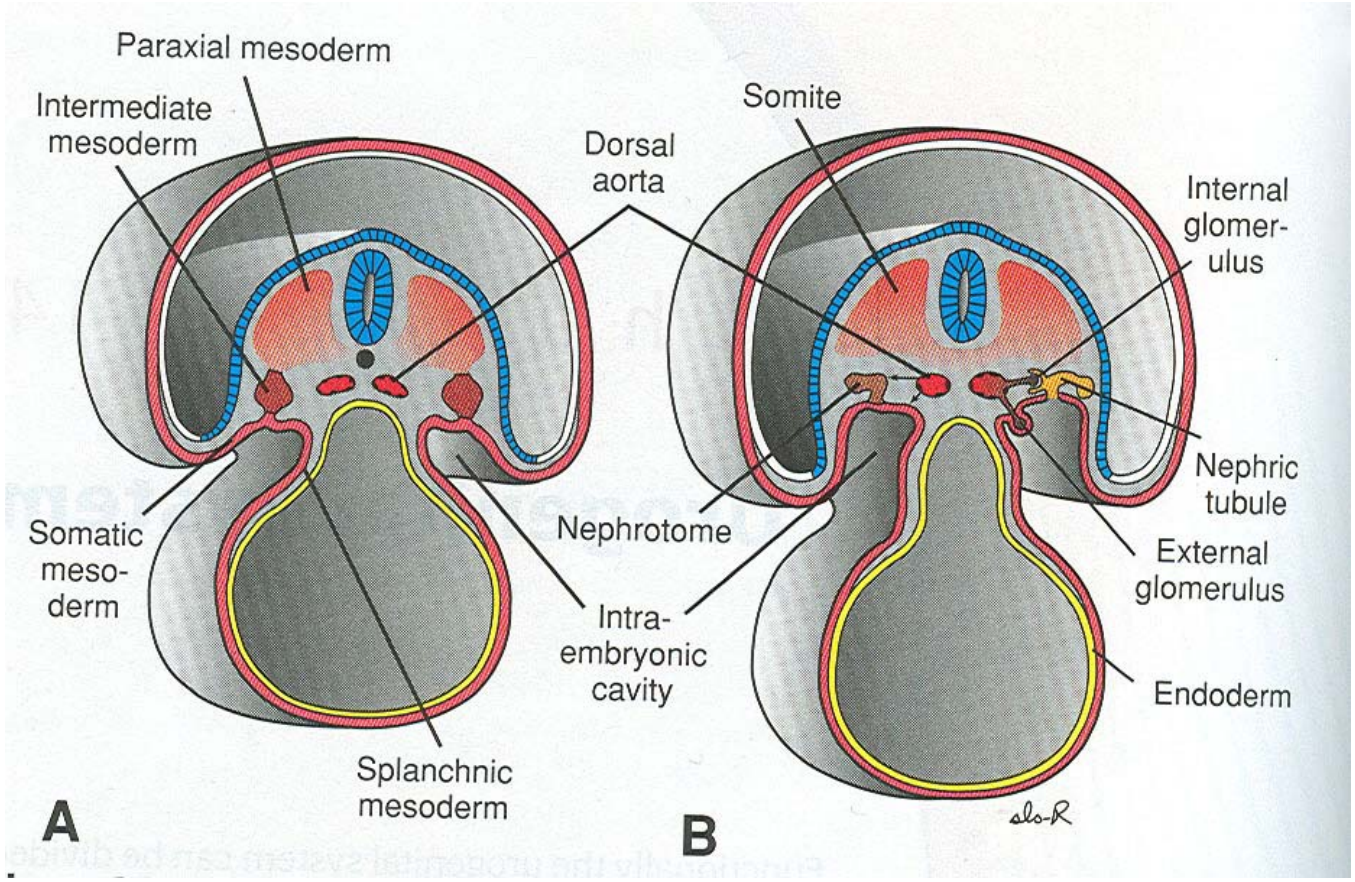
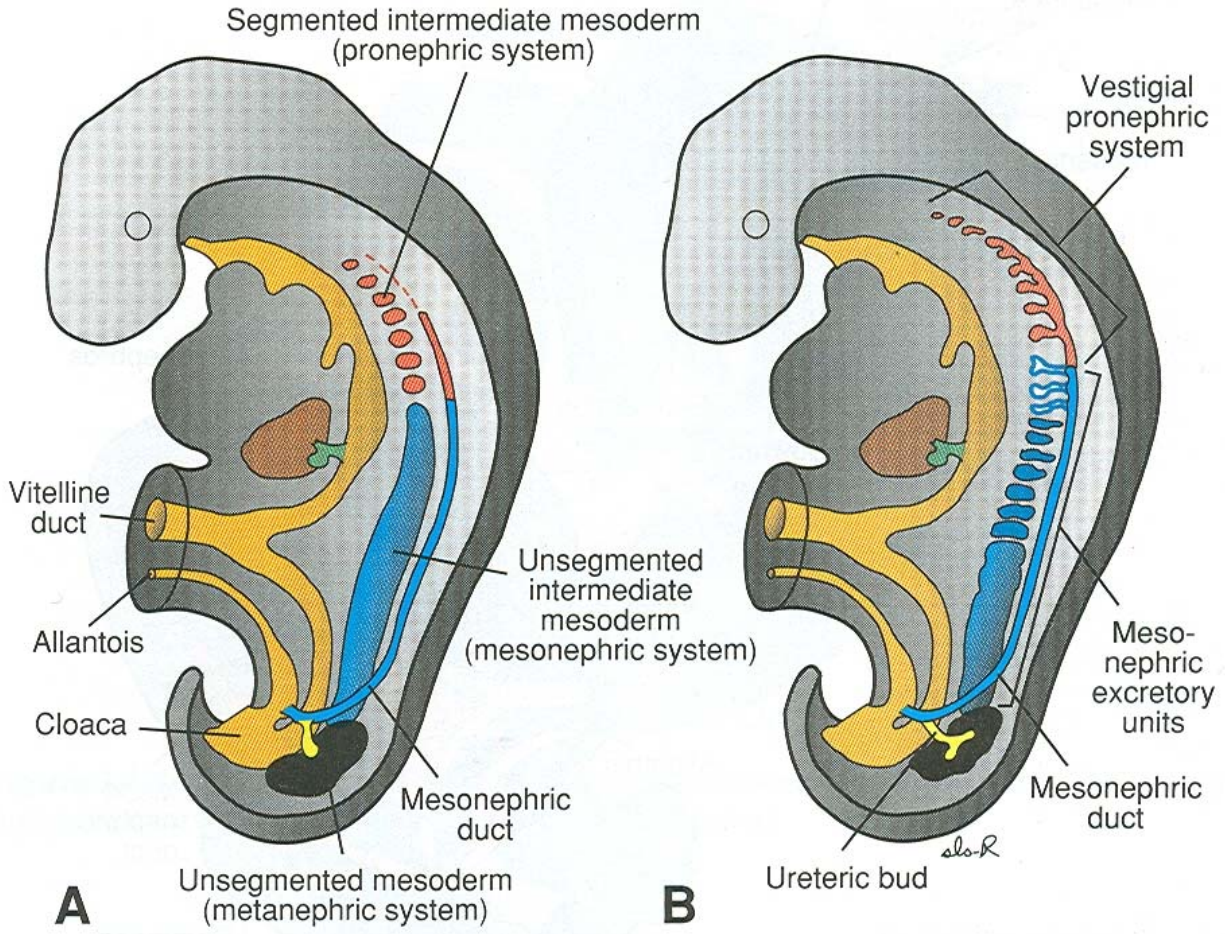
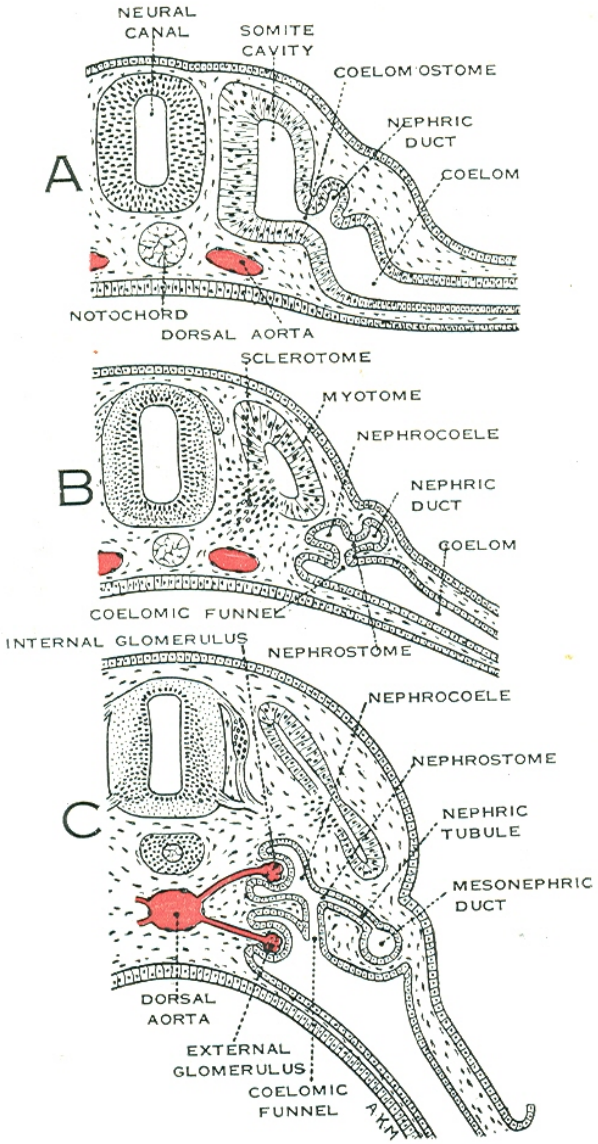
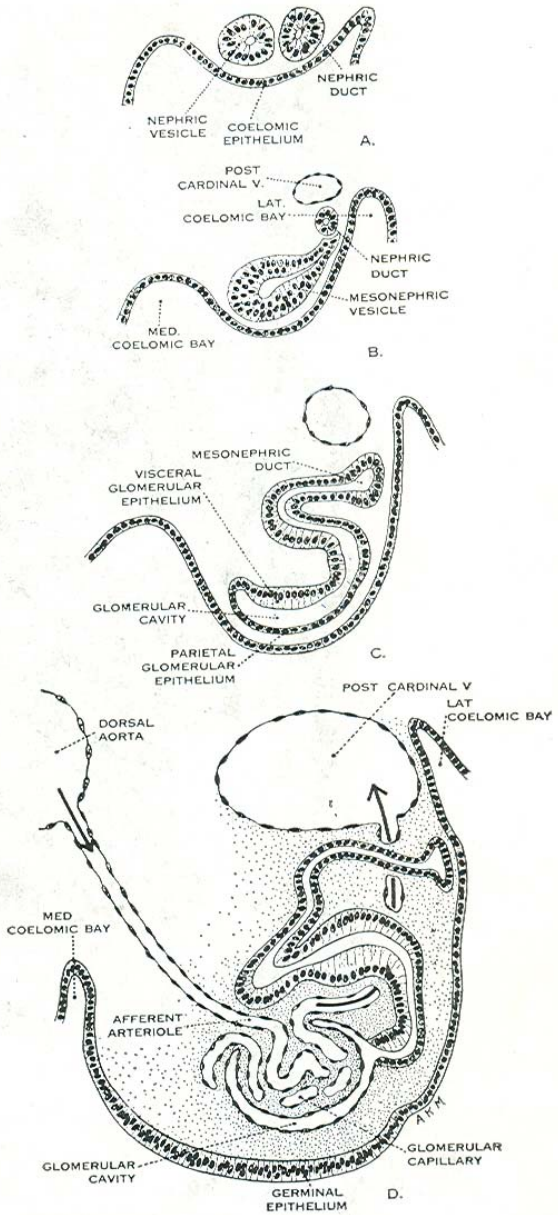
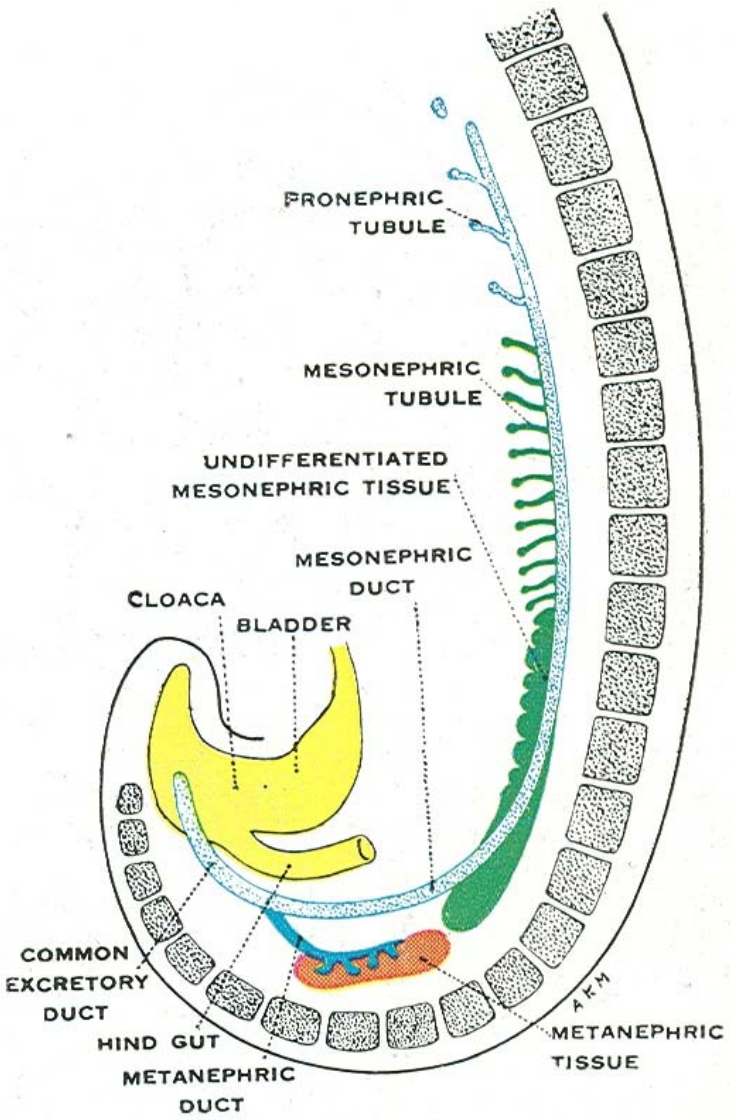
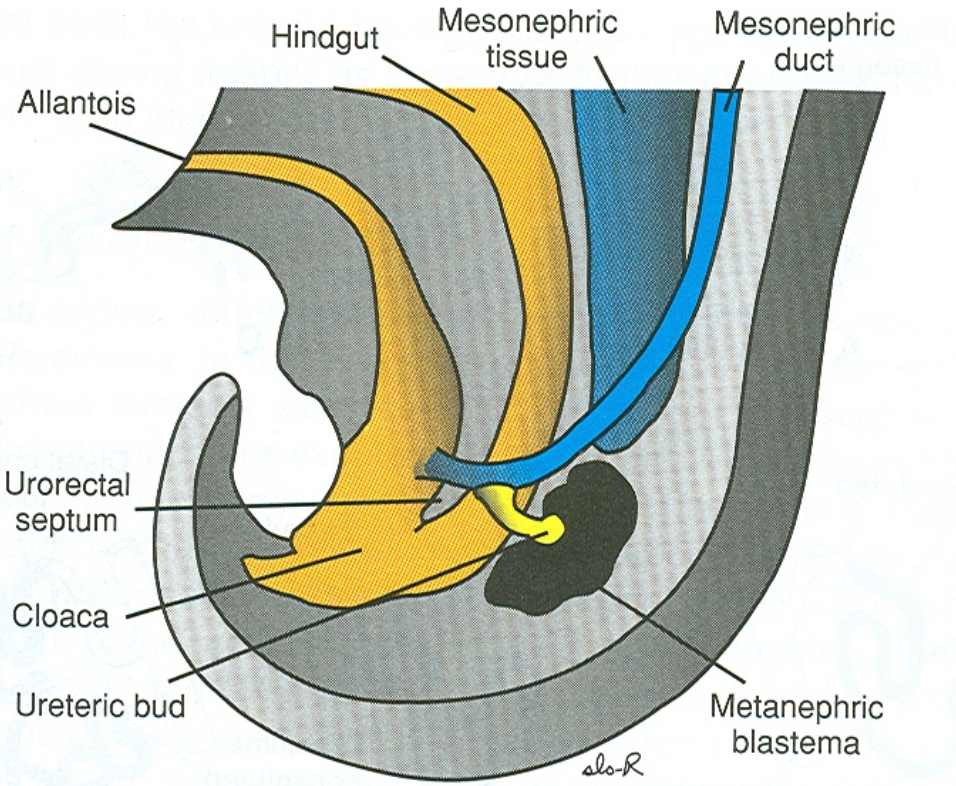

