International Master in
ANIMAL BREEDING AND REPRODUCTION
BIOTECHNOLOGY (6th edition)

Valencia and Barcelona (Spain), 1 October 2018 – 28 June 2019
September 2019 – June 2020

1. Objectives
Genetic improvement is a main factor contributing to profitability, sustainability and welfare in animal production. It is a complex discipline bringing together relatively disparate subjects. On one hand, population and quantitative genetics, that to date have been responsible for the main advances in the breeds and populations of the animals used in production. On the other hand molecular genetics, a more recent development, that is making an increasing contribution to breeding. Finally, reproduction biotechnology, that offers tools to enhance and facilitate the application of both quantitative and molecular breeding methods.

The programme provides sound training in these basic subjects that are essential to animal breeding and lead to the acquisition of experience through the critical revision of breeding and biotechnology programmes currently conducted in different species, discussions with professionals of the sector and technical visits to public and private institutions involved in breeding programmes.

The general objective of the Master is to train young professionals and scientists so that, both from the public and private sectors they will have the operative capacity to establish, develop and evaluate animal breeding programmes. Moreover, the second part of the programme represents a period of initiation to research.

The Master enables the participants to:
- Update the scientific grounds of the disciplines that constitute animal breeding.
- Acquire experience in the application of the most advanced methods and techniques and in the formulation of breeding strategies related to the main species of zootechnical interest.
- Gain the necessary expertise to join programmes of molecular genetics, genetic improvement, reproduction biotechnology and conservation of genetic resources, providing alternatives that improve the effectiveness of such programmes.
- Be competent in responding to the specific demands of administrations or firms.
- Be introduced into research, critically applying acquired knowledge, capacities and abilities to the treatment of real problems related to animal breeding.
- Exchange enriching experiences and points of view through the critical revision of breeding and biotechnology programmes currently conducted in different species, discussions with professionals of the sector and technical visits.

2. Degrees awarded
UPV, together with UAB, will award the International Official Master Degree to participants that have obtained the necessary 120 ECTS.
CIHEAM will award the Postgraduate Specialization Diploma to participants that have obtained 60 ECTS taking the full first part of the Master.

CIHEAM will award the Master of Science Degree to participants that have obtained 120 ECTS.

3. Academic organization
The first part of the Master is held in three terms, with morning and afternoon sessions. This part is made up of complementary but independent units so that participants may attend, if they wish, only one or several. Point 8 shows credits awarded to each unit.

This part of the programme will lead to the Postgraduate Specialization Diploma described below and access to the Doctorate in the official postgraduate programmes that recognise the credits obtained.

The second part of the Master (60 ECTS) constitutes a period of initiation to research in which participants work on the Master of Science Thesis. This part will begin from September 2019 onwards and will last for 10 months in which research work will be conducted followed by the elaboration of the thesis, that must be publicly defended and approved by an examining board.

4. Organization
The Master is organized by the Polytechnic University of Valencia (UPV) and the Autonomous University of Barcelona (UAB) as an interuniversity Official Master of the Spanish university system, and by the Mediterranean Agronomic Institute of Zaragossa (IAMZ) of the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM), with the participation of the Valencian Institute for Agricultural Research (IVIA) and the National Institute for Agro-food Research and Technology (INIA).

The Master is designed for a maximum of 25 participants. Two academic years of full-time basis (120 credits, following the European Credit Transfer System (ECTS)) and is structured in two parts.

The first part of the Master (60 ECTS) is professionally oriented and comprises lectures, practicals, round table discussions and technical visits and it will be held from 1 October 2018 to 28 June 2019. The first term will take place in Barcelona, at the Department of Animal Science and Food of the UAB; and the second and third terms will take place in Valencia at the Department of Animal Science of the UPV. Lectures will be given by well qualified lecturers from the organizing institutions, international organizations, and universities and research centres in different countries. Completion of the first part will lead to the Postgraduate Specialization Diploma described below and access to the Doctorate in the official postgraduate programmes that recognise the credits obtained.

