Technion- Israel Institute of Technology
The Rappaport Faculty of Medicine

The program for MSc degree in Medical science
Genetic Counseling Course

Background

Genetic counseling is a rapidly developing field and, due to increasing ability to diagnose genetic conditions, its role in public medical service is growing. Genetic conditions involve significant consequences to individuals along their lifespan, during the pre-conception stage and through birth, infancy, childhood adulthood and the aging period. There is growing demand for skilled practitioners in this field, and there is a need to train personnel to counsel individuals and families about genetic conditions and their implications.

Goals

To educate and train genetic counselors, by delivering updated knowledge in medical genetics. The aim of the program is to support trainees:

- to achieve understanding of molecular mechanisms of diseases from gene to protein
- to understand biological technologies for diagnosing and treating genetic diseases
- to estimate recurrence risk of genetic conditions in families
- to analyze test results and
- to provide appropriate recommendation for medical approaches to management of the condition.

Eligibility requirements

1. BA degree from an academic institute approved by the scientific counsel of Israel, in the field of life science, with minimum average grades of 85.
2. Approval of the committee of magister studies in medical science
3. Appropriate performance at personal interview.

Program details

1. The selected students will be accepted to the school for graduate students
2. The program includes courses that require students to undertake projects or seminars
3. The student must accomplish 40 academic points if the BA degree is achieved in a 4 year program, or 60 academic points if the BA degree is achieved in a 3 year program.

Special courses dedicated to the program

Genetic counseling-exposure to clinical and laboratory activity

Academic credit points: 12 points
Weekly hours: 16 hours, 2 semesters
Course description, content and aims: this is a practical component of the course. The student is exposed to activities in the genetic institute by:

a. Taking part in the genetic counseling given by a certified genetic counselor or a geneticist , including pre-session discussion about the medical aspects, genetic principles and planed interaction with the family, prior to the meeting, shadowing the practitioner during the session, and discussing the assessed outcome after the session, with special attention to medical subjects that were discussed, quality of interaction developed with the counselees in terms of emotional, communicational and personal aspects, analysis of the outcome in light of the aim and special aspects that were planed prior to the session, conclusions and lesson to learn. Students should have experience during the placement period in reproductive genetics, genetics related to adult onset diseases, pediatric genetics and cancer genetics.
b. Weekly participation in the staff meeting of the genetic institute
c. Attendance at weekly structured lectures given by a staff member (genetic counselor, geneticist or senior laboratory technician) in various subjects.
d. Visits for at least 20% of the time at cytogenetic and molecular genetic laboratories, in which the student will be exposed and practice common procedures, including: cell cultures, karyotyping, FISH technique, DNA extraction, PCR, Sanger sequencing, Cytogenetic-Microarray-Analysis.

Expected learning outcomes:

General

The student will progress from observation of practice (initially) to partial involvement in delivering care, through to management of cases (under supervision).

The student will:

- Develop awareness of the professional role of the genetic counselor, working within the professional code of conduct for genetic counselors, working safely as an autonomous practitioner
- Understand the limitations of his or her own skills and knowledge
- Develop communication and counselling skills
- Apply theory to practice
- Develop skills in caseload management, managing cases safely and effectively

- Acquire skills and understanding regarding how to prepare patients for testing and offering post- test support and counselling
- Develop an empathic relationship and effective communication with the patient
- Work collaboratively within the multi-disciplinary team
- Produce clear correspondence including referral letters and post-consultation summary letters
- Make clear and contemporaneous health records.

Specific expected learning outcomes:

As a result of undertaking the course the student will acquire knowledge and develop counselling skills regarding:

Knowledge

- The impact of family history on individual and family, impact of positive and negative test results on individual and family, the nature of pre-symptomatic testing and differences to diagnostic testing.
- Abnormal fetal ultrasound findings on ultrasound, including implications of major malformations and 'soft (minor) markers'.
- The benefits and limitations of prenatal imaging techniques (US & MRI).
- Develop specific counselling skills related to use of prenatal diagnosis, including techniques such as PGD, CVS, amniocentesis and NIPT.

- Prenatal screening tests (Down syndrome & NTD screening tests).

