

Master Course in Laboratory Animal Science and Welfare (March 2026)

Module 3: Genetics of Laboratory Animals and Experimental Models

Course Co-ordinators:

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Module programme responsible:

Belen Pintado Sanjuanbenito. Transgenesis Lab, Centro Nacional de Biotecnología (CBN)-CSIC, Madrid, Spain
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Course description

This module provides the practical and theoretical knowledge and skills regarding genetics and experimental models required by designated veterinarians and other onsite personnel responsible for the welfare and care of laboratory animals in the conduct of experimental procedures.

The module consists of two parts. The experimental models' component provides extensive knowledge of different experimental animal models in different research areas. The genetic component explores models of genetically modified animals, their production, maintenance and the implications for their use.

The content of this module also complies with the training requirements set out in European Directive EU63/2010, developed by the Expert Working Group, supported by the European Commission, in respect of the following modules: **3.2) Basic and appropriate biology (practical); 7) Minimally invasive procedures without anaesthesia (theory), 8) Minimally invasive techniques without anaesthesia (skills)**. For details, see: <https://op.europa.eu/s/z4ic>

Master's Degree in Laboratory Animal Science and Welfare accredited by FELASA as "Category D – Specialist in laboratory animal science" and the training program for Diplomates of the European College of Laboratory Animal Medicine (ECLAM). For veterinarians, this module forms part of the program **Certified Veterinarian in Laboratory Animal Science and Medicine (VetCEE approved)**.

The course thanks **Serveis Integrats de l'Animal de Laboratori (SIAL)**, **International Council for Laboratory Animal Science (ICLAS)**, **Laboratory Animals Limited** and to **Novartis** for their support with individual scholarships.

Special thanks to **Anapath Research**, Spain and **Institut de Ciències del mar (ICM-CSIC)** for facilitating the access to their facility.

Duration of course: 15 ECTS, 88 attendance hours

Methodologies: Theoretical classes (both webinars and lectures). Case studies. Discussion sessions. Practical sessions

Teaching Staff

- o Tania Alcañiz, Universitat Autònoma Barcelona, Spain
- o Joaquim Alves da Silva. Champalimaud Research, Lisbon, Portugal
- o Sandra Barbosa, Servei Estabulari, UAB, Barcelona, Spain
- o Carlos Baldellou, Universitat Autònoma de Barcelona, Spain
- o Salvador Bartolome, Laboratori de Luminescència i Espectroscòpia de Biomolècules, UAB, Spain
- o Fernando Benavides, Dpt. of Epigenetics and Molecular Carcinogenesis. MD Anderson Cancer Center, Houston, Texas, USA.
- o Sergio Berdun, Parc Científic de Barcelona (PCB) Barcelona, Spain
- o Cory Brayton, Johns Hopkins Medicine, Baltimore, USA
- o James Bussell, Biomedical Services Department. University of Oxford, United Kingdom
- o Agustí Casadesús. Toxicologist, Barcelona, Spain.
- o Estefanía Contreras, Servei Estabulari, UAB, Barcelona, Spain
- o Mariano Domingo Álvarez, CReSA-IRTA, Spain,
- o Verónica Domínguez Plaza, CNB-CSIC, Madrid Spain
- o Julia Fernández Punzano, Centro Nacional de Biotecnología, CNB-CSIC, Madrid, Spain
- o Graziano Fiorito, Stazione Zoologica Anton Dohrn, Napoli, Italy
- o Miriam Illa, BCNatal Foetal Medicine Research Center, Hospital Sant Joan de Deu, Barcelona, Spain
- o Jean Jaubert, Institute Pasteur, Paris, France
- o Eduard Martin, HIPRA, Amer, Spain
- o Lluís Montoliu, Centro Nacional de Biotecnología, CNB-CSIC, Madrid, Spain
- o Anna Martínez i Daunis, IRTA-CReSA, Barcelona
- o Ángel Naranjo, Centro Nacional de Biotecnología, CNB-CSIC, Madrid, Spain
- o Teresa Paramio, Departament de Ciència Animal, Universitat Autònoma de Barcelona
- o Belén Pintado. Centro Nacional de Biotecnología, CNB-CSIC, Madrid.
- o Jordi Polo, Anapath Research, Spain
- o Anna Pujol. Centre de Biotecnologia Animal Teràpia Gènica (CBATEG). UAB. Barcelona, Spain
- o Juan Ramos, Universitat Autònoma de Barcelona, Spain
- o Albert Ribera, Universitat Autònoma de Barcelona, Spain
- o Montserrat Rigol. IDIBAPS, Universitat de Barcelona, Spain
- o Mercè Roca, HIPRA, Amer, Spain
- o Jesús Ruberte. Centre de Biotecnologia Animal Teràpia Gènica (CBATEG), UAB, Spain
- o Jordi Savé, Anapath Research, Spain
- o Laura Soucek, Vall d'Hebron Institute of Oncology, VHIO, Barcelona, Spain
- o Javier Terriente. ZeClinics, Barcelona, Spain
- o Graham Tobin, expert laboratory animal nutrition, UK
- o Sandra Turon. Centre de Biotecnologia Animal Teràpia Gènica (CBATEG). UAB. Barcelona, Spain
- o Toni Ventura, Idibell, Barcelona, Spain
- o Roger Villanueva, Institut de Ciències del Mar, Barcelona, Spain
- o David P Wolfer, Neuroscience Center, Zurich, Switzerland
- o Sebastian Zagmutt, Universitat Internacional de Catalunya, Barcelona, Spain.

