

AL-FARABI KAZAKH NATIONAL UNIVERSITY
Faculty of Medicine and Healthcare
Higher School of Medicine
Department of Fundamental Medicine

PROGRAM
of final exam on discipline
MZiB2216 "Mechanisms of Defense and Disease (medical genetics, microbiology,
pharmacology)"
(10 credits)
Spring semester, 2021-2022 academic year

Expected outcomes: Students in the final exam must demonstrate the ability to:

1. Apply knowledge about molecular and genetic aspects of genetically determined diseases (chromosomal, monogenic, polygenic); understand the principles of genetic diagnostics and medical genetic counseling
2. Apply knowledge of molecular-genetic, biochemical mechanisms of the body's response to drugs and biologically active compounds
3. Understand the biochemical processes in the main pathological conditions and genetically determined diseases
4. Apply knowledge of the infectious process and its features in various types of human pathogens, apply knowledge of immunodiagnostics of infectious diseases, apply knowledge of immunoprophylaxis, demonstrate an understanding of the principles of infection control and biosafety
5. Interpret the results of specific molecular genetic diagnostic methods
6. Understand the role of relevant risk factors of diseases for decision-making with a view to their prevention
7. Integrate knowledge on human genetics, immune response, biochemical processes and the interaction of micro and macro-organism for the purposes of diagnosis and personalized treatment of human pathology
8. Know the pharmacokinetic parameters, mechanisms of absorption and biotransformation of drugs
9. Apply knowledge of pharmacodynamics and mechanisms of action of drugs in the main pathological processes (affecting the acid-base state, hemostasis and hematopoiesis, inflammation, infectious process, allergies, autoimmunity, onco-process). Know the types of undesirable side reactions and understand the possibilities of their correction
10. Demonstrate the ability to identify learning gaps and create strategies to enhance one's own knowledge and skills
11. Effectively communicate with other students and teachers regarding medical and scientific information, articulate their opinions clearly when discussing and work effectively as a member of the team

I MEDICAL GENETICS
(3 ECTS)

Approved final exam form - written exam

Topics included in final exam:

1. Introduction to Medical Genetics. Chromosomal disorders (Down syndrome, Patau syndromes, Edwards syndrome, Cri du chat syndrome)
2. Sex Chromosome disorders (Trisomy-X, Y-disomy, Klinefelter syndrome, and Turner

syndrome). Summary of chromosomal diseases

3. Mendelian classic disorders: autosomal inheritance (Phenylketonuria, galactosemia, alkaptonuria, fructosuria, Cystic fibrosis, Marfan syndrome, Achondroplasia, Wilson-Konovalov syndrome, Hypertrichosis)

4. Mendelian classic disorders: sex-linked inheritance (hemophilia, color blindness, Ichthyosis, Lesch–Nyhan syndrome, Duchenne Muscular Dystrophy, Vitamin-resistant rickets) 7-8. Non-mendelian genetic disorders (Prader-Willi syndrome, Angelman syndrome, Huntington's disease)

5. Fundamentals of population genetics

6. Polygenic multifactorial disorders. (Diabetes mellitus, Schizophrenia, Family Hypercholesterolemia, Arterial hypertension)

7. Cancer Genetics and Genomics (breast cancer)

8. Polygenic disorders: developmental malformation (Neural tube defect, Cleft lip and cleft palate, hip dysplasia).

After completing this course students will be able to:

