Digestion:

- breaking down of carbon compounds into smaller compounds for absorption.
- Mechanical Digestion: physical breaking up of food.
    - peristalsis (longitudinal movement in one direction)
    - segmentation (circular movement to help churn/mix)
    - mouth- chewing.
- Chemical Digestion: enzymes/bile/acids to breakdown food.
- Alimentary Canal: Where food moves through.
    - Stomach, Mouth, Esophagus, Small Intestine, Large Intestine
    - Mouth: chews food and produces amylase in salivary glands to help moisten food and break down starches,
    - Esophagus: transport from mouth to stomach.
    - Stomach: produces acids (pepsin) to help break down large carbon compounds to smaller; acidic environment with mucous membrane to protect gastric lining – initial stages of protein digestion.
    - Small Intestine: secretes enzymes and absorbs smaller monomers (nutrient absorption)
    - Large Intestine: absorption of water and ions.
- Accessory organs: Organs that aid in digestion
    - Liver: produces surfactants in bile (which is stored in gall bladder) to help break down lipid droplets in the small intestine. (emulsification)
    - Pancreas: Produces pancreatic enzymes into the small intestine:
        - Protease: breaks down polypeptides.
        - Lipase: breaks down triglycerides and phospholipids.
        - Amylase: breaks starch into maltose and dextrin
        - Releases alkaline compounds into small intestine.

Small intestine: secretes enzymes for further digestion to be absorbed:

- nuclease: nucleotides.
- Maltase: maltose -> glucose
- Lactase: lactose -> glucose and galactose
- Sucrase: sucrose -> fructose and glucose.
- exopeptidase: polypeptides -> dipeptides.
- Dipeptidase: dipeptides -> amino acids.

Glucose is polar and hydrophilic, so it absorbed with active transport through phospholipid bilayer.
amino acids – active transport
most monosaccharides – facilitated diffusion.
water- osmosis
exocytosis
Small intestine structure:
SMSM:

- serosa (outermost)

- muscle layer (movement)
- sub-mucosa
- mucosa (has villi -> microvilli (for increased surface area) to increase absorption.
- Epithelial cells on the villi.

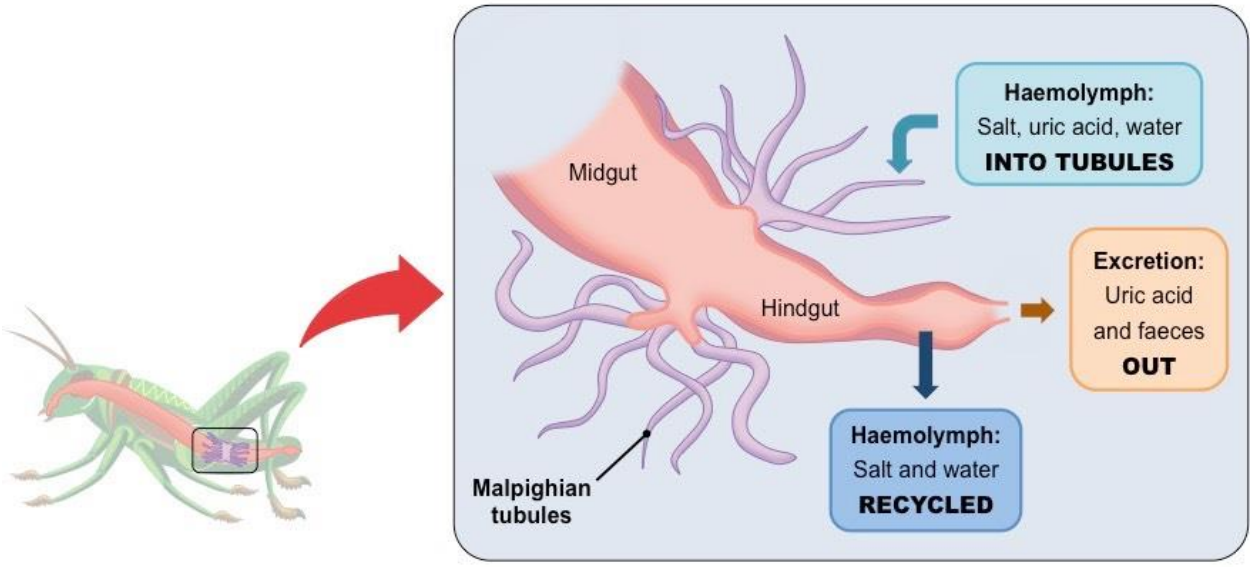
Amylase is produced in salivary glands and pancreas breaks down starch -> maltose (amylose) and dextrin (amylopectin) in small intestine.
Maltase in small intestine breaks down maltose to glucose to be absorbed.

