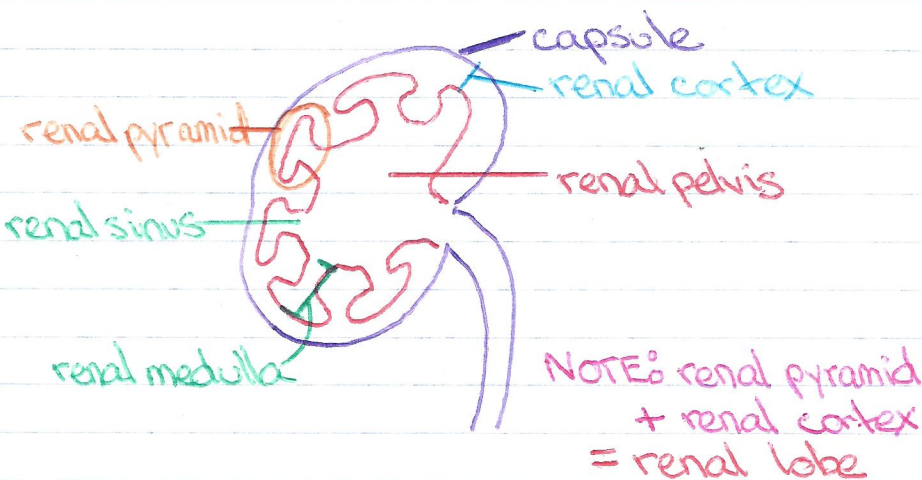


## MAJOR ORGANS OF THE URINARY SYSTEM

- 1) Kidneys - produce urine
- 2) ureter - carries urine from kidneys to bladder.
- 3) bladder - stores urine
- 4) urethra - moves urine out of the body.



## KIDNEY ANATOMY



## WASTE PRODUCTS IN URINE

- 1) Urea - formed by metabolism of proteins.  
\* produces toxic ammonia  $\text{NH}_3$  which combines with  $\text{CO}_2$  to form urea.
- 2) Creatinine - produced by breakdown of creatine phosphate  
\* backup energy molecule to ATP, used in muscle cells.
- 3) Uric Acid - produced by metabolism of nucleic acids  
\* buildup of crystals in joints causes pain and swelling. Gout.

## URINE FORMATION

### 3 STEPS

#### 1) Pressure Filtration

→ small molecules ( $H_2O$ , salts, nutrients, waste) filtered through capillaries into Bowman's Capsule  
\* fluid called glomerular filtrate

#### 2) Selective Reabsorption

→ Diffusion of  $NaCl$  reabsorbed in Proximal Convuluted Tubule  
→ Active Transport of Nutrients reabsorbed.

#### 3) Tubular Excretion

→ Active Transport large molecules into Distal Convuluted Tubule.

## URINE SHOULD NOT CONTAIN...

### Should NOT be found in urine...

1) protein - high BP, large proteins pushed out during pressure filtration.

2) blood - bruised kidneys, cause tubules & enters collecting duct capillaries to break in nephron.

3) glucose - ↑ blood glucose cause some to remain in urine, normally all reabsorbed  
urine output increased

4) nutrients - selective reabsorption not happening

bacterial infections originating in urethra can travel up to kidneys

\* No Urine Output = Kidney Failure

## HORMONES REGULATING WATER

### Hormones

1) Renin - produced in Juxtaglomerular Apparatus secreted when BP & BP become low (dehydration)

2) Aldosterone - produced in Adrenal glands  
 $Na^+$  &  $H_2O$  move out of Loop of Henle and into blood & concentrated urine

3) Atrial Natriuretic Hormone (ANH) - produced by atriet.  
stops juxtaglomerular apparatus from producing renin.

4) Anti-Diuretic Hormone (ADH) - produced in hypothalamus  
causes kidneys to absorb more water.

## NERVOUS SYSTEM FUNCTION & DIVISIONS

**Function:**  
1) collect & interpret sensory information, so the body can appropriately react.  
2) regulates & coordinates functions of other <sup>body</sup> systems.

