Osmolarity, diffusion, membrane transport and resting membrane potential

**Laboratory exercise and seminar in medical physiology**

Home preparation, study materials and learning objectives

**Learning objectives – what will you know?**

* Correctly recognize and describe the types of transport across the cell membrane
* Calculate examples of osmolarity, osmolality and concentration gradients
* Write down and graphically represent the diffusion equation and the factors that influence it
* Explain the importance of fluid osmolarity and osmosis in the body
* Calculate the equilibrium potential for each type of ion and write the Goldman equation for the membrane potential based on intracellular and extracellular ion concentrations
* Explain resting membrane potential in different cells

**Study materials**

* Lecture in Physiology
* Guyton and Hall Textbook of Physiology
* Costanzo 6th or 7th edition
  + pages 1-19
* Youtube

<https://www.youtube.com/watch?v=03yoPfRORGY&t=72s&ab_channel=ByteSizeMed>

<https://www.youtube.com/watch?v=X5KwJr_R_rU&t=0s&ab_channel=ByteSizeMed>

<https://www.youtube.com/watch?v=c8htHfVFt-E&t=0s&ab_channel=ByteSizeMed>

<https://www.youtube.com/watch?v=v3BTWpNTyLU&t=0s&ab_channel=ByteSizeMed>

<https://www.youtube.com/watch?v=qdNN6P_gmlo&t=0s&ab_channel=ByteSizeMed>

<https://www.youtube.com/watch?v=xHIzfkbj82U>

<https://www.youtube.com/watch?v=3q3weKdyw3M>

**Home preparation**

Explain the following terms in one sentence

* Passive transport
* Active transport
* Ligand-gated channels
* Osmosis
* Diffusion
* Concentration gradient
* Membrane transporters
* Osmotic pressure
* Oncotic pressure
* Tonicity
* Electrical gradient
* Resting membrane potential

**Serum osmolarity and osmolality**

* Write an equation to calculate an estimate of serum osmolarity.
* Calculate an estimate of serum osmolarity based on these values:
  + Na+ 141 mmol/l
  + Urea 6,8 mmol/l
  + Glucose 3,66 mmol/l
    - Why is it important to know serum osmolarity?
    - Explain the difference between serum osmolarity and osmolality.
* Explain changes in serum osmolality after alcohol consumption.

**Laboratory test of serum and its interpretation**

**BIOCHEMISTRY**

* Based on the attached biochemical test result, complete the table with reference limits (woman 70+ years old) and complete the assessment

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Result** | **Unit** | **Reference limits** | **Interpretation** |
| **S Natrium** | 139 | mmol/l |  |  |
| **S Potassium** | 4,92 | mmol/l |  |  |
| **S Chloride** | 99,4 | mmol/l |  |  |
| **S Urea** | 5,4 | mmol/l |  |  |
| **S Creatinine** | 98,5 | mmol/l |  |  |
| **S Glucose** | 10,66 | mmol/l |  |  |
| **S Bilirubin** | 20,1 | μmol/l |  |  |
| **S Cholesterol** | 8,1 | mmol/l |  |  |
| **S Triglycerides** | 1,97 | mmol/l |  |  |

Calculate serum osmolarity and assess whether it is physiological.

**Hyperkalemia - student presentation - detailed assignment**

Hyperkalemia is a life-threatening condition that can occur in many diseases. Determination of the K+ level therefore belongs to the basic examination in patients with corresponding symptoms.

1. What is the normal concentration of K+ in plasma?

2. How high a concentration is referred to as hyperkalemia?

3. In which diseases can hyperkalemia occur?

4. What symptoms can a patient with hyperkalemia have?

5. What is the cause of hyperkalemia symptoms?

6. How high concentration of K+ in plasma endangers the patient's life? Under what circumstances can a patient come in with extreme hyperkalemia without it directly threatening his life?

7. Why is a change in the concentration of +5mmol/l Na+ in human plasma not life-threatening, whereas the same change in the concentration of K+ is?