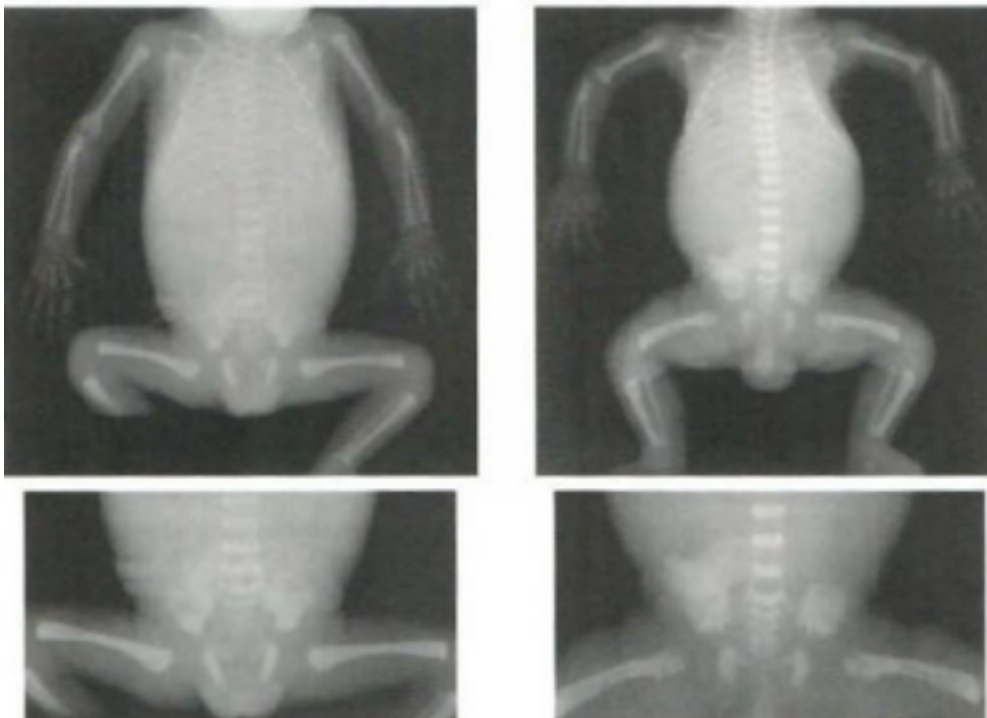
1. apply knowledge about molecular and genetic aspects of genetically determined diseases (chromosomal, monogenic, polygenic); understand the principles of genetic diagnostics and medical genetic counseling.

2. apply knowledge of molecular-genetic, biochemical mechanisms of the body's response to drugs and biologically active compounds.

3. understand the biochemical processes in the main pathological conditions and genetically determined diseases.

Sample typology of exam assignments

Case



P.S., a 30-year-old healthy woman, was 27 weeks pregnant with her first child. A fetal ultrasound examination at 26 weeks' gestation identified a female fetus with macrocephaly and rhizomelia (shortening of proximal segments of extremities). P.S.'s spouse was 45 years of age and healthy; he had three healthy children from a previous relationship. Neither parent has a family history of skeletal dysplasia, birth defects, or genetic disorders. The obstetrician explained to the parents that

their fetus had the features of achondroplasia. The infant girl was delivered at 38 weeks' gestation by cesarean section. She had the physical and radiographic features of achondroplasia, including frontal bossing, megalencephaly, midface hypoplasia, lumbar kyphosis, limited elbow extension, rhizomelia, trident hands, brachydactyly, and hypotonia. Consistent with her physical features, DNA testing identified an 1138G>A mutation leading to a glycine to arginine substitution at codon 380 (Gly380Arg) in the fibroblast growth factor receptor 3 gene (FGFR:JJ.)

Types of Questions. 5 of them to choose (2 from- of level I, 2- of level II, 1- of level 3):

1. Propose diagnosis. Explain which group of genetic diseases belongs this case to? (III level)
2. Describe (sketch) the proband family tree? (II level)
3. What are the main features of inheritance patterns of this genetic group of diseases? (I level)
4. Explain main genetic data/symbols given for this disease in OMIM (I level)
5. Propose and explain risk assessment strategy for this family/proband/siblings...(III level)
6. Write about the main causes leading to this disease? (I level)
7. What is the epidemiology of this disease? Prevalence rate? (I level)
8. What genetic variants of this disease do you know? (I level)
9. Explain the probably mechanism of mutations in this case /this disease in general / this type of diseases... (II level)
10. What phenotypic forms of this disease are known? Explain causes of phenotype diversity. (I level)
11. Propose genetic mechanisms that affect the proband phenotype and explain your thoughts? (III level)
12. Propose methods of diagnosis /prevention / treatment for this case /this disease in general/this type of diseases and explain your strategy (III level)
13. Name other disorders that are characterized by prevalence rate like this. What types of mutations are associated with these disorders? (III level)
14. Compare and contrast the pathological mechanisms of this disease in general/this type of diseases and correlate them with clinical presentation (III level)
15. Explain how phenotypic severity of this disease in general / this type of diseases... correlates with the type of mutation (II level)
16. Discuss probable ethical and legal issues regarding diagnosis /prevention / treatment for this case /this disease in general/this type of diseases...(II level)
17. Discuss probable religious, cultural, social and ethical beliefs and understanding might affect the decisions the patient/ family would make (II level)

