**Genetics**

Module control work 1 **“Genetic analysis methods”**

1. Genetics as a science. Basic concepts of genetics
2. Place of genetics among the biological sciences.
3. History of Genetics. Milestones of genetics
4. Problems and prospects of genetics as a biological science
5. Signs of living organisms
6. Define the terms: variability, heredity, inheritance, gene, allele, genome, genotype, phenotype
7. Sections of Genetics
8. Problems of Genetics
9. Nucleic acids - the carriers of genetic information
10. Chromosomes. Cytogenetics as the science of chromosome
11. Central dogma of molecular biology
12. General plan of prokaryotic and eukaryotic cell structure. The main differences of prokaryotic and eukaryotic cell structure
13. The unique structure of mitochondria
14. Cytoplasmic heredity research. Cytoplasmic carriers of genetic information
15. Plastid’s heredity
16. Cytoplasmic male sterility
17. Chromosomal genes and plasmogenes role in organism’s characteristics formation
18. Epigenetic inheritance
19. Methods of genetic analysis: hybridological method, genealogical method, twins method, population and statistical method, cytogenetic methods, biochemical and other methods
20. Dideoxy method of DNA sequencing
21. Autoradiography, or tracer method
22. Southern blotting
23. The law of hybrids uniformity in the first generation (dominance law)
24. The law of segregation
25. The law of features independent assortment
26. Testing genetic ratios
    1. Significant results in biological experiments
    2. Sample Size
    3. Degrees of Freedom
    4. Chi-Square Test
27. Standard phenotype classes’ numerical ratios for monohybrid, dihybrid, polyhybrid crosses
28. Causes of deviations from standard ratios

**Genetics**

Module control work 2

**“Principles of inheritance and genome organization”**

1. The nucleus, nuclear envelope
2. Chromatin and its types
3. Mitotic chromosomes, mitotic chromosomes matrix (scaffold)
4. Chromosomes structure and functions
5. Cell cycle and cell division: mitosis, meiosis, comparison of mitosis and meiosis
6. Types of reproduction
7. Apoptosis
8. Meiotic crossing over
9. Linked inheritance, linkage groups
10. Genes linear arrangement in the chromosomes
11. Values of crossing between genes
12. Cytological mechanism of crossing-over
13. Double and multiple crossing over
14. Interference
15. The ways for sex determination
16. Inheritance of sex-linked traits
17. Consequences of sex chromosomes nondisjunctions
18. Gynandromorphs
19. The basis for chromosome theory creation
20. Chromosome theory of heredity
21. T. Morgan experiments for distance between chromosomes measuring
22. Unit of the chromosome length
23. Distance between genes measuring
24. Genetic maps construction
25. Types of genes interaction
26. Interactions of allelic genes:
    1. complete dominance and recessiveness
    2. incomplete dominance
    3. co-dominance at multiple allelism
    4. super-dominance
27. Interaction of non-allelic genes
    1. complementarity
    2. epistasis
    3. cumulative and non-cumulative polymerism
    4. modifier genes action
28. Establishing of the inheritance type
29. Genome structural organization. Genomics
30. RNA types and structure
31. RNA and DNA comparison
32. DNA matrix function during replication
33. RNA transcription
34. RNA role in translation
35. Genetic code
36. Translation stages: initiation, elongation, and termination
37. NA denaturation and renaturation
38. Genetic engineering and its methods:
    1. Plasmid method
    2. Vector method
    3. Biolistic method
39. Marker genes
40. Plant transformation
41. Genetically modified and transgenic organisms
42. Transgenic animals
43. Cell culture
44. Genetic and cellular engineering

**Genetics**

Module control work 3 **“Variability of organisms”**

1. G. de Vries mutation theory
2. Types of variability
3. Mutations types
4. Combinative variability
5. Correlative variability
6. Modification variability
7. Radiating mutagenesis, mutagenes
8. The basic directions of radiating genetics
9. Molecular mechanisms of radiation mutagenic action
10. Types of infringements arising at irradiation
11. Molecular consequences of ionizable irradiation action
12. Chemical mutagens
13. Agents of mutations
14. Rates of Mutation
15. Induced mutations
16. The *Ames test*
17. Ways of chemicals mutative action
18. Most widespread chemical mutagens
19. The basic principles of various reparation reactions
20. "Straight line" reparation
21. Excision reparation
22. Reparation of the not coupled bases
23. Postreplicative, or recombinative, reparation
24. SOS-reparation
25. Chimerism
26. Mosaicism
27. Chimeras in botany
28. Chimeras in zoology
29. Fetal microchimerism
30. Maternal microchimerism

**Genetics**

Module control work 4 **“Immunogenetics”**

1. Gene expression.
2. NA structure
3. Denaturation and renaturation of DNA.
4. The matrix function of DNA during replication.
5. Semiconservative DNA replication.
6. Replicative fork and Okazaki fragments.
7. Initiation of new DNA chains formation and elongation in replicative fork.
8. Types and structure of RNA.
9. RNA transcription.
10. Post- transcriptional modification of RNA
11. Denaturation and renaturation of RNA.
12. The genetic code and the expression of genetic material.
13. Proteins translation.
14. Posy-translational proteins modification
15. Regulation of gene expression in prokaryotes
16. Regulation of gene expression in eukaryotes
17. Genetic passport of the human.
18. Genetic blood system.
19. Isoantigens and isoantibodies.
20. Immunoglobulins and the genes that encode them.
21. The system of erythrocyte antigens, structure, genetics, physiological role and methods of determination.
22. Determination of AB0 blood system.
23. The genetic polymorphism.
24. Stem Cells. General characteristics.
25. Types of stem cells and their differences.
26. Stem cells and their usage for the study of gene function.
27. Cloning of organs and tissues in regenerative medicine, cell therapy.
28. Modern biotechnology of stem cells obtaining
29. Modern molecular genetics research methods
30. FISH method for determination of cytogenetic changes
31. Methods for tissue typing.