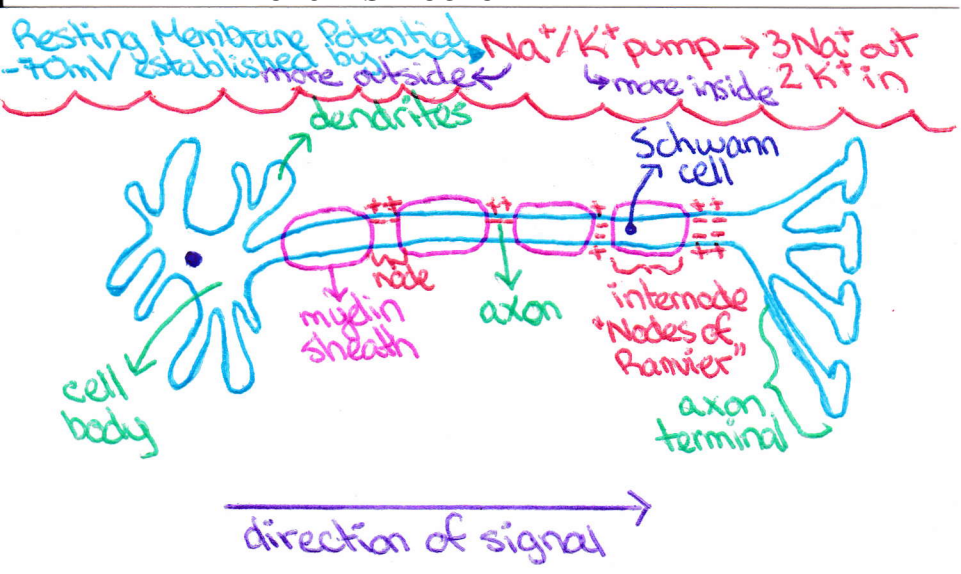
**Major Parts:** Brain, spinal cord, nerve cells (neurons, neuroglia)

- Divisions:**
- ① Central Nervous System CNS  
- brain & spinal cord
  - ② Peripheral Nervous System PNS  
- nerve tissue outside brain & spinal cord

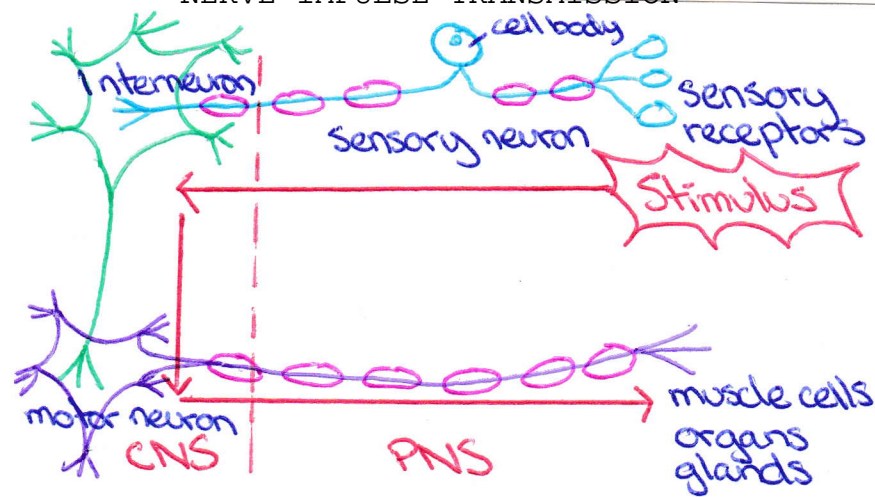
## TYPES OF NEURONS

- ① Sensory neuron  
→ receives stimuli & sends info from PNS to CNS  
cell body & axon ← → axon terminal
- ② Interneuron  
→ receives signal from PNS (sensory neuron) & sends within CNS.
- ③ Motor neuron  
→ sends signal from CNS to an effector within PNS.  
(muscle cell, organ, gland)

## NEURON STRUCTURE



## NERVE IMPULSE TRANSMISSION



## SALTATORY CONDUCTION

→ speeds up conduction from 0.5m/s to 150m/s or 540km/hr as action potential skips from node to node.

**PNS** → myelinated neurons allows impulse to travel long distances.

**CNS** → myelinated (white matter) lipid/fat  
• inside brain, transmits signals to the spine  
→ non-myelinated (grey matter)  
• outside brain

## PROTEIN CHANNELS

### 1) Na<sup>+</sup> channels

- opens with stimulus
- Na<sup>+</sup> diffuses in.

### 2) Voltage gated Na<sup>+</sup> channels

- opens when membrane potential reaches -55mV.
- Na<sup>+</sup> diffuses in.

threshold  
↓

### 3) Voltage gated K<sup>+</sup> channels

- opens when membrane potential reaches +35mV
- K<sup>+</sup> diffuses out.
- \*Na<sup>+</sup>/K<sup>+</sup> pump re-establishes RMP (-70mV)

## DEPOLARIZATION VS. REPOLARIZATION

### Depolarization

→ occurs as membrane potential changes from  $-70$  to  $+35$  mV.

### Repolarization

→ occurs when membrane potential returns to resting state  $+35 \rightarrow -70$  mV.