I. OVERVIEW
   A. Anatomy
      2 kidneys → 2 ureters → bladder → 1 urethra
   
   B. Functions – filter the blood at the chemical level
      1. Regulate blood volume & composition
      2. Regulate blood pressure
      3. Numerous other physiological functions

   At rest, kidneys get 21% of blood (but are < 1% of body weight)

II. KIDNEYS
   A. External anatomy
      1. retroperitoneal, T12 -- L3
      2. secured & surrounded by 3 layers of tissue: Fig. 25.2
         from superficial to deep:
         - renal fascia → thin layer of dense c.t.; anchors kidney in position
         - adipose capsule → cushions & anchors
         - fibrous capsule → transparent fibrous c.t; outer of layer of kidney itself
         - shapes kidney
      3. hilum: renal A & V, ureter pass
   
   B. Internal anatomy
      1. features: frontal section  KNOW FIG. 25.3b
         -- make a list:
         calyx = cup
      2. blood supply:

         renal artery
         ↓↓↓↓↓↓
         afferent arteriole
         ↓↓↓↓↓
         glomerulus
         (capillary network)
         ↓↓↓↓↓
         efferent arteriole
         ↓↓↓↓↓
         peritubular capillaries
         (in cortex) vasa recta
         (in medulla)
         ↓↓↓↓↓
         renal vein
C. **Nephron** – *KNOW* Fig. 25.6, 25.5

“kidney”

1. functional unit of kidney: ~ 1million/kidney
2. components:
   - renal corpuscle = glomerulus + glomerular (Bowman’s) capsule (capillary network)
     \[ \rightarrow \text{filtration occurs at the renal corpuscle} \]
   - renal tubule = proximal convoluted tubule + nephron loop (of Henle) + distal convoluted tubule
     \[ \rightarrow \text{filtrate is modified by reabsorption/secretion as it passes through renal tubule} \]

*Note the renal tubule includes the collecting duct, but that portion is *not* part of the nephron*

3. two types of nephrons
   - cortical nephrons (85%) – more superficial; short loops
   - juxtamedullary nephrons (15%) – near cortex/medulla border; long loops

4. Path of filtrate:
   nephron \(\rightarrow\) collecting duct \(\rightarrow\) papillary duct \(\rightarrow\) minor calyx \(\rightarrow\) major calyx \(\rightarrow\) renal pelvis
   \[ (~30/\text{papilla}) \quad (= \text{cup}) \]
   -- filtrate is considered “urine” once it enters collecting duct
III. TRANSPORT AND STORAGE ORGANS

A. Ureters (2)
   1. kidney → bladder; retroperitoneal
   2. pass obliquely through bladder wall = physiological sphincter
   3. small fold of mucosa acts as valve
   4. smooth muscle in wall: peristalsis assists urine flow

B. Bladder – **KNOW Fig. 25.11**
   1. hollow, muscular bag, retroperitoneal, posterior to pubic symphysis
   2. internal trigone at base (same area is fundus externally)
   3. Histology (from internal → external)
      ① mucosa -- transitional epithelium (text p. 62) with rugae
      ② muscularis (*detrusor*) -- 3 layers of smooth muscle
         -- forms **internal** urethral sphincter (involuntary)
      ③ adventitia -- loose c.t.
         (serosa on superior surface only)

C. Urethra (1)
   1. bladder → exterior
      short in females ~ 4 cm = ↑ incidence of urinary tract infections (↓ MALT)
      longer in males ~ 18 cm
   2. **external** urethral sphincter in *urogenital diaphragm* (Fig. 25.11)
      -- skeletal muscle (voluntary)
   3. external urethral orifice