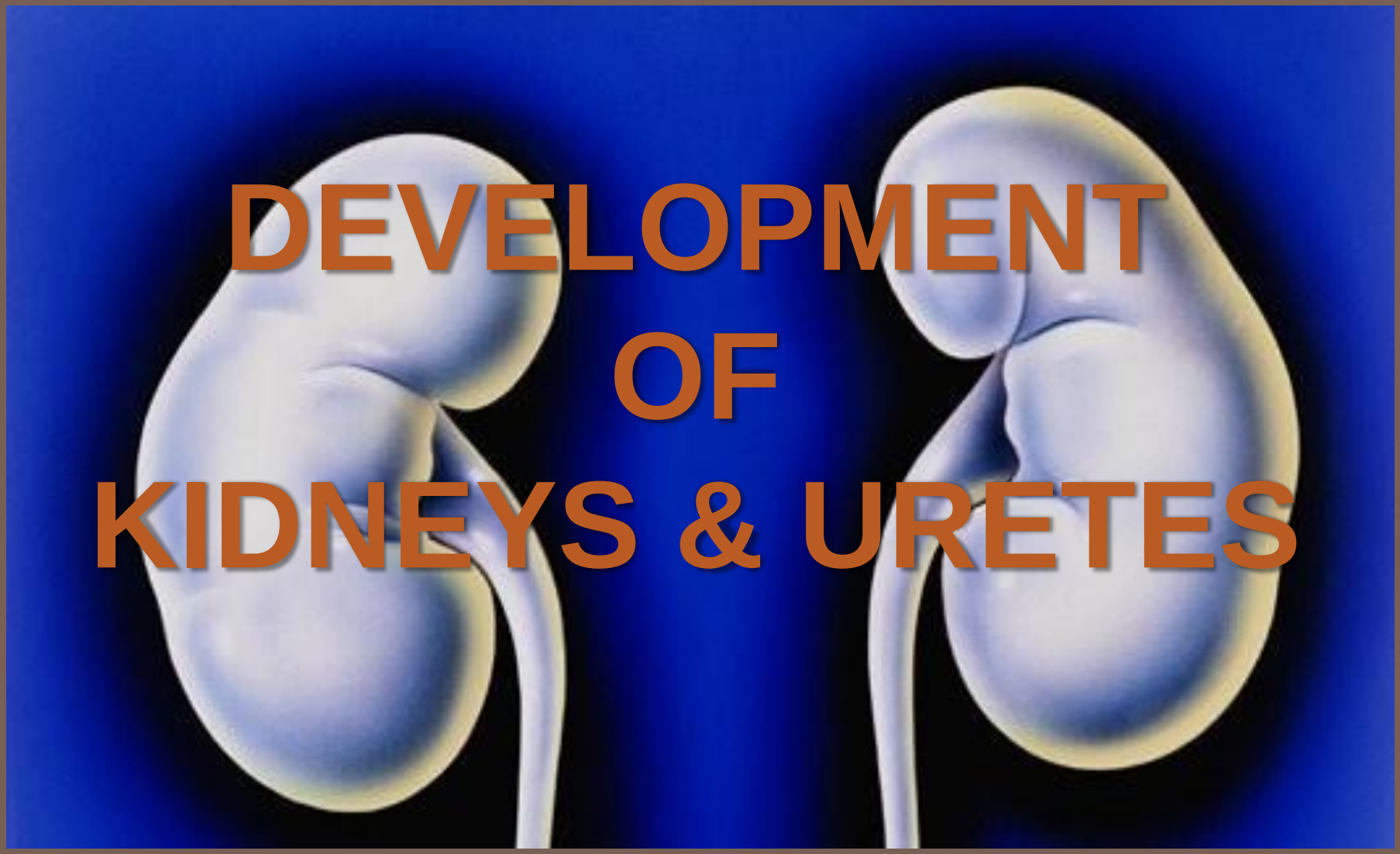


DEVELOPMENT OF KIDNEYS & URETES

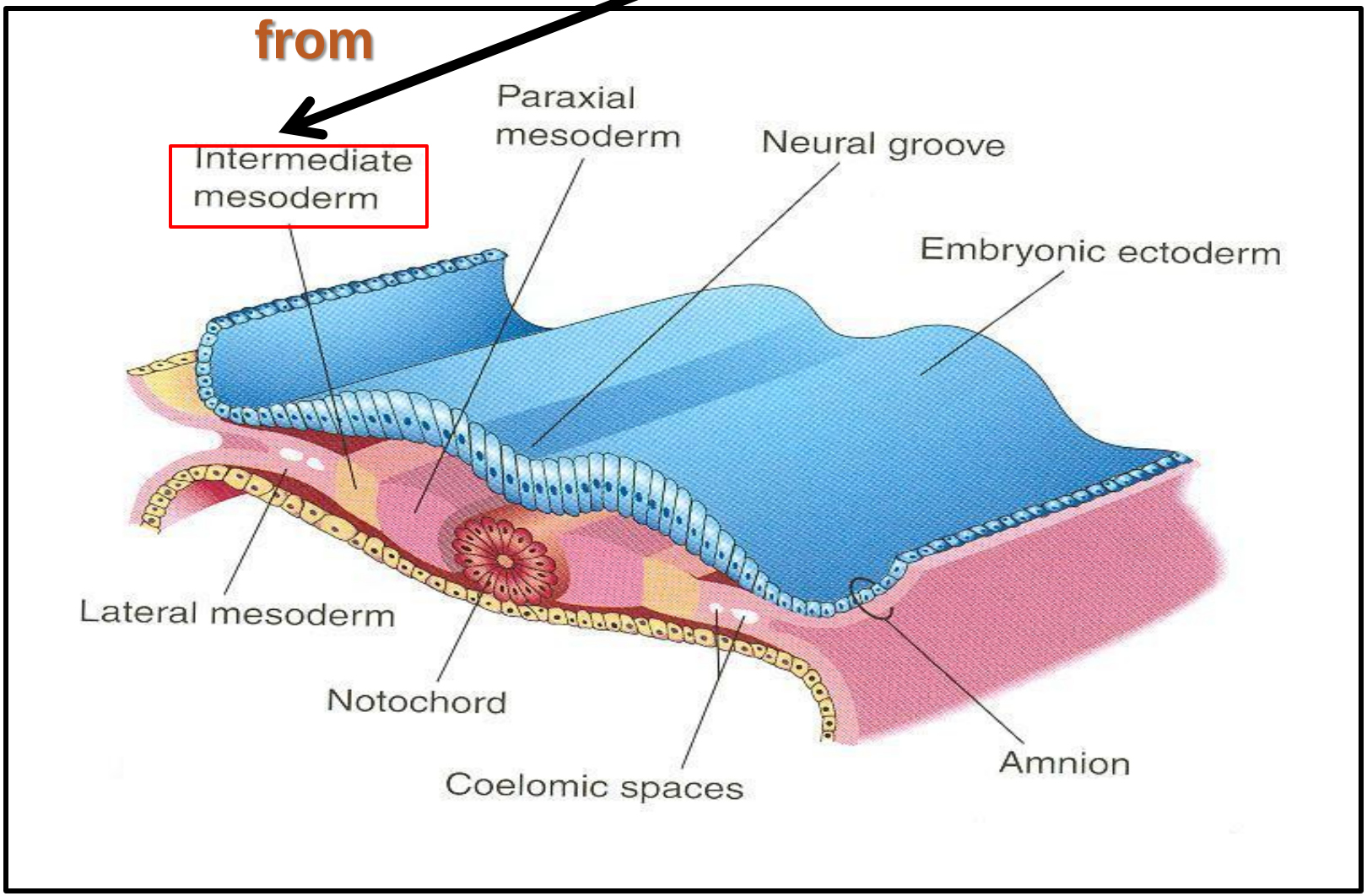
Dr. Jamila El Medany

OBJECTIVES

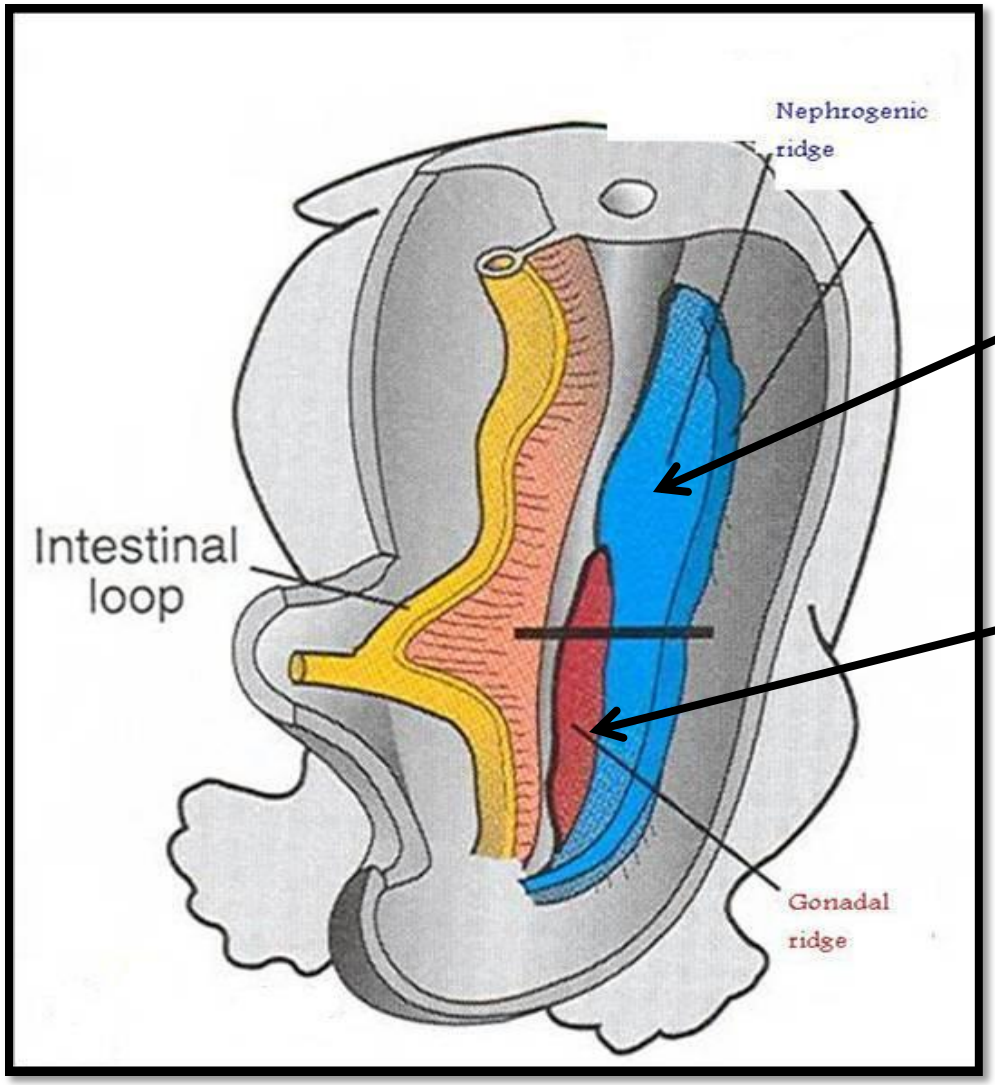
At the end of the lecture, students should be able to:

- Identify ***the embryological origin of kidneys & ureters.***
- Differentiate between ***the 3 systems of kidneys*** during development.
- Describe ***the development of collecting & excretory parts of permanent kidney.***
- Describe ***the fetal kidney*** & identify the pre- and postnatal changes that occur in the kidney.
- Enumerate ***the most common anomalies of kidneys & ureters.***

