

Physiology: spring semester 2013/2014

Part A

1. Structure and function of cell membranes
2. Structure and function of cell organelles
3. Passive transport across membranes. Co-transport
4. Compartmentalization of body fluids
5. Differences between intra- and extracellular fluids
6. Production and resorption of interstitial fluid (Starling forces)
7. Ion channels
8. Intercellular communication
9. Functions of the nerve cell
10. Functional morphology of synapses
11. Synthesis and break down of transmitters
12. Generation of resting membrane potential
13. Local response of membrane potential
14. Action potential
15. Excitability and refractoriness
16. Excitation-contraction coupling
17. Molecular mechanism of muscle contraction
18. Electrical and mechanical behaviour of skeletal muscle
19. Electrical and mechanical behaviour of smooth muscle
20. Electrical and mechanical behaviour of cardiac muscle
21. Isometric and isotonic contraction. Length-tension relation.
22. Neuromuscular junction
23. Temporal and space summation (summation and recruitment) in skeletal muscle
24. Energy production and conservation
25. Caloric content of food. Direct calorimetry.
26. Energy balance. Indirect calorimetry.
27. Physiological role of calcium
28. Vitamins – overview
29. Hypovitaminoses and hypervitaminoses
30. Basal metabolism
31. Regulating of food intake and its disorders
32. Hypoxia and ischemia
33. Heat production and heat loss
34. Physiological applications of law of Laplace
35. Electromyography
36. Registration of membrane potentials and currents
37. Lung ventilation, volumes, measurement
38. Dead space, measurement
39. Resistance of airways, measurement
40. Pneumography and pneumotachography
41. Maximal respiratory flow – volume curve (spirogram)
42. Respiratory quotient
43. Cardiopulmonary response to exercise
44. Sympathetic alpha- and beta-receptors
45. Physiological significance of positive and negative feed-back
46. Physiological regulations (overview)
47. Homeostasis
48. Functional morphology of nephron
49. Urine formation
50. Renal blood flow and its autoregulation
51. Glomerular filtration
52. Function of renal tubules
53. Juxtglomerular apparatus
54. Renal sodium transport, aldosteron
55. Passive transport in kidneys
56. Transport of glucose in kidneys
57. Urea formation
58. Hyper- and hypotonic urine. Counter-current system.
59. Osmotic and water diuresis
60. Acid-base balance
61. Regulation of pH by kidneys
62. Acid-base balance determined by the acid-base nomogram (relationship between pH, pCO₂ and HCO₃⁻)
63. Clearance
64. Regulation of renal functions
65. Micturition
66. Regulation of constant pH
67. Kidney in regulation of homeostasis
68. Intrapulmonary and pleural pressure. Pneumothorax.
69. Alveolar surface tension. Surfactant.
70. Compliance of lungs. Respiratory work.
71. Composition of atmospheric and alveolar air.
72. Gas exchange in lungs and tissues
73. Transport of O₂. Oxygen – haemoglobin dissociation curve.
74. Transport of CO₂
75. Herring-Breuer reflexes
76. Regulation of ventilation
77. Respiratory responses to irritants
78. Arteficial ventilation
79. Formation, composition and functions of saliva
80. Gastric production of HCl
81. Functions of the stomach
82. Motility of gastrointestinal tract
83. Regulation of gastric and pancreatic secretion
84. Co-ordination of GIT segments
85. Composition and function of pancreatic juice
86. Liver functions
87. Formation, composition and functions of bile
88. Digestion in the small intestine
89. Functions of colon
90. Resorption of lipids in the small intestine
91. Resorption of minerals and water in small intestine
92. Intermediary metabolism (overview)
93. Nitrogen balance
94. Metabolism of cholesterol. Atherosclerosis.
95. Metabolism of iron
96. Thermoregulation
97. Sympathetic nervous system (overview)
98. Parasympathetic nervous system (overview)
99. Adaptation to extreme environmental conditions
100. Adaptation to exercise
101. Integration of nervous and hormonal regulation
102. Regulation and adaptation

Part B

1. Blood composition – values
2. Red blood cell. Haemolysis.
3. Haemoglobin and its derivatives
4. Erythropoietin and erythropoiesis
5. Suspension stability of RBC (sedimentation rate)
6. Cellular immunity
7. Humoural immunity
8. Histocompatibility complex (MHC)
9. Cellular interactions in immune response
10. Blood groups antigens (ABO group, Rh group)
11. Function of platelets
12. Hemocoagulation
13. Anticlotting mechanism
14. Conduction system of the heart
15. Cardiac automaticity

16. Spread and retreat of excitation wavefront
17. Electric vector of the heart. Vectocardiography.
18. AV conduction, determination of QT interval
19. Examination of baroreflex sensitivity
20. Examination of heart rate and blood pressure variability
21. Special methods of ECG and blood pressure examination (vectocardiography, 24-hour-monitoring, His bundle electrogram)
22. Cardiovascular response to haemorrhage
23. Cardiovascular reflexes (Valsalva maneuver, Muller maneuver, diving reflex)
24. Invasive assessment of blood pressure
25. Non-invasive assessment of blood pressure
26. Measurement of cardiac output
27. Measurement of blood flow
28. Phonocardiography
29. ECG leads
30. ECG record in different leads
31. Estimation of electric axis of the heart
32. Cardiac contractility and its determination
33. Ejection fraction, heart failure
34. Polygraphic recording of one cardiac cycle (ECG, phonocardiogram, , aortic pressure, left ventricular pressure, left ventricular volume)
35. Specific features of cardiac metabolism
36. Heart as a pump
37. Differences between left and right heart
38. Determinants of cardiac performance: preload, afterload, inotropy
39. Cardiac reserve. Heart failure.
40. Cardiac cycle. Phases. Pressure-volume loop.
41. Stroke volume and cardiac output
42. Heart sounds. Diagnostic significance.
43. Starling principle (heterometric autoregulation of cardiac contraction)
44. Frequency effect (homeometric autoregulation of cardiac contraction)
45. Heart rate
46. Regulation of cardiac output
47. Overview of arrhythmias
48. Mechanism of re-entry
49. Athlete's heart
50. Coronary circulation
51. Coronary reserve. Ischaemic heart disease.
52. Cardiovascular system – general principles
53. Significance of Poiseuille-Hagen formula for blood flow
54. Vascular resistance
55. Blood pressure. Hypertension.
56. Arterial elasticity – significance
57. Arterial pulse wave
58. Physiological role of endothelium
59. Vasoactive substances
60. Micro-circulation
61. Venous pressure
62. Venous return. Venous stasis and embolism.
63. Lymphatic system
64. Pulmonary circulation
65. Cerebral circulation
66. Skin circulation
67. Muscle and splanchnic circulation
68. Regulation of blood circulation upon orthostasis
69. Placental and faetal circulation
70. Circulatory adjustments at birth
71. Bone formation and resorption
72. Hyperthermia and hypothermia
73. Autocrine, paracrine, endocrine regulation
74. General principles of endocrine regulation
75. Chemical characteristics of hormones
76. Examination methods in endocrinology (RIA, enzymo-immuno-analysis)
77. Effect of hormones on target cells
78. Second messengers
79. Up- and down-regulation of receptors
80. Hypothalamo-pituitary system
81. Hypothalamic releasing hormones
82. Glandotropic hormones of anterior pituitary gland
83. Growth hormone and growth factors (IGF)
84. Formation and secretion of posterior pituitary hormones
85. Effects of thyroid hormones
86. Metabolism of iodine; Thyroid hormones synthesis
87. Hyper- and hypothyroidism
88. Endocrine pancreas
89. Insulin – mechanism of action
90. Glycaemia
91. Hyper- and hypoglycaemia. Diabetes mellitus.
92. Adrenal cortex. Functions, malfunctions.
93. Metabolic and anti-inflammatory affects of glucocorticoids
94. Adrenal medulla. Synthesis of catecholamines.
95. Parathormone
96. Vitamin D and calcitonin
97. Antidiuretic hormone
98. Natriuretic peptides
99. Endogenous opioid system
100. Pineal gland. Circadian rhythm.
101. Puberty and menopause
102. Ovarian cycle and its control
103. Uterine cycle
104. Physiology of pregnancy
105. Physiology of parturition
106. Physiology of lactation
107. Hormonal contraception
108. Endocrine functions of testes
109. Regulation of body fluid volume
110. Regulation of constant osmotic pressure
111. Regulation of calcium metabolism
112. Regulation of glycemia
113. Regulation of adrenal cortex