

Physiology: spring semester 2017

Part A

1. Structure and function of cell membranes and cell organelles
2. Transport across cell membranes
3. Compartmentalization of body fluids
4. Differences between intra- and extracellular fluids
5. Production and resorption of interstitial fluid (Starling forces)
6. Ion channels
7. Intercellular communication
8. Generation of resting membrane potential
9. Local response of membrane potential
10. Action potential
11. Excitability and refractoriness
12. Excitation-contraction coupling
13. Molecular mechanism of muscle contraction
14. Electrical and mechanical behaviour of various types of muscle
15. Isometric and isotonic contraction. Length-tension relation.
16. Neuromuscular junction
17. Temporal and space summation (summation and recruitment) in skeletal muscle
18. Energy metabolism and its measurement
19. Physiological role of calcium
20. Vitamins
21. Regulating of food intake and its disorders
22. Hypoxia and ischemia
23. Heat production and heat loss, thermoregulation
24. Physiological applications of law of Laplace
25. Lung ventilation, volumes, measurement
26. Dead space, measurement
27. Resistance of airways, measurement
28. Maximal respiratory flow – volume curve (spirogram)
29. Respiratory quotient
30. Cardiopulmonary response to exercise
31. Physiological significance of positive and negative feed-back
32. Physiological regulations (overview)
33. Homeostasis
34. Functional morphology of nephron
35. Tubular processes, tubular reabsorption and secretion, urine formation
36. Renal blood flow and its autoregulation
37. Glomerular filtration, principals and regulation, juxtaglomerular apparatus
38. Renal sodium, potassium, chlorid transports, their regulation
39. Urea formation
40. Water resorption, hyper- and hypotonic urine. Counter-current system.
41. Osmotic, water and pressure diuresis
42. Examination of renal function. Clearance.
43. Micturition
44. Metabolic and endocrine renal function
45. Kidney in regulation of homeostasis
46. Alveolar surface tension. Surfactant.
47. Compliance of lungs. Respiratory work. Pneumothorax.
48. Composition of atmospheric and alveolar air. Gas exchange in lungs and tissues
49. Transport of O₂. Oxygen – haemoglobin dissociation curve. Transport of CO₂
50. Regulation of ventilation
51. Respiratory responses to irritants
52. Formation, composition, functions and regulation of saliva
53. Formation, composition, functions and regulation of gastric secretion
54. Functions of the stomach
55. Formation, composition, functions and regulation of pancreatic juice
56. Motility of gastrointestinal tract
57. Co-ordination of GIT segments
58. Liver functions
59. Formation, composition, functions and regulation of bile
60. Digestion and resorption in the small intestine
61. Functions of colon
62. Adaptation to extreme environmental conditions
63. Adaptation to exercise, athlete's heart
64. Integration of nervous and hormonal regulation
65. Regulation and adaptation
66. The importance and the regulatory role of nervous system
67. Cellular base of nervous system
68. Intracranial compartment, intracranial pressure
69. Membrane voltage, action potential – generation and propagation through nerve fibers
70. Structure of synapse and integration of information on the synaptic level, neurotransmission vs. neuromodulation
71. Receptors, receptor potential vs. action potential, receptive field
72. Basic functional comparison of somatosensitivity, viscerosensitivity and proprioception, the importance of sensitivity for immediate and long-term survival
73. Pain
74. The basic physiology of olfactory and gustatory system – brief characterization of the modality, basic information about signal detection and processing
75. The basic physiology of auditory and vestibular system – brief characterization of the modality, basic information about signal detection and processing
76. The basic physiology of visual system – light detection vs. image formation, circadian rhythms
77. The basic physiology of visual system – rods and cones function, on/off receptive field, nervus opticus vs. tractus opticus
78. Upper and lower motor neuron, neuromuscular junction, muscle contraction
79. Hierarchic organization of motor system – reflex vs. voluntary motor activity
80. The basic functions of basal ganglia
81. The basic division and functions of autonomic nervous system
82. The importance of limbic system and brief characterization of basic functions – somatic and limbic arousal systems, sleep and wakefulness
83. The importance of limbic system and brief characterization of basic functions – learning and memory, the influence of hypothalamus on neocortex, the role of amygdala
84. The basic characterization of neocortical functions – primary vs. association areas, topographical overview of cortical functions
85. The basic characterization of neocortical functions – language and social brain, basic overview of functional diagnostic methods used in neurology

Part B

1. Blood composition – values
2. Red blood cell. Haemolysis.
3. Haemoglobin and its derivatives. Metabolism of iron.
4. Erythropoietin and erythropoiesis
5. Suspension stability of RBC (sedimentation rate)
6. Mechanism of innate immunity
7. Acquired immunity
8. Blood types
9. Function of platelets
10. Hemocoagulation
11. Anticlotting mechanism, fibrinolytic system
12. Conduction system of the heart
13. Cardiac automaticity
14. Spread and retreat of excitation wavefront. Electric vector of the heart.
15. Variability of circulatory parameters, 24-hour-monitoring, baroreflex sensitivity
16. Cardiovascular response to haemorrhage
17. Cardiovascular reflexes (diving reflex, Valsalva maneuver, Muller maneuver)
18. Invasive and non-invasive methods of blood pressure assessment
19. Cardiac output and its measurement
20. Measurement of blood flow
21. ECG leads. ECG record in different leads
22. Estimation of electric axis of the heart
23. Cardiac contractility and its determination
24. Polygraphic recording of one cardiac cycle (ECG, phonocardiogram, aortic pressure, left ventricular pressure, left ventricular volume)
25. Specific features of cardiac metabolism
26. Differences between left and right heart
27. Determinants of cardiac performance: preload, afterload, inotropy
28. Cardiac reserve. Heart failure.
29. Cardiac cycle. Phases. Pressure-volume loop.
30. Heart sounds. Diagnostic significance.
31. Starling principle (heterometric autoregulation of cardiac contraction)
32. Frequency effect (homeometric autoregulation of cardiac contraction)
33. Heart rate
34. Regulation of heart functions
35. Arrhythmias
36. Coronary circulation. Coronary reserve.
37. Cardiovascular system – general principles
38. Significance of Poiseuille-Hagen formula for blood flow
39. Vascular resistance in various parts of circulation
40. Arterial blood pressure. Hypertension.
41. Arterial elasticity – significance
42. Arterial pulse, pulse wave
43. Physiological role of endothelium
44. Vasoactive substances
45. Micro-circulation
46. Venous pressure
47. Venous return. Venous stasis.
48. Lymphatic system
49. Pulmonary circulation
50. Cerebral circulation
51. Skin circulation
52. Muscle and splanchnic circulation
53. Regulation of blood circulation upon orthostasis
54. Placental and foetal circulation. Circulatory adjustments at birth
55. Autocrine, paracrine, endocrine regulation
56. General principles of endocrine regulation
57. Chemical characteristics of hormones
58. Effect of hormones on target cells
59. Second messengers
60. Up- and down-regulation of receptors
61. Hypothalamo-pituitary system
62. Prolactin
63. Glandotropic hormones of anterior pituitary gland
64. Growth hormone and growth factors (IGF)
65. Formation and secretion of posterior pituitary hormones
66. Thyroid hormones. Regulation and dysregulation.
67. Endocrine pancreas
68. Insulin and mechanism of its action
69. Glycaemia, its regulation and dysregulation
70. Adrenal cortex. Functions, malfunctions.
71. Metabolic and anti-inflammatory affects of glucocorticoids
72. Adrenal medulla. Functions, malfunctions.
73. Bone formation and resorption. Regulation of calcaemia.
74. Natriuretic peptides
75. Endogenous opioid system
76. Pineal gland. Circadian rhythm.
77. Puberty and menopause
78. Cyclic changes in non-pregnant women
79. Physiology of pregnancy
80. Physiology of parturition
81. Physiology of lactation
82. Hormonal contraception – the principles
83. Endocrine functions of testes, its regulation
84. Regulation of body fluid volume
85. Regulation of constant osmotic pressure