The urinary system
- Structure and physiology of the kidney
- Major urinary structures and their function
- Urine: formation of and normal components and characteristics of
- Role of the renal system in fluid and electrolyte balance

Kidney location

Approximately 1/4 of our blood is filtered by the kidneys every minute!
Kidneys are partly responsible for blood composition

Nephrons
Structural and functional unit of kidneys; responsible for urine formation
Consists of two main structures:
- glomerulus
- renal tubule
Two types of nephrons:
- juxtamedullary
- cortical

Nephron anatomy
Nephron anatomy

Urine formation

Filtration
Tubular reabsorption
Tubular secretion

Filtration
Takes place at glomerulus
Non-selective, passive process
Filtrate is essentially blood plasma without any proteins
Normal blood pressure is normally sufficient for filtrate formation

Tubular reabsorption
Mostly occurs in proximal convoluted tubule
Many useful substances must be reclaimed by the blood (water, glucose, amino acids, ions)
Some is done passively (water --> osmosis)
Most is done actively (requires ATP); tubules contain selective transporters
Waste products (urea, uric acid, creatinine) are hardly reabsorbed at all
Ions are reabsorbed selectively, depending on need

Tubular secretion
Essentially reabsorption in reverse
Important for getting rid of substances not already in the filtrate such as drugs
Can also be used to control blood pH

Urine formation
Urine

In 24 hours, you filter about 175 liters of blood plasma
You only produce 1-1.8 liters of urine
Urine contains nitrogenous wastes and unneeded substances
Generally clear to deep yellow (yellow is due to urochrome)
Urine is sterile
Smells like ammonia only after bacteria have invaded it

Kidney functions

(1) Excretion of nitrogenous wastes
(2) Water and
(3) Electrolyte balance of the blood
(4) Ensuring proper blood pH

Water balance

Water is probably between 50-60 percent of your body mass
Even though water plays a large role in our body, salts (electrolytes) must also be taken into consideration

Maintaining proper hydration

Water and electrolyte reabsorption in the kidneys is regulated by hormones
When blood pressure drops, osmoreceptors signal the release of antidiuretic hormone, which causes increased water reabsorption

Maintaining proper hydration

When blood is too dilute, aldosterone inhibits the absorption of sodium, which causes water to flow into the blood
Blood acid-base balance

Blood pH must be maintained between 7.35-7.45

Hydrogen ions continuously are produced in the body, thus disturbing the acid-base balance. The three major blood buffers are:

- Bicarbonate
- Phosphate
- Protein buffers

Respiratory system controls

Renal control

Kidneys maintain acid-base balance by:

- Excreting bicarbonate ions
- Reabsorbing bicarbonate ions