# Animal Husbandry and Climate Change

# Adaptation and Animal Welfare Module

## Prof. Erminio Trevisi

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

Provide a technical and scientific preparation for assessing the adaptation of animals to climatic conditions, estimate their state of well-being on farms, and identify actions to improve their living conditions.

At the end of the course, students will be able to:

* Evaluate the degree of adaptation in different conditions and physiological phases;
* Understand the components that contribute to achieving a satisfactory state of animal welfare;
* Identify useful indices for assessing the state of well-being and learn how to use them;
* Evaluate the state of breeding well-being with the help of multifactorial models.
* Identify the management factors (e.g. thermal, nutritional, logistic stresses) that interfere with the conditions of well-being and realize actions to prevent and/or mitigate distress

***COURSE CONTENT***

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| Topic | ECTS |
| *Adaptation* *to environmental changes*: Definition and evaluation of environmental stressors in pets. Physiological modifications and adjustments of animals. Resilience in physiology. Effects and consequences of thermal stress. Mitigation systems and equipment. | 1.5 |
| *Animal welfare (AW).* Definitions and historical evolution of the AW concept. Principles of ethology and animal behaviour. Factors that change AW in intensive and extensive pet farms. Relationship between AW, performance and production quality. Legislation. | 1.0 |
| *AW evaluation.* Indirect (environmental, structural, dietary) and direct (physiological, behavioural, health, productive, reproductive) indicators. Available AW evaluation models and their validation. Description of the critical points in breeding and comparison between alternative management applications. | 1.0 |
| The IDWS (Integrated Diagnostic Wellness System) model for assessing welfare on dairy farms. Practical evaluation of direct and indirect indicators. Case studies (herd visits). | 0.5 |

***READING LIST***

Appleby M.C., Olsson I.A.S., Galindo F., *Animal welfare*, 3rd ed. CABI, 2018.

Calamari L., Bertoni G., *Model to evaluate welfare in dairy cow farms.* Ital. J. Anim. Sci. 2009, 8, 301-323.

EFSA, *Scientific report on the effects of farming systems on dairy cow welfare and disease.* *Report of the Panel on Animal Health and Welfare.* Annex to the EFSA J. (2009) 1143, 1-38.

Ekesebo I., Gunnarson S., *Farm animal behaviour*. 2nd ed., CABI, 2018.

Moberg G.P., Mench J.A., *The Biology of Animal Stress: Basic Principles and Implications for Animal Welfare*. CABI, 2000.

SANDRUCCI A., TREVISI E. (a cura di), *Produzioni Animali*. ED. EDISES, 2022.

von Keyserlingk M.A.G., *The welfare of dairy cattle. Key concepts and the role of science.* J. Dairy Sci., 2009, 92: 4101-4111.

Welfare quality, *Assessment protocol for cattle.* Netherlands Standardisation Institute, 2010.

Review and slides presented during the course (Blackboard platform).

***TEACHING METHOD***

The course is divided into frontal lectures (21 hours), and tutorials on farming and seminars (18 hours).

1) Frontal lectures to present the key concepts of the subject, with the opportunity for widespread interaction. The lectures are accompanied by PowerPoint slides, which are subsequently made available to students on the Blackboard platform.

2) Tutorials on farming, to learn the IDWS evaluation system of animal welfare and adaptation to thermal stress.

3) Tutorials in the classroom, to discuss the field results and propose improvements in the analysed examples.

***ASSESSMENT METHOD AND CRITERIA***

An oral exam comprising three questions on general topics, which will then give rise to further more specific questions. Each question is assessed with a mark from 0 (no answer) to 10 (exemplary answer). The mark is assigned on the basis of the following criteria: a) objective knowledge of the topics and mastery of the subjects; b) presentation clarity; c) ability to respond exhaustively to questions, linking different topics. Honors will be given in case of full understanding of the subject and brilliancy in the exposition.

***NOTES AND PREREQUISITES***

The student must possess knowledge of animal husbandry, animal physiology and nutrition.

Should the health situation relating to the Covid-19 pandemic not allow face-to-face teaching, remote teaching in synchronous or asynchronous mode will be guaranteed; this will be communicated in good time to students.

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

Zootechnics and Climate Change (Genetics and Adaptation Module)

Prof. Paolo Ajmone Marsan

COURSE AIMS AND INTENDED LEARNING OUTCOMES

The course will cover the expected effects of climate change on the genome and epigenome of livestock species and on strategies for the identification of genes associated with climate adaptation.

Knowledge and ability to understand

At the end of the course, students will be able to know and understand the effects of stress on the genome and epigenome of animals in production and the strategies to identify genetic variants associated with environmental variables.

Understanding and applying knowledge

At the end of the course, students will be able to understand how some genes regulate adaptation to climate change and how they can be included in genetic improvement programmes in a livestock species.

Autonomous judging skills

At the end of the course, students will be able to suggest strategies to include genes with adaptive value in genetic improvement programmes.

Communication skills

At the end of the course, students will be able to appropriately use the scientific language and specific vocabulary of genetics, epigenetics and genetic improvement.

Learning ability

At the end of the course, students will be able to learn more about animal genetics and epigenetics independently through the consultation of texts, scientific articles and web resources.

COURSE CONTENT

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| --- | --- |
|  | ECTS |
| Domestication and subsequent adaptation of livestock species to very different environmental conditions. | 0.5 |
| Introduction to epigenetics: what is epigenetics, DNA methylation, histone modification, chromatin remodelling, noncoding RNA. Molecular methods for the study of the epigenome. How the climate affects the epigenome. | 1.0 |
| Genetics and adaptation: how to search for genes associated with environmental variables using molecular markers and genome sequencing. The signs of natural selection, the genomics of the landscape. | 1.0 |
| How to use genes associated with adaptation in selection, marker- and gene-assisted selection, and genome editing. | 0.5 |
| Tutorials.  Technical visits, topical seminars. | 1.0 |

READING LIST

Preferred texts

M. Romano, *Epigenetica,* Editore Zanichelli, 2021.

Suggested texts

Damiano Galimberti, Giovanni Battista Gidaro, Vittorio Calabrese, Alessandro Gelli, Stefano Govoni, *Nutrigenomica ed epigenetica. Dalla Biologia alla clinica* EditoreEDRA*,* Milan, 2017.

LD Van Vleck-EJ Pollak-EAB Oltenacu, *Genetica per le Scienze Animali,* SEU, Servizio Editoriale Universitario (University Publishing Service) of Pisa, 1988.

TEACHING METHOD

- Dialogue-based and theoretical frontal lectures supported by PowerPoint slides, during which the effects of climate changes on the genome and epigenome of livestock species are presented and discussed in the light of modern molecular analysis technologies and strategies for genetic improvement in favour of adaptation to new environmental conditions.

- The course will be supplemented with seminars involving external experts on specific topics relevant to genetics and the selection of animals in livestock production.

ASSESSMENT METHOD AND CRITERIA

At the end of the course there will be a final oral exam.

NOTES AND PREREQUISITES

Prerequisites: Basic genetics, Basic genomics, Basic statistics.

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