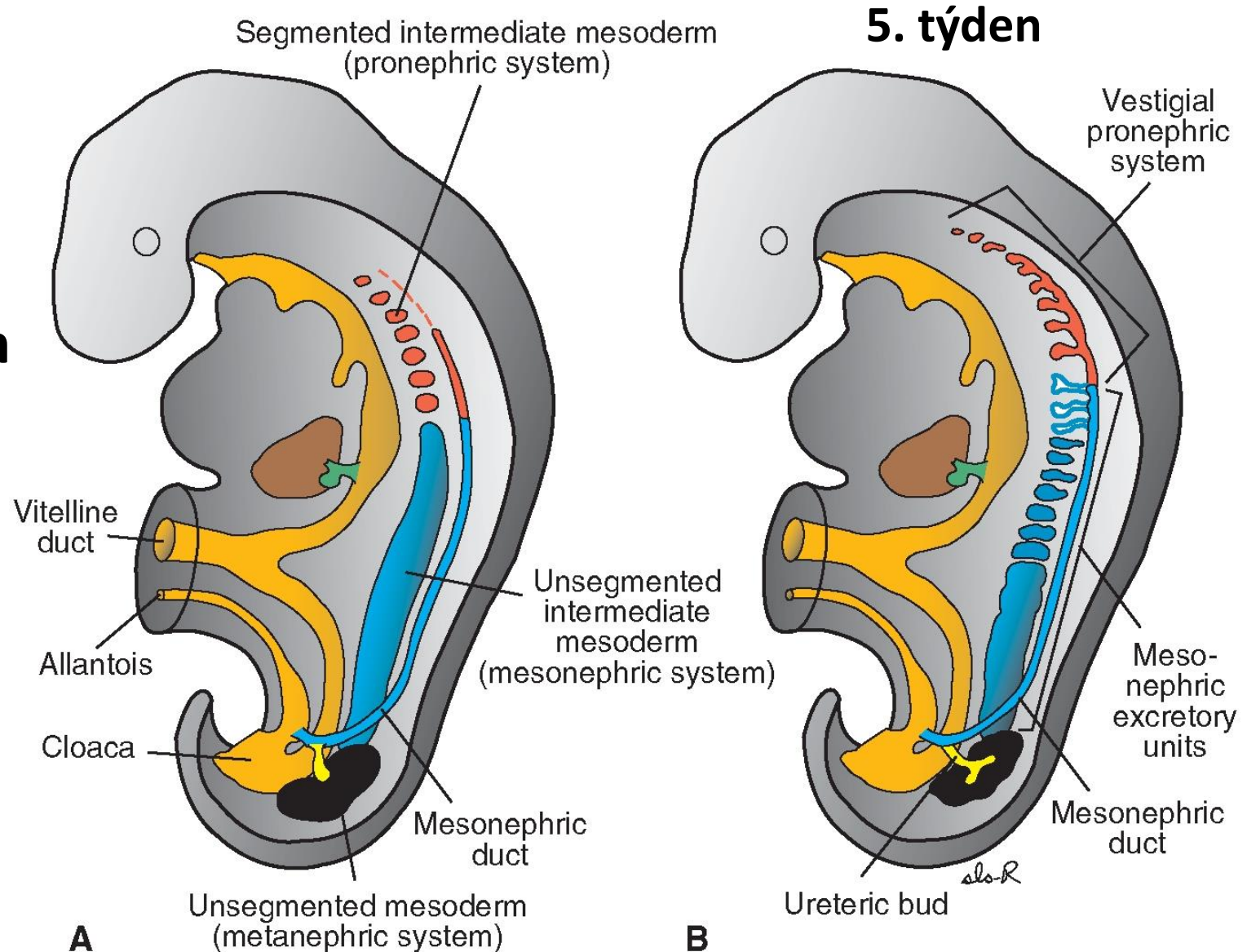
- Dočasný orgán v krční oblasti (C2,3 – Th1)
- Zcela zaniká

- **MESONEPHROS: 4. – 6. týden**

- Horní hrudní – horní bederní segmenty (Th2 – L3)
- Částečně zaniká – jiný osud u muže a u ženy

- **METANEPHROS: od 5. týdne**

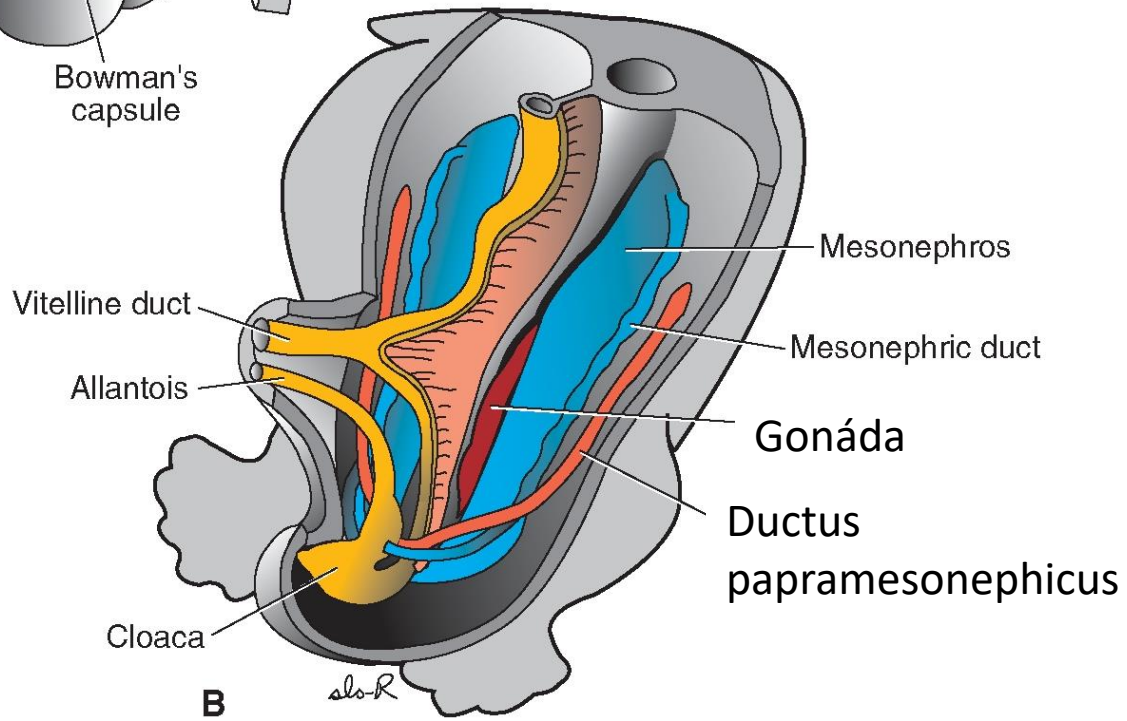
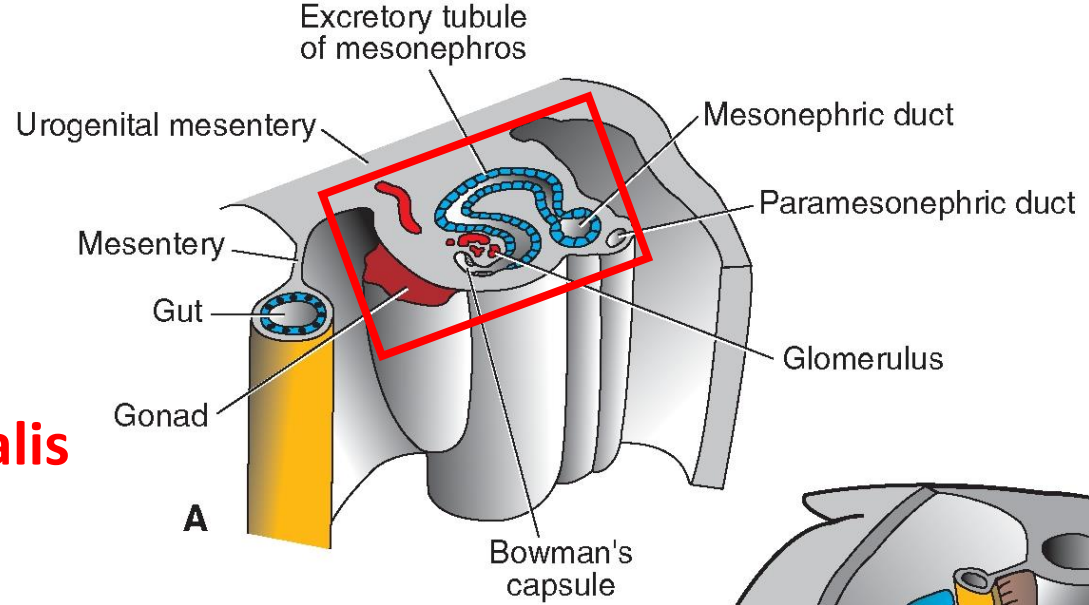
- U vyústění mesonephros do kloaky (L4,5)
- Definitivní ledviny



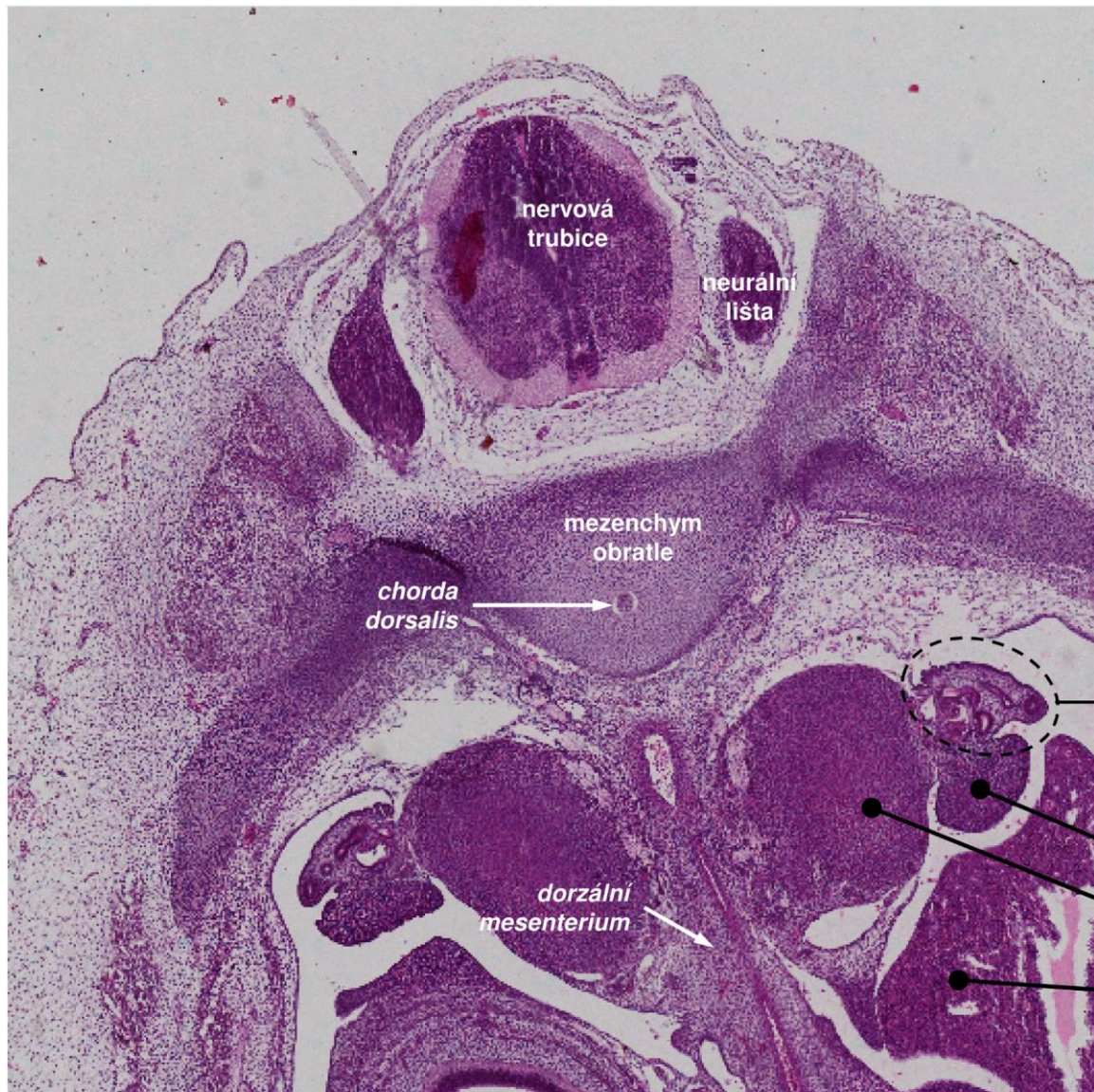
Intermediární mezoderm, urogenitální lišta

5. týden

Plica urogenitalis



Intermediární mezoderm, urogenitální lišta



mesonephros
mesonefrický (Wolffův) vývod
paramesonefrický (Müllerův) v.

gonáda v indiferentním stádiu

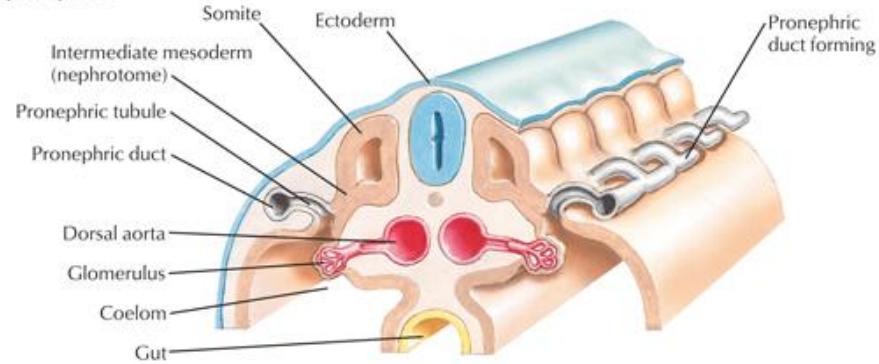
kůra nadledviny

játra

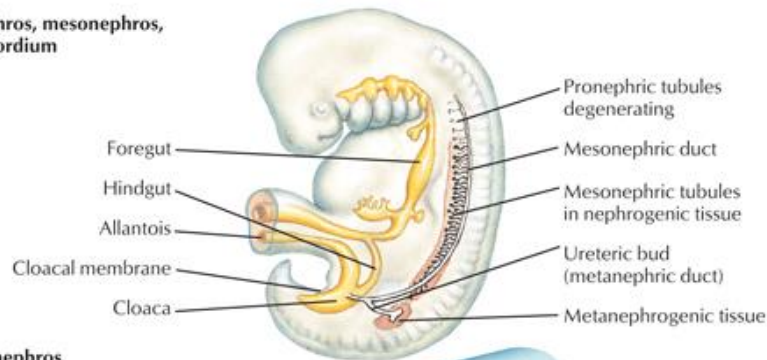
Gonadální lišta (Carnegie 17, ~42. den, 12 mm, transverzální řez) – H&E

Pronephros, mesonephros

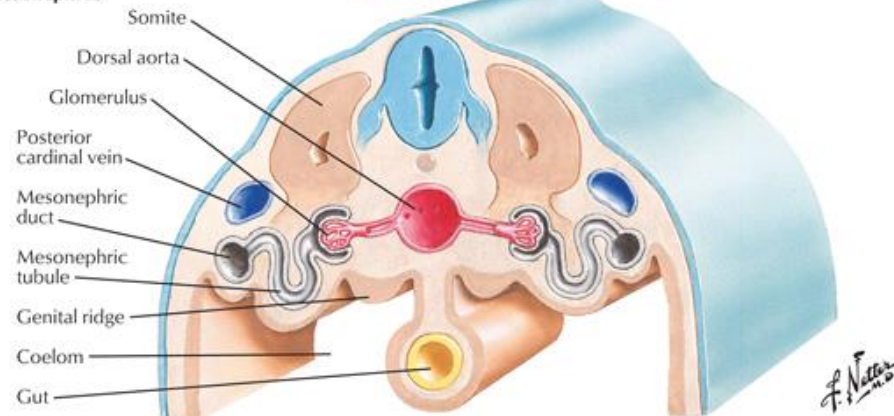
Section through pronephros



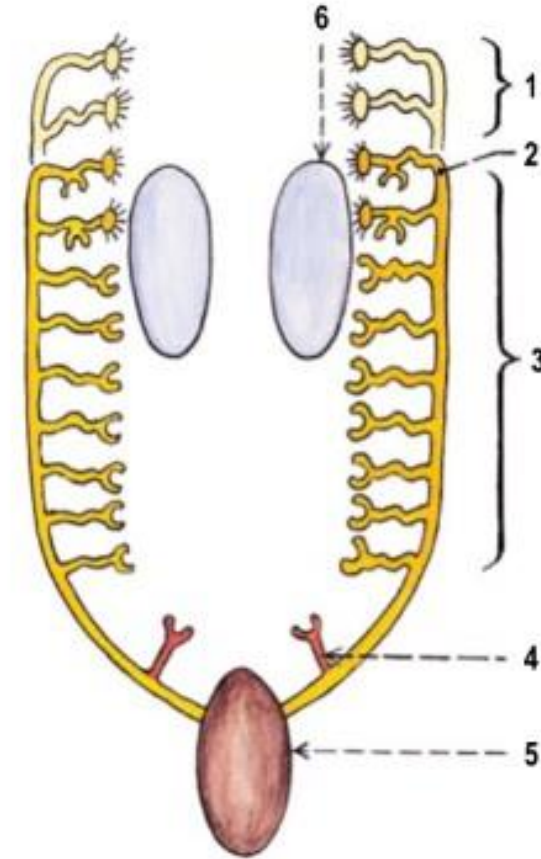
Topography of pronephros, mesonephros, and metanephric primordium



Section through mesonephros



Cochard: Netter's Atlas of Human Embryology
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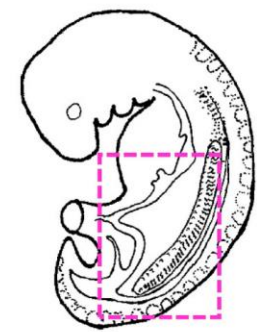
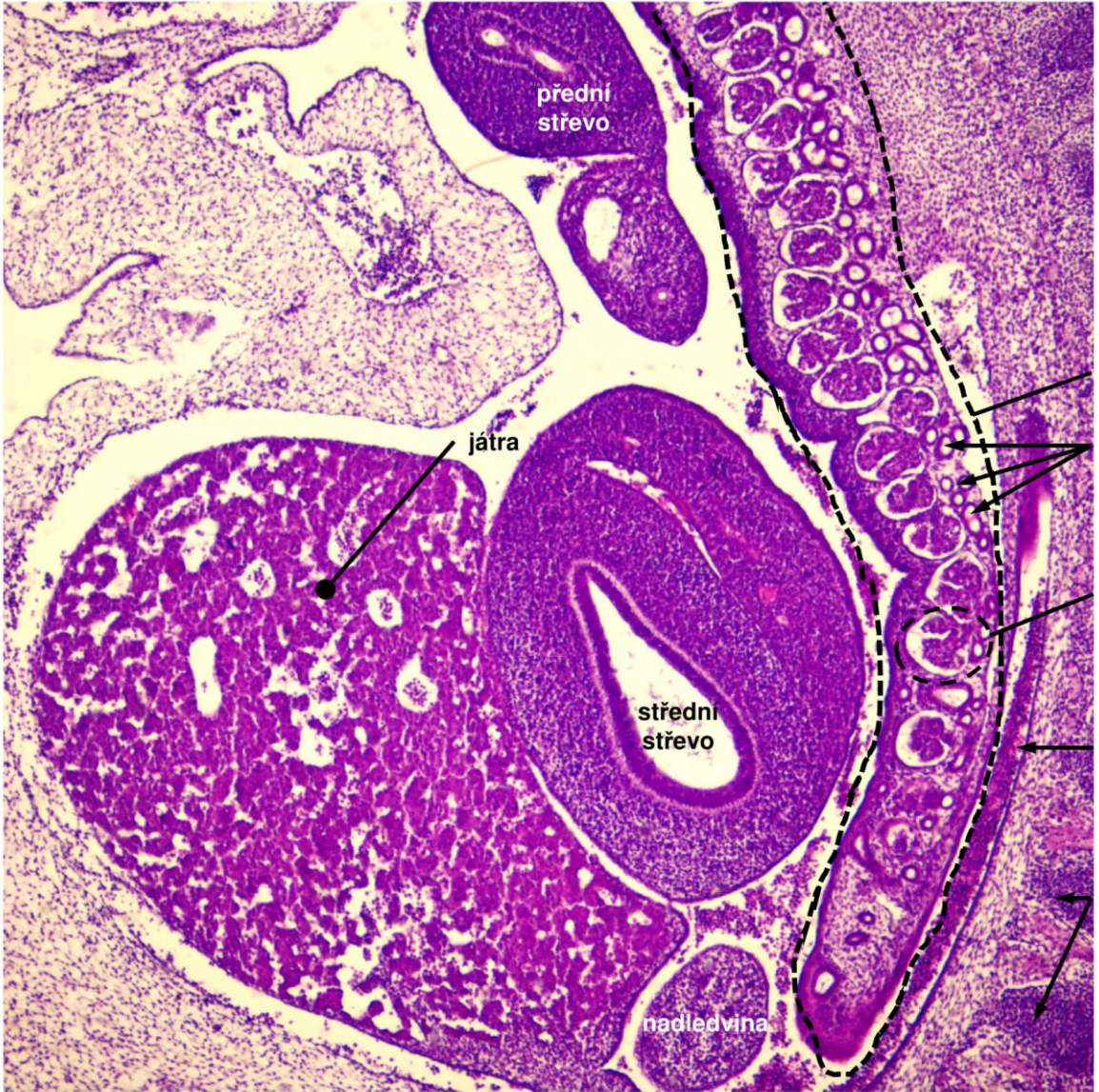


Obr. 208. SCHEMA RANÝCH VÝVOJOVÝCH FÁZÍ MOČOVÉHO ÚSTROJÍ

- 1 zanikající kanálky pronephros
- 2 ductus Wolffii
- 3 kanálky mesonephros
- 4 ureterový pupen
- 5 kloaka
- 6 základ gonády

Čihák R, Anatomie 2, Druhé, upravené a doplněné vydání, Grada, 2002

Mesonephros



- mesonephros
- odvodné kanálky
- corpusculum renale (tj. glomerulus a Bowmannovo pouzdro)
- abdominální aorta
- tvůřící se obratle

Mesonephros (Carnegie 15, ~35. den, 8 mm, sagitální řez) – H&E

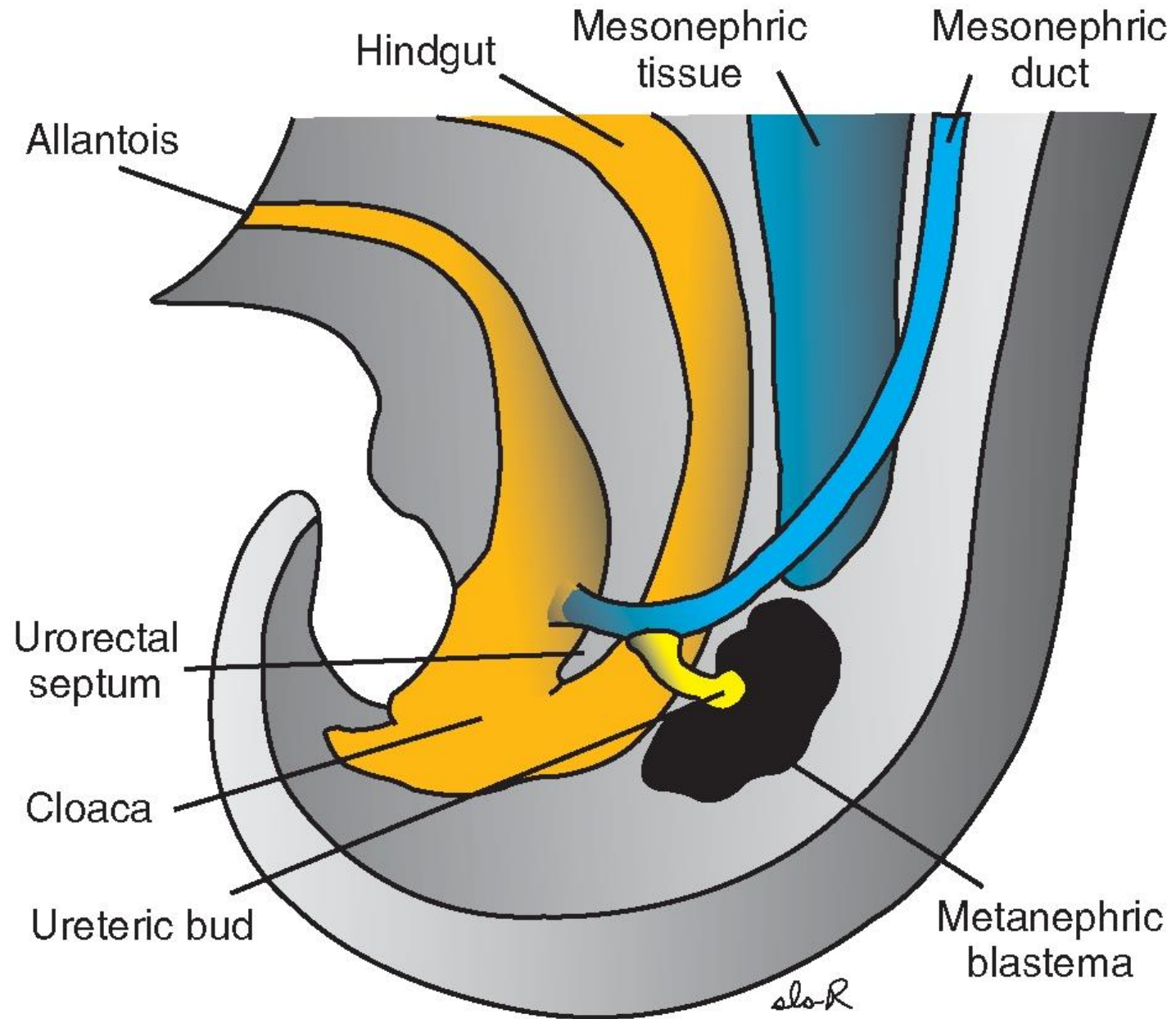
Metanephros

- **URETEROVÝ PUPEN**

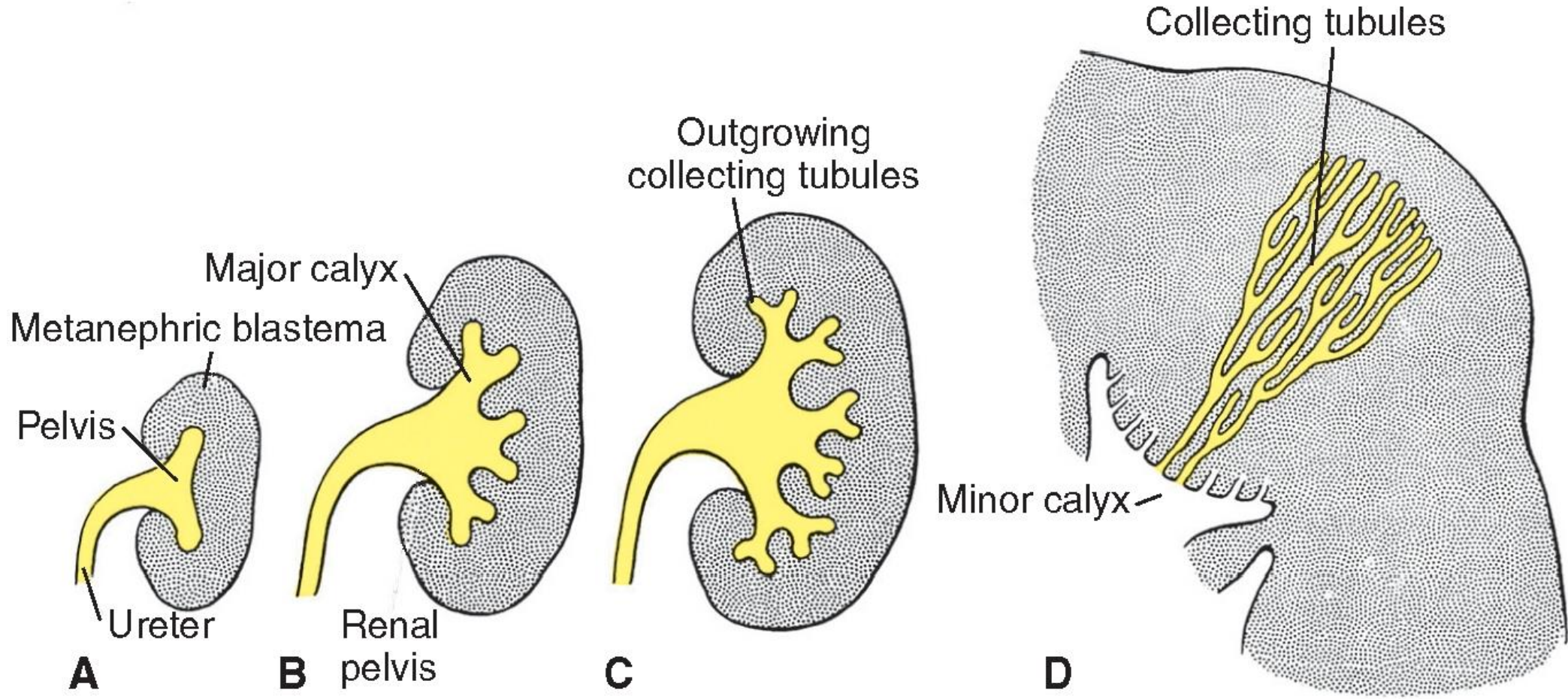
- Sběrací a odvodné kanálky ledviny
- Části močových cest:
 - ledvinové kalichy
 - ledvinová pánvička
 - močovod