protease -> product is amino acids.
Amylase-> product is maltose.

Kidney and Osmoregulation (AHL)

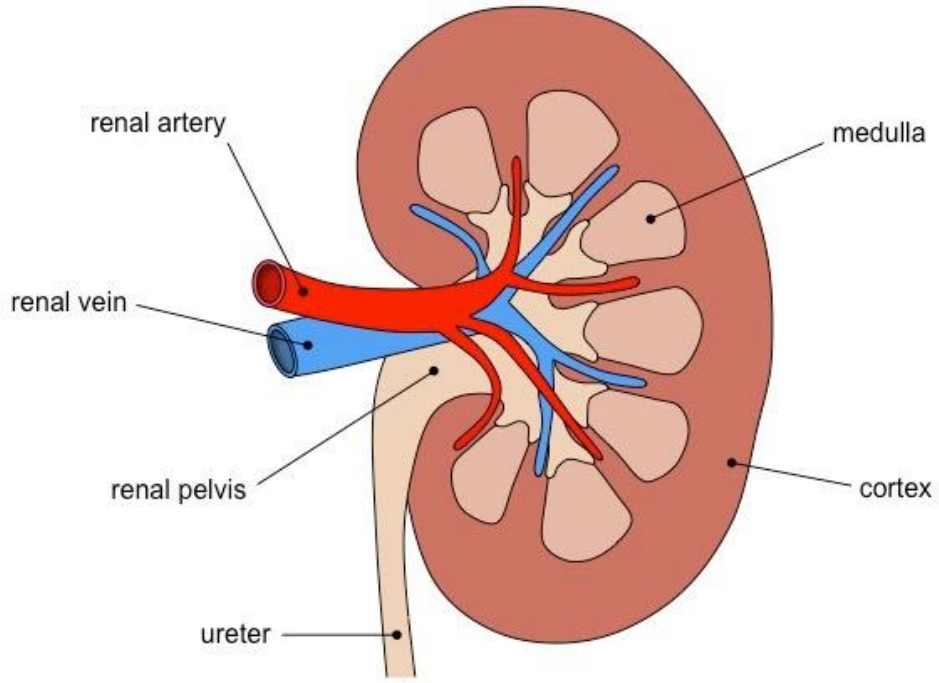
Excretory system: removal of nitrogenous wastes and excess water.
Insects: Malpighian tubules
Humans: kidneys

Malpighian Tubules:
hemolymph (uric acid and water) -> Malpighian tubule -> hindcut -> rectum