EMBRYOLOGICAL ORIGIN



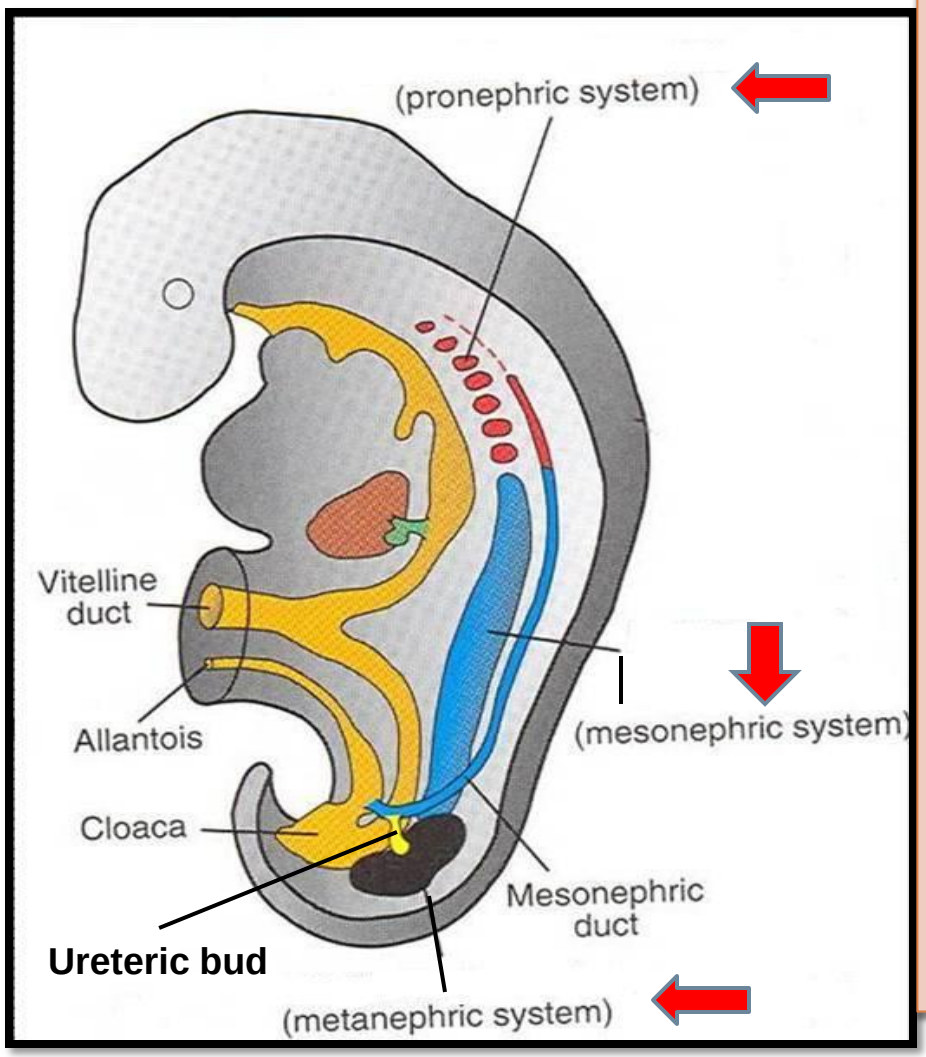
INTERMEDIATE MESODERM



Differentiates into:

1. **Nephrogenic ridge (cord): forms kidneys & ureters**
2. **Gonadal ridge: forms gonads (testes or ovaries)**

DEVELOPMENT OF KIDNEYS



Three systems of kidney develops:

1. **Pronephric system:**
   - appears at **beginning of 4th week** in **cervical region**
   - analogous to kidney of fish
   - formed of tubules & a duct
   - not function in human
   - disappears
2. **Mesonephric system:**
   - appears at **end of 4th week** in **thoracic & abdominal regions**
   - analogous to kidney of amphibians
   - formed of tubules & a duct
   - function temporarily
   - The duct: **In male**: forms genital duct
   - **In both sexes**: forms ureteric bud
3. **Metanephric system:**
   - appears at **5th week** in **pelvis**
   - **starts to function at 9th week**

METANEPHROS
(PERMANENT KIDNEY)

