



DEVELOPMENT OF KIDNEYS & URETERES

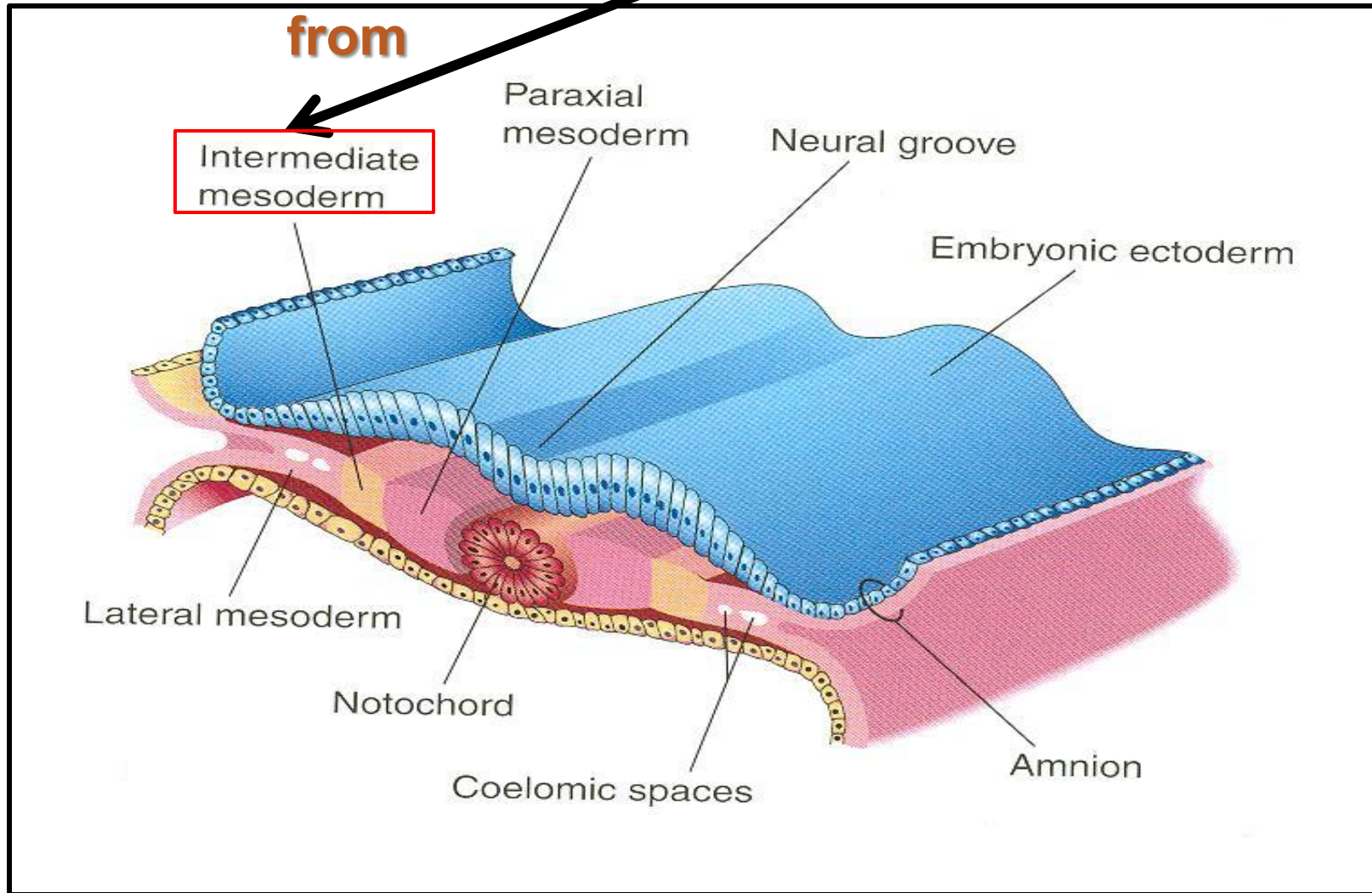
Dr. Jamila El Medany

OBJECTIVES

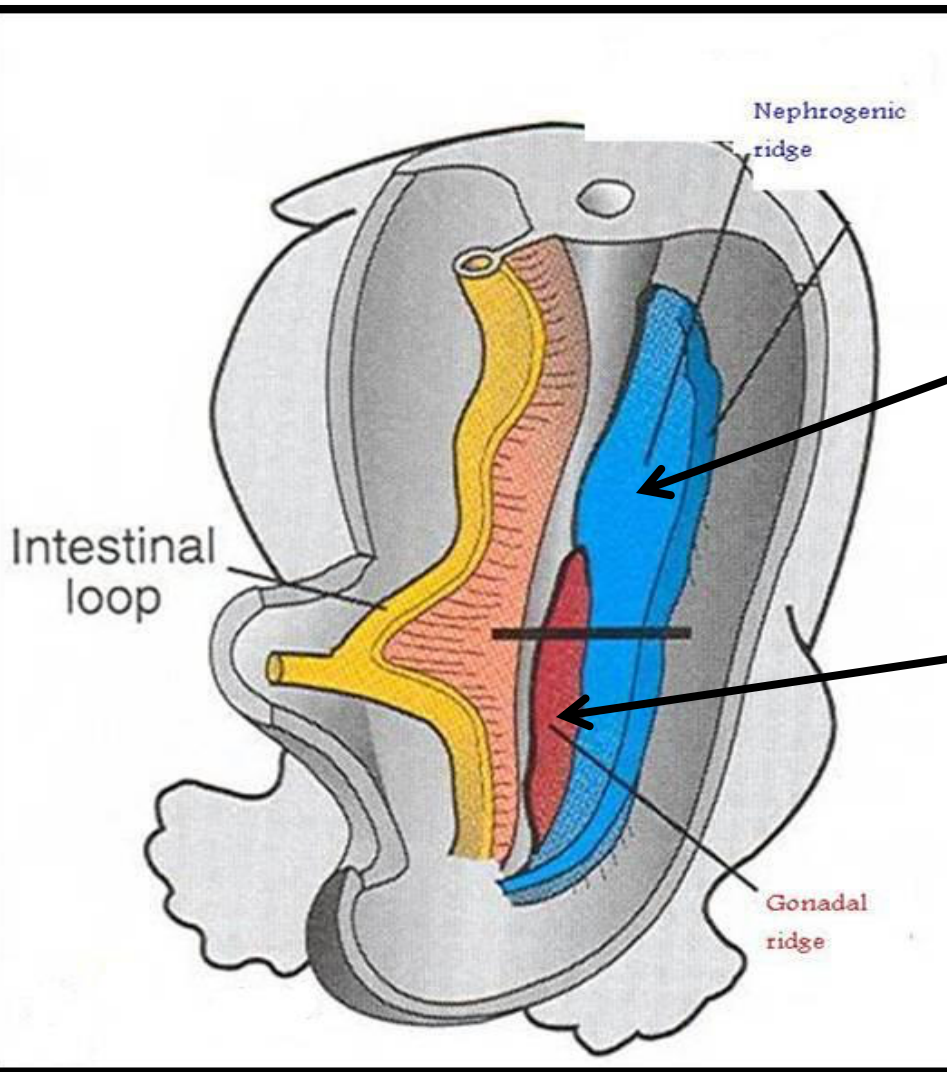
At the end of the lecture, students should be able to:

- ❑ ***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



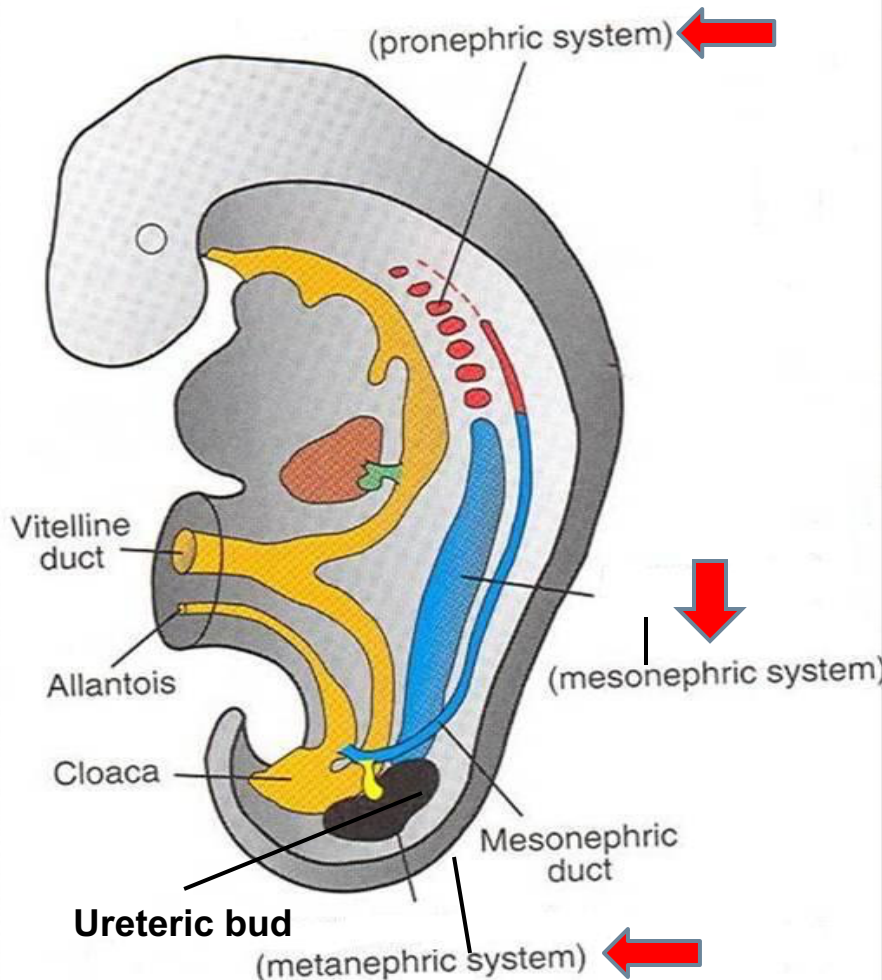
INTERMEDIATE MESODERM



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)

