



# DEVELOPMENT OF KIDNEYS & URETERES

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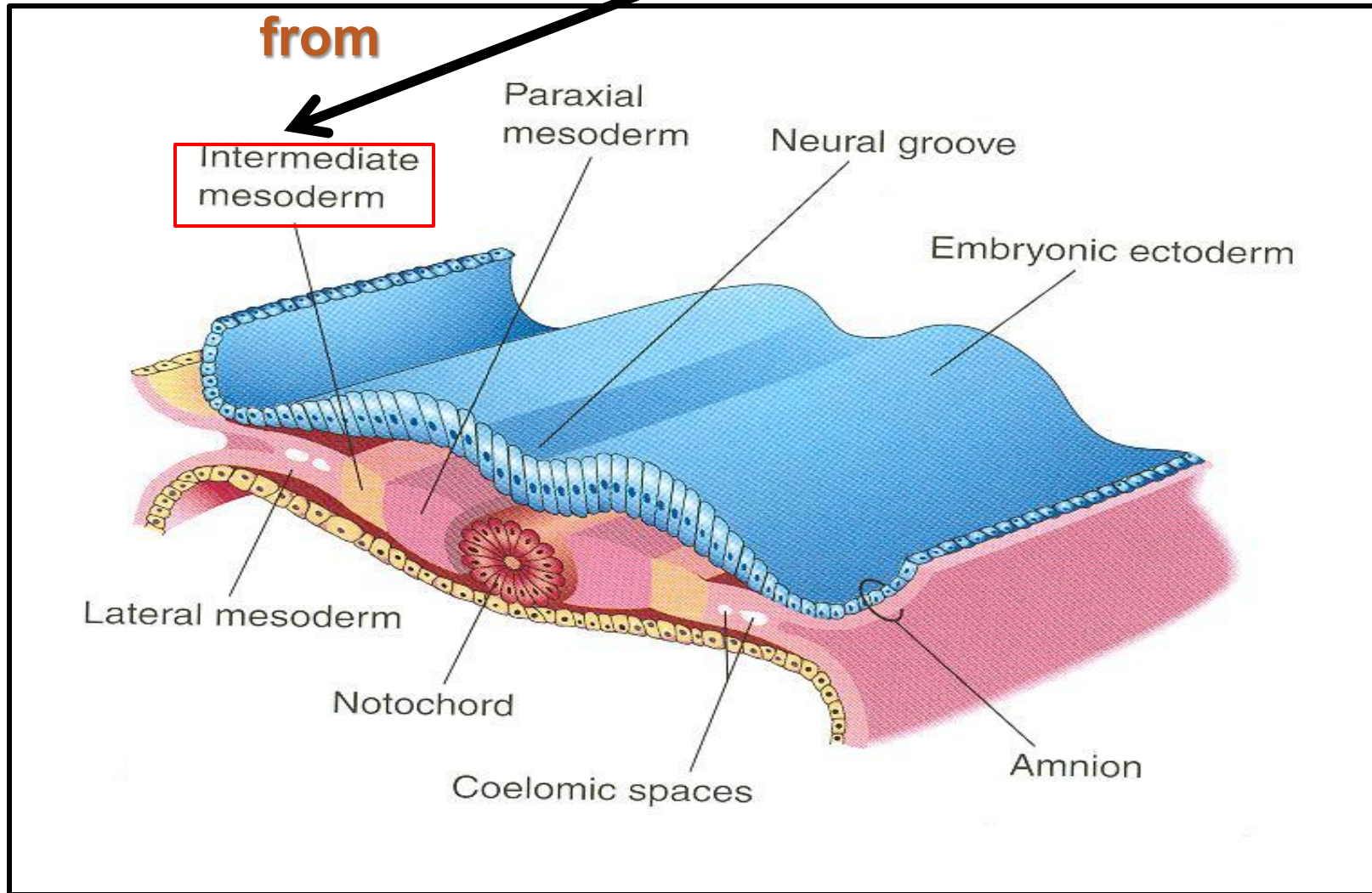
# OBJECTIVES

