

**The Exercise Topics**

**Subject: MOLECULAR BIOLOGY AND GENETICS  
for MEDICINE ENGLISH DIVISION Students,  
1<sup>st</sup> year  
2013/2014**

**Class No. 1 [5 academic hours]** □□□□ □□□□□□□□□□□□□□□□

**Subject: Introductory Exercise**

1. Overview of the Rules of classes – Handout 1
2. Principles of microscopy techniques – PowerPoint 1 [Do not show last 2 slides]

**Subject: The structure of prokaryotic and eukaryotic cells**

1. Powerpoint 2 – Gram positive versus gram negative
2. Powerpoint 3 - Prokaryotic vs. Eukaryotic cells - structure and function of cellular organelles / Comparison of prokaryotic and eukaryotic cells / Examples of many disease causing bacteria

**In the Lab**

1. bacteria – microscopic slides: *Bacillus anthracis*, *Clostridium botulinum*, *Shigella dysenteriae*, *Streptococcus pyogenes* - □□ students draw what they see

under the microscope

2. The structure of the eukaryotic cell

a. microscopic slides - Comparison of human erythrocytes, frogs erythrocytes and chicken erythrocytes - students draw what they see under the microscope

### **Subject: The division of genetic material during cell divisions - mitosis and meiosis**

1. Powerpoint 4 - The cell cycle (interphase, G1 phase, S phase, G2 phase, G0 phase) / The division of somatic cells – mitosis / The division of gamete cells – meiosis

### **In the Lab**

1. Mitosis - students draw what they see under the microscope

a. microscopic slide - The stages of mitosis in root growth cone cells of *Allium cepa* - drawing,

b. microscopic slide - The stages of mitosis in cells of *Ascaris* sp. - drawing

2. Meiosis - students draw what they see under the microscope

a. microscopic slide - The stages of meiosis in cells of *Lillium* sp. – drawing

b. microscopic slide - The stages of meiosis in cells of *Ascaris* sp. - drawing

3. cell division model - Comparison of mitosis and meiosis – Students compete in groups to properly arrange the sequence of meiosis with the modelling kit – members of team who complete model first have 2 extra points.

**Class No. 2** [5 academic hours]

**Subject: Introduction to medical genetics**

1. Powerpoint 5 - Genetic material (location in the cell, chemical composition and structure of nucleic acids, functions, genetic code, codon, anticodon, intron, egson, nucleosome)
2. Basic concepts of genetics (gene, allele, locus, phenotype, phenocopy, genotype, dominant and recessive trait, genome, chromosome, autosome, heterosome)
3. Mendel's Laws (*Parentes* cross, test cross, backcross)
4. Interaction of alleles (co-dominance, incomplete and complete dominance)
5. The interaction between genes (epistasis, complementation)
6. Pleiotropy
7. Lethal and sub-lethal genes
8. Poligenes, oncogenes
9. Gene conversion
10. Linkage genes, crossing – over, genetic distance

### **In the Lab**

- a. microscopic slide The location of DNA and RNA in onion (*Allium cepa*) root tip cells

Subject: **Inheritance of human traits**

1. Powerpoint 6 - Basic concepts of inheritance monogenic traits which are autosomal dominant, recessive and codominant with examples of enzymopathy and hemoglobinopathy.
2. Genetics of blood group and human Rh factor. Serological conflict of Rh system.
3. Principles of quantitative traits inheritance - analysis of chosen quantitative traits in human

### **In the Lab**

- a. microscopic slide - spherocytosis - blood smear of the patient --drawing
- b. microscopic slide - sickle cell disease - a patient's blood smear – drawing
- c. demonstration - phenylketonuria – urine sample –
- d. demonstration - alcaptonuria – detection
- e. Inheritance of quantitative traits - a quantitative analysis of selected human populations
  - measuring the length and width of your own head - each student in the group does this
  - measuring the cranial capacity of Homo sapiens by Broca - experimental protocol
  - calculation of the capacity of his own head by Lee Pearson - each student in the group does this
  - Calculating the Size of your body - each student in the group does this
  - Rohrer index calculation - each student in the group does this

**Class No. 3 [5 academic hours]**

### **Subject: Inheritance of human traits**

1. Powerpoint 7 - Sex Human Chromatin / Inheritance of linkage with sex traits

a. daltonism – detection of abnormal color vision with pseudochromatic Ishiharas tables – demonstration with description

b. hemophilia A, B

### **In the Lab**

1. microscopic slide - Sex chromatin in granulocytes - "stick drummer"
2. microscopic slide - Barr body

