



INSTITUT PASTEUR COURSE - EDUCATION CENTER

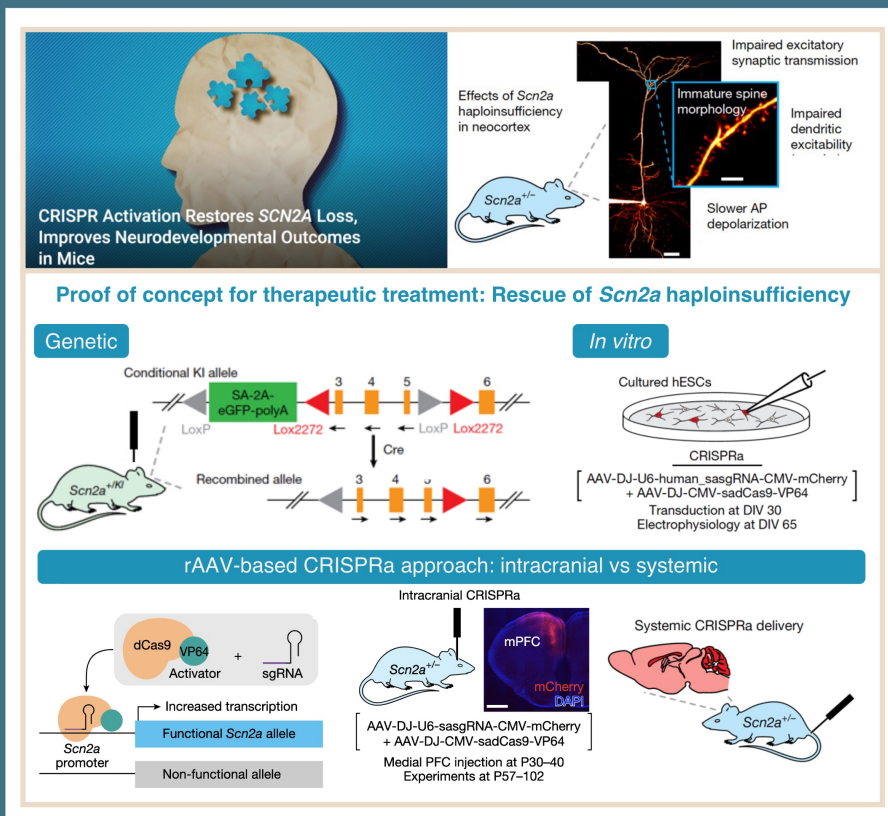
Programme 2025–2026

Mouse Genetics for Disease Modelling

Institut Pasteur, Paris, January 5 – February 13, 2026

Directors: Michel Cohen–Tannoudji, Glenda Comai

Head of laboratory practicals: Caroline Manet



CRISPR activation for neurodevelopmental disorders

SCN2A haploinsufficiency is a frequent cause of neurodevelopmental disorders, including autism, intellectual disability, and in some cases epilepsy. Tamura et al. show that restoring *Scn2a* expression in adolescent *Scn2a*^{+/-} mice, either by a knock-in strategy or by AAV-mediated CRISPRa, rescues electrophysiological and synaptic deficits in neocortical pyramidal neurons and protects against chemoconvulsant-induced seizures. CRISPRa treatment also restores excitability in human SCN2A-haploinsufficient human stem-cell-derived neurons. These preclinical data showcase the potential of this approach to rescue SCN2A haploinsufficiency and demonstrates that even postnatal treatment can ameliorate neurodevelopmental phenotypes. Tamura, S. et al., 2025, Nature 646, 983–991.

WWW.PASTEUR.FR/EN/EDUCATION



DESCRIPTION OF THE COURSE

The mouse has become the most powerful experimental system we have for mammalian research. The mouse has genetic and physiological systems and a metabolism that truly resembles those of humans. It is also a technically advanced system, permitting facile and powerful experimentation. Finally, the mouse model is practically feasible, relatively inexpensive and easily transported from one laboratory to the other. However, working with mice requires specific knowledge. The *Mouse Genetics for Disease Modelling* course is an intensive laboratory and lecture course of five weeks. It is composed of lectures given by internationally renowned scientists. The *Mouse Genetics for Disease Modelling* course gives specific knowledge and explores the cutting edge of research in embryology, Mendelian and complex traits genetics, genomics, functional genetics, gene manipulation, and mouse models for translational research.