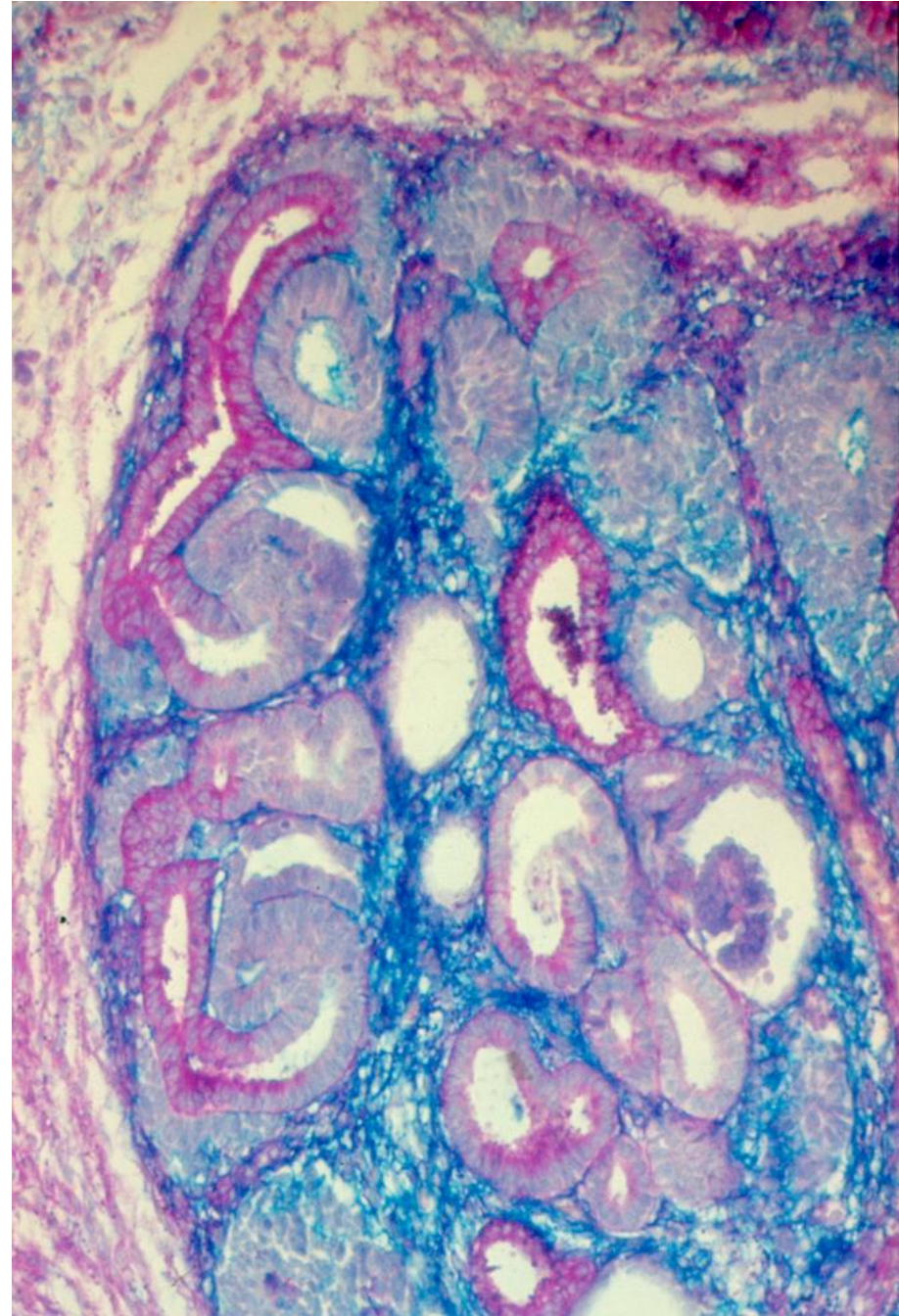
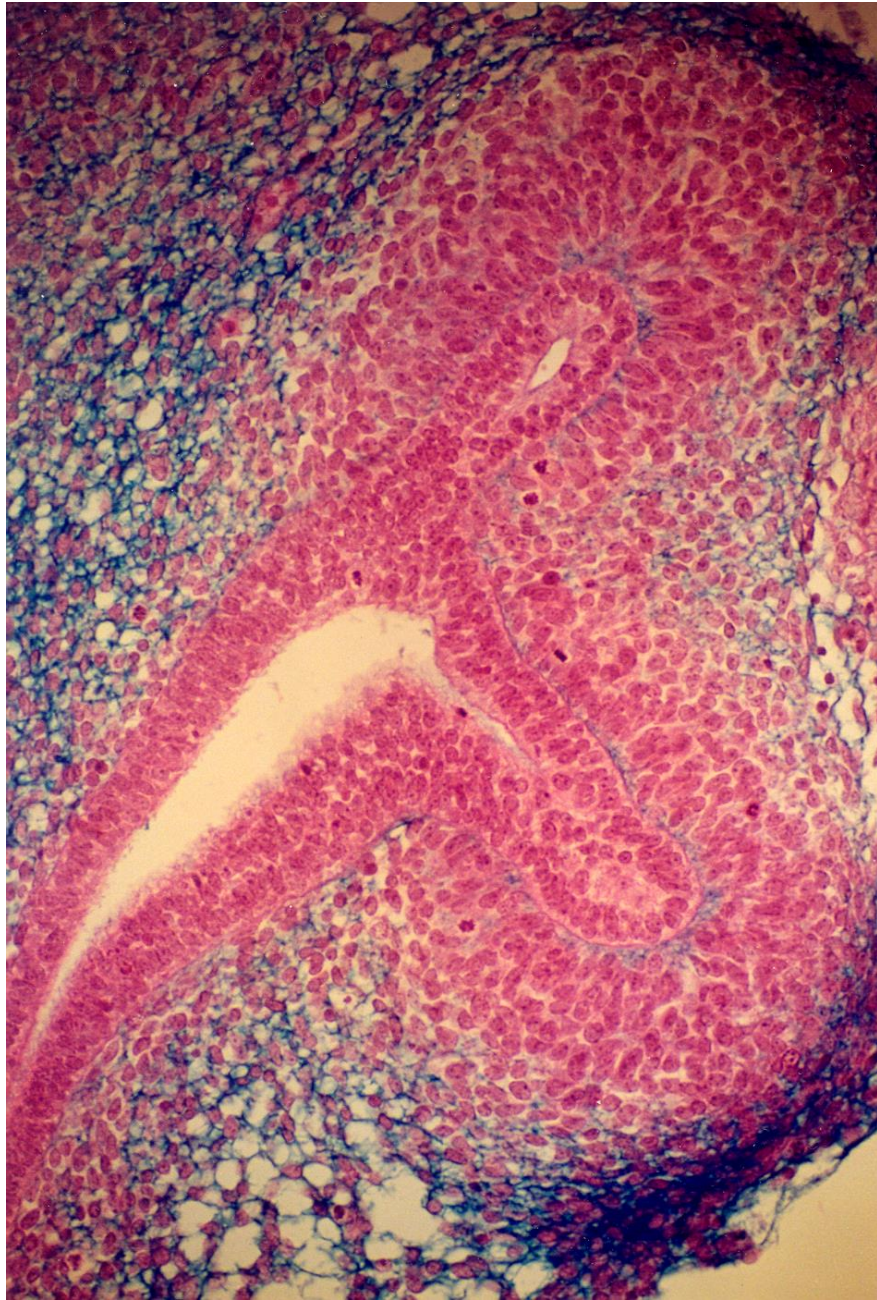
- **METANEPHROGENNÍ BLASTÉM**

- Nefron:
 - Bowmanovo pouzdro
 - Proximální tubulus
 - Henleova klička
 - Distální tubulus

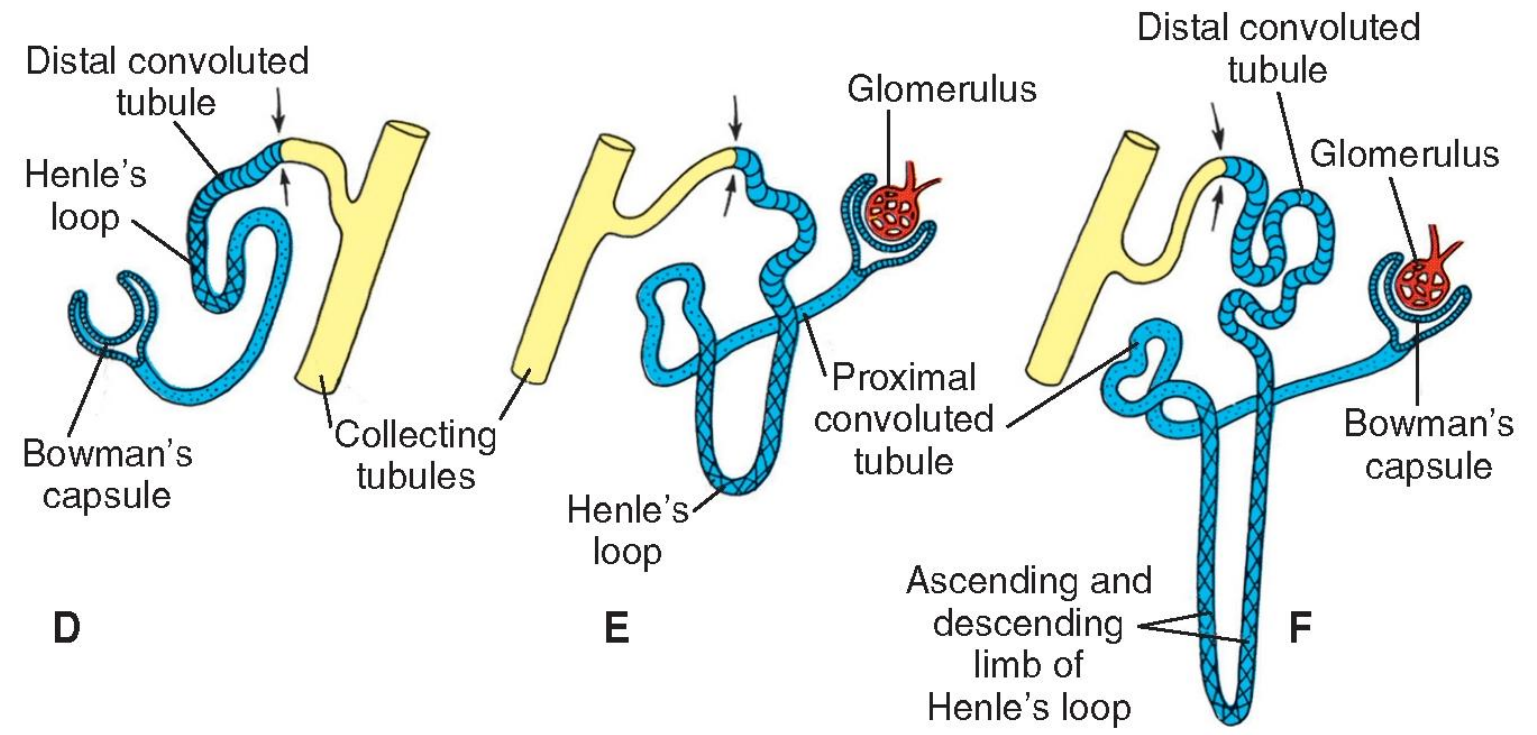
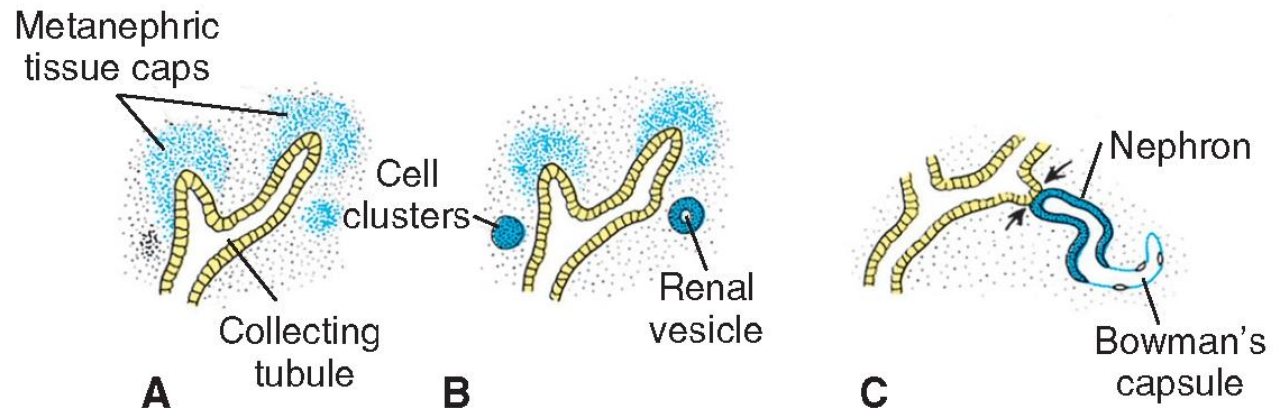


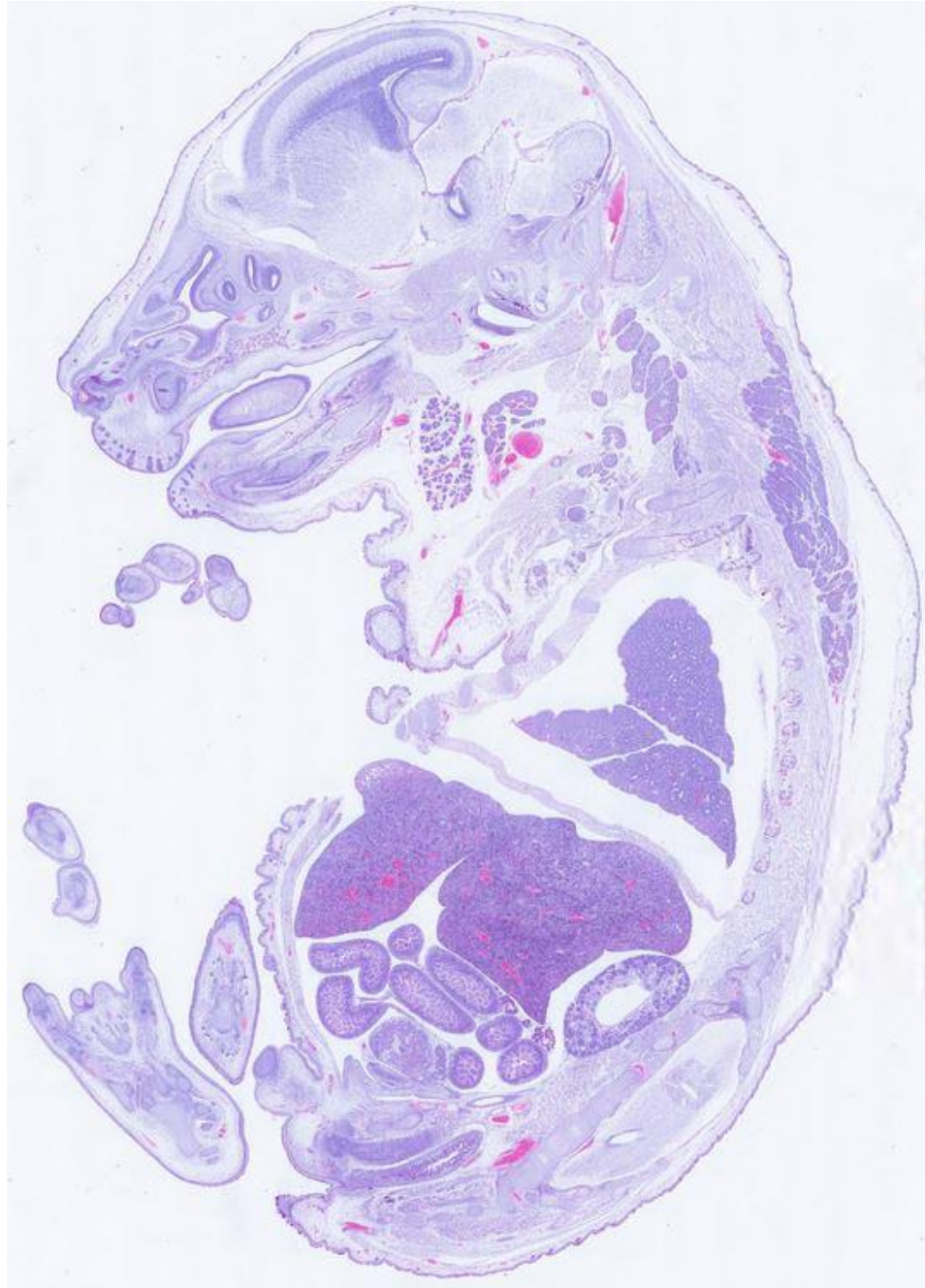
Metanephros – ureterový pupen





Metanephros

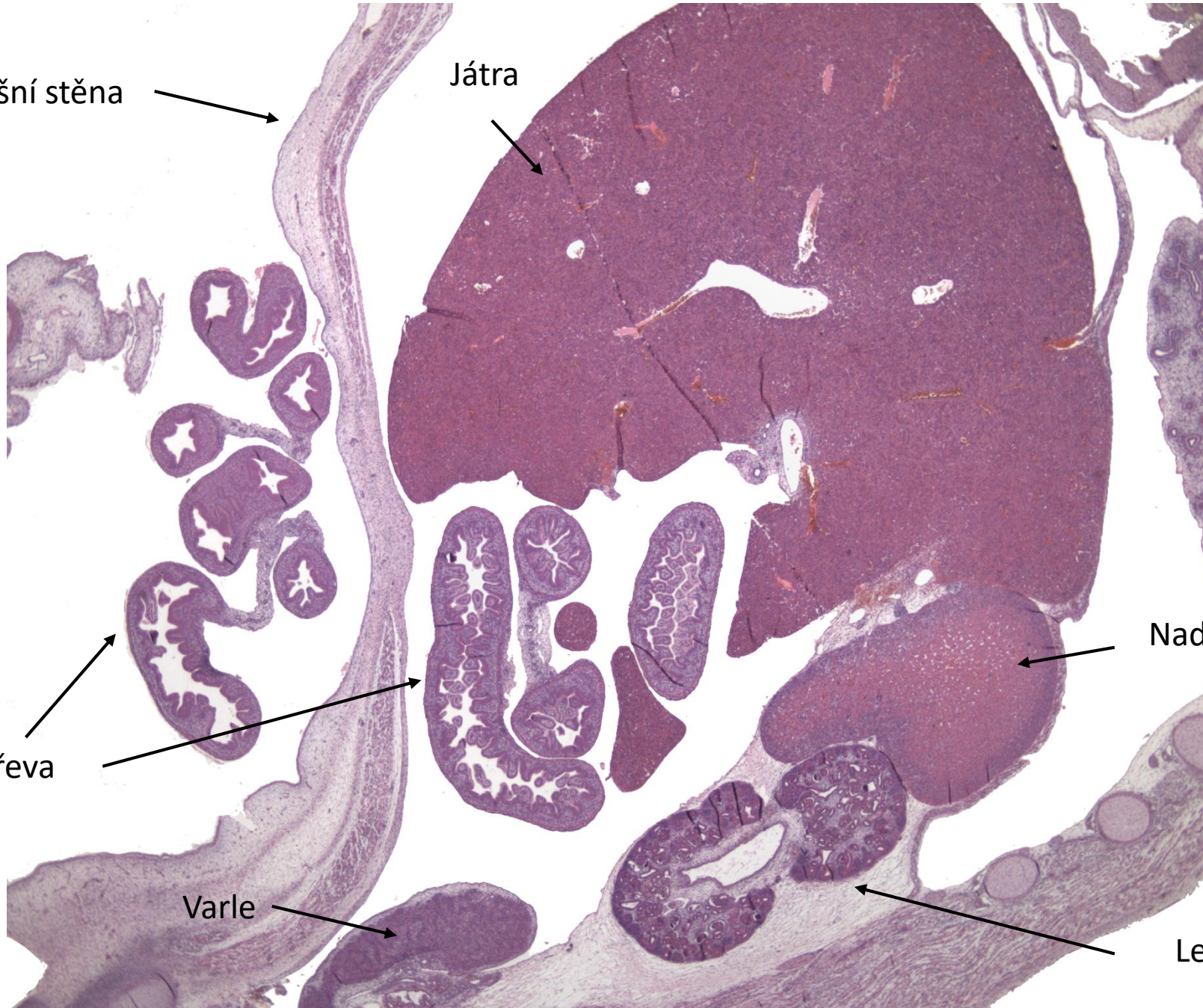




<https://lfp.smartzoom.com/share/e6a5c68328ce5d6fb00749f59d65d39d8c72a720d44820c467687175ceed4291>

