

Human Physiology and Pathophysiology

Examination topics for the state doctoral examination

Student selects combination of 3 from the 14 thematic areas. Each thematic area consists of specific questions. The questions are selected by draw. Obligatory thematic areas combinations:

- 1, 4, 14
- 2, 5, 13
- 3, 7, 12
- 4, 7, 11
- 5, 6, 11
- 6, 8, 12
- 7, 10, 14
- 8, 14, 2
- 9, 5, 10
- 10, 2, 4
- 11, 8, 1
- 12, 8, 2
- 13, 14, 7
- 14, 9, 2

1. Principles of physiological regulations

- 1.1 Tissue oxygen supply
- 1.2 Isotonia, isoosmia, isohydria. Water and ion balance
- 1.3 Regulation of metabolic processes
- 1.4 Overview of blood pressure and circulation control
- 1.5 Overview of control of food and water intake and processing; micturition, defecation
- 1.6 Control of breathing
- 1.7 Interaction between nerves, hormones and immunity; psychoneuroendocrinology
- 1.8 Local, systemic and integrated control of physiological processes
- 1.9 Shock
- 1.10 Stress
- 1.11 Metabolic and neuronal control processes
- 1.12 Hunger and thirst
- 1.13 Multiorgan failure during sepsis
- 1.14 Mechanisms of adaptation to environment
- 1.15 Genetic determination of disease

2. Cell physiology

- 2.1 Function of the cell membrane and inter-cellular contacts
- 2.2 Membrane transport systems
- 2.3. Channels for water and ions
- 2.4 Intracellular signals systems
- 2.5 Functions of cell organelles
- 2.6 Cell cycle
- 2.7 Autocrine and paracrine information and communication
- 2.8 Gene expression and cell differentiation
- 2.9 Apoptosis and necrosis
- 2.10 Cell receptors and their disorders
- 2.11 Membrane potential
- 2.12 Excitation and contraction coupling in smooth and skeletal muscle

3. Inner environment and defence functions

- 3.1 Body fluids
- 3.2 Homeostasis
- 3.3 Intercellular space
- 3.4 Inner environment of brain
- 3.5 Regulation of extracellular concentration of potassium and sodium
- 3.6 Immunity mechanisms and disorders
- 3.7 Aging mechanisms
- 3.8 Disorders of acid base balance
- 3.9 Significance of calcium in organism

4. Cardiopulmonary system

- 4.1 Blood and lymphatic circulation
- 4.2 Mechanism of heart contraction and relaxation
- 4.3 Heart automaticity and electrical activity of heart muscle
- 4.4 Heart pump, cardiac revolution
- 4.5 Cardiovascular control mechanisms
- 4.6 Coronary blood flow
- 4.7 Blood flow through brain, splanchnic, skin and skeletal muscle
- 4.8 Placental blood flow. Fetal circulation.
- 4.9 Lung circulation
- 4.10 Relation of renal blood flow and renal functions
- 4.11 Short and long –term regulation of blood pressure

5. Pathophysiology of cardiopulmonary system

- 5.1 Adaptation of myocardium on the work load
- 5.2 Remodelling of myocardium and vascular wall
- 5.3 Heart failure, stunning and hibernation
- 5.4 Elementary disorders of the heart rhythm
- 5.5 Arterial hypertension
- 5.6 Hypotension, collapse, circulatory shock
- 5.7 Disorders in generation and conduction of electrical stimuli in the heart
- 5.8 Congenital heart diseases, valve defects
- 5.9 Causes of arteriosclerosis and its complications
- 5.10 Ischemic heart disease
- 5.11 Pulmonary hypertension and cor pulmonale
- 5.12 Classification of types of hypoxia

6. Metabolism

- 6.1 Tissue respiration
- 6.2 Thermoregulation
- 6.3 Metabolic functions of the liver
- 6.4 Regulation of plasma glucose concentration
- 6.5 Plasma lipids and their metabolism
- 6.6 Quantitative and qualitative disorders of nutrition
- 6.7 Protein metabolism
- 6.8 Metabolism of saccharides

7. Excretion systems and their disturbances

- 7.1 Excretion systems and organs
- 7.2 Role of kidney and breathing in acid-base balance
- 7.3 Role of hormones and body composition in water excretion
- 7.4 Control of renal excretion of potassium, natrium, phosphates and calcium
- 7.5 Micturition and its disorders
- 7.6 Causes and consequences of the impairment of renal concentration ability
- 7.7 Acute renal failure
- 7.8 Chronic renal failure
- 7.9 Defects of tubular transport
- 7.10 Glomerular functions and their disorders

8. Endocrine regulation

- 8.1 General principles of humoral regulation
- 8.2 Role of hypothalamo-hypophyseal system in control of peripheral glands
- 8.3 Metabolic and regulatory consequences of adrenal insufficiency

- 8.4 Reproduction endocrinology
- 8.5 Pathophysiology of thyroidea
- 8.6 Hormonal control of metabolism of calcium and phosphates
- 8.7 Pathogenesis of type I and II diabetes mellitus. Impaired glucose tolerance
- 8.8 Disorders of growth and sexual differentiation

9. Blood and breathing

- 9.1 Blood and hemopoietic organs
- 9.2 Hemostasis and its defects
- 9.3 Hemoglobin (ontogenesis, functional types)
- 9.4 Central regulation of breathing
- 9.5 Peripheral chemoreceptors and regulation of breathing
- 9.6 Lung ventilation
- 9.7 Ventilation/perfusion relationship
- 9.8 Blood gas transport
- 9.9 Pathologic forms of breathing
- 9.10 pH of blood, blood buffers
- 9.11 Regulation of organ blood flow

10. Sensory systems, information entry

- 10.1 Vision and its disorders
- 10.2 Disorders of the balance
- 10.3 Hearing and its disorders
- 10.4 Taste and smell
- 10.5 Proprioception
- 10.6 Nociception, pain
- 10.7 Somatosensory system and its disorders
- 10.8 Function of the receptor cells
- 10.9 Central processing of sensory signals

11. Efferent functions of nervous system

- 11.1 Muscle types, muscle contraction
- 11.2 Motor functions and their disorders
- 11.3 Central control of motility
- 11.4 Autonomic nervous system
- 11.5 Disorders of peripheral nerves"
- 11.6 Spinal cord injury syndromes
- 11.7 Intracranial hypertension

12. Physiology and pathophysiology of behavior. Biorhythms.

- 12.1 Sleep and its disorders
- 12.2 Biorhythms. Mechanisms and disorders
- 12.3 Memory. Physiology and pathophysiology
- 12.4 Mechanisms of learning
- 12.5 Motivations, instincts
- 12.6 Descendent and ascendent reticular formation
- 12.7 Emotion
- 12.8 Brain degenerative disorders. Alzheimer disease.

13. Developmental physiology

- 13.1 Main periods of ontogenesis. Critical developmental periods
- 13.2 Significance of perinatal and weaning periods for individual development
- 13.3 Ontogenetic development of homeostasis
- 13.4 Puberty
- 13.5 Development of endocrine and reproduction systems
- 13.6 Functional changes during aging, mechanisms of aging

14. Gastrointestinal system

- 14.1 Food processing in mouth. Secretion of saliva
- 14.2 Swallowing
- 14.3 Stomach. Motility and secretion
- 14.4 Function and pathology of small intestine
- 14.5 Pancreas and liver
- 14.6 Large intestine. Motility. Secretion and resorption. Defecation
- 14.7 Overview of GIT motility
- 14.8 Control mechanisms of GIT
- 14.9 Control of food intake. and its disorders