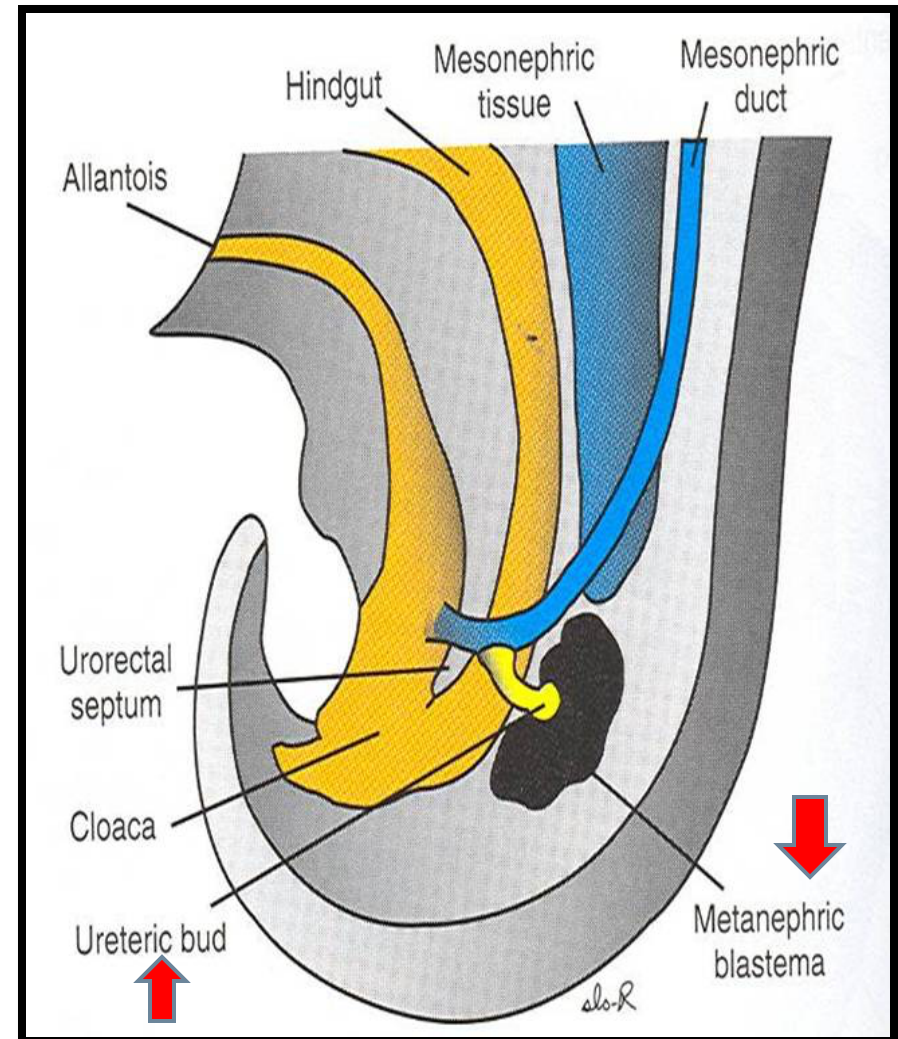
Formed of 2 origins:

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**



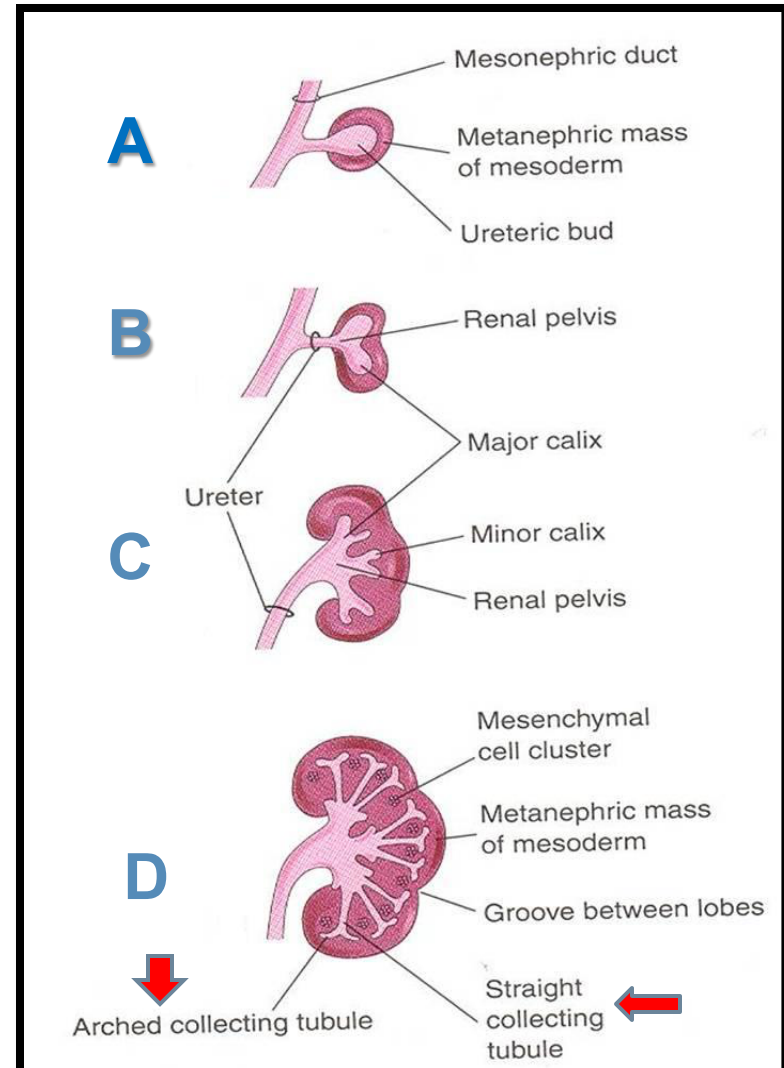
COLLECTING PART

A- Ureteric bud elongates & penetrates metanephric mass.

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

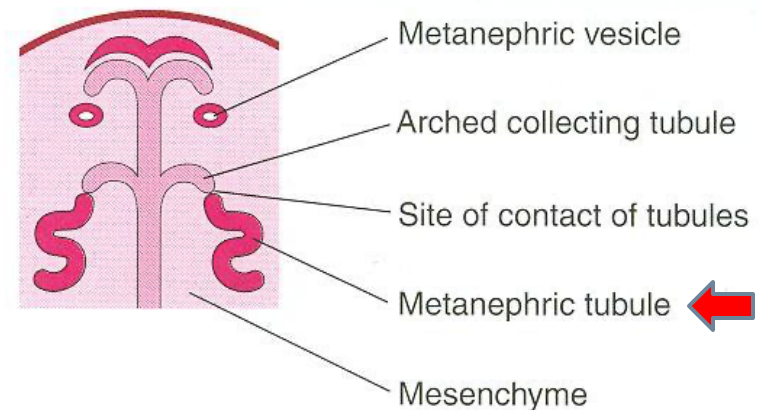
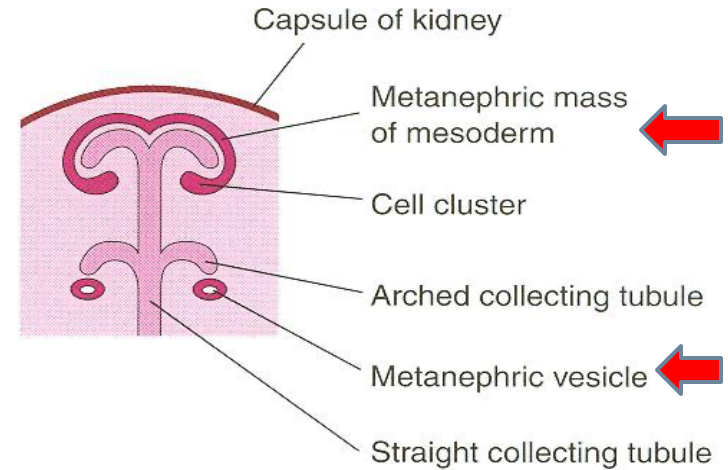
C- Branching of renal pelvis gives **3 major calices. Branching of major calyces gives **minor calyces**.**