- The impact of consanguinity.
- Common genetic conditions (symptoms, natural history, molecular basis of disease, prevalence, penetrance, testing options, inheritance patterns, condition management) including: dysmorphology, pediatric, neurological, cardiac, oncology, skeletal, metabolic, endocrine & hematology conditions.
- Correlation of mutations and chromosomal abnormalities to disease.

- Uses and applications of genetic testing (diagnostic, carrier, PND, presymptomatic testing, screening),
- Therapeutic options.

- The roles of members of the multi-disciplinary team
- Different technologies and laboratory methods used for genetic disease diagnosis and research, and being aware of limitations of molecular and other forms of genetic testing.

- The psychological, personal and emotional aspects of genetic healthcare, including dealing, facilitating and supporting patients in situations of uncertainty and assessing the patient's psychological state (prior/ current).

- The range of potential psychological and emotional reactions to living with a genetic condition in the family or living at risk, potential reactions of individuals such as siblings, parents, obligate carriers to genetic risk or test results and the impact of living with disease and test result.

- Issues related to family communication, including the possibility of non-disclosure of information between family members.
- Ethical principles for healthcare practice, components of informed consent, human rights (including those of the fetus), genetic law and guidelines, cultural competence, impact of illness and/or disability on the individual family and society, insurance, employment and discrimination issues relevant to genetic conditions.

The student will develop skills in:

- Ascertaining & interpreting relevant medical information from the individual medical documents
- Assessing the risk for a genetic condition, accessing relevant medical information and using the relevant details needed for case management.
- The use of genetics databases required for the work of the genetic counsellor.
- Developing the ability to develop self- awareness to reflect on and inform own practice, use clinical and counseling supervision, consulate other health professionals about specific genetic diseases in order to discuss with the family screening options, management options and prognosis.
- Preparing a patient for the potential outcomes of a genetic test, make the patient aware of possible psychological responses to their situation,
- Exploring patient's past and current psychosocial situation, ascertain practical and psychological needs of the individual and family,
- Supporingt individuals to disclose genetic information to family,
- Refering to professional health care in mental health if needed, identify relevant organizations and patient organizations and communicate information to the families.
- Explaining the risks/ probability to the genetic condition and the implications of the abnormal sonographic or genetic test inding to the patient, provide and explain information on reproductive and PND options in appropriate and culturally sensitive language,
- Providing information on possible investigations, management, and referral to patients.
- Use of a range of appropriate communication and counselling skills, communicate effectively with the patient and family,
- Provide information about the genetic disorder and risk, appropriate to the families according to their language, understanding abilities, religious and cultural views,
- Facilitate decision-making and enable individuals to make informed choices about the implications of genetic diagnosis on the family members.

- Address issues of disclosure of risk to other family members and support patients to do this.

- Attitudes- Develop the ability to adopt a non- judgmental approach, develop unconditional acceptance of each individual.

Evaluation:

1. Weekly provision of structured 4 summaries of genetic counseling sessions in which the student was involved, including psychosocial aspects. Assessing these reports constitutes 30% of final grade (attached is the format)
2. Oral board examination of 4 teachers (genetic counselors and geneticists), assessing knowledge in various topics of genetic counseling, with an emphasis of medical knowledge and communicational skills. 70% of the final grade.

Format of genetic counseling summary to be done by the student:

(Details related to the student, the teacher and the counselee)
Referral reason
Participants in the session
Personal and familial medical history
Pedigree
Consanguinity yes/no
Pregnancy yes/no, gestation week
Tests that were done during the pregnancy, and their results
Summary of information provided during the counselling
Options discussed and/or recommendations that were given
Short scientific summary of the medical aspects discussed during the counseling session
References
Psychological-communicational aspects: did the counsellees ask questions during the session? Do you have the impression that the messages were understood? What means did the counsellor use to improve the messages? Was the counseling directive, did the counselor facilitate specific actions? Did the counsellee exhibit stress? Did the counsellor respond and what was done in order to ease the stress?