Břišní stěna

Játra

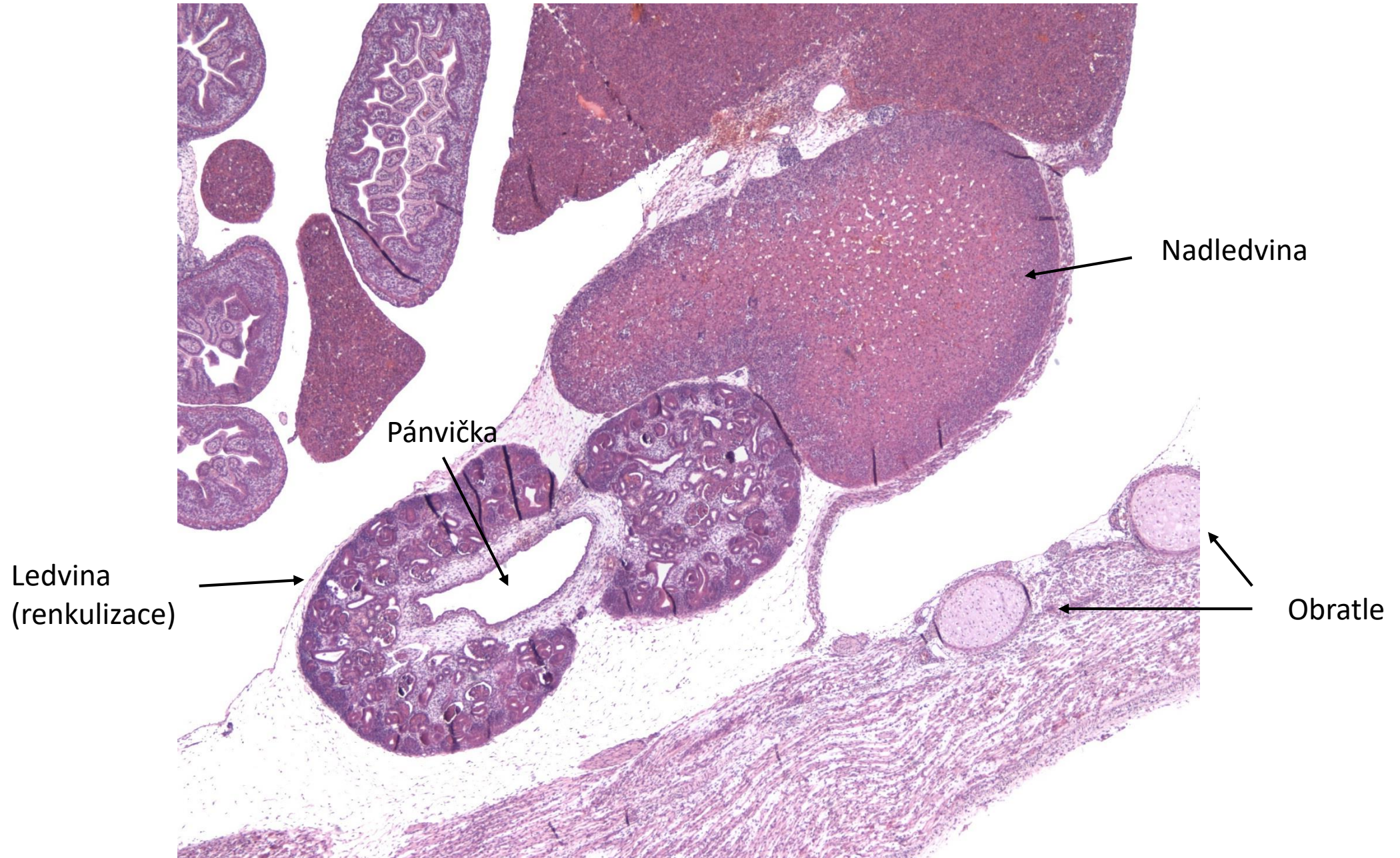


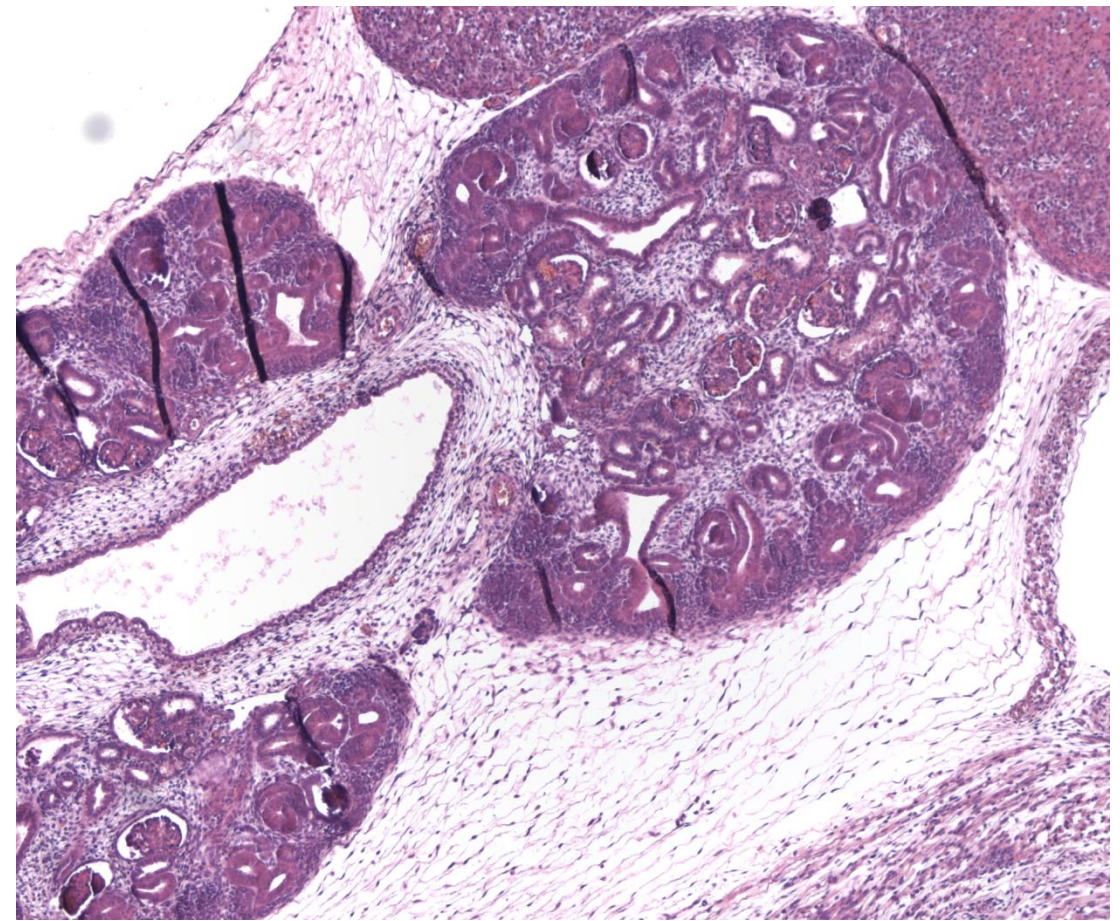
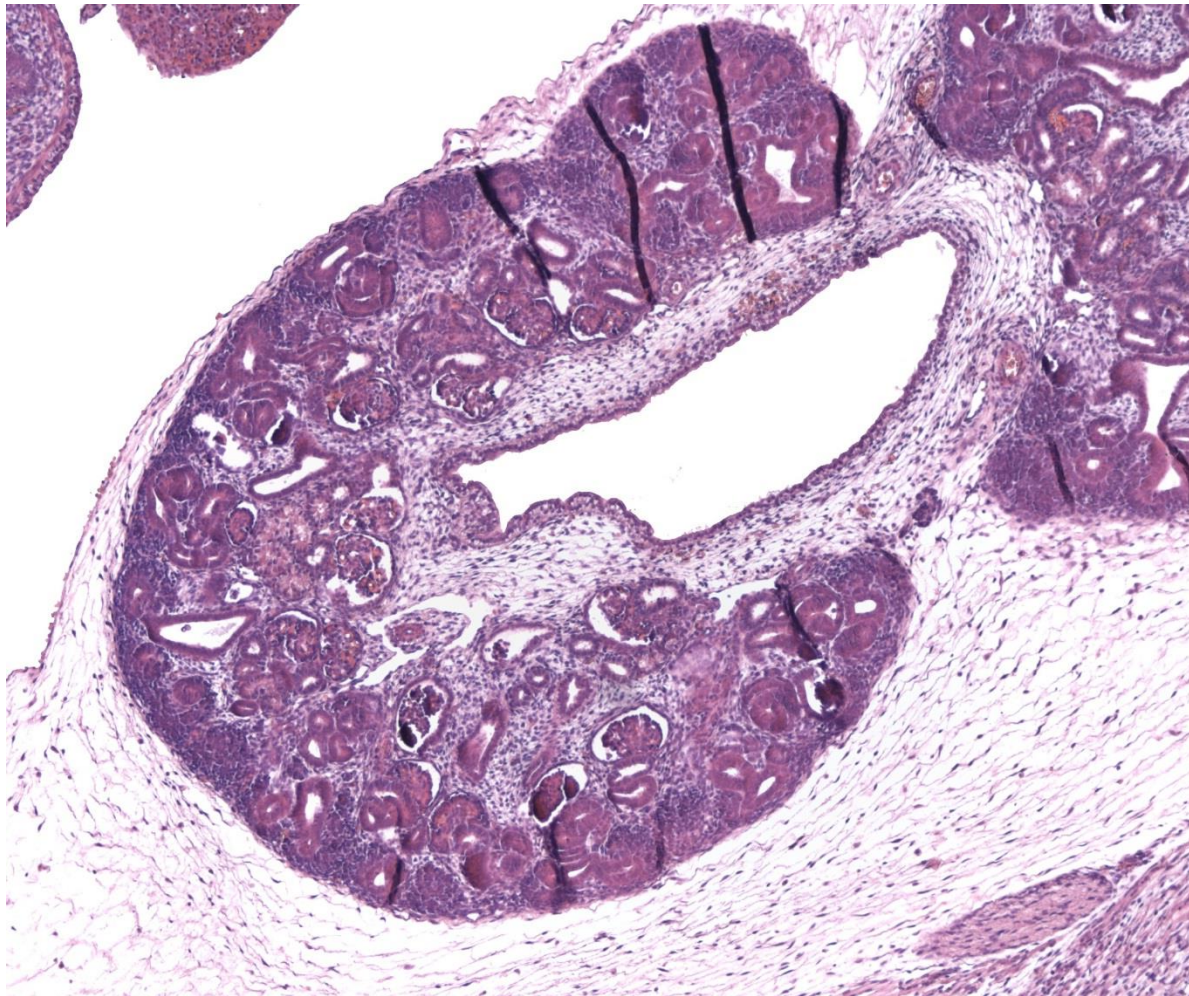
Střeva

Varle

Nadledvina

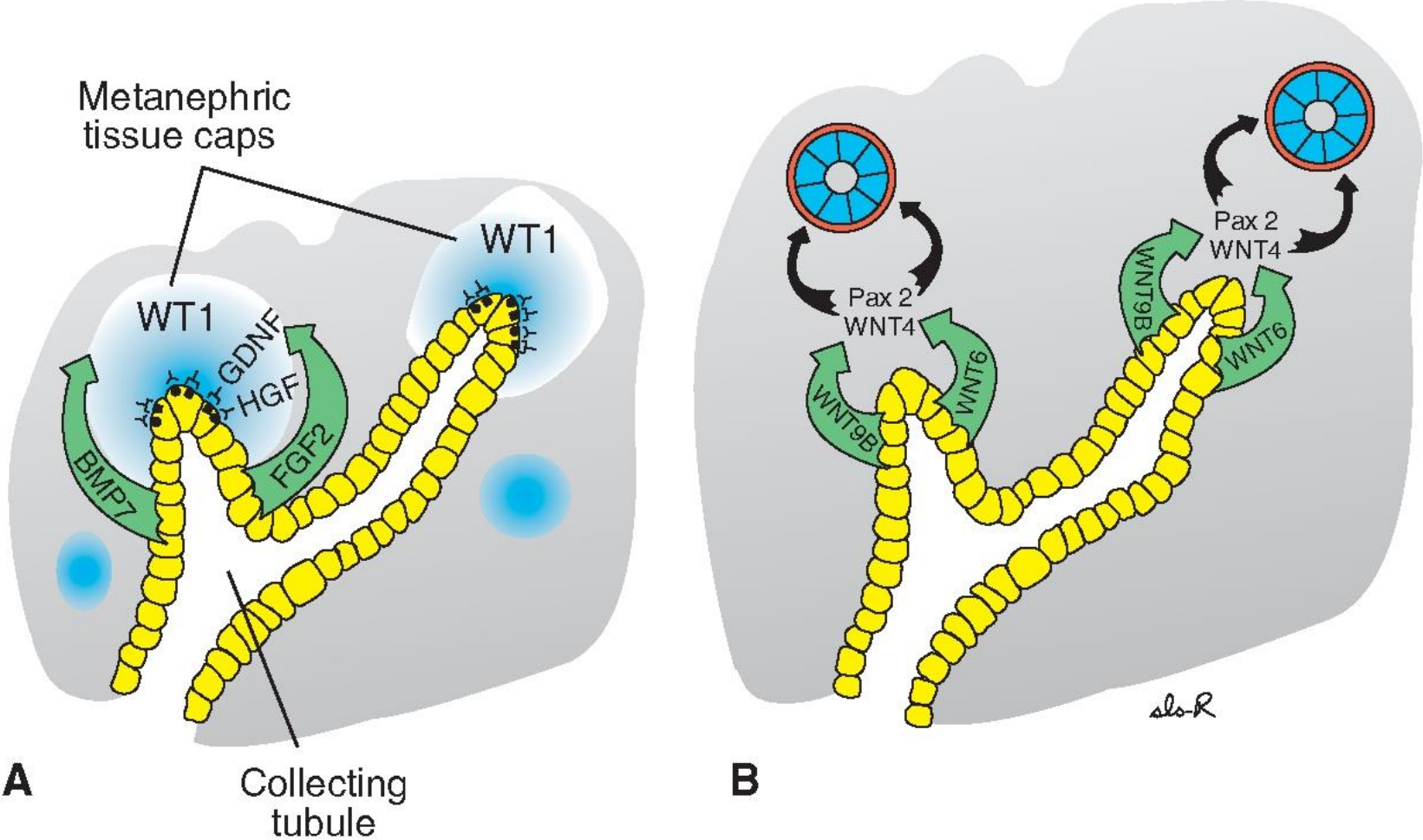
Ledvina





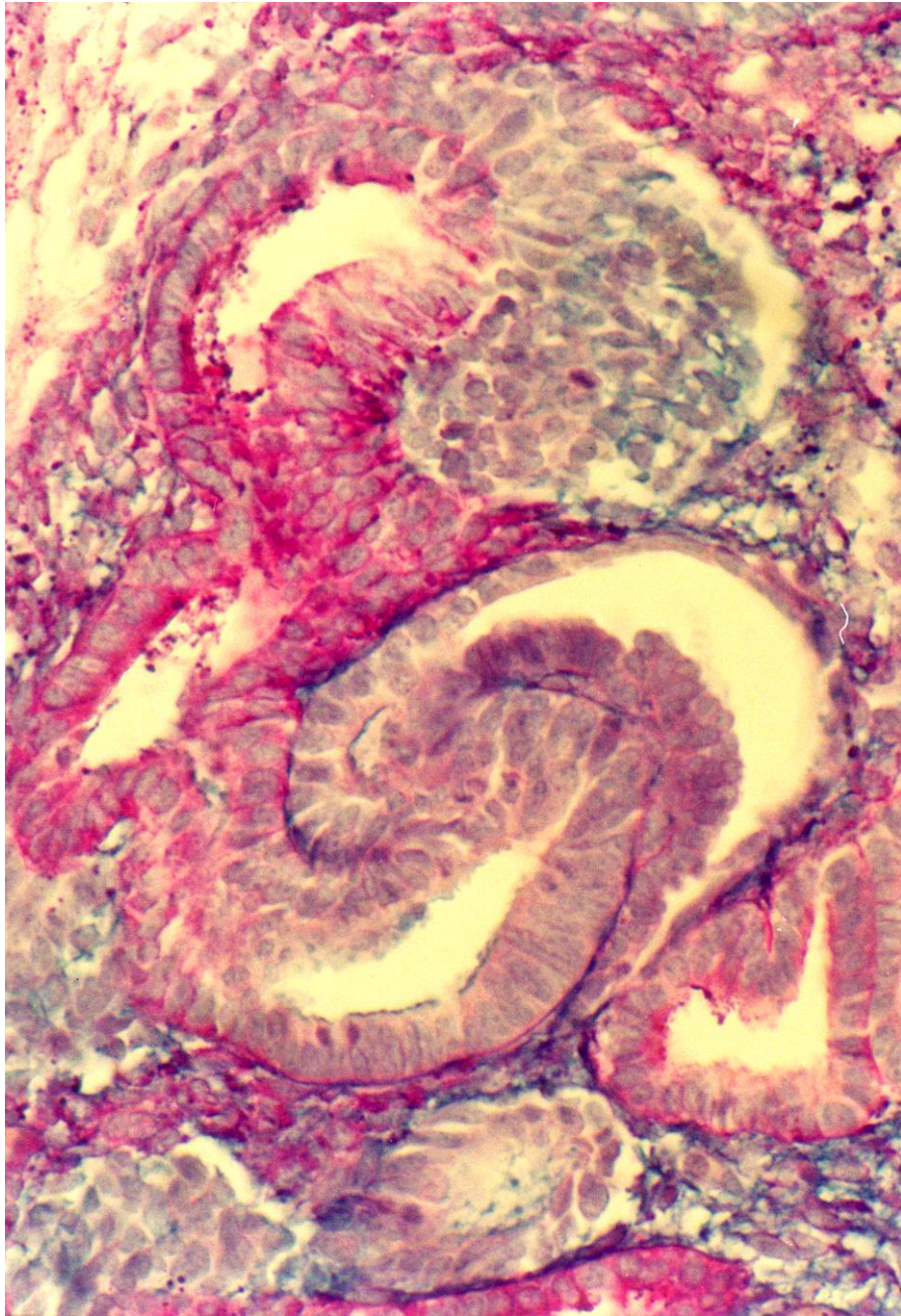
Ledvina
(renkulizace)

Metanephros – molekulární regulace vývoje ledvin



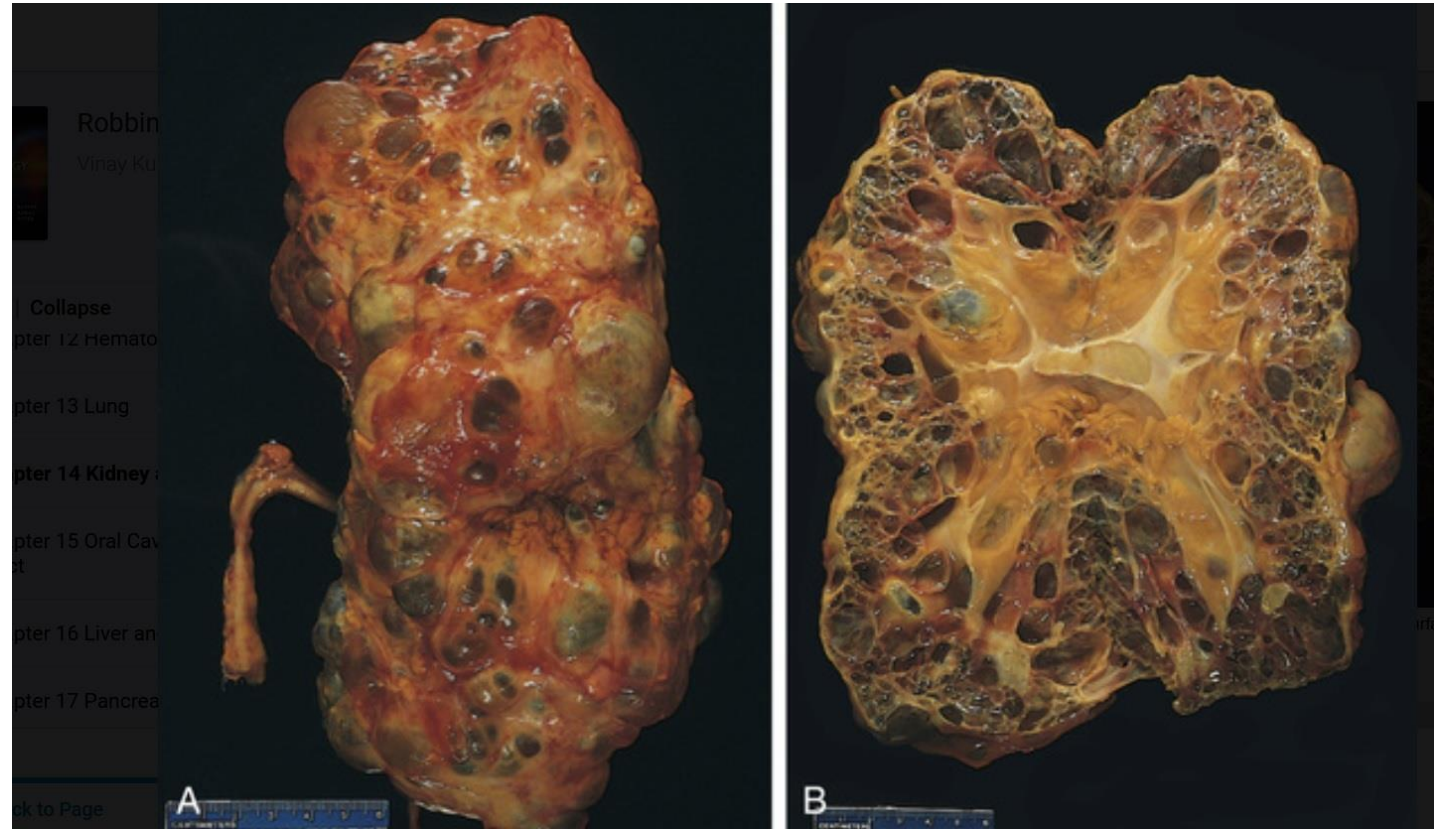
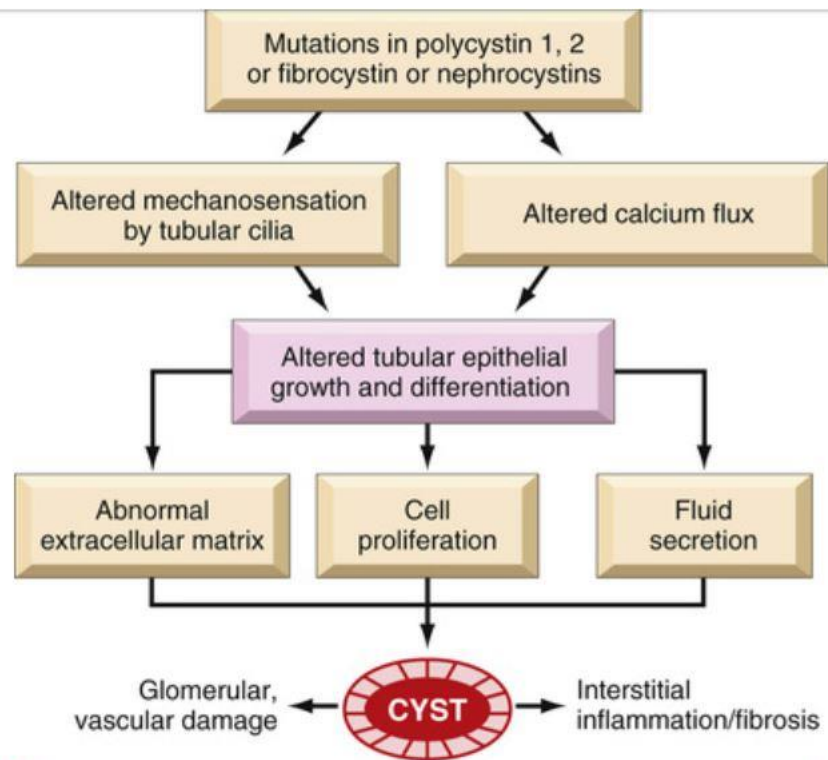
A

B



Polycystické ledviny

- AUTOZOMÁLNĚ RECESIVNÍ
- AUTOZOMÁLNĚ DOMINANTNÍ
 - 10 % pacientů s chronickým renálním selháním



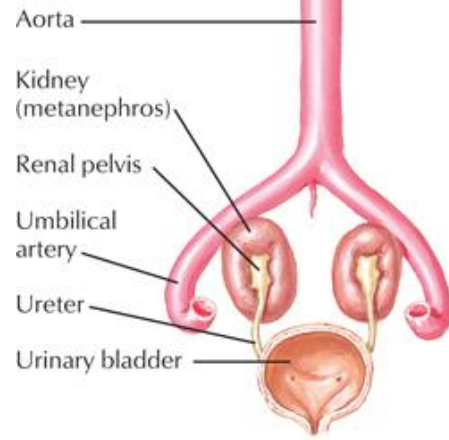
Kumar, Vinay, et al. *Robbins Basic Pathology*. Available from: Elsevier eBooks+, (10th Edition). Elsevier - OHCE, 2017.

FIG. 14.21 Possible mechanisms of cyst formation in cystic kidney diseases (see text).