Technical support: Antonio Acosta, UAB, Spain

Location of course:

Webinars: using Teams (pre and post UAB attending sessions)

Attending sessions: Seminar to determine, Veterinary School, UAB

Practical sessions:

Laboratories at the Veterinary School V0-137 and V0-133, 1, 2 and 3 Farm

Facilities at Anapath Research

Institut de Ciències del Mar (ICM-CSIC)

Syllabus

Topic 1. Genetics, genetic control and genetically modified rodents.

- 1.1. Basic Concepts of the genetics of mammals.
Teacher: Jean Jaubert
- 1.2. Genetically defined lines of mice.
Teacher: Jean Jaubert
- 1.3. Genetic modification: transgenesis, targeted mutagenesis and genome editing. Tools and applications.
Teacher: Anna Pujol
- 1.4. Genetically defined lines of rats and other rodents used in animal experiments. Spontaneous mutations. International standardized nomenclature of lines and mutations in rodents
Teacher: Fernando Benavides
- 1.5. Genetic control and genetic contamination. Molecular Biology tools used in genetics of rodents. Practical cases.
Teacher: Fernando Benavides
- 1.6. Discussing PCR and genetic control results
Teacher: Fernando Benavides
- 1.7. Standard nomenclature inbred, outbred congenic and mutant mice and rats
Teacher: Fernando Benavides
- 1.8. Managing conditionals and inducible models
Teacher: Belen Pintado
- 1.9. Rodent embryo manipulation. Collection, culture and transfer. Comparing mice and rats.
Teacher: Anna Pujol
- 1.10. Genetic altered models in fish
Teacher: Javier Terriente
- 1.11. Management of colonies. Breeding strategies to keep consanguinity and avoid consanguinity. Breeding schemes in genetically altered animals.
Teacher: Angel Naranjo
- 1.12. Influence of genetic background on phenotype, examples in neurobiology
Teacher: David Wolfer
- 1.13. Epigenetics, concept and impact on genotype and phenotype
Teacher: Belén Pintado
- 1.14. Microbiota and Phenotype