Investigation project

Academic credit points: 8 points
Course time-line: 2 semester course, (time is not structured)
Course description, content and aims: the students should prepare an investigation plan focused on patients or families affected with genetic inherited condition. This theoretical project should yield results allowing genetic counselling to family members, and genetic tests for directed counseling. The project will be based on authentic medical charts of patients attending the genetic center, and include authentic medical data, but the research plan will be theoretical. The project will be mentored by senior geneticist. The course aim is training the student to be able to plan research and to learn the scientific structure of presentation or writing of such projects.
Expected learning outcomes: the student will gather the medical data of the patients involved in the project, will discuss the differential diagnosis, and various laboratory approaches for promoting the diagnostic process. The student will be able to discuss the value of test results, further diagnostic approaches and their implication to patients, family and science. The student will learn and practice the use of genetics databases required for the work of the genetic counselor.
The student will be able to draw scientific plan according to accepted scientific structure.
Evaluation: assessment of the written research project by the mentor, presentation of the project to board of examiners, and oral test of the project's content.
The course program: the mentor will present the student the families or patients (or suggest a few options) for the project. The student will present the layout of the proposed project, and after approval- will write the research plan.
Structure of research project:

- Introduction: research subject, student name, the genetic center and the mentor name.
- Abstract: scientific background, hypothesis and research aim, research methods, expected findings and results, importance of the research for patients and the general population.
- Key words
- The research hypothesis
- The research aim
- Expected benefits to patients, their families and medicine
- The research plan body: medical background, preliminary results (if available), detailed research plan (research principles, inclusion criteria, pedigrees, clinical data. Laboratory approach including the rationale of choosing specific technologies, advantages and disadvantages of the suggested laboratory methods), presenting the theoretical expected results and analyzing these results, discussion and references.

Selected seminars in genetic counseling

Academic credit points: 2 points
Weekly hours: 2 hours
Course description, content and aims: Face to face presentations of each student, who will be mentored by either a senior geneticist or medical expert in the field of interest (dermatologist, rheumatologist, etc.). The course focuses on selected subjects in genetics including deafness, intellectual disability, metabolic diseases, skeletal disorders, neurological diseases, microdeletion or microduplication chromosomal syndromes, inflammatory diseases and FMF. An emphasis will be given to embryology, genetic patho-mechanism, epidemiology, examples of relatively common diseases and their clinical significance, prognosis and available treatments, and the implicated genetic counseling. The course aim is to systematically teach central concepts in medical genetics either by independent learning and teaching of the student, or by listening to peers.
Expected learning outcomes: for the presenter- to study genetic concepts independently, comprehend the medical genetic data and transform it to a teaching session for peers. For the listeners, to learn about medical aspects of various fields of medical genetics, so that when asked to counsel families in these subjects, they will have acceptable body of knowledge.
Evaluation: assessment of seminars by the mentors.

The course program:

- Neonatal genetic screening in Israel
- Perinatal population genetic screening tests
- Intellectual disability
- Growth disorders- overgrowth and failing to throve/short stature
- Connective tissue disorders
- Ethics in genetics, and the Israeli Act of Genetic Information
- Microscopic chromosomal disorders
- Syndromes associated with CNVs- microdeletion and microduplication syndromes
- Syndromes of mosaic etiology
- Triplet repeats diseases
- Storage disorders
- Diseases of cartilage and bone.

Integrated introduction to genetic counseling

Academic credit points: **2**
Course hours: 1 week (8 hours X 5 days)
Course description, content and aims: face to face lectures given by experienced senior genetic counsellors and geneticists in various subjects that are central and common in daily activity in the genetic centers.
The lectures are focused in common genetic conditions and include discussion of their implications in terms of genetic counselling, the approaches to dealing with genetic diseases in families and the general population, and options, including genetic tests. The course aim is to orient the students towards their exposure to genetic counselling in the genetic centers, allowing them to better grasp the genetic counseling sessions' structure, interactions, communication and content.

