

I DMD

Topic 1. Medical Ecology I - Introduction

1. Overview of the regulations of didactic training.
2. Rules of microscopic slides examination — slide of *Lilium sp.*- pollen, microscopic preparation, unstained
 - a. naked eye observation - description
 - b. microscopic observation - magnification 100x - description
 - c. microscopic observation - magnification 400x, or 600x - description
 - d. microscopic observation - magnification 1000x - oil immersion - description
3. Introduction to the medical ecology:
 - a. basic terms of ecology (biotope, biocenosis, ecosystem, population, ontocenosis)
 - b. some basic principles of ecology, medical ecology, human ecology
 - c. characteristics of hydrosphere, lithosphere, aerosphere
 - d. biotope of modern man
 - e. biocenotic interactions
 - f. human modification of biosphere
 - g. home - a source of risk for its inhabitants

Knowledge required before attending classes:

- basic terms of ecology (biotope, biocenosis, ecosystem, population, ontocenosis, environment)
- basic principles of ecology, medical ecology, human ecology
- influence of abiotic factors on organisms
- world human population growth
- human biology
- the characteristic of life
- questions about smoking, tobacco and health
- drug abuse

Recommended literature:

1. Syllabus
2. Campbell, J.B. Reece: Biology. Pearson, Benjamin Cummings, Seventh Edition 2005
3. Meder S., Windelspecht M.: Human Biology. McGraw-Hill Science/Engineering/Math, Twelfth Edition 2011

Topic 4. Medical Ecology IV- Abiotic factors: the influence of physical and chemical factors on the vital functions of organisms; factors with teratogenic effect.

1. Temperature and water as life functions limiting factors
 - a. anabiosis of moss fauna - experiment, report
 - b. freeze drying bacteria *Lactobacillus acidophilus* – demonstration
 - c. temperature influence on *Daphnia sp.* heart function - experiment, report
2. Teratogen-induced abnormalities in vertebrate organism
 - a. *Gallus sp.*
 - crossed beak and cyclopia - macroscopic preparation fixed in 4% formalin - demonstration
 - schistocelia - macroscopic preparation fixed in 4% formalin - demonstration
 - non-retracted yolk sac - macroscopic preparation fixed in 4% formalin - demonstration
 - b. *Homo sapiens L.*
 - exencephalia (cranialis atrophy) and abdominal hernia - fetus fixed in 4% formalin – demonstration

Knowledge required before attending classes:

- abiotic factors

Recommended literature:

1. Syllabus
2. Campbell, J.B. Reece: Biology. Pearson, Benjamin Cummings, Seventh Edition 2005

Topic 5. Medical Ecology V - Biotic factors: antagonistic and protectional environmental interactions (antibiotics, mycotoxins, plants volatile oils); models of population growth.

I. Antagonistic interactions

1. The effect of *Penicillium notatum* Mantelli et Negri on *Staphylococcus aureus* Rosenbach - description
2. Mycotoxins of *Aspergillus flavus* Link
 - a. infected arachidonic nuts (*Arachis hypogaea* L.) – demonstration
 - b. *Aspergillus flavus* Link - culture on Sabouraud medium – growth description
 - c. evaluation of the susceptibility of *Paramecium* sp. on the extract from fungus mold - experiment, report
 - d. *Phytophthora infestans* (Montagne) de Barry in potato (*Solanum tuberosum*)
 - infected potatoes - macroscopic preparation – demonstration
 - infected leaves - macroscopic preparation - demonstration
3. The effect of phytoncides of garlic (*Allium sativum* L), onion (*Allium cepa* L.) and horseradish (*Armoracia lapathifolia* Gilib.) on *Escherichia coli* (Migula) Castellani et Chalmers - demonstration
4. The kit of essential oils useful in medicine – demonstration

II. Protectional interactions

1. *Cetraria islandica* (L.) Arachius - Iceland moss
 - a. microscopic preparation, magnification 100x, 400x or 600x – figure
 - b. macroscopic preparation - demonstration
2. *Lupinus* sp. and *Rhizobium* sp
 - a. The roots of *Lupinus* - macroscopic preparation, demonstration
 - b. *Rhizobium* sp. - soil forms - fixed microscopic slide, Gram stained, magnification 1000x – figure
 - c. *Rhizobium* sp. - noduli forms - fixed microscopic slide, Gram stained, magnification 1000x – figure

Knowledge required before attending classes:

- terms: biotic and abiotic factors, symbiosis, mutualism, commensalism, parasitism, herbivory, predation, competition, antibiotics, volatiles in plants, lichens

Recommended literature:

1. . Syllabus
2. Campbell, J.B. Reece: Biology. Pearson, Benjamin Cummings, Seventh Edition 2005

Topic 6. Medical Ecology VI -Biotic factors: selected poisonous animals, plants and fungi with toxicological and pharmacological significance.

