

## Topics of the oral final exam

- 1.1. Body fluid compartments and their determination. The extracellular and intravascular fluid.
  - 1.2. Structure, permeability and transport functions of the cell membrane. Transepithelial transports
  - 1.3. Signal transduction: receptors, G proteins, second messengers.
  - 1.4. Classification, function and main features of ion channels. Voltage-gated  $\text{Ca}^{2+}$  channels. Cellular calcium metabolism.
  - 1.5. The development of the resting membrane potential. The development and properties of the electrotonic potential.
  - 1.6. The development of the action potential in excitable cells: similarities and differences between distinct cells. Conduction of the action potential.
  - 1.7. Physiology of nerve cells. Synaptic transmission and its regulation. Neurotransmitters.
  - 1.8. The physiology of smooth muscle. The functions of different types of smooth muscle.
  - 1.9. Neuromuscular junction and physiology of the skeletal muscle.
  - 1.10. Parasympathetic and sympathetic efferent mechanisms.
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- 2.1. Impulse generation and conduction in the heart. Mechanism of pacemaker potential. Control of pacemaker activity and impulse conduction.
  - 2.2. Electrocardiography, the human electrocardiogram.
  - 2.3. The heart cycle. Changes in pressure and volume during the cardiac cycle. Heart sounds.
  - 2.4. Pump function of the heart. Cardiac output and its control.
  - 2.5. Organization of the circulatory system. Hemodynamic functions of different vessel segments in the systemic circulation. Biophysical basis of blood flow. Relationship of pressure and flow.
  - 2.6. Measurement of arterial blood pressure. Factors influencing arterial blood pressure.
  - 2.7. Functional organization of microcirculation and its control. Control of interstitial fluid volume, Starling forces.
  - 2.8. Venous circulation, factors determining venous pressure and flow. Control of capacity vessels. Lymph flow.

2.9. Local control of circulation. Myogenic, humoral control mechanisms. Functional and reactive hyperemia.

2.10. Neurohormonal and reflex control of circulation: baroreceptor and chemoreceptor reflexes. Cardiovascular centers.

2.11. Circulation of the skeletal muscle. Circulatory effects of physical exercise. Splanchnic circulation.

2.12. Coronary circulation. Circulation of the brain. Cerebrospinal fluid. Blood-brain barrier.

3.1. Lung volumes. Dead space in the breathing apparatus. Alveolar ventilation. Mechanical properties of the airways, chest wall and lung. Pressure-volume relationship in the respiratory system, surface tension in the alveolus and compliance of the chest wall.

3.2. Gas exchange in the respiratory system. The pulmonary circulation. Ventilation-perfusion relationship.

3.3. Oxygen and carbon dioxide transport. Hemoglobin. Types of hypoxia.

3.4. Localization and function of the respiratory control centers. Neural and chemical control of the respiration.

3.5. Cardiopulmonary adaptation during change in the body position and during physical exercise.

4.1. Circulation of the kidney. Glomerular-filtration.

4.2. Tubular transport processes.

4.3. Concentration and dilution in the kidney. The function of the urinary bladder and the regulation of the urination.

4.4. Control of body fluid volumes and extracellular fluid osmolality.

4.5. The acid-base balance. The role of the lung and kidney in the regulation of the pH and in the compensation of acid-base imbalances.

5.1. Hematopoiesis. The composition of the blood.

5.2. Hemostasis and the role of thrombocytes.

5.3. Blood coagulation. Fibrinolysis. Physiological anticoagulant mechanisms.

5.4. The human blood group systems. Blood transfusion procedures.

6.1. Regulation in the gastrointestinal tract: enteric nervous system and gastrointestinal hormones.

6.2. Motor functions of the gastrointestinal tract and their control:

6.3. Function of the salivary glands and regulation of salivary secretion. Gastric secretion and its control.

6.4. Exocrine secretion of pancreas and its regulation. Bile production of the liver. Metabolism and secretion of bile pigments.

6.5. Degradation and absorption of nutrients. Absorption of water, potassium and sodium. Absorption of iron and vitamin B12.

6.6. Energy balance of the body. The quantitative and qualitative requirements of food. The regulation of food intake. Control of body weight.

7.1. The hypothalamus-pituitary gland system. Growth hormone and somatomedins.

7.2. The function of the adrenal cortex.

7.3. Production and effects of thyroid hormones (T3/T4). The regulation of their secretion.

7.4. Insulin secretion and the regulation of the secretion. The effects of insulin on the intermediary metabolism. Diabetes mellitus.

7.5. Glucagon secretion and the regulation of the secretion. Endocrine mechanisms protecting from hypoglycemia. Endocrine and metabolic changes related to starving and physical exercise.

7.6. Calcium metabolism. The physiology of bone and growth.

7.7. Endocrine physiology of sexual development. Male reproductive physiology.

7.8. Female sexual endocrinology.

7.9. Endocrinology of pregnancy, delivery, and lactation.

7.10. The function of adrenal medulla. Adaptation to environmental stress.

8.1. Physiology of nerve and glia cells.

8.2. The somatovisceral Sensory System: properties of the receptors, afferent pathways, role of the thalamus and the cerebral cortex. Tactile sensations.

8.3. Physiology of pain sensation.

8.4. Physiology of vision.

8.5. Physiology of hearing.

8.6. Physiology of equilibrium. The senses of taste and smell.

8.7. Motor functions of the spinal cord. Cord reflexes. Spinal cord transection and spinal shock.

8.8. Supraspinal regulation of muscle functions. Postural reflexes.

8.9. The role of the cerebellum and basal ganglia in motor functions.

8.10. Thermoreceptors. Thermoregulation. Regulation of the circulation of the skin.

8.11. Electroencephalogram (EEG); sleep phenomena. Learning and memory.

8.12. Integration of autonomic responses. Regulation of behavioral mechanisms. Motivation. Emotion.