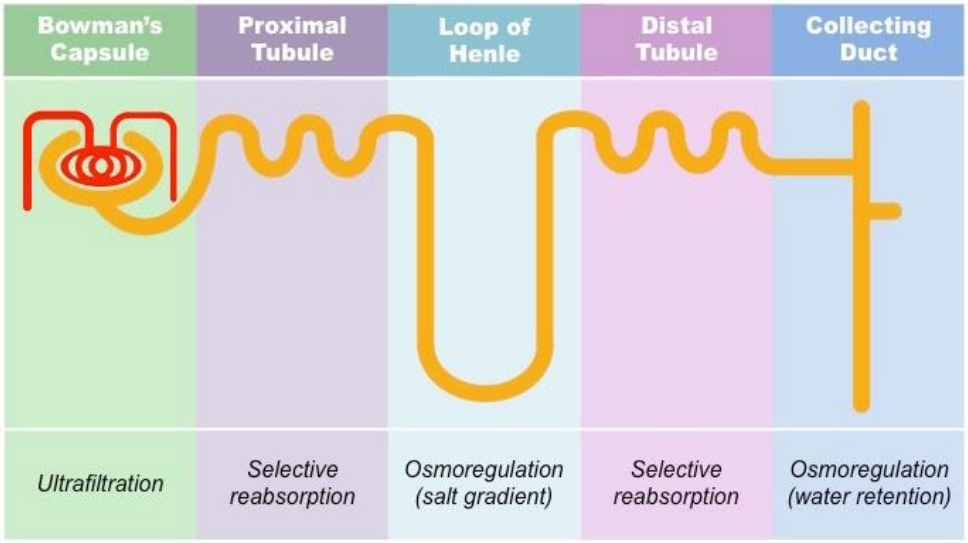


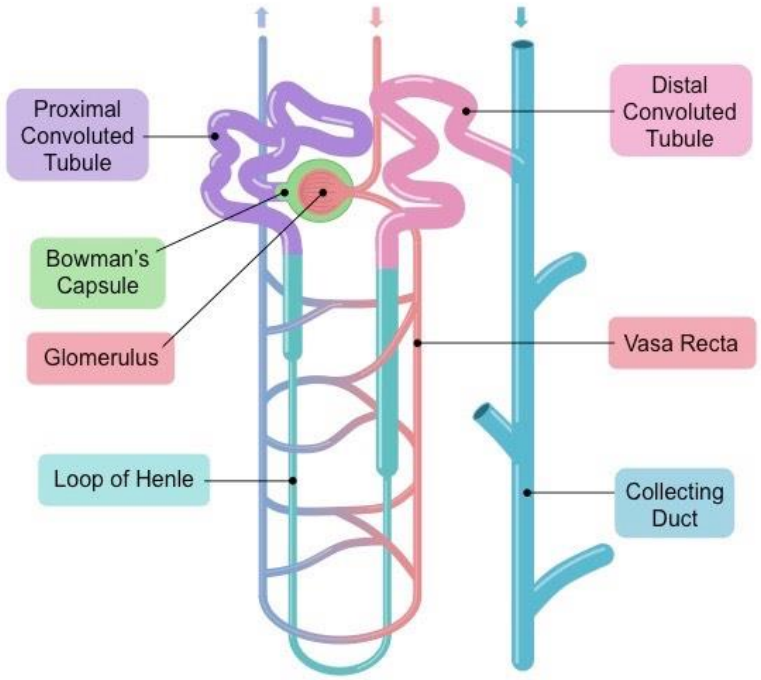
Osmolarity: regulation of solute concentration in a solution
Osmoregulation: maintain constant internal solute concentration (requires energy but is unaffected by environment)
Osmoconformers: match solute concentration to environment (no energy)