I. Selected poisonous animals:

1. *Aurelia aurita* L. - sea nettle - macroscopic preparation fixed in 4% formalin - demonstration
2. *Apis mellifera* L. - Honey Bee
 - a. imago - macroscopic preparation - demonstration
 - b. sting - microscopic slide fixed in 70% ethanol, unstained, magnification 100x, 400x or 600x- figure
3. *Paravespula* syn. *Vespula vulgaris* L. - Common Wasp
 - a. imago - macroscopic preparation - demonstration
 - b. sting - microscopic slide fixed in 70% ethanol, unstained, magnification 100x, 400x or 600x - figure
4. *Vespa crabro* L. - European Hornet - imago - macroscopic preparation -demonstration
5. *Bufo bufo* L. - Toad - macroscopic preparation fixed in 4% formalin - demonstration
6. *Vipera berus* L. - Viper, adder - macroscopic preparation fixed in 4% formalin - demonstration
7. *Leiurus* sp. - Scorpion - macroscopic preparation fixed in 4% formalin – demonstration

II. Selected plants and fungi with toxicological and pharmacological significance:

1. *Atropa belladonna* L. - Deadly Nightshade - berries fixed in 70% ethanol, macroscopic preparation - demonstration
2. *Datura stramonium* L. - Thornapple - seed capsules, macroscopic preparation - demonstration
3. *Digitalis purpurea* L. - Digitalis - macroscopic preparation - demonstration
4. *Claviceps purpurea* L. - Ergot (*Secale cornutum*) - macroscopic preparation - demonstration
5. *Amanita phalloides* (Vaill.:Fr.) Link. - Deathcap
 - a. mushroom's fruitbody - macroscopic preparation - figure
 - b. spores - microscopic slide, unstained, magnification 400x or 600x, 1000x - figure
6. *Agaricus campestris* L. - mushroom's fruitbody - macroscopic preparation - figure

Knowledge required before attending classes:

- fungi impact on ecosystems and human welfare,
- poisonous fungi: *Claviceps purpurea* (ergot), *Paxillus involutus*, *Amanita phalloides*
- plants: *Atropa belladonna*, *Datura stramonium*, *Digitalis purpurea* and their role in medicine
- characterization, venom components and their effects on human of *Apis mellifera*, *Paravespula* (*Vespula*) *vulgaris*, *Vespa crabro*, *Leiurus* sp., *Bufo bufo*, *Vipera berus*

Recommended literature:

1. Syllabus
2. Campbell, J.B. Reece: Biology. Pearson, Benjamin Cummings, Seventh Edition 2005

Topic 3. Medical Ecology III – Hydrosphere, Aerosphere

I. Hydrosphere,

I. Classes of water purity:

1. Polisaprobic water

- a. examination of direct samples of water - microscopic slide, magnification 100x,400x or 600x – demonstration with description, figure of organisms
- b. index organisms - macroscopic preparation fixed in 70 % ethanol - demonstration
- c. *Mucor sp.* - culture in Sabouraud medium - growth description
- d. *Rhizopus sp.* - culture in Sabouraud medium - growth description

2. Mezosaprobic water

- a. examination of direct samples of water - microscopic slide, magnification 100x,400x or 600x - demonstration with description, figure of organisms
- b. index organisms - macroscopic preparation fixed in 70 % ethanol – presentation
- c. *Hirudo medicinalis L.* - macroscopic preparation - presentation

3 Oligosaprobic water

- a. examination of direct samples of water-microscopic slide, magnification 100x,400x or 600x - demonstration with description, figure of organisms
- b. index organisms - macroscopic preparation fixed in 70 % ethanol - presentation
- d. *Acanthamoeba sp.* - methanol fixed slide, Giemsa stained, magnification 1000x – figure

II. Determination of selected water quality indices:

I. Water physical and chemical parameters: pond, well, tap water

- a. chlorides – experiment, report.

