

DEVELOPMENT OF URINARY SYSTEM

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URINARY SYSTEM

- ✘ Origin – From Intermediate mesoderm

Developmental process

- At first a bulging develops on the dorsal abdominal wall at the lateral aspect of the dorsal mesentery of the developing gut which extends from the cervical to sacral region of the embryo.
- These linear bulging are called nephrogenic cord. The primitive kidney develops from this cord.

**Paraxial
Mesoderm**

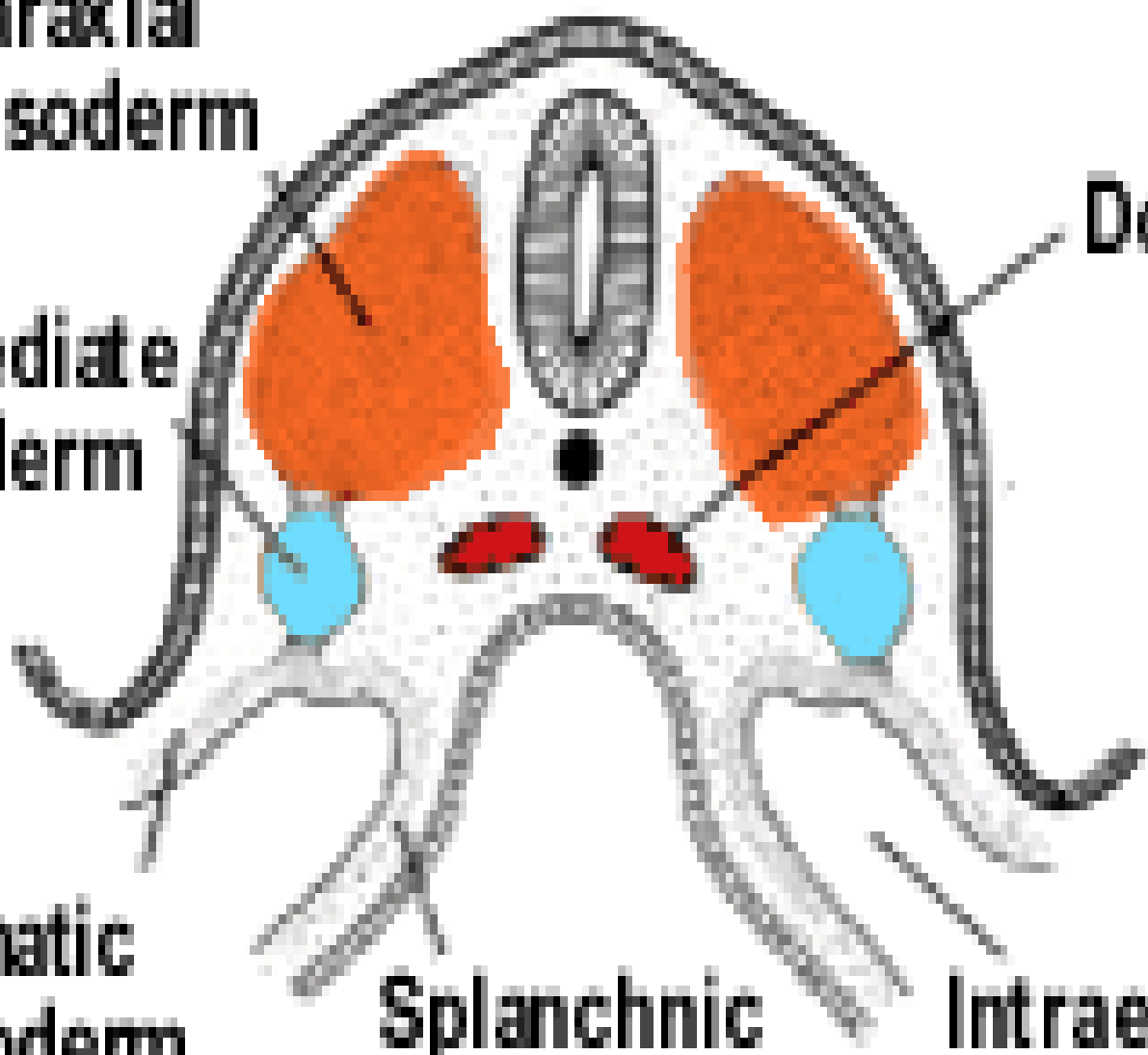
**Intermediate
Mesoderm**