The themes that are included in this course are:
The structure of the genetic counseling session, planning and executing genetic counselling.
Professional behavior,drawing pedigrees, the symbols used and accepted principles.
The medical background, epidemiology and genetic counselling principles of chromosomal syndromes.
The genetic counselling principles of autosomal dominant conditions, and medical discussion of common conditions in this group.
The genetic counseling principles of autosomal recessive conditions, and medical discussion of common conditions in this group.
The genetic counseling principles of X linked conditions, and medical discussion of common conditions in this group.
The genetic counseling principles of multi-factorial conditions, and medical discussion of common conditions in this group.
Systematic approach to dysmorphology, principles of practice, use for diagnosis of genetic conditions and the implications for genetic counseling.
Purpose of prenatal diagnosis, description of the various approaches, their benefits and risks, and discussion of various applications and national protocols.
Principles of screenings tests, the available screening tests for Down syndrome, including first and second trimester tests, tools to interpret various results of these test results and the national protocols.
Risks associated with advanced maternal age, the accepted medical approach and principles of genetic counselling.
The principles of adopting genetic tests into population screening, leading examples to conditions that are included, tests that are practiced, the flowchart of activities in such projects, and updated recommended and available screening tests in Israel.
Medical implications, genetic background and practical approach to couples with reproductive problems, including recommended diagnostic approaches and the medical implications of abnormal tests results.
Current approaches to plan a session of delivering news, principles of approaches and ways to support counsellees, described with various examples.
Medical background to common type of cancers with prominent genetic causes, available tests and the implications of abnormal test results, principles of genetic counselling in these families and supporting the counsellees.

The general principles of ethics in medicine, and the specific ethical bases to genetics, its implication in various situations in genetic counseling, supported by examples, with an emphasis on counseling challenges in multi-cultural society. The main points of the Israeli genetic law of genetics, and the implicated norm of practice in light of the law.
The effect of various maternal medical conditions and medications on the developing fetus, current recommendations due to current understanding of the effects supported by examples, and approach during pregnancy.
The main up-to-date genetic databases that serve practitioners as sources for background scientific knowledge, deferential diagnosis, updated genetic recommendations and tests, such as OMIM, GeneReviews, or London Database, and websites of families and patients groups.

Expected learning outcomes:

After completing this course the student will have knowledge of:

- Mendelian and non- Mendelian inheritance and the underlying mechanisms by which genetic disease may occur.
- Common genetic conditions (symptoms, natural history, molecular basis of disease, prevalence, penetrance, testing options, inheritance patterns, condition management) including: dysmorphology, pediatric, neurological, cardiac, oncology, skeletal, metabolic, endocrine & hematology conditions.
- Psychological theories including grief and loss, responses to risk, impact of event, protection mechanisms.
- The difference between diagnostic tests to screening tests and the principles and history of population & genetic screening.
- National screening programs conducted in Israel including new born screening, carrier screening, Down syndrome and neural tube defects screening.
- Principles and terms in population genetic & statistics, demographics, cultural, and religion characteristics of the populations in Israel, and the impact of consanguinity and genetic screening tests for at risk populations.
- The structure of the genetic counselling session and the principles under which the interactions is conducted.

After completing this course the student will be able to:

- Effectively interpret the medical background and history of families in genetic counselling

Evaluation: mandatory presence in all lectures.

The course program:

1. The role of the genetic counsellor
2. Creating pedigrees
3. Common numerical and structural chromosomal changes
4. Autosomal dominant conditions
5. Autosomal recessive conditions
6. X linked inheritance conditions
7. Multifactorial inheritance
8. Introduction to dysmorphology
9. Approaches to prenatal diagnosis
10. Screening tests for Down syndrome

11. Implications of advanced maternal age
12. Common "soft" and gross sonographic abnormal findings
13. Genetic test screenings to the general population and population at risk
14. Reproductive medicine- recurrent abortions and infertility
15. Delivering results
16. Ethics and the Israeli act of Genetics
17. Teratology
18. Using data bases for practicing genetic counselling.

Ultrasound examination during pregnancy- from the normal fetus to abnormal findings

Academic credit points: 2 points
Weekly hours: 2 hours
Course description, content and aims: frontal lectures given by experienced senior peri-natologists, exerts in pre-natal ultrasound examinations. The lectures include presenting the normal structure and appearance of organs and anatomical systems of the developing fetus, and diagnosing abnormal findings. The emphasis will be given to embryology, patho-physiology, epidemiology, and clinical significance, prognosis and available treatments of abnormal findings.
Expected learning outcomes: understanding medical summaries of ultrasound examinations during pregnancies, including the benefits and sensitivity limitations of the technology, purpose of the examination and its use in low and high risk pregnancies. The students will learn the clinical implications of various abnormal findings, including differential diagnosis.
Evaluation: written multiple choice examination.
The course program:

1. The benefits of ultrasound examination
2. Congenital heart defects
3. The central nervous system part 1
4. The central nervous system part 2
5. The fetal face
6. Gastrointestinal tract and the abdominal wall
7. The urinary and genital systems
8. Abnormal sonographic findings in genetic syndromes
9. From cystic hygroma to hydrops fetalis
10. The fetal environment, including multiple pregnancies
11. The skeletal system
12. Invasive procedures in pregnancy
13. Discussion of cases.