Teacher: To determine

1.15. Rederivation

Teacher: Belén Pintado

1.16. The 3Rs in GA models. How to use international resources

Teacher: Belen Pintado

1.17. Production and Management of GA colonies for Phenotyping Platforms

Teacher: James Bussell

1.18. Rodent basic phenotyping

Teacher: James Bussell

1.19. Phenotypes by image

Teacher: Jesus Ruberte

1.20. Models in Neurobiology

Teacher: Joaquim Alves da Silva

1.21. Reproductive biotechnology. Cryopreservation. FIV

Teacher: Belen Pintado

1.22. Legal management of genetically altered animals

Teacher: Belen Pintado

1.23. Establishing a new genetically altered line according to Directive 2010/63/EU. Practical issues.

Teacher: Belen Pintado

1.24. Large animals genetic modification in pigs

Teacher: Joaquin Gadea

1.25. Practical sessions:

1.25.1. Genotyping procedures

Teacher: Salvador Bartolomé

1.25.2. Obtaining sperm, FIV and scrotal vasectomy

Teachers: Belén Pintado, Julia Fernández

1.25.3. Cryopreservation 2 cells and morulae

Teachers: Belén Pintado, Julia Fernández

1.25.4. Collection and Transfer of mouse-1-cell embryos

Teachers: Anna Pujol, Sandra Turon, Carles Baldellou

Topic 2. Selection of animal model according to biological characteristics

- 2.1. Biology, management and care guidelines in cephalopods
Teacher: Graziano Fiorito
- 2.2. Nutrition and its influence on research
Teacher: Graham Tobin
- 2.3. **Practical sessions** on management, sexing, marking, administration and taking samples in the main species of experimental animals:
 - 2.3.1. Mice and rat
Teachers: Sergio Berdún, Sandra Barbosa, Carlos Baldellou, Albert Ribera, Estefanía Contreras, Anna Martínez
 - 2.3.2. Rabbits
Teachers: Sergio Berdún, Agustín Casadesús
 - 2.3.3. Pigs
Teachers: Mercè Roca, Eduard Martín
 - 2.3.4. Ruminants
Teachers: Estefanía Contreras, Tania Alcañiz
 - 2.3.5. Birds
Teachers: Eduard Martin
 - 2.3.6. Fish
Teachers: Juan Ramos, Toni Ventura
 - 2.3.7. Amphibians
Teachers: Juan Ramos
 - 2.3.8. Cephalopods
Teachers: Roger Villanueva
 - 2.3.9. Dogs (demonstration)
Teachers: To determine
 - 2.3.10. Nonhuman primates (demonstration)
Teachers: To determine

Topic 3 Selection of experimental model according to type of research.

- 3.1. Introduction to animal models.
Teacher: Sergio Berdún

- 3.2. Experimental models in neurodegenerative and rare diseases.
Teacher: Lluís Montoliu
- 3.3. Experimental models in cardiovascular diseases.
Teacher: Montserrat Rigol
- 3.4. Experimental models in oncology.
Teacher: Laura Soucek
- 3.5. Experimental models in diabetes and metabolic diseases.
Teacher: Sebastian Zagmutt
- 3.6. Experimental models in Reproduction.
Teacher: Teresa Paramio
- 3.7. Experimental models in foetal medicine.
Teacher: Miriam Illa
- 3.8. Experimental models in immunology.
Teacher: Cory Brayton
- 3.9. Experimental models in infectious diseases.
Teacher: Mariano Domingo

Timetable

UAB Attending Sessions

Monday, 9 March 2026 (Seminar X)		
09:00 - 09:30	Welcome to the course	Patri Vergara Esteras Estefanía Contreras Belén Pintado Sergio Berdún
09:30 - 11:00	Topic 1.1. Basic concepts of the genetics of mammals	Jean Jaubert
11:00 - 11:30	Break	
11:30 - 13:30	Topic 1.2. Genetically defined lines of mice	Jean Jaubert
13:30 - 14:30	Lunch	
14:30 - 16:30	Topic 1.3. Genetic modification: transgenesis, targeted mutagenesis and genome editing. Tools and applications.	Anna Pujol
16:30 - 16:45	Break	
16:45 - 17:45	Topic 1.7. Standard nomenclature inbred, outbred congenic and mutant mice and rats	Fernando Benavides
17:45 - 19:45	Genotyping procedures (PCR) Groups 1A and 1B Lab. X	Obtaining sperm and FIV, Vasectomy Groups 2A and 2B Lab. X

Tuesday, 10 March 2026 (Seminar X)		
09:00 - 10:30	Topic 1.4. Genetically defined lines of rats and other rodents used in animal experiments. Spontaneous mutations. International standardized nomenclature of lines and mutations in rodents	Fernando Benavides
10:30 - 11:00	Break	
11:00 - 13:00	Topic 1.20. Reproductive biotechnology. Cryopreservation. FIV.	Belén Pintado
13:30 - 14:30	Lunch	
14:30 - 16:30	Topic 1.9. Rodent embryo manipulation. Collection, culture and transfer. Comparing mice and rats.	Anna Pujol
16:30 - 17:00	Break	
17:00-19:00	Genotyping procedures (PCR) Groups 2A and 2B Lab. X	Obtaining sperm and FIV, Vasectomy Groups 1A and 1B Lab. X

