MEDICAL UNIVERSITY - PLOVDIV

MEDICAL FACULTY

SYLLABUS

IN

MEDICAL GENETICS

Accepted by the Department Council №9 on May 04, 2022

Approved by the Faculty Council with Protocol №6/15.06.2022

MEDICAL GENETICS

Syllabus

Discipline	Final exam/ semester	Auditorium classes				ECTS non-auditorium classes	ECTS total	Academic hours in years and semesters	
								4th year	
		Total	Lectures	Practices	ECTS			VII	VIII
MEDICAL GENETICS	VII	60	15	45	2.0	1.0	3.0	1/3	

DISCIPLINE:

Medical Genetics

TYPE OF DISCIPLINE ACCORDING TO THE UNIFORM STATE REQUIREMENTS:

Mandatory

LEVEL OF QUALIFICATION:

Master / M /

FORMS OF TRAINING:

Lectures, practicals, self-preparation.

YEAR OF TRAINING:

IV

DURATION OF TRAINING:

One semester

ACADEMIC HOURS:

15 hours of lectures, 45 hours of exercises

TECHNICAL EQUIPMENT APPLIED IN THE TRAINING:

Multimedia presentations, discussions, demonstration of methods for genetic analysis, observation of microscopic preparations, karyograms for analysis, reagents for the implementation of methods, solving practical problems, building and analyzing a pedigree.

FORMS OF EVALUATION:

Current evaluation, tests, colloquiums, essay writing.

EVALUATION CRITERIA:

The average current grade for the semester is formed.

ASPECTS OF EVALUATION CRITERIA:

Participation in discussions, solving tests.

SEMESTER EXAM:

Yes (written test and oral)

STATE EXAM:

No

LECTURER:

Full Professor from the Department of Pediatrics and Medical Genetics.

DEPARTMENT:

Pediatrics and Medical Genetics

ANNOTATION

The discipline "Medical Genetics" provides an opportunity to acquire modern knowledge about the patterns of inheritance of genetic diseases; features of hereditary pathology; etiology and clinic of the most common genetic diseases - chromosomal, monogenic and multifactorial and skills for active involvement in the prevention of hereditary diseases and predispositions.

BASIC AIMS OF THE DISCIPLINE

 Acquisition of knowledge about the basics of medical genetics; understanding the genetic nature of hereditary diseases, hereditary predispositions to diseases and pathology due to somatic mutations;

 Introduction to modern diagnostic methods of medical genetics and algorithm of behavior;

 Acquisition of skills for active participation in the prevention of hereditary diseases and predispositions through competent referral of patients to genetic counseling, assistance in conducting screening programs, assessment of indications for DNA diagnostics, cytogenetic analysis, prenatal, preimplantation and postnatal diagnosis.

EXPECTED RESULTS

After completing the training, students must have knowledge and specific practical skills:

• to build pedigrees of families with hereditary diseases and predispositions;

• to determine the type of inheritance, to assess the genetic risk in Mendelian and multifactorial diseases;

• recognize, classify and interpret congenital malformations;

• know the cytogenetic, molecular genetic and biochemical diagnostic tests;

• to know the indications, the main tasks and the organization of the medical-genetic consultation;

• to know the indications for prenatal diagnosis and types of antenatal diagnosis;

• to assist in the implementation of existing screening programs;

• use clinical information to search for various inherited diseases in databases.

LECTURES

LECTURE № 1 - 2 hours. Genetic counselling. Prophylactic and diagnostics of genetic disorders.

Genetic counselling: nature, indications, tasks. The organization of the medical-genetic consultation. Prenatal diagnosis - methods, indications. Mass and selective screening. Prenatal diagnosis - methods, indications.

LECTURE № 2 - 2 hours. Chromosomal abnormalities - numerical And structural. Clinical and cytogenetic characteristics. Genetic counselling.

Chromosomal pathology. Numerous and structural chromosomopathies: etiology, pathogenesis, cytogenetic forms, clinical and characteristics, genetic counselling.

LECTURE № 3 - 3 hours. Monogenic disorders. Pedigree analysis. Autosomal dominant and autosomal recessive type of inheritance – criteria and exceptions. Genetic counselling. Examples.

Autosomal dominant and autosomal recessive type of inheritance type of inheritance: clinical and genealogical criteria, features, deviations. Examples: etiology, pathogenesis, clinical characteristics, genetic counselling.

LECTURE № 4 - 2 hours. X-linked disorders. X-linked dominant and x-linked recessive type of inheritance. Genetic counseling. Examples.

X-dominant and X-recessive type of inheritance: clinical and genealogical criteria, features. Examples: etiology, pathogenesis, clinical characteristics, genetic counselling.

LECTURE № 5 - 2 hours. Non-mendelian patterns of inheritance. - multifactorial inheritance. Common multifactorial disorders.

Genetics of diseases with multifactorial heredity - criteria, features. Multifactorial inheritance and common diseases. Genetics of congenital defects with multifactorial heredity. Genetic predisposition to certain mental, cardiovascular, gastrointestinal and other diseases. Genetic counselling.

LECTURE № 6 - 2 hours. Cancer genetics.

Genetic aspects of cancer. Cell cycle. Apoptosis. Tumorogenesis - oncogenes, tumor suppressor genes, activation mechanisms. Hereditary and sporadic cancers.

Pharmacogenetics and pharmacogenomics - definition, characteristics, application.

LECTURE № 7 - 2 hours. Pharmacogenetics and pharmacogenomics.

Pharmacogenetics and pharmacogenomics. History, principles. Types of pharmacogenetic variations. Pharmacogenetics in practice.

PRACTICES

№ 1 - 3 hours:

Organization of genetic material in the cell. Cell cycle. Types of mutations. Revision

1. Cell Cycle and Mitosis.
2. Spermatogenesis and ovogenesis.
3. DNA, Replication, Transcription and Translation.
4. Subcellular organization of the genome.
5. Mutations. Mutations at the gene level. Mutations at the chromosome level.

6. Karyotype.

№ 2 - 3 hours: Genetic methods

1. Introduction to the cytogenetic laboratory
2. Technique for obtaining chromosomes

a. Preparation of lymphocyte cultures from peripheral blood (application of biostimulants and mitostatics)
b. Hypotonic processing, fixation and preparation of preparations for chromosome analysis
c. Coloring techniques: routine and tape

3. Technique for preparation of preparations for X sex chromatin
2. Microscopy of preparations for chromosome analysis and X sex chromatin.
3. Work with karyograms and karyotyping.
4. Cytogenetic diagnosis in normal and abnormal karyotype. Philadelphia chromosome.
5. Forensic examination by chromosome markers.

№ 3 - 3 hours: Autosomal chromosomal diseases

1. Consideration of a case of a family with a child with a common form of Down syndrome (trisomy 21) and medical-genetic consultation. Discuss the age of the parents as a risk factor.
2. Consideration of a case of a family with a child with a congenital translocation form of Down syndrome and medical-genetic consultation.
3. Consideration of a case of a family with a child with a hereditary translocation form of Down syndrome and medical-genetic consultation.
4. Consideration of a case of a family with a child with a mosaic form of Down syndrome and medical-genetic consultation.
5. Prenatal biochemical screening - types; discussion of results.

№ 4 - 3 hours: Autosomal chromosomal diseases - continuation

1. Consideration of a case of a family with a child with Patau's syndrome (trisomy 13) and medical-genetic consultation
2. Consideration of a case of a family with a child with Edwards syndrome (trisomy 18) and medical-genetic counseling
3. Consideration of a case of a family with a child with Rethore syndrome (partial trisomy 9p) and medical-genetic consultation
4. Consideration of a case of a family with a child with “cri du chat” syndrome (partial monosomy 5p) and medical-genetic consultation

№ 5 - 3 hours: Gonosomal chromosomal diseases (numerical and structural)

1. Consideration of a case of a family with a child with Turner's syndrome (total monosomy X) and medical-genetic consultation
2. Consideration of a case of Turner syndrome with other cytogenetic variants and medical-genetic consultation
3. Consideration of a case with Triple X syndrome and medical-genetic consultation
4. Consideration of a case with Klinefelter's syndrome and medical-genetic consultation

5. Consideration of a case with "supermen" syndrome and medical-genetic consultation
6. Prenatal biochemical screening - discussion of results.

№ 6 - 3 hours: Summary exercise on chromosomal diseases and colloquium
1. Chromosomal diseases
2. Cytogenetic methods
3. Test

№ 7 - 3 hours: Autosomal recessive diseases
1. Consideration of a case of a family with a child with cystic fibrosis and medical-genetic consultation. DNA analysis techniques: Southern blot hybridization, PCR amplification.
2. Consideration of a case of a family with a child with phenylketonuria and medical-genetic consultation. Guthrie test.
3. Consideration of a case of a family with a child with Werdnig-Hoffmann disease and medical-genetic consultation.
4. Consideration of a case of a family with a child with adrenogenital syndrome and medical genetic counseling.
5. Consideration of a case of a family with a child with thalassemia and medical-genetic consultation.

№ 8 - 3 hours: Metabolic diseases
1. Consideration of a case of a family with a child with glycogenosis and medical-genetic consultation.
2. Consideration of a case of a family with a child with Hurley's disease and medical-genetic consultation.
3. 3.Consideration of a case of a family with a child with Wilson-Konovalov disease and medical-genetic consultation

№ 9 - 3 hours: Autosomal dominant diseases. Examples
1. Consideration of a case of a family with a child with Huntington's disease and medical-genetic consultation.
2. Consideration of a case of a family with a child with achondroplasia and medical-genetic consultation.
3. Consideration of a case of a family with a child with myotonic dystrophy and medical-genetic consultation.
4. Consideration of a case of a family with a child with Neurofibromatosis and medical-genetic consultation.

№ 10 - 3 hours: Heterogeneous diseases
1. Consideration of a case of a family with a child with Osteogenesis imperfecta and autosomal recessive type of inheritance and medical-genetic consultation.
2. Consideration of a case of a family with a child with Osteogenesis imperfecta and autosomal dominant type of inheritance and medical-genetic consultation.
3. Consideration of a case of a family with a child with Polycystosis renis and autosomal recessive type of inheritance and medical-genetic consultation.
4. Consideration of a case of a family with a child with Polycystosis renis and autosomal dominant type of inheritance and medical-genetic consultation.

5. Commentary on families with deafblindness, albinism, etc.

№ 11 - 3 hours: X - recessive diseases
1. Consideration of a case of a family with a boy with Duchene muscular dystrophy and medical-genetic consultation.
2. Consideration of a case of a family with a boy with hemophilia and medical-genetic consultation.
3 Consideration of a case of a family with a boy with Wiscott-Aldrich and medical-genetic consultation.
4. Consideration of a case of a family with a boy with G6FD and medical-genetic consultation.
5. Consideration of a case of a family with "Fragile X" syndrome and medical-genetic consultation.

№ 12 - 3 hours: X-dominant type of inheritance. Examples. Non-Mendelian type of inheritance. Examples
1. Clinical-genetic criteria of X - dominant type of inheritance
2. Diseases inherited as XD type .
3. Consideration of a case of a family with incontinentio pigmenti and medical-genetic consultation.
4. Uniparal disomy. Genomic imprinting.
5. Mosaicism.
6. Mitochondrial type of inheritance.
7. Consideration of a case of a family with Prader-Willi syndrome and medical-genetic consultation

№ 13 - 3 hours: Multifactorial defects. Screening for open neural tube defects.
1. Consideration of a case of a family with a previous child with anencephaly and medical-genetic consultation.
2. Consideration of a case of a family with a previous child with spina bifida and medical-genetic consultation.
3. Consideration of a case of a family with a previous child with a cleft palate and medical-genetic consultation.
4. Consideration of a case of a family with a child with heart malformation and medical-genetic consultation.
5. Ultrasound screening - interpretation and comment of results.
6. Prenatal biochemical screening for open fetal defects.

№ 14 - 3 hours: Summary exercise on monogenic and multifactorial diseases, screening tests and colloquium.
1. DNA research methods in monogenic diseases.
2. Types of inheritance in monogenic diseases and differential diagnosis.
3. Multifactorial defects and diseases.
4. Screening.
5. Test.

№ 15 - 3 hours: Genetics of cancer

1. Consideration of a case of a family with breast cancer.
2. Consideration of a case of a family with ovarian cancer.
3. Consideration of a case of a family with colorectal cancer and endometrial cancer.

BIBLIOGRAPHY

Basic

1. Genomic Medicine (edited by D. Toncheva; V. Ganev) ed. Simelpress, 2016.

2. Rare genetic diseases. (edited by D. Toncheva), ed. Simelpress, 2014.

Additional

1. Nussbaum R., R.McInnes, H.Willard. Thompson & Thimpson GENETICS IN MEDICINE, 7th ed. Saunders Elsevier, 2007.
2. Strachan T. Human Molecular Genetics, Garland Publishing Inc, 2010
3. Read A. New Clinical Genetics, Scion Publishing LTD, 2010
4. Turnpenny P. D. Emery's Elements of Medical Genetics, Churchill Livingstone, 2011
5. Gardner R.J.M., Chromosome Abnormalities and Genetic counseling. Oxford University Press Inc, 2011
6. Francis R. C. Epigenetics. WW Norton & Co, 2012

Web sites:

http://www.ncbi.nlm.nih.gov

http://www.geneticalliance.org/

http://www.ncbi.nlm.nih.gov/Omim/allresources.html

http://archive.uwcm.ac.uk/uwcm/mg/hgmd0.html

http://www.ncbi.nlm.nih.gov/Omim/allresources.html#LocusSpecific

http://www.ncbi.nlm.nih.gov/Omim/allresources.html#ModelOrganisms

http://www.mitomap.org/

http://www.ncbi.nlm.nih.gov/Omim/allresources.html#Phenotypes

http://www.ncbi.nlm.nih.gov/ncicgap/

http://www.ncbi.nlm.nih.gov/Homology/Davis/

http://www.gene.ucl.ac.uk/nomenclature/

http://www.ncbi.nlm.nih.gov/disease/

http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?CMD=search&DB=omim

http://www.docnmail.com/learnmore/medical/genetics.htm

http://www.who.int/genomics/public/geneticdiseases/en/index1.html

http://www.wellcome.ac.uk/en/genome/genesandbody/hg06b010.html

CONSPECTUS FOR SEMESTRIAL EXAM

1. Material bases of heredity. Nucleic acids. Proteins. Gene - structure and function, mechanisms of gene regulation. Genetic code.

2. Molecular and subcellular organization of human chromosomes. Karyotype.

3. Gene mutations. Mutagenic factors. Significance of mutagenesis. Genetic monitoring.

4. Basic disorders of the karyotype. Mechanisms of chromosomal aberration, designation.

5. Chromosomal diagnostics - methods (direct and indirect). Tape techniques - diagnostic capabilities. Chromosomal polymorphism. Heterochromatin markers. Sex chromatin - essence, diagnostic value.

6. DNA analysis. PCR. Southern blot. Mutation analysis. DNA sequencing and cloning. Human genomic project. Gene mapping and identification strategies. Human gene map.

7. Chromosomal pathology. Chromosomal diseases associated with numerous aberrations of autosomes, complete and mosaic forms. Genetic counseling.

8. Chromosomal pathology. Chromosomal diseases associated with structural aberrations of autosomes. Partial monosomies and trisomies. Microdeletion syndromes. Subtelomeric aberrations. Molecular cytogenetics.

9. Chromosomal pathology. Chromosomal diseases associated with gonosome aberrations. Genetic counseling.

10. Gender determination and differentiation. Male and female pseudohermaphroditism, true hermaphroditism. Examples. Genetic counseling

11. Autosomal dominant type of inheritance - clinical and genetic patterns, examples. Genetic

12. Autosomal recessive type of inheritance - clinical and genetic patterns. Examples. Genetic counseling.

13. Sex-related type of inheritance (X-recessive and X-dominant). Clinical and genetic patterns, examples, genetic counseling. Gender-dependent scars.

14. Heterogeneous diseases - nature, examples, clinical-genetic polymorphism.

15. Multifactorial type of inheritance - clinical and genetic patterns, examples, genetic counseling. Diseases with hereditary predisposition.

16. Non-Mendelian type of inheritance - species. Dynamic mutations. Expansion of triplet repetitions - nature, examples, clinical and genetic characteristics. Genetic counseling.

17. Non-Mendelian type of inheritance - species. Genetic imprinting - essence, examples, clinical-genetic characteristics. Genetic counseling.

18. Mitochondrial genome. Mitochondrial type of inheritance - nature, examples, clinical and genetic characteristics. Genetic counseling.

19. Cystic fibrosis - clinical and genetic characteristics, Genetic counseling.

20. Phenylketonuria - clinical and genetic characteristics, treatment, genetic counseling. Other hereditary aminoaciduria. Mass screening for hereditary diseases in newborns.

21. Hemophilia - types, clinical and genetic characteristics,gGenetic counseling.

22. Muscular dystrophy type Duchenne and type Becker. Clinical and genetic characteristics, Genetic counseling.

23. Enzymopathies and lysosomal diseases of accumulation - lipidosis, mucopolysaccharidosis, glycogenosis. Clinical-genetic characteristics, genetic counseling.

24. Hereditary diseases of lipid metabolism. Hyperlipidemia. Kinds. Clinical-genetic characteristics, genetic counseling.

25. Defects of purine metabolism, clinical and genetic characteristics, genetic counseling.

26. Polycystic kidney disease - types, clinical and genetic characteristics, genetic counseling.

27. Hereditary diseases of collagen - examples, clinical and genetic characteristics, genetic counseling.

28. Hemoglobin. Hemoglobinopathies and hemoglobinosis - clinical and genetic characteristics, genetic counseling.

29. Hereditary diseases of metals. Hemochromatosis. Wilson-Konovalov disease. Clinical-genetic characteristics, genetic counseling.

30. Immunogenetics. Gene regulation of immunity. Hereditary immunodeficiency conditions. Clinical-genetic characteristics, genetic counseling. Complement system - genetic disorders and diseases. Genetic counseling.

31. Pharmacogenetics. Pharmacogenetic defects and pharmacogenetic polymorphism. Glucose-6-PDN. Clinical-genetic characteristics, genetic counseling.

32. Oncogenetics. Oncogenes and tumor suppressor genes. Chromosomal markers in leukemias, lymphomas and myelodysplastic conditions. Diagnosis. Prognostic significance, attitude to therapeutic behavior.

33. Leukemia - molecular genetic studies, diagnostic and prognostic significance.

34. Prevention and therapy of hereditary pathology - basic approaches. Genetic counseling. Prenatal diagnosis.

35. Screening of hereditary diseases and defects: mass and selective, prenatal and postnatal. Biochemical screening in pregnant women.