URINARY SYSTEM

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Functions of the urinary system

- Homeostatic regulation of blood plasma
  - Regulating blood volume and pressure
  - Regulating plasma ion concentrations
  - Stabilizing blood pH
  - Conserving nutrients

Organization of the Urinary System

- Kidneys – produce urine
- Ureters –transport urine to bladder
- Urinary bladder - stores urine
- Urethra- transports urine to exterior

KIDNEYS

- FILTRATION
- RESORPTION
- EXCRETION
- Produces 2-2,5 lt of urine from 1700 lt blood/24 hours

KIDNEYS

- Located **retroperitoneally**
- Lateral to T_{12}–L_3 vertebrae
- Average kidney
  - 12 cm tall, 6 cm wide, 3 cm thick

Internal Gross Anatomy of the Kidneys

- Frontal section through the kidney
  - Renal cortex
  - Renal pyramids
  - Renal pelvis
    - Major calicies
    - Minor calicies
- Gross vasculature
  - **Renal arteries**
  - Branch into **segmental arteries**

- %20-25 of cardiac output
- 1,2 lt/min – 1700 lt/day
- 170 lt/day glomerulary filtrate
- 1,7-2 lt/day urine

- ***Renal artery***
  - Abdominal aorta
  - L1-L2

Nephron – The Functional Unit of Kidney

- Nephron consists of:
- Renal corpuscle
- Renal tubule:
  - Proximal convoluted tubule (PCT)
  - Loop of Henle
  - Distal convoluted tubule (DCT)
- Nephron empties tubular fluid into a system of collecting ducts and papillary ducts

Renal Corpuscle

- Consists of:
  - Glomerulus – tuft of *fenestrated* capillaries
  - Glomerular (Bowman's) capsule
    - Parietal layer – simple squamous epithelium
    - Visceral layer – consists of podocytes
- Blood travels from efferent arteriole to peritubular capillaries
- Blood leaves the nephron via the efferent arteriole

Glomerulus anatomy

- Podocytes cover lamina densa of capillaries
  - Project into the capsular space
  - Pedicels of podocytes separated by filtration slits

Two types of nephron

- Cortical nephrons
  - ~85% of all nephrons
  - Located in the cortex
- Juxtamedullary nephrons
  - Closer to renal medulla
  - Loops of Henle extend deep into renal pyramids

Nephron

- Proximal convoluted tubule (PCT)
- Loop of Henle
  - Descending limb
  - Ascending limb
  - Each limb has a thick and thin section

Nephron

- Distal convoluted tubule (DCT)
  - Actively secretes ions, toxins, drugs
  - Reabsorbs sodium ions from tubular fluid

Collecting Tubules (Collecting ducts)

- Collecting tubules - Receive urine from distal convoluted tubules

Figure 23.8

Types Of Capillary Beds In Nephron

- **Glomerulus -** Fed and drained by afferent and efferent arterioles
- **Peritubular capillaries**
  - Arise from efferent arterioles
  - Low-pressure, porous capillaries
  - Absorb solutes
- **Vasa recta**
  - Thin-walled looping vessels
  - Part of the kidney's urine-concentrating mechanism

Mechanisms of Urine Production

- **Filtration -** filtrate of blood leaves kidney capillaries
- **Reabsorption –** most nutrients, water, and essential ions reclaimed
- **Secretion - a**ctive process of removing undesirable molecules

Summary of Nephron Function

- Each segment of nephron and collecting system contribute
  - Glomerulus
  - PCT
  - Descending limb
  - Thick ascending limb
  - DCT and collecting ducts
- Concentrated urine produced after considerable modification of filtrate

Urine Excretion

- Leaves Collecting System
- Enters renal pelvis
- Rest of urinary system transports, stores and eliminates
  - Ureters
  - Bladder
  - Urethra

Histology of Ureter

- Mucosa – **transitional epithelium**
- **Muscularis** – two layers
  - Inner longitudinal layer
  - Outer circular layer
- **Adventitia** – typical connective tissue

URETERS

- Abdominal part
- Pelvic part
- Intramural part
  - 1,5-2 cm

Urinary Bladder

- A collapsible muscular sac
- Stores and expels urine
  - Full bladder – spherical
    - Expands into the abdominal cavity
  - Empty bladder – lies entirely within the pelvis

BLADDER

- 350-500 ml
- Posterior to pubic symphysis
- Pelvis floor
- Retroperitoneal
- Male
  - Anterior to rectum, superior to protate
- Females
  - Anterior to uterus and vagina

BLADDER

- Apex
- Fundus
  - Trigone
- Corpus
- Cervix
  - Internal urethral opening

URETHRAE

- URETHRAE MASCULINA
- URETHRAE FEMININA

Urinary Bladder and Urethra - Male

- Males – 20 cm in length
- Three parts
  - Prostatic urethra
  - Membranous urethra
  - Spongy (penile) urethra

Urinary Bladder and Urethra - Female

- 3–4 cm
- **trigone**