

GENERAL AND VETERINARY GENETICS

1. Material basics of heredity.

- Introduction to genetics. Chronology of important events.
- Euchromatine and heterochromatine. Main differences, types and role.
- Chromosome construction. Types of chromosomes: metacentric, submetacentric, acrocentric, telocentric.
- Giant chromosomes – lamp-brush chromosomes, polytene chromosomes.
- Karyotype, ideogram.
- Cell division, mitosis, meiosis, gametogenesis.

2. Basics of molecular genetics.

- DNA as the genetic material – history of discoveries.
- Definition of genome. Differences between prokaryotes and eukaryotes genome.
- Organization of the DNA in the nucleus.
- Types of nucleic acids.
- Construction of nucleotide. Types of nitrogen bases.
- Watson and Crick discovery. Construction of DNA.
- Organization of animal genome. Unique and repetitive sequences.
- RNA types and roles.
- DNA replication – scheme of process and its meaning.
- Expression of genetic material I – transcription, gene splicing, characteristics of genetic code.
- Expression of genetic material II – translation.
- Construction of gene, structure and regulation.

3. Mutagenesis.

- Definition of mutation.
- Spontaneous and induced mutations.
- Mutations types: gene, chromosome and genome mutations.
- Beneficial and adverse effects of mutations.
- Mutagenic factors: physical, chemical and biological.
- Mechanisms for repairing DNA damage.

4. Determination of sex, anomalies in the sexual determination.

- Sex chromosomes.
- Types of sex inheritance: *Lygeus*, *Protenor*, *Abraxas*, *Fumea*. Homogametic and heterogametic sex.
- Chromosomal mechanism of sex determination in Insects.
- Sex determination in Mammals.
- Sex determination in Birds: Z and W chromosomes.
- The influence of environmental factors on sex determination.
- Disorders of sexual differentiation in humans and animals.

5. Genetic diseases and inherited abnormalities.

- Animal genetic diseases caused by point mutations. Metabolic blocks.
- Genetic diseases related to changes in the number of sex chromosomes and autosomes.
- Hereditary defects - etiological factors, lethal, semi lethal and subvital genes.
- Hereditary defect vs. phenocopy – examples.
- Basics of cancerogenesis.
- Oncogens, oncogenic viruses.
- The role of telomeres and telomerase in cancerogenesis.

6. Non-nuclear inheritance. Mitochondrial diseases.

- Location of DNA outside the nucleus: plasmids, mitochondria, plastids.
- Autonomy, construction and gene content of mitochondrial DNA (mtDNA).
- Maternal inheritance of mitochondria.
- Mutations of mtDNA – frequency, factors and repair.
- Mitochondrial diseases caused by single nucleotide deletions and point mutations in mtDNA – description.

7. Introduction to molecular methods in veterinary practice.

- Good laboratory practice in molecular biology lab.
- DNA sources and extraction methods.
- Agarose electrophoresis as a method for qualitative and quantitative evaluation of DNA.
- PCR and PCR-based techniques as a tools for genotyping and identification of mutations.