Human genetics

Academic credit points: 2 points
Weekly hours: 2 hours
Course description, content and aims: face to face lectures given by faculty members from the Human Genetics department. The course content includes genetic mechanisms in humans, patho-mechanisms of various genetic diseases, common current approaches to dealing with genetic diseases in families and in the population.
Topics of the course:

- The structure of the human genome.
- Mutation types in humans, inherited variants and polymorphism.
- Laboratory diagnosis of point mutations, deletion and insertion mutations.
- Sanger technique for sequencing, high throughput sequencing (NGS), Linkage analysis and homozygosity mapping.
- Multifactorial inheritance, genetic and environmental factors, Hardy-Weinberg equation, factors affecting it, various frequencies of mutation-causing diseases in different ethnic groups.
- The structure of the chromosome, karyotyping, structural and numerical chromosomal abnormalities, submicroscopic chromosomal aberrations (CNVs), Laboratory technique for diagnosing chromosomal abnormalities.
- The genetic basis of cancer, oncogenes and tumor suppressing genes, genetic tests for detection of individuals in risk for cancer.
- Genetic diseases associated with receptor defects, patho-mechanism, clinical expression and therapeutic approaches.
- Genetic diseases associated with structural proteins, patho-mechanism, clinical expression and therapeutic approaches.
- Genetic diseases associated with genomic (triplets) repeats, patho-mechanism, clinical expression and therapeutic approaches.
- Genetic diseases associated with mitochondrial defects (mitochondrial genes or abnormal mitochondrial function), patho-mechanism, clinical expression and therapeutic approaches.
- Genetic diseases associated with enzymatic defects, patho-mechanism, clinical expression and therapeutic approaches.
- Cystic Fibrosis disease as a model for monogenic disease: allelic heterogeneity, phenotype-genotype relations, medical expression, available treatment procedures.
- The structure of genetic counseling process and its purpose, risk calculation in various diseases, pedigrees and situations.
- Neonatal screening tests program in Israel, perinatal genetic screening test program in Israel, methods of pre-natal diagnosis and using medical genetic tools in family planning, benefits and risks, purposes of the different available approaches.
- Ethical principles in medical genetic service, ethical dilemmas in medical genetic service.

Expected learning outcomes:

After completion of the course, students will have a knowledge of:

- The specific aspects of the human genome
- Genetic factors leading to diseases in humans, methods and approaches to diagnose those diseases
- Various approaches to treat and prevent these diseases, and developing medical approach according to the detailed understanding of the patho-mechanisms of the diseases.
- Genetic mechanisms of humans, mechanisms of development of diseases, and what are the various current medical ways to dealing with diseases.
- Laboratory methods for diagnostic tests of different genetic diseases, comprehending the benefits and limitations of the different tests
- The effect of technological development on diagnostic abilities, principles of decision making regarding preferring one technology over another
- Patho-mechanisms of genetic diseases, such as chromosomal microscopic aberration, copy number variant abnormalities, changes in single gene of multi-factorial events.
- The medical and phenotypic features of selected genetic conditions
- Therapeutic different approaches in selected genetic conditions
- Mechanisms leading to cancer, distinguishing between familial and sporadic cases and the implicated risks for family members, knowing genetic tests of germinal or somatic mutations and their importance for promoting the diagnosis, the genetic counseling principle to the affected individual and family members.
- Genetics databases required for the work of the genetic counselor.
- Principles of information needed to be delivered to families regarding relevant genetic diseases, the associated recurrence risks and the options the patients have in order to make personal decisions.
- Preventive strategies of genetic conditions
- Principles guiding decision makers regarding inclusion of genetic conditions in population screening tests program
- Pre-natal diagnosis test options
- The ethical principles guiding genetic counseling and services,
- The complexity of situations that become ethical challenges, full comprehension of informed consent idea by family members, facilitating and supporting them to get informed consent and decisions.

