GENETICS

Study program	Veterinary Medicine
Year of study	II
Semester	I
Regime of the discipline	DOB
Category of the discipline	Dsf
Number of lectures hours per week	2
Number of seminar/laboratory/project hours per week	3
Total number of hours according to the curriculum: lectures/seminars/laboratory/project	28 hours lectures/42 hours laboratory
Number of transferable credits	5

SPECIFIC SKILLS

Professional Competence	**Graduated students of course will have theoretical and practical knowledge about the possibilities of cytogenetic and molecular analyses of the genetic material, either normal or modified, in domestic animals.** **The discipline assures general competences in genetic manipulation of quantitative and qualitative characters in animals of professional interest.**

LEARNING OUTCOMES

Knowledge	The student describes the molecular and cellular organization of genetic material, describes embryonic development, the mode of inheritance of characters. The student identifies, describes, explains and classifies the mechanisms of production of diseases with a genetic cause.
Skills	The student applies molecular principles and methods to identify cellular components. The student correctly interprets and applies fundamental notions regarding the mechanisms of hereditary genetic diseases and methods for investigating genetic alterations.
Responsibility and autonomy	The student integrates fundamental notions and methods for investigating biological functions, formulates conclusions regarding the general mechanisms of disease production and general principles of treatment.

COURSE OBJECTIVES

General objective of the course	Proof that the normal or deviated form or functioning of an organ or organism has the same material base-DNA, the difference being ensured by intrinsic-spontaneous or induced changes of DNA. Ensuring the necessary competencies to carry out scientific research in the field of veterinary medicine
Specific objectives	Understanding the information coding, starting with the level of DNA nucleotides and protein synthesis for understanding diverse functions. Knowing the mode of organization, stocking and possibilities of modification either spontaneous or induced, of the genetic information in eukaryote organisms. Understanding the mode of transmission to descendents of the quantitative and qualitative characters in animals of professional interest. Presentation and initialization of the customary techniques along with the new methods of analyses and manipulation of the genetic material of domestic animals.

COURSE CONTENT

LECTURES	Number of hours
Topic no. 1 Definition, the object and importance of genetics. The evolution of ideas about heredity and medical genetics.	**2**

Cellular structures (cytoplasmic and nuclear) with genetic role.	
Topic no. 2 The molecular organization of genetic material. DNA: Characteristics and types. Epigenetics. Importance-historical. Epigenetic mechanisms of action on genetic material. Epigenetic implications in veterinary medicine.	**2**
Topic no. 3 The cellular organization of genetic material -chromosomes: - origin and evolution, structure and ultrastructure of the eukaryotic chromosomes. Restructuring of chromosomes in eukaryotes: controlled chromosomal restructuring; spontaneously, induced chromosomal restructuring. Chromosome number variation in eukaryotes: production mechanisms, effects, propagation.	**2**
Topic no. 4 The genes in eukaryotes. Definition, classification, structure, particularities of genes in eukaryotes: discontinuity; anti-sense genes; pleiotropy, genes penetrance and expression; genes lethality. Gene interaction: dominance, epistasis, complementary. Gene mutation: molecular mechanisms	**2**
Topic no. 5 Genetics of the development process. Genetic control of evolution: generalities. Genes involved in embryonic development: maternal genes; segmentation genes; polarisation genes; organogenesis genes.	**2**
Topic no. 6 Sex Genetic determination and sexual heredity. Chromosomal sex determination: Heterosomal sex determination; heterosomes characteristics. Genetic regulation of sex differentiation in birds and mammals. Hereditary - linked, influenced and limited by the sex.	**2**
Topic no. 7 Genetic sterility: classification. Chromosomal sterility. Gonadal sterility: *pure dysgenesis, with intersexuality, with chimeras.*	**2**
Topic no. 8 Genetic engineering notions. Genetic engineering – roles and implications. DNA-recombinant technology: steps; achievements; perspectives. Cell hybridisation and cell cybridisation: steps; achievements; perspectives. CRISPR-Cas technology: steps; achievements; perspectives	**2**
Topic no. 9 Definition, objective and importance of hereditary disorders in animals. Classification of hereditary disorders. Hereditary diseases of: *brain and skull, nervous system.*	**2**
Topic no. 10 Hereditary disorders: *bucco-facial fistula, maxillars, beak and tooth.*	**2**
Topic no. 11 Hereditary disorders of : *ears, eyes and eyelids*	**2**
Topic no. 12 Hereditary disorders of: *central spine cord, bone system, locomotor system, joints.*	**2**
Topic no. 13 Hereditary disorders of: *muscle, skin and skin production, digestive system. Congenital hernia.* Hereditary disorders of: *mammary gland.*	**2**
Topic no. 14 Hereditary disorders of proteic metabolism. Metabolic storage disorders. Hereditary disorders of pigments metabolism.	**2**
SEMINAR/LABORATORY	Number of hours
Rules regarding work protection. Bibliography recommendations. Techniques used in genetic tests	3
Molecular organization of genetic material. Techniques for molecular analysis of genetic material (Ist part)	3
Techniques for molecular analysis of genetic material (IInd part)	3
Cellular organization of genetic material. Chromosomes in eukaryotes: components, types. The stages of making a cytogenetic smear Methods for studying chromosomes in mitosis (somatic cells).	3
Methods for studying chromosomes in meiosis (germinative cells).	3

Methods for the study of chromosomal bands. Types of bands. Importance of chromosome banding.	3
Karyotype. Karyotype particularity in mammals and birds	3
Methods for testing clastogenic potential of some chemical and physical agents. Micronucleus test	3
Chromosomes and oncogenesis. Chromosomes study during some malign diseases in animals	3
Methods for studying heterosomes in nuclei during interphase. Sex diagnostic through cytogenetic methods	3
Medical investigation in case of hereditary diseases. Pedigree analysis. Types of pedigree	3
Diagnostic criteria in the transmission of genetic diseases: diagnostic criteria in dominant autosomal transmission, diagnostic criteria in recessive autosomal transmission, diagnostic criteria in sex-linked transmission, diagnostic criteria in polygenic transmission	3
Analysis of cases with congenital malformations existing in the discipline's collection.	3
Final evaluation	3

BIBLIOGRAPHY:

- **Marc Zarcula Simona, Bonca GH.,** Notions of molecular genetics and cytogenetics, Ed. Politehnica, 2020
- **Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P.,** Biology of the Cell 5th Ed., Garland Science, 2008
- **Klug, W.S., Cummings, M.R., Spencer, C.A., Palladino, M.A.,** Concepts of Genetics 10th Ed. William S. Klug, 2009
- **Marc Zarcula Simona, Bonca GH., Mircu C.,** Guide for practical and seminars in Veterinary Medical Genetics, 2014, Ed. Mirton
- **Arsham M.S., Barch M.J., Lawce H.L,** *The AGT Cytogenetics Laboratory Manual*, 2017, 4rd Ed., pag. 294 - 295-263-319-909

ASSESSMENT

Activity type	Assessment criteria	Assessment methods	Percentage of final grade
Lectures	Minim standards Knowledge of how to store and transmit genetic information in successive generations Integration of theoretical knowledge in the arsenal of modern biotechnologies that allow obtaining genotypes and phenotypes of practical interest. Knowing how to express morbid conditions (diseases), that are caused by alterations in genetic material	Oral examination	50%
Seminar/laboratory/clinical sessions	Theoretical knowledge and practical work exam	Oral examination	50%
Other activities			

Course coordinator: Senior Lecturer Dr. DVM Marc Simona
Practical activities coordinator L/S/P: Assist. Prof. Dr. DVM. Spătaru Ioana Irina