II MEDICAL MICROBIOLOGY

(3 ECTS)

Approved final exam form - written exam

Topics included in final exam:

1. Gram-positive cocci. Microbiological diagnostics. Filling the staphylococcal infection research algorithm. The rules for the collection and delivery of material for infectious and somatic diseases caused by gram-positive cocci. Principles of treatment and prevention. Gram-negative cocci. Microbiological diagnostics. Filling the research algorithm for meningococcal infection. The rules for the collection and delivery of material for infectious and somatic diseases caused by gram-negative cocci. Principles of treatment and prevention
2. Isolation of a pure culture of enterobacteria (1-4 days of the study). Escherichia. Shigella. Vibrios. Diseases caused. Features of microbiological diagnosis in connection with the pathogenesis of diseases. Principles of treatment, prevention
3. Salmonella. Features of microbiological diagnosis in connection with the pathogenesis of caused

diseases. Principles of treatment, prevention. Differential diagnosis of bacteria of the intestinal group. Campylobacter. Helicobacter. Features of microbiological diagnosis in connection with the pathogenesis of diseases. Principles of treatment, prevention

4. The causative agents of zoonotic infections. Brucellosis, plague, anthrax, tularemia. Features of microbiological diagnosis in connection with the pathogenesis of diseases. Statement of the reaction of Ascoli, Hedelson, Wright. Interpretation of the results. Principles of treatment, prevention

5. Pathogenic and conditionally pathogenic corynebacterium. Bordetella. Algorithm for laboratory diagnosis of diphtheria, pertussis and pertussis. Features of microbiological diagnosis in connection with the pathogenesis of diseases. Formulation of the Ouchterlony reaction. Interpretation of the results. Principles of treatment, prevention

6. Pathogenic and opportunistic mycobacteria. Tuberculosis. Features of microbiological diagnosis in connection with the pathogenesis of diseases. Algorithm for laboratory diagnosis of tuberculosis. Principles of treatment, prevention

Leprosy. Features of microbiological diagnosis in connection with the pathogenesis of diseases. Principles of treatment, prevention

7. Pathogens of sexually transmitted diseases. Spirochetes. Mycoplasmas. Chlamydia Algorithm for laboratory diagnosis of sexually transmitted diseases. Features of microbiological diagnosis in connection with the pathogenesis of diseases. Principles of treatment, prevention

8. The causative agents of anaerobic infections. Algorithm for laboratory diagnosis of anaerobic infections. Features of microbiological diagnosis in communication with the pathogenesis of diseases. Principles of treatment, prevention. Rickettsia, Borrelia. Features of microbiological diagnosis in connection with the pathogenesis of diseases. Principles of treatment, prevention

9. Adenoviruses. Poxviruses. Rhabdoviruses. Role in human pathology. The principles of treatment. Prevention

Orthomyxoviruses (influenza virus). Paramyxoviruses (viruses of parainfluenza, mumps, measles, respiratory syncytial virus). Statement of RGA, RTGA, RTGA in paired sera. Interpretation of the results

10. Picornaviruses - causative agents of poliomyelitis, Coxsackie viruses, ECHO. Principles of treatment, prevention. Statement of reaction of color test. Interpretation of the results. Color sample mechanism

Arboviruses. Role in human pathology. The principles of treatment. Prevention Rubella virus. Role in the pathology of pregnant women. Principles of treatment, prevention 11. AIDS virus. ELISA for the diagnosis of HIV infection. Interpretation of the results. Principles of treatment, prevention. Oncoviruses. Principles of treatment, prevention. CMV infection. Role in human pathology. The principles of treatment. Prevention

12. Hepatitis A, B, C. viruses. Treatment principles, prevention. Herpes viruses (alpha beta, gamma herpes viruses). Principles of treatment, prevention

Types of questions for final exam:

1. Characterize main pathogenic types of gram-positive cocci, their properties and differentiate the pathogenic factors of staphylococcus and streptococcus in the development of pathological conditions.