**Somatic
mesoderm**

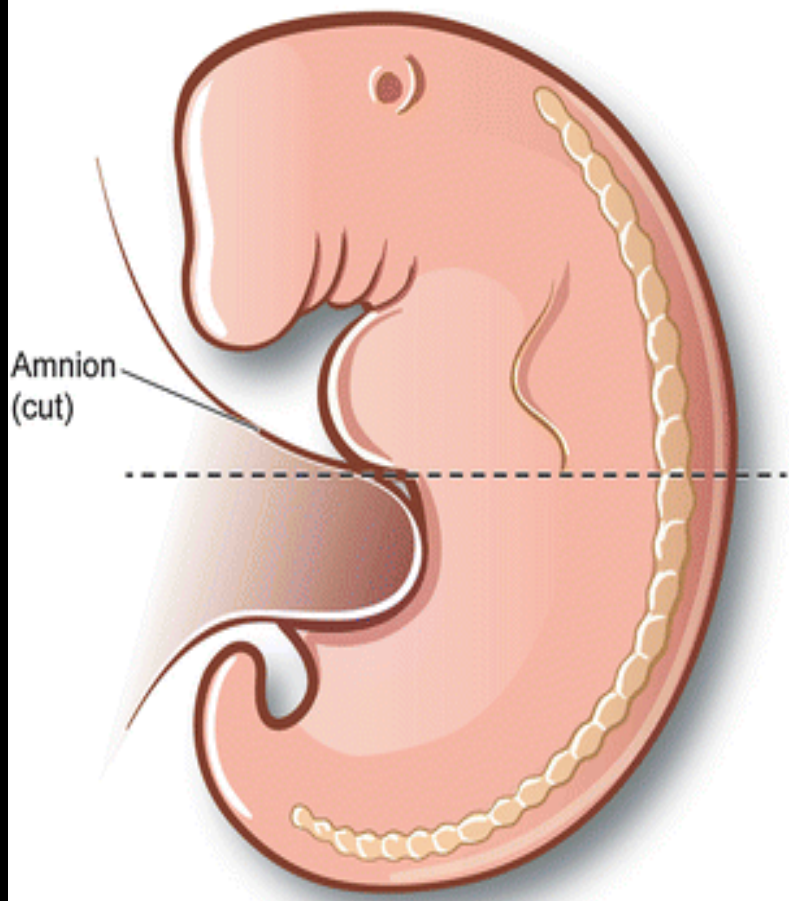
**Splanchnic
mesoderm**

Dorsal aorta

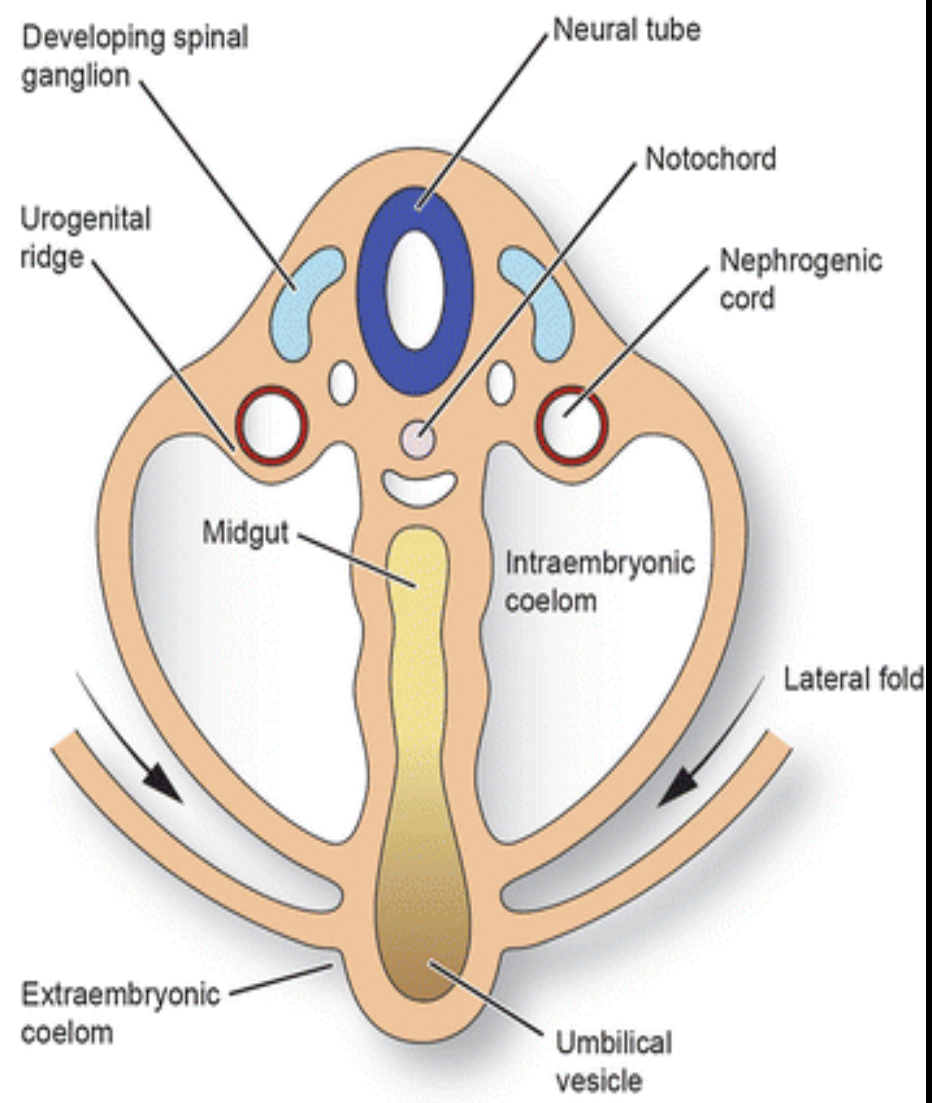
**Intraembryonic
coelom**



a



b



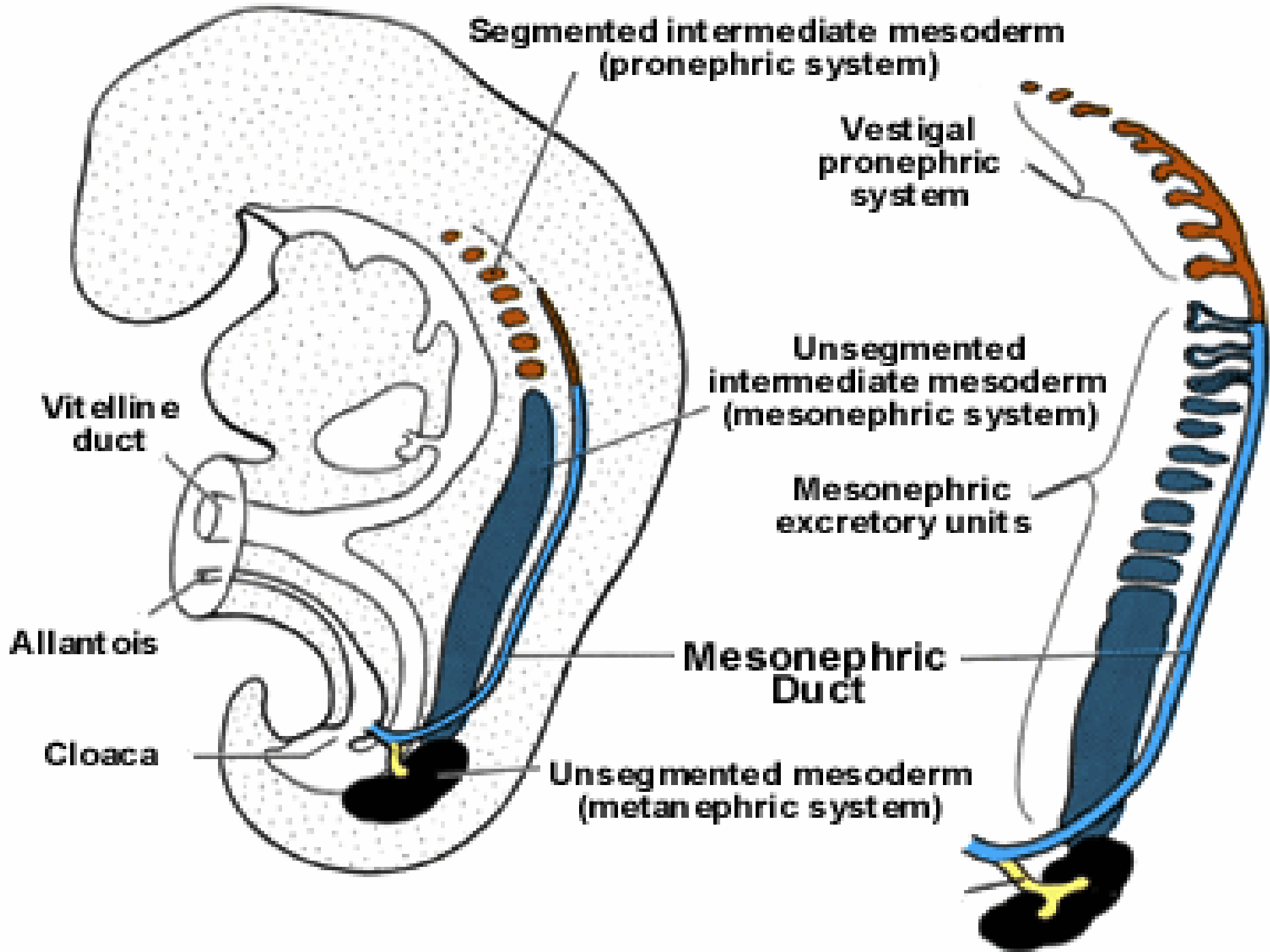
DEVELOPMENT OF THE KIDNEY

- Three slightly overlapping kidney systems are formed in a cranial to caudal sequence during intrauterine life in mammals in 3 stages :
 - Pronephros
 - Mesonephros
 - Metanephros.
- The first of these systems is rudimentary and non-functional; the second may function for a short time during early fetal period; the third forms the permanent functional kidney.

Formation of Pronephros (Pronephric Kidney)

- At first pronephros is formed in the cervical region of the nephrogenic cord (1st month of gestation).
- In cervical region intermediate mesoderm separate from somatic plate.
- Fragmentation takes place in intermediate mesoderm & **nephrotome** is formed (7-8 fragments).
- Lumen development takes place & pronephric tubules are formed.
- These open into coelom medially & laterally unite to form pronephric duct.
- This process ends upto 4 weeks.

