***ANIMAL SCIENCE***

# *Part 1 - Animal physiology*

## Prof. Licia Colli

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

 This course aims at introducing the students to the basic concepts of farm animal anatomy and physiology, particularly those related to livestock productions. Cellular and molecular mechanisms will be presented to build a general view of physiological principles and bodily functions. Emphasis will be placed on nervous, muscular, endocrine, and reproductive systems.

Expected learning outcomes are the following:

Knowledge and understanding

On completion of this course, students will have learnt the basic structure and functions of cells, tissues, and organs, the general functioning and anatomical features of the animal body. The students will also know the regulatory mechanisms that maintain homeostasis, and the physiological mechanisms underlying farm animal productions (e.g. milk, meat, eggs) and reproduction.

Ability to apply knowledge and understanding.

By the end of the teachings, the will become able to successfully deliver a correct and precise description of the main physiological mechanisms, using proper scientific and biological terms and to integrate the information gained during the course with knowledge on biochemistry and genetics.

***Autonomy of judgement, Communication skills and Learning ability***

At the end of the course the students are expected to hold learning capacities suitable to autonomously elaborate on specific topics related to animal physiology, and to communicate them to both professionals and non-professionals, and to evaluate the concepts in a critical way.

***COURSE CONTENT***

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| Topics | CFU |
| **Classroom lessons:** |  |
| From cell to organism. This part of the course will illustrate the basics of biochemical processes, the anatomy of animal cells, the anatomy and basic functions of the organelles, the main tissues types and functions, the general organisation of farm animal organs and apparata. | 1.0 |
| The nervous system. This section will focus on the structure and functions of neurons and synapses, the action potential, and the structure and functions of the nervous system. | 0.50 |
| The endocrine system. This part of the course will explain the chemical nature of hormones and receptors, their mechanism of action, and the anatomy and physiology of endocrine glands. | 0.50 |
| Osteology and myology. This section will describe the structure and anatomy of the bones and of the axial and appendicular skeleton, the neuromuscular synapses, the features of the different types of muscle tissue, and the mechanisms and physiology of muscle contraction. | 0.75 |
| The reproductive system. This part will illustrate the anatomy and physiology of gametogenesis, the anatomy, morphology and physiology of the udder, the processes underlying the production and ejection of milk (lactogenesis and galactopoiesis). Special emphasis will be given to the processes related to milk production, milk yield and parturition. | 0.75 |
| **Exercise section:** |  |
| This section will take advantage of practical computer-based activities to revise and to explore cell and tissue structure and functions further. | 0.15 |
| A technical visit will be organized to demonstrate how physiological functions should be considered when dealing with farm animals in the filed. | 0.35 |

***READING LIST***

##### OYSTEIN V. SJAASTAD, IAV SAND, KNUT HOVE, *Physiology of Domestic Animals, 3. ed,* Scandinavian Veterinary Press, 2016. Reference textbook.

R.M. AKERS, D.M. DENBOW, *Anatomy and Physiology of Domestic Animals*, Wiley-Blackwell, 2013.

W.O. REECE, H.H. ERICKSON, J.P. GOFF, E.E. UEMURA, *Dukes' Physiology of Domestic Animals*, Wiley-Blackwell, 2015.

J. C. CUNNINGHAM, *Textbook of veterinary physiology*, Philadelphia, Saunders, 2002.

Additional material will be suggested during the course.

***TEACHING METHOD***

The teaching method will comprise different types of activities:

i) classroom lectures (28 hours) which will cover both the theoretical topics of the course and a set of relevant real-life examples on animals and humans. The teacher will often intract with the student during the lectures, to stimulate individual involvement and discussion.

ii) indoor exercise sessions (4 hours) focused on practical computer-based activities.

iii) an outdoor technical visit (2 hours) to a livestock farm and/or reproductive technology center, that will allow the students to appreciate how the application of physiological principles can help improve the efficiency of livestock productions.

Learning activities may also include seminars.

***ASSESSMENT METHOD AND CRITERIA***

At the end of the course there will be a written test (total maximum score is 33) consisting in 30 true-false questions (maximum score is 30) and a “fill-in the blanks” exercise based on a picture taken from the textbook (maximum score is 3). The students will be given 2 hours to complete the test. Correct answer value is +1 points, wrong answer value is -1 points, no answer is 0 points. Students reaching a score of 18 or more can accept the score directly without taking the oral exam. Students who want to imporve the mark can take the oral exam the same day of the written test. Also students who reached a score of at least 16 in the written test can attempt the oral exam *sub judice*. The final evaluation is calculated as the average between the scores of the written tests and the oral exam.

During the rest of the year the exam will be in oral form. Its score will be based on: a) the actual knowledge of the subject and the overall handling of the matter; b) use of proper terms and clearness of exposition during the interview; c) ability to make connections between different topics and subjects.