After completing the course, the student will be able to:

- Calculate the recurrent risk of disease in family or an individual
- Understand the complexity of this process in specific situations
- Understand the central role of achieving the accurate genetic basis of the specific diseases and the implicated needed genetic tests, in order to draw final conclusions.

Evaluation: written multiple choice examinations.

The course program:

1. The structure of human genome and mutation types
2. Molecular methods to diagnose causative genes in monogenic disorders
3. Multifactorial inheritance
4. Human genome project
5. Population genetics

6. Medical cyto-genetics
7. Genetics of cancer
8. Enzymatic diseases
9. Diseases of receptors
10. Diseases of structural proteins
11. Diseases of genomic repeats
12. Mitochondrial diseases
13. Cystic fibrosis
14. Genetic counseling
15. Ethic in genetics
16. Prenatal diagnosis
17. Screening tests in population.

Embryology

Academic credit points: 3 points
Weekly hours: 3 hours
Course description, content and aims: the course will cover the development of the human embryo according to the different body systems.
After completion of the course, the student will understand:

- The normal development of the different human body system according to its timeline
- The aetiology of various congenital malformations associated with these systems.

Evaluation: two personal assignments (10% each), laboratory report (5%), multiple choice examination (75%).
The course program:
Fertilization
Axis determination
Somatogenesis
Nervous system
Cardiovascular system
Respiratory system
Gastrointestinal system
Urinary system
Reproductive system
The placenta
Fetal period.

Endocrinology

Academic credit points: 3 points
Weekly hours: 3 hours
Course description and content:

- the hormonal pathways of the main hormonal system of the human being including the central nervous system controlled hormone release,
- thyroid hormones,
- the hormones produced by the adrenal,
- the hormones produced by the pancreas with special emphasis on diabetes,
- the development of the reproductive system and its function in different ages,
- homeostasis and control of ions in the human body.

Expected learning outcomes:

After completing the course, students will understand:

- The main hormonal pathways of the human body
- Their function in health state and the consequences of aberrant function, clinically, biochemically and molecularly.

Evaluation: written multiple choice examinations.
The course program:

- Hypothalamus and pituitary gland
- The thyroid gland
- The adrenal gland
- Pancreatic hormones
- Type 2 diabetes
- Overweight
- Sexual development
- The female reproductive system
- The male reproductive system
- Mineral control
- Calcium homeostasis.

Ethics and law in medicine

Academic credit points: 2 points
Weekly hours: 2 hours
Course description, content and aims.
Moral dilemmas, occasionally painful, are integrative part of the daily medical activity. Since making decisions is a must, the practitioner must analyze these decisions in criticizing filtering, to test whether these decisions meet moral norms. In this course, student will review the central values that should be considered by the practitioner. Examples of moral and ethical dilemmas will be thoroughly discussed. The course also provides information about the law and court verdicts in the medical field.
Expected learning outcomes:
After completing the course, students will understand:

- The ethical principles for healthcare practice
- The ethical and legal framework relevant to genetic counseling, including concepts of confidentiality and security of genetic information.
- The different aspects of human rights, genetic law and guidelines, impact of illness and/or disability on the individual family and society.
- Potential conflicts and hazards such as insurance, employment and discrimination issues relevant to genetic conditions.

The students will develop the skills to:

- Recognize & respect the individual's culture, values and beliefs.

Evaluation: written multiple choice examination.
The course program:
Introduction. What are the ethical principles?
Basic concepts in medical ethics
Autonomy and paternalism
Informed consent
Medical confidentiality and telling the truth
Patient rights' act
The dying patient act
Ethics and law in psychiatry
Medical negligence
Discussions of ethical dilemmas.

Psychology

Academic credit points: 2 points
Weekly hours: 2 hours
Course description, content and aims: In the framework of this course we will learn the psychology as a science used to analyze human behavior. Participants will study traditional and current issues which this field touches upon, including interrogation methods and areas of specialization. Special emphasis will be placed on areas of psychology topics relevant to their specialized areas. The main goal is to learn about new developments in the field of theoretical and empirical implications for human behavior and use relevant information from psychology to analyze and understand major issues dealt with by the medical profession.
Expected learning outcomes:
After completing the course, the student will have a knowledge of:

- Relevant psychological theories including grief and loss
- Responses to risk
- Impact of event
- Protection mechanisms
- Dealing with situations of uncertainty
- Assessing past and current psychosocial situation
- Classification of various psychological abnormalities and the therapeutic approach.