Kidney: Osmoregulator, excretion



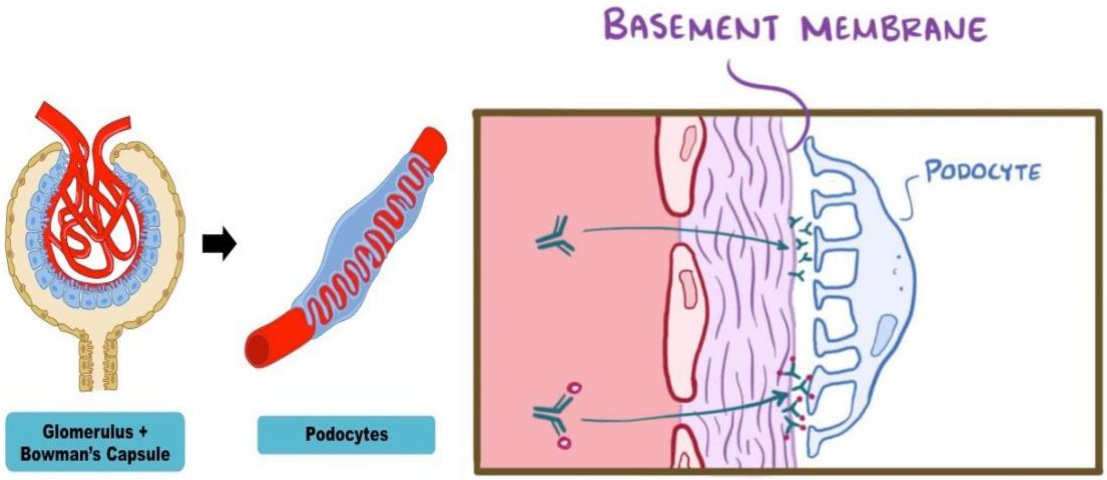
Renal artery: smaller diameter
Renal vein: larger diameter
Renal artery: more toxins, excretory waste, oxygen, glucose, water, salt
Cortex: where the glomeruli is (ultrafiltration units)
Nephrons: filter blood and reabsorb useful materials from filtrate before eliminating the remainder





Glomeruli:
bed of capillaries-> covered by basement membrane and pedicels.
Fluid must pass through fenestrations in the capillaries, basement membrane mesh, and gaps between pedicels when filtered.

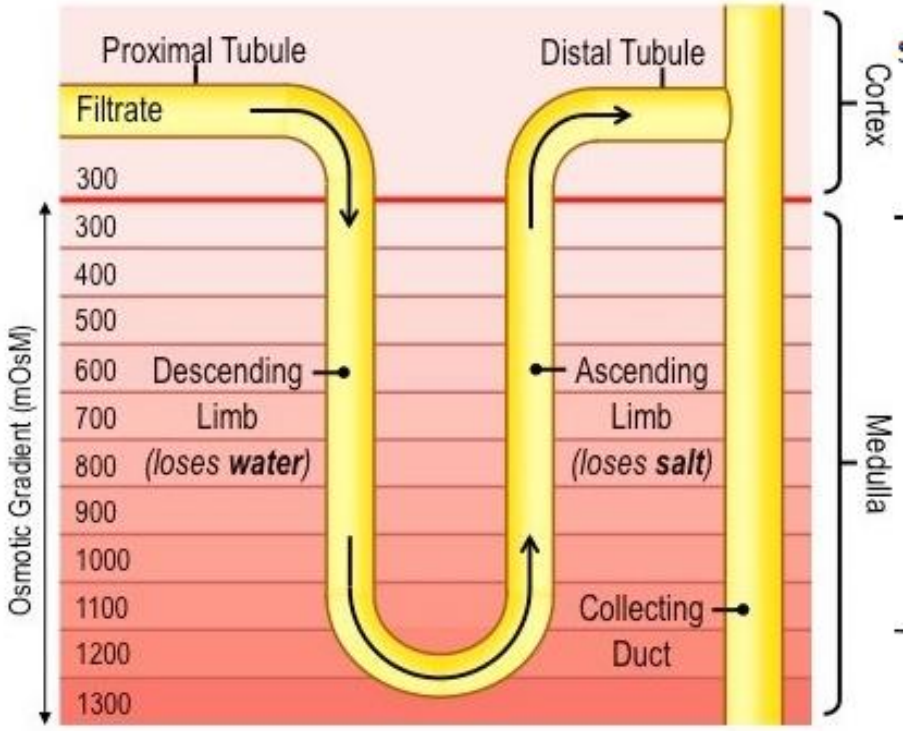
only small molecules can pass through basement membrane, proteins cannot.
Ultrafiltration: blood is filtered out of glomerulus to the bowman's capsule to form filtrate.
Increased pressure can push fluid through glomerulus.