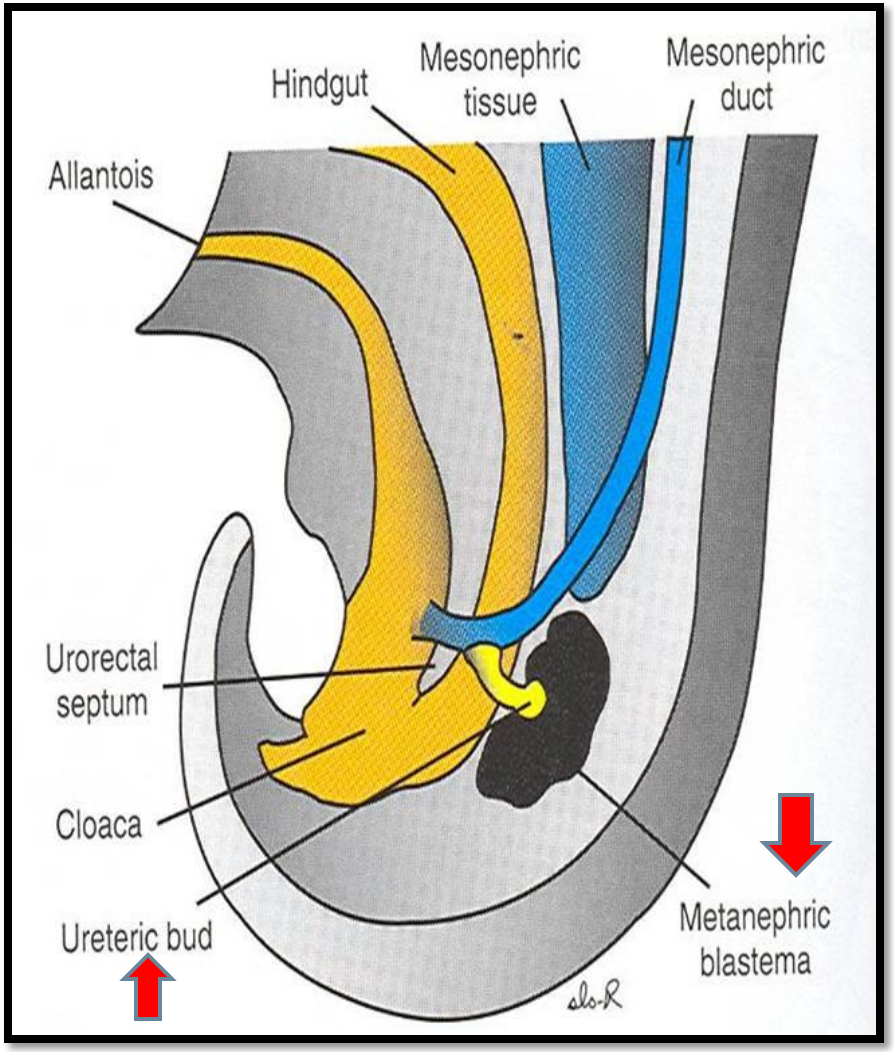
- **Formed of 2 origins:**

1) **Ureteric Bud (derived from mesonephric duct):**

gives Collecting part of kidney

2) Metanephric Blastema (Mass): derived from nephrogenic cord

gives Excretory part of kidney



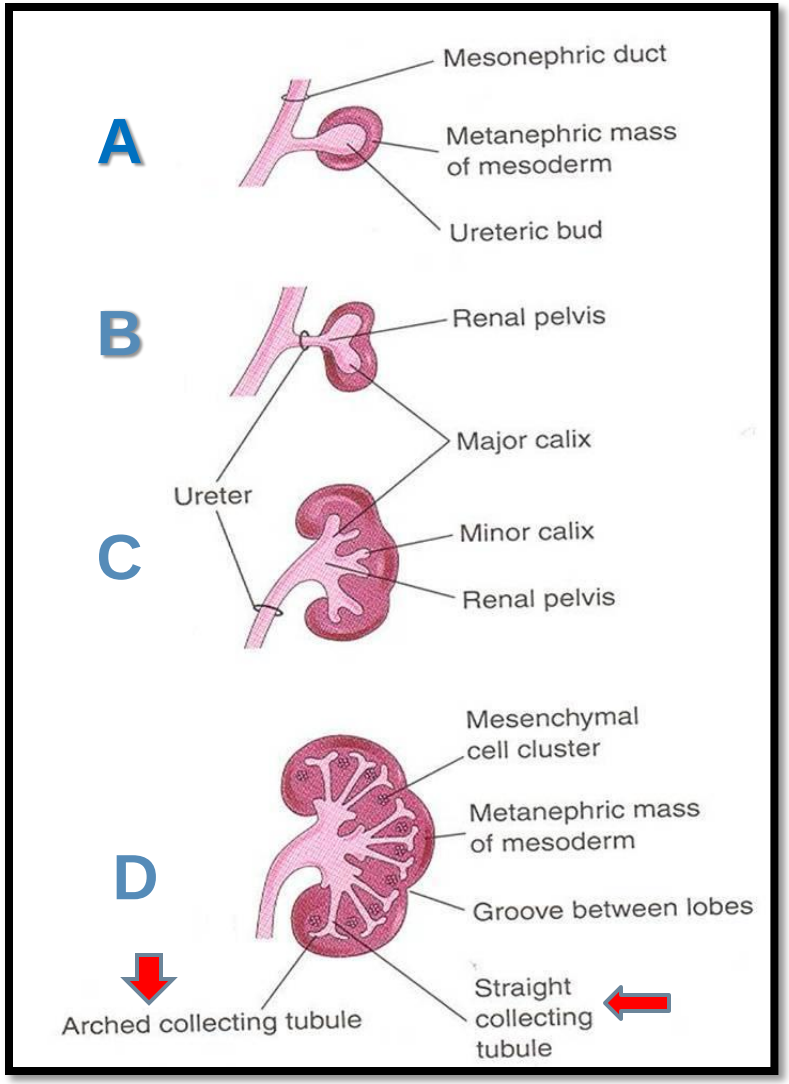
COLLECTING PART

A- Ureteric bud elongates & penetrates metanephric mass.

B- Stalk of ureteric bud forms ureter & its cranial end forms renal pelvis.

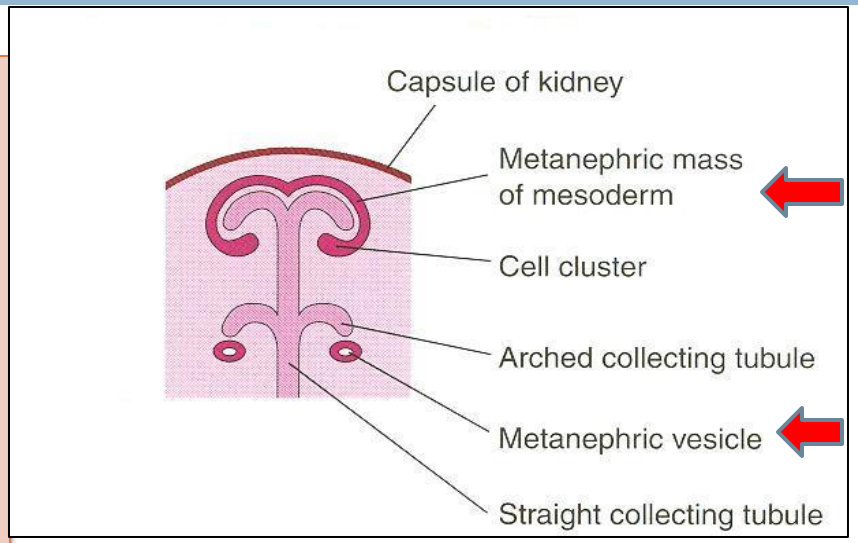
C- Branching of renal pelvis gives 3 major calices. Branching of major calyces gives minor calyces.

