# THE HUMAN EXCRETORY SYSTEM

- Excretion - Excretion is the removal of the metabolic wastes of an organism. Wastes that are removed include carbon dioxide, water, salt, urea and uric acid. All excreted wastes travel at some time in the blood.
- Organs of the Excretory System
  1. Lungs – removal of excess carbon dioxide
  2. Liver – produces urea and uric acid as a by-product of the breakdown of proteins
  3. Skin – removal of excess water, salt, urea and uric acid
  4. Urinary System – kidneys filter the blood to form urine, which is excess water, salt, urea and uric acid

# THE SKIN

- 2 Layers of the Skin
  1. Epidermis – outer protective layer without blood vessels
  2. Dermis – inner layer containing blood vessels, sensory nerve endings, sweat and oil glands, hairs, and fat cells
- Functions of the Skin
  1. Excretion – Wastes such as excess water, salt, urea and uric acid are removed from the body in sweat.
  2. Waterproofing – The skin with its oil glands prevents the entry of water into, and loss of water out of the body.
  3. Protection from Disease – The intact skin prevents invasion of micro-organisms and dust into the body.
  4. Protection from Ultraviolet Rays – Pigments reduce the intake of UV rays.
  5. Regulation of Body Temperature – The thin layer of fat cells in the dermis insulates the body. Contraction of small muscles attached to hairs forms 'goosebumps' and creates an insulating blanket of warm air. Also, sweat produced by sweat glands uses excess body heat to evaporate, providing a cooling effect.
     In an unusual case, if a person has a fever as a result of infection, the body may lose so much heat in a short time by radiation to the surroundings that the person may experience 'chills'.
  6. Sensory Detection – The nerve endings or receptors in the dermis detect heat, cold, touch, pressure and pain.

*Refer to the diagram of Human Skin in your textbook.*

*Did You Know That…?* Skin wrinkles after a bath because water soaks into the callus of the skin in areas such as hands and feet where it is particularly thick, and this causes distortion of the skin.

# THE URINARY SYSTEM

Urine

- The first nitrogenous waste to be formed from the breakdown of protein is ammonia, a highly toxic chemical that is quickly converted to urea and uric acid in the liver. These other nitrogenous wastes are less toxic and are transported in the blood to the kidneys for excretion in urine. Urine consists of excess water, excess salt, urea and uric acid.

## Parts of the Urinary System

*Refer to the diagram of the Human Urinary System in your textbook.*

- Renal Arteries – 2 renal arteries constantly transport blood to the kidneys.
- Kidneys – 2 kidneys composed of millions of nephrons constantly filter about 170 to 200 litres of blood to produce about 1.5 to 2 litres of urine daily.
- Renal Veins – 2 renal veins return useful nutrients back into the body circulation.
- Ureters – 2 ureters carry urine from the kidneys to the urinary bladder.
- Urinary Bladder – The urinary bladder temporarily stores urine until it is released from the body.
- Urethra – The urethra is the tube that carries urine from the urinary bladder to the outside of the body. The outer end of the urethra is controlled by a circular muscle called the urethral sphincter.

## The Structure of the Kidney

*Refer to the diagram of the Human Kidney in your textbook.*

- There are 2 kidneys located on the dorsal wall of the abdominal cavity.
- Each kidney has 3 regions, the outer cortex containing the glomerulus and Bowman's Capsule and the proximal and distal convoluted tubules of the nephrons, the middle medulla containing the Loop of Henle and the collecting tubule of the nephrons, and the inner pelvis which transfers the urine into the ureter.

## The Nephron

*Refer to the diagram of the Human Nephron in your textbook.*

- The nephron is the basic filtering unit of the kidney.
- There are over 1 million nephrons in each kidney.
- 2 important processes occur in the nephron – filtration and reabsorption.

### Filtration

- Blood pressure of the Renal Artery forces blood plasma fluid to be filtered through the walls of the Glomerulus into Bowman's Capsule.
- Blood cells and large proteins remain in the glomerulus.
- The filtrate which enters Bowman's Capsule contains a large amount of water, salt, urea and uric acid to be excreted, but also useful nutrients that the body needs such as glucose. The filtrate does not contain blood cells nor large proteins.

### Reabsorption

- As the filtrate containing both wastes and useful nutrients passes through the Convoluted Tubules and the Loop of Henle, the useful substances such as water and glucose are reabsorbed through the walls of the tubule into blood capillaries, and then back into the Renal Vein. Water is reabsorbed passively by osmosis. Glucose is reabsorbed by active transport.

- Desert animals need to reabsorb more water and therefore have a very long Loop of Henle in each nephron. A cross-section of the kidney of a desert animal would show a thicker medulla.
- The urine formed then travels through the Collecting Tubule to the pelvis of the kidney and then to the ureter.

*Did You Know That…?*

- People urinate more in winter than in summer. In summer, a lot of water is lost through sweating, and there is less water left to urinate.
- Normal urine in the urinary bladder contains no bacteria. It is sterile.