2. Differentiate the features of microbiological diagnosis in connection with the pathogenesis of caused diseases by gram-negative cocci. Specify principles of treatment and prevention. 3. Differentiate pathogens of zoonotic infections by the level of epidemicity and severity, describe the pathogenesis of diseases.

4. Explain the concept of quarantine infections and the rules of the anti-epidemic regime in the occurrence and development of anthrax and plague.

5. Differentiate causative agents of diphtheria and pertussis in the development of diseases of the upper respiratory tract and describe the relationship between symptoms and toxin damage.

6. Differentiate pathogenic and opportunistic mycobacteria. Explain the pathogenesis of tuberculosis. Describe the features of microbiological diagnosis in connection with the pathogenesis of diseases.
7. Differentiate causative agent of sexually transmitted diseases by clinical manifestations and consequences, explain pathogenesis of the development of the disease.
8. Differences in the pathogenesis of anaerobic infections caused by spore forming and non spore forming anaerobes. Specify the effect of pathogenicity factors such as enzymes, endo-and exotoxins, and non-specific metabolic factors.
9. Describe the role of hepatitis and herpes viruses in the development of AIDS. 10. Describe the differences in the pathogenicity of poliovirus depending on the serotype and explain principles of laboratory diagnosis.
11. Differentiate the pathogenicity of the human herpes virus and the herpes simplex virus by the tropicity and severity of the disease and describe principles of prevention and treatment of herpetic infections.
12. Differentiate causative agents of hepatitis by way of a transmission and form of the disease and describe principles of laboratory diagnosis.

III. GENERAL PHARMACOLOGY (4 ECTS)

Approved final exam form - written exam

Topics included in final exam on General Pharmacology

1. Introduction to Pharmacology, Pharmacokinetics, Pharmacodynamics.
2. PNS. Cholinergic drugs.
3. PNS. Adrenergic drugs.
4. Analgesics.
5. Anti-inflammatory drugs.
6. Diuretics.
7. Antihypertensive drugs, Antianginal drugs.
8. Antibiotics. Classification. Beta-lactams. Macrolides. Tetracyclines, Aminoglycosides. Peptide antibiotics.
9. Antibiotics. Nitroimidazoles and nitrofurans. Quinolones. Linezolid. Sulfonamides. Trimethoprim.
10. Antifungal preparations.
11. Antibiotics. TB
12. Antiviral drugs. Treatment of HIV infection.
13. Pharmacology of ES. Pancreas, diabetes.
14. Pharmacology of hematopoiesis and hemostasis system.
15. Drug abuse. Addiction. Tolerance.
16. Adverse drug reactions.
17. Acute intoxication.
18. Drug interaction.

List of drugs to repeat before final examination

- | | |
|-------------------------|---------------------|
| 1. Epinephrine | Losartan |
| 2. Norepinephrine | Hydrochlorothiazide |
| 3. Enalapril | Insulin Actrapid |
| 4. Acetylsalicylic acid | Insulin NPH |
| 5. Metoprolol | Fluticasone |

- | | |
|-------------------------------|--------------------|
| 11. Salbutamol (Albuterol) | 28. Azithromycin |
| 12. Amoxicillin/clavulanate | 29. Gliclazide |
| 13. Cortisol (hydrocortisone) | 30. Fluconazole |
| 14. Spironolactone | 31. Acyclovir |
| 15. Metformin | 32. Amphotericin B |
| 16. Neostigmine | 33. Rifampicin |
| 17. Dexamethasone | 34. Furazolidone |
| 18. Heparin | 35. Co-trimoxazole |
| 19. Warfarin | 36. Pioglitazone |
| 20. Furosemide | 37. Morphine |
| 21. Ceftriaxone | 38. Diclofenac |
| 22. Prazosine | 39. Rivaroxaban |
| 23. Nifedipine | 40. Nitroglycerin |
| 24. Isoniazid | 41. Doxycycline |
| 25. Streptomycin | 42. Vancomycin |
| 26. Metronidazole | 43. Interferon |
| 27. Ciprofloxacin | |

After completing this course students will be able to:

1. know the pharmacokinetic parameters, mechanisms of absorption and biotransformation of drugs.
2. apply knowledge of pharmacodynamics and mechanisms of action of drugs in the main pathological processes (affecting the hemostasis and hematopoiesis, inflammation, infectious process, hypertension, hyperglycemia, hypotension). Know the types of undesirable side reactions and understand the possibilities of their correction.
3. demonstrate the ability to identify learning gaps and create strategies to enhance one's own knowledge and skills.

Approximate typology of exam tasks

Part1.

Case

A 75-year-old patient, whose elevated blood pressure was successfully controlled by taking loop diuretic, recently began complaining of muscle weakness, paresthesia, dyspeptic disorders, tachycardia. Because of these side effects, he cannot cope with his daily work.

Types of questions:

1. Tell the mechanism of action of the drug
2. Explain the mechanism of drug side effects
3. Explain the mechanism of drug interaction
4. Explain the pharmacologic basis of switching one drug to another
5. Compare mechanism of action of two drugs with similar effect
6. Propose agonist/antagonist of hormone
7. Explain the mechanism of action of hormone, and how drugs can affect it
8. Describe the drug – partial agonist, agonist, inverse agonist
9. List the additional medication, that can help in this condition
10. Explain how the side effects are linked with drug mechanism of action

Part 2.

Write a Prescription for the following drugs:

1. Enalapril

2. Amoxicillin/clavulanate
3. Epinephrine

Guidelines for exam technology at OQYLYQ

1. The exam lasts 3 hours.
2. At the specified time the student enters the site "app.oqylyq.kz".
3. The student receives a login and password from the IS Univer.
4. Tickets for each student are made automatically.
5. The exam starts with a mandatory proctor (you can't turn off the camera and microphone): - You need a laptop with a webcam or a home computer. If not, you can use your smartphone's camera, for example, with the DroidCam client application.
6. The answer is printed in the OQYLYQ program itself. Acceptance of a handwritten response form on paper is NOT provided.
7. At the end of the exam the student presses the "Finish" button.

Guidelines for exam conducted offline in the classroom.

WRITTEN EXAM:

TRADITIONAL - ANSWERS TO QUESTIONS.

The process of taking a written exam by the student involves the automatic creation of an exam ticket for the student, to which you must form a written answer by direct handwriting.

Exam Technology Instructions

1. The duration of the exam is exactly 3 hours.
2. Written exams are administered according to the approved schedule.
3. Students may enter the auditorium where the written exam is administered only with an ID card (Passport or student ID card). The presence of persons not participating in the examination procedure is prohibited.
4. The proctor reconciles the identification document with the admission permission slip. A student who has a discipline clearance rating of less than 50% is not allowed to take the written exam.
5. The proctor (calls the names from the list and sits them down according to the list) starts them in the auditorium.
6. Late students are not allowed to take the exam.
7. Proctor gives each student an answer sheet (if necessary, the student may take an additional answer sheet) and gives the student the opportunity to choose a ticket for the discipline being passed (the text of the ticket should not be visible to the student).
8. Students present at the exam must sign the admission form.
9. The start and end times of the written exam are recorded on the blackboard.
10. During the written exam, students' questions on the content of the examination tickets are not considered.
11. If the student does not comply with the established requirements at the exam: uses crib notes, mobile and other devices, allows disciplinary violations, disturbs other students with their actions, the proctor has the right to remove student from the audience. In this case, an act of violation of the examination procedure is drawn up, the answer sheet is annulled by crossing out diagonally, the mark "Removed for violation" is made in the admission sheet, "0" points will be

given in the sheet.

12. At the end of the exam, the student must turn in his/her ticket and answer sheet.

Scale of response quality

Evaluation	Criteria	Scale, points
Excellent	<ol style="list-style-type: none"> 1. All key aspects included and presented logically; 2. High accuracy (relevance, without redundancy) and consistent focus on question; 3. Excellent integration of theoretical issues; 4. Provision of relevant examples; 5. In-depth analysis and theoretical justification of given problem (if applicable), all key aspects identified and interpreted; 6. Fluency in use of professional terminology 	90 - 100
Good	<ol style="list-style-type: none"> 1. All key aspects included and presented logically; 2. Consistent focus on question with satisfactory accuracy, and relevance, and/or some redundancy; 3. Satisfactory integration of theoretical issues; 4. Lack of examples; 5. Satisfactory analysis and theoretical justification of given problem (if applicable), most key aspects identified and interpreted; 6. Correct use of professional terminology 	70 - 89
Satisfactory	<ol style="list-style-type: none"> 1. Most key aspects included; 2. Satisfactory focus on question - some lapses of relevance and/or noticeably redundancy; 3. Theoretical issues presented without noticeable integration; 4. Provision of unsuccessful examples or no examples; 5. Some analysis and theoretical justification of given problem (if applicable), most key aspects identified and interpreted; 6. Correct use of professional terminology 	50 - 69
Unsatisfactory (FX)	<ol style="list-style-type: none"> 1. Most key aspects missed; 2. Lack of focus on question - no relevance and notable redundancy; 3. Some theoretical issues presented in some way; 4. No or irrelevant examples; 5. Some analysis and theoretical justification of a given problem (if applicable), most key aspects missed; 6. Lapses in use of professional terminology 	25 - 49
Failed	<ol style="list-style-type: none"> 1. Most or all key aspects missed; 2. No focus on question, irrelevant information; 3. Theoretical issues missed or superficial; 4. No or irrelevant examples; 5. No analysis and no theoretical justification of a given problem (if applicable), most key aspects missed; 	0-24

6. Lapses in use of professional terminology

Grading system

Letter Grade	The digital equivalent of points	% content	Traditional system assessment
A	4,0	95-100	Excellent
A-	3,67	90-94	
B+	3,33	85-89	Good
B	3,0	80-84	
B-	2,67	75-79	
C+	2,33	70-74	
C	2,0	65-69	Satisfactory
C-	1,67	60-64	
D+	1,33	55-59	
D-	1,0	50-54	
FX	0	25-49	Unsatisfactory
F	0	0-24	Unsatisfactory
I (Incomplete)	0	-	“Discipline is not completed” <i>(not taken into account when calculating GPA)</i>

Basic literature:

1. Thompson & Thompson genetics in medicine (2016) Robert L. Nussbaum, Roderick R. McInnes, Huntington F. Willard, Ada Hamosh. Philadelphia, PA: Elsevier
2. Basic & Clinical Pharmacology [Electronic resource]: collection / ed.: B. G. Katzung, A. J. Trevor. - 13th ed. - New York; Chicago; San Francisco: McGraw-Hill Education, 2015. - 1837 p. - ISBN 978-0-07-182641-9: 0.00
3. Jawetz, Melnick & Adelberg's Medical microbiology. Geo F. Brooks, Karen C. Carroll, Janet S. Butel, Stephen A. Morse, Timothy A. Mietzner. 26th edition, 2013

Additional literature:

1. Jorde, L.B. et al. (2016) Medical Genetics. Philadelphia, PA: Elsevier
2. Emery's Elements of Medical Genetics (2017) Turnpenny, P.D., Ellard S. 15th Edition, Elsevier

3. Hartwell, L. et al (2017) Genetics: from genes to genomes, 6th edition. New York, NY: McGrawHill Education
4. USMLE Step 1 Lecture Notes (2017): Biochemistry and Medical Genetics. Kaplan Publishing

WWW resources:

1. OMIM® Online Mendelian Inheritance in Man® An Online Catalog of Human Genes and Genetic Disorders <https://www.omim.org/>
2. The Genetic Testing Registry (GTR®) <https://www.ncbi.nlm.nih.gov/gtr/>
3. Genetics Home Reference. <https://ghr.nlm.nih.gov/resources>
4. ClinGen: Clinical Genome Resource <https://www.clinicalgenome.org/>
5. Learn.Genetics <https://learn.genetics.utah.edu/content/basics/>
6. Clinical Genetic Education Resources (Courses and Lectures) <https://www.kumc.edu/gec/prof/genecour.html>
7. Genomics Education Program. <https://www.genomicseducation.hee.nhs.uk>
8. ELSEVIER “Clinical learning” training program, 2018
9. Computer program "Diamorph" - "Medical Microbiology" - atlas-guide to the bacteriology of mycology, protozoology and virology edited by Acad. Prof. Vorobyova A.A. <https://www.msmanuals.com/professional/clinical-pharmacology>