The maximum number of participants is 18, which includes selected Master 2 students from Sorbonne Université, Université de Paris Cité and Université Paris-Saclay, foreign postgraduate students and established scientists in an interactive classroom setting. The course is intended to be a platform of excellence in which students can meet and closely interact with worldwide top-level scientists to discuss, exchange ideas, and establish valuable contacts in the perspective of establishing a network of mouse geneticists at an early stage in their careers. Students will be able to understand the importance of basic research and of a broad interdisciplinary approach to contribute to human and animal health improvement. We also aim at providing orientations and mentoring to help students in their future career.

The 2025-2026 course includes a series of lectures dealing with current and emerging topics and resources in mouse genetics, such as genetic and epigenetic regulations of gene expression, novel methods to analyze cell lineages in embryos and adult mice, the use of mouse genetic reference populations to integrate phenotypic data, sophisticated methods to edit the mouse genome and generate conditional mutations, large-scale standardized and comprehensive phenotypic programs and mouse models to understand pathophysiology and for translational applications.

These lectures will be completed by hands-on experiments in the training laboratory, focused respectively on mouse anatomy and pathology, embryology, genetic mapping of Mendelian and complex traits, behavioral studies, pluripotent and adult stem cells, manipulation of the mouse genome, and phenotypic characterization.

More specifically, the attendees will:

- Map a recessive mutation,
- Study the genetics of a complex trait,
- Mine databases for genetic, genomic and phenotypic information,
- Manipulate embryonic stem (ES) cells,
- Produce induced pluripotent stem (iPS) cells from fibroblasts,
- Use reporter genes to track the expression of targeted genes in cultured cells and embryos,
- Perform *in vitro* fertilization experiment.
- Generate different types of organoids

Mouse Genetics and Disease Modelling course 2025-2026

All practical works involving mice will be performed in compliance with European and French regulation on the ethical use of animals in research, to which students will be introduced.

The final exam of the course consists in the design and presentation of an imaginary scientific project based on the critical analysis of recent scientific articles, and on strategies and technical approaches learned during the course. Students submit a written document and then discuss their project following a slide presentation.

The course evaluation includes an oral presentation of the student's past scientific experience, a report on the practical work sessions, and the final exam.

The Mouse Genetics for Disease Modelling Course takes place at

The Institut Pasteur
Pavillon Louis Martin (Building 09)
28, rue du Docteur Roux
75724 PARIS Cedex 15

Theoretical training: Room n°6 (-1 level)

Practical training: Ground floor

Mouse Genetics and Disease Modelling course 2025-2026

Week 1	Monday	Tuesday	Wednesday	Thursday	Friday
9:00	Introduction	Necropsy and sample collection for histology Edouard Reyes Gomez	Genetic analysis in the mouse (part 2) Xavier Montagutelli	TP 2 Mapping Step 1 (electrophoresis)	TP 2 Mapping (data analysis)
9:30					
10:00	Welcome coffee and tea	TP 1 Mouse necropsy		TP 2 Mapping (Gene-Link)	Mouse preimplantation development Jerôme Artus
10:30	On the use and protection of animals in research and education Caroline Manet				
11:00					
11:30					
12:00					
12:30					
13:00					TP 2 Mapping Step 2 (data entry, analysis)
13:30	Safety rules	Genetic analysis in the mouse (part 1) Xavier Montagutelli	TP 2 Mapping	The analysis of behaviour in mice Sylvie Granon	
14:00	Elements in formal genetics Xavier Montagutelli				
14:30			TP 2 Mapping Step 1 (PCR + prep gel)	TP 2 Mapping (data entry)	
15:00	The mouse genetic populations Caroline Manet	Transgenic models Michel Cohen-Tannoudji			
15:30					
16:00					
16:30			Student presentations x 4	Student presentations x 4	Practical training report + questionnaire
17:00					
17:30		Student presentations x 3			
18:00					
18:30					
19:00					

Lab	Lecture room	Lecture room	Lecture room	Lecture room
-----	--------------	--------------	--------------	--------------