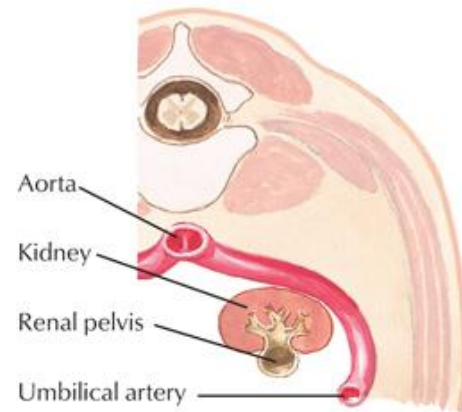
Vzestup a rotace ledviny

Apparent "ascent and rotation" of the kidneys in embryological development

6 weeks

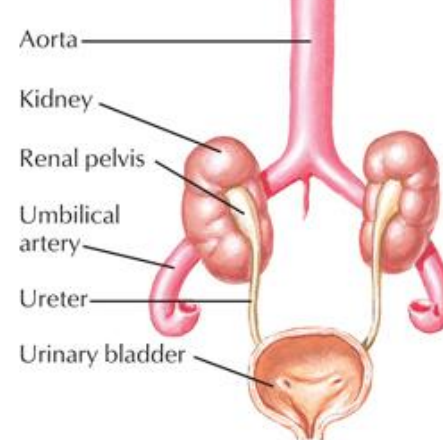


Frontal view

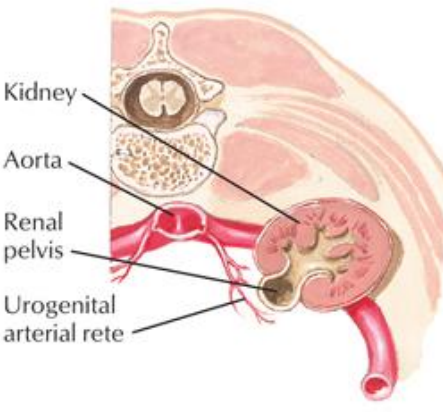


Cross section

7 weeks

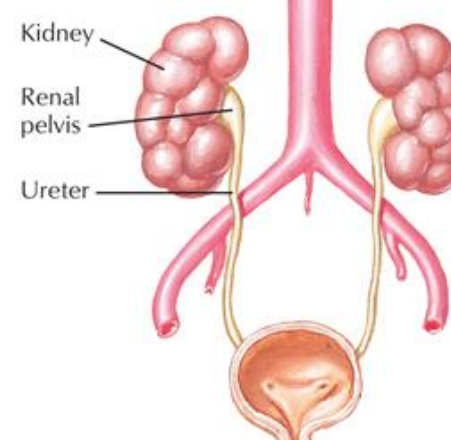


Frontal view

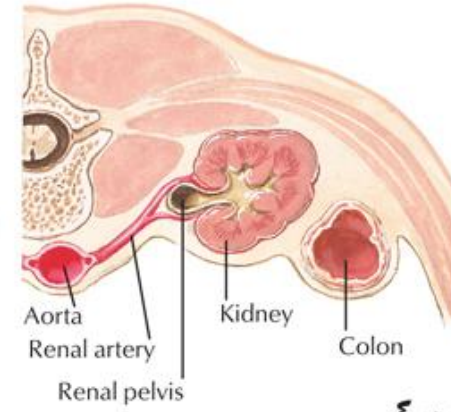


Cross section

9 weeks



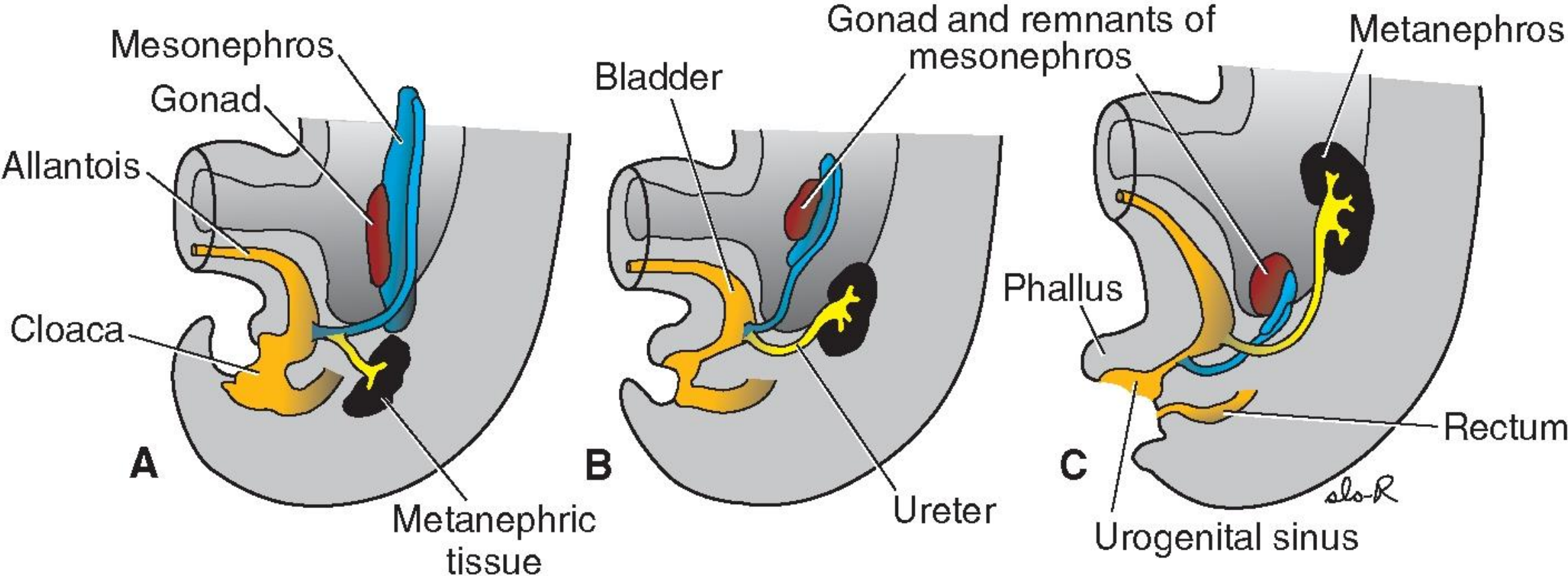
Frontal view



Cross section

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Vzestup a rotace ledviny



Vrozené vývojové vady ledvin – atypické tvary

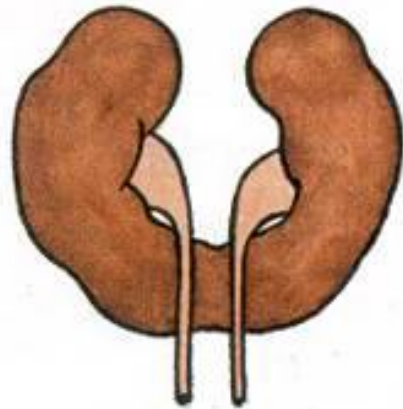
Lalůčkovitá
ledvina

ren renculisatus



Podkovovitá
ledvina

ren arcuatus
podkovovitá ledvina
horseshoe kidney



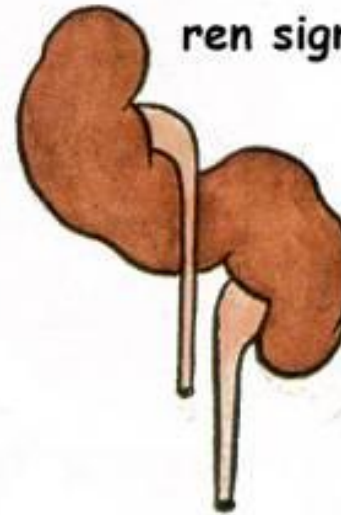
Zdvojená
ledvina

ren duplex



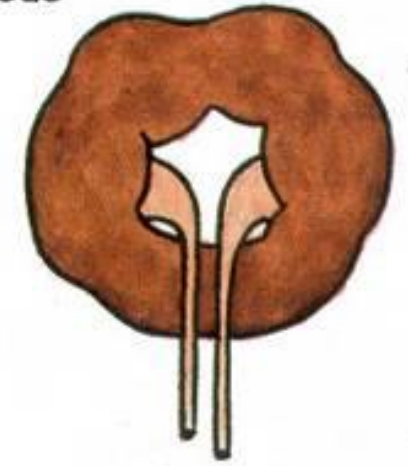
Esovitá
ledvina

ren sigmoideus

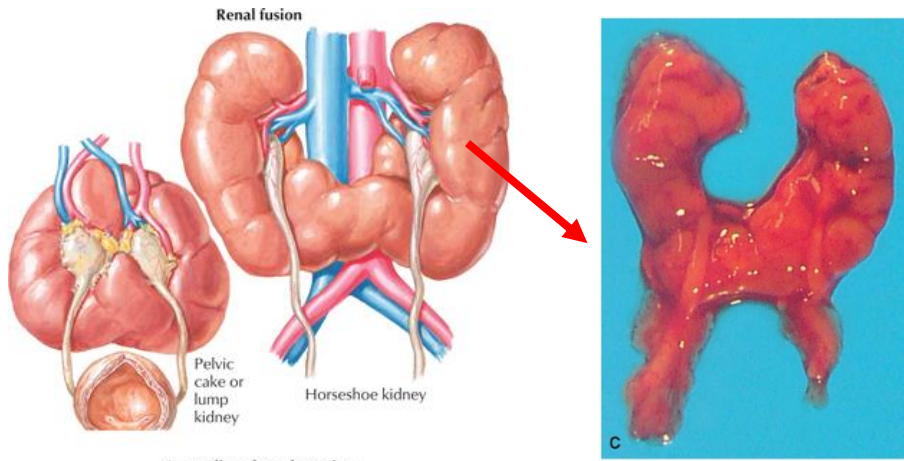


Koláčovitá
ledvina

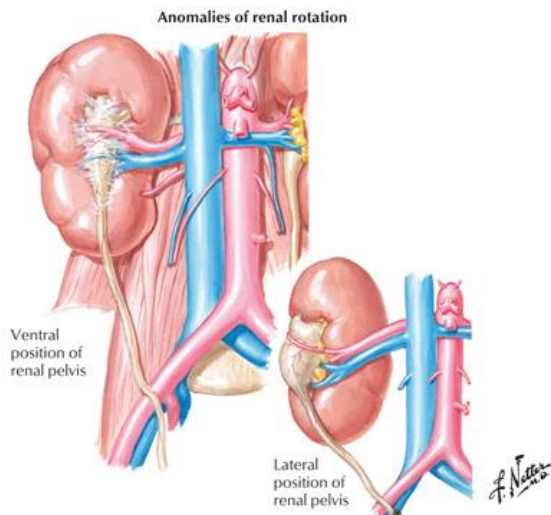
ren fungiformis



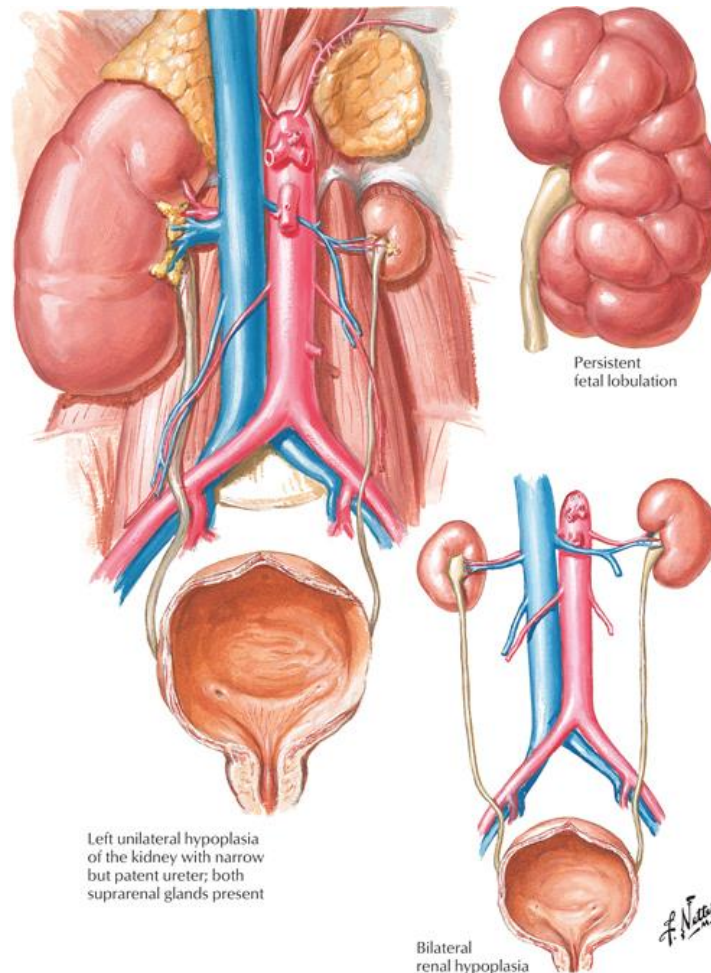
Vrozené vývojové vady ledvin – atypické tvary, poruchy rotace, hypoplazie, ageneze



Podkovovitá ledvina



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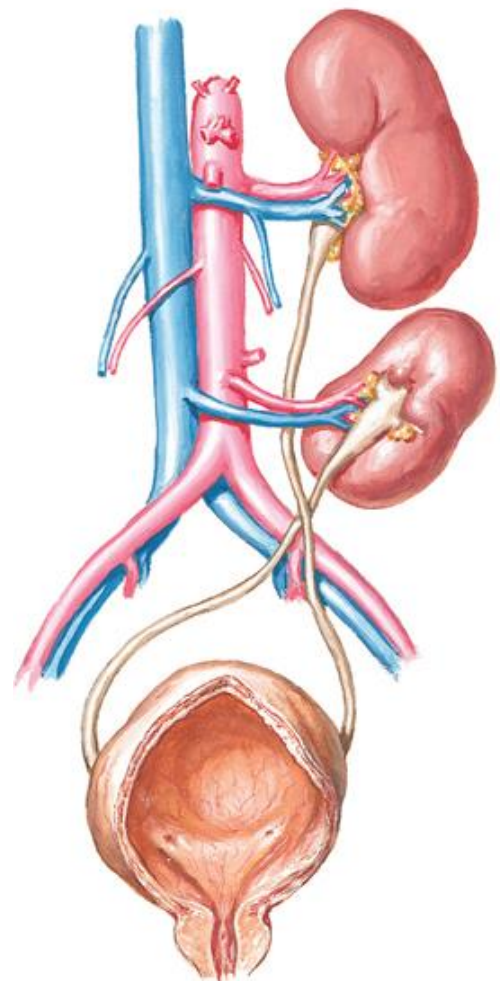


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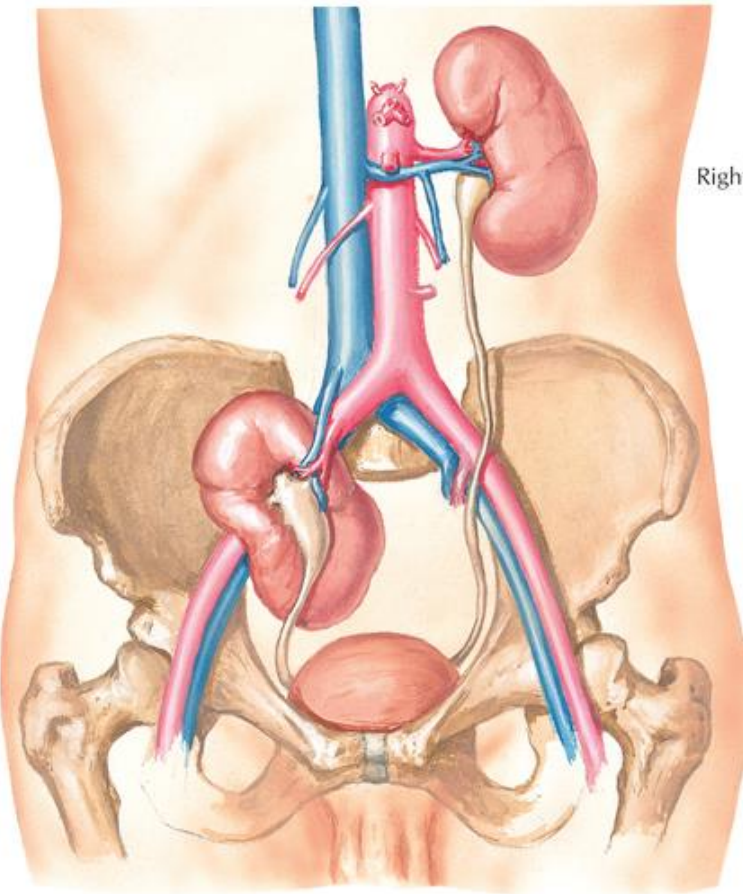


Ektopie ledviny

Ectopia of the kidney



Crossed ectopia of the right kidney



Right pelvic kidney

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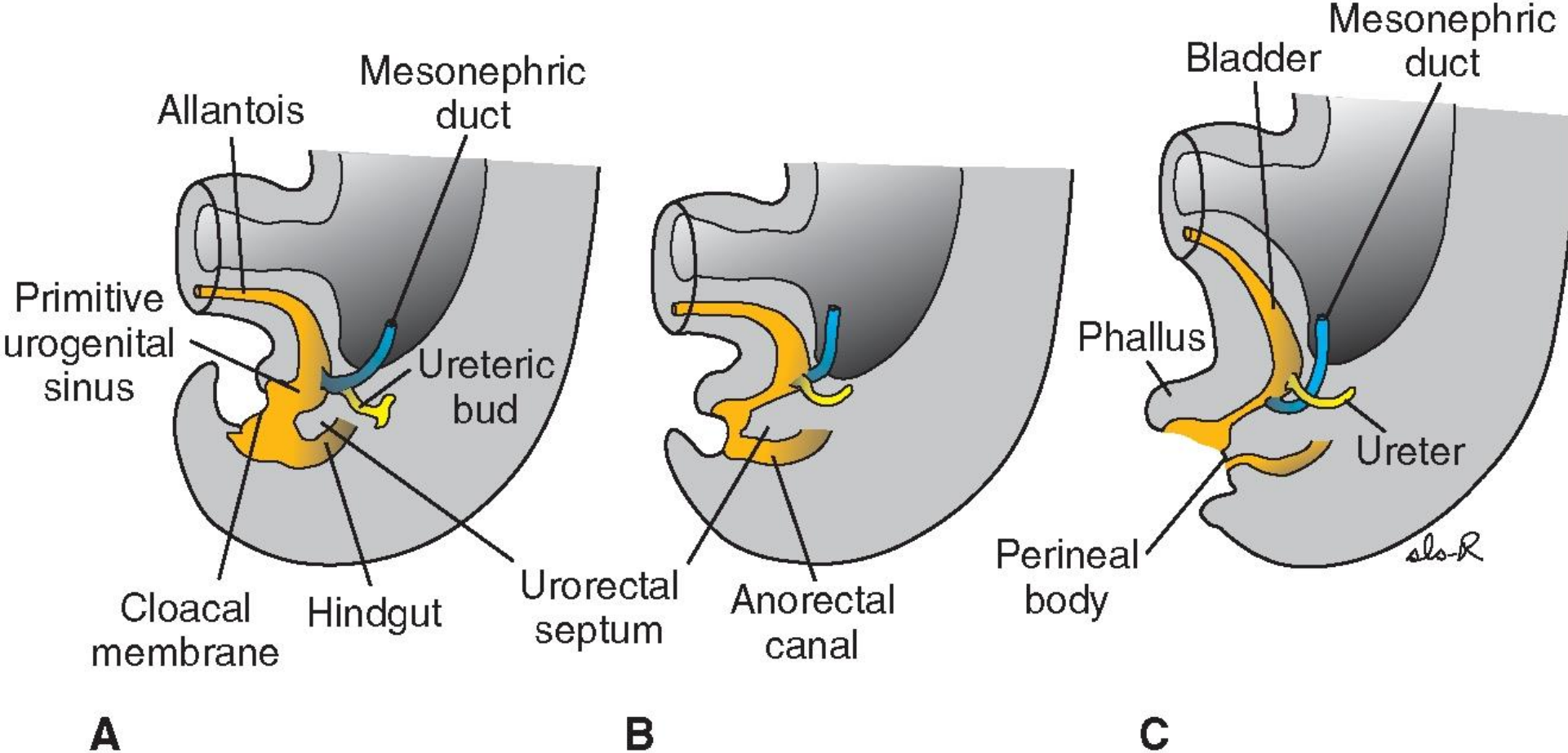
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Ren migrans



Case courtesy of Sami Elhinnawi, Radiopaedia.org, rID: 56632

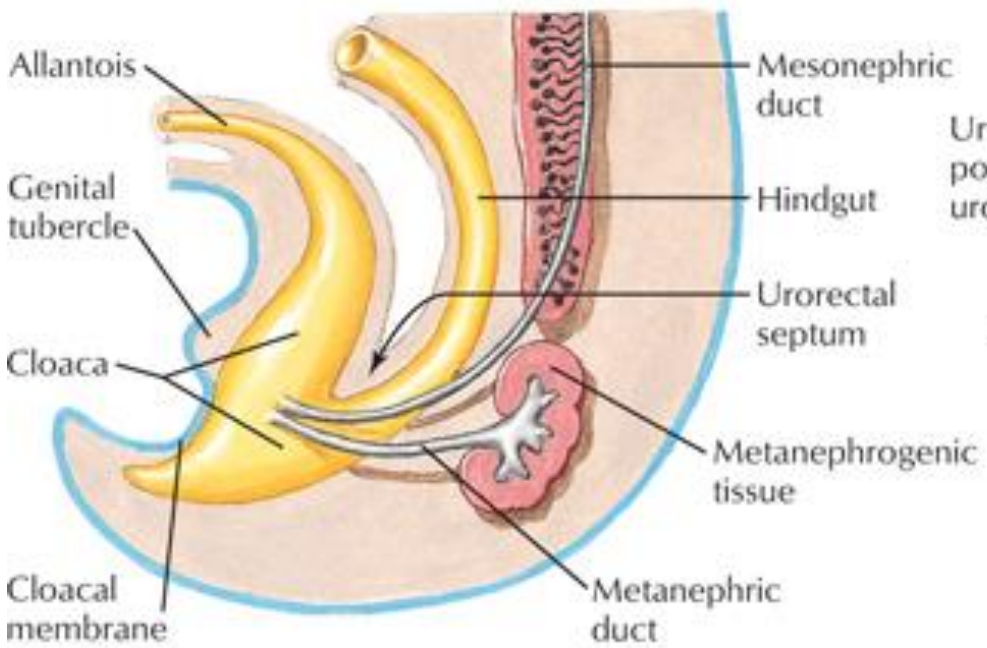
Rozdělení kloaky – septum urorectale



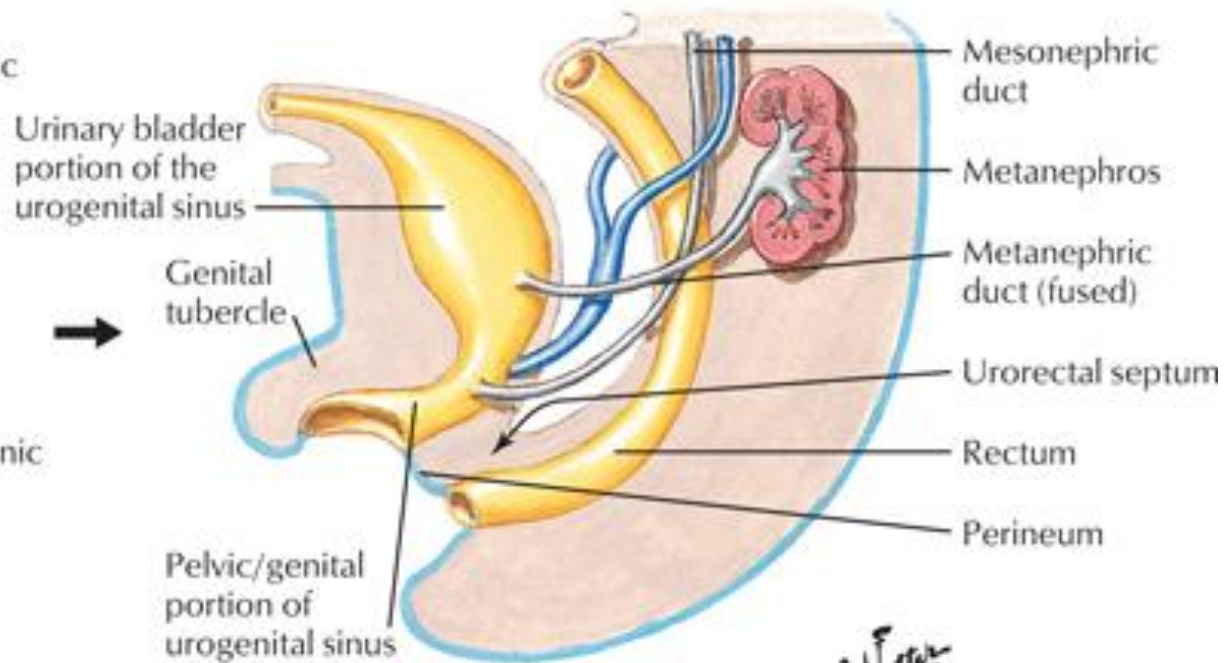
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Rozdělení kloaky – septum urorectale

Division of the cloaca by the urorectal septum



Urogenital sinus and rectum

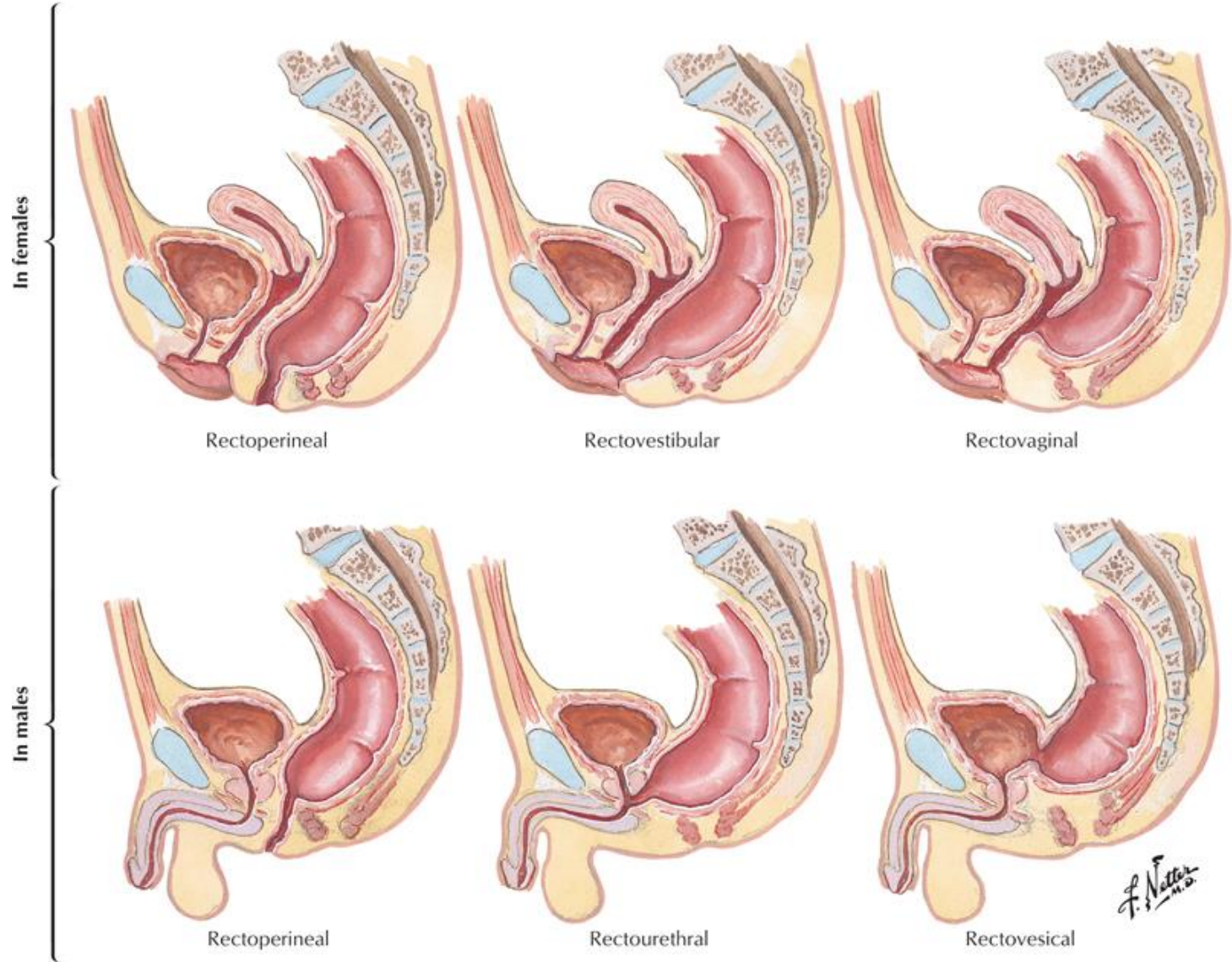


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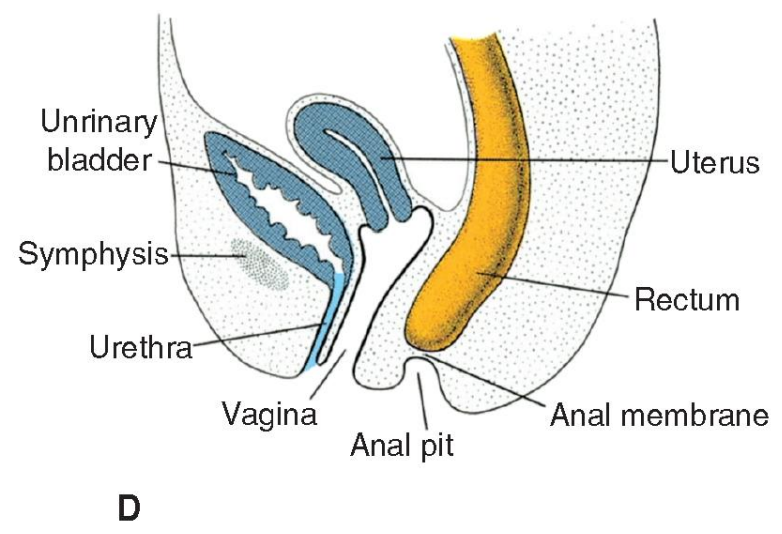
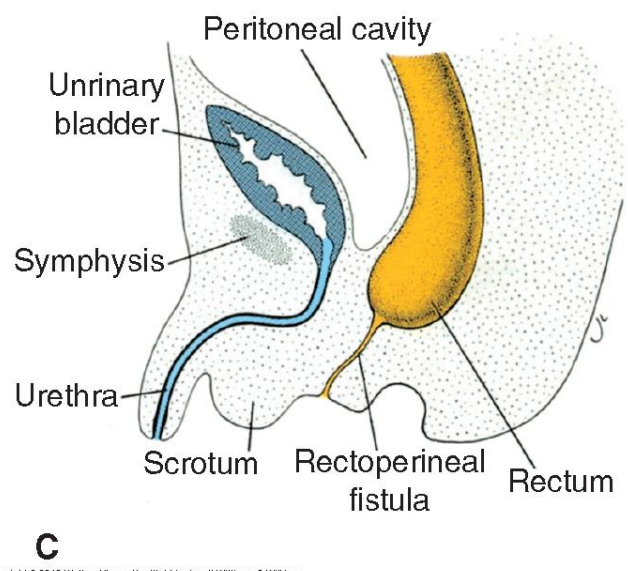
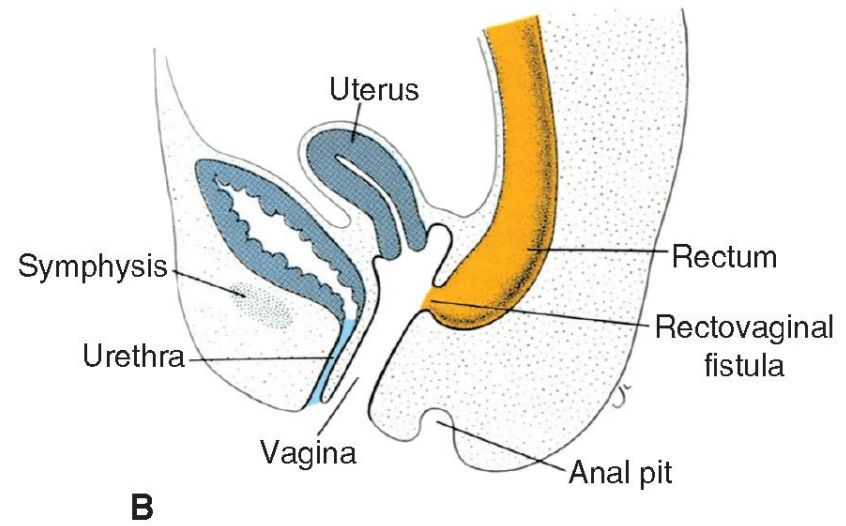
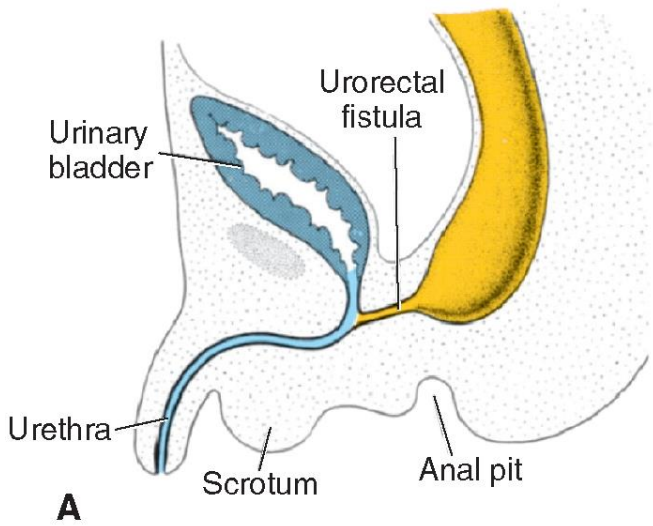
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Rozdělení kloaky – vrozené vývojové vady