Paraxial mesoderm
Intermediate mesoderm
Somatic meso-derm
Splanchnic mesoderm
A
Dorsal aorta
Somite
Internal glomer-ulus
Nephric tubule
Nephrotome
External glomerulus
Intra-embryonic cavity
Endoderm
B

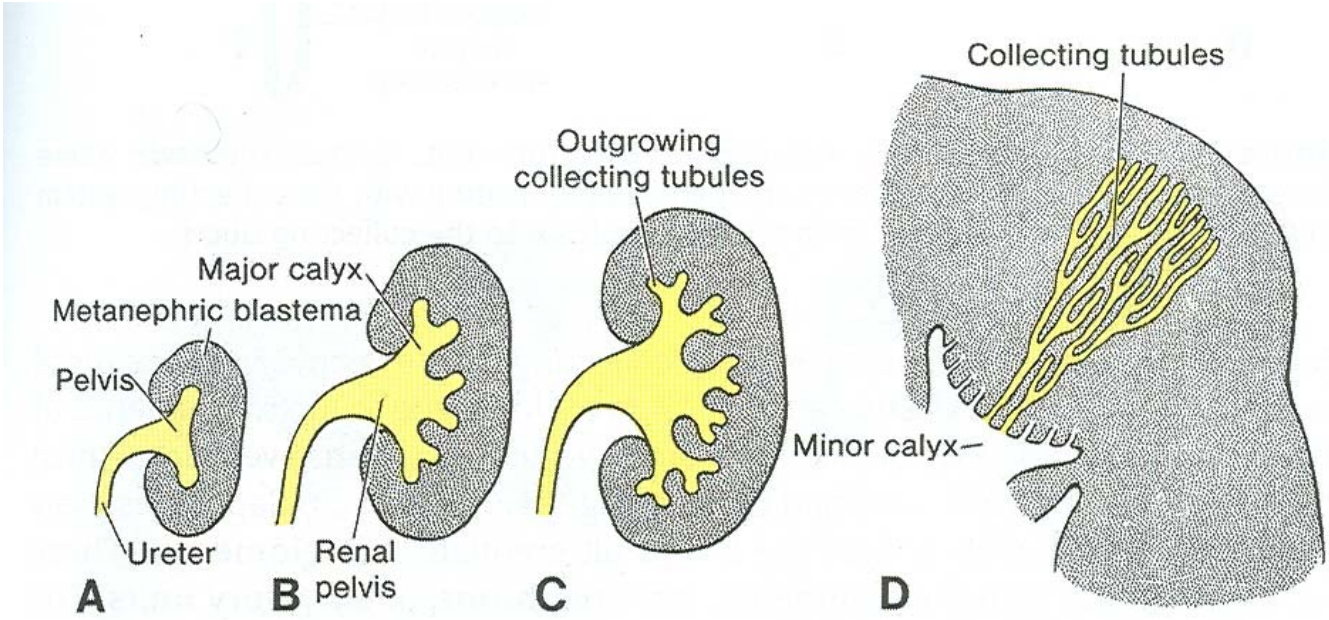

Segmented intermediate mesoderm
(pronephric system)
Vitelline
duct
Allantois
Cloaca
Unsegmented
intermediate
mesoderm
(mesonephric system)
Mesonephric
duct
Unsegmented mesoderm
(metanephric system)
A
Vestigial
pronephric
system
Meso-
nephric
excretory
units
Mesonephric
duct
Ureteric bud
B

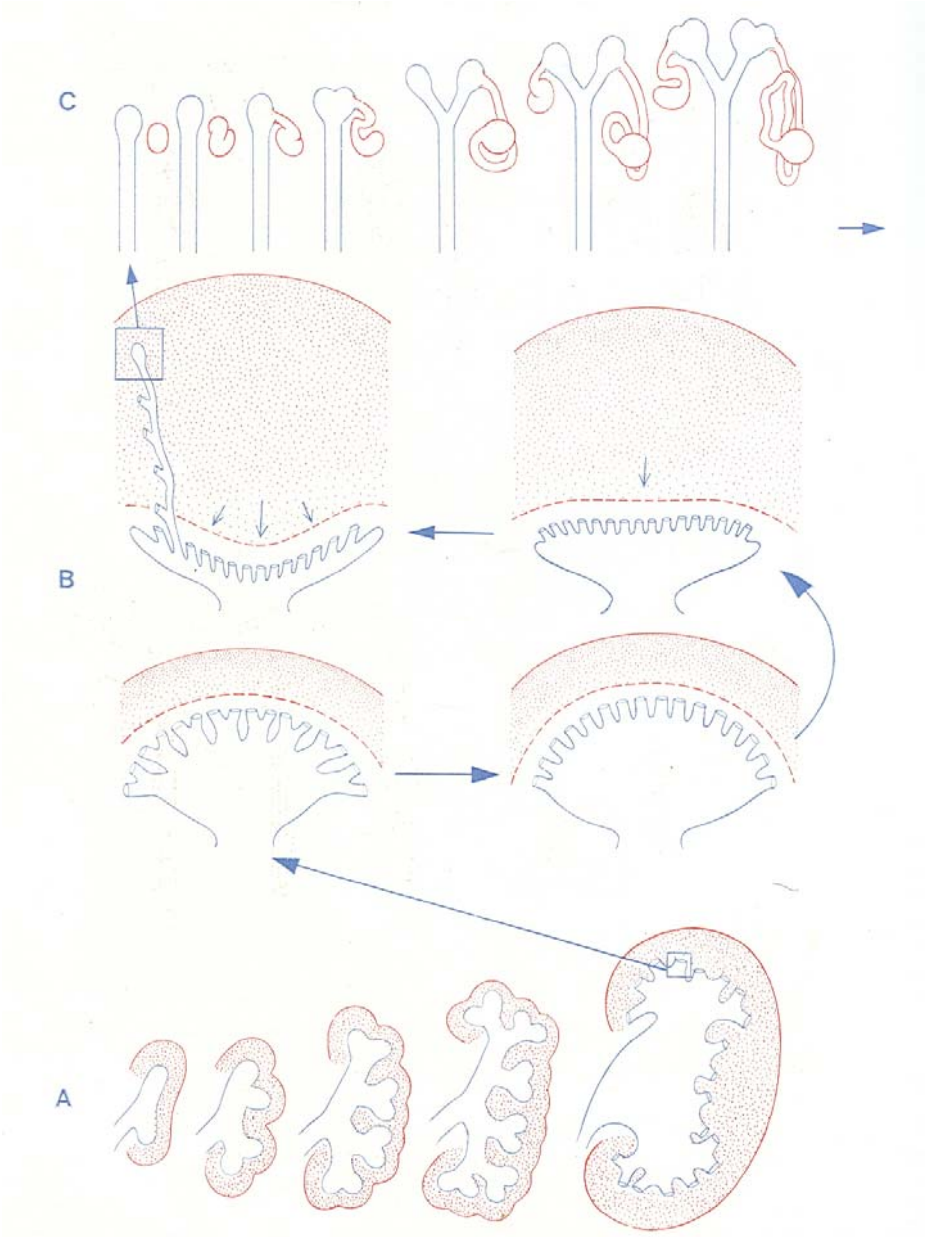

A
NEURAL CANAL
SOMITE CAVITY
COELOMOSTOME
NEPHRIC DUCT
COELOM
NOTOCHORD
DORSAL AORTA
B
SCLEROTOME
MYOTOME
NEPHROCOELE
NEPHRIC DUCT
COELOM
COELOMIC FUNNEL
INTERNAL GLOMERULUS
NEPHROSTOME
C
NEPHROCOELE
NEPHROSTOME
NEPHRIC TUBULE
MESONEPHRIC DUCT
DORSAL AORTA
EXTERNAL GLOMERULUS
COELOMIC FUNNEL
AKM