### **Subject: Basics of cytogenetics**

1. Powerpoint 8 - Types of sex determination / The structure and principles of human chromosomes classification
2. Video – DNA Mutation

### **Subject: Mutagenesis. Genomic mutations.**

1. Powerpoint 8 - Molecular genesis of mutagenesis and types of mutagenic factors. / Gene Mutations: gene mutations of chosen diseases: phenylketonuria, mucopolysaccharidosis,

alcaptonuria, albinism

### In the Lab

a. microscopic slides - *Drosophila sp*-mutants – *white*, *Bar*, *vestigial*, *antennapedia*, *yellow*, *ebony*

b. microscopic slide chromosomes of a woman and a man from lymphocyte culture

c. Activity - arrangement of human karyotype

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**Class No. 4** □□□ [5 academic hours]□□

### **Subject: Numeric and structural aberrations of chromosomes**

1. Powerpoint 9 - Numeric – aneuploidia of heterosomes

a. monosomy 45, X (Turner syndrome)

b. trisomy 47, XXY (Klinefelter syndrome)

c. Other examples of trisomy

• 47, XXX - karyotype subject

• 47, XYY - karyotype subject

**Subject: Numeric and structural aberrations of chromosomes**

1. Powerpoint 10 - Numerical aberrations: aneuploids of autosomes

- a. trisomy 21 (Down syndrome)
- b. trisomy 18 (Edwards syndrome)
- c. trisomy 13 (Patau syndrome)

2. Autosomal structural aberrations

- deletion of the short arms of chromosome from group B (band "cri du chat")

3. Notation of karyotype and arrangement of human karyograms with chosen numerical and structural aberrations of chromosomes.

1. Fingerprints

**Subject: Population genetics**

1. Powerpoint 11 - Hardy-Weinberg Law

2. The frequency of selected alleles in human populations.

a. frequency of recessive and autosomal traits – protocol of experience

b. The sensation of taste phenylthiocarbamide (PTU) - the calculation of gene frequencies and genotype on the basis of the Hardy-Weinberg - protocol of experience

3. Influence factors (mutation, selection and genetic drift) on the change of allele frequencies in the population

a. Genetic drift - an analysis of the model - protocol of experience

**Class No. 5 [5 academic hours]**

**Subject: Influence of biological and chemical environmental factors on human health.**

1. Powerpoint 12 - **Venomous and poisonous animals**

**In the Lab - Drawing**

- *Apis mellifera* – honey bee:
  - a. imago - macroscopic specimen - drawing
  - b. sting - microscopic slide - drawing
- *Paravespula son. Vespa vulgaris* - common wasp
  - a. imago - macroscopic specimen - demonstration
- *Vespa crabro* - menacing hornet:
  - a. imago - macroscopic specimen - drawing

Fish from the family Tetradontidae (*Diodon hystrix*)

Echinoidea – marine invertebrate

*Araneus diadematus* – photo - demonstration – drawing

2. Powerpoint 13 - **Poisonous mushrooms**

1. Botanical and toxicological characteristics of poisonous fungi



2. Poisonous mushrooms, and similar edible specimens:

**In the Lab - Drawing**

- *Amanita phalloides* -sporocarp - macroscopic specimen - drawing
- *Russula emetica* -sporocarp - macroscopic specimen- drawing
- *Hypholoma fasciculare* -sporocarp - macroscopic specimen - drawing
- *Scleroderma vulgare* -sporocarp - macroscopic specimen – drawing

*Secale cornutum* – macroscopic slide – drawing

3. Powerpoint 14 - **Poisonous plants**

**In the Lab - Drawing**

- Atropa belladonna* - macroscopic plant - drawing  
*Datura stramonium* - macroscopic plant - drawing

*Nicotiana tabacum* – macroscopic plant – drawing

**Class No. 6 [5 academic hours]**

**Subject: The effects of psychoactive chemicals on the human body**

1. Carcinogenic factors, teratogenic and mutagenic - types, effects on the human body.

2. Effect of chemicals on the human body
  1. drugs: simulated infant with symptoms of drug addiction – demonstration
  2. nicotine - the impact of nicotine on the human body
    - the effects of smoking – demonstration of an active model
  3. alcohol – the impact of alcohol on the human body - demonstration of an active model
  4. Simulation of alcohol intoxication - demonstration of glasses that simulate effects of alcohol
  5. simulated newborn with fetal alcohol syndrome (FAS) - demonstration

Subject: **Theoretical colloquium / test.**