Week 2	Monday	Tuesday	Wednesday	Thursday	Friday
9:00	TP 2 Mapping Step 3 (PCR)	TP 2 Mapping (final analysis and conclusions)	Genomic imprinting and X inactivation Maud Borensztein	Optogenetics Alexandre Mourot	Mouse pathology Edouard Reyes Gomez
9:30					
10:00	Genome editing Michel Cohen-Tannoudji	Scientific project	The mouse and its reproduction Laurent Tiret	Introduction to organoids culture Aurélie Chiche, Giulia Nigro, Aline Stedman	TP 3 Virtual slides Edouard Reyes Gomez
10:30					
11:00					
11:30					
12:00					
12:30					
13:00					
13:30	TP 2 Mapping Step 3 (electrophoresis)	Pluripotent stem cells Michel Cohen-Tannoudji	Group photo	TP 10 Organoids	TP 4-7 ES diff Reprogramming Cre/loxP CRISPR
14:00					
14:30	Humanized mouse models of human immune diseases Friederike Jönsson and Pierre Bruhns	Transposable elements Deborah Bourc'his	TP 4-6 CRISPR Reprogramming Cre/loxP		
15:00					
15:30	TP 2 Mapping Step 3 (photo)				
16:00					
16:30	Practical training report	Practical training report		Practical training report + questionnaire	
17:00					
17:30					
18:00					
18:30					
19:00					

Mouse Genetics and Disease Modelling course 2025-2026

Week 3	Monday	Tuesday	Wednesday	Thursday	Friday	
9:00	Management of rodent colonies Aur�lie Jory	TP 8 FIV	Oncogenes Iva Simeonova	TP 9 Data mining Jean Jaubert Caroline Manet	Mouse Phenotyping: High throughput to new innovations Sara Wells	
9:30						
10:00	Reflections on the Cre/loxP system Michel Cohen-Tannoudji			Tumor suppressor genes Franck Toledo	TP 9 Data mining Jean Jaubert Caroline Manet	T cells and inflammation Paula Clark
10:30						
11:00						
11:30						
12:00			TP 8 FIV			
12:30						
13:00						
13:30	TP 7 ES diff	Behavioural adaptation Philippe Faure			TP 8 FIV	
14:00				Rodent models for studying addiction Morgane Besson	Stem cell derived embryo model Alexandre Mayran	
14:30			TP 4, 6 , 7 and 10 Microscopy Embryoid bodies		TP 7 and 10	
15:00		TP 8 FIV				
15:30				TP10, Debrief minigut		
16:00						
16:30						
17:00						
17:30			The mouse genetic reference populations Caroline Manet	Practical training report + questionnaire		
18:00					Practical training report	
18:30						
19:00						

Week 4	Monday	Tuesday	Wednesday	Thursday	Friday
9:00	Introduction to quantitative genetics Caroline Manet	Double-strand break repair in immune cells Ludovic Deriano	TP 12 LacZ in embryos	Adrenal gland Andreas Schedl	Duchenne Muscular Dystrophy models Frédéric Relaix
9:30					
10:00		Lineage tracing Elisa Gomez-Perdiguero		Animal models to understand pathophysiology Frédéric Jaisser	Friedreich ataxia Mouse models Hélène Puccio
10:30	TD 11 Quantitative trait analysis Caroline Manet				
11:00					
11:30					
12:00					
12:30					
13:00					
13:30	TP 5, 7 and 10	Muscle heterogeneity in development, evolution and disease Glenda Comai	Role of GnRH in cognition Vincent Prévot	TP 12	Hercule Poirot in Mouse Genetics
14:00					
14:30		TP 7	TP 7 Debrief gastruloids		End of course
15:00					
15:30					
16:00		Transgenic and optical approaches to image cells <i>in situ</i> Jean Livet	Practical training report	TP 4-10 Debrief mammary gland organoids, final observations and clean-up	
16:30					
17:00					
17:30					
18:00				Practical training report + questionnaire	
18:30					
19:00					

On-line pre-start meeting
Friday December 19th, 11:00

Programme
- WEEK 1 -

THEORETICAL TRAINING: *Ethics and animal welfare; Formal genetics; Mouse genetic populations; Mouse anatomy and necropsy; Genetic analysis; Early development of the mouse embryo; Analysis of mouse behaviour; Transgenic models.*

PRACTICAL TRAINING: *Anatomy and necropsy of aged, inbred mice; Mapping of a recessive mutation in the mouse.*

Monday January 5 2026

9:00-10:00 Welcome and introduction to the course.

10:00-10:30 Welcome coffee and tea.

