Excretion

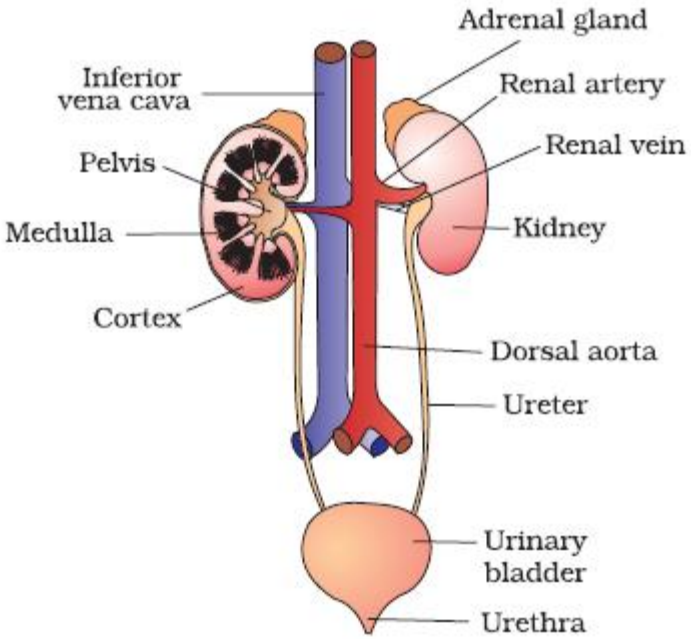

Figure 19.1 Human Urinary system

- Excretion is the removal from the body of the waste products of metabolism, toxic materials and substances in excess of requirements

Excretory products

- Carbon dioxide made in the body tissues during respiration, it is transported to the lungs in the blood plasma
- Urea is made in the liver from excess amino acids
- Substances that are excreted are produced by cells during metabolism
- Substances that have been egested have been eaten and passed through the alimentary canal without being digested and absorbed into the bloodstream

Assimilation

- Assimilation means that food molecules that have been absorbed now becomes a part of the cells or are used by cells

The functions of the liver as part of assimilation

- Stores glucose by removing it from the blood and storing it as glycogen. This helps to regulate the concentration of glucose in the blood
- Uses amino acids to make proteins such as fibrinogen
- Breaks down excess amino acids
- Converts fatty acids and glycerol into fat which is stored around the body
- Produces cholesterol from fats

Roles of the liver

- The liver carries over 200 different roles in the body
- All the blood from the digestive system flows through the digestive system before going into the rest of circulation
- The liver makes bile to neutralise acid when entering the small intestine and emulsifies fat
- The liver breaks down harmful substances such as alcohol and drugs

Deamination

- Excess amino acids are broken down by the liver
- Each amino acid is broken down into two by the proves of deamination
- One molecule is converted to carbohydrate or fat and used as a source of energy
- The other molecule is ammonia which combines with carbon dioxide to form urea
- This is carried to the kidneys, filtered and excreted as urine

Kidney structure

- Responsible for the excretion of urea and excess salts from the body
- They control the concentration of water and ions in the body
- Waste chemicals are transported to the kidney
- Blood enters the kidneys through the renal artery
- Inside each kidney is a complex network of filtering units called kidney tubules
- As the blood flows through the units, small molecules such as glucose, salts, water and urea are forced out of the blood plasma to form the filtrate
- The filtrate passes along the tubule and useful substances are reabsorbed into the blood
- The volume of water reabsorbed depends on the body's water concentration
- If you are dehydrated the body will reabsorb as much water as possible and produce concentrated urine to preserve water
- If you have taken in a lot of water or it is really cold, the kidneys will absorb less water and you will produce dilute urine
- At the end of each tubule, urine is released and flows into the ureter and to the bladder where it is stored
- From here it leaves the body, at intervals, through a shorter tube called the urethra
- The renal vein carries blood with a low concentration of chemicals away from the kidneys