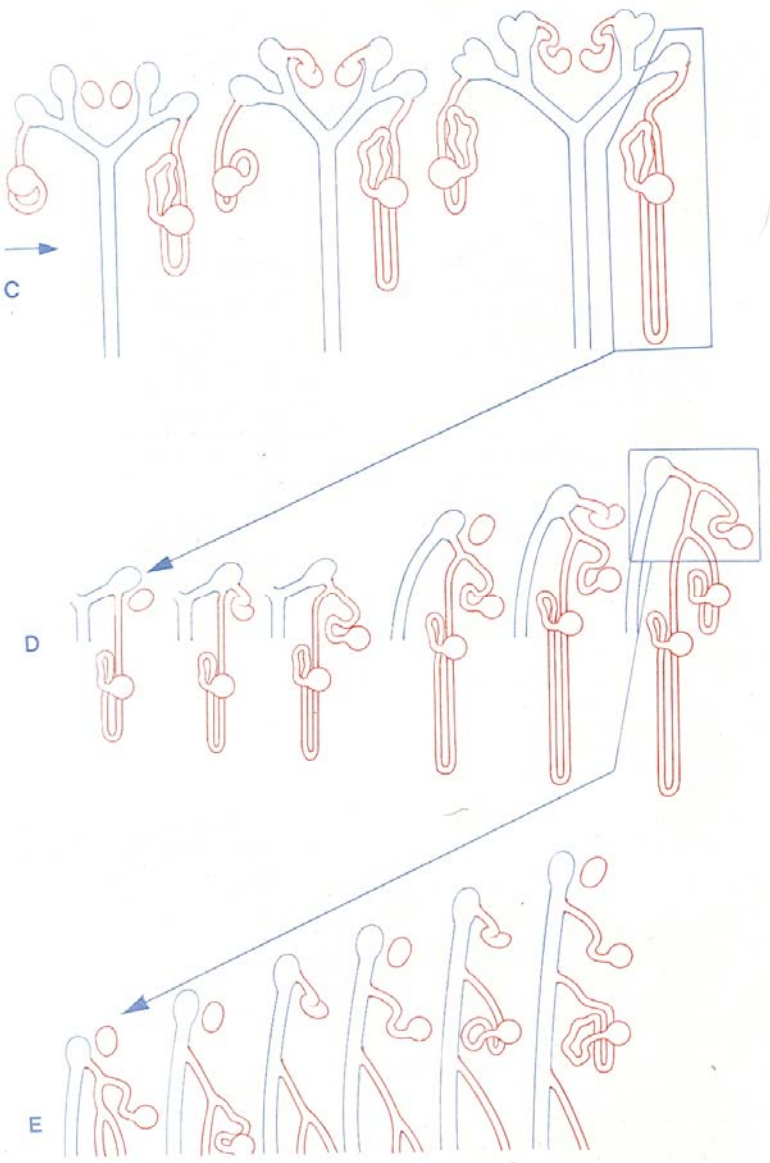

NEPHRIC DUCT
NEPHRIC VESICLE
COELOMIC EPITHELIUM
A.
POST CARDINAL V.
LAT. COELOMIC BAY
NEPHRIC DUCT
MESONEPHRIC VESICLE
MED. COELOMIC BAY
B.
MESONEPHRIC DUCT
VISCERAL GLOMERULAR EPITHELIUM
GLOMERULAR CAVITY
PARIETAL GLOMERULAR EPITHELIUM
C.
POST CARDINAL V
LAT COELOMIC BAY
DORSAL AORTA
MED COELOMIC BAY
AFFERENT ARTERIOLE
GLOMERULAR CAPILLARY
GLOMERULAR CAVITY
GERMINAL EPITHELIUM
D.

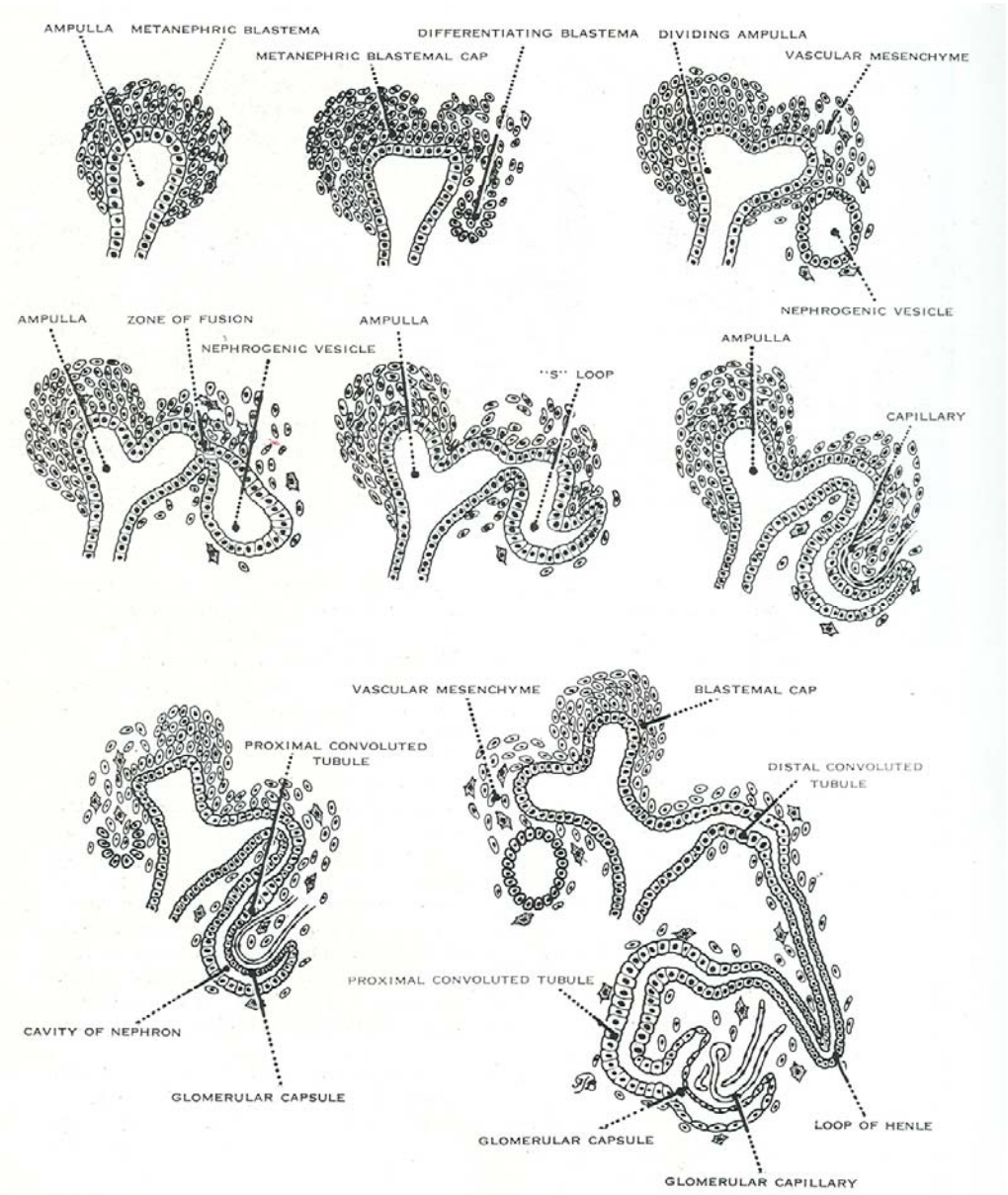

PRONEPHRIC TUBULE
MESONEPHRIC TUBULE
UNDIFFERENTIATED MESONEPHRIC TISSUE
MESONEPHRIC DUCT
CLOACA
BLADDER
COMMON EXCRETORY DUCT
HIND GUT
METANEPHRIC DUCT
METANEPHRIC TISSUE
A.K.M.

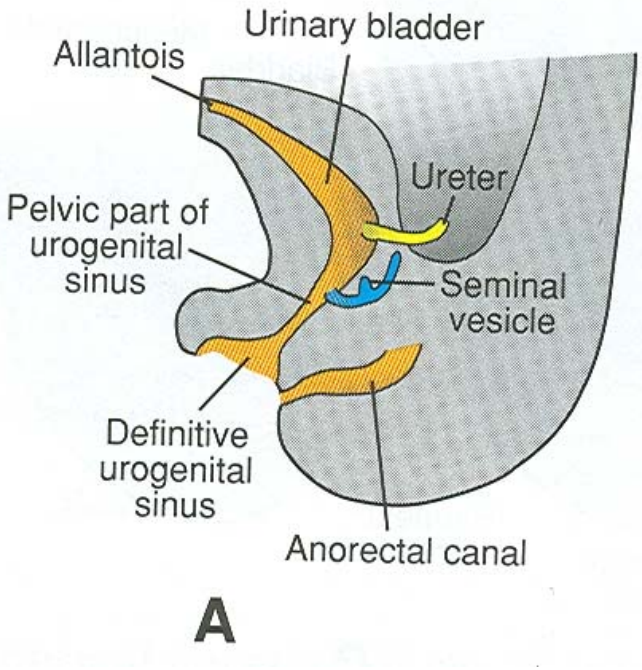

Hindgut
Mesonephric tissue
Mesonephric duct
Allantois
Urorectal septum
Cloaca
Ureteric bud
Metanephric blastema

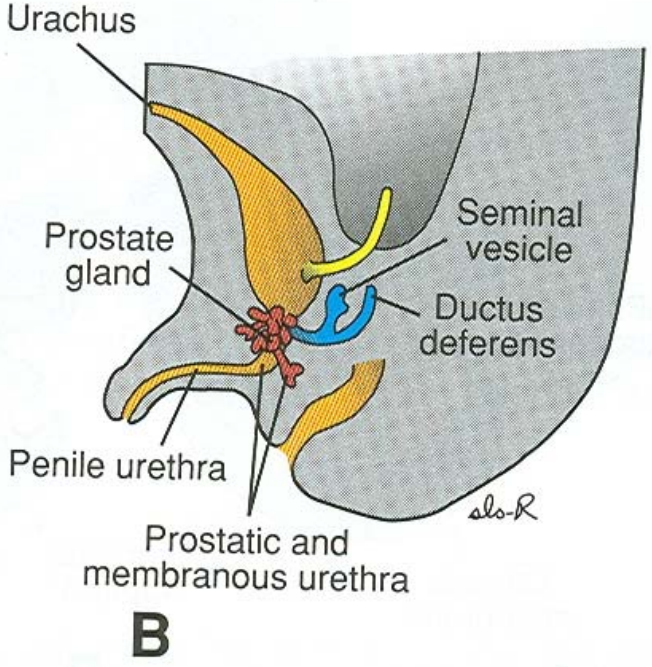

Collecting tubules
Outgrowing collecting tubules
Major calyx
Metanephric blastema
Pelvis
Minor calyx
Ureter
Renal pelvis
A
B
C
D