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

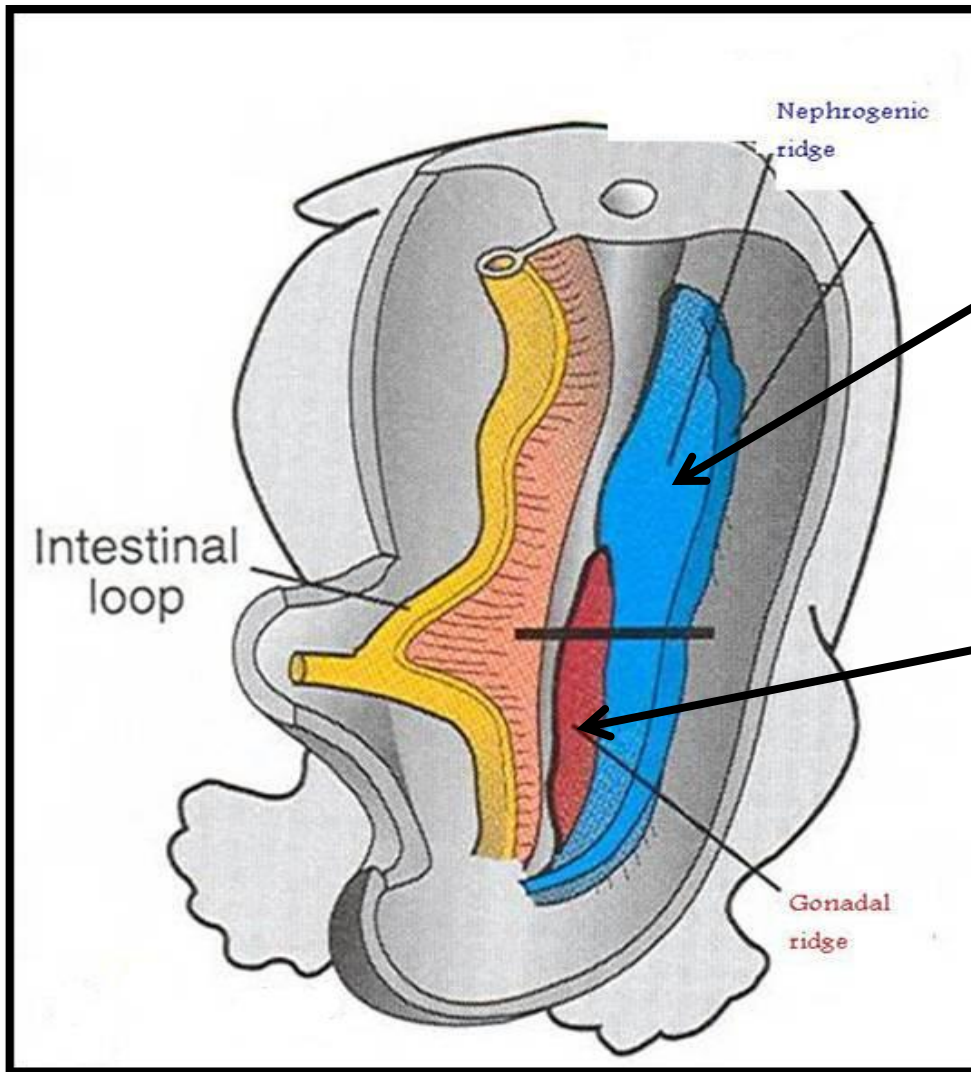
- ❑ ***Identify the embryological origin of kidneys & ureters.***
- ❑ ***Differentiate between the 3 systems of kidneys during development.***
- ❑ ***Describe the development of collecting & excretory parts of permanent kidney.***
- ❑ ***Describe the fetal kidney & identify the pre- and postnatal changes 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

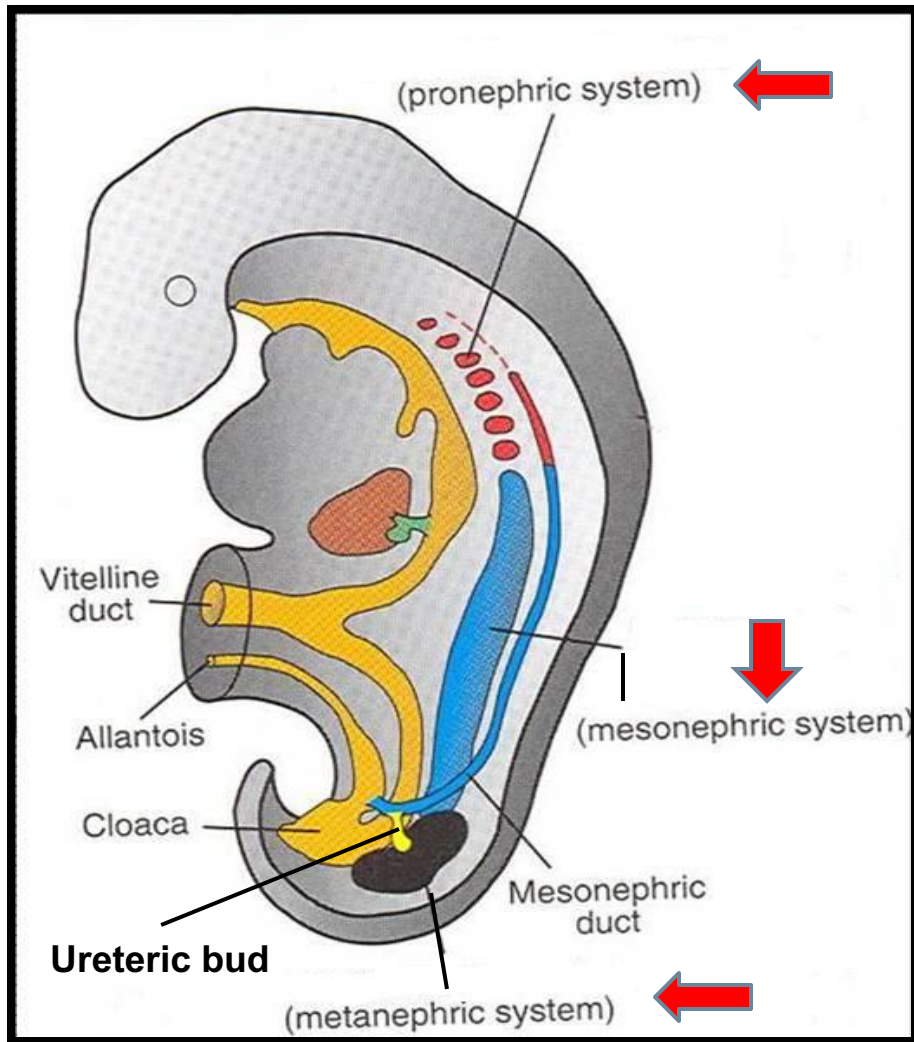
2. Gonadal ridge:

forms gonads (testes or ovaries)





