Cheatography

Biology - Module 5.3 Cheat Sheet

by Taalithaa (Taalithaa) via cheatography.com/183017/cs/40375/

The kidney

The kidney are excretory organs which are vital for survival

The functions of the kidney	
Removal of urea	Regulating the water potential of blood plasma

The structure of the kidney	
Capsule	Layer of lipid surrounding the kidney that acts as a protective layer
Renal Cortex	The outer region of the kidney
Renal Medulla	The inner region of the kidney
Nephron	The functional unit of the kidney located in between the renal cortex and the renal medulla the nephron is made of two sections… - the renal corpuscle - the renal tubules
Renal Corpuscle	The renal corpuscle is made of the Glomerulus and the Bowman's Capsule
Renal Tubules	The renal tubules are made up of proximal convoluted tubules, loops of Henle, and distal convoluted tubules
Pelvis	The pelvis removes any of the urine form the nephrons
Ureter	The ureter removes any urine from the pelvis to the bladder
Urethra	The urethra is a tube that removes urine from the bladder and expels it out of the body.

Processes that occur in the kidneys	Location
1- Ultrafiltration	Renal corpuscle
2- Selective Reabsorbtion	Renal tubule
3- Water Reabsorbtion	Renal tubule

1- ULTRAFILTRATION

1- ULTRAFILTRATION (cont)

1. SELECTIVE REABSORBTION

Ultrafiltration	the process by which the blood is first filtered in the nephron for any small molecules leaving behind the erythrocytes and the large plasma proteins.
Location	Ultrafiltration occurs in the glomerulus and the small molecules are filtered into the bowman's capsule which leads to the proximal convoluted tubule.
Key Terms	
Glomerulus	network of capillaries where ultrafiltration occurs
Bowman's capsule	Cup shaped structure that surrounds the glomerulus and is responsible for the initial stage of urine formation.
Endothelium	the inner lining of the capillaries which are thin and permeable to allow the exchange of materials.
Basement membrane	the basement membrane is made of collagen fibres and proteins that prevents the removal of large molecules from the capillary
Podocytes	Lining of the bowman's capsule - they are specialised epithelial cells they contain pedicels
Pedicels	finger like protections that are found on the podocytes that wrap around the capillary creating slits to stop the removal of any large molecules from the capillary

Process

1. The unclean blood **enters** into the kidney by the **afferent arteriole** and **exits** the kidney through the **efferent arteriole**

2. The **afferent arteriole** has a **wide lumen** to maintain a **high hydrostatic pressure** from the artery - the hydrostatic pressure must be greater than the hydrostatic pressure in the Bowman's capsule so that it maintains a **hydrostatic pressure gradient**.

3. The **small molecules** are forced out of the capillary through the **endothelium** due to the **hydrostatic pressure gradient** - this it the **first filter**

4. The filtrate is then filtered through the **basement membrane** which prevents the removal of any large molecules - this is the **second filter**

5. The filtrate is then filtered through the **podocytes** that **line the Bowman's capsule** the filtrate is forced through teh gaps between the podocytes have **pedicels**

6. The filtrate is now in the **bowman's capsule** with everything but the erythrocytes and the large plasma proteins and is now referred to as **glomerular filtrate**.

7. The glomerular filtrate moves then to the **proximal convoluted tubule**

Selective Reabsorbtion	selective reabsorbtion is the process by which specific, necessary molecules are re absorbed from the glomerular filtrate to the proximal convoluted tubule such as glucose and sodium ions (leaving the urea) to decrease the water potential in the PCT to re absorb more water from the glomerular filtrate.
Location	selective reabsorbtion occurs in the first section of the renal tubules - the molecules are absorbed from the proximal convoluted tubule in the the capillary network surrounding the PCT
Key Terms	
Na+	sodium ions
Co-transport	the mechanism of active transport involving the simultaneous movement of two different substances across a biological membrane

Process

1. **Na+** (sodium ions) is **actively transported** into the **tissue fluid** from the **cells** lining PCT tubule walls using a **sodium-potassium pump**

2. This **reduces** the **concentration** of **Na+** in the **cytoplasm** of the PCT cells

By **Taalithaa** (Taalithaa)
cheatography.com/taalithaa/

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1. SELECTIVE REABSORBTION (cont)

3. The **Na+** molecules are then transported into the **PCT cells** from the **glomerular filtrate** with **glucose or amino acids** using **co-tansoporter proteins** by **facilitated diffusion**

4. As the **glucose and amino acid concentrations rise** in the **PCT cells** the glucose and amino acids **diffuse by facilitated diffusion** out the other side of the cell into the the **tissue fluid** down their **concentration gradient**

5. The **substances** in the **tissue fluid diffuse** into the **blood** and are carried away to the rest of the body.

6. The **reabsorbtion of Na+, glucose and amino acids reduces the water potential in the cells** and the water potential **increases in the tubule fluid**

7. **Water** will enter into the **PCT cells** by **osmosis** down their **water potential gradient**.

Adaptation of cells lining the PCT

Many microvilli	- adapted to increase the surface area for increased reabsorbtion of necessary molevules in filtrate such as glucose, amino acids and sodium ions
Co-transporter proteins	- adapted to allow sodium ions, glucose and amino acids to perform facilitated diffusion
Many mitochndria	- adapted to produce ATP for active transport of sodium ions into the blood stream from the PCT cells using sodium-potassium pumps.

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