

Applications of Biotechnology in Animal Science [6]

COURSE OUTLINE

(1) GENERAL

SCHOOL	ANIMAL BIOSCIENCES		
ACADEMIC UNIT	DEPARTMENT OF ANIMAL SCIENCE		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	6	SEMESTER	8 th
COURSE TITLE	APPLICATIONS OF BIOTECHNOLOGY IN ANIMAL SCIENCE		
INDEPENDENT TEACHING ACTIVITIES		WEEKLY TEACHING HOURS	CREDITS
Theory		2	2
Laboratory Practicals		2	2
Total			3
COURSE TYPE	Scientific area – Developing skills		
PREREQUISITE COURSES:	Biochemistry, Principles of cellular and molecular biology, Genetics, Genetic improvement, Methods in genetic improvement, Nutritional physiology of animals, Feed science and technology		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS:	YES (in English)		
COURSE WEBSITE (URL):	https://oeclass.aua.gr/eclass/courses/EZPY189/		
TEACHING STAFF:	Theory: Prof. K. Mountzouris, Assoc. Prof. A. Hager, Ass. Prof G. Theodorou Laboratory Practicals: Prof. K. Mountzouris, Assoc. Prof. A. Hager, Ass. Prof G. Theodorou		

(2) LEARNING OUTCOMES

Learning outcomes
The course of “Applications of Biotechnology in Animal Production” aims to educate students on issues related to applications of biotechnological methods, processes and nutritional bioactive ingredients targeting to improve Animal Production. Upon successful completion of the course, students will be able (according to Bloom) to: - Understand and appreciate the importance of biotechnology in addressing current challenges in the livestock sector (Knowledge / Comprehension). - Describe and analyze the molecular processes of cells that control gene expression and protein synthesis, including the central dogma of molecular biology, genome structure, and basic bioinformatic analysis methodologies (Knowledge / Comprehension / Analysis). - Explain the possibilities of applying biotechnology in Animal Husbandry, including genetic variability, genetic markers, molecular genotyping methods, and their applications in genetic improvement, rare breed conservation, and product provenance control (Knowledge / Application / Comprehension). - Recognize and evaluate the effects of nutrients on gene expression (nutrigenomics) and understand the contribution of “omics” technologies to nutritional science (Comprehension / Analysis / Evaluation). - Apply biotechnological approaches in the animal feed sector, including production of new feed materials, improving dietary value of conventional feeds and agro-food by-products, enhancing gut function and health, and tailoring nutrition for higher productivity and product quality while ensuring farm-to-fork safety (Application / Synthesis / Evaluation). - Identify and apply analytical methodologies (PCR, ELISA, LC-MS/MS) to determine contaminants (e.g., mycotoxins) and detect genetic modifications in feed (GM feed) in compliance with the legal framework (Application / Comprehension / Evaluation). - Develop skills in scientific writing, referencing, and bibliography management for effective communication of research (Application / Synthesis). - Use databases and bioinformatics tools to analyze, evaluate, and interpret data for suitability in specific applications (Application / Analysis / Evaluation).
General Competences
- Search, analysis and synthesis of data and information with the use of the required technologies - Decision making

- Autonomous work
- Teamwork
- Work in a multidisciplinary environment
- Production of new research ideas

(3) SYLLABUS

- Introduction: Biotechnology and its role in Animal Production - modern challenges
- Basic concepts of molecular biology and introduction to molecular cloning. Methods of genetic engineering in livestock.
- Biotechnological applications of reproduction in farm animals
- Genomic analysis. Comparative genomics, genome mapping - Applications in bioinformatics.
- Applications of molecular biology in the certification of origin and adulteration of animal products.
- Applications related to genetic improvement: Methods for molecular genotyping of animals for qualitative and quantitative characteristics - parents authentication methods to reconstruct genealogical tree animals - Examples of transgenic farm animals for biomedical applications (gene pharming).
- Diet and gene expression (nutrigenomics): importance for animal health and productivity
- Objectives and prospects for improvement of animal nutrition - role of biotechnology
- Feed quality improvement - tools for enhancing the nutritional value of conventional feedstuffs as well as various agro-food by-products. Genetically modified feedstuffs and legal framework
- Microbial products (biomass, primary and secondary metabolites) - suitability and applications in nutrition
- Bioactive additives: Enzymes, Probiotics, probiotic bioactive substances, Amino Acids, Peptides, Acidifiers, Antibiotics - Growth factors
- State of the art databases and analytical detection techniques for the determination of contaminants and genetic modifications in feed.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	In class, face to face and via specialized teaching platforms (e.g. OpeneClass, MS teams)	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	PowerPoint and video presentations. Communication with students via e-mail. Teaching support through access to the e-class platform, to on-line databases and Specialized Software etc.	
TEACHING METHODS	Activity	Semester workload
	Lectures - Laboratory practice	52
	Literature search and analysis	8
	Writing assignments	15
	Course total (25 h of workload per ECTS)	75
STUDENT PERFORMANCE EVALUATION	I. Theory a) Optional attendance of lectures by students (progress, assignments, etc.) b) Written final exam (100%) which includes: short essay questions and multiple choice and/or true/false questions II. Laboratory practicals Compulsory attendance of the laboratory exercises by the students, with attendance records (progress, assignments, exercises, etc.) III. The evaluation language is Greek IV. The evaluation criteria are communicated to the students	

(5) ATTACHED BIBLIOGRAPHY

- Bedford M.R. and Partridge G.G. Enzymes in farm Animal Nutrition. 2010. Second edition, CABI, Oxfordshire, UK.
- EFSA. Safety and nutritional assessment of GM plants and derived food and feed: The role of animal feeding trials. Report of the EFSA GMO Panel Working Group on Animal Feeding Trials Food and Chemical Toxicology 46 (2008) S2-S70
- Griffiths, A.J.F., Wessler S., Carroll S.; Doebley J. An introduction to genetic analysis. 2015. 11th edition. W.H. Freeman and Co., New York.
- Halford G. N. Genetically modified crops. 2012. Second Edition, Imperial College Press. London
- ISAAA 2016 Global Status of Commercialized Biotech/GM Crops. ISAAA Brief 52 <http://www.isaaa.org>
- Krebs J.E., Goldstein E.S., Kilpatrick S.T., Lewin's Genes XII. 2018. Jones and Bartlett Publishers. London

- Leng R.A. Application of biotechnology to nutrition of animals in developing countries. 1991. FAO ANIMAL PRODUCTION AND HEALTH PAPER 90.
- Mutch D.M., Wahli W and Williamson G (2005) Nutrigenomics and nutrigenetics: the emerging faces of nutrition The FASEB Journal 19: 1602-1616.
- Nelson G.C. Genetically Modified Organisms in Agriculture. 2001. Academic Press, London
- Renaville R. and Burny A. Biotechnology in Animal Husbandry. 2001. Kluwer Academic Publishers, Dordrecht, the Netherlands.
- Russell P.J. iGenetics: A Molecular Approach. 2009. Pearson; 3rd edition

Relevant Scientific Journals:

Animal Biotechnology
 Animal Feed Science and Technology
 Biotechnology Advances
 BMC Biotechnology
 Current Opinion in Biotechnology
 EFSA Journal
 The FASEB Journal
 Genetics Selection Evolution
 Journal of Animal Science
 Journal of Animal Science and Biotechnology
 Journal of Biotechnology
 Livestock Science
 PLoS ONE
 Trends in Biotechnology

Lecture and Laboratory exercise notes are available on eclass