10:30-12:00 **Theoretical training:** On the use and protection of animals in research and education. **Caroline MANET**
(Institut Pasteur - Paris)

13:30-14:00 Safety rules. **Léo LECLERC**
(Institut Pasteur - Paris)

14:00-16:00 **Theoretical training:** Elements in formal genetics. **Xavier MONTAGUTELLI**
(Institut Pasteur - Paris)

16:15-17:45 **Theoretical training:** The mouse genetic populations. **Caroline MANET**
(Institut Pasteur - Paris)

Tuesday January 6 2026

9:00-10:00 **Theoretical training:** Necropsy and sample collection for histology. **Edouard REYES GOMEZ**
(Ecole nationale vétérinaire d'Alfort
Maisons-Alfort)

Mouse Genetics and Disease Modelling course 2025-2026

10:00-12:30	Practical training 1: Necropsy of inbred mice.	Edouard REYES GOMEZ (Ecole nationale vétérinaire d'Alfort Maisons-Alfort) Glenda COMAI Caroline MANET (Institut Pasteur - Paris)
13:30-15:00	Theoretical training: Genetic analysis in the mouse (part 1).	Xavier MONTAGUTELLI (Institut Pasteur - Paris)
15:15-17:15	Theoretical training: Transgenic models to study the regulation of gene expression.	Michel COHEN-TANNOUDJI (Institut Pasteur - Paris)
17:30-18.30	Presentations by the participants (15' talk, 5' questions) 1- Teddy Gobe: "Tertiary Lymphoid Structures (TLS) as Biomarkers of Response to Immunotherapy." 2- Pauline Sieger: TBA 3- Suzy Perdrix: "Dynamics of Pericentromeric Heterochromatin and Its Role in Gene Regulation."	

Wednesday January 7 2026

9:00-11:00	Theoretical training: Genetic analysis in the mouse (part 2).	Xavier MONTAGUTELLI (Institut Pasteur - Paris)
11:15-12:30	Practical training 2: Mapping a recessive mutation in the mouse. - Objectives and strategies.	Caroline MANET (Institut Pasteur - Paris)
13:30-14:30	Practical training 2: Mapping a recessive mutation in the mouse. - Discussion on the mapping strategy of the patchwork mutation.	Caroline MANET Léo LECLERC (Institut Pasteur - Paris)
14:30-16:30	Practical training 2: Mapping a recessive mutation in the mouse (step 1). - Microsatellites PCR amplification from DNA of backcross mice. - Preparation of the agarose gels.	Caroline MANET Laurine CONQUET Léo LECLERC (Institut Pasteur - Paris)

Mouse Genetics and Disease Modelling course 2025-2026

- 16:45-18.30 Presentations by the participants (15' talk, 5' questions)
- 4- Arthur Fau:** "Study of the coupling between transcriptional regulation and RNA degradation in the functionality of chromatin-associated HP1 proteins."
- 5- Cristina Doran:** "Evaluating the impact of clonal hematopoiesis on a murine model of rheumatoid arthritis."
- 6- Abdul Malik:** "Consequences of TEL-AML1 fusion gene expression in original subpopulations of early human hemato-lymphoid progenitors, towards an ex vivo model of the pre-leukemic stages of pediatric B-cell acute lymphoblastic leukemia."
- 7- Thomas Lajeunesse:** "Présentation de mon parcours scientifique et de mon projet de M2."

Thursday January 8 2029

- | | | |
|-------------|--|--|
| 9:00-12:30 | Practical training 2: Mapping a recessive mutation in the mouse (step 1). <ul style="list-style-type: none">- Migration of the PCR products.- Introduction to the Gene-Link program.- Photography of the gels | Caroline MANET
Laurine CONQUET
Léo LECLERC
<i>(Institut Pasteur - Paris)</i> |
| 13:30-15:00 | Theoretical training: The analysis of behaviour in mice. | Sylvie GRANON-CRESSANT
<i>(Université Paris Saclay
CNRS UMR 8195 Orsay)</i> |
| 15:15-16:45 | Practical training 2: Mapping a recessive mutation in the mouse (step 1). <ul style="list-style-type: none">- Data entry in Gene-Link. | Caroline MANET
Léo LECLERC
<i>(Institut Pasteur - Paris)</i> |

Mouse Genetics and Disease Modelling course 2025-2026

- 17:00-18:30 Presentations by the participants (15' talk, 5' questions)
- 8- Nathan Boyer:** "Rôle de TET2 dans la différenciation et le devenir des cellules B du centre germinatif au cours de la réponse immunitaire humorale."
- 9- Pauline Guillaud:** "Impact of POLE Tumor Variants on DNA Replication Dynamics and Mutational Signatures."
- 10- Andrea Celant:** "Investigating chromatin remodelers in X chromosome inactivation escape in the immune system."
- 11- Emilie Bonanno:** "Role of interhemispheric cerebral connectivity in the early establishment of the foundations of intellectual development."