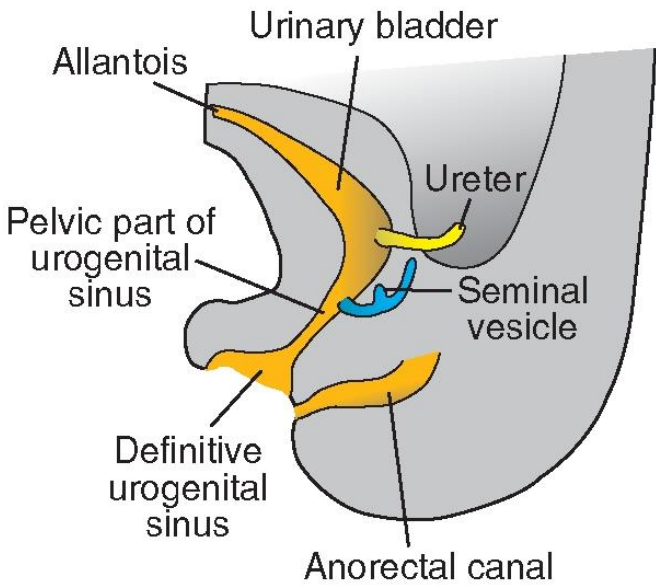
Fistulas resulting from the incomplete division of the cloaca



Rozdělení kloaky – vrozené vývojové vady

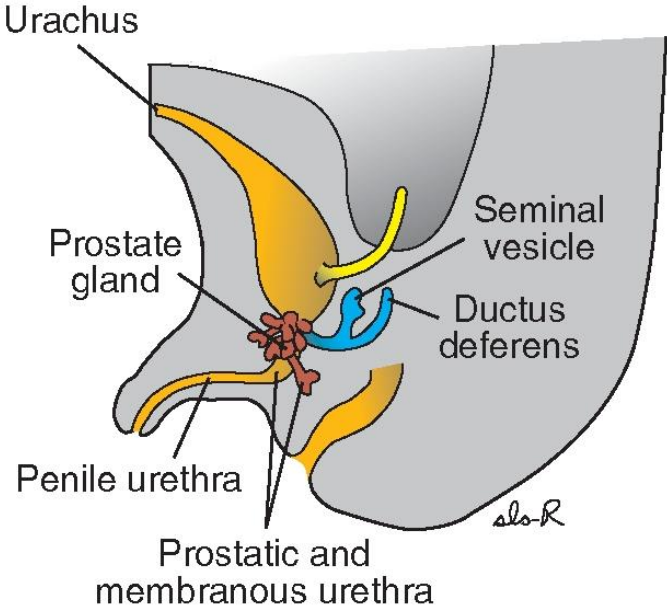


Močovod, močový měchýř



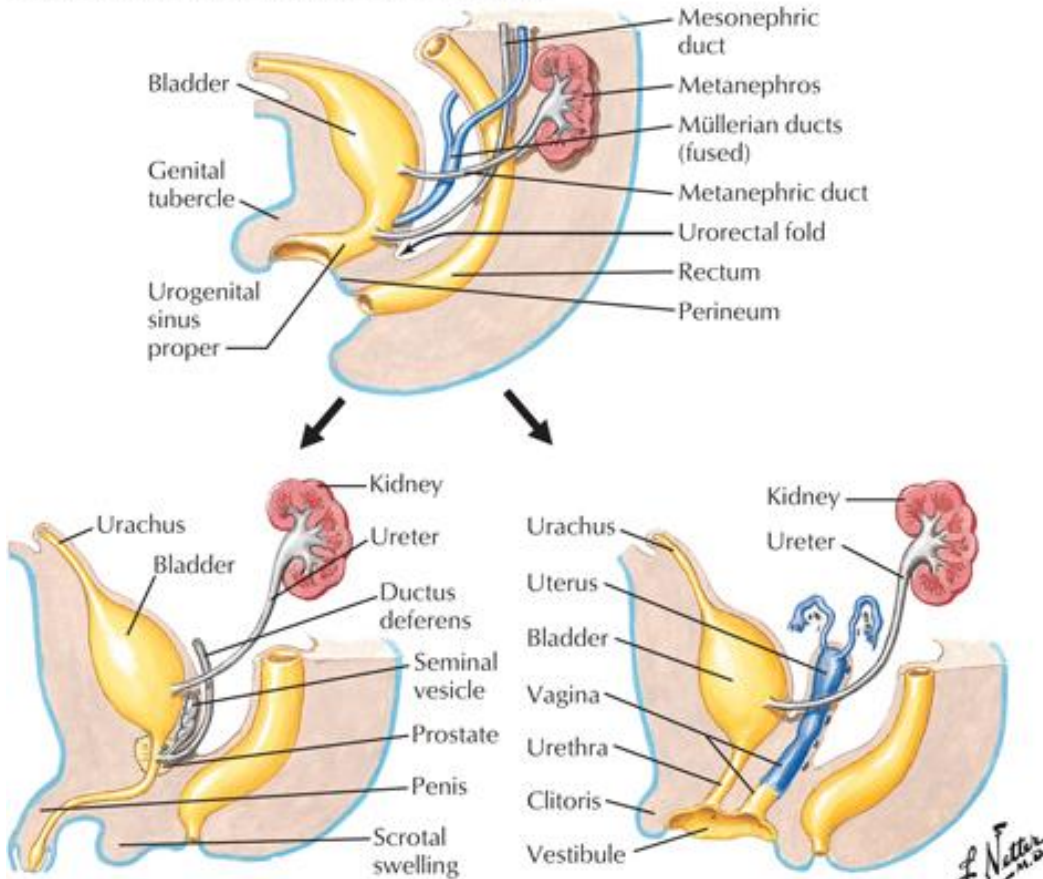
A

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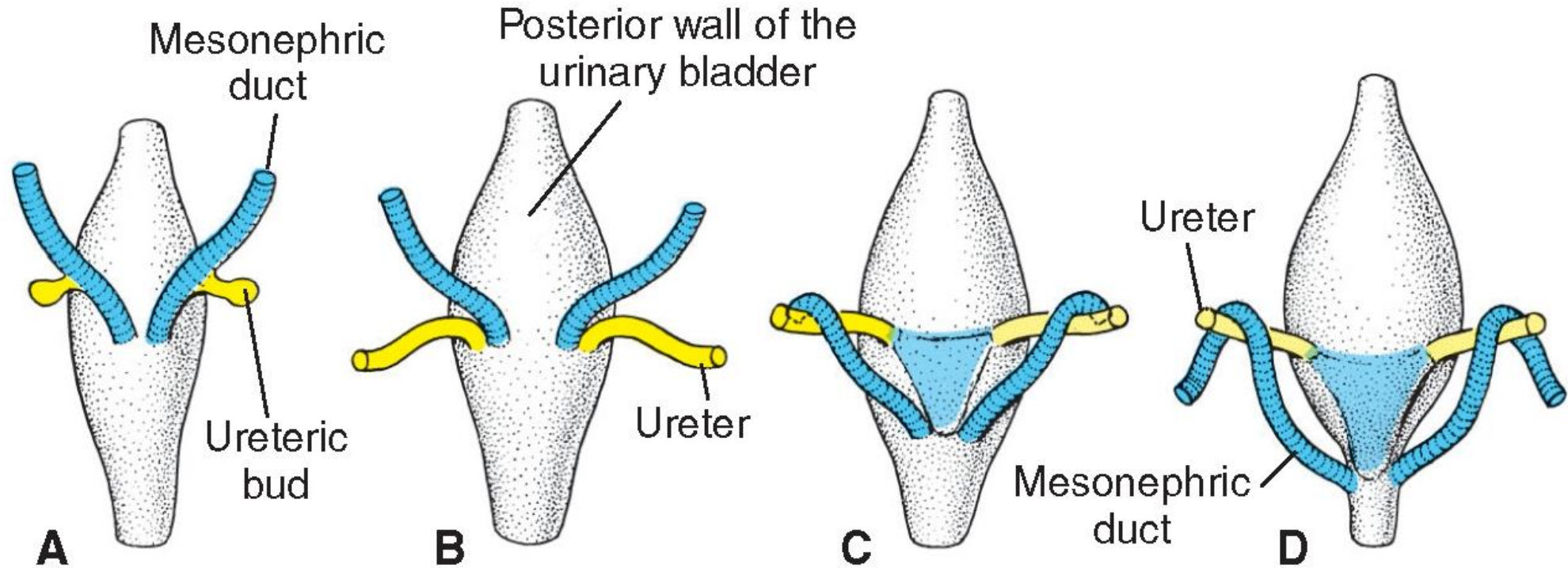
B

Lateral view (both sexes have identical primordia)



Male
Female
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Močovod, močový měchýř, osud ductus mesonephricus

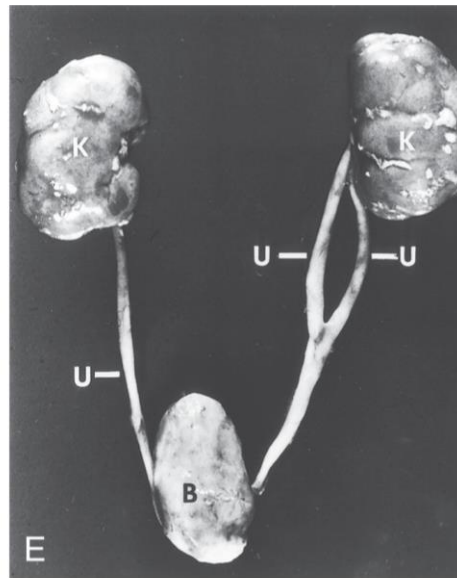
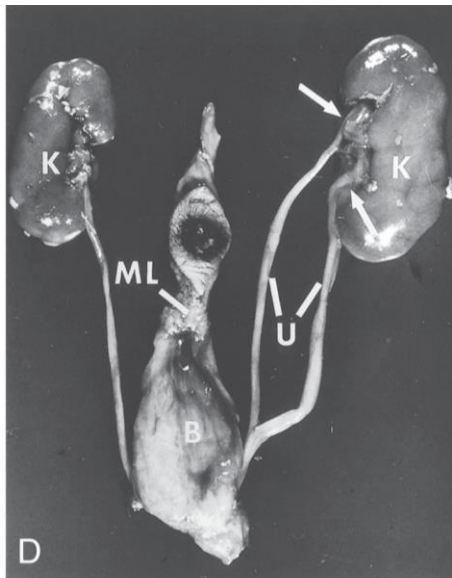
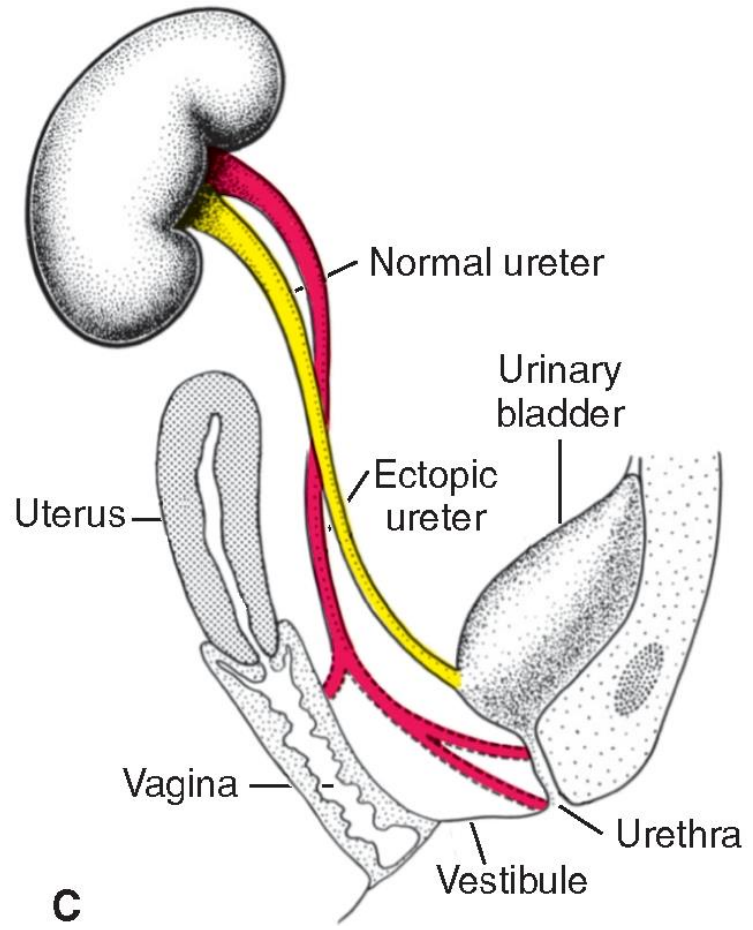
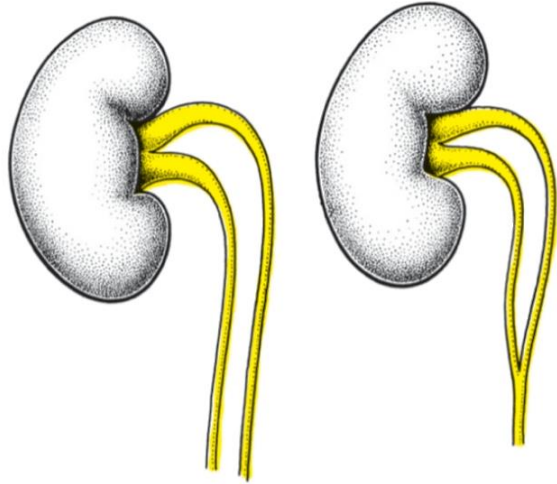


Vrozené vývojové vady – močovody

Ureter duplex

Ureter fissus

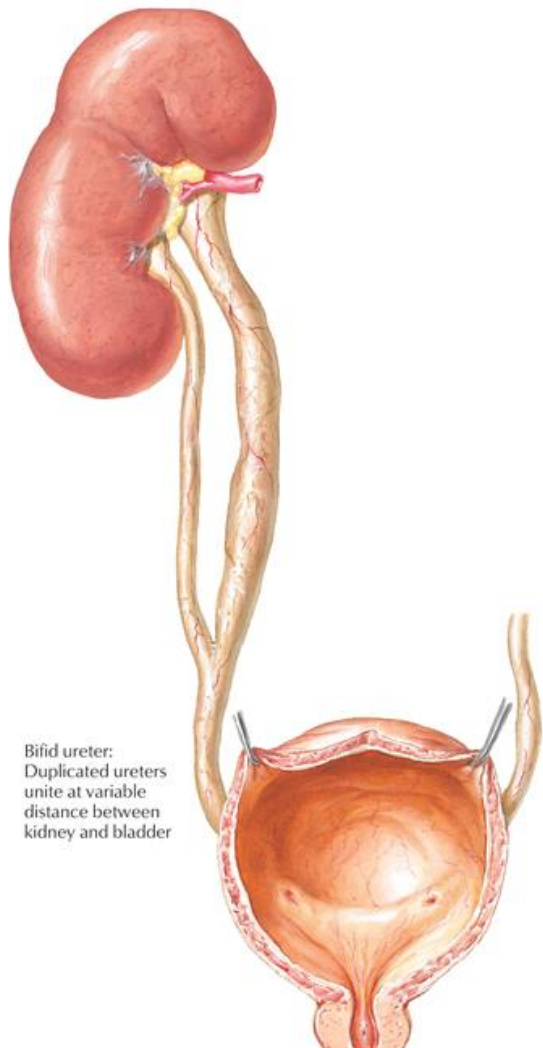
Ektopické vyústění ureteru



Vrozené vývojové vady – močovody

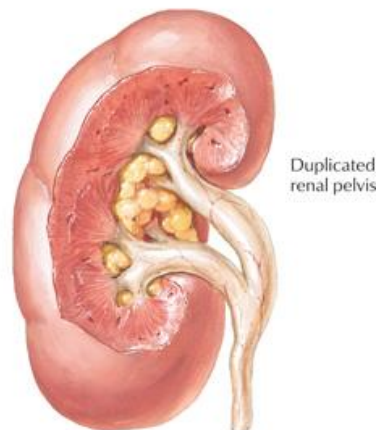
Fistula congenita vesicouterina/vesicovaginalis

Incomplete duplication of ureter



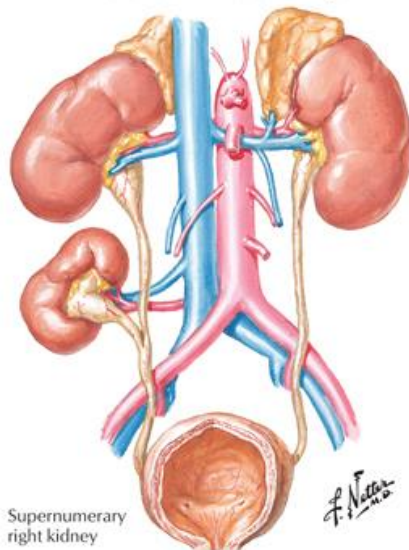
Bifid ureter: Duplicated ureters unite at variable distance between kidney and bladder

Anomalies of renal pelvis and calyces



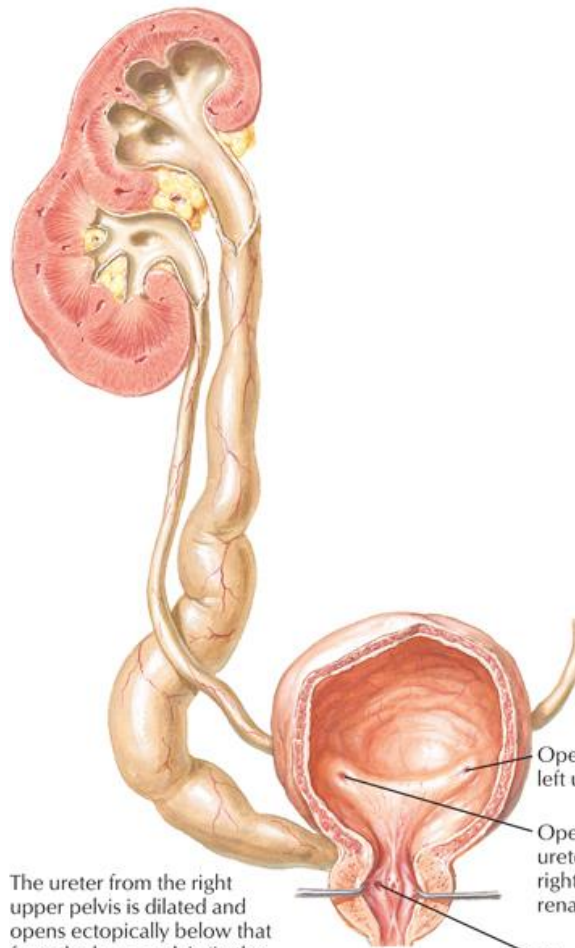
Duplicated renal pelvis

Anomalies in number of kidneys



Supernumerary right kidney

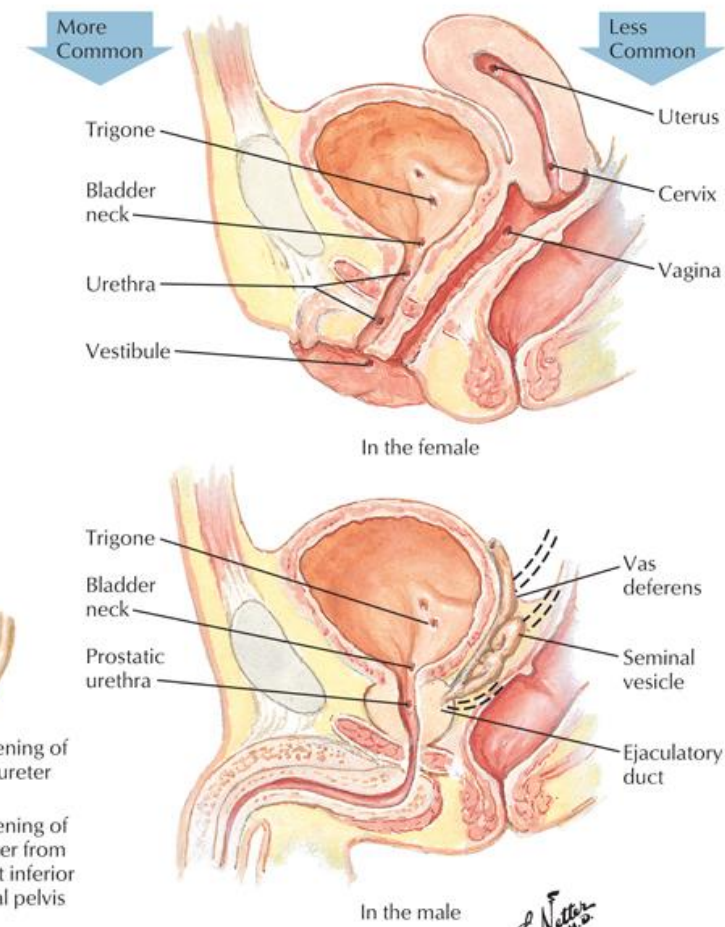
Complete duplication of the ureter



The ureter from the right upper pelvis is dilated and opens ectopically below that from the lower pelvis (in the prostatic urethra) according to the Weigert-Meyer law

Opening of left ureter
Opening of ureter from right inferior renal pelvis
Opening of ureter from right superior renal pelvis

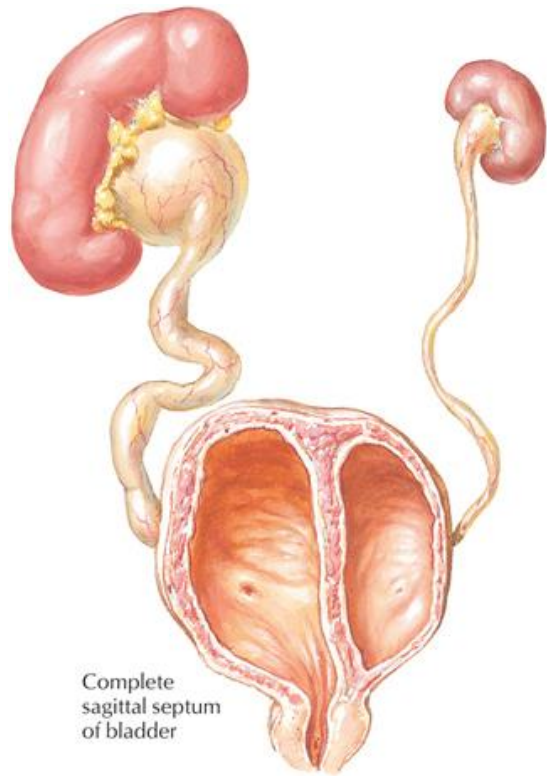
Observed sites of ectopic ureteral orifices