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



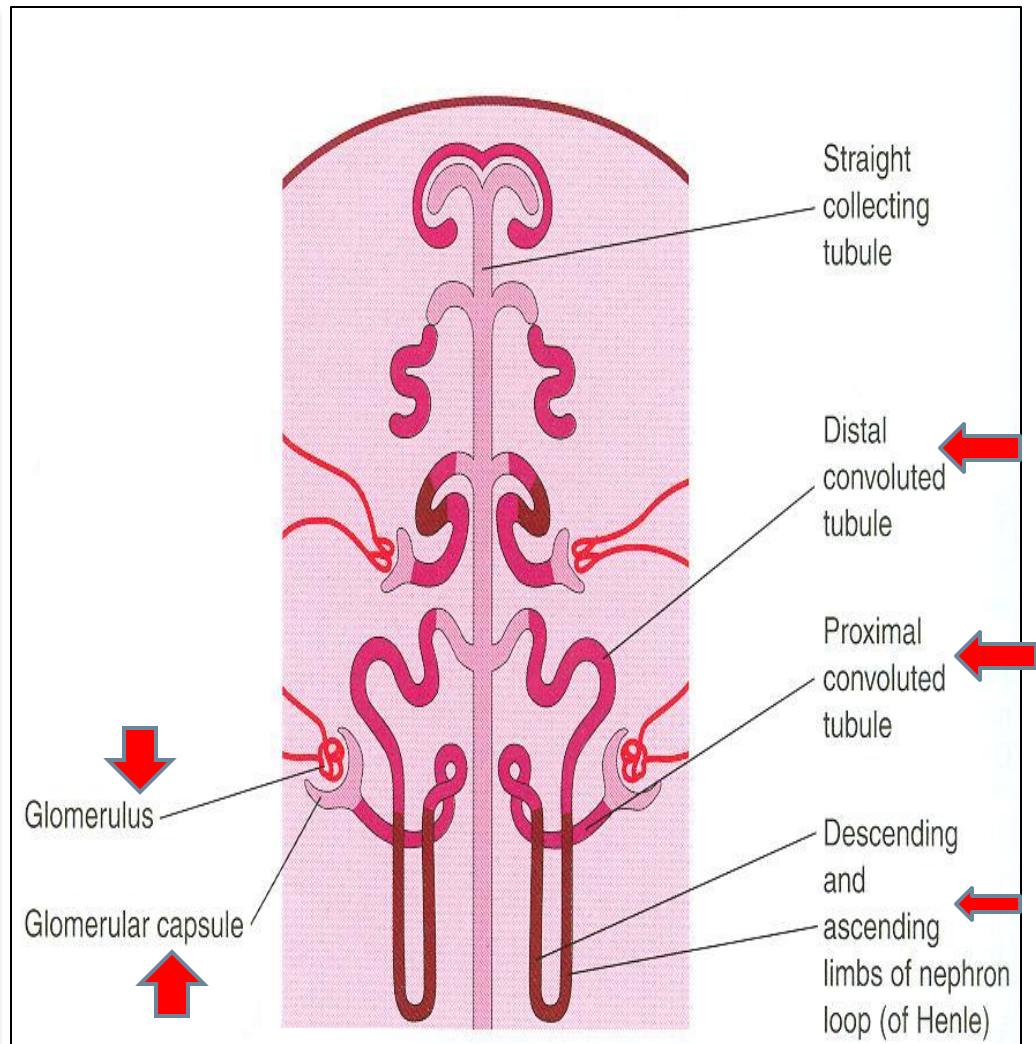
EXCRETORY PART

- 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

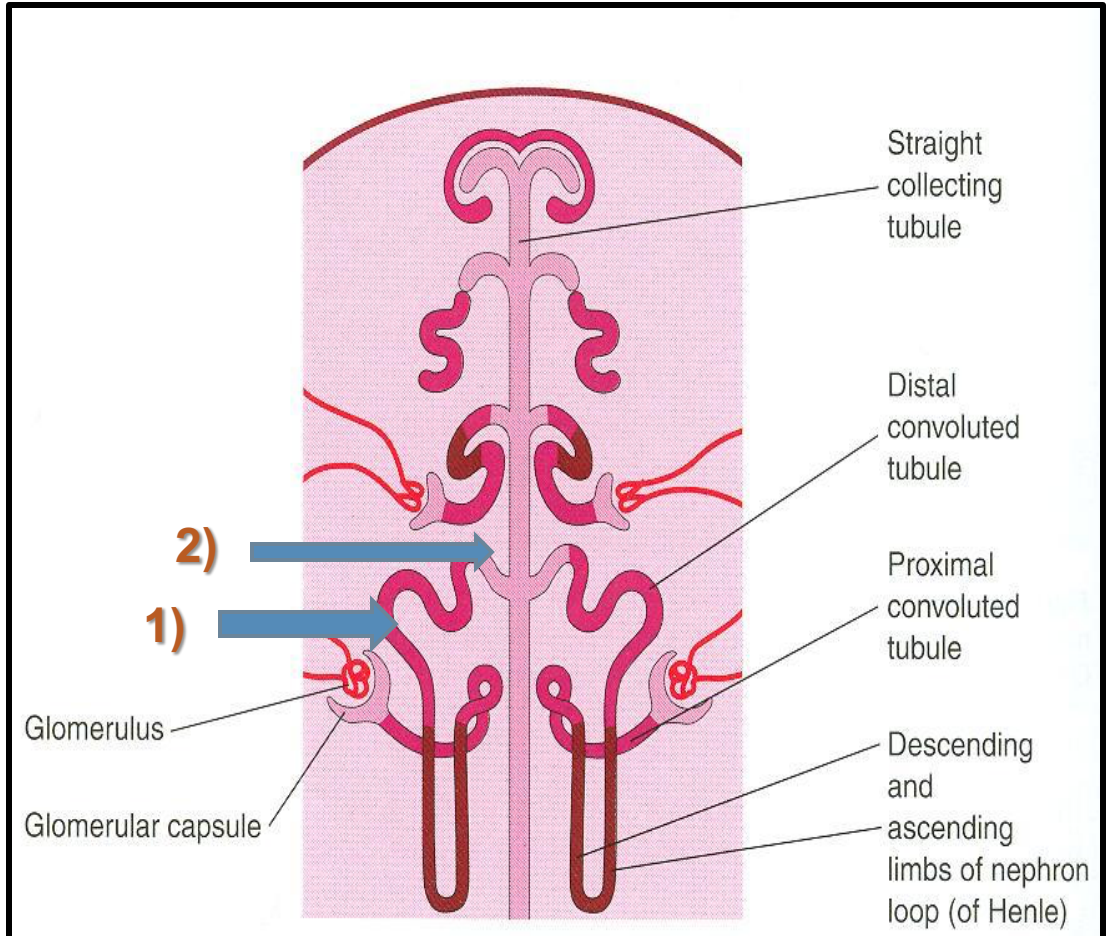
(FUNCTIONAL UNIT OF KIDNEY)