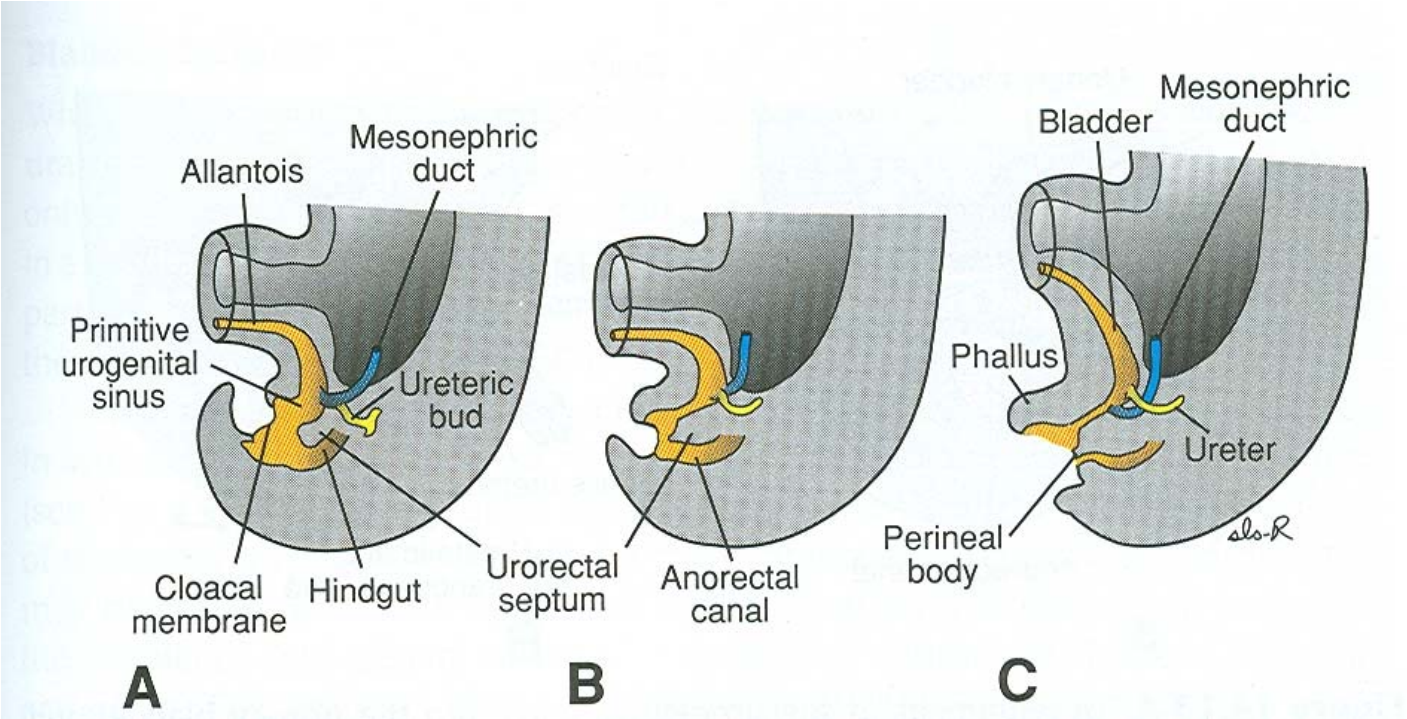

C
B
A

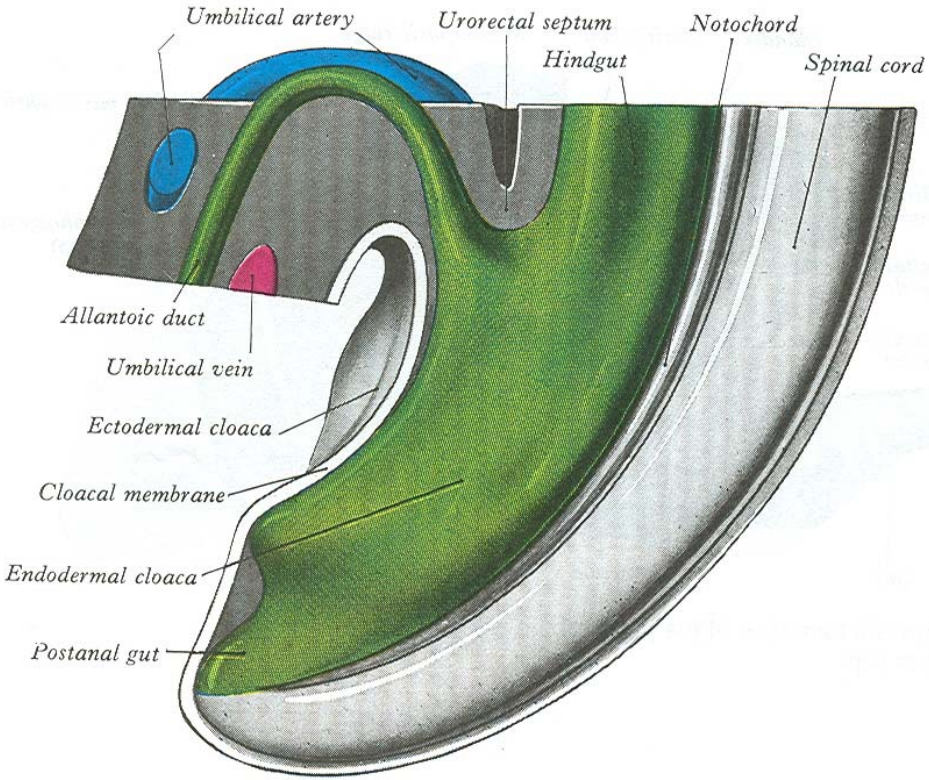

C
D
E

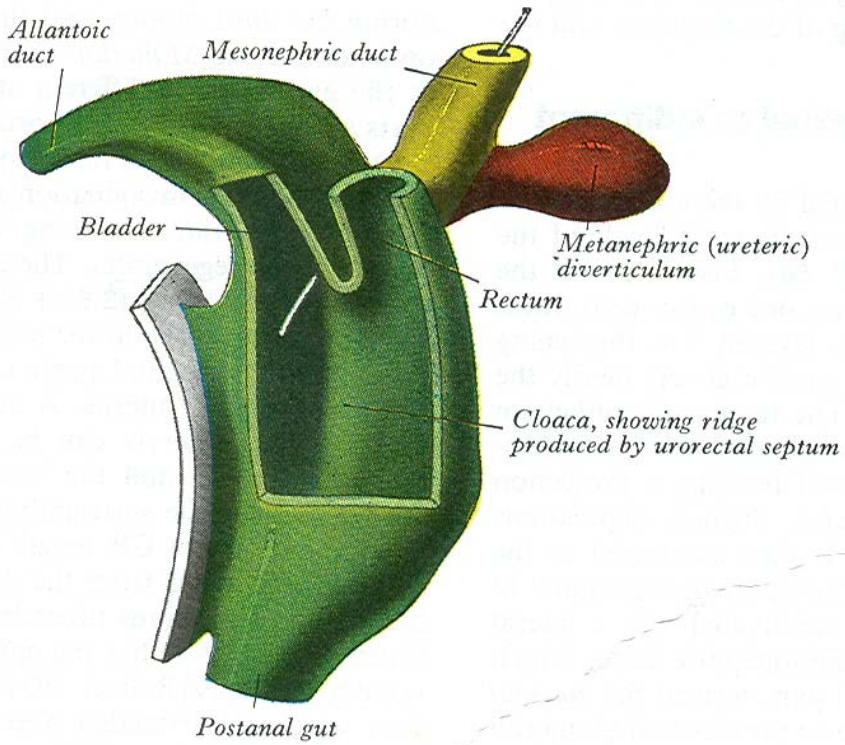

AMPULLA
METANEPHRIC BLASTEMA
DIFFERENTIATING BLASTEMA
METANEPHRIC BLASTEMAL CAP
DIVIDING AMPULLA
VASCULAR MESENCHYME
NEPHROGENIC VESICLE
AMPULLA
ZONE OF FUSION
NEPHROGENIC VESICLE
AMPULLA
"S" LOOP
AMPULLA
CAPILLARY
VASCULAR MESENCHYME
BLASTEMAL CAP
PROXIMAL CONVOLUTED TUBULE
DISTAL CONVOLUTED TUBULE
PROXIMAL CONVOLUTED TUBULE
CAVITY OF NEPHRON
GLOMERULAR CAPSULE
GLOMERULAR CAPSULE
LOOP OF HENLE
GLOMERULAR CAPILLARY

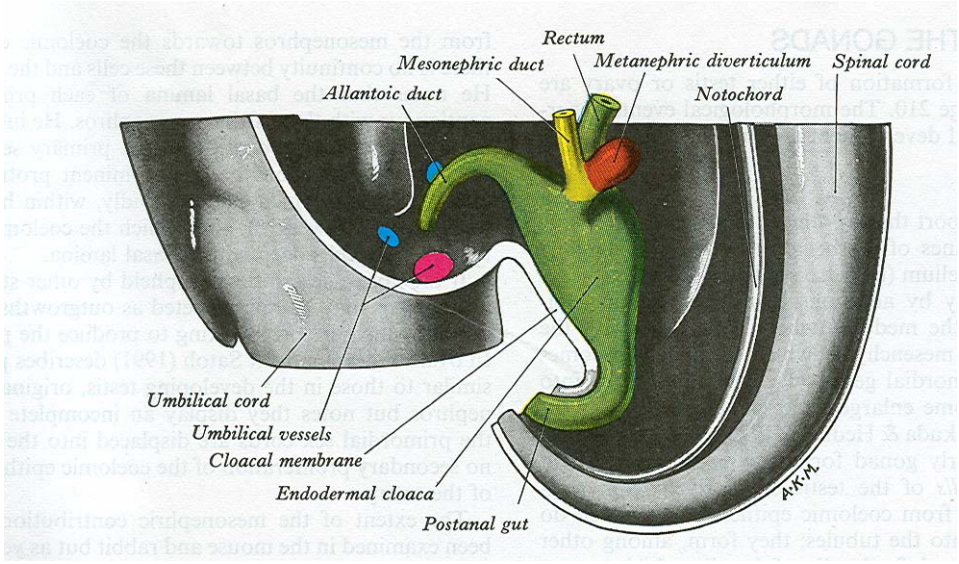

Allantois
Urinary bladder
Ureter
Pelvic part of urogenital sinus
Seminal vesicle
Definitive urogenital sinus
Anorectal canal
A

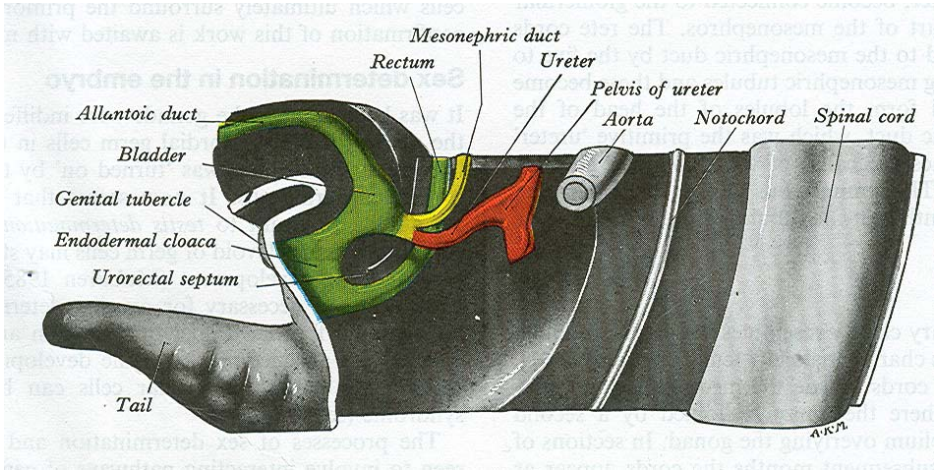

Urachus
Seminal vesicle
Prostate gland
Ductus deferens
Penile urethra
Prostatic and membranous urethra
B

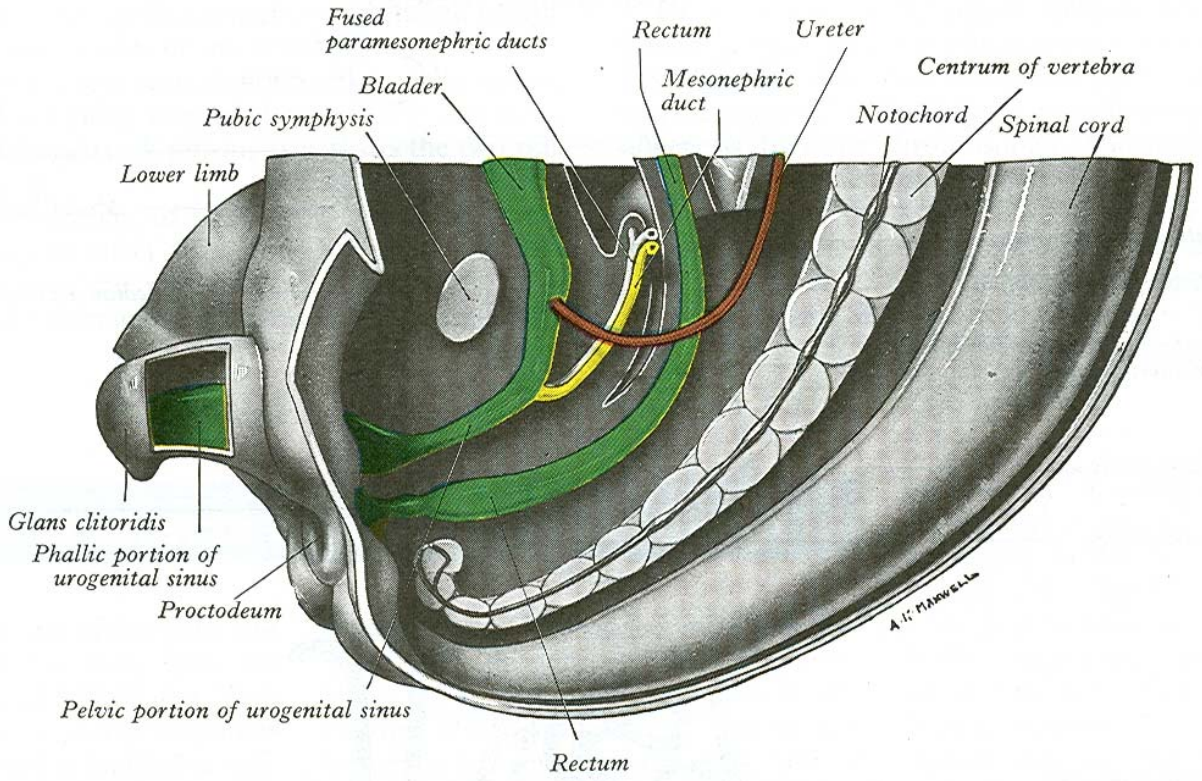

Allantois
Mesonephric duct
Primitive urogenital sinus
Ureteric bud
Cloacal membrane
Hindgut
Urorectal septum
Anorectal canal
Bladder
Mesonephric duct
Phallus
Ureter
Perineal body
A
B
C