# DEVELOPMENT OF KIDNEYS



Three systems of kidney develops:

1. **Pronephric system:**

- appears at **beginning of 4<sup>th</sup> 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 4<sup>th</sup> 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 **5<sup>th</sup> week** in **pelvis**
- **starts to function at 9<sup>th</sup> week**



# METANEPHROS

## (PERMANENT KIDNEY)

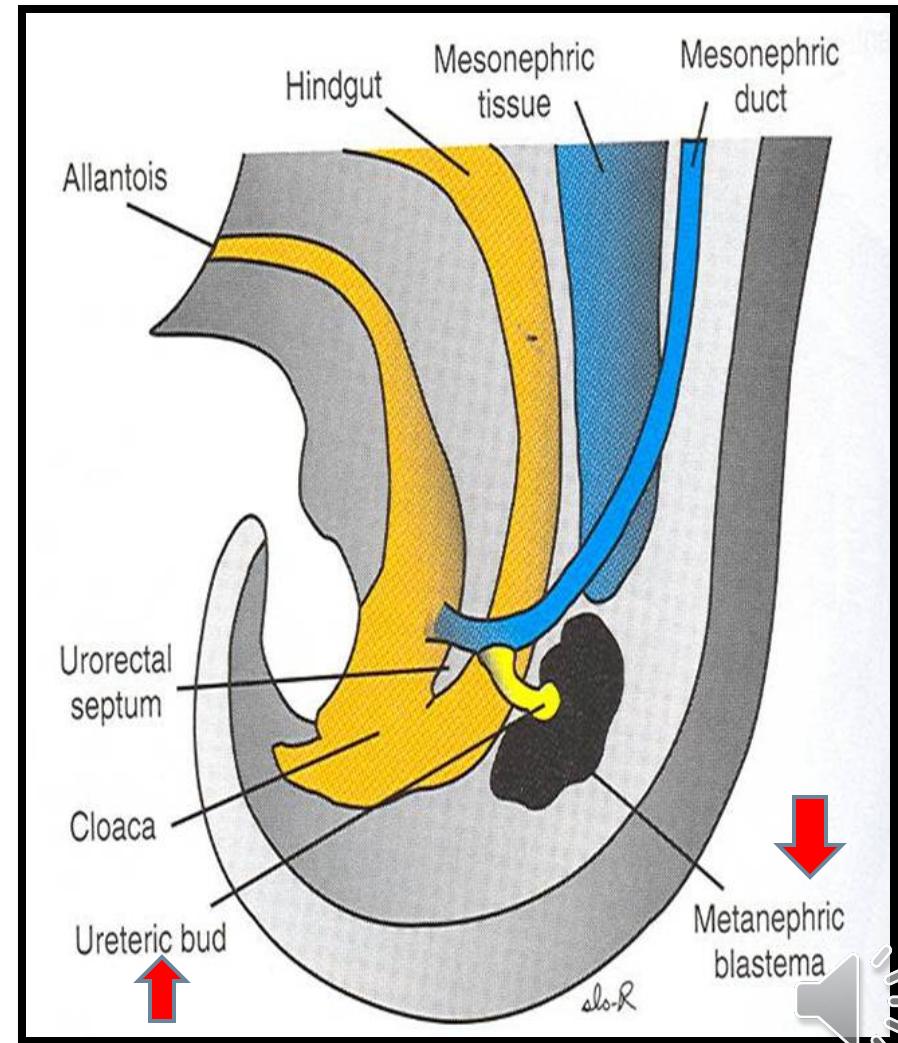
Formed of 2 origins:

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**



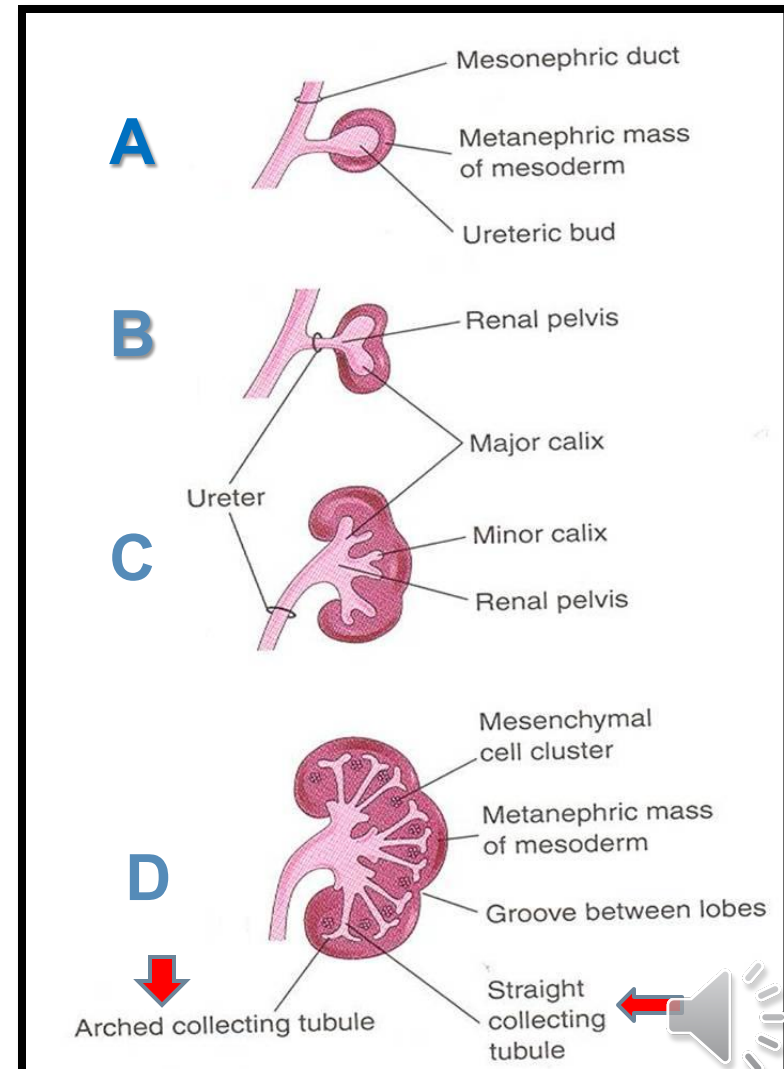
# COLLECTING PART

**A- Ureteric bud elongates & penetrates metanephric mass.**

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

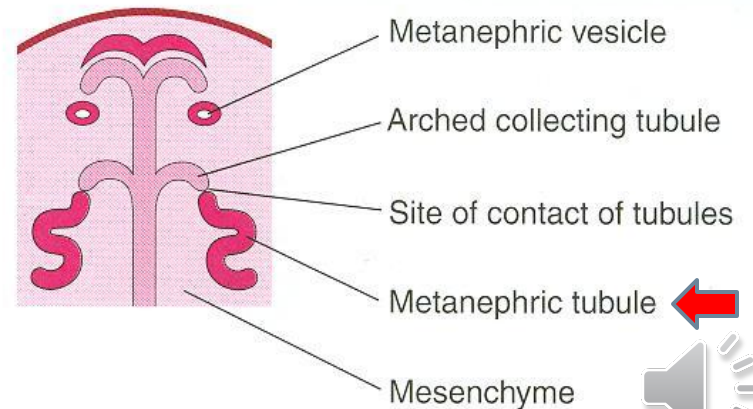
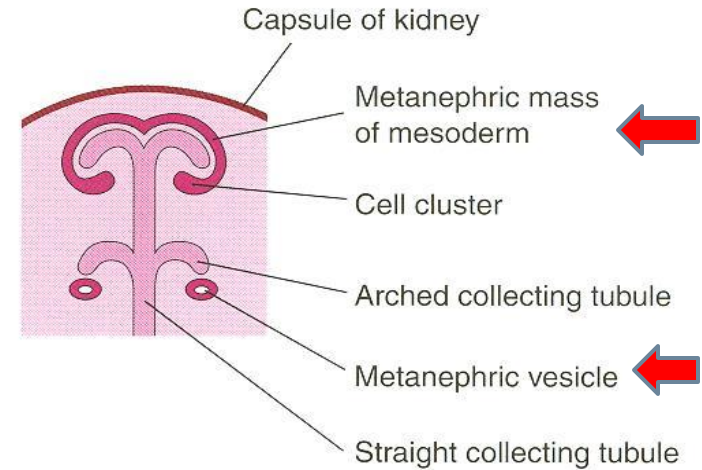
**C- Branching of renal pelvis gives **3 major calices**.  
Branching of major calyces gives **minor calyces**.**