In the female

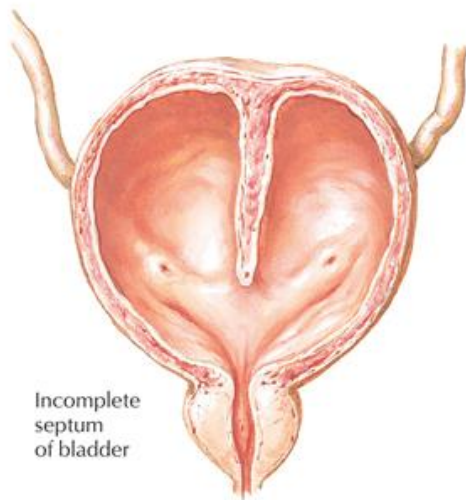
In the male

Vrozené vývojové vady – močový měchýř

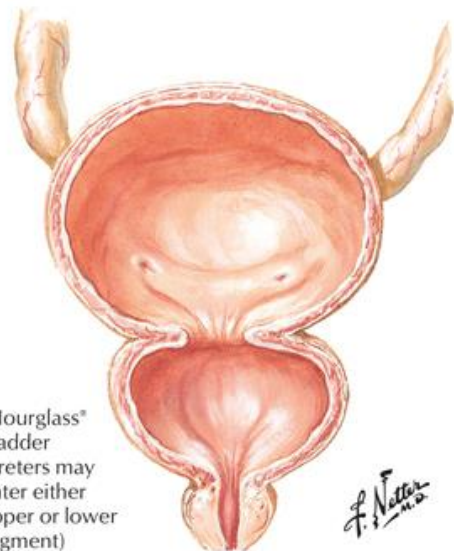


Complete sagittal septum of bladder

Incomplete duplication of bladder



Incomplete septum of bladder



"Hourglass" bladder (ureters may enter either upper or lower segment)

F. Netter M.D.



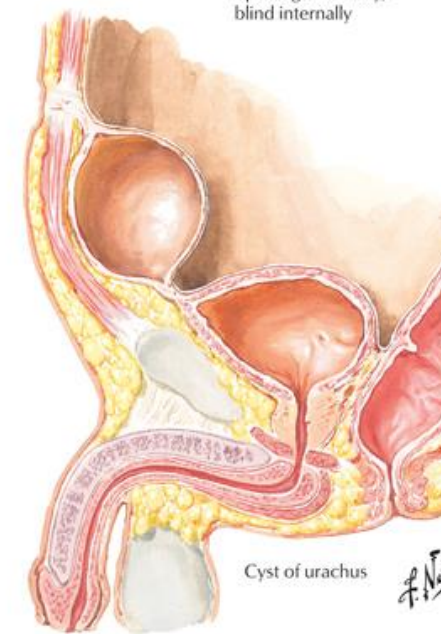
Completely patent urachus



Partially patent urachus; opening externally, blind internally



Partially patent urachus; opening internally, blind externally



Cyst of urachus

F. Netter

Vrozené vývojové vady – močový měchýř

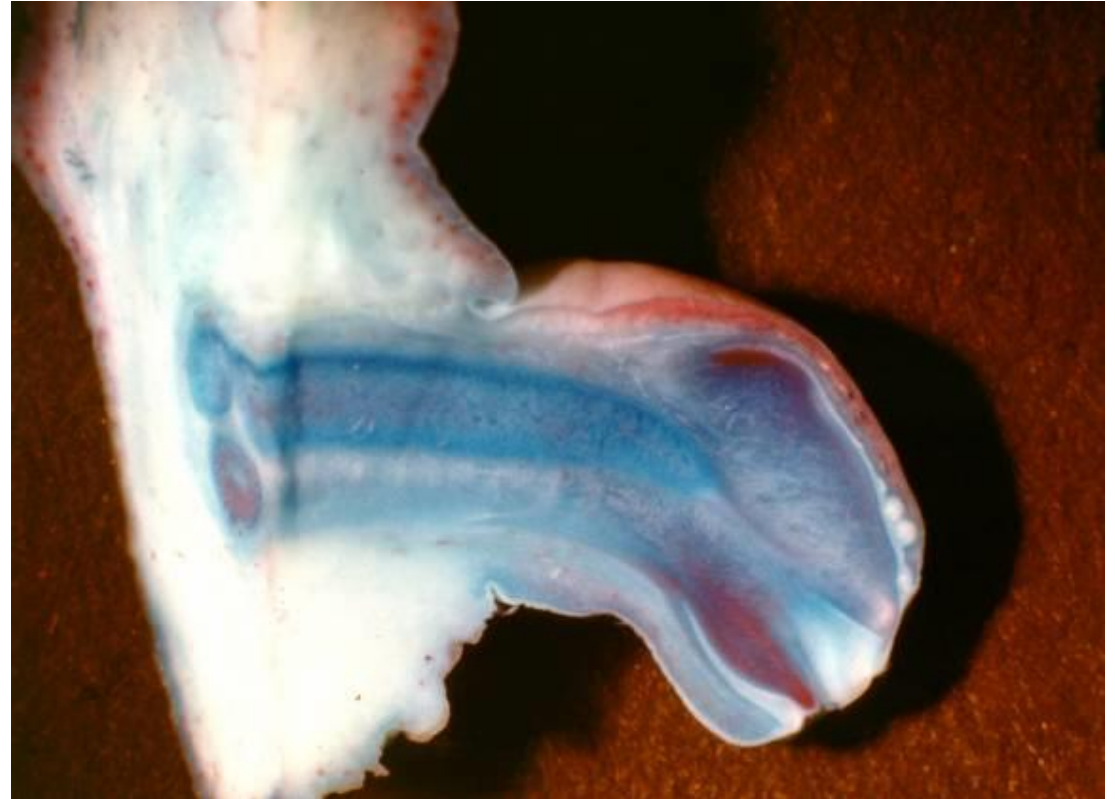
Exstrofie měchýře



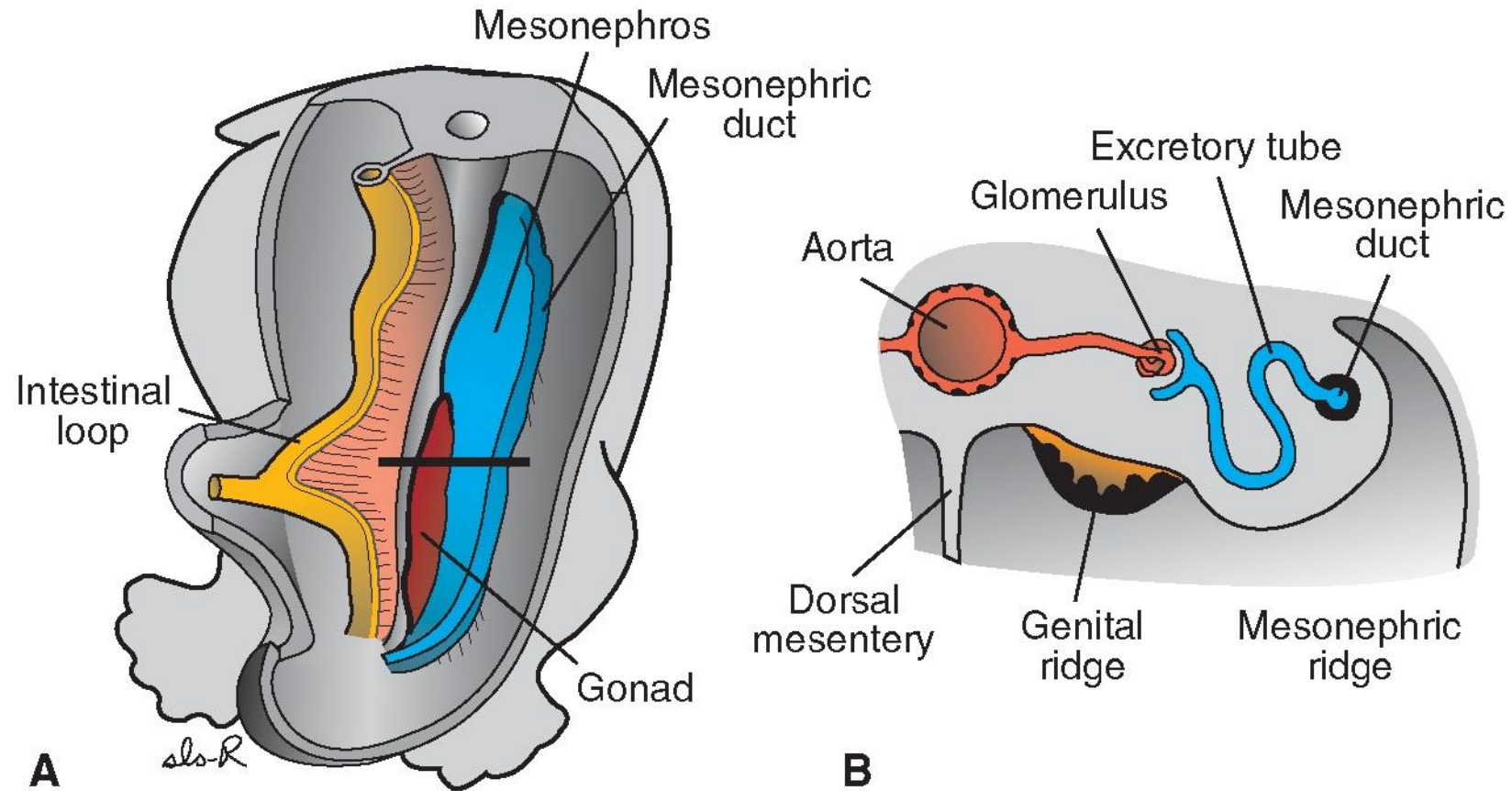
Exstrofie kloaky



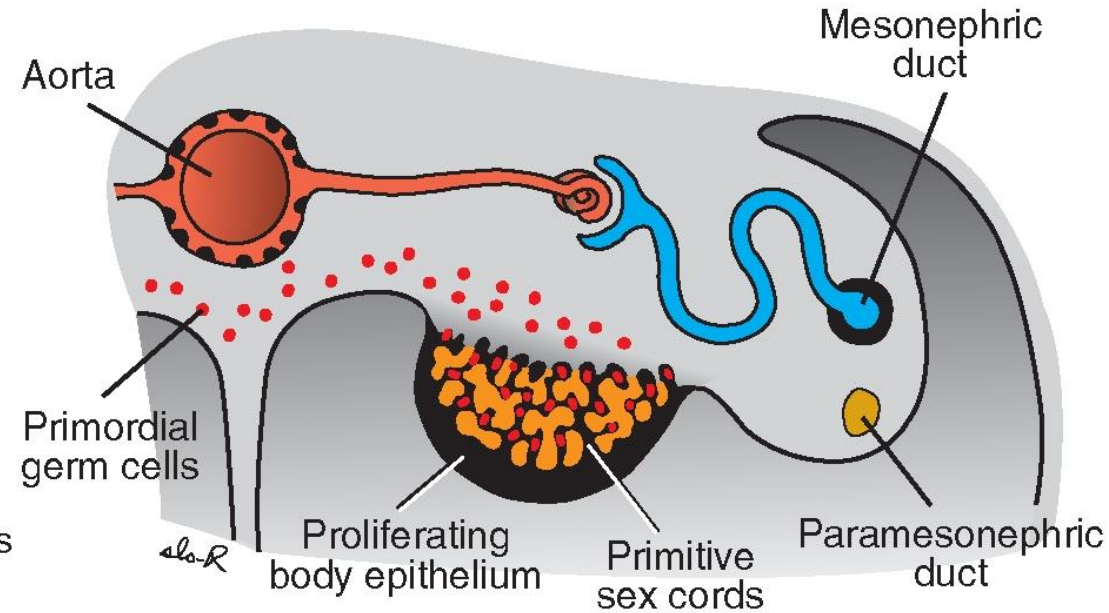
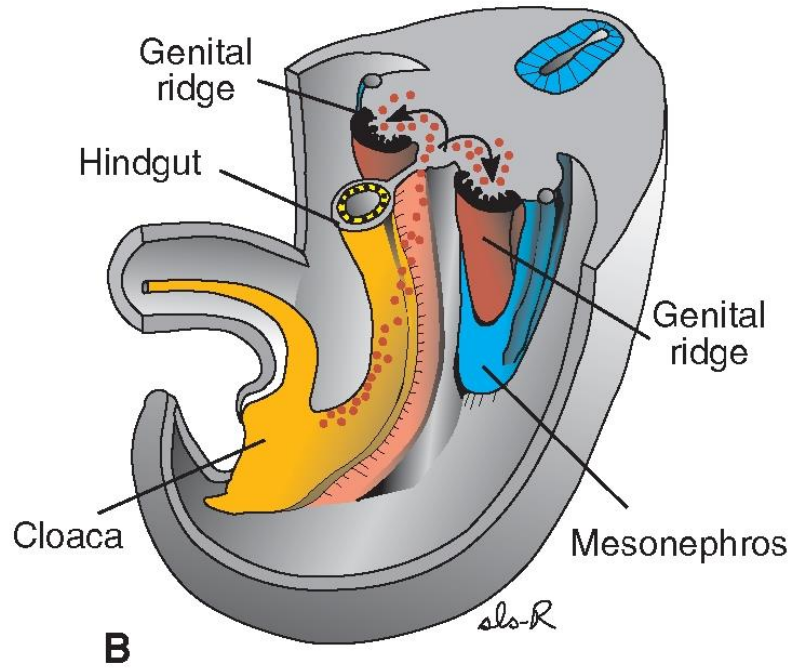
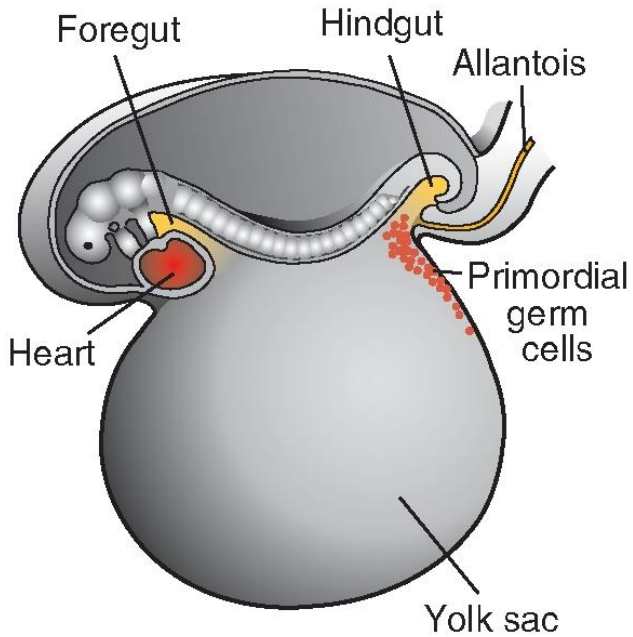
Pohlavní systém



Indiferentní stádium vývoje gonád a vývodných cest pohlavních

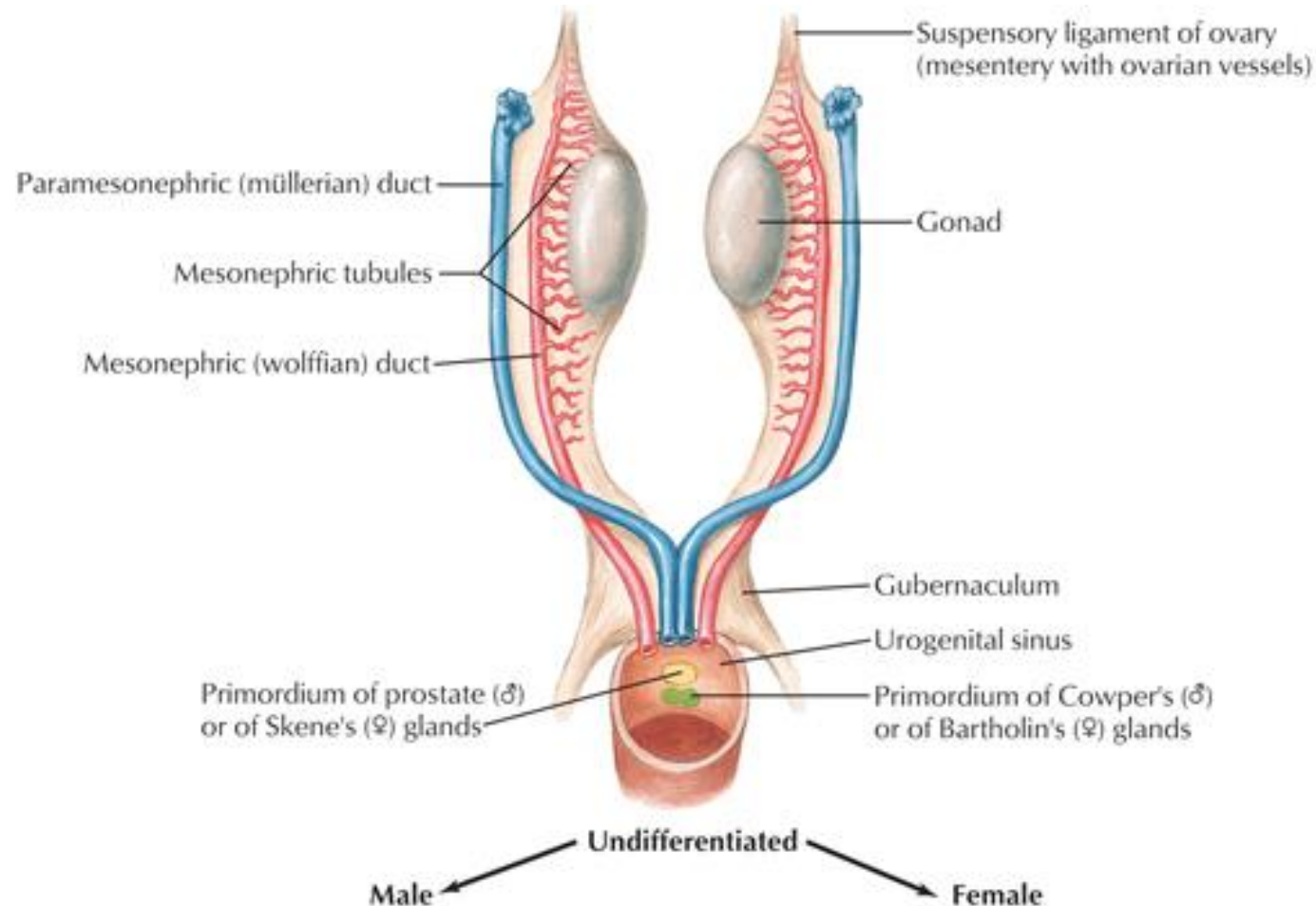


Indiferentní stádium vývoje gonád a vývodných cest pohlavních

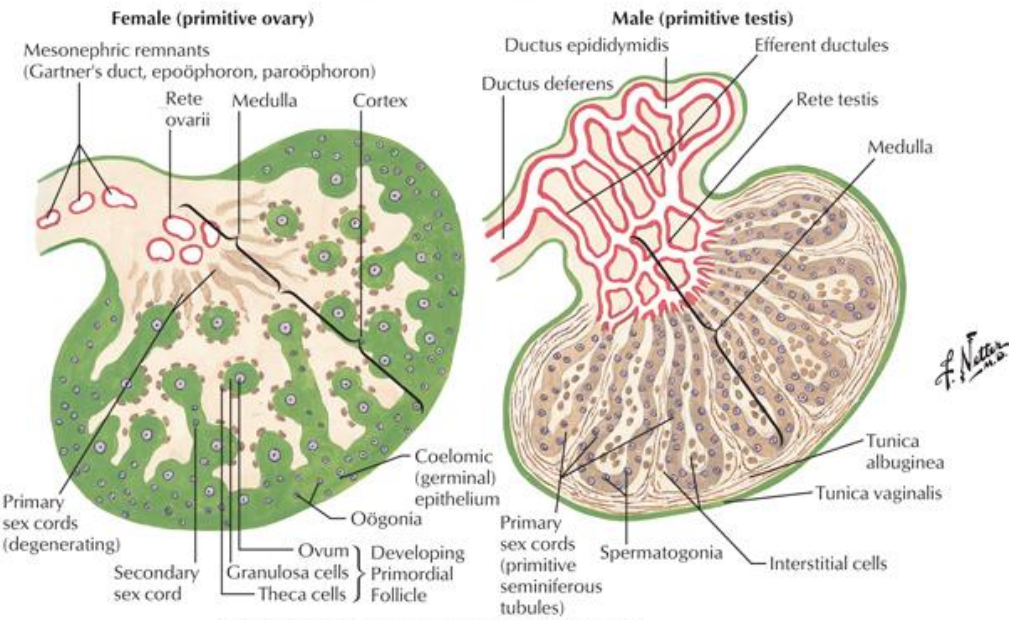
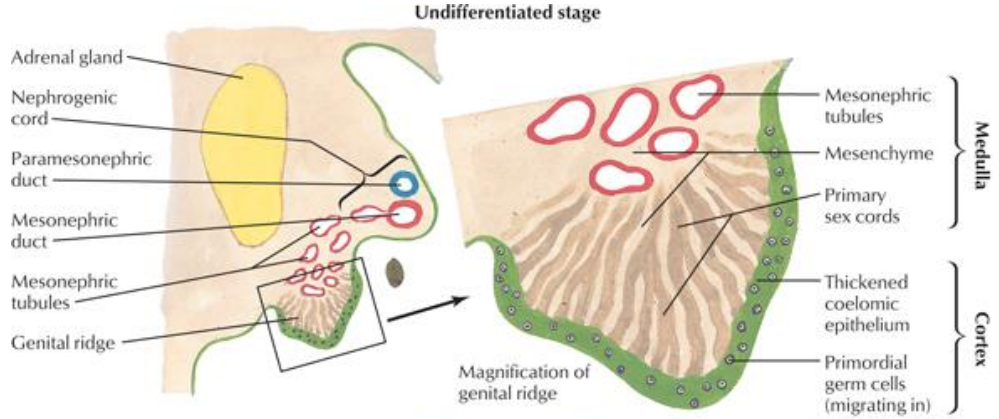


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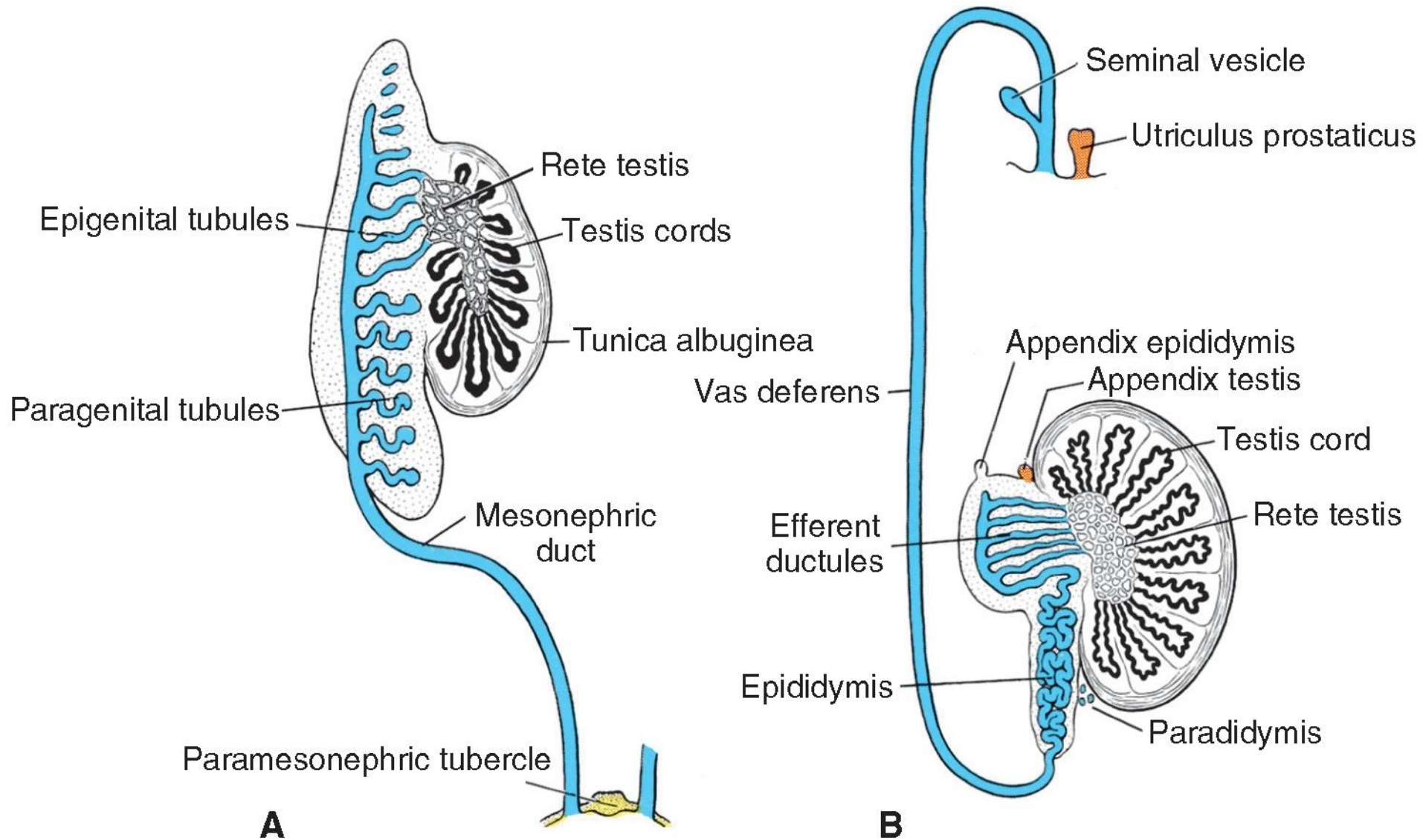
Indiferentní stádium vývoje gonád a vývodných cest pohlavních



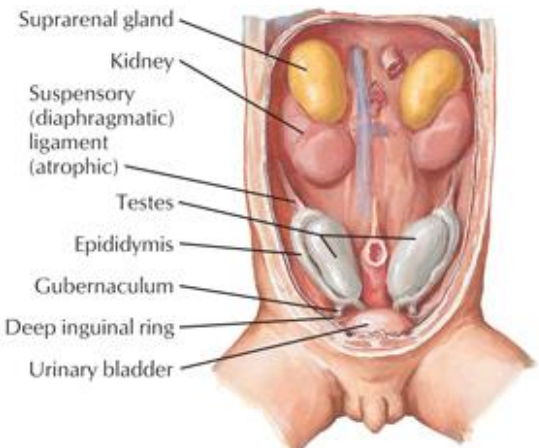
Indiferentní stádium vývoje gonád a vývodných cest pohlavních