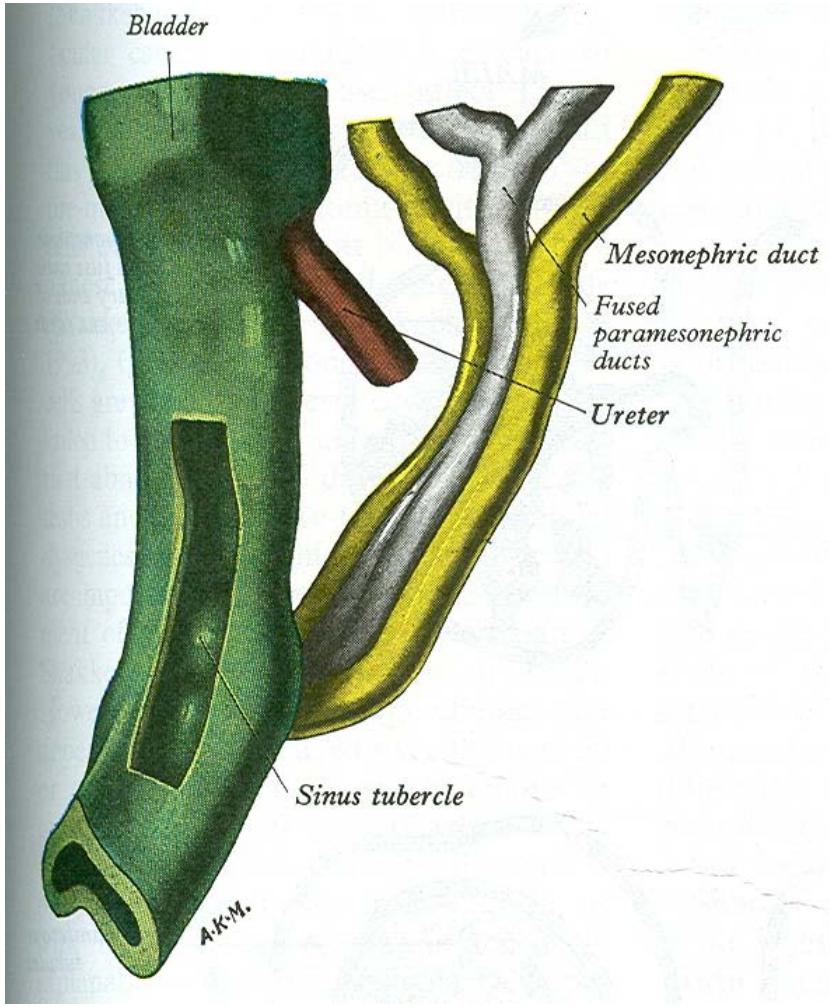

Umbilical artery
Urorectal septum
Notochord
Hindgut
Spinal cord
Allantoic duct
Umbilical vein
Ectodermal cloaca
Cloacal membrane
Endodermal cloaca
Postanal gut

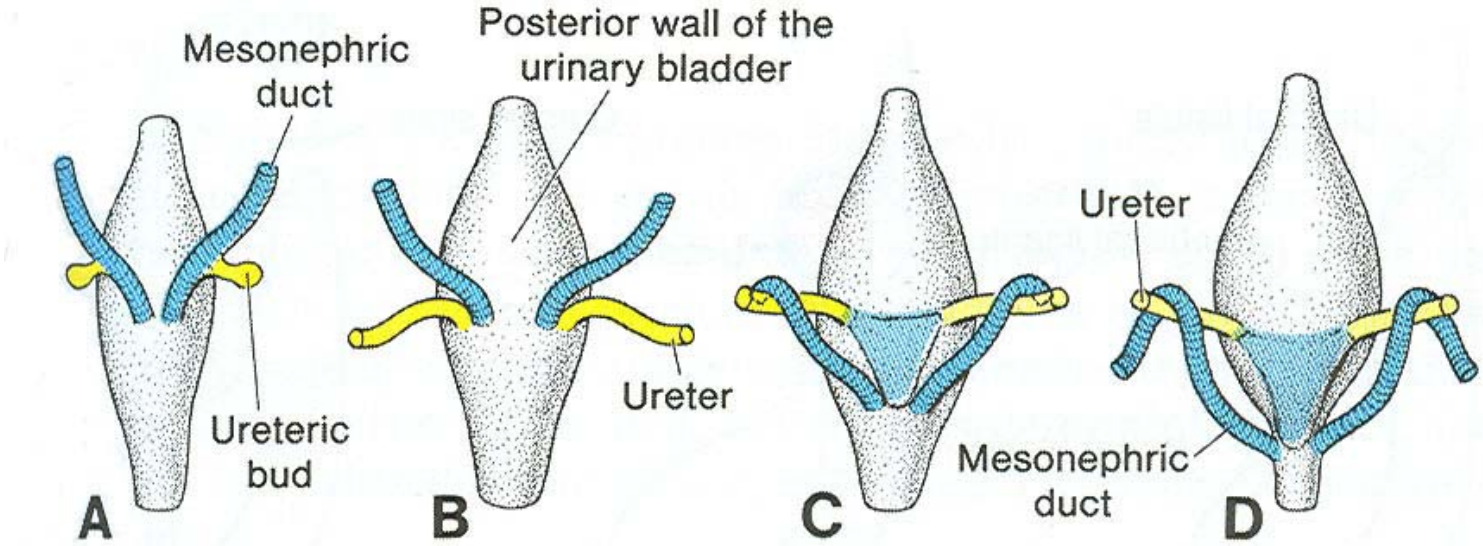

Allantoic duct
Mesonephric duct
Bladder
Metanephric (ureteric) diverticulum
Rectum
Cloaca, showing ridge produced by urorectal septum
Postanal gut

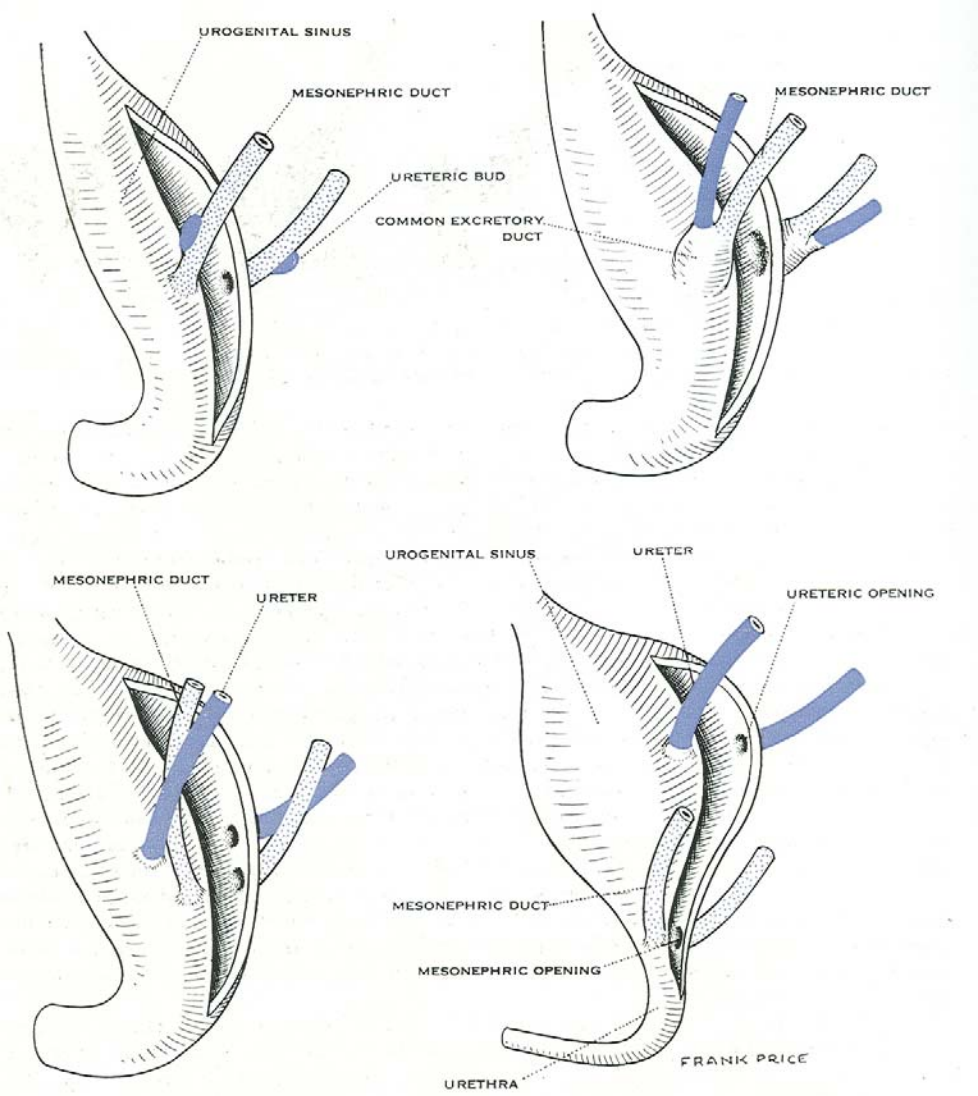

Rectum
Mesonephric duct
Metanephric diverticulum
Spinal cord
Allantoic duct
Notochord
Umbilical cord
Umbilical vessels
Cloacal membrane
Endodermal cloaca
Postanal gut
A.K.M.

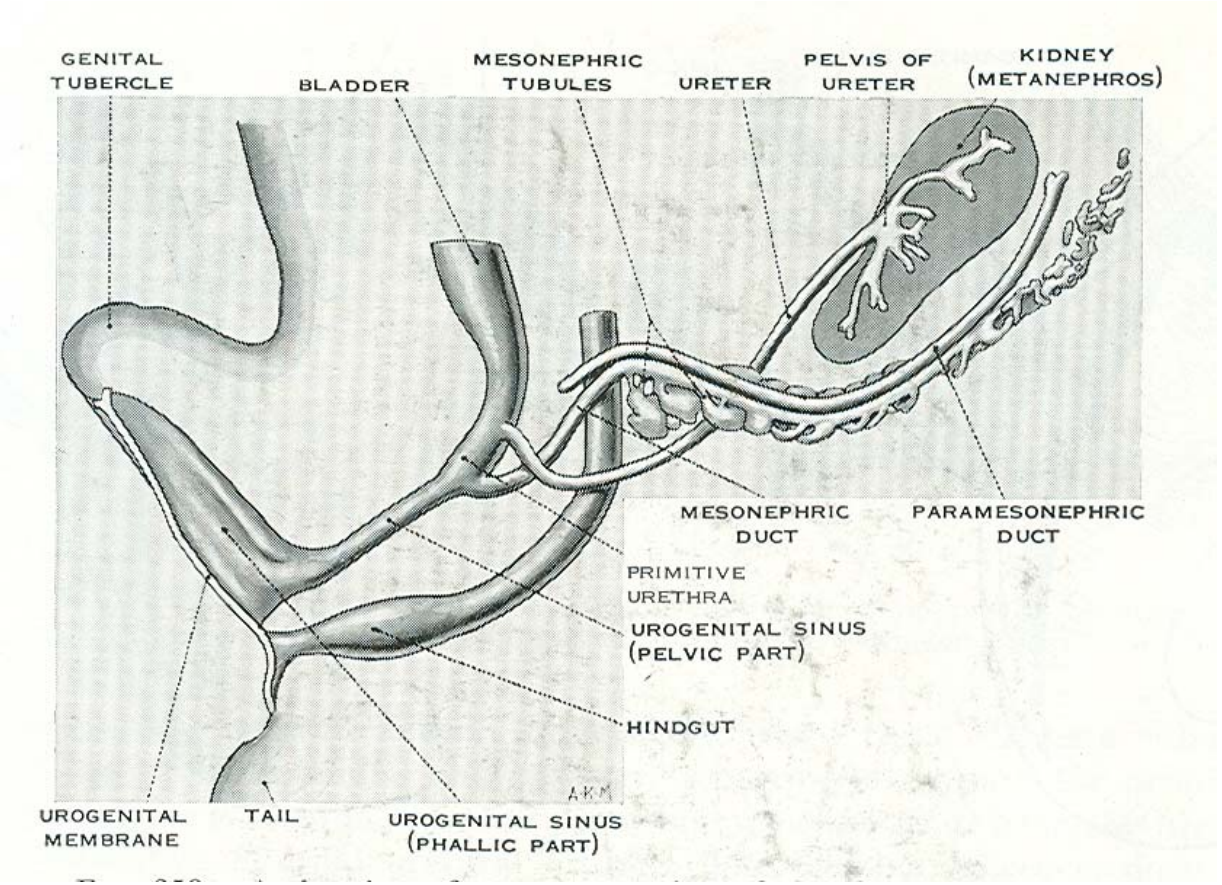

Mesonephric duct
Rectum
Ureter
Pelvis of ureter
Allantoic duct
Aorta
Notochord
Spinal cord
Bladder
Genital tubercle
Endodermal cloaca
Urorectal septum
Tail
A.K.M.