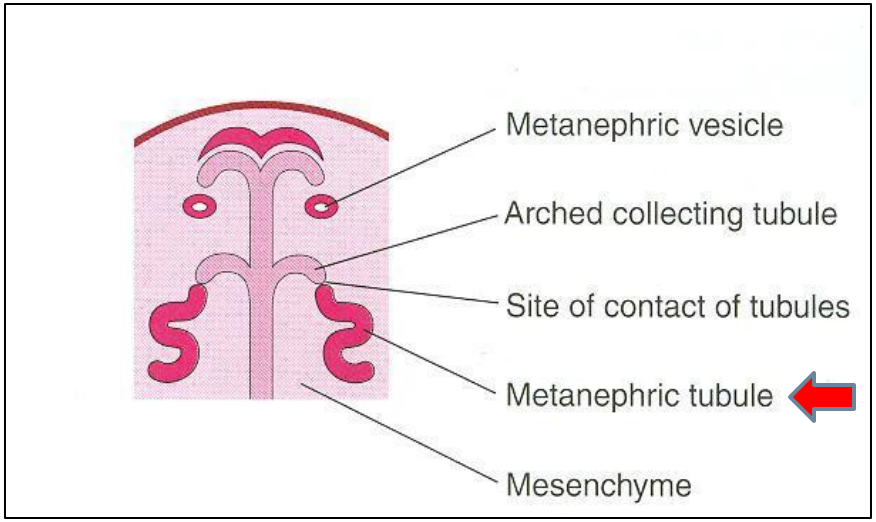
D- Continuous branching gives straight & arched collecting tubules



EXCRETORY PART

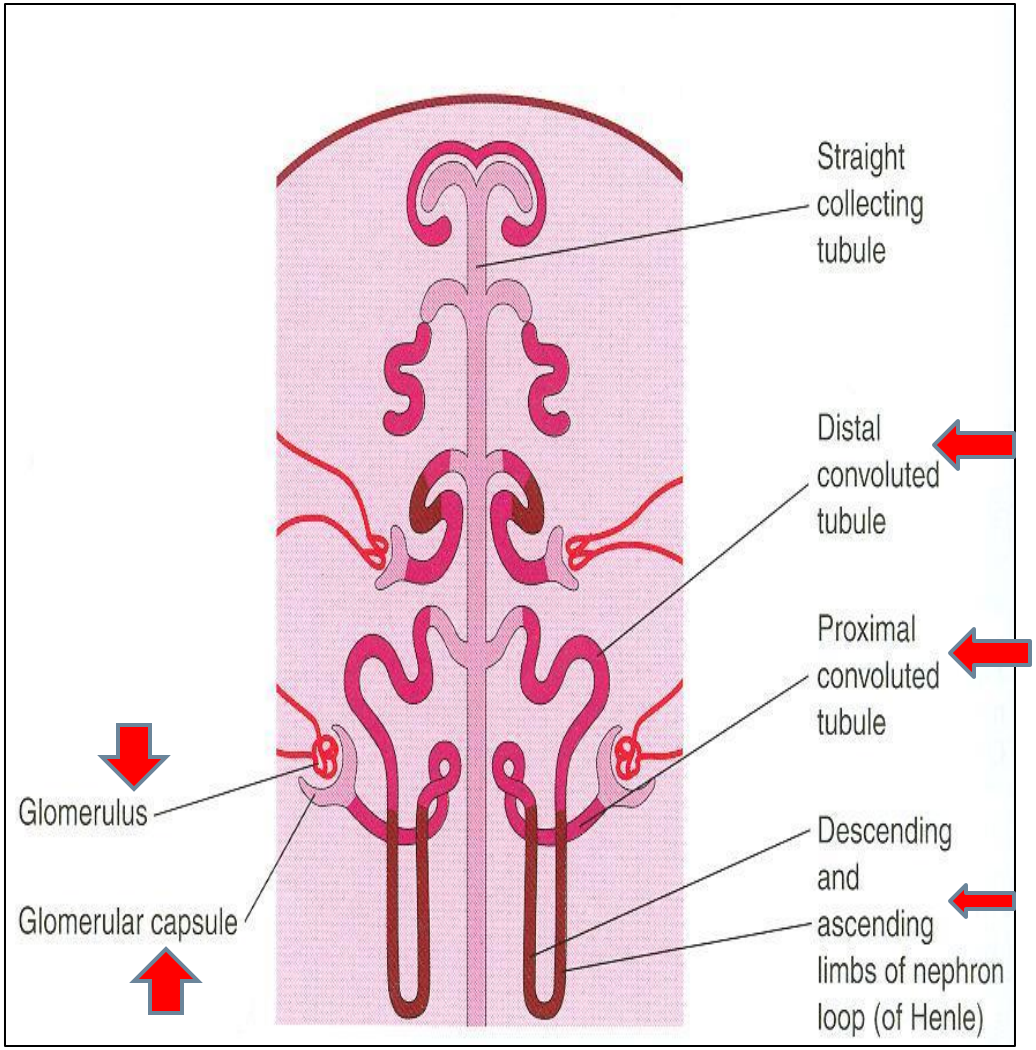
- Each arched collecting tubule is surrounded by a cap of metanephric mass.
- (metanephric vesicle).
- The metanephric vesicle elongates to form an S-shaped metanephric tubule.





EXCRETORY PART

- The end of each tubule forms **Glomerular (Bowman's)** capsule.
- Each glomerular capsule is invaginated by capillaries (**Glomerulus**).
- The tubule lengthens to form: **Proximal & Distal convoluted tubules + Loop of Henle**