Proximal convoluted Tubule:
selective reabsorption -> glucose/amino acids is absorbed back into blood stream from filtrate through active transport.

- water – osmosis
- mineral ions – protein pumps
- hormones- carrier proteins'
- microvilli can increase surface area for absorption and increased number of mitochondria.

Osmoregulation: loop of Henle:
salt gradient created.
On descending limp: there is a hypertonic solution of medulla: water is reabsorbed.
Ascending: salt is reabsorbed.



Distal Convoluted Tubule: also, selective reabsorption

- excess water, metabolic waste, goes to collecting duct for excretion.
- Water can be drawn out of collecting duct.

ADH: antidiuretic hormone: released when dehydrated so that water can be reabsorbed from permeable collecting duct and increased release of water in blood stream to be retained.

- urine is more concentrated.

Dehydration: more water leaves the body than comes in (body fluid is hypertonic)

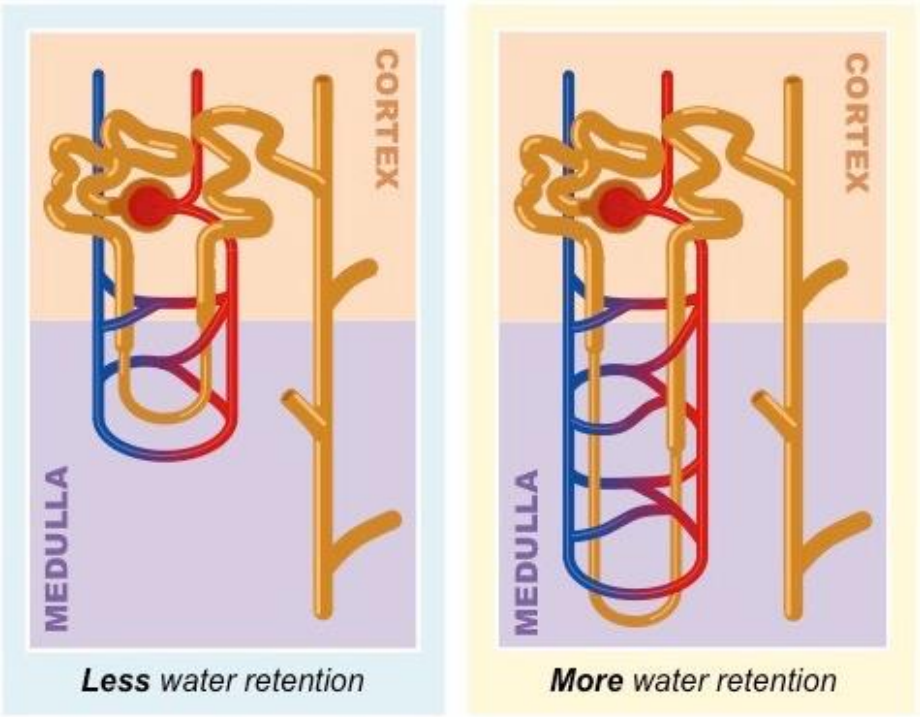
- thirst, concentrated urine, decreased bp, increased heart rate, decreased ability to regulate body temp.

Overhydration: body fluid is hypotonic:

- increased (diluted) urine output, swelling of cells, headache, nerve function is disrupted.

Longer loop of Henle = more water reabsorbed (during descending limp)

- common for animals in dry environments
- thick medulla



Urinalysis: see blood cells, glucose, proteins, drugs in the urine.

Kidney failure:

- hemodialysis: external filtration
- kidney transplant

Uric acid (insects), ammonia (break down of amino acids) – sea animals, urea (humans)

Uric acid can be secreted in more concentrated forms than ammonia.