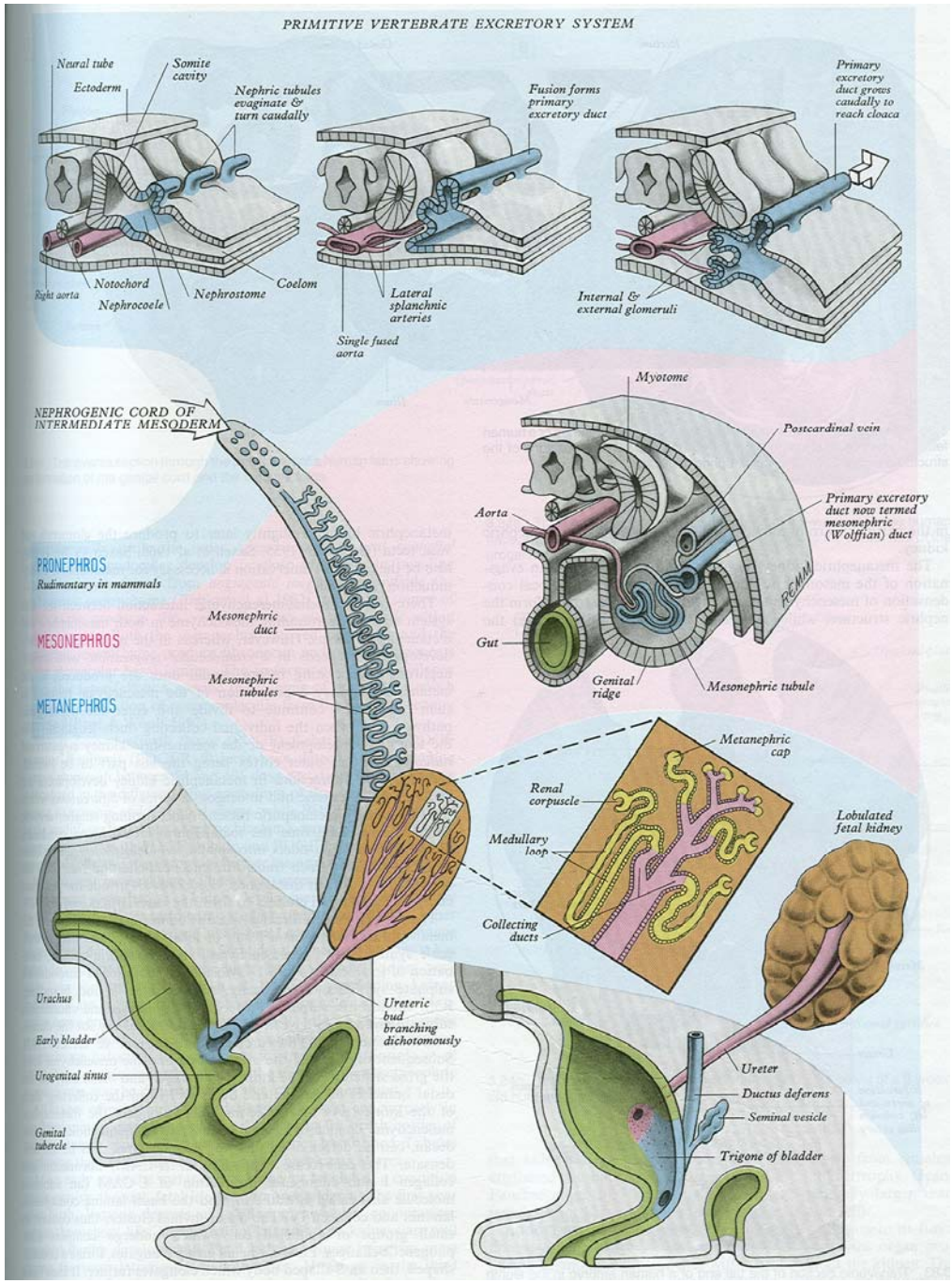

Fused paramesonephric ducts
Rectum
Ureter
Centrum of vertebra
Bladder
Mesonephric duct
Notochord
Spinal cord
Pubic symphysis
Lower limb
Glans clitoridis
Phallic portion of urogenital sinus
Proctodeum
Pelvic portion of urogenital sinus
Rectum


Bladder
Mesonephric duct
Fused paramesonephric ducts
Ureter
Sinus tubercle
A.K.M.


Mesonephric duct
Ureteric bud
A
Posterior wall of the urinary bladder
Ureter
B
C
Ureter
Mesonephric duct
D


UROGENITAL SINUS
MESONEPHRIC DUCT
URETERIC BUD
COMMON EXCRETORY DUCT
MESONEPHRIC DUCT
MESONEPHRIC DUCT
URETER
UROGENITAL SINUS
URETER
URETERIC OPENING
MESONEPHRIC DUCT
MESONEPHRIC OPENING
URETHRA
FRANK PRICE


GENITAL TUBERCLE
BLADDER
MESONEPHRIC TUBULES
URETER
PELVIS OF URETER
KIDNEY (METANEPHROS)
MESONEPHRIC DUCT
PARAMESONEPHRIC DUCT
PRIMITIVE URETHRA
UROGENITAL SINUS (PELVIC PART)
HINDGUT
UROGENITAL MEMBRANE
TAIL
UROGENITAL SINUS (PHALLIC PART)


PRIMITIVE VERTEBRATE EXCRETORY SYSTEM
Neural tube
Somite cavity
Ectoderm
Nephric tubules evaginate & turn caudally
Fusion forms primary excretory duct
Primary excretory duct grows caudally to reach cloaca
Right aorta
Notochord
Nephrocoele
Nephrostome
Coelom
Lateral splanchnic arteries
Single fused aorta
Internal & external glomeruli
NEPHROGENIC CORD OF INTERMEDIATE MESODERM
PRONEPHROS
Rudimentary in mammals
MESONEPHROS
METANEPHROS
Mesonephric duct
Mesonephric tubules
Myotome
Postcardinal vein
Aorta
Primary excretory duct now termed mesonephric (Wolffian) duct
Gut
Genital ridge
Mesonephric tubule
Metanephric cap
Renal corpuscle
Medullary loop
Collecting ducts
Lobulated fetal kidney
Urachus
Early bladder
Urogenital sinus
Genital tubercle
Ureteric bud branching dichotomously
Ureter
Ductus deferens
Seminal vesicle
Trigone of bladder

Urinary system

Kidneys: Derived from Intermediate mesoderm in the 4th week of IU life.

- **Pronephros**: Formation of nephric ridge in lower cervical region.

  Segmental nephric tubules develop. Pronephric duct develops laterally.

  Rudimentary in humans, starts disappearing with in a week.

- **Mesonephros:** Segmental tubules appear in thoracic and lumbar regions. Due to rapid differentiation caudally there is no segmentation.

  The mass appears as mesonephros. Pronephric duct continues as mesonephric duct which elongates, receives mesonephric tubules and then passes anterior to mesonephros and opens in to urogenital sinus.

- **Metanephros** (Permanent Kidney)

Metanephric mesoderm

Excretory (secretory) unit of kidney i.e, renal corpuscles, glomeruli, PCT, loops of Henle and DCT are from metanephric cap.

Mesonephric duct – ureteric bud

Collecting parts of urinary system i.e, collecting tubules, minor and major calyces and pelvis and ureter are formed from ureteric bud.

Ascent and rotation of kidney

Urinary system

Ureter

- Ureteric bud (Mesonephric duct)
- 2 dilatations – lumbar
  pelvic

Urinary Bladder

- Trigone is formed by absorbtion of mesonephric duct (mesoderm)
- Rest of urinary bladder is formed by upper part of urogenital sinus (cranial part of vesico uretheral canal of endodermal cloaca)

Urinary system

Urethera

Males:

1. Prostatic urethra above the openings of ejaculatory ducts is formed by caudal part of vesico uretheral canal

   - Its posterior wall is formed by absorbtion of mesonephric ducts

2. Lower part of prostatic and membranous urethera are formed by pelvic part of definitive UGS
3. Penile uretha is formed by phallic part of UGS
4. Terminal part of penile urethera is ectodermal

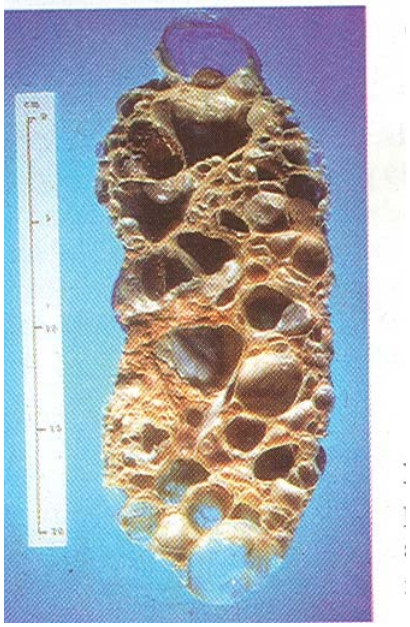
Female:

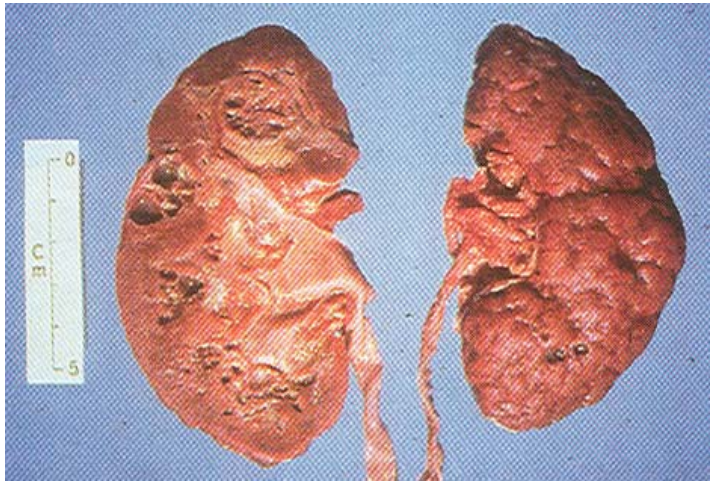
- Is formed by caudal part of vesico uretheral canal

  Its posterior wall is formed by absorbtion of mesonephric ducts

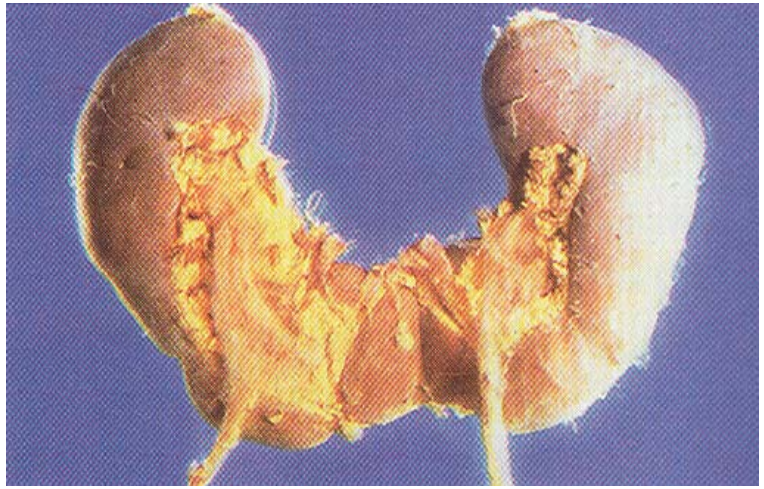
  Whole of female urethra is homologous to upper part of prostatic urethra

