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SYNOPSIS
FOR THE PHYSIOLOGY EXAMINATION
2015/2016 academic year


1. Homeostasis. Functional systems of the body. Control systems of the body. Negative and positive feedback loops.
2. Structure of the cell membrane. Membrane composition. Cell membrane proteins. Transport through the cell membrane - passive transport.
3. Active transport through the cell membrane - primary and secondary active transport. Ingestion by the cell - endocytosis. Transport through cellular sheets.
4. Basic physics of membrane potentials. Resting membrane potential of nerves. Generation of action potential.
5. Propagation of the action potential. Re - establishing sodium and potassium ionic gradients after action potentials. Special characteristics of signal transmission in nerve trunks.
6. Synaptic transmission. Types of synapses. Chemical synapses. Postsynaptic potentials. Summation of synaptic inputs - temporal and spatial.
7. Synaptic transmitters. Transmitter receptors in the postsynaptic membrane. Neuropeptides.
8. Physiologic anatomy of skeletal muscle. General mechanism and molecular mechanism of muscle contraction. Neuromuscular junction. Muscle action potential. Motor unit. Excitation - contraction coupling.
9. Characteristics of whole skeletal muscle contraction.
10. Relation between muscle length, tension and velocity of contraction. Sources of energy for muscle contraction. Muscle fatigue.
11. Physiology of smooth muscle. Types of smooth muscle. Smooth muscle contraction in comparison with skeletal muscle contraction. Nervous and hormonal control of smooth muscle contraction
12. Blood components. Plasma. Physiological functions of plasma proteins.
13. Red blood cells. Production of red blood cells and its regulation. Reactions of hemoglobin. Iron metabolism.
14. Leukocytes (white blood cells). Types of white blood cells. Defensive properties of neutrophils and macrophages.
15. Events in hemostasis. Mechanism of blood coagulation. Intravascular anticoagulants.
16. Resistance of the body to infection. Innate and acquired immunity.
17. Blood groups. Transfusion reactions resulting from mismatched blood types.
18. Physiology of cardiac muscle. Specialized excitatory and conductive system of the heart. Ionic basis of automaticity. Action potentials in cardiac muscle. Contraction of cardiac muscle.
19. Electrical activity of the heart. Spread of the cardiac impulse through the heart. The normal electrocardiogram.
20. The cardiac cycle. The atrial, ventricular and aortic pressure curves. Function of the valves. Heart sounds.
21. Work output of the heart. Stroke volume. Cardiac output. Factors controlling cardiac output. Intrinsic regulation of heart pumping (the Frank-Starling mechanism).
22. Extrinsic regulation of heart. Control of the heart by autonomic nervous system. Chemical control.
23. Physical characteristics of the circulation. Interrelationships among pressure, flow and resistance.
24. Arterial pressure. Pressure in the various portions of the circulation. Transmission of the pressure pulses.

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25. Microcirculation. Exchange through the capillary wall. Formation of lymph. Rate of lymph flow.
26. Local, nervous and humoral regulation of the circulation.
27. Veins and their function.
28. Role of the nervous system in rapid control of arterial pressure.
29. Long - term control of arterial pressure.
30. The integrated system for arterial pressure regulation.
31. Circulation through special regions - coronary, cerebral and pulmonary circulation.
32. Respiration. Mechanics of pulmonary ventilation. Pulmonary volumes and capacities.
33. Physical principles of gas exchange. Diffusion of oxygen and carbon dioxide through the respiratory membrane. Diffusing capacity.
34. Uptake of oxygen by the pulmonary blood. Transport of oxygen in the blood. Oxygen - hemoglobin dissociation curve.
35. Diffusion of carbon dioxide from the tissue into the tissue capillaries and from the pulmonary capillaries into alveoli. Transport of carbon dioxide in the blood.
36. Regulation of respiration. Respiratory center. Chemical control of respiration - direct chemical control of respiration and peripheral chemoreceptor system.
37. Respiratory physiology of high altitude, aviation and hyperbaric conditions.
38. General principles of gastrointestinal function. Motility. Enteric nervous system. Autonomic and hormonal control of the gastrointestinal tract.
39. Mastication and swallowing. Motor function of the stomach. Regulation.
40. Movements of the small intestine. Movements of the colon. Defecation.
41. Secretion of the saliva. Composition and function of the saliva. Regulation of salivary secretion.
42. Gastric secretion. Regulation of gastric secretion.
43. Pancreatic secretion. Regulation.
44. Secretion of the bile by the liver. Secretion of the small intestine. Regulation.
45. Basic principles of gastrointestinal absorption. Absorption of water, ions and vitamins.
46. Digestion and absorption of proteins in the gastrointestinal tract.
47. Digestion and absorption of fats in the gastrointestinal tract.
48. Digestion and absorption of carbohydrates in the gastrointestinal tract.
49. Liver. Metabolic functions of the liver. Excretion of bilirubin in the bile.
50. Dietary balances. Energy available in foods. Daily requirements for proteins, fats and carbohydrates. Energetics and metabolic rate.
51. Vitamins and minerals. Functions and daily requirements. Trace elements.
52. Carbohydrate metabolism. General role of glucose in carbohydrate metabolism. Storage of glycogen in liver and muscle (glycogenesis). Glycogenolysis. Gluconeogenesis. Hormonal regulation.
53. Protein metabolism. Hormonal regulation of protein metabolism.
54. Lipid metabolism. Regulation of fat utilization.
55. Body temperature. Heat production and heat loss. Regulation of body temperature - role of the hypothalamus.
56. Functions of the kidneys in homeostasis. Physiological anatomy of the kidneys - the nephron as a functional unit of the kidney. Renal blood supply. Glomerular filtration - the first step in urine formation. Physiological control of glomerular filtration.
57. Urine formation. Reabsorption and secretion along different parts of the nephron.
58. Regulation of tubular reabsorption. Glomerulotubular balance. Hormonal control of tubular reabsorption.
59. Urine concentration and dilution. Micturition. Use of clearance methods to quantify kidney function.
60. Body fluid compartments. Balance of fluid intake and output. Regulation of extracellular fluid composition (ionic composition) and volume.

