

**Description of Study Course** EXPERIMENTAL RESEARCH IN MEDICAL CHEMISTRY

- 1. Course title:** EXPERIMENTAL RESEARCH IN MEDICAL CHEMISTRY
- 2. Course code:** 3825(pavasars) CFUBK\_025
- 3. Year of studies and semester:** 1st year 1st semester 3825(pavasars)
- 4. Course author:** assistant professor Aris Kaksis , [aris.kaksis@rsu.lv](mailto:aris.kaksis@rsu.lv)
- 5. Number of credit points (CP):** 2
- 6. Number of ECTS (aprēķina forma KP x 1,5):** 3
- 7. Academic unit:** Department of Human physiology and biochemistry, Dzirciema street 16, room A- 403, Riga LV-1007, phone: 67061550, 67061552; e-mail: [cfbk@rsu.lv](mailto:cfbk@rsu.lv)
- 8. Status of the course in the study Programme:** choice B level study subject, 2<sup>nd</sup> level professional higher education study programme „Medicine”.

**9. Prerequisites:** The knowledge of secondary school: Language and computer skills writing and oral, as well as Sciences: Chemistry, Physics, Mathematics (Algebra and Geometry) and Biology

**10. Course description and objectives of the course:**

**Course description:** Study and experimental research:

Proteins, polypeptides and peptides building, structure, biochemistry and physiology functions in human organism. Building of lipids and lipid bilayer membranes its structure, biochemistry and physiology functions in human organism. Building of steroid molecules its structure, biochemistry and physiology functions in human organism. Water  $\text{H}_2\text{O}$  and its solutions transport blocking thru membranes; and building of water  $\text{H}_2\text{O}$  and oxygen  $\text{O}_2$  molecule transport channels - aquaporins across lipid bilayer membranes its structure, biochemistry and physiology functions in human organism. Building of proton  $\text{H}^+$  and  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{HCO}_3^-$   $\text{Cl}^-$  ion transport channels across lipid bilayer membranes its structure, biochemistry and physiology functions in human organism. Membrane potential driven ATPase reactions of ATP synthesis enzyme as well opposite by ATP hydrolyze driven ionic pumps enzyme ATPase work across lipid bilayer membranes its structure, biochemistry and physiology functions in human organism. Natural sources of peroxide  $\text{H}_2\text{O}_2$  as lipid peroxidation agent in bilayer membranes. Leukotrien as eicosanoid precursor, arachidonic acid **C20:4** peroxidation its products formation processes in chain reaction: initiation –radical formation, propagation (continues chain reaction), termination – recombination reaction are lipid bilayer membrane biochemical and physiological functions contamination with poison peroxidation products in human organism. Enzyme CATALASE disproportionation reaction research for peroxide  $\text{H}_2\text{O}_2$  disproportionation in water  $\text{H}_2\text{O}$ , oxygen  $\text{O}_2$  and heat  $Q$  as mechanism of action, building, structure, biochemistry and physiology functions in human organism. Human immunoglobulin for Lysozyme binding in blood plasma medium  $\text{pH}=7.36$  building, structure and mechanism of intermolecular forces its biochemistry and physiology functions in human organism. Building of Cyclo-oxygenase enzyme its structure, biochemistry and physiology functions in human organism for synthesis of eicosanoids from arachidonic acid **C20:4**: **prostaglandins PGs**, **prostacyclins PGI<sub>2</sub>**, **thromboxans TXs** un **leukotrienes LTs**.  $\text{O}_2$  adsorbitions – desorbitions enzymes myoglobin and hemoglobin its building, structure, biochemistry and physiology functions in human organism. Human **DNA deoxyribonucleic acid** polymer building of 4 934 582,000 kbp (kilo base pairs) its structure, biochemistry and physiology functions in human organism. **DNA nucleosomes** enzymes for compact storage mechanisms its building, structure, biochemistry and physiology functions in human organism and human genom expression enzymes. Transport **tRNA** ribonucleic acid 64 molecules of 21 amino acids and its anticodons carry enzyme mechanism to ribosomes for protein synthesis its building, structure, biochemistry and physiology functions in human organism. C vitamin analyze in papric, limes and in pharmacological products. Vitamin B3 oxidation-reduction NADH reduced form carrying 2  $e^-$  to  $\text{NAD}^+$  form, building of **B2** and **PP** vitamin oxidized and reduced forms its structure, biochemistry and physiology functions in human organism. Carbonic anhydrase (**CA**) enzyme

Form No M-3 (5)

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**objectives of the course:** is promote to days concept formation about living processes substantial basement in human organism, including exchange processes and substantial building of human body, it's functions, as well as understanding about biochemical mechanisms and biomedical properties, that could reveal disease native reasons and scientifically correct would implement actual medical problem solutions.

### **11. Learning outcomes and assessment criteria:**

\* **Knowledges:** Students in results of study subject mastering are able:

- to formulate and to explain Medical Chemistry and Static Biochemistry concepts;
- to describe quantitative and qualitative concepts of Medical Chemistry processes;
- to estimate concentration meaning in human body of oxygen, glucose,  $\text{CO}_2$ , blood pH and osmolar concentration;
- to explain ion channel made membrane potential principles;
- to appose influence on health with food used nutrition compounds against some times wrong used harmful compounds;

\***Practical skills and \*Competence** Student know how to analyses biologic compound exchange and states of homeostasis. Will know how estimate compound exchange and conversion in equivalent amounts, to be based on mass conservation and energy conservation rules. To be able analyses atomic properties of chemical elements integration and conversion into molecular buildings and aggregates properties, that would be able estimate interaction with environment and integrated compound exchange for maintenance of living functions, what will reflect student registered study work results, practical work conclusions, tests and colloquia.

\***Assessment criteria:** during semester colloquia, writing test works and practical work report paper examination; on finish of semester oral test the practical work report protocols for **Medical Chemistry** experimental research study results and notated in study data base products.

**12. Students' independent work and tasks:** [http://aris.gusc.lv/Chemistry\\_Research.html](http://aris.gusc.lv/Chemistry_Research.html) Individual and work in paired groups in practical protocol and notes preparation classwork plane of studies. Self studies of theoretical subjects, using books or other sources including scientific publications - literature.

### **13. Readings:**

\* **Recommended:**

1. DavidL. Nelsone, MichaelM. Cox. *Lehninger Principles of Biochemistry*. ©2005. W.H.Freeman and Company, New York ISBN: 0-7167-4339-6; EAN:9 780716 743392
2. A.Kaksis. "General Medical BioChemistry", Med. BioChem Data Base RSU department, 2014.g, interneta home page: <http://aris.gusc.lv/2017-18MFArzBkurss.pdf>;

\* **Optional:**

1. F. Horn, G. Lindenmeier u.a. 3.,grundl.überarb.Aufl. © 2005 Biochemie des Menschen 640 S., 1160 Abb., kart. Das Lehrbuch für das Medizinstudium

\* **Other sources:**

Publications in PubMed data base journals selected for course materials:

<http://aris.gusc.lv/>;

**14. Language:** English