Polycystic kidney

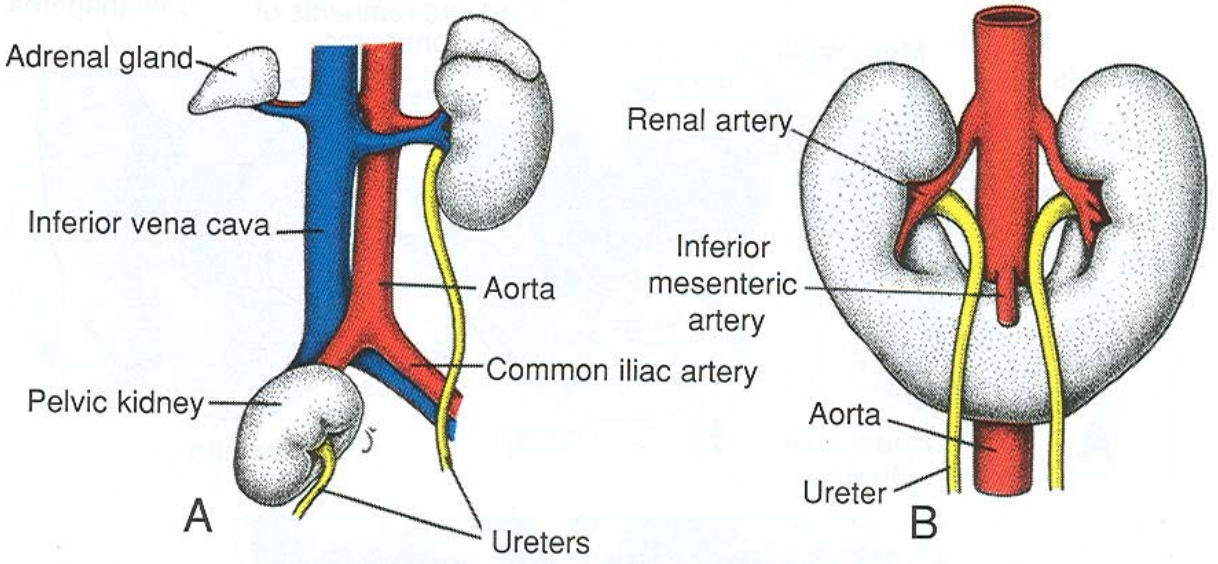




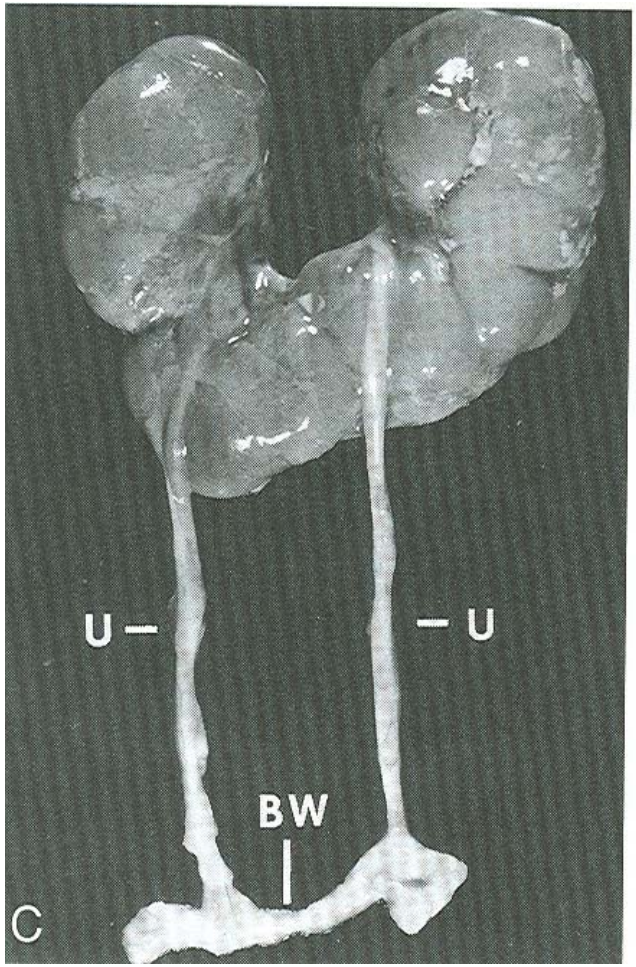
Medullary sponge kidney



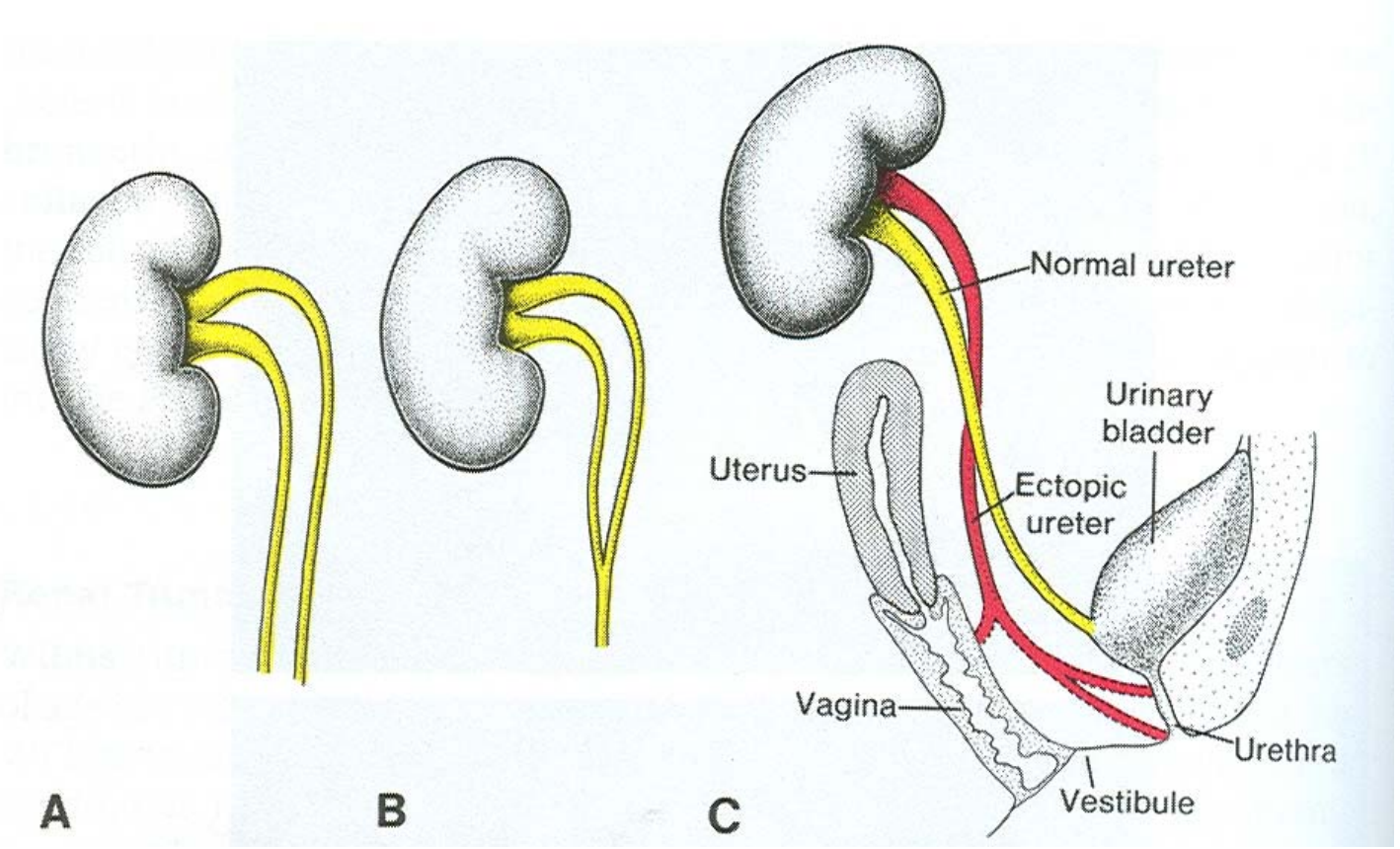
Horse shoe kidney



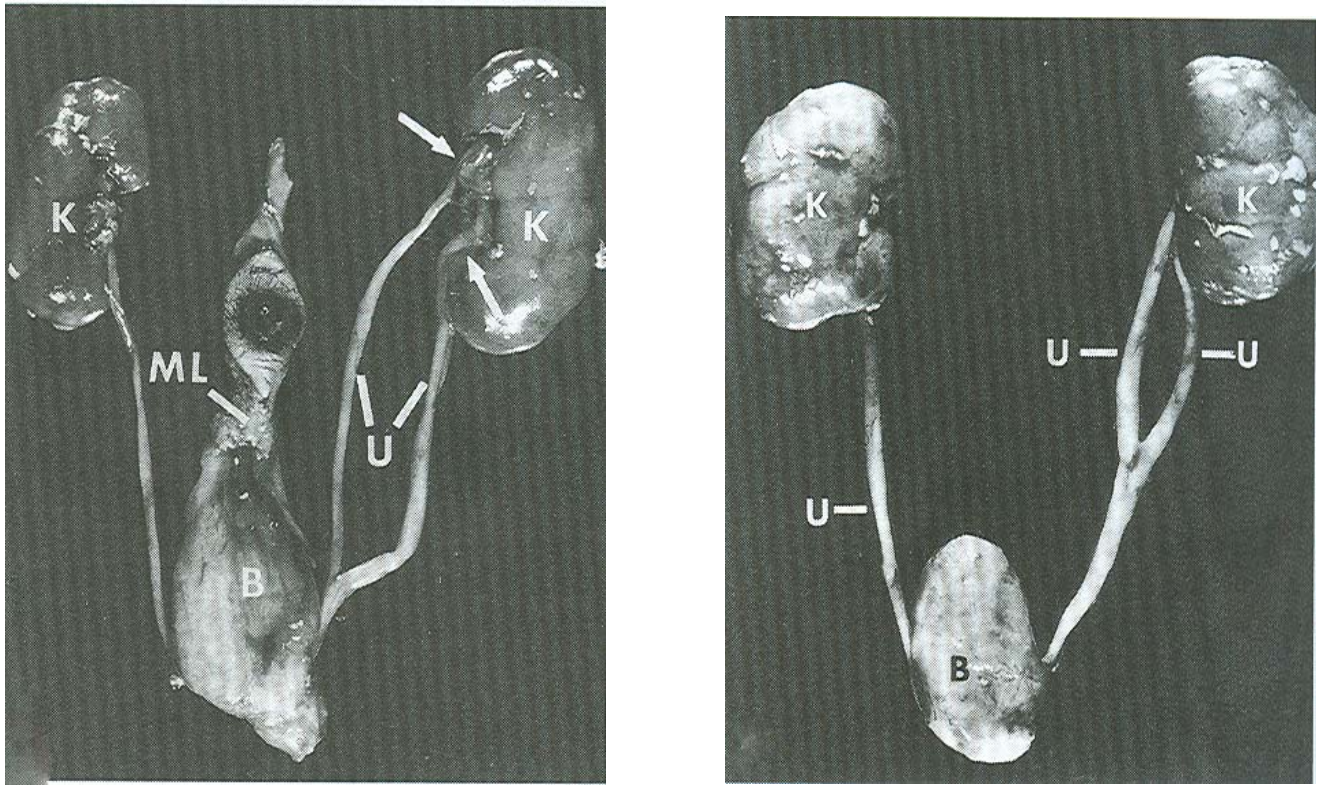
Ectopic kidney



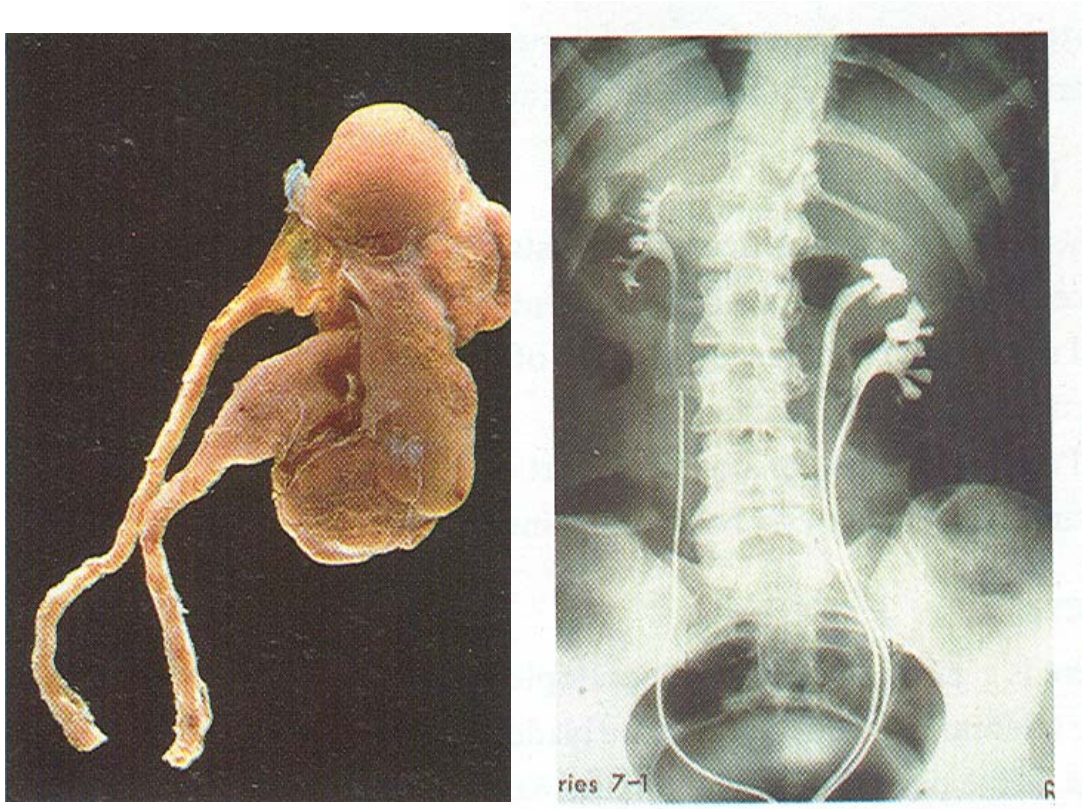
Horse shoe kidney



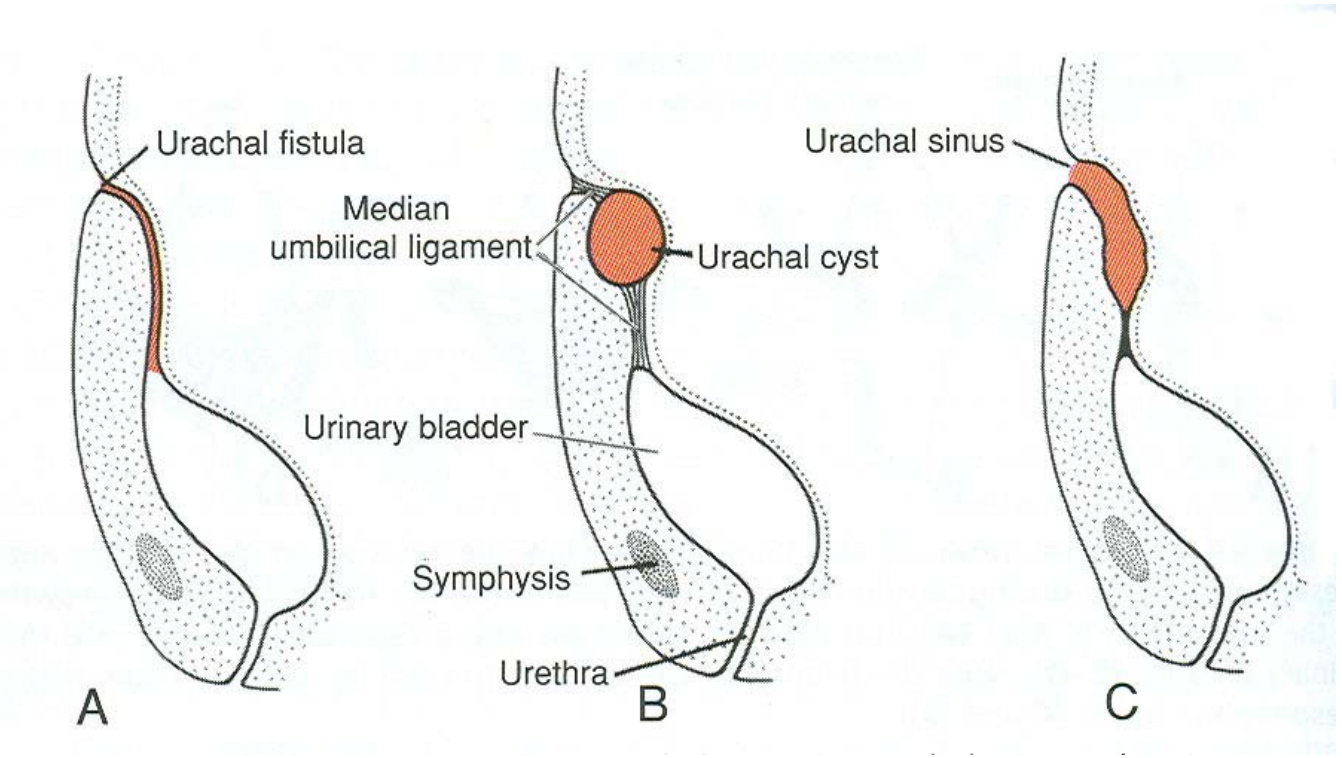
Double ureter



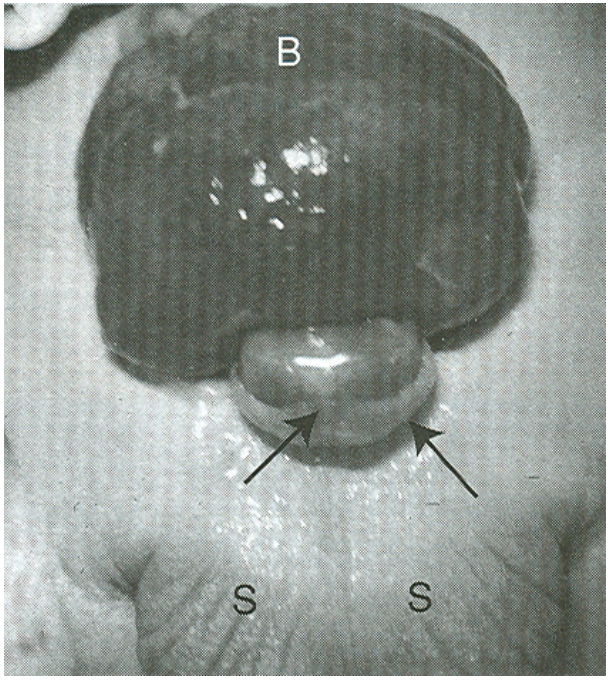
Double ureter

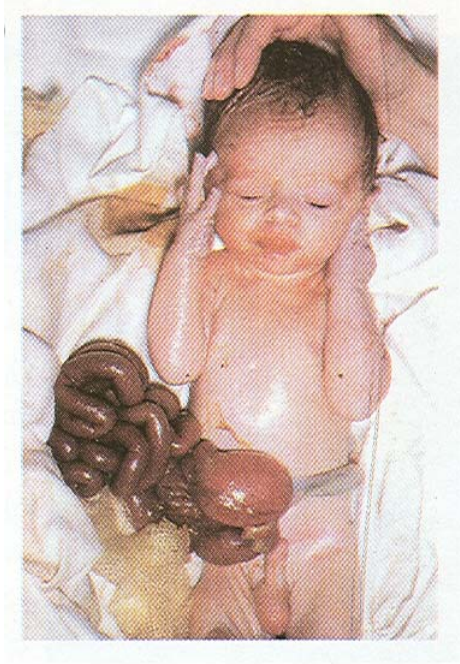


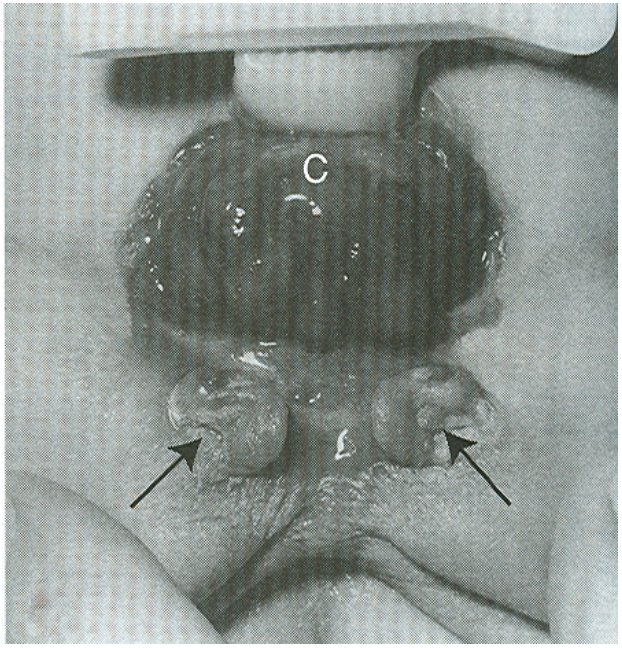
Double kidney and ureter



Anomalies of urachus