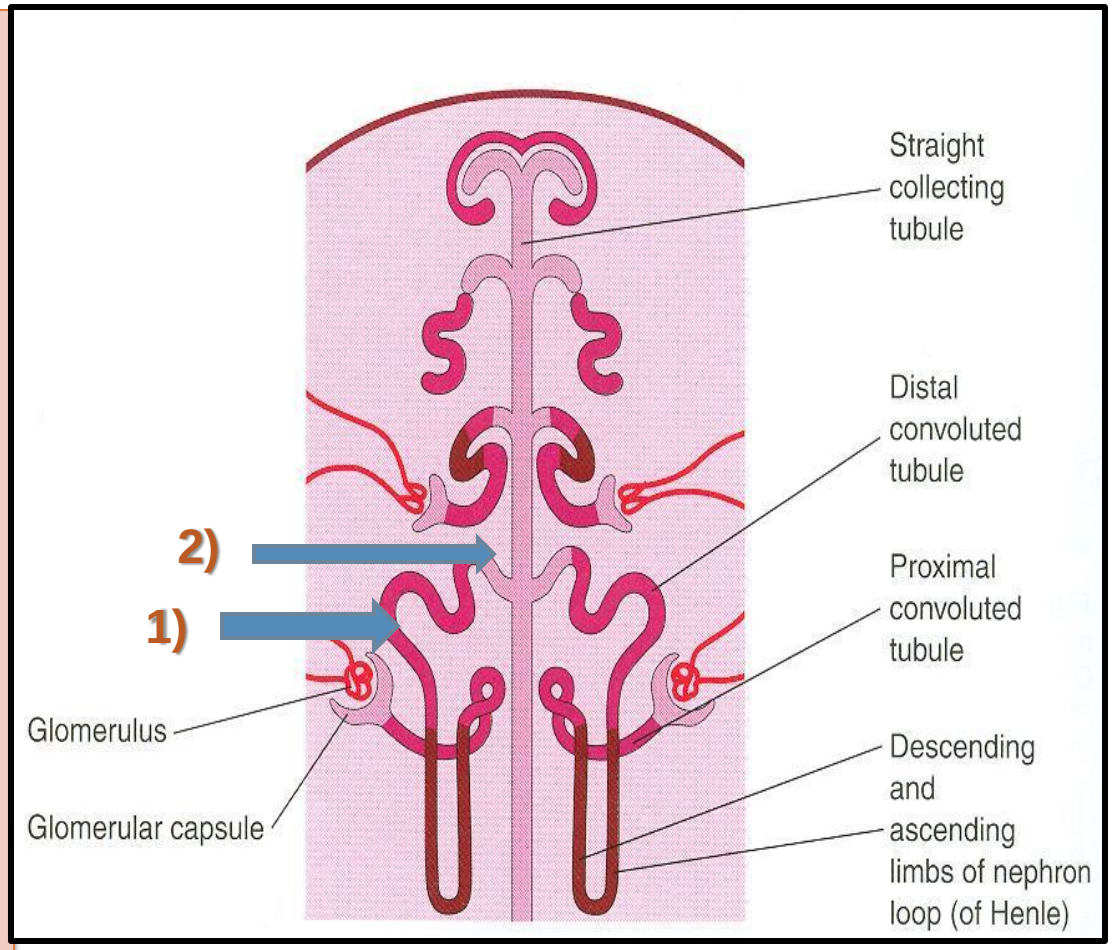
THE NEPHRON
(FUNCTIONAL UNIT OF KIDNEY)

The **Nephron** is formed by fusion of:

1) **Excretory tubule** (from metanephric mass (cap).
2) **Arched collecting tubule** (from ureteric bud).

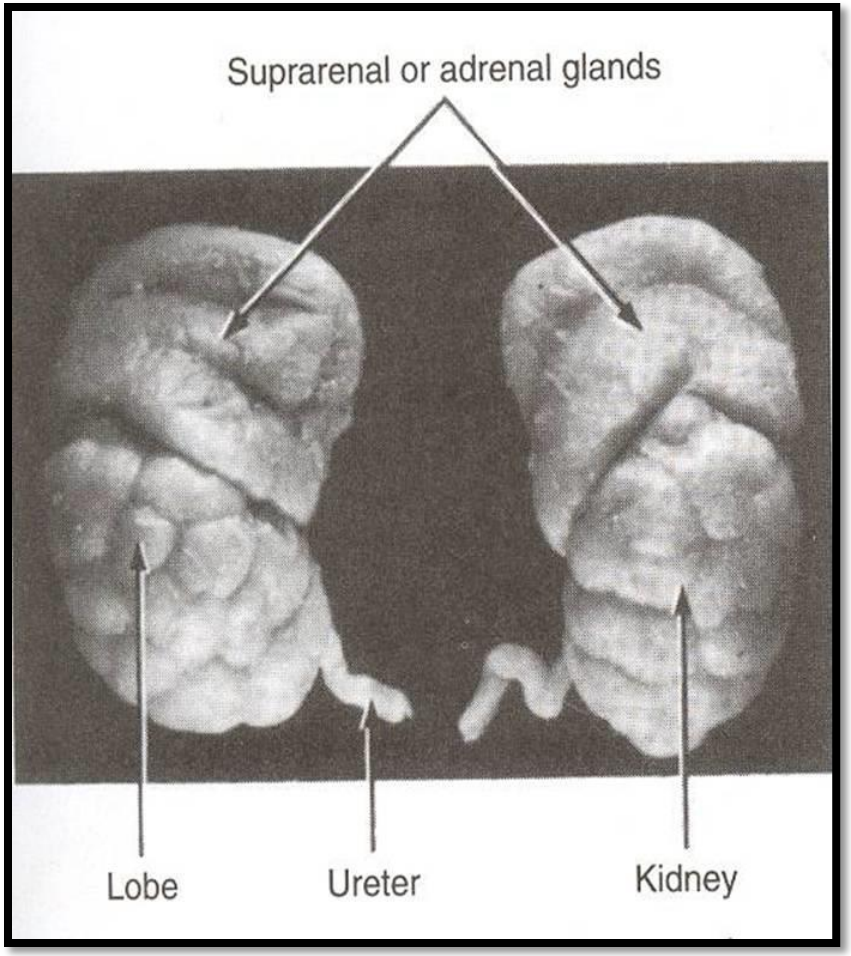
At Full Term:

each kidney contains: 800000 – 1000000 nephrons.