Wednesday, 11 March 2026 (Seminar X)		
9:00 - 11:00	Topic 1.5. Genetic control and genetic contamination. Molecular Biology tools used in genetics of rodents. Practical cases	Fernando Benavides
11:00 - 11:30	Break	
11:30 - 13:00	Topic 1.11. Management of colonies. Breeding strategies to keep consanguinity and avoid consanguinity. Breeding schemes in genetically altered animals.	Ángel Naranjo
13:30 - 14:30	Lunch	
14:30-16:30	Topic 1.6. Discussing PCR and genetic control results	Fernando Benavides Belén Pintado
16:30 - 17:00	Break	
17:00 - 19:00	Cryopreservation Groups 1A and 1B Lab. X	1 cell embryo transfer Groups 2A and 2B Lab. X

Thursday, 12 March 2026 (Seminar X)		
09:00 - 10:00	Topic 1.8. Managing conditionals and inducible models	Belén Pintado
10:00 - 11:00	Topic 1.22. Large animals genetic modification in pigs	Joaquín Gadea
11:00 - 11:30	Break	
11:30 - 13:30	Topic 1.16. Production and management of GA colonies for phenotyping platforms.	James Bussel
13:30 - 14:30	Lunch	
14:30 - 16:00	Topic 1.17. Rodent basic phenotyping. Practical issues.	James Bussel
16:30 - 17:00	Break	
17:00 -19:00	Cryopreservation Groups 2A and 2B Lab. X	1 cell embryo transfer Groups 1A and 1B Lab. X

Friday, 13 March 2026 (Seminar X)		
09:00 - 11:00	Topic 1.19. Models in Neurobiology	Joaquim Silva
11:00 - 11:30	Break	
11:30 - 12:30	Topic 1.19. Models in Neurobiology	Joaquim Silva
12:30 - 13:30	Topic 1.13. Epigenetics, concept and impact on genotype and phenotype	Belén Pintado
13:30 - 14:30	Lunch	
14:30 - 16:00	Topic 1.10. Genetic altered models in fish	Javier Terriente
16:00 - 16:30	Break	
16:30 -17:30	Topic 1.12. Influence of genetic background on phenotype, examples in neurobiology	David Wolfer
17:30 -19:00	Topic 1.18. Phenotyping by image	Jesús Ruberte

Saturday, 14 March 2026 (Seminar X)		
09:00 – 09:05	Introduction	Sergio Berdún
09:05 – 10:35	Topic 2.1. Biology, management and care guidelines in cephalopods	Graziano Fiorito
10:35 – 11:00	Break	
11:00 – 12:00	Topic 2.1. Biology, management and care guidelines in cephalopods (cont.)	Graziano Fiorito
12:00 – 12:15	Break	
12:15 -14:15	Group 2 Rat Lab X	Group 1 Mice Lab X

Monday, 16 March 2026 (Seminar X)		
09:00 - 10:30	Topic 3.4. Experimental models in oncology	Laura Soucek
10:30 - 11:00	Break	
11:00 – 12:00	Topic 3.4. Experimental models in oncology (cont.)	Laura Soucek
12:00 - 13:00	Topic 3.7. Experimental models in foetal medicine	Miriam Illa
13:00 - 14:00	Lunch	
14:00 - 15:00	Group 1 Coach transport to Anapath Research SAU, Santa Perpetua	Group 2 Coach Transport to Anapath Research SAU, Castellar del Vallès
15:00 - 16:30	Non-Human Primates	Dogs
16:30 – 17:30	Coach Transport to Anapath Research SAU, Castellar del Vallès	Coach transport to Anapath Research SAU, Santa Perpetua
17:30 – 19:00	Dogs	Non-Human Primates
19:00 -20:00	Return to UAB by Coach	Return to UAB by Coach

Tuesday, 17 March 2026 (Seminar X)			
09:00 - 10:30	Topic 3.5. Experimental models in diabetes and metabolic diseases		Sebastian Zagmutt
10:30 - 11:00	Break		
11:00 – 13:30	Group 1 Birds Lab X		Group 2 Rabbits Lab X
13:30 - 14:30	Lunch		
14:30 - 15:15	Group 1 Coach transport to ICM	14:30 – 17:00	Group 2 Birds Lab. X
15:15 - 18:15	Cephalopods practical session	17:00 – 17:15	Break
18:15 -19:00	Coach transport to UAB	17:15 – 19:15	Group 2 Xenopus Lab X.