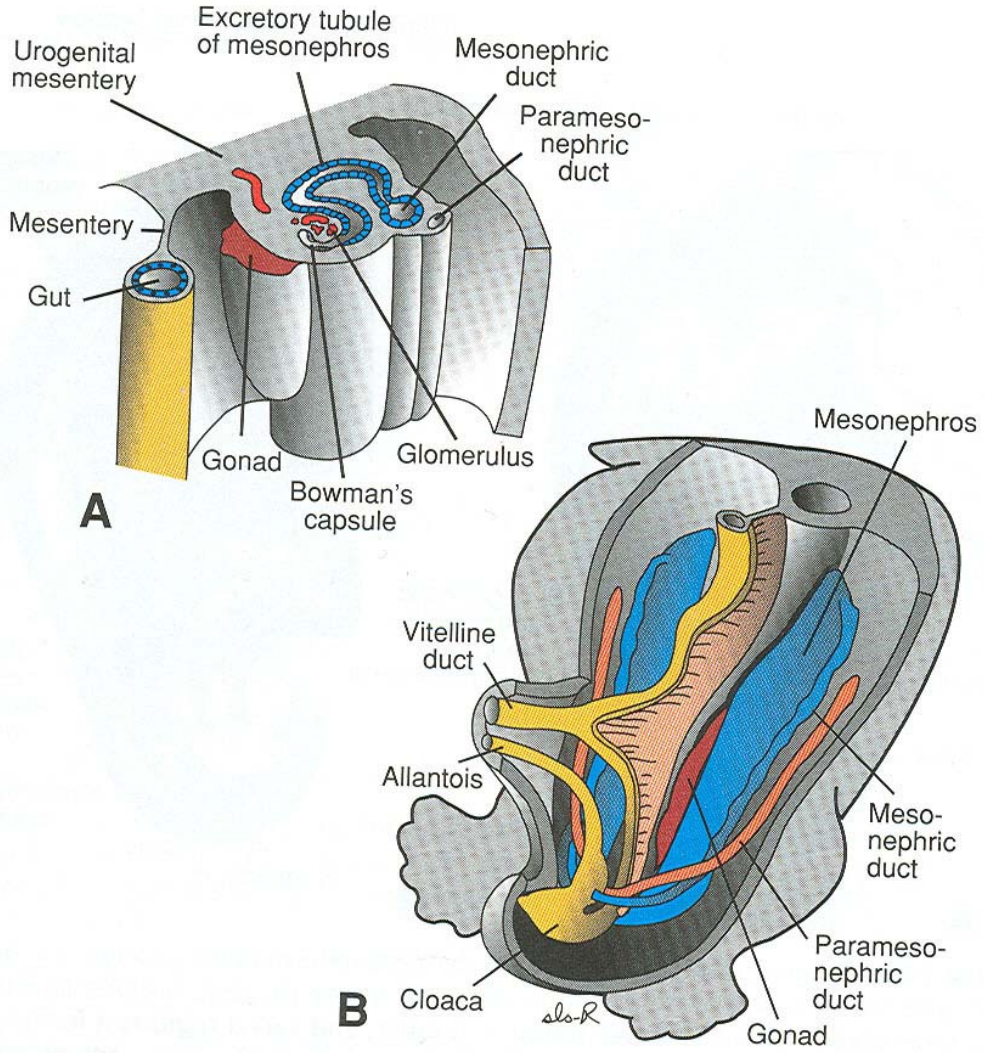


Ectopia vesicae

Congenital Anomalies

Urinary system

- Renal agenesis/dysplasia
- Medullary sponge kidney
- Polycystic kidney
- Ectopic kidney
- Horse shoe kidney
- Pancake kidney
- Duplex kidney and ureter
- Aberrant renal artery
- Ectopic ureter
- Persistent (Patent) urachus
- Ectopia vesicae (Exstrophy of bladder)


Excretory tubule of mesonephros
Urogenital mesentery
Mesonephric duct
Paramesonephric duct
Mesentery
Gut
Gonad
Glomerulus
Bowman's capsule
A
Mesonephros
Vitelline duct
Allantois
Mesonephric duct
Paramesonephric duct
Cloaca
Gonad
B