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

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

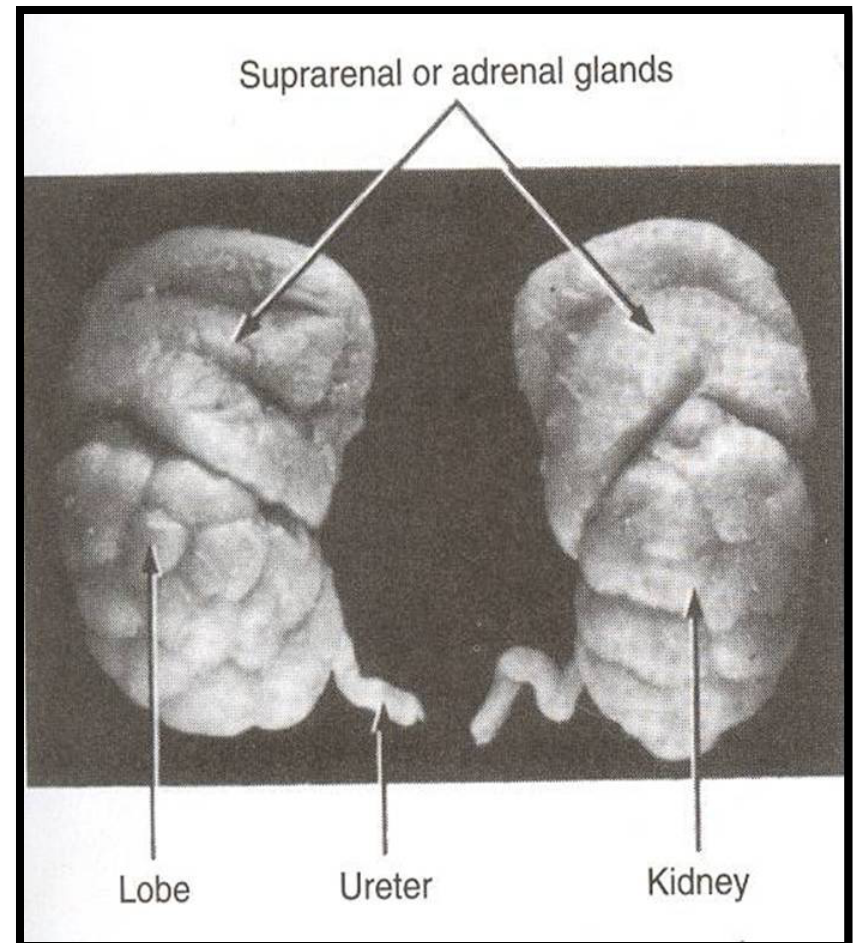
At Full Term:

each kidney contains:
800000 – 1000000
nephrons.

