

Organs of the Urinary System

- Ureters
- Urinary bladder
- Urethra
- Kidneys
 - Maintains the chemical consistency of blood
 - Filter many liters of fluid from blood
 - Send toxins, metabolic wastes and excess water out of the body
- Main waste products
 - Urea
 - Uric acid
 - Creatinine

Location and External Anatomy of Kidneys

- Located **retroperitoneally**
- Later to T12-L3 vertebrae
- Average kidney is 12 cm tall, 6cm wide, 3 cm thick
- **Hilum**
 - On concave surface
 - Vessels and nerves enter and exit
- **Fibrous capsule** surrounds the kidney

Gross Anatomy of the Kidney

- Renal cortex
- Renal medulla
- Renal pyramid
 - Renal pelvis
 - Major callicies
 - Minor callicies

Summary of Blood Vessels Supplying the Kidney (fig. 24.4)

- **Renal arteries** branch into **segmental arteries**
 - Segmental arteries branch into **interlobar arteries**
 - Arcuate arteries

Mechanisms of Urine Production

- Filtration

- Filtrate of blood leaves kidney capillaries
- Reabsorption
 - Most nutrient, water, and essential ions reclaimed
- Secretion
 - Active process of removing undesirables

Nephron Structures

- **Nephron** is composed of:
 - **Renal corpuscle**
 - Renal tubule
- Renal corpuscle: glomerulus and glomerular capsule
 - Glomerulus: tuft of fenestrated capillaries
 - Glomerular: (bowman's capsule)
 - Parietal layer: epithelium
 - Visceral layer: podocytes

Filtration Membrane

- The filtration membrane lies between blood in the glomerulus and capsular space. It has 3 layers:
 - Fenestrated endothelium of the capillary
 - Basement membrane
 - Slits between foot processes of podocytes

Renal Corpuscle and the Filtration Membrane

- Basement holds back most proteins
 - Allow through:
 - Water
 - Ions
 - Glucose (recycled)
 - Amino acid
 - Urea

Renal Tubules

- Filtrate proceeds to renal tubules from glomerulus
 - Proximal convoluted tubule
 - Nephron loop
 - Descending limb/Ascending Limb
 - Thin segment/Thick segment
 - Distal convoluted tubule
 - Collecting ducts
 - Receive urine from several nephrons

Classes of Nephron

- **Cortical nephron**
 - 85% of nephrons
- **Juxtamedullary nephrons**
 - Deep into the medulla
 - 15% of nephrons
 - contribute to kidney's ability to concentrate urine
- Nephrons always associate closely with two capillary beds
 - Glomeruli (all nephrons)
 - Peritubular capillaries (*Cortical* nephrons)
 - Vasa recta (*Juxtamedullary* nephrons)

Blood Vessels Associated with Nephrons

- **Glomeruli**
 - Produce filtrate that becomes urine
 - Fed and drained by **afferent and efferent arterioles**
 - Efferent arteriole has the smaller diameter (ergo high blood pressure in the glomeruli)
 - Generate 1 liter of fluid every 8 minutes
 - 99% of filtrate is reabsorbed by tubules
- **Peritubular capillaries**
 - Arise from the efferent arterioles
 - Are adapted for absorption
 - Low pressure, porous capillaries
 - All molecules secreted into urine are from Peritubular capillaries
- **Vasa Recta**
 - Continue from efferent arterioles of Juxtamedullary nephrons
 - Are thin-walled looping vessels that descend into the medulla
 - Part of the kidneys urine concentrating mechanism

Urinary Bladder and Ureter

- Urinary bladder: collapsible muscular sac (stores & expels urine)
 - Full bladder is spherical and expands into the abdominal cavity
 - An empty bladder lies entirely within the pelvis
- Ureter carry urine from the kidneys to the urinary bladder
 - **Oblique** entry into bladder prevents back flow of urine

Structure of the Urinary Bladder and Urethra

- Bladder has 3 layers:
 - Mucosa of transitional epithelium (not labeled)
 - Thick muscular layer:
 - **Detrusor muscle** (contracts during urination)
 - Fibrous adventitia