

Topic List Dentistry students
2024-25 1st semester

- 1. Principles of control theory**
- 2. Passive transport mechanisms of the cell membrane**
- 3. Active transport mechanisms of the cell membrane.**
- 4. The resting membrane potential**
- 5. The electric properties of neuronal membranes. The axonal propagation of the action potential. Axon classification.**
- 6. Neurotransmission.**
- 7. Receptors, signal transduction mechanisms.**
- 8. The parasympathetic division of the autonomic nervous system.**
- 9. The sympathetic division of the autonomic nervous system. The adrenal medulla.**
- 10. Fluid compartments of the body. The blood plasma.**
- 11. The general features of red blood cells. Erythropoiesis. Hemoglobin degradation, bilirubin metabolism.**
- 12. White blood cell types. The differential leucocyte count. Cellular and humoral elements of the innate immunity.**
- 13. The humoral and cellular elements of the specific (adaptive) immunity.**
- 14. The AB0 and Rh blood groups.**
- 15. The characterization and functions of thrombocytes. Primary hemostasis.**
- 16. Secondary hemostasis: blood clotting (coagulation). Inhibition of clotting. Fibrinolysis.**
- 17. The peripheral nervous system: motor neurons, neuromuscular junction.**
- 18. Structural comparison of the skeletal and smooth muscle. Muscle subtypes, contraction types**
- 19. Comparison of the skeletal and smooth muscle based on their function.**
- 20. Cardiac muscle: structural and functional characterization, the excitation-contraction coupling. The metabolic properties of the cardiac muscle.**
- 21. Cardiac muscle: cellular electrophysiology. Electrocardiography (ECG)**
- 22. Cardiac cycle.**
- 23. Factors determining the cardiac output. Regulation of the contractile force of the cardiac muscle. The Frank-Starling law of the heart.**
- 24. The coronary circulation**
- 25. Blood viscosity and basic biophysical principles of circulation (Hagen–Poiseuille’s law, Laplace’s law, Bernoulli’s law)**
- 26. Hemodynamics: the function of the aorta and the arteries. The characteristics of the venous circulation.**
- 27. The microcirculation: capillary solute exchange, lymphatic circulation and edema formation**
- 28. The regulation of local blood flow. Autoregulation of blood flow, functional hyperemia, vasoactive mediators**
- 29. Short-term control mechanisms of arterial blood pressure.**

30. Long-term control of arterial blood pressure. Volume regulation: The regulation of Na^+ -metabolism and extracellular fluid volume.
31. Respiratory mechanics: Static mechanics of the lung and the chest. Spirogram. The rhythmogenesis of breathing.
32. Pulmonary gas exchange. Oxygen and carbon-dioxide transport in blood.
33. Pulmonary circulation. The chemical control of ventilation. Ventilatory reflexes elicited from the lung.
34. Glomerular filtration: the factors determining the volume and composition of filtrate
35. Renal blood flow. The regulation of GFR and RBF.
36. The general features of transport mechanisms in the renal tubuli (reabsorption and secretion). Renal clearance
37. Renal tubular transport of NaCl and water, production of the medullary osmotic gradient. The concentration and dilution of urine. Osmoregulation. The regulation of K^+ metabolism.
38. The physiology of the urinary tract. Micturition reflex.
39. Thermoregulation, cutaneous blood flow.
40. Skeletal muscle blood flow. Sports physiology: the cardiovascular, respiratory and muscular effects of training. Factors determining performance in sports.

2nd semester

41. Acid-base balance
42. Principles of the regulation of the gastrointestinal tract. Special functional features of the gastrointestinal smooth muscle.
43. The splanchnic circulation
44. Functions of the upper GI tract: chewing, salivation, swallowing.
45. Motor functions of the stomach. Vomiting (emesis). The mechanism and regulation of gastric juice secretion.
46. The exocrine pancreas: secretion and regulation. The bile: secretion, storage, mobilization, regulation.
47. The small intestine: motor function, digestion and absorption.
48. The functions of the colon: motor functions, digestion, absorption. Defecation reflex.
49. Nutrition: energy metabolism, the role of macronutrients in energy intake.
50. Nutrition: water, minerals, trace elements, vitamins, dietary fibers.
51. Nutrition: The internal control of food intake. The control of fluid and salt intake.
52. Principles of endocrine control systems.
53. Characterization of the hypothalamo-hypophyseal (neuroendocrine) system. Central integration of autonomic functions.
54. Hormone synthesis in the adrenal cortex. The glucocorticoids: biosynthesis, regulation and physiological

effects. Stress and general adaptation syndrome. Sex steroids of the adrenal cortex.

55. Thyroid hormones: biosynthesis, regulation and physiological effects.

56. The endocrine pancreas. The integrated endocrine control of metabolism.

57. The development and physiology of the male reproductive system. The physiology of the sexual act

58. The physiology of the female reproductive system: sexual steroids, ovarian and endometrial cycle, the physiology of the sexual act.

59. Fertilization and implantation. The neuroendocrine control of pregnancy, parturition and lactation.

60. The regulation of Ca^{2+} and phosphate metabolism. The role of the bones in the Ca-homeostasis. Physiology of bones

61. Physiology of growth and puberty (hormonal changes)

62. The control of cerebral blood flow, the cerebrospinal fluid, barrier systems of the brain.

63. The peripheral nervous system: primary sensory neurons

64. The somatosensory nervous system: comparison of the dorsal column (medial lemniscus system) and the anterolateral pathways

65. The mechanism of pain sensation. Inflammatory pain. Pain evoked body reactions. the physiological background of pain management, the endogenous control of pain.

66. The visual system: protection of the eye, image formation, refraction errors. The function of the photoreceptors, retinal signal processing. The visual field and the visual pathways. Cerebrocortical mechanisms. Binocular vision, color vision.

67. Hearing: the function of the outer, the middle and inner ear. Hearing tests. The auditory pathways

68. The physiology of olfaction and taste sensation.

69. The structure and function of muscle proprioceptors. The motor reflex. The myotatic and the inverse myotatic spinal reflex. The gamma fusimotor servomechanism (gamma-loop).

70. The control of muscle tone and body posture. The vestibular system.

71. The cerebrocortical control of movements. Cerebellum and basal ganglia in motor control. The consequences of spinal cord hemisection and transection.

72. Electroencephalogram (EEG) and the physiology of sleep-wake cycles. The circadian rhythm and the pineal gland.