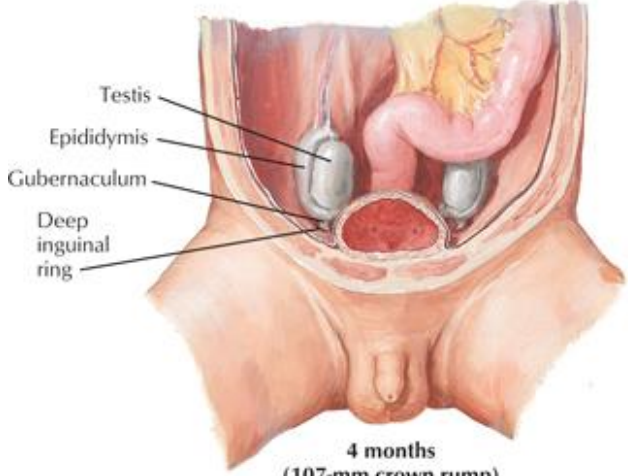
Varle, nadvarle, vývodné cesty



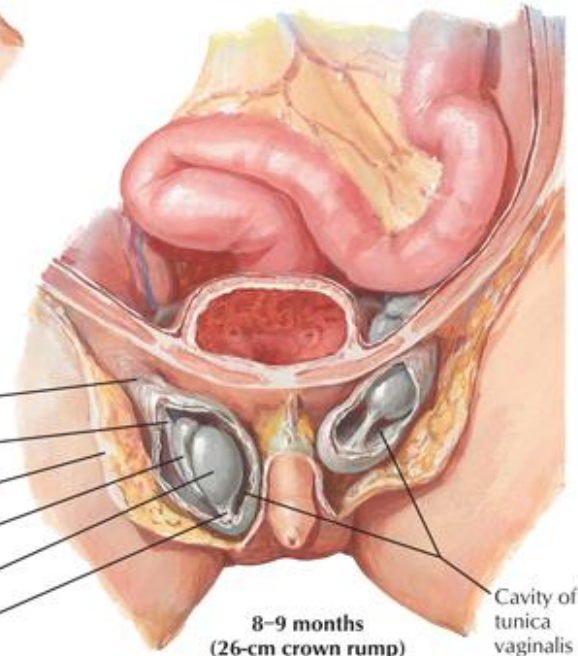
Sestup varlat



11 weeks
(43-mm crown rump)



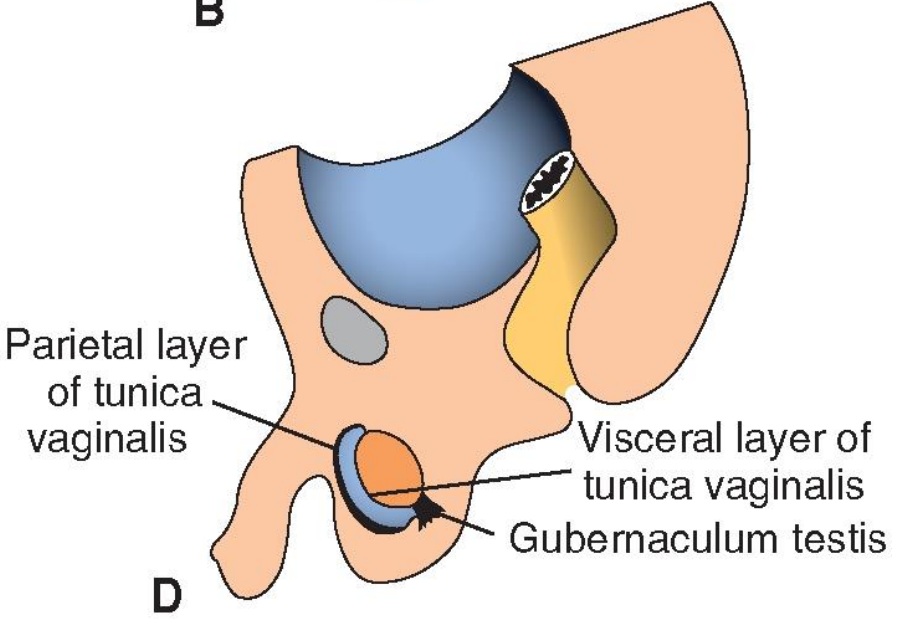
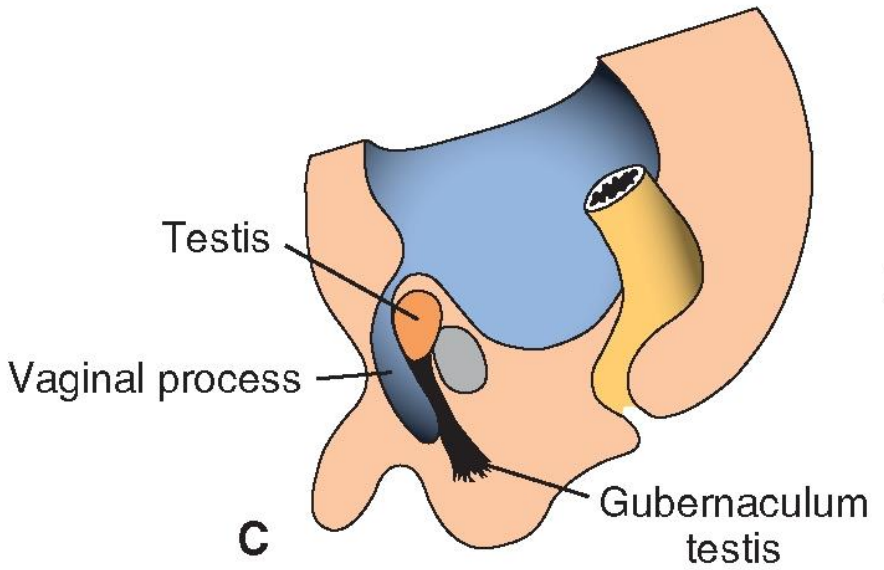
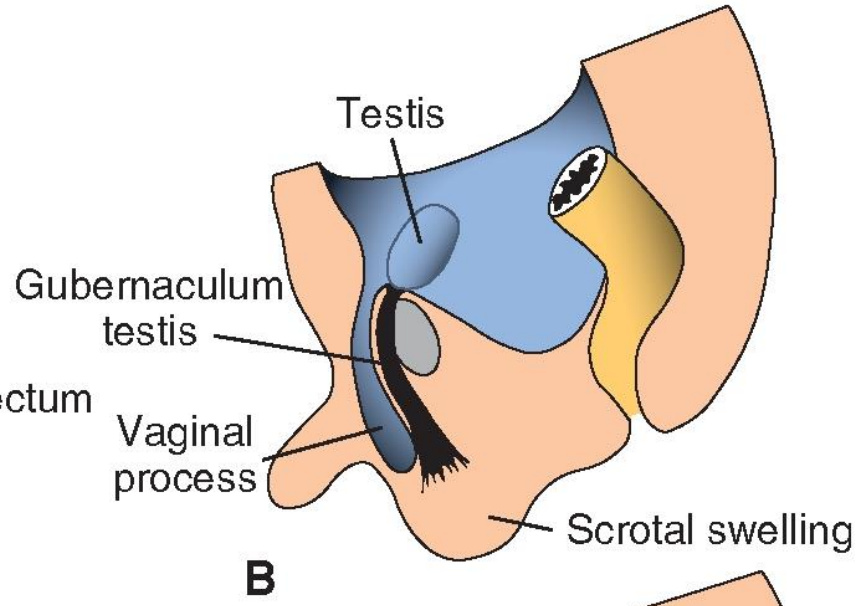
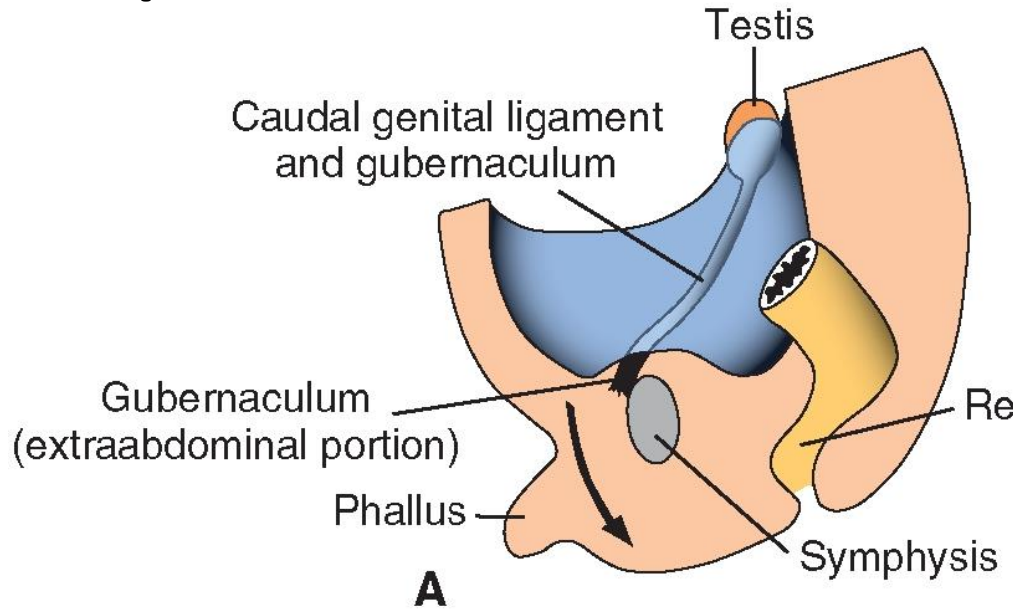
4 months
(107-mm crown rump)



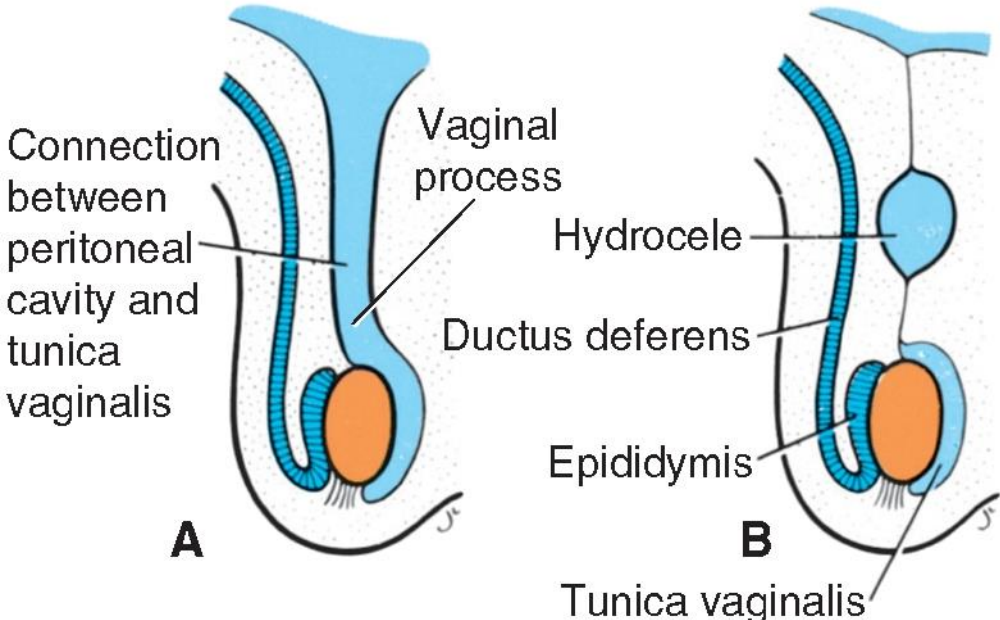
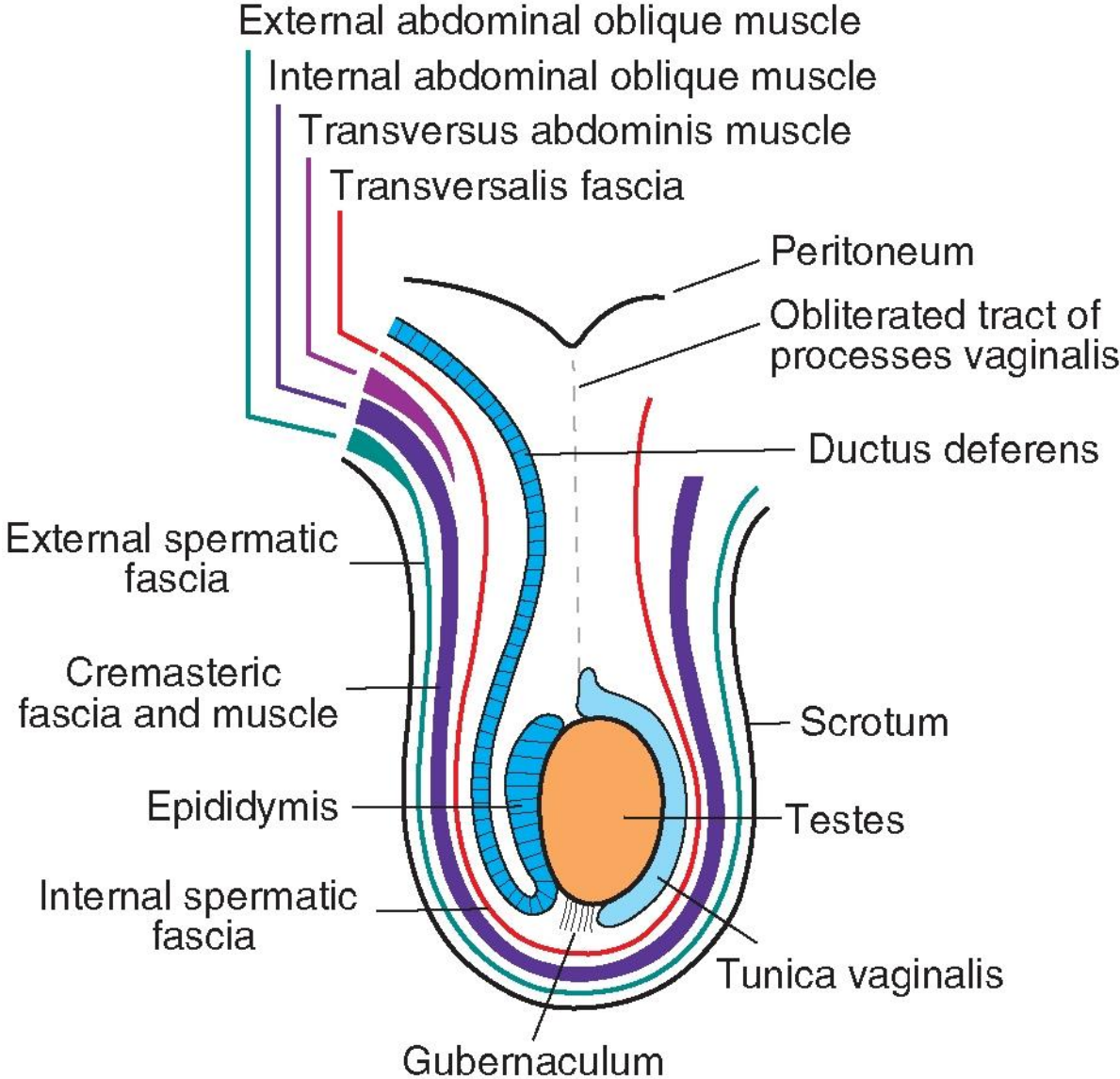
8-9 months
(26-cm crown rump)

F. Netter M.D.

Sestup varlat



Scrotum

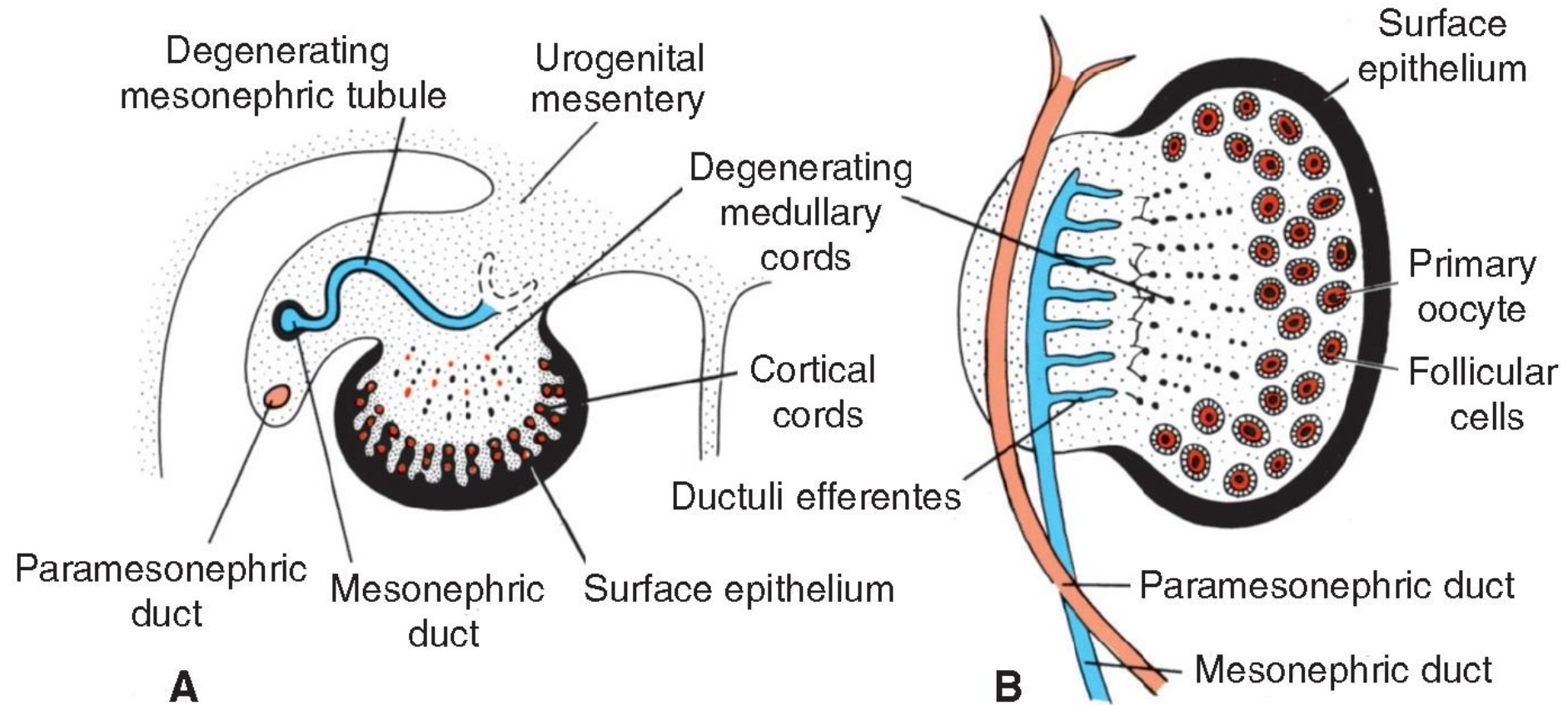


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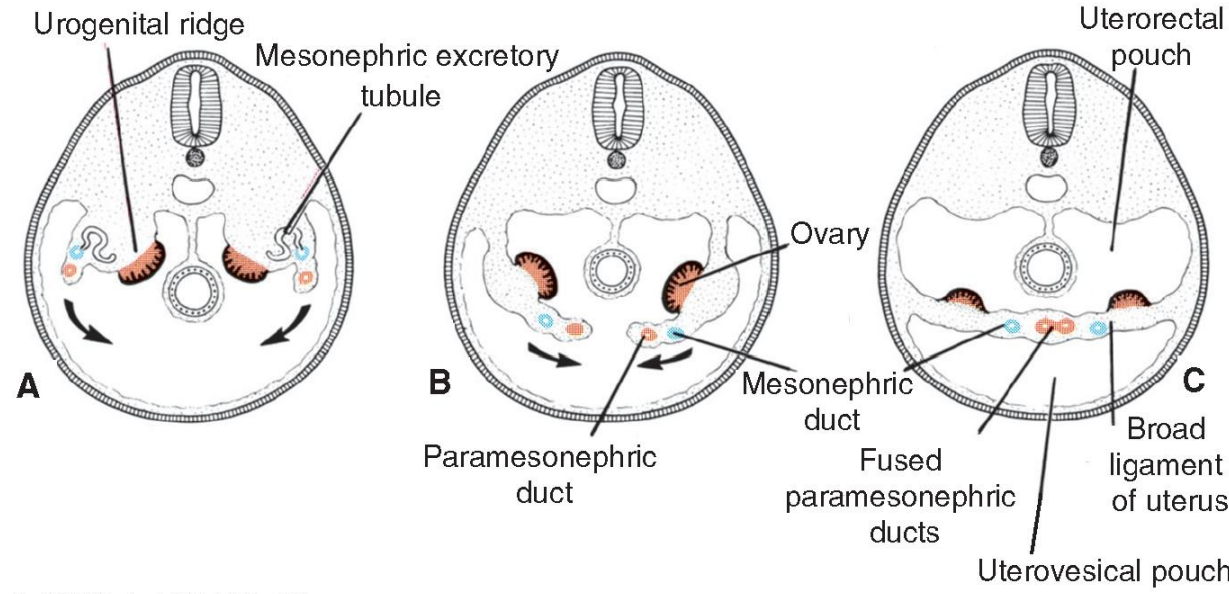
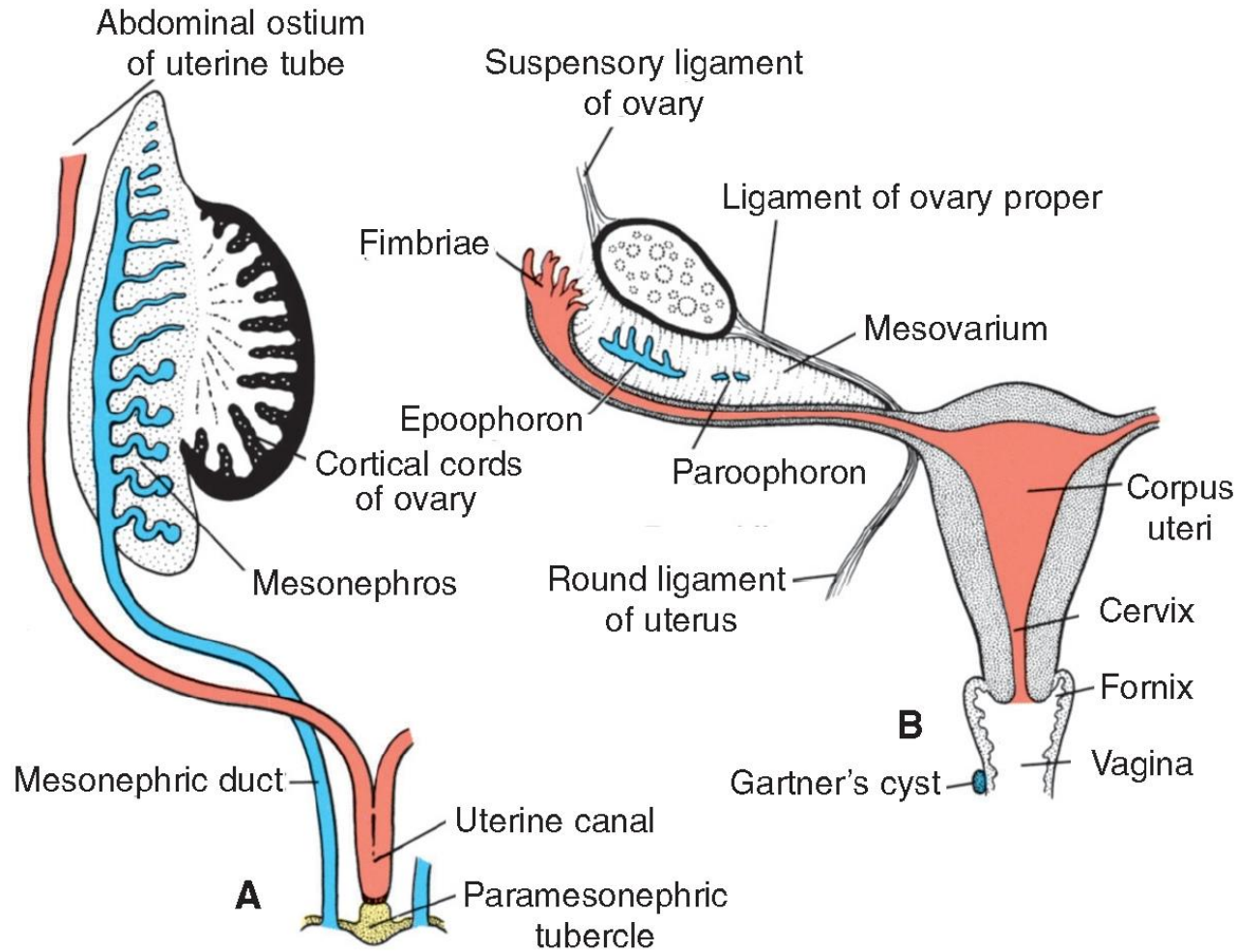
Vrozená tříselná kýla