**D- Continuous branching gives **straight & arched** collecting tubules**



# EXCRETORY PART

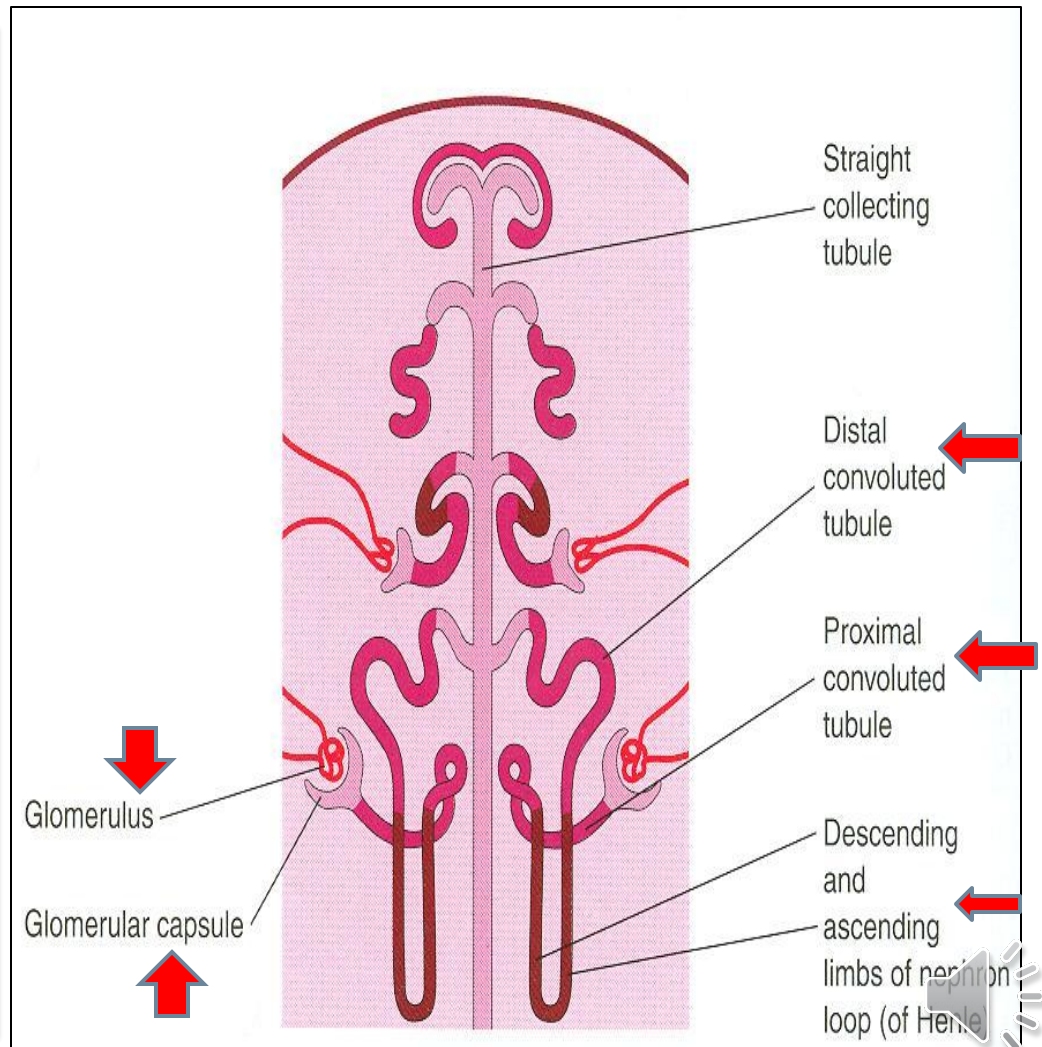
- Each **arched collecting tubule** is surrounded by a **cap of metanephric mass**.
- **(metanephric vesicle).**
- The metanephric vesicle elongates to form an **S-shaped metanephric tubule**.





# 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

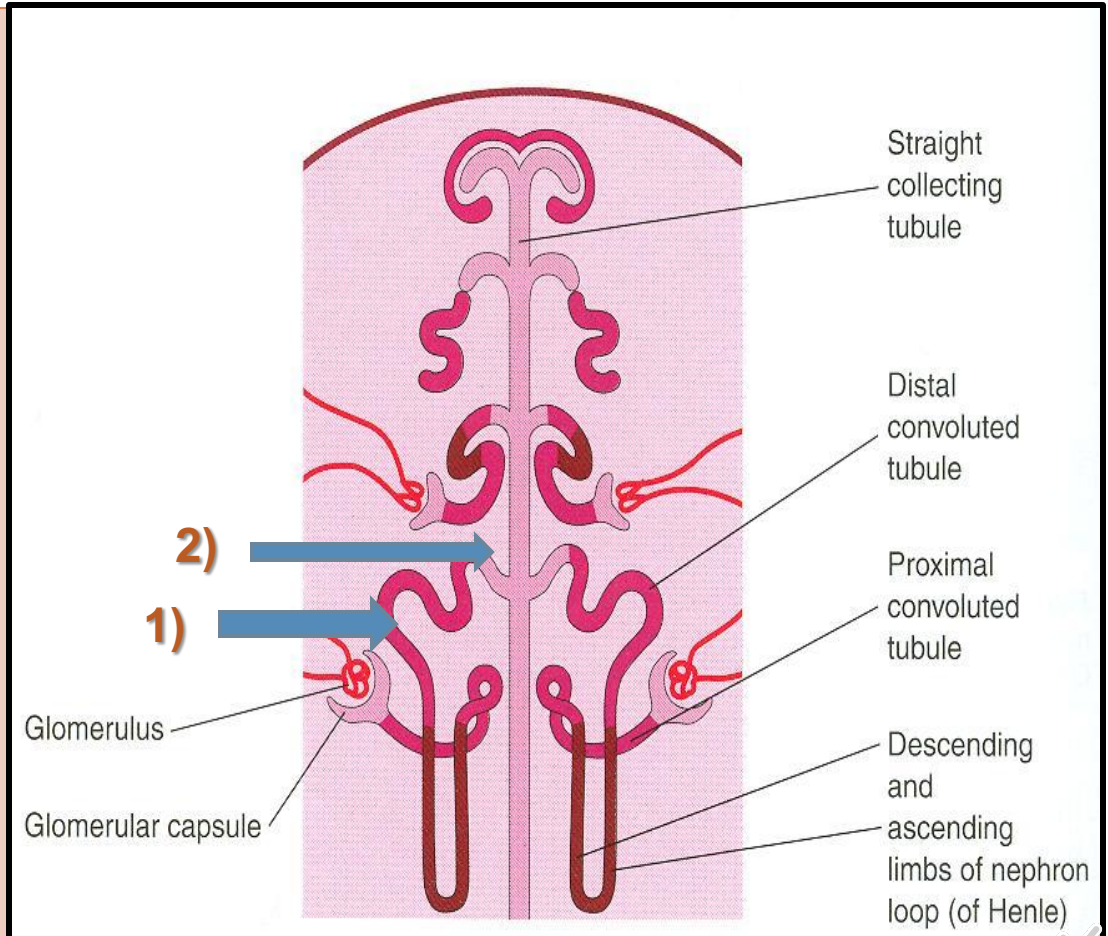
## (FUNCTIONAL UNIT OF KIDNEY)