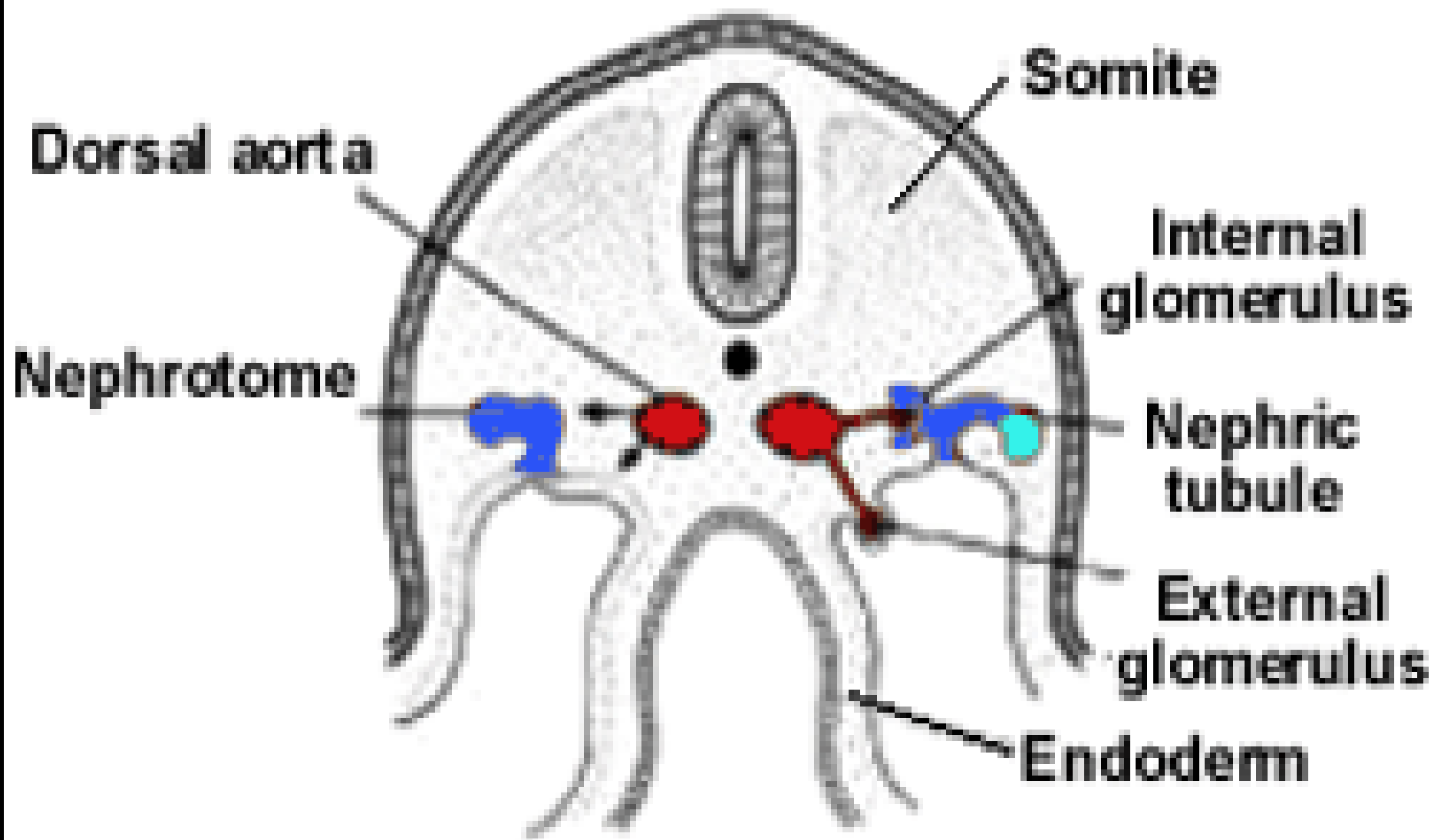
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- The pronephric kidney remains as functional kidney only in some cyclostomes and fishes.
 - In higher vertebrates the pronephros is non-functional and disappear soon. But the pronephric duct persists.
 - The pronephric kidney is replaced by the mesonephric kidney which utilises the pronephric duct as its own and now called as **Mesonephric duct** (Wolffian duct).