Hydrokéla

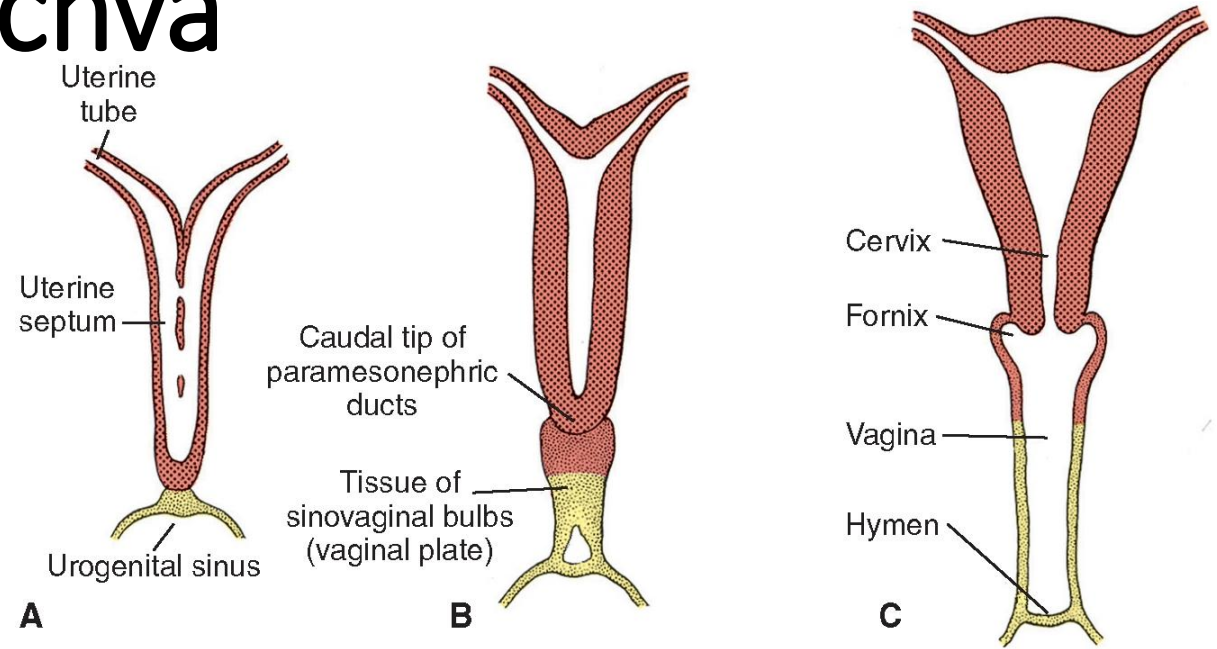
Vaječník



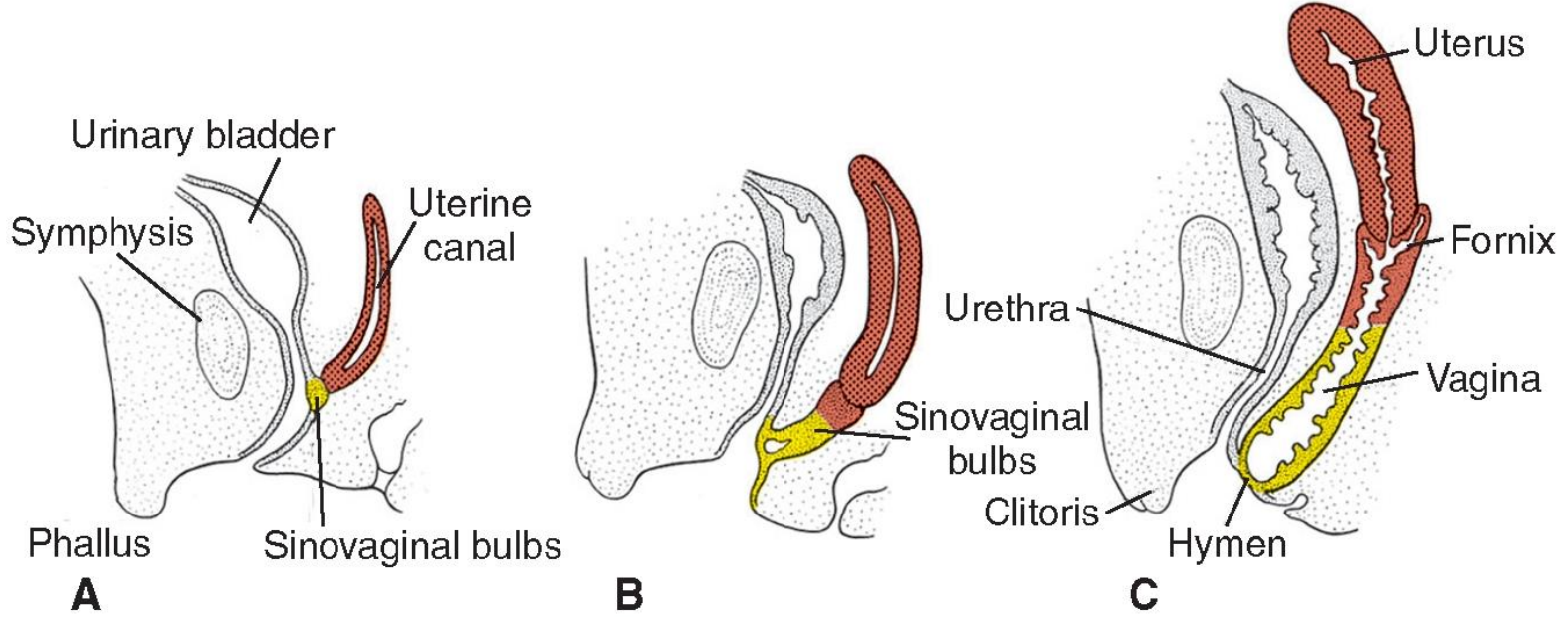
Vaječník, děloha, pochva



Děloha, pochva

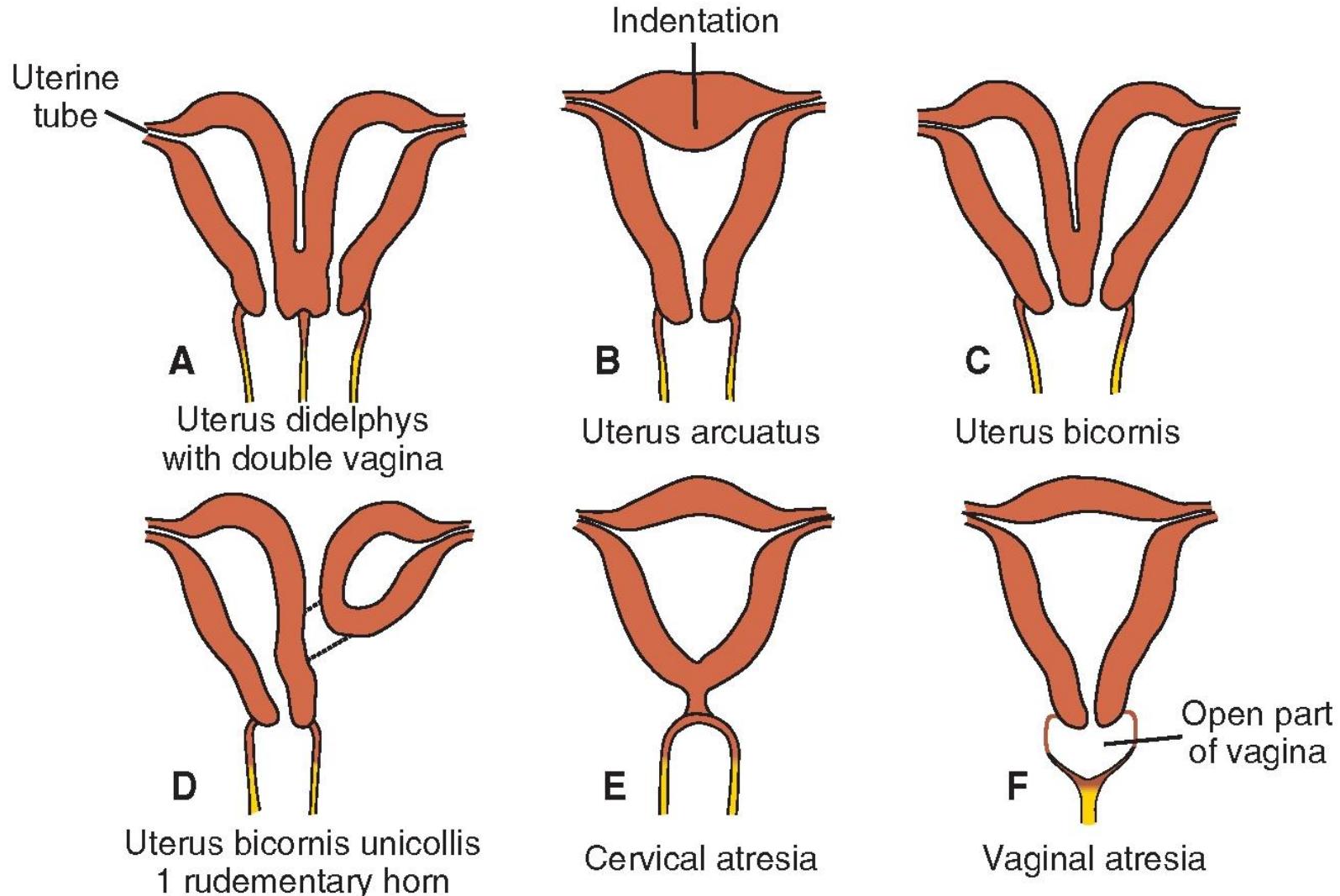


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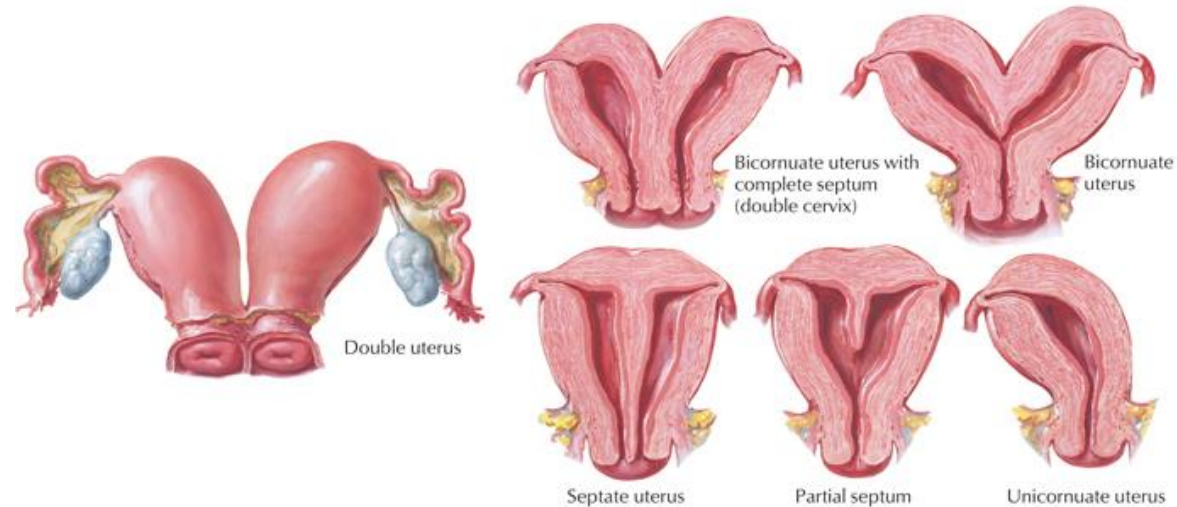
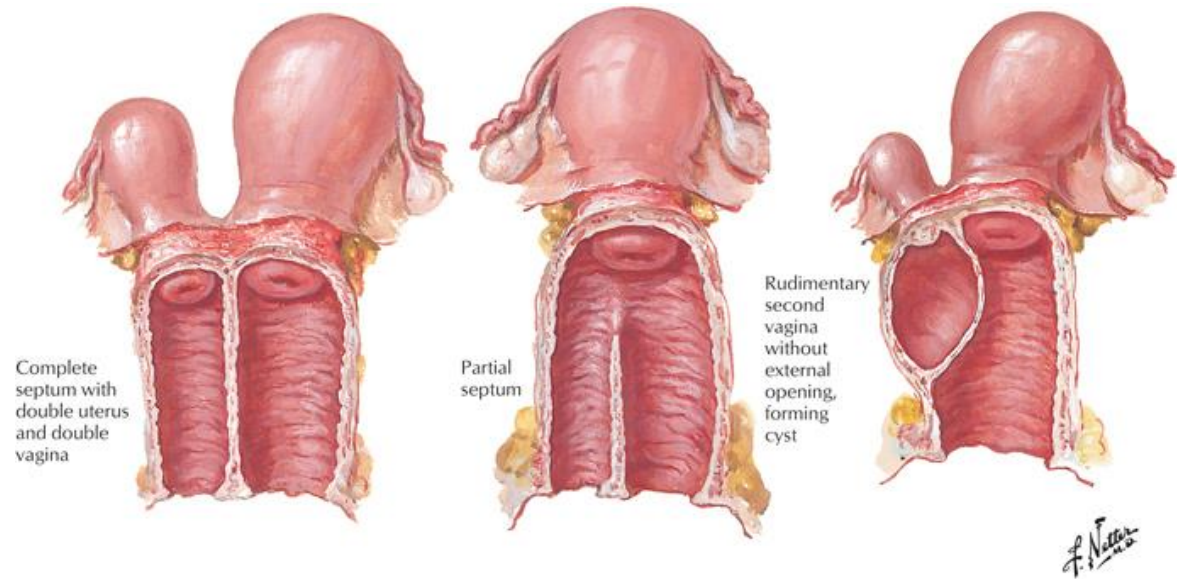


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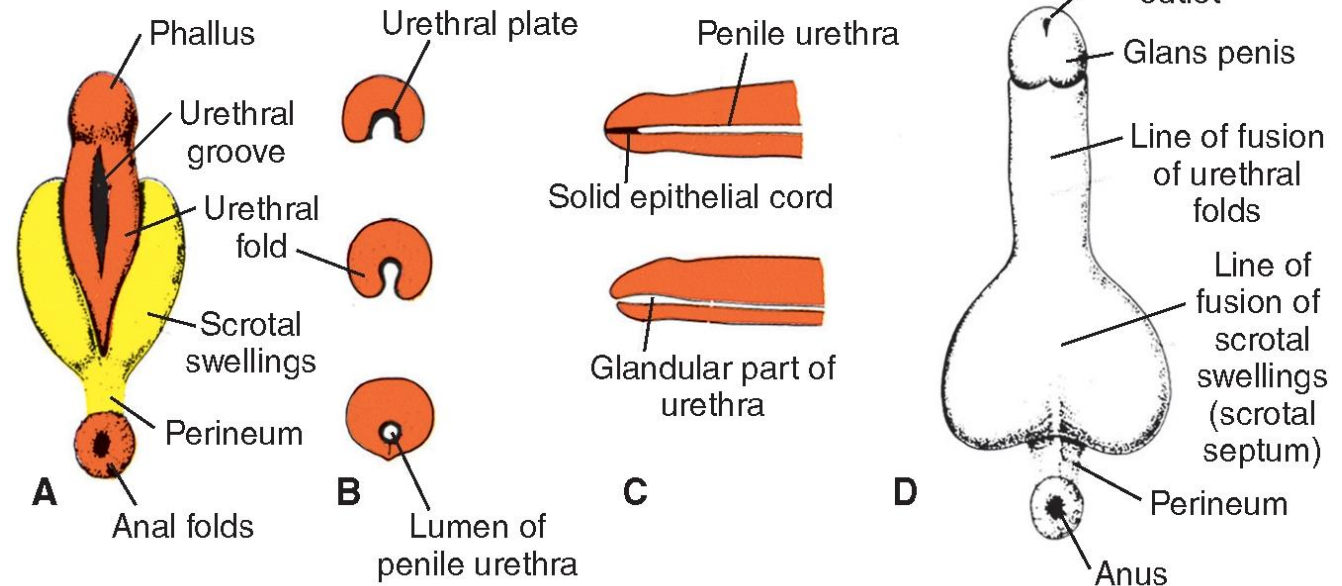
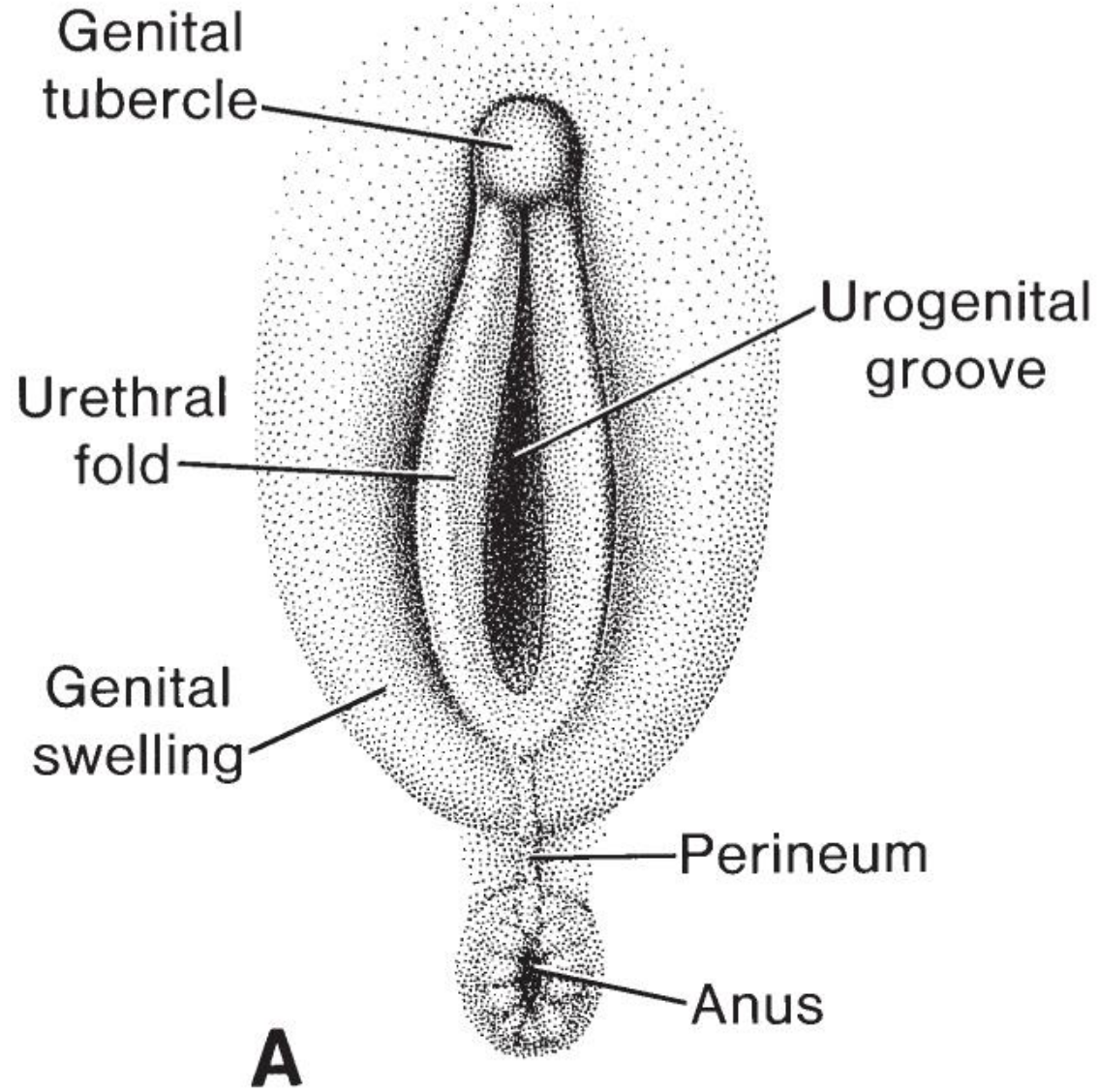
Vrozené vývojové vady – děloha, pochva



Vrozené vývojové vady – děloha, pochva

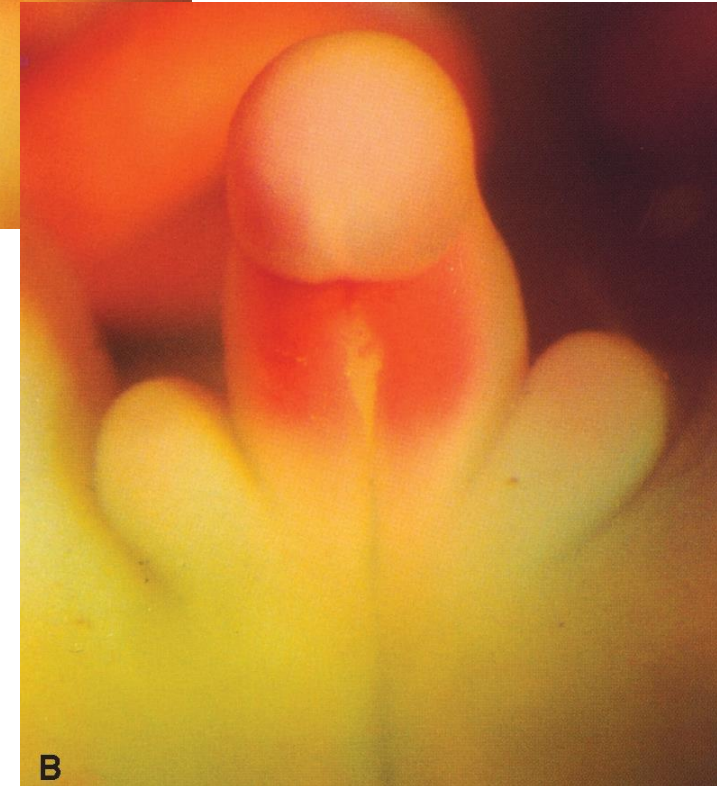
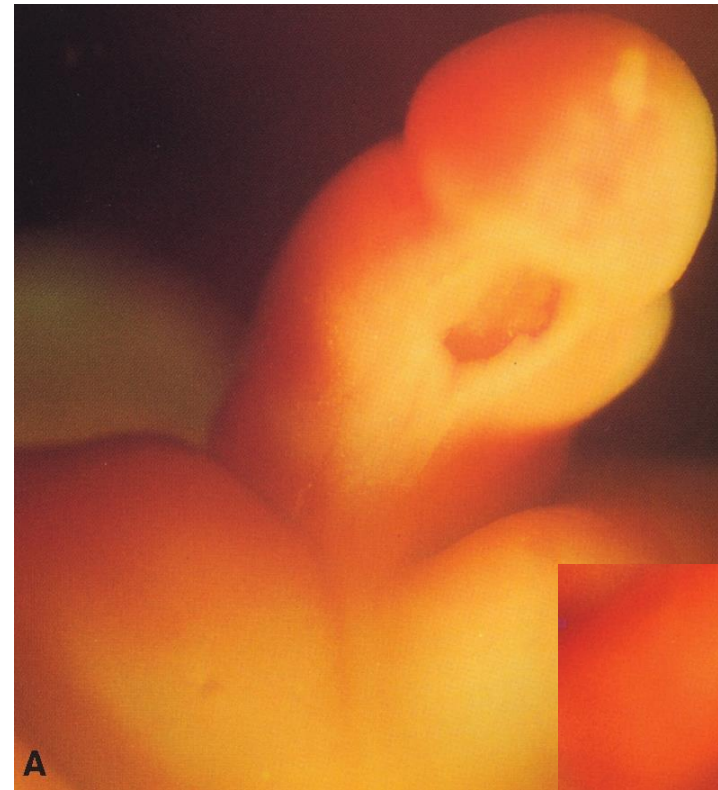
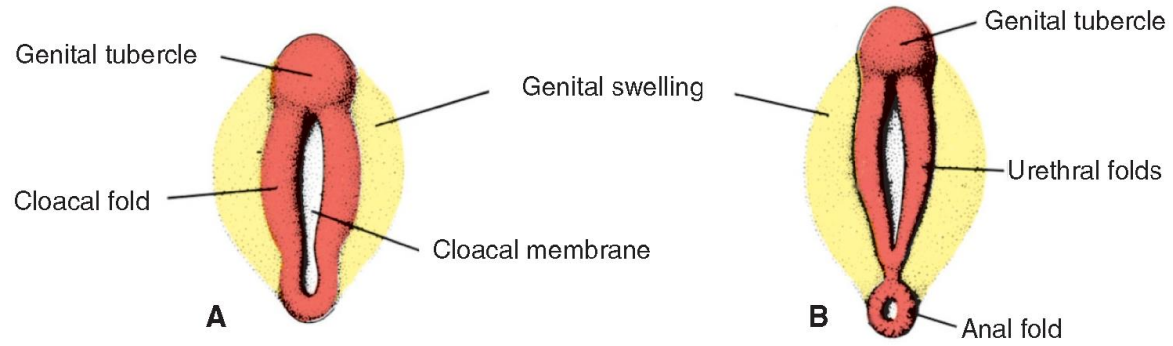


Vnější genitálie



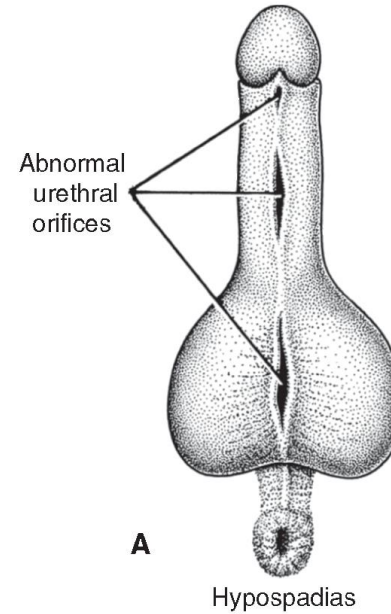
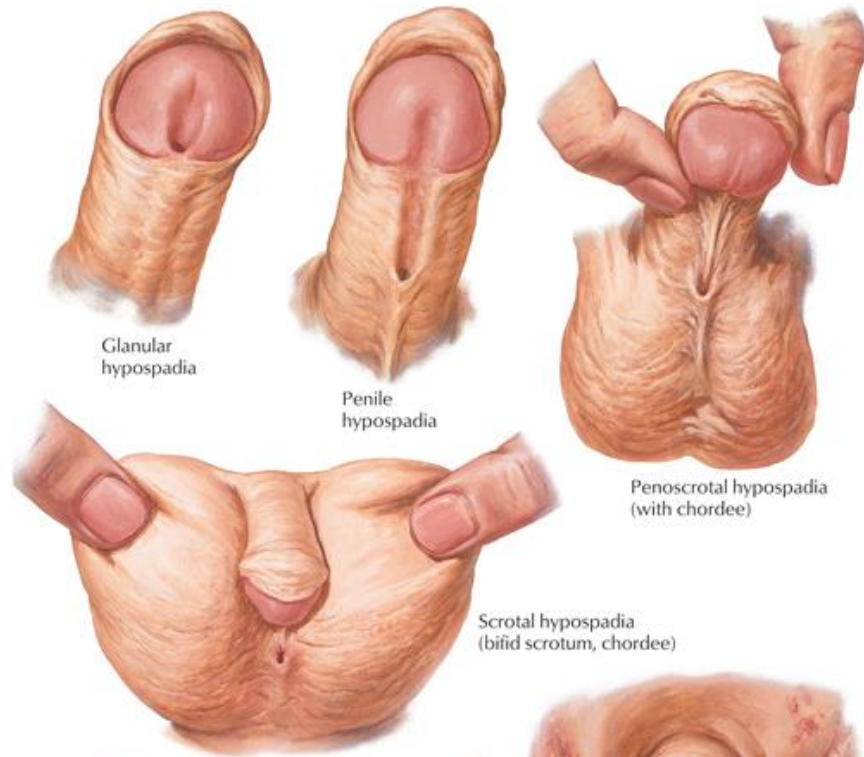
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Vnější genitálie



Vrozené vývojové vady – vyústění uretry u muže

Hypospadié



Epispadié

