

**Assessment tools for certification
in the discipline "Molecular regulation of metabolism and cell cycle"
for students of the educational program
specialist in the specialty 33.05.01 Pharmacy,
direction (profile) Pharmacy,
form of study full-time
for the 2023-2024 academic year**

1. Composition of membranes and their structural features. Integral membrane proteins. Membrane functions.
2. Transport systems of the cells.
3. Ions channels. Types.
4. Unmanaged (independent) channels. Potential-controlled channels.
5. Structure and functions of ligand-controlled channels, jointly-managed and indirectly-managed channels.
1. 6. Structure and functions of stimulus-controlled and actin-controlled channels.
6. Signalosomes, definition, significance. Features of the structure of the signalosome (give an example).
7. Necrosome, structure and their functions. Formation of a necrosome. Inflammasomes, structure and functions. Role in innate immunity.
8. Fundamentals of molecular recognition: active center, ligand, affinity, complementarity, specificity. Ligand binding to the active center: dissociation constant for a protein with one active center.
9. The concept of agonists, super agonists, partial agonists, neutral agonists, reverse agonists, antagonists. Selective and non-selective ligands. Bivalent ligands. A privileged structure (give examples).
10. Modern databases of measured affinities and various proteins and ligands. Databases of ligand-receptor interactions.
11. The general structure of the G-protein. Trimeric G-proteins, their structure and properties. Monomeric G-proteins, families, their structure and properties. The family of α -subunits of G-proteins.
12. G-protein coupled receptors (GPCR). The mechanism of G-protein activation by activated GPCR (α and β adrenoreceptors, M-cholinergic receptor).
13. Protein kinases A, C, G: structure, active centers and regulatory centers. Features of the structure of protein kinases, the relationship with the functions performed. The role of phosphatases.
14. Stages of hormonal signal transmission to the cell through intracellular receptors (scheme). Classification of intracellular receptors. The structure of lipophilic hormone receptors.

15. Ca²⁺ signaling. "Turning on" and "Turning off" the Ca²⁺ signaling path. The use of calcium signal in cells.
16. Receptor with tyrosine kinases activity. Activation of the EGF receptor. The mechanism of action of cytokine receptors. SH2, SH3 domains.
17. Intracellular effects of insulin. RAS signal path.
18. Glycolysis in hypoxia, HIF1 α as the most important transcription factor. Modern ideas about the role of lactate as a signaling molecule. Lactate receptor GPRC81.
19. Phases of the cell cycle. Control points of the cell cycle. Signaling pathways regulating the cell cycle. Interphase G₀, features.
20. Mitosis, phases of mitosis. Main events. Meiosis, phases of meiosis. Main events.
21. Cyclins and cyclin-dependent kinases (CDKs). General description. Inhibitors of cyclin-dependent kinases.
22. Regulation of the cell cycle, control over the passage of the cell cycle. Control objects and verification points (ATM-Chk2 and ATR-Chk1 paths; PAK1 path).
23. Apoptosis. General views. Triggering factors and biological role. Morphology of apoptosis and necrosis. MAP kinase signaling cascade. Mechanisms of stopping the cell cycle or transition to apoptosis.
24. Cytoplasmic proteases-caspases. Caspase cascades. Endonucleases.
25. Mitochondrial factors. The p53 protein system (self-regulation of content and activity; factors that change its content and activity; caused effects).
26. Schemes of apoptosis. "Apoptosis from within", "apoptosis on command". Apoptosis and associated proto-oncogenes and tumor suppressors.
27. A family of Toll-like receptors. Signaling of LPS/TLR4 and other TLRs.
28. Afferent neurons and their signals. Receptors of afferent neurons. The concept of threshold and receptor potentials.
29. Potential-dependent ion channels. Classification of channels. V-dependent sodium channels. Thermosensitive ion channels. Structure and functioning of TRP channels.
30. Inflammatory mediators and nociceptors. The mechanism of pain. Transmission of pain signals to the central nervous system.
31. The role of opioid receptors in the regulation of pain.
32. Gas transmitters. Nitric oxide. Sources, synthesis reaction. NO-synthase. Structure, isoforms of NO-synthase.
33. Nitric oxide in the nervous system. The role of nitric oxide in the development of oncological diseases. The role of NO in the functioning of the cardiovascular system. Cytotoxic effect of NO.

34. Intercellular interactions via integrin receptors. Integrin molecules as extracellular matrix receptors, their structure and diversity. Contacts of integrins with intracellular molecules and the mechanism of integrin activation.
35. Platelet adhesion and aggregation.
36. The structure of src kinases.
37. Transmission of a mechanical signal through src kinases.
38. WNT and NOTCH alarm.
39. Protease-dependent signaling.

The full fund of assessment tools for discipline in the EIES of VolgSMU at the link (s):

<https://elearning.volgmed.ru/course/view.php?id=7408#section-3>

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Head of the Department



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