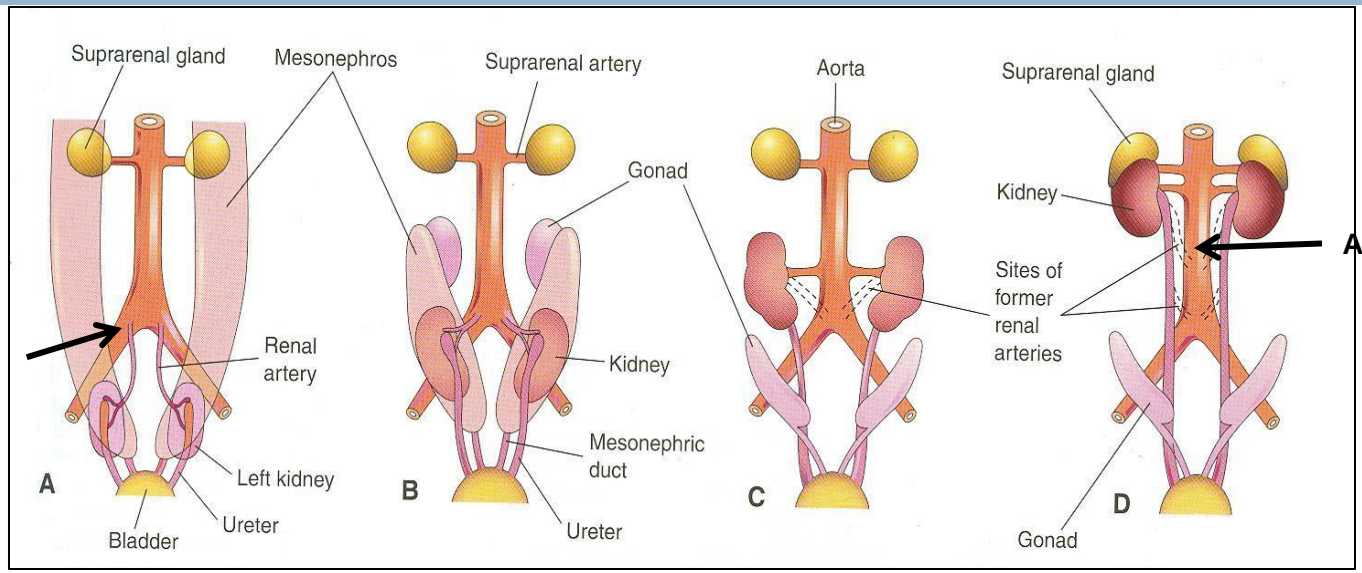


Criteria of The Fetal Kidney

- The Kidney is subdivided into **Lobes** that are visible externally.
- Lobulation **diminishes** at the end of fetal period.
- Nephron formation is **complete at birth.**



CHANGES of kidney Before Birth

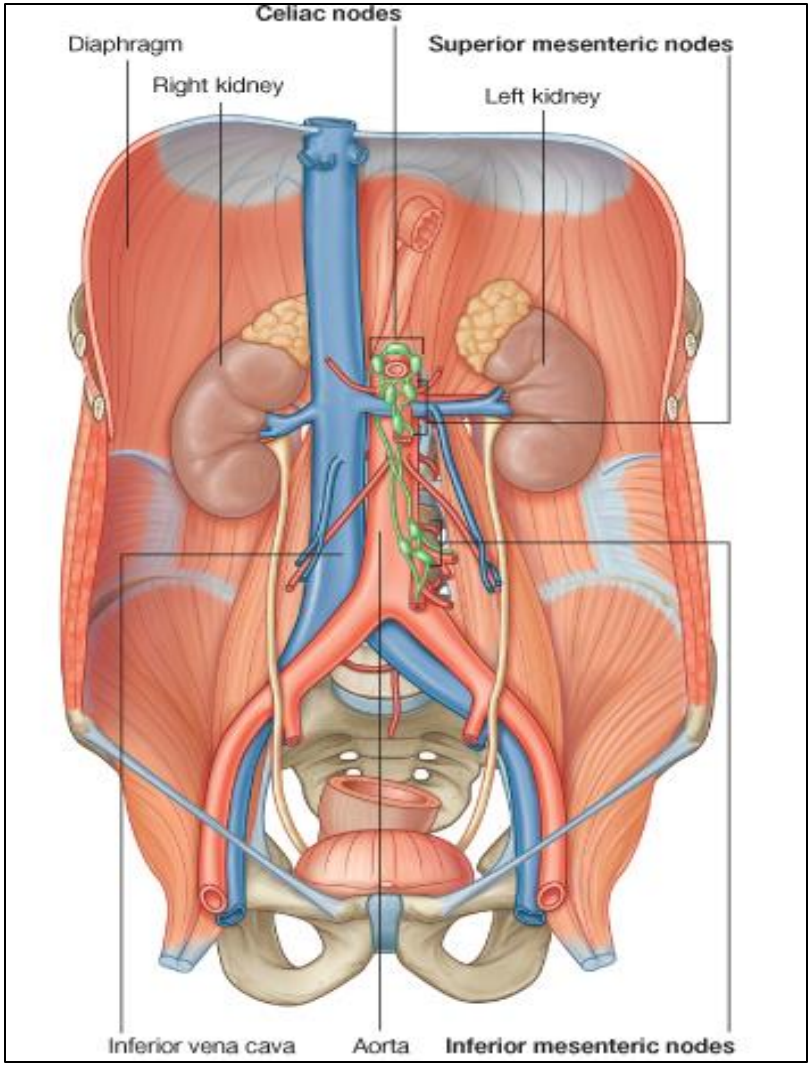


- **Position:** The kidney ascends from pelvis to abdomen & attains its adult position, **caudal to suprarenal gland.**

- **Blood Supply:** As the kidney ascends, its blood supply changes from renal branches of common iliac arteries into **renal branches of abdominal aorta.**

- **Rotation:** Initially, the **Hilum** is **ventral** then rotates medially about 90° & becomes **medial.**

What Happens At The 9TH WEEK



- Beginning of glomerular filtration (start of function).
- The kidney attains its **adult position.** Receives its arterial supply from abdominal aorta.
- The hilum is rotated medially

