

Lecture 8.3 URINARY SYSTEM (Chapter 24)

Function: removal of metabolic waste materials (mostly urea)

Urea: metabolic waste material formed from the digestion of proteins

Protein digestion releases ammonia which is detoxified in the liver by attaching a CO₂ molecule producing urea.

Urinary System

Nutrients → digestive system → blood → liver (urea production) → blood → urinary system → excretion

Kidneys

- Functions
 - Removal of waste from blood (urine formation)
 - Regulate body water volume
 - Diluted urine (removal of excess water)
 - Concentrated urine (conservation of water)
- Location
 - Retroperitoneal
 - Level of T12-L3 vertebrae
- Capsule
 - Fibrous capsule: outer layer of kidney, maintains shape
- Hilum
 - Where the renal artery, renal vein, and ureter leave the kidney

Internal

- Cortex
 - Renal cortex
 - Contains millions of nephrons
- Medulla and renal pyramids
 - Renal medulla
 - Pyramids
 - Collect urine from tubules
- Papilla: tip of the pyramid that points inward
- Renal columns: separate adjacent pyramids
- Renal lobe: single renal pyramid plus the cortical tissue that surrounds that pyramid
- Renal sinus
 - Filled space that contains the renal vessels and nerves, some fat and urine carrying tubes called renal pelvis and calices
- Renal pelvis: expanded part of the ureter
 - Major and minor calyces: branches superior from the renal pelvis from the ureter, collect urine draining from the papillae and empty it into the renal pelvis and into the ureter to the bladder
 - Minor: encloses the papillae of the pyramids, at the tip of pyramids
 - Major: each divide to form several minor calyx

Nephron: each contain about the corpuscle, tubule

- **Renal corpuscle: only in the cortex**
 - o Glomerulus (efferent and afferent arterioles)
 - Supplied by the Afferent arteriole → enters and drained by the efferent arteriole
 - o Glomerular (Bowman's) capsule
 - Filtration membrane
 - o Capsular space is usually urine
 - o Efferent arteriole (exits)
- **Renal tubule is divided into the:**
 - o Proximal convoluted tubule
 - o Nephron loop (Loop of Henle)
 - o Distal convoluted tubule
 - o Collecting tubule
- Peritubular capillaries: surround the tubules

Ureters

- o Slender tube
 - Connects renal pelvis to bladder
 - Approx. 25 cm (12 inches) long
 - Approx 3 mm in diameter
 - Where you get kidney stones, they are so painful because the diameter is small

Bladder and micturition

- o Stores urine
- o Expels urine (detrusor muscle layer)
- o Bladder is larger in males than in females
- o Detrusor muscle: muscle that surrounds and makes up part of the bladder
- o Trigone: white triangle thing
- o Ureteric openings Internal urethral sphincter
- o Urination
 - o Micturition reflex
 - Initiated by stretching of bladder
 - Detrusor muscle contraction
 - Internal sphincter relaxation (involuntary)
 - External sphincter relaxation (voluntary)

Urethra

- o Tube from bladder to external excretion opening

- o Longer in males than in females
- o Internal sphincter
 - o Smooth muscle that keeps urethra closed
- o External sphincter
 - o Skeletal muscle
- o External urethral orifice

Blood vessels (figure 24.4b)

- o Arteries (Left and Right):
 - o Aorta → Renal → Segmental → Interlobar → Arcuate → Cortical radiate (interlobular) → Afferent arteriole → Glomerulus → Efferent arteriole → Peritubular capillaries and vasa recta
- o Veins (Left and Right):
 - o Vasa recta → Interlobular (cortical radiate) → Arcuate → Interlobar → Renal → IVC

Renal plexus