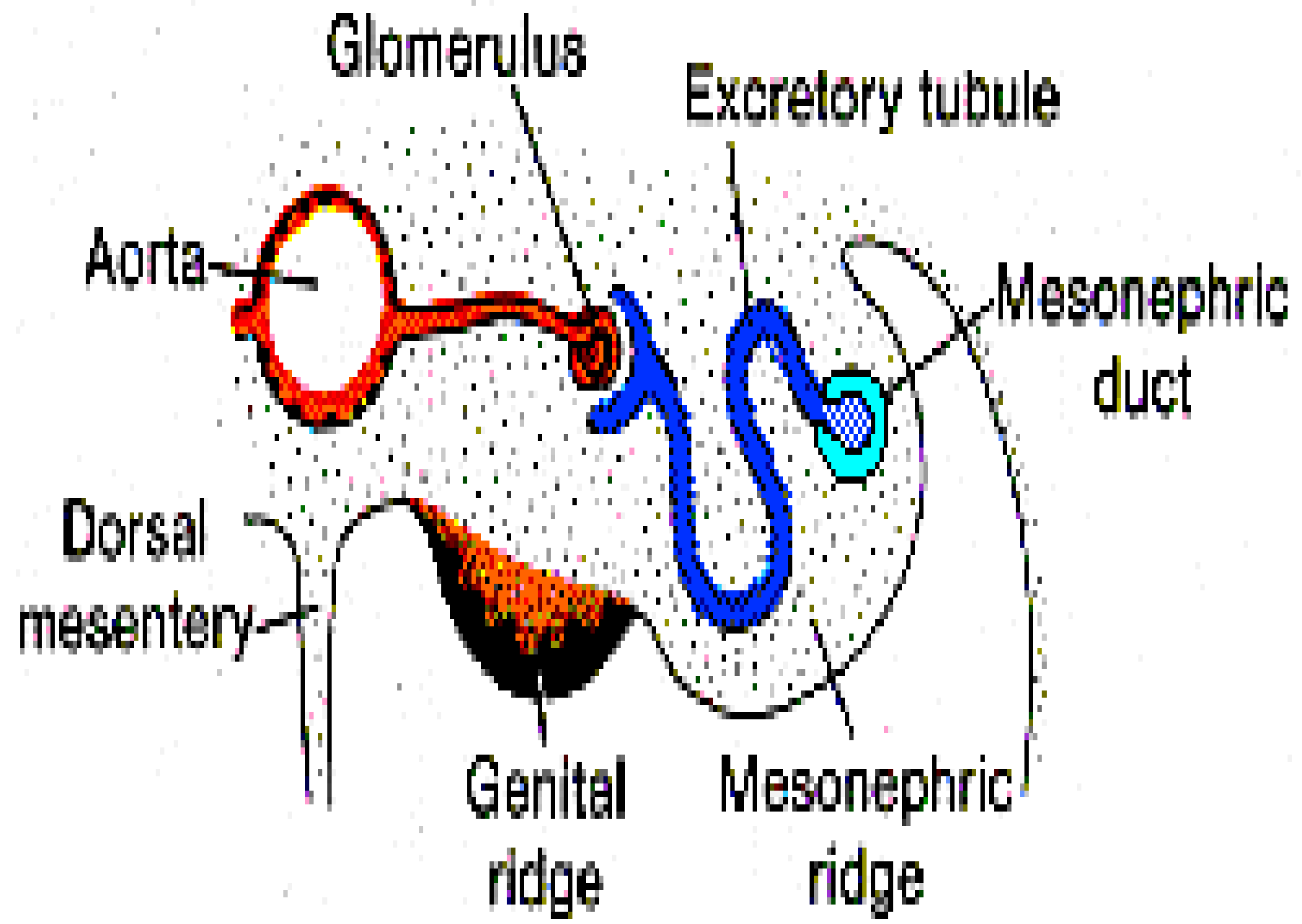


Formation of Mesonephros (Mesonephric Kidney)

- Development starts in thoraco-lumbar region.
- 60-80 mesonephric tubules (S- shaped) are formed.
- The medial end of each mesonephric tubule becomes dilated and receives an internal glomerulus from a branch of developing aorta.
- The lateral end makes unions & open into mesonephric duct.
- This development ends after 2 months of gestation.

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- All the mesonephric tubules do not appear at a time. Few proximal tubules disappear and some distal tubules appear and join with the mesonephric duct. The process continues.
 - In higher vertebrates, most of the mesonephric tubules disappear but few persists. In male embryo, these persistent mesonephric tubules are modified to form the ductuli efferenti of the testis. The mesonephric duct forms the duct of epididymis, vas deferens, seminal vesicles and ejaculatory duct.
 - In female, the remnant of mesonephric duct is present as small canal on the floor of vagina known as canal of gartner.