Wednesday, 18 March 2026 (Seminar X)			
09:00 - 11:00	Topic 3.9. Experimental models in infectious diseases		Mariano Domingo
11:00 – 11:15	Break		
11:15 – 13:30	Group 1 Rabbit Lab X		Group 2 Fish Lab X
13:30 - 14:30	Lunch		
14:30 - 16:30	Group 1 Fish Lab. X	14:30 – 15:15	Group 2 Coach transport to ICM
16:30- 17:00	Break	15:15 – 18:15	Cephalopods practical session
17:00 -19:00	Group 1 Xenopus Lab X.	18:15 – 19:00	Coach transport to UAB

Thursday, 19 March 2026 (Seminar X)		
09:00 - 10:30	Topic 2.2. Nutrition and its influence on research	Graham Tobin
10:30 - 11:00	Break	
11:00 - 12:00	Topic 2.2. Nutrition and its influence on research (cont.)	Graham Tobin
12:00 - 13:00	Topic 2.2. Nutrition self-study	Graham Tobin
13:00 - 14:00	Lunch	
14:00 - 15:30	Topic 3.3. Experimental models in cardiovascular diseases	Montserrat Rigol
15:30 - 16:00	Break	
16:00 - 18:00	Group 1 Rat Lab. X	Group 2 Mice Lab. X

Friday, 20 March 2026 (Seminar X)		
09:00 - 11:00	Group 1 Ruminants Farm	Group 2 Pigs Farm
11:00 - 11:30	Break	
11:30 - 13:30	Group 1 Pigs Farm	Group 2 Ruminants Farm
13:30 - 14:30	Lunch	
14:30 - 15:30	Topic 3.6. Experimental models in Reproduction	Teresa Paramio
15:30 - 16:30	Topic 2.2. Nutrition case studies	Graham Tobin
16:30 - 17:00	Closure and farewell	

Webinars Post-attending sessions

8 April 2026 Webinar (times in Central European Time (CEST))		
13:00 – 13:05	Presentation of the webinar	Patri Vergara Estefanía Contreras Belén Pintado
13:55 – 14:05	Topic 1.21. Legal management of genetically altered animals	Belén Pintado
14:05 – 14:30	Break	
14:30 – 15:30	Topic 1.14. Rederivation	Belén Pintado
15:30– 15:45	Conclusion	Patri Vergara Estefanía Contreras Belén Pintado

10 April 2026 Webinar (times in Central European Time (CEST))		
13:00 – 13:05	Presentation of the webinar	Patri Vergara Estefanía Contreras Belén Pintado
13:05 - 14:05	Topic 1.15. The 3Rs in GA models. How to use international repositories	Belén Pintado
14:05 – 14:30	Break	
14:30 – 17:00	Microbiome and Phenotype	To determine
	Conclusion	Patri Vergara Estefanía Contreras Belén Pintado

15 April 2026 Webinar (times in Central European Time (CEST))		
13:00 – 13:05	Presentation of the webinar	Patri Vergara Estefanía Contreras Sergio Berdún
13:05 – 15:05	Topic 3.2. Experimental models in neurodegenerative and rare diseases	Lluís Montoliu
15:05– 15:15	Conclusion	Patri Vergara Estefanía Contreras Sergio Berdún

<u>17 April 2026 Webinar (times in Central European Time (CEST))</u>		
13:00 – 13:05	Presentation of the webinar	Patri Vergara Estefanía Contreras Sergio Berdún
13:05 – 14:20	Topic 3.1. Introduction to animals models	Sergio Berdún
14:20 – 14:30	Break	
14:30 – 16:00	Topic 3.8. Experimental models in immunology	Cory Brayton
16:00– 16:15	Conclusion	Patri Vergara Estefanía Contreras Sergio Berdún

Groups for the practical sessions: