

## **TOPICS IN MEDICAL MICROBIOLOGY FOR EXAM SESSION**

### **English-speaking medical students**

#### **General microbiology**

1. Subject and tasks of microbiology. The role of Pasteur and Koch for development of medical microbiology. Taxonomy of microorganisms – nomenclature and classification. General characteristics of different groups of microorganisms.
2. Morphology of bacteria – shape, size, arrangement. Methods for studying bacterial morphology. Bacterial structure – essential and nonessential components: cell envelope, cytoplasm and cytoplasmic inclusions, capsules, flagella, fimbriae, spores.
3. Bacterial genetics. Genotype and phenotype of bacteria. Genetic apparatus in bacteria. Bacterial chromosome as a genetic system. Extrachromosomal genetic elements. Bacteriophages – main types, structure, interactions with the microbial cell – lytic cycle, moderate phage, prophage, phage conversion. Phage typing. Mutations. Mutagenic factors – chemical and physical, mechanism of action, practical use. Genetic transfer – transformation, conjugation, transduction – mechanisms. The importance of bacterial and phage genetics. Genetic engineering. Contemporary genetic methods in clinical microbiology. DNA probes. PCR – polymerase chain reaction.
4. Bacterial physiology. Chemical composition of bacterial cell. Bacterial enzymes. Bacterial metabolism – catabolic and anabolic processes. Bacterial respiration. Bacterial nutrition. Transport of nutrients.
5. Bacterial growth and reproduction. Growth phases and growth curves. Bacterial culture – basic principles, culture media. Bacterial growth factors.
6. Influence of physical factors on microorganisms: heat, drying, light, atmospheric pressure, osmotic pressure, radiation. Sterilization. Methods of sterilization. Influence of chemical factors on microorganism. Disinfection types of disinfectants. Mechanism of action of chemicals upon bacteria. Oligodynamics. Influence of biological factors upon microorganisms: symbiosis, antagonisms, antibiosis.
7. Antimicrobial agents. Main groups and mechanism of action. Mechanisms of resistance to antimicrobial agents. Antibiotic susceptibility tests.

8. Viruses. Nature and properties. Methods for cultivation. Classification. Rickettsia. Nature and properties. Methods for cultivation. Classification.
9. The surrounding environment as a factor for spreading causative agents of infectious diseases. Microbial flora in water, soil, air. Microorganisms in foodstuff, hospital services, etc. Microorganisms of sanitary importance.

### **Infection and Immunity**

10. Infection and infectious process. The role of microorganism in the infectious process. Pathogenicity. Virulence. Invasiveness. Toxigenicity. Pathogenic factors. Pathogenesis of the infectious process. Characteristics of infectious disease. Forms of the infectious process. The role of macroorganism in the infectious process. The role of environment for development and course of the infectious process. Epidemic process. Factors and mechanisms of transmission of the infectious agents in the epidemic process.
11. Innate immunity. The protective role of skin, mucous membranes, organs and normal microbial flora. Humoral factors of innate immunity – lysozyme, complement system, interferons and cytokines. Cellular factors of innate immunity. Phagocytosis. Inflammation.
12. Immunity. Definition. Types of immunity. The anatomy and structure of the immune system. Central and peripheral organs. Cells of the immune system.
13. Antigens. Types of antigens. Antigenic characteristics of microorganisms.
14. Humoral immunity. Mediators. Characteristics of antibodies (immunoglobulins). Structure and function of different immunoglobulin classes. Mechanism of action of antibodies. Local immunity.
15. Cellular immunity. Cells and mechanism of action. Forms of cellular immunity. Cellular cooperation in the immune response.
16. Development of the immune response. Recognition of antigens. The role of APC and MHC molecules. Dynamics of the immune response – primary and secondary immune response. Genetic control of the immune response. Humoral regulation of the immune response.
17. Allergy – definition and forms. Immediate allergic reactions – anaphylaxis, atopy, clinical significance. Cytotoxic allergic reactions. Allergic phenomena due to immune complexes – serum sickness, Arthus, clinical significance. Delayed type hypersensitivity – Koch phenomenon, contact dermatitis. Clinical significance.
18. Immunopathology. Immunopathological reactions and diseases. Immunological tolerance. Autoimmune diseases. Immunodeficiencies – disorders and diseases. Infectious diseases of the immune system.
19. Antigen-antibody reactions. Types: agglutination, precipitation, neutralization – toxin, antitoxin, ASO, virus-neutralization test. Complement fixation test. Mechanism and practical application of the reactions in microbiological diagnosis.

20. Labelled immune reactions – immunofluorescence, radioimmune and immunoenzyme tests. Hybridoma biotechnology. Monoclonal antibodies.
21. Immunoprophylaxis and immunotherapy. Vaccines and sera. Immunomodulation.

### **Special microbiology**

22. Microbiological diagnosis of infectious diseases. Collection, transport and examination of specimens. Interpretation of results.
23. *Staphylococcus* spp. Classification. Morphology, biology, biochemical and toxin production. Pathogenic factors. Pathogenicity and Immunity. Microbiological diagnosis. Antibiotic treatment. MRSA – clinical importance and diagnosis.
24. *Streptococcus* spp. Classification. Morphology, biology, antigenic structure, biochemical and toxin production. Pathogenic factors. Pathogenicity of streptococcal infections. Disease and immunity. Microbiological diagnosis. Antibiotic treatment. *Streptococcus pneumoniae*. Morphology, biology, biochemical production and antigenic structure. Pathogenesis, diseases and immunity. Microbiological diagnosis. Specific prophylaxis and therapy.
25. *Neisseria meningitidis*. Morphology, biology, biochemical production, antigenic structure. Pathogenic factors. Pathogenesis, clinical forms of disease and immunity. Microbiological diagnosis. Specific prophylaxis and therapy. *Neisseria gonorrhoeae*. Morphology, biology, biochemical production. Pathogenic factors. Pathogenesis, clinical forms of disease and immunity. Microbiological diagnosis. Prophylaxis and therapy.
26. Enterobacteriaceae. Main groups enteric bacteria. General characteristics – morphology, biology, biochemical production, antigenic structure. Pathogenic factors. *Escherichia coli*. Morphology, biology, biochemical production, antigens, pathogenic factors, diseases. The role of coli bacteria in human pathology. Immunity. Microbiological diagnosis.
27. *Proteus* spp. *Providencia* spp. *Morganella*. General characteristics – morphology, biology, biochemical production. Diseases. Their role as causative agents of infections. Microbiological diagnosis. Therapy. *Klebsiella* spp. Morphology, biology, biochemical production, pathogenic factors. Diseases. Microbiological diagnosis. Therapy. *Pseudomonas* spp. Morphology, biology, biochemical production. Pathogenic factors. Diseases. Immunity. Microbiological diagnosis. Therapeutic problems.
28. *Salmonella* spp. General characteristics – morphology, biology, biochemical production. Antigenic composition and Kauffmann-White classification. Pathogenic factors. Diseases – typhoid and paratyphoid fevers, food poisoning. Pathogenesis and immunity. Microbiological diagnosis. Specific prophylaxis and therapy in salmonella infections.

29. The causative agents of dysentery (*Shigella* spp.). Classification. Morphology, biology, biochemical production. Antigenic composition. Pathogenesis and immunity. Microbiological diagnosis. *Helicobacter pylori*. Morphology, biology, biochemical production. Disease. Microbiological diagnosis. Therapy. *Clostridium difficile*. General characteristics.
30. *Yersinia* spp. The causative agent of plague (*Yersinia pestis*). Morphology, biology, pathogenic factors. Pathogenesis and immunity. Microbiological diagnosis. Specific prophylaxis and therapy. *Yersinia enterocolitica*. General characteristics.
31. *Vibrio cholerae*. Morphology, biology, biochemical production. Antigenic composition. Sero- and biotypes. Pathogenicity and immunity. Microbiological diagnosis. Specific prophylaxis and therapy.
32. *Bordetella* (*Bordetella pertussis*, *Bordetella parapertussis*). Morphology, biology, pathogenic factors. Pathogenesis and immunity of whooping cough and other diseases. Microbiological diagnosis. Specific prophylaxis and therapy. *Haemophilus* spp. Morphology, biology, antigenic structure. Pathogenic factors. Disease and immunity. Microbiological diagnosis. Specific prophylaxis and therapy. *Listeria monocytogenes*. General characteristics.
33. *Brucella*. Species. Morphology, biology, biochemical production and pathogenic factors. Pathogenesis and immunity. Microbiological diagnosis. Specific prophylaxis. *Francisella tularensis*. General characteristics. *Legionella pneumophila*. General characteristics.
34. *Corynebacterium* spp. *Corynebacterium diphtheriae*. Morphology, biology, biochemical production and pathogenic factors. Pathogenicity and immunity. Microbiological diagnosis of diphtheria. Specific prophylaxis and therapy. Coryneforms (*C. jeikeum*, *C. urealyticum*, *C. amycolatum*, *C. pseudodiphtheriticum*). Clinical importance.
35. *Mycobacteria*. *Mycobacterium tuberculosis*. Morphology, biology. Pathogenic factors. Pathogenicity and immunity. Microbiological diagnosis. Specific prophylaxis. Atypical mycobacteria. *Mycobacterium leprae*. Morphology, biology, clinical forms. Microbiological diagnosis. Prophylaxis.
36. Genus *Bacillus*. *Bacillus anthracis*. Morphology, biology, pathogenic factors. Pathogenicity, disease and immunity. Microbiological diagnosis. Specific prophylaxis and therapy. *Bacillus cereus*. General characteristics and disease.
37. Anaerobic spore-forming bacteria – genus *Clostridium*. General characteristics. *Clostridium tetani*. Morphology, biology and toxin production. Pathogenicity and immunity. Microbiological diagnosis. Specific prophylaxis and therapy. The causative agents of gas gangrene. Morphology, biology and toxin production. Pathogenicity, disease and immunity. Microbiological diagnosis. Prophylaxis and therapy. *Clostridium botulinum*. Morphology, biology and toxin production. Pathogenesis and immunity. Microbiological diagnosis. Prophylaxis and therapy.

38. Spirochetes (Spirochaetaceae). General characteristics. The causative agent of syphilis (*Treponema pallidum*). Morphology and biology. Pathogenesis and immunity. Microbiological diagnosis. *Leptospira* spp. Morphology and biology. Pathogenesis and immunity. Antigenic composition and serological types. Microbiological diagnosis. The causative agent of relapsing fever (*Borrelia recurrentis*). Morphology and biology. Pathogenesis and immunity. Microbiological diagnosis. The causative agent of Lyme Disease (*Borrelia burgdorferi*). Pathogenesis, immunity, microbiological diagnosis.
39. *Mycoplasma* spp. Classification. Morphology, biology, diseases. Microbiological diagnosis. L-forms of bacteria. Chlamydia. General characteristics. The causative agent of psittacosis and trachoma. Morphology and biology. Pathogenesis and disease. Microbiological diagnosis. Chlamydia as causative agents of sexually transmitted diseases. Therapy.
40. Pathogenic fungi. *Candida* spp. Morphology, biology. Pathogenesis and clinical forms. Immunity. Microbiological diagnosis. Therapy. *Aspergillus*, *Cryptococcus*, *Actinomycetaceae*. Morphology, biology, disease and microbiological diagnosis.
41. The causative agent of louse-borne typhus (*Rickettsia prowazeki*). Morphology and biology. Pathogenesis and immunity. Microbiological diagnosis. Specific prophylaxis. The causative agent of Mediterranean fever (*Rickettsia conorii*). Morphology and biology. Microbiological diagnosis. The causative agent of Q fever (*Coxiella burnetii*). Morphology and biology. Microbiological diagnosis. The causative agents of human ehrlichiosis (*Ehrlichia*). The causative agent of cat-scratching disease (*Bartonella henselae*). Morphology and biology. Immunity. Microbiological diagnosis.
42. Picornaviridae. Genus Enterovirus – the causative agent of polyomyelitis, coxackie infections and ECHO infections. Genus Rhinovirus – the causative agents of infectious rhinitis. Genus Aphotavirus – the causative agent of foot-and-mouth disease.
43. Orthomyxoviridae. The causative agents of grippe.
44. Paramyxoviridae. The causative agents of paragrippe, epidemic parotitis, measles. Respiratory syncytialvirus.
45. Arboviruses and rubella. Togaviridae – Genus Alphavirus and Genus Rubivirus. Flaviviridae – the causative agents of yellow fever, dengue, Sandfly fever, tick-borne encephalitis. Bunyaviridae – the causative agent of Crimean-Congo haemorrhagic fever. Hantaan virus.
46. Poxviridae – the causative agent of smallpox. Adenoviridae. Rhabdoviridae – the causative agent of rabies. Rotaviridae.
47. Herpesviridae. The causative agent of herpes simplex, the causative agent of varicella and herpes zoster. Human cytomegalovirus. The causative agent of infectious mononucleosis. Other herpesviruses.

48. The causative agents of viral hepatitis (HAV, HBV, HCV, HDV, HEV, HGV). Characteristics. Pathogenesis and immunity. Specific prophylaxis.
49. Retroviridae – the causative agent of AIDS (HIV).
50. Coronaviruses. SARS-CoV-2 and the disease COVID-19.

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