***NOTES AND PREREQUISITES***

The student should possess basic knowledge on inorganic and organic chemistry, biochemistry and genetics.

Prof. Licia Colli is available to meet students by appointment at the Department of Animal Science, Food and Nutrition (DIANA).

***Part 2 – Applied animal science***

## Prof. Antonio Gallo

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

 The course aims to describe the relation between feeds composition and animal needs for meeting nutrients requirements through absorption and utilization of nutrients into gastro-intestinal tract, in order to maximize feed efficiency and quality of food productions. The overall course aim is to integrate the chemistry of feeds with animal metabolism for productive purposes.

Knowledge and understanding

At the end of the course, students will be capable of evaluating the nutritional value of feeds required for ration formulation to maximize feeds’ efficiency in livestock production, to reduce the environmental impact, to ensure animal welfare and safety of food from animal origin.

Ability to apply knowledge and understanding.

By the end of the teachings, students will be capable of correctly describe parameters used in feed evaluation and animal nutrition, using proper scientific and biological terms and to address learnings of the course with knowledge on biochemistry and animal physiology.

***Autonomy of judgement, Communication skills and Learning ability***

At the end of the course the students are expected to have knowledge for specific scenario evaluation on animal nutrition and feeding, to hold learning capacities suitable to autonomously elaborate on specific topics related to animal nutrition, to communicate them to both professionals and non-professionals, and to evaluate the concepts in a critical way.

***COURSE CONTENT***

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| Topics | ETCS |
| **General part: components of feeds** |  |
| Chemistry of feeds and major components supplying energy and amino acids (i.e., carbohydrates, lipids, proteins), vitamins and trace minerals.  | 1.0 |
| **Applicative part: digestion and metabolism of nutrients** |  |
| Physical and chemical processes by which an animal obtains nutrients from ingested feeds and how they are subsequently utilized.  | 1.0 |
| Mechanisms underlying digestive processes that lead to nutrients absorption through the intestinal wall, metabolism and differences between ruminants and monogastric. | 1.0 |
| Supplied nutrients quantification, measurement of digestion over the whole digestive tract and for different sections using digestibility/degradability techniques and analysis of factors affecting the estimated biological parameters. Special emphasis is given to the approaches used in animal nutritional models. | 1.0 |
| **Practical section: modelling digestion and passage of nutrients** |  |
| Assumptions, logic and mathematical approaches used for describing the digestion and flow rate of nutrients in different compartments of the gastro-intestinal tract of animals as adopted by the current nutritional models. | 1.0 |

***READING LIST***

INRA. 2018. *INRA feeding system for ruminants*. Wageningen Academic Publishers, Wageningen, the Netherlands, 640 pp.

NorFor. 2011*. NorFor–The Nordic Feed Evaluation System*. 1st ed. Wageningen Academic Publishers, Wageningen, Netherlands.

NRC, 2001. *Nutrient requirements of dairy cattle*, National Academy Press, Washington D.C., 2001.

NASEM, 2021. Nutrient Requirements of Dairy Cattle, Eighth Revised Edition, National Academy Press, Washington D.C., 2021.

McDonald, P., Edwards, R., Greenhalgh, J., Morgan, C., L. A. Sinclair and R. G. Wilkinson (2014). Animal Nutrition. 7th ed. Essex: Addison Wesley Longman Limited.

***TEACHING METHOD***

The teaching method will include two types of activities:

i) classroom lectures (32 hours) where the key concepts of the course are exposed along with comparative examples between different digestive systems.

ii) classroom or lab practical activities (8 hours), with exercise focusing on both computer-based activities and mathematical exercises applied to animal nutrition.

***ASSESSMENT METHOD AND CRITERIA***

 There will be an optional intermediate test concerning the general part. This test will be carried out in oral form or written form. If written form it will consist of 30 multiple-choice questions. Students will be given 2 h time to answer to questions on the program. No answer gives no point, wrong answers may give penalizations, whereas correct answers will provide 3 points. At the end of the course, there will be a final test in oral form, both for students who have taken and passed the test and for those who have not taken and/or passed the test. During the year the exam will be in oral form. The final score will be given based on both the written exam (50% of final evaluation) and the oral exam (50% of final evaluation) or only based on oral exam (100% of final evaluation). Its score will be based on: a) the actual knowledge of the subject and the overall handling of the matter; b) use of proper terms and clearness of exposition during the interview; c) ability to make connections between different topics and subjects.

***NOTES AND PREREQUISITES***

The student should possess basic knowledge on inorganic or organic chemistry.

Prof. Antonio Gallo is available to meet students by appointment at the Department of Animal Science, Food and Nutrition (DIANA).

Information on office hours available on the teacher’s personal page at <http://docenti.unicatt.it/>.