Excretion: The process of ridding the body of waste in order to maintain homeostasis.

Structures involved in Excretion

- Skin → Sweat is removed by the skin as a waste product (trying to remove heat)
- Lungs → Removes waste gases such as CO₂
- Liver → Removes Nitrogenous waste (Urea)

HUMAN EXCRETORY SYSTEM

Function:
- The excretory works to maintain proper water balance in the body and to also remove liquid waste (urine).

Parts of the Human Excretory System

A. Kidney
B. Ureters
C. Urinary Bladder
D. Urethra

A. KIDNEY
- The kidney is a lima bean shaped structure found on both sides of the spinal column in the lower back.
- Function of Kidneys: Maintain water balance and rid the body of nitrogenous wastes (Urine) created by the liver.

STRUCTURE OF THE KIDNEY

The kidney has three distinct regions:
1. Renal Cortex
2. Renal Medulla
3. Renal Pelvis

1. RENAL CORTEX
   - The outer region of kidney.
   - Function: Filter Blood

2. RENAL MEDULLA
   - This is the middle region of the kidney. Made up of collecting ducts.
   - Function: Collects filtrate (filtered materials from the blood) and carries it to the renal pelvis.

3. RENAL PELVIS
   - This is the inner section of the kidney. It is a cavity in the center of a kidney connected to the ureters.
   - Function: Filtrate (now called urine) drains from the pelvis into the ureters for removal.
B. **URETERS**
   - Hollow tubes connecting the renal pelvis to the Urinary bladder.
     - Function: Carry urine from the kidney to the urinary bladder.

C. **URINARY BLADDER**
   - Hollow muscular pouch located in the pelvic area of a human.
     - Function: Hold urine until it is released from the body. A typical bladder is able to hold up to about 500 mL of urine.

D. **URETHRA**
   - Hollow tube leading from the urinary bladder to the outside of the human body.
     - Function: Carry urine from the bladder to the outside of the body.

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### THE KIDNEY NEPHRON

**Nephron:**
- The basic functional unit of a kidney.
- This is the structure responsible for filtering the blood and maintaining proper water balance.
- There are about 1.25 million nephrons per kidney.
- The kidney Nephron extends from the renal cortex (glomerulus/Bowman’s capsule) into the renal medulla (Loop of Henle).

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### STRUCTURE OF A NEPHRON

**Parts of a Nephron:**

a. **Renal Artery:** This is the artery that carries blood TO the kidney to be filtered.

b. **Renal Vein:** This is the vein that carries blood FROM the kidney AFTER it has been filtered.

c. **Glomerulus:** A tight ball of blood capillaries located in the bowman’s capsule of Nephron. Blood Pressure created here causes materials to be filtered from the blood.

d. **Bowman’s Capsule:** A cup-shaped structure that receives filtrate from the glomerulus.

e. **Proximal Tubule:** Tube connected to the Bowman’s capsule. Filtrate enters the proximal tube from the Bowman’s capsule. **Reabsorption of amino acids and glucose occurs here.**

f. **Loop of Henle:** Long U-shaped tube that extends into the renal medulla. Responsible for maintaining salt balance by reabsorbing or releasing salt in the filtrate.

g. **Distal Tubule:** Tube extending from the loop of henle. It also reabsorbs materials from the filtrate. **Tubular secretion occurs here.** Materials such as creatinine and drugs are added to the filtrate.

H. **Collecting Tubule:** Tube that extends from the distal tubule to the renal pelvis. This portion of the Nephron is mainly responsible for reabsorption of water.
THE FORMATION OF URINE

Urine (A liquid of water, urea and salts) is created in two stages.

**Filtration**

- During this stage, blood in the glomerulus is put under pressure and materials such as urea, glucose, salt and water are forced out of the blood and into the Bowman’s capsule.

**Reabsorption**

- This is the reabsorbing of materials from the filtrate back into the body. This happens all the way along the Nephron, especially in the collecting tubules.
- When all materials possible have been reabsorbed into the body by the Nephron, what remains is called Urine.

THE NEPHRON AND WATER BALANCE

The Nephron helps to maintain water balance in the body via the collecting tubules.

The collecting tubules have cells whose permeability is affected by a hormone called **Vasopressin** or **Antidiuretic Hormone (ADH)**

**Two cases to consider**

A. **NOT ENOUGH WATER IN THE BODY.**

- ADH IS RELEASED by the PITUITARY.
- ADH causes cells in the collecting tubules to become **PERMEABLE** to water. Water is reabsorbed by the body.

**NOTE:** When this happens the colour of urine becomes much darker.

B. **TOO MUCH WATER IN THE BODY**

- ADH is NOT secreted and the cells in the collecting tubules DO NOT reabsorb water.
- Excess water is secreted out through the ureters.

**NOTE:** When this happens the colour of urine becomes lighter.
Excretory System Disorders

These are problems associated with the kidneys, bladder, ureters.

We will examine the following disorders:

1. Urinary Tract Infections
   - Cystitis
   - Urethritis
   - Pyelonephritis

2. Kidney Stones

### 1. Urinary Tract Infections, UTI's

- These are *Bacterial infections* of the kidneys, bladder or Urethra.
- There are 3 types of UTI’s

1. **Cystitis** → Infection of the **Bladder**.
2. **Urethritis** → Infection of the **Urethra** (tube leading from the bladder to the outside of the body)
3. **Pyelonephritis** → Infection of the **Kidney**

**Causes of UTI’s**

- Bacteria from the anus (females).
- Blocked Prostate (men)
- Bacterial Infection from other areas of body.

**Note:** UTI’s are more *common* in females than males.

**Symptoms of UTI’s**

- Painful urination
- Burning sensation
- Bloody or brown urine
- Chills, fever, nausea

**Dangers of UTI’s**

- Permanent damage to kidneys and possible kidney failure.

**Treatments of UTI’s**

- Antibiotics
2. Kidney Stones

What are Kidney Stones?

- These are **hard crystals** of calcium oxalate or uric acid that form in the kidney, bladder or ureter/urethra
- Kidney stones form when materials in the urine solidify.
- Kidney stones are more common in men than women.

Causes of Kidney Stones?

- Urinary tract infections
- Not drinking enough water
- Too much vitamin C and D.

Symptoms of Kidney Stones

- Severe pain in abdomen and back.
- Blood in urine
- Nausea
- Vomiting

Treatments of Kidney Stones

- Change diet
- Drink lots of water
- Ultrasound (breaks up the stone so it can pass)
- Surgery