BIOL1008 Comprehensive/Complete Notes 2021

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Topic 8: Excretion

Describe the anatomy of the kidney, the structure of the nephron and name and describe the structure and function of regions of the nephron.

Glomerulus

- Tangle of porous capillaries

Bowman's Capsule

- Surround's glomerulus, filters and absorbs

Renal corpuscle

- This is where the filtration occurs, collecting urine
    - 20% plasma volume removed into nephron
    - 70% reabsorbed almost immediately in the **Proximal Convoluted Tubule**
- *Process*
    - Taking everything out of the blood
    - Checking composition
    - Putting nearly everything back in, removing waste into urine.

Describe the glomerular filter.

Glomerular Filter

1. Wall of capillary (endothelium)
2. Glomerular basement membrane
3. Podocytes

- **Podocytes** surround the glomerulus, ensuring large items stay in blood (RBC) and smaller items are filtered through the gaps in the cells
- **Glomerular Filtration Rate**
    - 2 common tests
        0. Inulin - not reabsorbed at all by the kidney
            a. How efficiently is it passing through the blood into the urine
        1. Creatinine - not reabsorbed
- *Calculations*
    - **GFR =** (Concentration in Urine * Urine Flow Rate)/Concentration in Blood

Distinguish the properties of the blood components the glomerular filter allows to pass and appreciate the methods used to measure it.

- **What filters?**
    - Small molecules (<3nm), water, glucose, amino acids, urea, small ions Na+, K+
- **What doesn't?**
    - RBC
    - Large Proteins

Describe the mechanism of the reabsorption of glucose.

- Reabsorption of glucose can only occur in the proximal tubule and occurs regardless of the concentration gradient as it is completed via secondary active transport. It is reabsorbed using a co-transporter with sodium

Explain the concept of a renal threshold

Renal Thresholds

- *Glucose:* 10mmoles/L
- *Mean Blood Glucose:* 4-7mmoles/L
- Beyond the mean we would expect to see glucose in the urine

Describe the role of the Proximal Convoluted Tubule, loop of Henle, Distal Convoluted Tubule and collecting duct in the reabsorption and excretion of Na+, K+ and water.

Proximal Convoluted Tubule

- Lined with microvilli (increase surface area of tubule)
    - Reabsorption of glucose (filtered out in glomerulus, reabsorbed back in PCT)

Topic 10: The Nervous System I

Define the terms central nervous system, peripheral nervous system, and autonomic nervous system.

The CNS

- The CNS comprises the brain and spinal cord

The PNS

- The PNS consists of all the nerves distributed throughout the rest of the body.
- The PNS is divided into three separate subsystems, the somatic, autonomic, and enteric nervous systems.
- Somatic nerves mediate voluntary movement.

The autonomic nervous system

- A subsection of the PNS
- The autonomic nervous system (controlling smooth muscle, heart muscles and secretory glads) is further subdivided into the sympathetic and the parasympathetic nervous systems.
    - The sympathetic nervous system is activated in cases of emergencies to mobilise energy, while the parasympathetic nervous system is activated when organisms are in a relaxed state. The enteric nervous system functions to control the gastrointestinal system.

Describe the basic structure of a neurone and how it relates to function at the cellular level, and at the level of networks within the nervous system.

The Neurone

- Dendrites collect info - transmit to cell body - information moves to the axon into the dendrite of the next neurone
- Action potentials are of the same size regardless of the stimulus, what determines pain is the frequency of them
- **White matter is axons**
    - Its white because its **Myelin**
        - Myelin is 80% fat (lipid based)
        - Myelin reduces the amount of action potentials required to pass a stimulus through the neurone

Explain the relationship between neurones and nerves.

- A neuron is a nerve cell that is the basic building blocks of the nervous system. Neurons are like other cells in the human body in several ways, but there is one key difference between neurons and other cells. Neurons are specialized to transmit information throughout the body.

List the components of the central, peripheral, and autonomic nervous systems and give a general description of their roles.

The Brain (CNS)

- Information is sent from the nerves using electrical signals called action potentials. These signals travel along nerve fibres to the spinal cord and are relayed to the brain. Information is sent to the cerebral cortex, where the brain disseminates information to areas.
- The brain comprises of the cerebral cortex, the cerebellum, and the brain stem. The brain stem comprised of the diencephalon, the midbrain, the pons, and the medulla oblongata

Neurons

- Nerve cells, or neurons, are found in the brain, spinal cord, and nerves