Inside the kidneys

- If you cut open the kidney lengthways, youkan see the areas;
    i. The cortex- a brown outer layer
    ii. The medulla- a reddish inner area
    iii. The pelvis- a white area
- Inside each kidney are thousands of tiny tubes called kidney tubules which you can only see with a microscope
- The function of the kidney tubules is to filter blood and remove waste chemicals and determine how much water is excreted
- The filtering is carried out in the cortex
- The waste chemcials and excess water are removed from the body in the urine which flows from the kidneys down the ureter and is stored in the bladder

Kidney Functions

Structure of a kidney tubule

- Blood containing waste chemicals flows into the kidney via renal artery
- Renal arteries branch into many arterioles, arterioles supply blood to closely packed capillaries called a glomerulus
- After filtration, blood flows out of the glomerulus into another arteriole
- Blood flows around the rest of the tubule which joins to form the renal vein
- The kidney consists of a Bowman's capsule at one end
- The end of the kidney tubule drains into a collecting duct which goes through the medulla, empties in the pelvis and then flows into the ureter

Filtration

- Blood pressure in renal artery is high, blood vessel entering glomerulus is thicker than blood vessel leaving it, more blood entering glomerulus than leaving it, causes pressure, pressure causes the blood to be filtered

- Ling of capillary is like a net, blood cells and large molecules, like blood proteins are too big to pass through wholes so remain in blood
- Small molecules like urea, glucose, salts, and water pass out of the glomerulus into the Bowman's capsule

Reabsorption

- All glucose, some salts and much water is reabsorbed in kidney tubule/nephron
- Reabsorption requires active transport
- Adaptations to reabsorption:
    i. Microvilli provide a large surface area for reabsorption
    ii. Numerous mitochondria provide energy for active transport
- After reabsorption, excess salts and urea are dissolved in water
- Fluid flows through nephron some water may be reabsorbed by body if low concentration of water in body
- Fluid enters collecting ducts as urine
- Flows from collecting duct to ureter and then bladder
- Urine collects and stored in bladder
- Expelled through urethra at intervals
- Blood leaving kidneys has lower concentration of waste chemicals

Kidney Dialysis

- Protein in the urine indicates damage to the glomeruli, ruptured membranes allow larger molecules to pass through
- A person can survive with one kidney that has only 10-15% normal function

Dialysis

- A tube is connected to one of the patient's veins
- Blood flows along the tube into the machine
- Blood is pumped over a surface of dialysis membrane-membrane separates blood from dialysis fluid
- Dialysis fluid contains glucoses and salts (in normal concentrations0 so net movement of these access membrane
- Waste and urea leaves the machine in the dialysis fluid
- Cleaned blood passes back into vein
- Membrane is semi permeable
- Dialysate has the same water potential as blood as it contains no excess salts
- Dialysate contains no toxic chemicals or urea initially
- Blood and dialysate moves in opposite directions
- All of the toxic chemicals and urea will diffuse into the dialysate
- Only excess water and salts diffuse across the membrane into the dialysate
- Proteins can't move across the membrane
- The small arrows indicate a nett movement of substances into the blood due to a lower concentration of water/salts

Advantages

i. There is no shortage of dialysis machines

Disadvantages

i. Dialysis is expensive in the long run
ii. Patients have to stick to a strict diet
iii. Dialysis patients require treatment 3 times a week, each lasting for 4 hours

Kidney Transport

- Replaces the dysfunctional kidney with a healthy one from a donor
- Blood type and tissue type needs to be matched reduces chances of rejection due to immune attack on new tissue
- Immune suppressants drugs are given

Advantages

i. Transplant is completed once and doesn't require weekly hospital treatments
ii. Allows patients to lead a normal life

Disadvantages

i. Shortage of kidneys-need to match tissue and blood type
ii. Patients have to take immune suppressant drugs ∴ more susceptible to disease
iii. Generally last for 8 years, immune system can reject transport immediately or after a few years