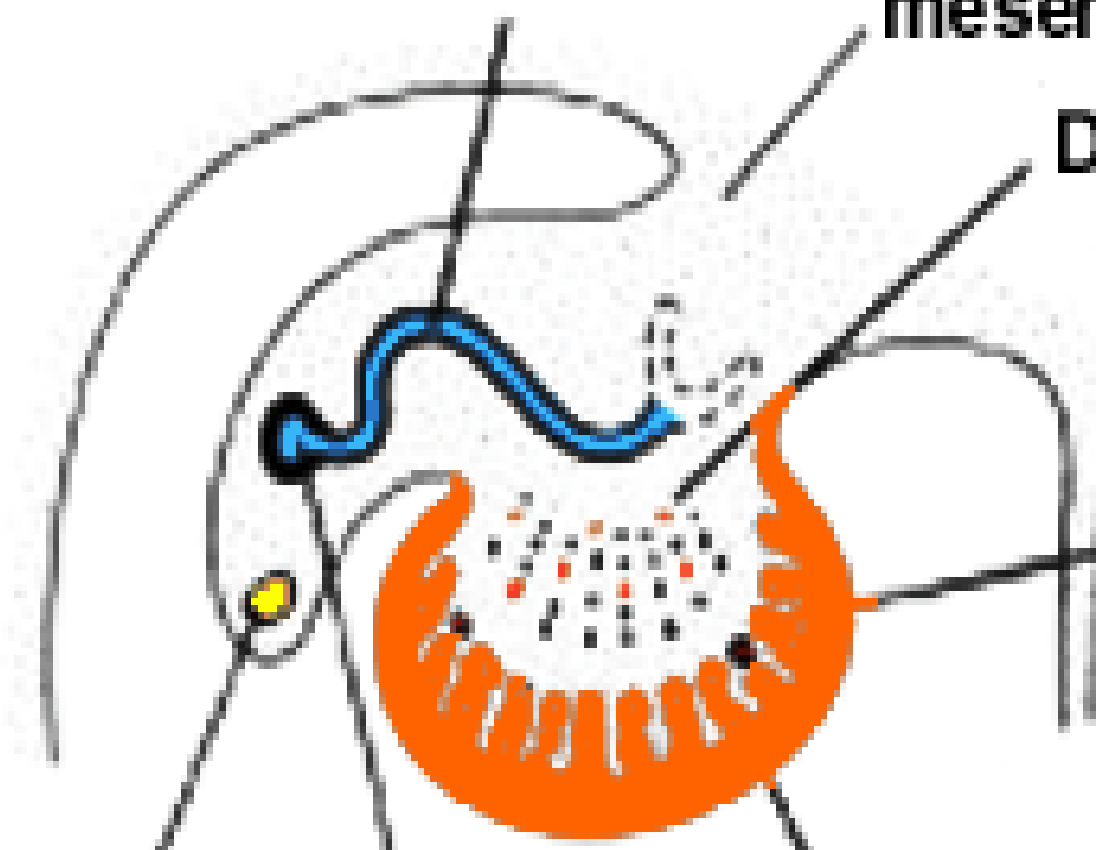


**Degenerating
mesonephric tubule**

**Urogenital
mesentery**

**Degenerating
medullary
cords**

**Cortical
cords**



**Paramesonephric
duct**

**Mesonephric
duct**

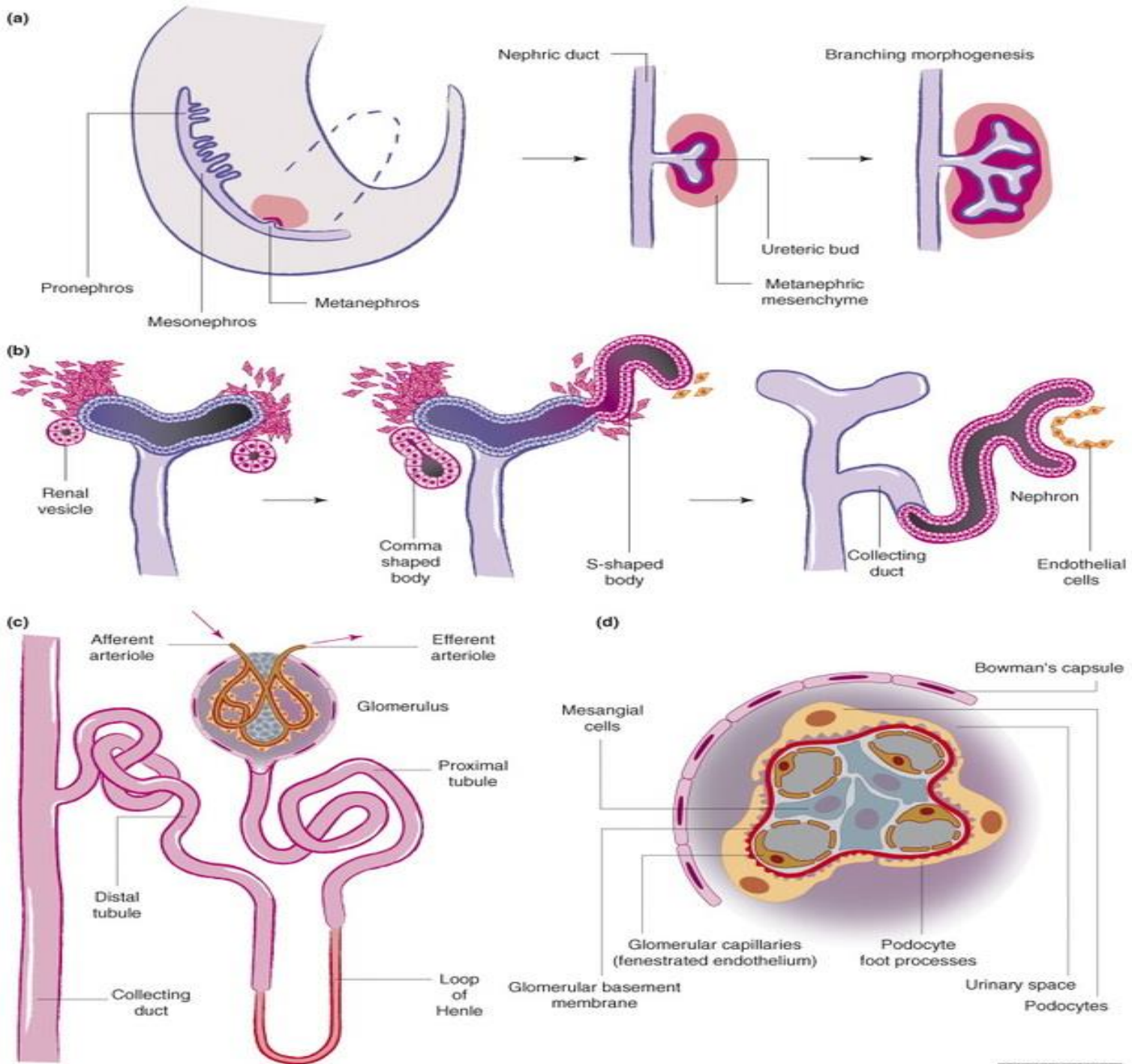
**Surface
epithelium**

Formation of Metanephros (Metanephric Kidney)

- The mesonephric kidney is replaced by the metanephric kidney.
- Development starts in the lumbo-sacral region of nephrogenic cord.
- The development of metanephric kidney occurs in two parts:
 - Collecting part
 - Excretory part

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- Mesonephros on the dorso-medial aspect at the point where it opens into the cloaca forms the ureteric bud.
 - The dilated end of the ureteric bud invades the caudal part of the nephrogenic cord.