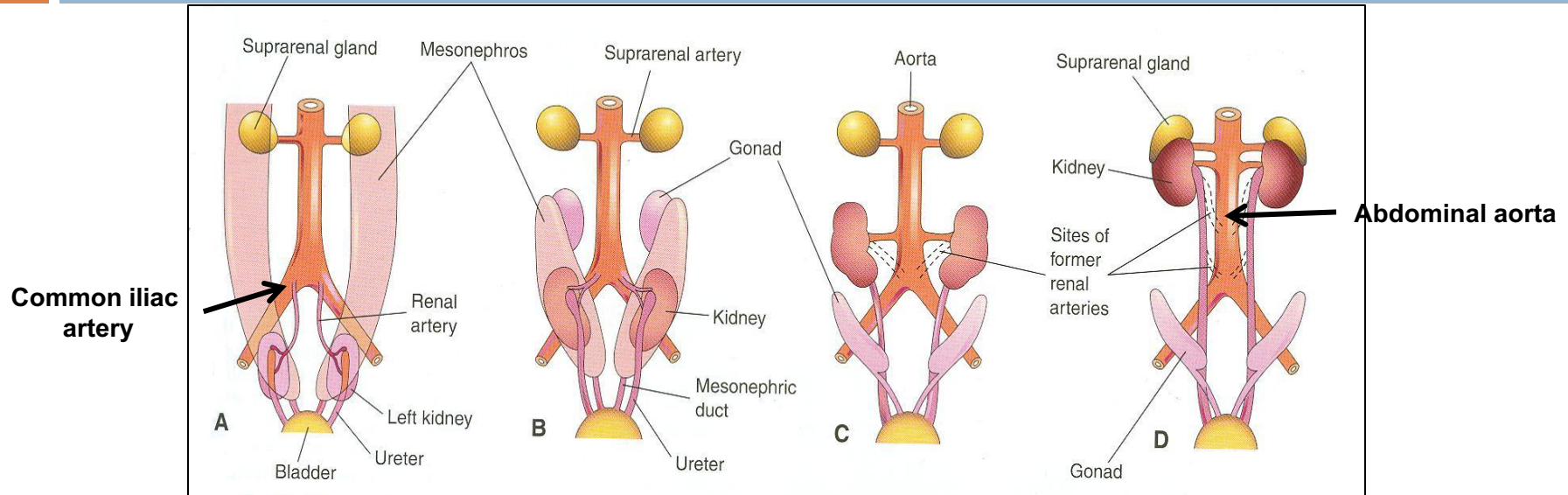


Criteria of The Fetal Kidney

- 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

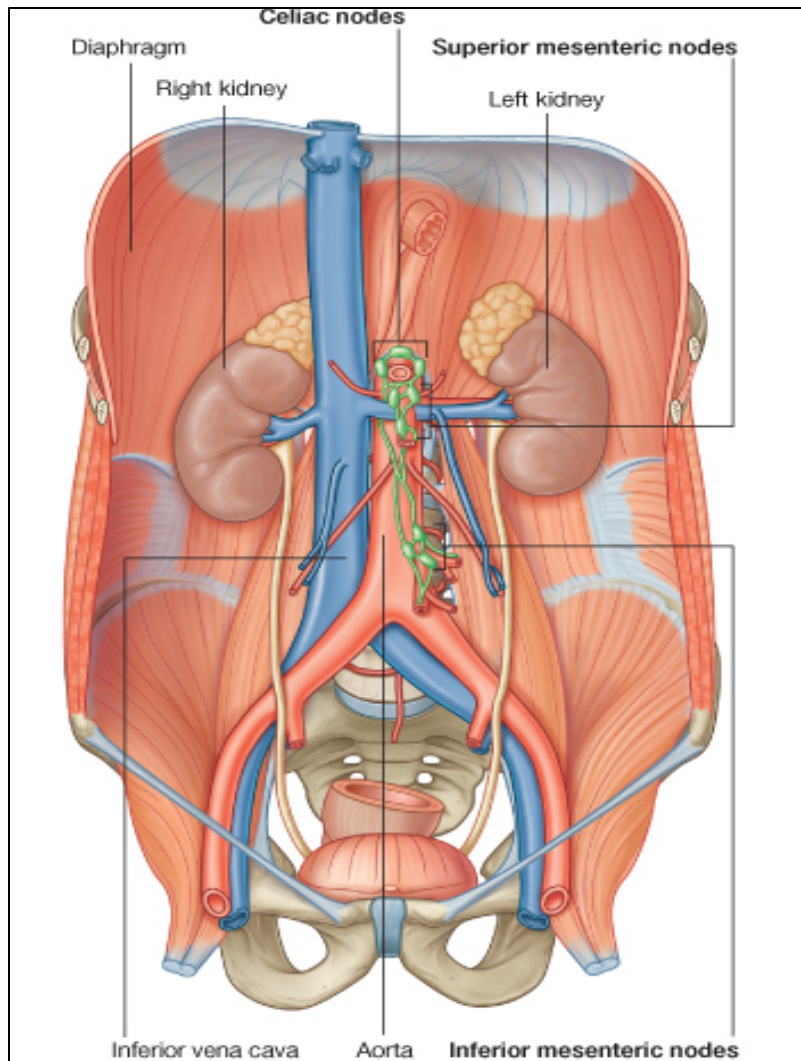


-Position: The kidney ascends from pelvis to abdomen & attains its adult position, **caudal to suprarenal gland.**

-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



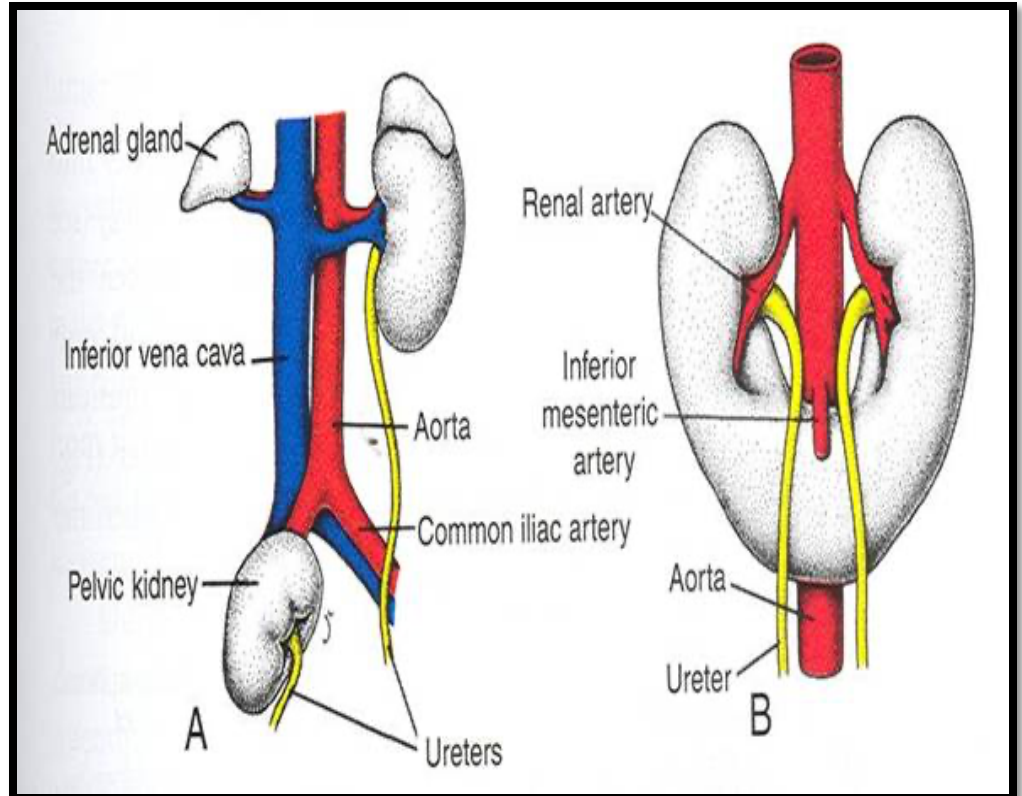
- Beginning of glomerular filtration (start of function).
- The kidney attains its **adult position**.
Receives its arterial supply from abdominal aorta.
- The hilum is rotated medially