The second part of the Master (60 ECTS) constitutes a period of initiation to research in which participants work on the Master of Science Thesis. This part will begin from September 2019 onwards and will last for 10 months in which research work will be conducted followed by the elaboration of the thesis, that must be publicly defended and approved by an examining board.
1. MOLECULAR GENETICS
1.1. Molecular bases of animal genetics (5 ECTS)
1.1.1. Basic concepts of animal genetics
1.1.2. Organization and structure of the eukaryotic genome
1.1.3. Control of gene expression in eukaryotes
1.1.4. Molecular techniques to study variability
1.1.5. Genetic markers
1.2. Animal genomics (5 ECTS)
1.2.1. Structural genomics: genetic maps; comparative genomics; gene identification; genome sequencing
1.2.2. Functional genomics: general techniques in the study of gene function; microarrays; proteome analysis; mutation-independent techniques: molecular bases for disease resistance; animal transgenesis and modifications of the genome
1.3. Laboratory of molecular genetics (5 ECTS)
1.4. Bioinformatics practicals (5 ECTS)

2. APPLIED BREEDING
2.1. Fundamentals of statistical genetics (4 ECTS)
2.2. Quantitative genetics I (5.5 ECTS)
2.2.1. Variation and types of gene action
2.2.2. Concepts and basic types of selection by additive value; selection methods; multiple selection for several traits
2.3. Quantitative genetics II (4 ECTS)
2.3.1. Mixed linear model
2.3.2. Detection and use of QTLs
2.3.3. Crossbreeding
2.4. Quantitative genetics III (4 ECTS)
2.4.1. Estimation of variance components, random regression and Bayesian estimation
2.4.2. Analysis and experimental design in animal breeding
2.5. Management and conservation of genetic resources (3 ECTS)
2.6. Breeding programmes (7 ECTS)
2.6.1. Dairy and beef cattle
2.6.2. Dairy and meat sheep
2.6.3. Goats
2.6.4. Pigs
2.6.5. Poultry
2.6.6. Rabbits
2.6.7. Aquaculture
2.6.8. Royalty of breeding techniques in developing countries

3. REPRODUCTION BIOTECHNOLOGY
3.1. Reproduction fundamentals and techniques (5 ECTS)
3.1.1. Basic concepts of reproduction
3.1.2. Spermatogenesis and semen production
3.1.3. In vitro oocyte and embryo production
3.1.4. In vivo embryo production and embryo transfer
3.1.5. Fundamentals of cryobiology: cryopreservation of oocytes and embryos
3.1.6. Transgenic embryo production. Microinjection, ICSI and somatic cloning
3.2. Practicals in reproduction techniques (3.5 ECTS)
3.3. Reproduction biotechnologies per species: cattle, sheep, goats, pigs, rabbits, poultry (4 ECTS)

LECTURERS PARTICIPATING IN THE FIRST PART OF THE MASTER

M. AMILLS, Univ. Autónoma Barcelona (Spain)
M. ARANGO, Morelia Inter, Aldea, USA
M. AVENDAO, Avigen Group, Newbridge (UK)
A. BLASCO, Univ. Politécnica Valencia (Spain)
E. BLESBOIS, INRA, Tours (France)
R. CHIMENT, Universidad Buenos Aires (Argentina)
M.J. CARABANO, INIA, Madrid (Spain)
J. CASELLAS, Univ. Autónoma Barcelona (Spain)
J.M. FOLCH ALBAREA, Univ. Autónoma Barcelona (Spain)
J. GARJE, Univ. Castilla-La Mancha, Albacete (Spain)
M.A. GIL, Univ. Murcia (Spain)
E. GOMEZ, IVIA, Segorbe (Spain)
G. GONZALEZ, INIA, Madrid (Spain)
A. GUTIERREZ, INIA, Madrid (Spain)
J.P. GUTIERREZ, Univ. Complutense Madrid (Spain)
G. IBARRA, Univ. Autónoma Barcelona (Spain)
F. MARCO, Univ. Politécnica Valencia (Spain)
E. MOCE, IVIA, Segorbe (Spain)
R.N. PENA, Univ. Lleida (Spain)
M. PEREZ-ENCISO, Univ. Autónoma Barcelona (Spain)
Y. RAMAYO-CALDAS, Univ. Autónoma Barcelona (Spain)
S. RAMOS-ONSINS, CRAG, Barcelona (Spain)
D. RIZOS, INIA, Madrid (Spain)
J. ROCA, Univ. Mieres (Spain)
A. SANCHEZ, Univ. Autónoma Barcelona (Spain)
M.A. SANTACREU, Univ. Politécnica Valencia (Spain)
M.A. TORO, Univ. Politécnica Madrid (Spain)
E. UGARTE, NEIKER, Vitoria (Spain)
J.S. VICENTE, Univ. Autónoma Barcelona (Spain)
B. VILLANUEVA, INIA, Madrid (Spain)
J. YANIZ, Univ. Zaragosa, Huesca (Spain)