II Aerosphere

1. Influence of dust pollution on mammal organism:

- a. *Rattus norvegicus* Berkenhout - lung with experimental silicosis - formalin fixed microscopic slide, hematoxylin and eozylin stained, magnification 100x,400x or 600x - figure
- b. lung of healthy rats - formalin fixed microscopic slide, hematoxylin and eozylin stained, magnification 100x,400x or 600x - figure
- c. rat's peritoneum malignant mesothelioma - formalin fixed microscopic slide, hematoxylin and eozylin stained, magnification 100x,400x or 600x - demonstration
- d. *Homo sapiens L.* - lung with antracosis - formalin fixed microscopic slide, hematoxylin and eozylin stained, magnification 100x,400x or 600x - figure
- e. lung of healthy man - formalin fixed microscopic slide, hematoxylin and eozylin stained, magnification 100x,400x or 600x - figure
- f. man's lung with antracosis - macroscopic preparation, formalin fixed – presentation with description
- g. man's healthy lung - macroscopic preparation, formalin fixed – presentation with description

2. Examples of microorganisms found finding in the Lodz air

- a. *Aspergillus niger* - culture in Sabouraud medium - growth description
- b. *Penicillium sp.* - culture in Sabouraud medium - growth description
- c. agar plate with micro-organism found in the Lodz air - microbiological analysis of the air with the Koch sedimentation method – experiment, report.
- d. *Alternaria sp.* - culture in Sabouraud medium - presentation

3. Calculation of parasites growth index – mathematical task

Knowledge required before attending classes:

- air contaminants and their pathogenicity
- characteristic of pneumoconiosis, collagen and non-collagen dust disease
- definition and types of smog
- biological contaminants and connected diseases
- water classifications and saprobity
- definitions of BOD, COD, Bi, coliform titre, coliform index
- classes of water purity
- human activities

Recommended literature:

1. Syllabus
2. L. Chomicz: Fundation of medical parasitology. Compendium for medical students. Medical University of Warsaw
3. Meder S., Windelspecht M.: Human Biology. McGraw-Hill Science/Engineering/Math, Twelfth Edition 2011

Topic 2. Medical Ecology II- Lithosphere

1. Microbiological and mycological evaluation of soil.

Soil as a reservoir of saprophytic and pathogenic organisms.

a. *Streptomyces sp.*

- microscopic slide fixed with 70% ethanol, stained with methylene blue, magnification 100x, 400x or 600x - demonstration

b. *Trichophyton sp.*

- cultivation on liquid and solid Sabouraud medium - demonstration

- hair perforation test - description

- hair perforation by dermatophytes - slide fixed with 70% ethanol, unstained, magnification 100x - demonstration

2. Parasitological evaluation of soil – experiment, report.

3. The stages of the most common parasites found in soil

a. *Trichuris sp.* - whipworm

- eggs - slide fixed with 70% ethanol, unstained, magnification 100x, 400x or 600x - figure

b. *Ascaris sp.* - roundworm

- embryonated (invasive) and non-embryonated (non-invasive) eggs - slide unstained, magnification 100x, 400x or 600x - figure

Knowledge required before attending classes:

- characteristic of lithosphere
- soil as a reservoir of pathogenic organisms
- human activities
- human as of resources and pollution

Recommended literature:

1. Syllabus
2. L. Chomicz: Fundation of medical parasitology. Compendium for medical students. Medical University of Warsaw
3. Meder S., Windelspecht M.: Human Biology. McGraw-Hill Science/Engineering/Math, Twelfth Edition 2011

Topic 7. Medical Ecology VII – Homeostasis in humans – regulation systems; Assesment of Ecology

1. Unstable regulation system:

a. Traube's cell – experiment, report

2. Stable regulation systems:

a. exercise tests:

- Ruffier's and Master's trials – experiments, reports

- changes of heart action after exercise in humans with different physical efficiency – graph, demonstration

b. buffer properties of blood serum – experiment, report

c. regulation of glucose concentration in human blood – structural scheme – demonstration with description

d. thermoregulation system in humans – structural scheme – demonstration with description

Knowledge required before attending classes:

- terms: homeostasis, positive feedback, negative feedback, mechanisms of human thermoregulation

- homeostasis (in human organization)

- blood – homeostasis

- gas exchanges in the body

- urinary system: acid-base balance of body fluids; acid base buffer system

- skeletal system: boneremodeling and its role in homeostasis

-muscular system: energy for muscle contraction, homeostasis (how the muscular system contributet to homeostasis)

- endocrine system : homeostsis

Recommended literature:

1. Syllabuses

2. Campbell, J.B. Reece: Biology. Pearson, Benjamin Cummings, Seventh Edition 2005

3. Meder S., Windelspecht M.: Human Biology. McGraw-Hill Science/Engineering/Math, Twelfth Edition 2011

Topic 8. Introduction to genetics

1. Structure of DNA and chromosomes.
2. Mitosis and meiosis, crossing over.
3. Mendelian inheritance.
4. Penetration, expression of genes.