 - The nephrogenic tissue forms a cup-like investment around the dilated end of ureteric bud called the **Metanephric blastima**.
 - Ureteric bud penetrate into the metanephric blastima, branch upto 12 degenerations & give **calyx major, calyx minor, collecting tubule & ureter (Collecting part)**.

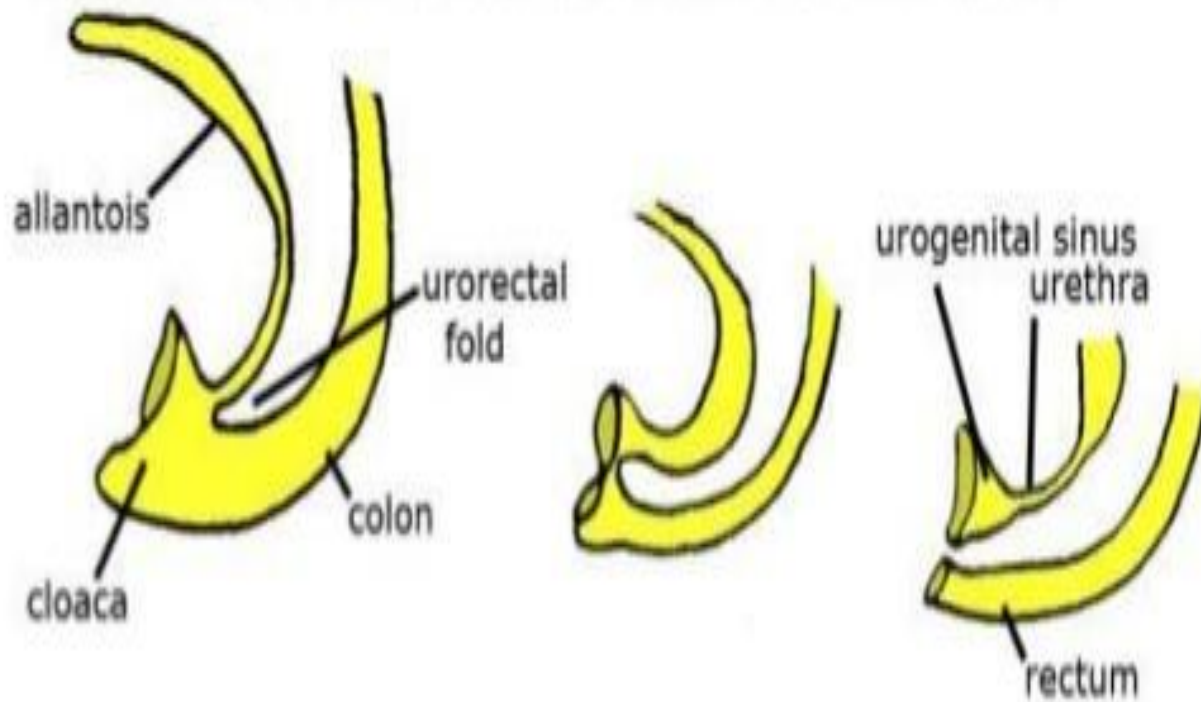
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- The cells of the metanephric blastema surrounding the ampulla of ureteric bud becomes hollow and form a vesicle.
 - The vesicles become elongated and opens into the ampulla.
 - The vesicles then form S-shaped tubule.
 - The closed end of the S-shaped tubule become dilated and gets invaginated by tuft of capillaries to form the glomerulus.
 - The various parts of the **Nephron** are derived from the primitive 'S' shaped tubule (**Excretory part**).