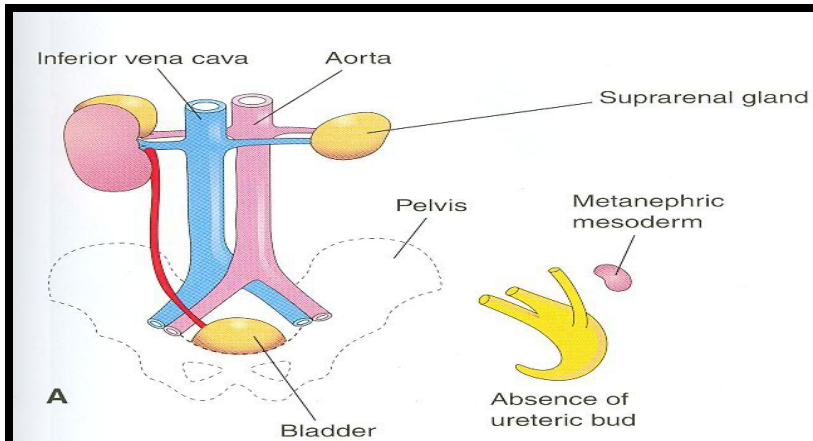
Changes of kidney After BIRTH

- 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**

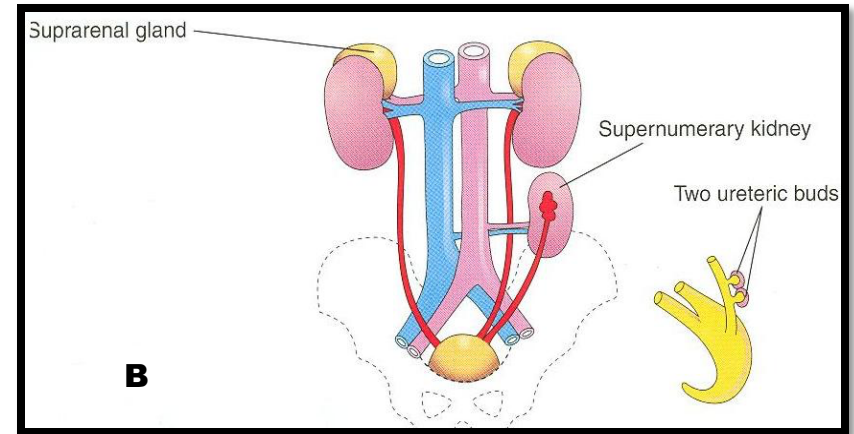
Congenital Anomalies

- 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**

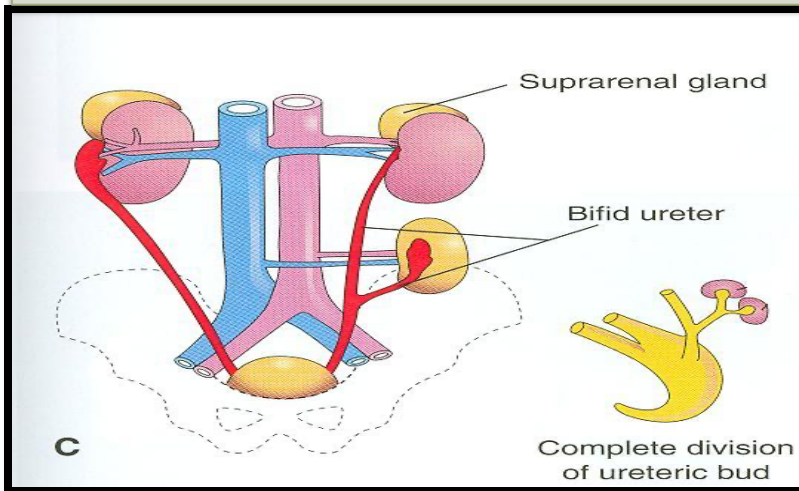




A- Unilateral renal agenesis: due to absence of one ureteric bud



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



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

GOOD LUCK