Evaluation: written multiple choice examination.

The course program:

- Nature of psychology

  Definition of the field, interrogation methods, areas of development, the contribution of science to psychology
- Body and Soul

  Heredity and environment

  The history of psychology

  Various aspects of psychology
- Perception

  Learning and Memory
- Personality theories

  The dynamic theories: Freud's theory

  Psychology and myself - Anna Freud and Erickson

  Object relations-Wyncote

- Coping with stressful situations- protection mechanisms
  How to define stress? What causes stress? Coping methods with stress on an individual level and a national level
  What are the most common stressful situations in a doctor's work, and what are possible coping mechanisms
- Introduction to psychopathology
  Diagnosis and classification
  Depiction of disorders
  Treatment methods
- Social Psychology
  Creating positions
  Inter personal attraction
  Group effects
  Leadership
  Decision Making.

The biologic basis of cancer

Academic credit points: 2 points
Weekly hours: 2 hours
Course description, content and aims: face to face lectures given by experienced researchers in the field of cancer, describing cellular and molecular current understanding of cancer development, including environmental factors leading to malignant transformation. The course aim is to review biological mechanism of cancer in terms of the tumor's growth, factors affecting the malignant cells survival, the patho-mechanism of metastases, and the connection between the data about patho-mechanism of cancer to developing therapeutic strategies.
Expected learning results:
After completing the course, the student will have a knowledge of:

- Cancer development in light of molecular- cellular-tissue aspects
- The application of this understanding to development of therapy.

Evaluation: written multiple choice examination.

The course program

Introduction to cancer biology and the malignant process
Viruses causing cancer and oncogenes
Signaling in cancer and receptors
Growth control and cancer
Genomic instability inhibition and protein metabolism control in cancer
The outer-cellular environment in cancer
Angiogenesis in cancer
The biology of malignant metastases
The environment of the tumor
Malignant stem cells
New therapies for cancer

Biostatistics

Academic credit points: 2 points
Weekly hours: 2 hours

Course description, content and aims: describing and analyzing basic statistical methods for analysis of data and draw conclusions of data, with an emphasis of implication and applications in medical research. Teaching sessions will be delivered via face to face lectures and practical exercises using computer software for statistical analyses of data.

Expected learning outcomes:
After completing the course, the student will be able to:

- Analyze relevant patient and family information to determine genetic risk
- Calculate genetic risk by various means
- Review calculations of data that were done by others and re-assess the conclusions
- Use genetic databases and registers for information retrieval and data analyses.
- Use available resources, including genetic websites, specialist databases and statistics programs to draw relevant conclusions.

Evaluation: weekly exercise (15%), multiple choice test (85%)
The course program:
Descriptive statistics, location, distribution and relative location
Normal and other types of distributions
Interlocution to probability
Statistical deduction
Hypotheses examination of single average
Hypotheses examination of proportion
Tests for comparing 2 averages
Comparing 2 proportions
Examination of associated between categorical variables
Examination of linear association between 2 sequenced variables
Linear regression.

Clinical biochemistry

Academic credit points: 4 points
Weekly hours: 4 hours

Course description, content and aims: diabetes as a model for abnormal hormonal control- the physiology of blood glucose level, insulin structure and function, metabolism of fats, role of corticosteroids in gluconeogenesis, treatment of diabetes and glycogen storage diseases. Classification and structure of lypoproteins, their metabolism and their receptors. The metabolism of bile acids, amino acids, amonia, and urea cycle. The structure and function of the blood proteins. The structure and function of human hemoglobin. Biochemical pathways of sphingolipids, positional cloning as a strategy to discover causative genes, the biochemical roles of vitamins

Expected learning results:
After completing the course, the student will have a knowledge of:

- Carbohydrate metabolism and the role of the hormones that are involved, including the relationship between abnormal structure and function of these hormones to diseases and the pathophysiology of common diseases such as diabetes.
- Patho-mechanism of glycogen storage disease, hypercholesterolemia and atherosclerosis.
- Patho-mechanism of jaundice and congenital diseases involving abnormal liver function and tests for assessment of liver function.
- The relationship between abnormal levels of blood proteins and various pathological conditions, and the patho-mechanism of haemoglobinopathies.
- The relationship between the abnormal biochemical pathway of sphingolipids and disease in man
- The role of abnormal vitamin levels and medical features of the conditions caused.