Required knowledge:

- the structure and the role of nucleic acids and chromosomes
- transmission of hereditary information
- mitosis, meiosis and crossing over, cell cycle
- genotype, phenotype
- genetic crosses
- inheritance of traits
- The Mendel Laws – Mendelian genetics and inheritance

Recommended literature:

1. Syllabus
2. Campbell, J.B. Reece: Biology. Pearson, Benjamin Cummings, Seventh Edition 2005
3. Jorde L.B.; Carey J.C.; Bamshad M.J.; White R.L.: Medical Genetics, Third Edition 2006

Topic 9. Medical Genetics I- Dominant/recessive inheritance in humans.

1. Selected diseases inherited in the monogenic pattern in humans:

a. hereditary spherocytosis -slides

b. sickle cell anaemia

- description of the conditions, differences in the blood smear of patients (differences between the appearance of red blood cells), diagnostics and treatment

c. phenylketonuria

- urinary test – experiment, report

d. alkaptonuria

- method of detection – experiment, report

e. tyrosinemia - slides

f. albinism - slides

2. Pedigree analyses

- pedigrees of selected features in humans

- determination of genotypes

3. Genetic tasks

Required knowledge:

- inheritance of genetic disorders

- pedigree analysis

Recommended literature:

1. Syllabus

2. Campbell, J.B. Reece: Biology. Pearson, Benjamin Cummings, Seventh Edition 2005

3. Jorde L.B.; Carey J.C.; Bamshad M.J.; White R.L.: Medical Genetics, Third Edition 2006

Topic 10. Medical Genetics II

1. Detection of antigens of ABO system:

- in saliva – experiment, report
- on surface of human erythrocytes:
 - with horse serum – experiment, report
 - with fitoagglutinin from *Dolichos biflorus* - experiment, report

2. Genetic tasks

Required knowledge:

- basic terms: antigen, antibody, agglutination, universal donor and recipient, lectins
- characteristic of ABO and Rh systems (inheritance, structure of A and B antigens)

Recommended literature:

1. Syllabus
2. Campbell, J.B. Reece: Biology. Pearson, Benjamin Cummings, Seventh Edition 2005
3. Jorde L.B.; Carey J.C.; Bamshad M.J.; White R.L.: Medical Genetics, Third Edition 2006

Topic 11. Medical Genetics III- Sex as a genetic trait

1. Sex of *Drosophilla sp.*

a. female - microscopic slide fixed in ethanol, unstained, magnification 100x - demonstration

b. male - microscopic slide fixed in ethanol, unstained, magnification 100x - demonstration

2. Sex chromatin in humans

a. "drumstick" in neutrophilic leukocytes - microscopic slide fixed and stained by Pappenheim method, magnification 1000x - execution and description of the method, figure

b. Barr body - photography – demonstration

c. "Y body" in lymphocytes - photography - demonstration

3. Sex - linked traits

a. Sex linkage - examples of tasks – description

b. tests for color blindness by *Ishihara charts* - description

4. Genetic tasks

Required knowledge:

- sex determination

- sex-linked traits

- sex –linked inheritance

Recommended literature:

1. Syllabus

2. Campbell, J.B. Reece: Biology. Pearson, Benjamin Cummings, Seventh Edition 2005

Topic 12. Medical Genetics IV- Aneuploidy of autosomes and sex chromosomes

I. 1. Chromosomes:

- a. in fruit fly (*Drosophila melanogaster*) larvae salivary glands - microscopic slide fixed in 70% ethanol, magnification 100x - figure
- b. in mouse (*Mus sp.*) cornea epithelium cells - microscopic slide fixed in Carnoy's fluid, hematoxylin stained, magnification 1000x-figure
- c. from mouse (*Mus sp.*) bone marrow cells - microscopic slide, Giemsa stained, magnification 1000x-figure
- d. from human lymphocytes culture - microscopic slide, Giemsa stained, magnification 1000x-figure

II.2. Genome mutations - aneuploidy of sex chromosomes:

- a. monosomy 45,X - Turner syndrome
 - lymphocyte metaphase chromosomes, karyotype - photography
 - phenotypic traits of the syndrome - photography
 - morphogram - photography
- b. trisomy 47,XXY - Klinefelter syndrome
 - lymphocyte metaphase chromosomes, karyotype - photography
 - phenotypic traits of the syndrome - photography
- c. other trisomies
 - 47,XXX - karyotype - photography
 - 47,XYY - karyotype - photography