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61. Regulation of acid - base balance. The chemical acid - base buffer systems of the body fluids. Respiratory and renal control of acid - base balance.
62. General principles of hormonal regulation. Chemistry of hormones. Storage and secretion of hormones. Mechanisms of hormonal action.
63. Function of the anterior pituitary gland. Control of pituitary secretion by the hypothalamus. Physiological functions of growth hormone.
64. The posterior pituitary gland and its relation to the hypothalamus. Physiological function of antidiuretic hormone and oxytocin.
65. The thyroid gland. Functions of the thyroid metabolic hormones. Regulation of thyroid hormone secretion.
66. Parathyroid hormone, Calcitonin, calcium and phosphate metabolism.
67. Endocrine function of the pancreas. Insulin and its metabolic effects. Glucagon and its functions. Regulation of the blood glucose concentration.
68. The adrenal glands. Functions of the mineralcorticoids.
69. The adrenal glands. Functions of the glucocorticoids.
70. Adrenal androgens. Abnormalities of adrenocortical secretion. The prostaglandins.
71. Reproductive and hormonal function of the male. Functions of testosterone. Control of male sexual functions by hypothalamus and anterior pituitary gland.
72. Female physiology before pregnancy. The monthly ovarian cycle and function of the gonadotropic hormones. Functions of the ovarian hormones. The monthly endometrial cycle and menstruation. Interplay between the ovarian and hypothalamic - pituitary hormones.
73. General design of the nervous system. Major levels of central nervous system function. Physiologic anatomy of the neuron. Transmission and processing of signals in neuronal pools. Neuronal circuits. Cerebrospinal fluid.
74. Types of sensory receptors. Receptor potentials. Adaptation of receptors.
75. Somatic sensations. General organization. The tactile and position senses. Sensory pathways for transmission of somatic signals into the central nervous system. Somatic sensory cortex.
76. Somatic sensations. Thermal sensations. Pain sensation, pain suppression, referred pain, visceral pain and headache.
77. The vestibular system. The vestibular apparatus and vestibular sensations. The maintenance of equilibrium.
78. The auditory system. External, middle and inner ear. Sound transmission. Function of the organ of Corti.
79. The auditory system. Central auditory pathway. Functional organization of central auditory system. Determination of sound direction.
80. The eye. Optics of vision.
81. The visual system. Receptor and neural function of the retina. Receptive field organization. Visual pathway. Organization and function of the visual cortex.
82. The visual system. Fields of vision, perimetry. Eye movements and their control. Fusion of the visual images from the two eyes. Light and dark adaptation. Color vision.
83. The chemical senses - taste and smell.
84. Motor function of the spinal cord. Principles of spinal organization. Muscle sensory receptors. Spinal reflexes - myotatic, flexor and withdrawal.
85. Reflexes of posture and locomotion. Role of the brain stem in controlling motor function. Vestibular postural reflexes.
86. The cerebellum and its motor functions.
87. The basal ganglia and their motor functions. Diseases of the basal ganglia.
88. Cortical control of motor function.
89. Activating - driving systems of the brain. Brain electrical activity.

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90. States of brain activity. Sleep - basic theories of sleep, the cycle between sleep and wakefulness.
91. The autonomic nervous system - basic characteristics of sympathetic and parasympathetic function. Functions of the adrenal medulla. "Alarm" or "stress" response of the sympathetic nervous system.
92. Vegetative and endocrine control functions of the hypothalamus.
93. Functional anatomy of the limbic system. Behavioral functions of hypothalamus and associated limbic structures. Function of the hippocampus and the amygdale.
94. Cerebral cortex. Functions of specific cortical areas. Cerebral dominant.
95. Cerebral cortex. Intellectual functions of the brain. Learning and memory.
96. The cardiovascular system in exercise. Muscle blood flow and cardiac output during exercise.
97. Respiration and oxygen consumption in exercise.
98. Body heat production, fluids and salts in exercise.

RECOMMENDED LITERATURE:

1. Guyton & Hall, Textbook of Medical Physiology, 12th edition, SAUNDERS ELSEVIER Inc., Philadelphia, USA, 2011
2. Linda S. Constanzo, Physiology, 5th edition, SAUNDERS ELSEVIER Inc., Philadelphia, USA, 2014
3. Ganong's Review of Medical Physiology, 24th edition, International edition, Singapore, 2012

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