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

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

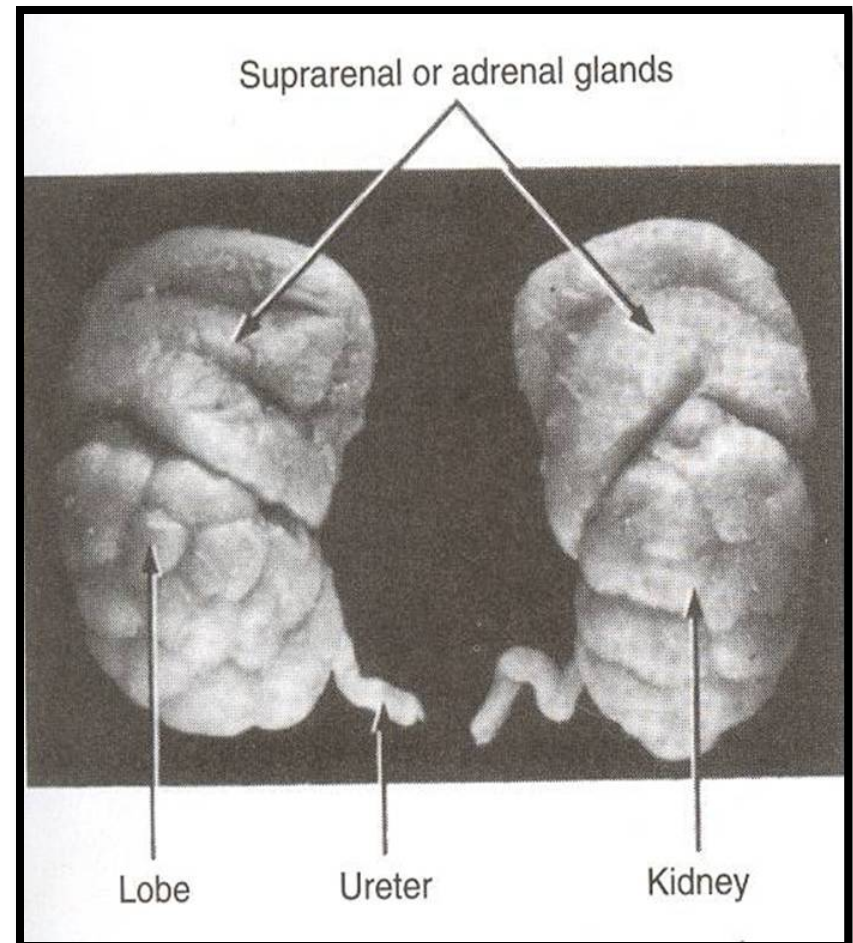
At Full Term:

each kidney contains:  
**800000 – 1000000**  
**nephrons.**



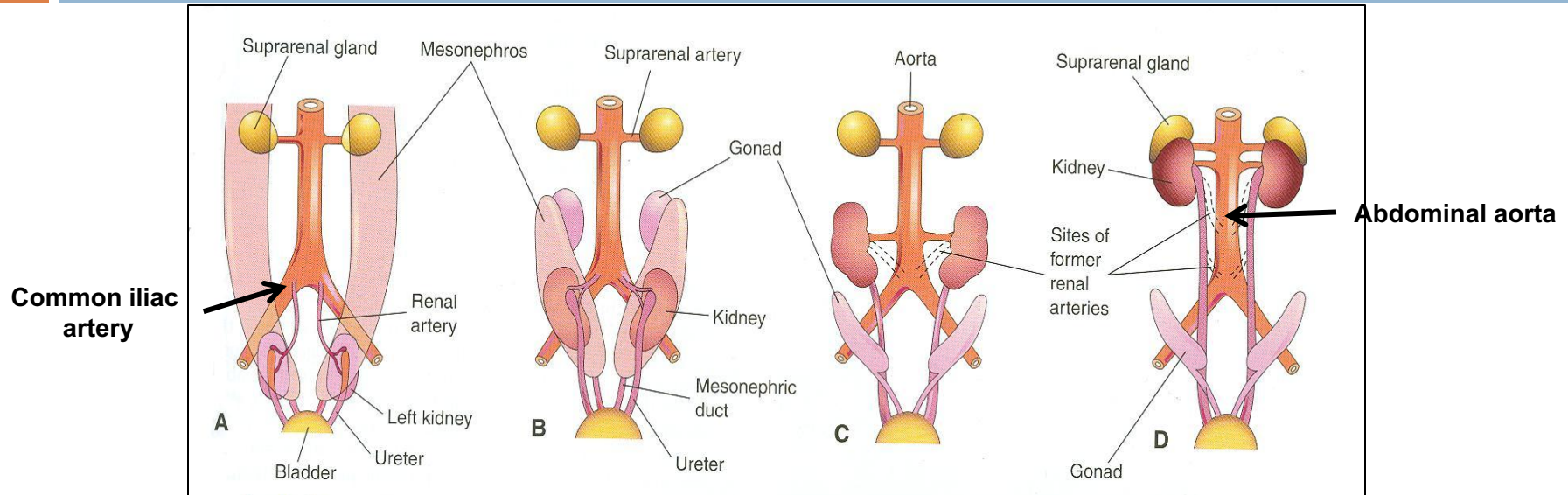
# Criteria of The Fetal Kidney

- 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.**

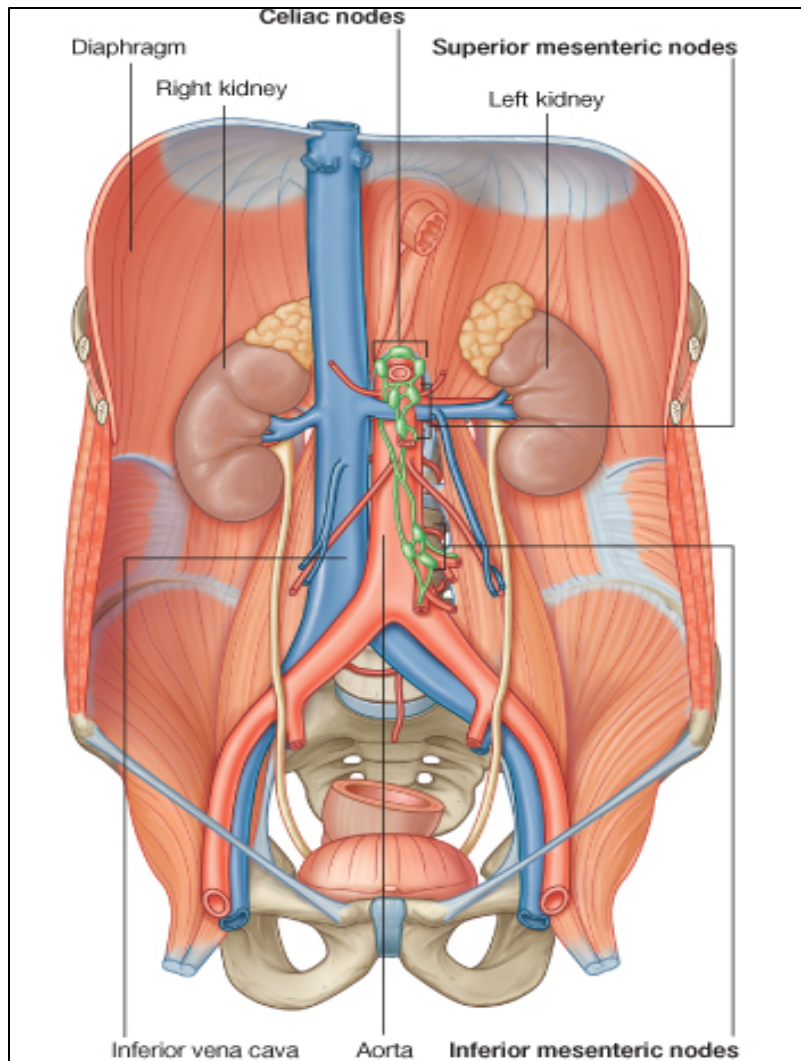
**-Blood Supply:** As the kidney ascends, its blood supply changes from renal branches of common iliac arteries into **renal branches of abdominal aorta.**