Evaluation: laboratory exercises, written multiple choice examination.

The course program:
Hormonal control of metabolism
Plasma lipoproteins
Abnormal liver function, metabolism of amino-acid and ammonia
Diagnostic enzymology, blood proteins
Molecular basis of hemoglobin diseases
Selected inherited diseases
Vitamins.

Epidemiology
Academic credit points: 2 points
Weekly hours: 2 hours
Course description, content and aims: Research and applied principles of epidemiology play an increasing role and necessity for doctors training in the 21st century. In the era of rapid development of information and diagnostic and therapeutic technologies, a doctor is faced with complex challenges. Training in data collection, intelligent use of existing databases and research methods, combined with critical analysis and processing of information and tools for decision-making in the field of health policy, help the physician to successfully meet these challenges.

Expected learning outcomes:

After completing the course, the student will have a knowledge of:

- Recognition and understanding of basic concepts and methods in epidemiology
- Tools for evaluating the health of populations, analysis of differences between populations, and applying knowledge for preventive interventions, diagnosis and treatment.
- Basic tools for planning and performance of population studies, and logical deduction of conclusions.
- Basic tools for analyzing and drawing conclusions from studies published in scientific literature
- Knowledge of the main principles and approaches to primary and secondary prevention of diseases.

After completing the course, the student will develop:

- Basic skills for presentation, reading and interpretation of epidemiological data, and educated use of existing database
- Ability to recogniseof the application areas of epidemiology, and its importance as a tool for decision-making in public health and clinical medicine.

Evaluation: written multiple choice examination.

The course program:

- Introduction to Epidemiology

- Measurement of morbidity and mortality: prevalence and incidence
- Morbidity and mortality indices
- Rates comparison of morbidity and mortality among populations
- Clinical trials for evaluation of treatments and interventions
- Cohort Study
- Cross-sectional study
- Ecological research
- Measures of the relationship parameters in epidemiological research
- Monitoring and supervision of infectious diseases
- Epidemiological investigation
- Conclusions drawing from study results: biases (selection information)
- Early disease detection and diagnosis tests.

Recent topics in Human genetics

Academic credit points: 2 points
Weekly hours: 2 hours
Course description, content and aims: face to face lectures on DNA structure, genes, transcription, translation, protein synthesis, types of mutations and their effects, ways to differentiate between mutations and polymorphic changes, the human genome and genetic variation, and somatic mutations. The aim of the course is to provide knowledge about techniques for detecting abnormalities (karyotyping, chromosomal microarray, FISH, mutation detection methods, next generation sequencing), for understanding different technologies and laboratory methods used for genetic disease diagnosis and research. It will also aim to make students aware of limitations of molecular and other forms of genetic testing. The course also will provide tools for bioinformatics analysis of next generation sequencing data

Expected learning outcomes:

After completing the course, the student will have a knowledge of:

- The possibility of incidental findings that are disclosed in advanced molecular tests (whole exome sequencing, whole genome sequencing).

After completing the course, the student will be able to:

- Correlate single gene mutations and chromosomal abnormalities to a specific disease
- Evaluate the suitable technologies for each individual case
- Provide information on possible investigations, management, and referral to the individuals and their families. The student will have awareness of

Evaluation: written multiple choice examination.
The course program:

Phenotypic and genotypic variability in human genetics
Modifier genes for monogenic diseases
The use of iPS for modeling genetic disorders
Genome editing
Gene Therapy
Next generation sequencing as a novel tool in human genetics: Challenges and opportunities
Advanced diagnostic approaches in genetics
The genetic basis for autism
Population based disease gene discovery
Personalized medicine

Mutation detection in genetic diseases and implications for treatment
Non coding RNAs in hereditary human diseases
Somatic mosaicism