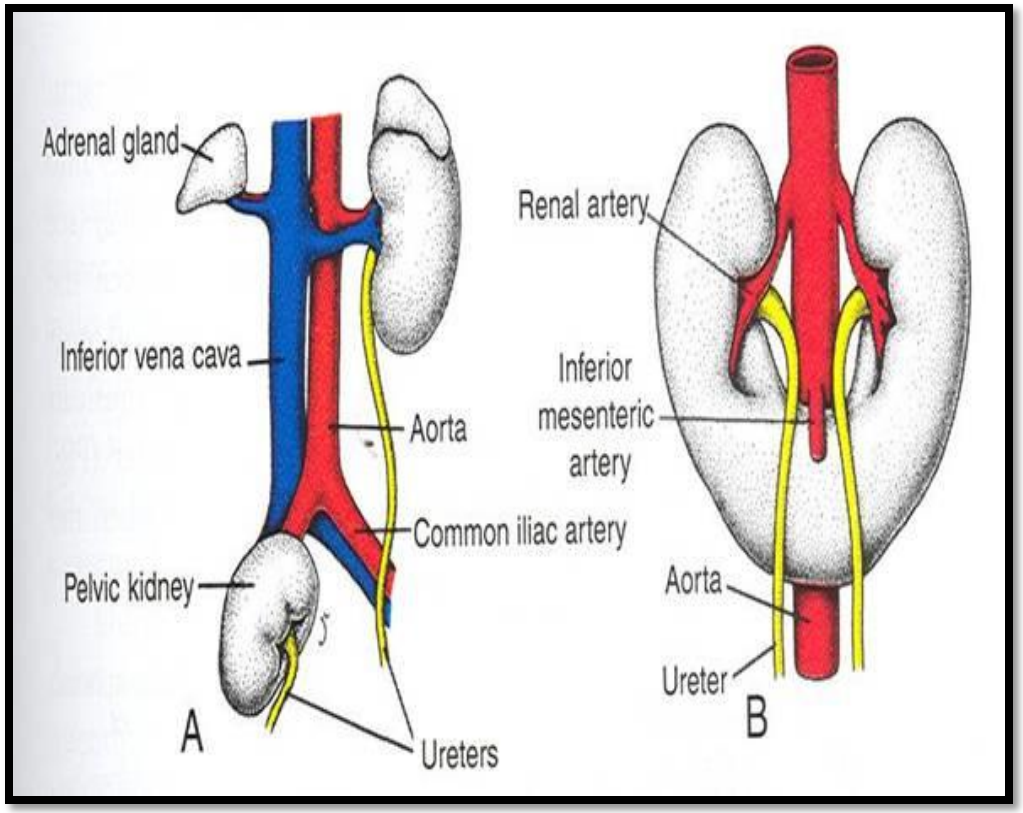
Changes of kidney After BIRTH

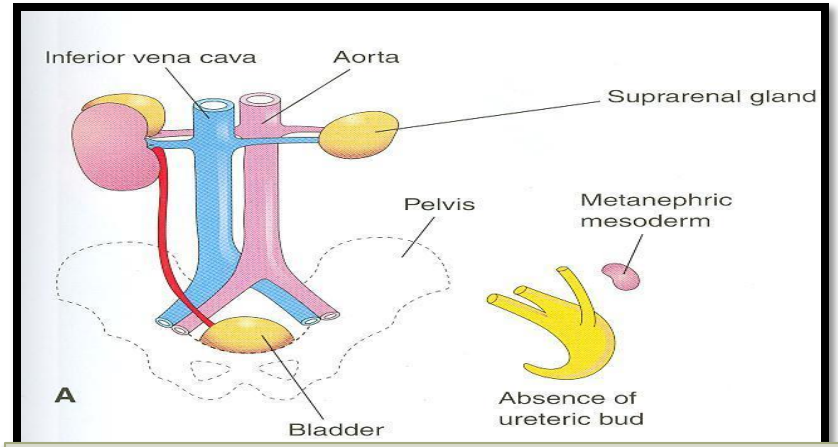
1) **Increase in size:** due to elongation of tubules and increase in connective tissue between tubules (not due to increase in number of nephrons)
2) **Disappearance of kidney lobulation**

Congenital Anomalies

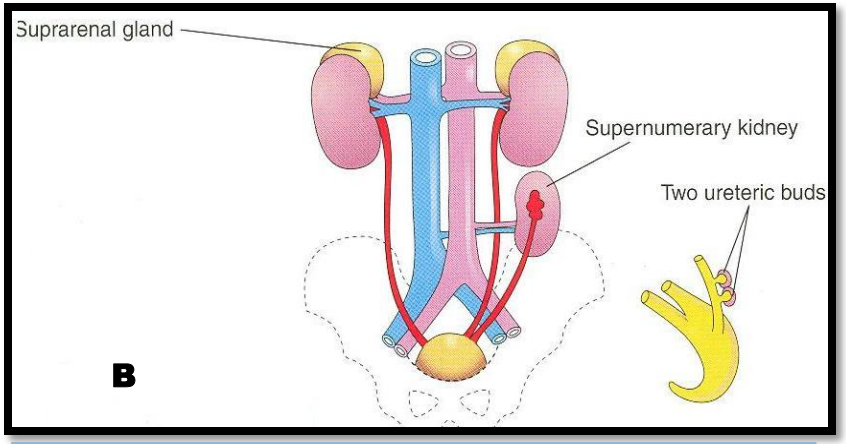
A. **Pelvic kidney:** failure of ascent of one kidney (ureter is short)

B. **Horseshoe kidney:** the poles of both kidneys (usually the lower poles) fuse: the kidneys have a lower position than normal but have normal function

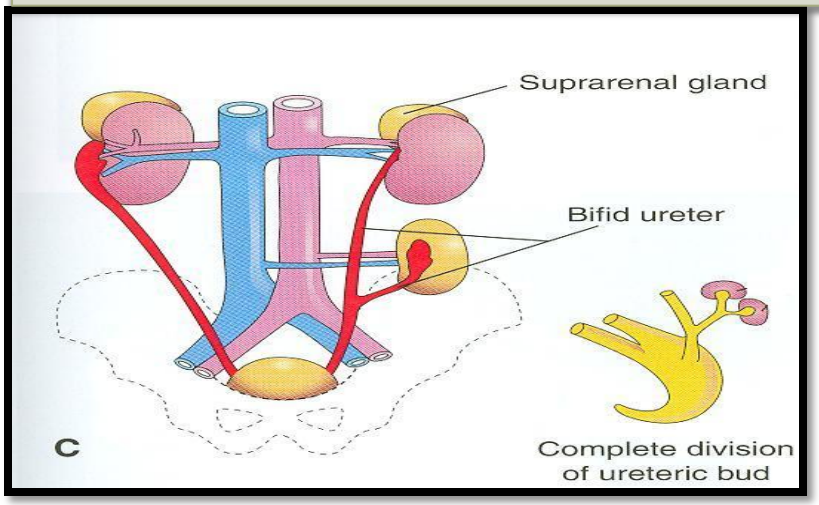




A- Unilateral renal agenesis: due to absence of one ureteric bud



B- Supernumerary kidney: due to development of 2 ureteric buds



C- Right side: malrotation of kidney
Left side: bifid ureter & supernumerary kidney


GOOD LUCK