FORMATION OF UROGENITAL SINUS (UGS)

- In the developing cloaca (caudal part of the hind gut), two grooves appear bilaterally. These grooves deepens and form a urorectal septum/urorectal fold.
- This septum subdivides the cloaca into a broad ventral part and a narrow dorsal part.
- The ventral part forms the urogenital sinus and the dorsal part forms the rectum.

Progression of the urorectal fold to divide the cloaca



UGS

Cranial part

Caudal part

Anterior portion

Posterior portion

Anterior portion

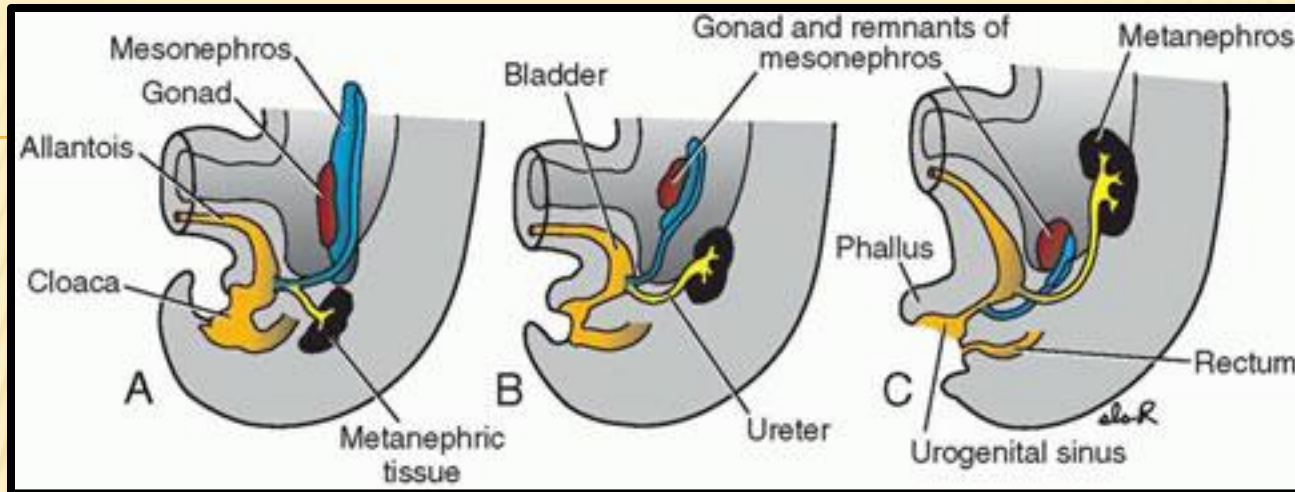
Posterior portion

Urinary bladder

Female Urethra and Prostatic part of male urethra

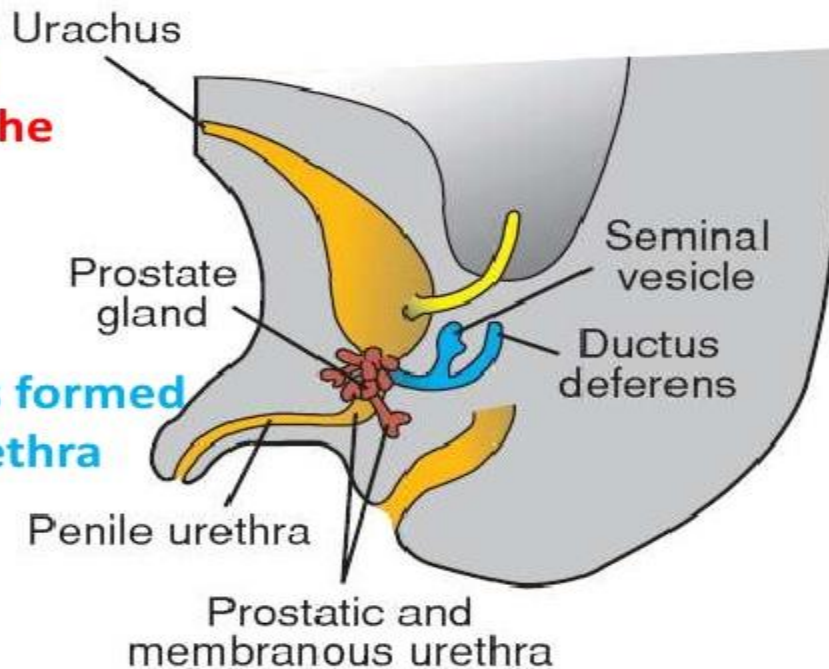
Pelvic part of male urethra

Penile part of male urethra



In the male the definitive urogenital sinus develops into the penile urethra.,

The prostate gland is formed by buds from the urethra



ASSIGNMENT:

- A well labelled pictorial representation of development of the Urinary system in practical note book.

THANKS