**-Rotation:** Initially, the **Hilum** is **ventral** then rotates medially about  $90^\circ$  & becomes **medial.**





# What Happens At The 9<sup>TH</sup> 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



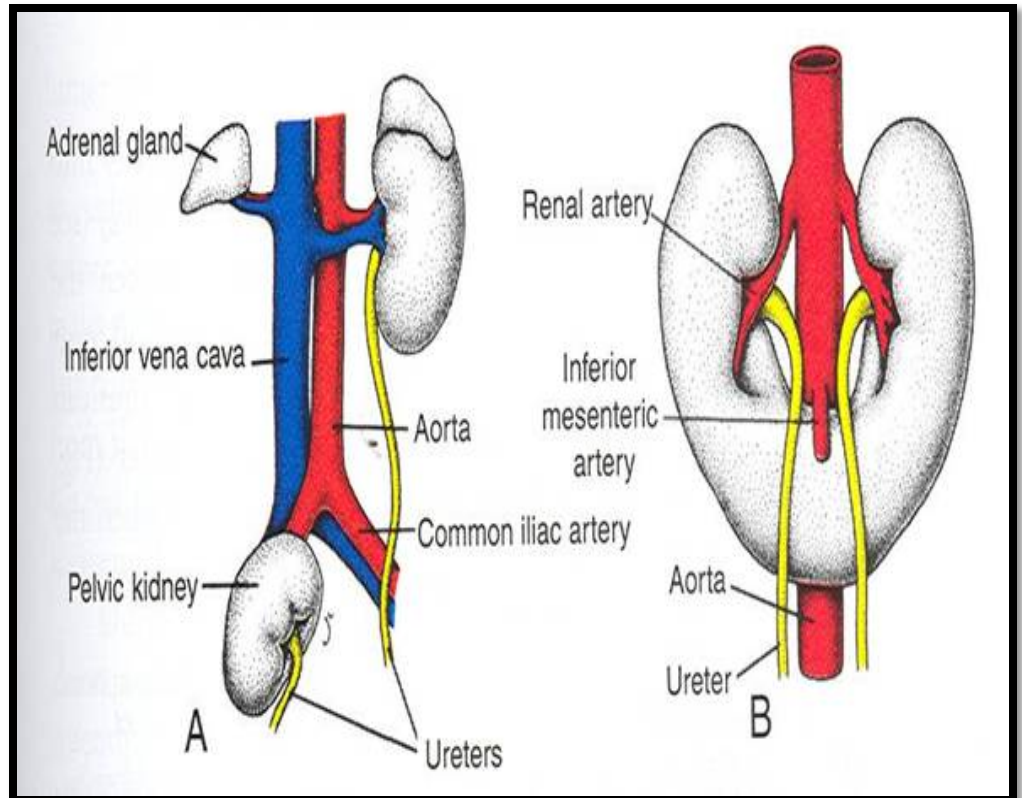
# Changes of kidney After BIRTH

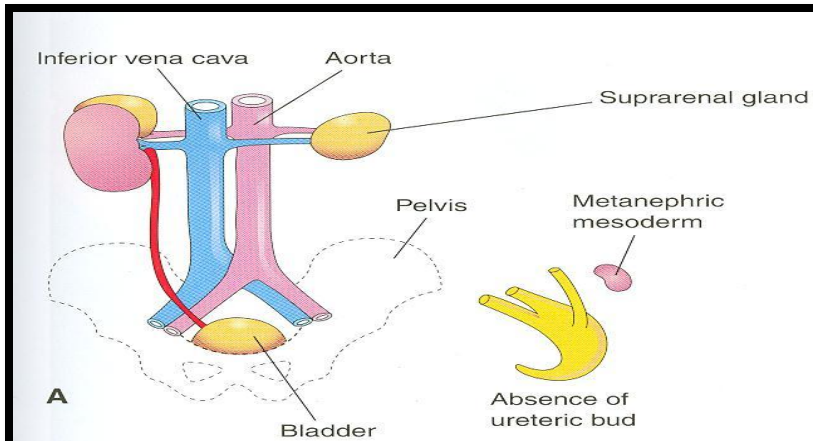
- 1) **Increase in size:** due to elongation of tubules and increase in connective tissue between tubules (not due to increase in number of nephrons)
- 2) **Disappearance of kidney lobulation**



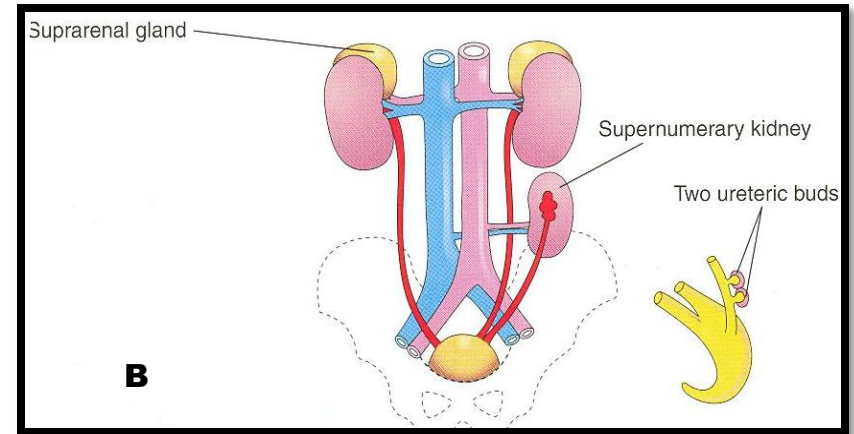
# Congenital Anomalies

- 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**

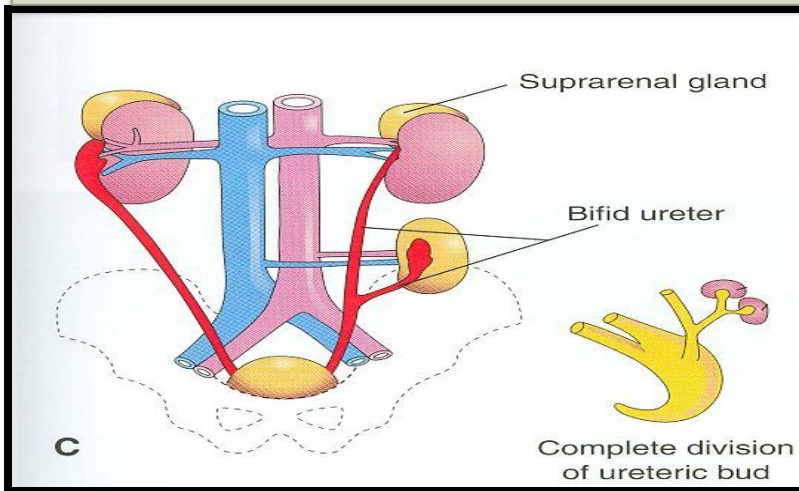




**A- Unilateral renal agenesis:** due to absence of one ureteric bud



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



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





*GOOD LUCK*