3. Morphogram - making of the own morphogram, report

III 1. Chromosomal abnormalities- aneuploidy of autosomes

- a. trisomy 21 (Down syndrome)
 - metaphasal chromosomes from lymphocytes, figure - demonstration
 - slides, demonstration
- b. trisomy 18 (Edwards syndrome)
 - metaphasal chromosomes from lymphocytes, figure - demonstration
 - slides, demonstration
- c. trisomy 13 (Patau syndrome)
 - metaphasal chromosomes from lymphocytes, figure - demonstration
 - slides, demonstration

2. Cancer chromosomal abnormalities

- a. He-La cells (Endometrial Uterus Cancer)- microscopic slide fixed in methanol, stained by Giemsa method, magnification 1000x - demonstration
- b. NK/Ly cells (Nemeth-Kellner Lymphoma) - microscopic slide fixed in methanol, stained by Giemsa method, magnification 1000x - demonstration

3. Structural chromosomal abnormalities

- a. "cri du chat" syndrome (5p deletion)
 - metaphasal chromosomes from lymphocytes, figure - demonstration
 - slides, demonstration

4. Gene mutations

- a. *Drosophila sp* mutants
 - white, bar, nub - microscopic preparations fixed in methanol, unstained, magnification 100x - descriptions
 - yellow, ebony - macroscopic preparations, magnification 100x- descriptions

5. Genetic tasks

Required knowledge:

- chromosome inheritance
- karyotype
- alterations of chromosome number or structure and genetic disorders they cause

Recommended literature:

1. Syllabus
2. Campbell, J.B. Reece: Biology. Pearson, Benjamin Cummings, Seventh Edition 2005

Topic 13. Medical Genetics V- Quantitative inheritance in humans

1. Distribution of random events frequency - balls distribution curve in the Galton apparatus – experiment, report
2. Examination of multifactor quantitative property in human population
 - a. measurement of the head length and width – experiment, report
 - b. calculation of the head length-width index – experiment, report
 - c. own skull capacity measurement by Lee Pearson method – experiment, report
3. *Homo sapiens* L. - description of own dentition
4. Calculation of own body surface area.
5. Calculation of Rohrer index
6. Examination of multifactorial quantitative characteristics in human population
 - a. Wechsler's intelligence scale
 - b. Self-evaluation of IQ using MENSA test example
7. Human dermatoglyphics in genetics
 - a. Types of human fingerprints patterns - diagrams - presentation with description
 - b. Performing own dactylogram - experiment, report
 - c. Examples of dermatoglyphic disturbances in various genetic disorders - diagrams, presentation with description
8. Genetic aspects of transplantation:
 - a. Inheritance of HLA haplotypes – diagram - presentation
 - b. Examples of HLA alleles with striking disease associations – table - presentation.
9. Genetic tasks

Required knowledge:

- polygenic inheritance
- polygenic quantitative traits
- multifactor quantitative property in human population
- transplantation (blood, organ, tissue transplantation)
- role of the MHC

Recommended literature:

1. Syllabus
2. Campbell, J.B. Reece: Biology. Pearson, Benjamin Cummings, Seventh Edition 2005
3. Jorde L.B.; Carey J.C.; Bamshad M.J.; White R.L.: Medical Genetics, Third Edition 2006

Topic 14. Medical Genetics VI- Genetics of human population: Hardy-Weinberg equilibrium; Assesment of Genetics

1. Frequencies of some alleles in human population:

a. those determining autosomal allele-morphological traits – phenotypes frequency table of students of the 1st course of Medical Faculty of Medical University of Lodz; calculation of gene and genotypic frequencies of one selected trait using Hardy-Weinberg rule

b. multiple alleles – calculation of AB blood group frequency in South America - task

c. recessive sex-linked alleles – calculation of frequency of disturbances in color vision in Caucasian and in African women

2. Recessive allele selection in population - task

3. Genetic drift – experiment, report

Required knowledge:

- the Hardy-Weinberg theory/ equilibrium
- presentation of allele frequencies
- condition for Hardy-Weinberg equilibrium
- population genetics and human health
- natural selection
- genrtic drift
- gene variation
- presentation of gene variation
- sexual selection

Recommended literature:

1. Syllabus
2. Campbell, J.B. Reece: Biology. Pearson, Benjamin Cummings, Seventh Edition 2005