Friday January 9 2029

- | | | |
|-------------|--|--|
| 9:00-10:30 | Practical training 2: Mapping a recessive mutation in the mouse (step 1).
- Data analysis. | Caroline MANET
Léo LECLERC
<i>(Institut Pasteur - Paris)</i> |
| 10:45-12:15 | Theoretical training: The early development of the mouse embryo. | Jérôme ARTUS
<i>(Université Paris Saclay - Inserm U935 Villejuif)</i> |
| 13:15-14:15 | Practical training 2: Mapping a recessive mutation in the mouse (step 2).
- Data entry
- Data analysis. | Caroline MANET
Léo LECLERC
<i>(Institut Pasteur - Paris)</i> |
| 14:15-15:15 | Practical training 1: Necropsy of inbred mice.
- Analysis of morphological traits. | Caroline MANET
<i>(Institut Pasteur - Paris)</i> |

Mouse Genetics and Disease Modelling course 2025-2026

15:30-17:30 Presentations by the participants (15' talk, 5' questions)

12- Mohammed Aladham: "Characterization of the impact of an autism-related CNTNAP2 missense variant on neocortex development in mice."

13- Julian Primig: "TLR9 polarizes intratumoral cDCs toward mregDCs in mice and humans."

14 Tristan Robert-van Houtteghem: "Understand and harness CAR T Cell Therapy against Multiple Myeloma."

15 Jeanne Lescaret: "Deciphering the pathophysiology of Muenke Syndrome using in vitro and in vivo models."

17:15-18:30 Practical training report and questionnaire

Mouse Genetics and Disease Modelling course 2025-2026

Programme - WEEK 2 -

THEORETICAL TRAINING: *Genome editing; Transposable elements; Pluripotent stem cells; Physiology of reproduction; Mouse pathology; X-inactivation and genomic imprinting; Optogenetics; Transgenic and humanized models in immunology.*

PRACTICAL TRAINING: *Mapping a recessive mutation in the mouse (cont.); Pathology of rodents; Maintenance and differentiation of mouse ES cells; Reprogramming mouse fibroblast into iPS; Manipulation of Cre/loxP system and fluorescent proteins; Gene editing in mouse ES cells; Intestinal and mammary gland organoid cultures.*

Monday January 12 2026

9:00-10:15 **Practical training 2:** Mapping a recessive mutation in the mouse (step 3).
- Microsatellites PCR amplification.
- Preparation of the agarose gels.

Caroline MANET
Laurine CONQUET
Léo LECLERC
(Institut Pasteur - Paris)

10:30-12:30 **Theoretical training:** Genome editing by homologous recombination and CRISPR-Cas9.

Michel COHEN-TANNOUDJI
(Institut Pasteur - Paris)

13:30-14:30 **Practical training 2:** Mapping a recessive mutation in the mouse (step 3).
- Migration of the PCR products.

Caroline MANET
Laurine CONQUET
Léo LECLERC
(Institut Pasteur - Paris)

14:45-15:30 **Theoretical training:** Dissecting FcR-dependent mechanisms in FcR-humanized mice

Friederike JÖNSSON
(Institut Pasteur - Paris)

15:30-16:15 **Theoretical training:** Transgenic mouse models to test novel therapeutics and vaccines

Pierre BRUHNS
(Institut Pasteur - Paris)

16:30-17:30 **Practical training 2:** Mapping a recessive mutation in the mouse (step 3).
- Photography of the gels

Caroline MANET
Laurine CONQUET
Léo LECLERC
(Institut Pasteur - Paris)

17:30-18:30 Practical training report

Tuesday January 13 2026

9:00-11:00 **Practical training 2:** Mapping a recessive mutation in the mouse (step 3).
- Data collection and analysis. Final discussion.

Caroline MANET
Léo LECLERC
(Institut Pasteur - Paris)

Mouse Genetics and Disease Modelling course 2025-2026

- 11:15-12:30 **Discussion: The scientific project for the final examination.** **Michel COHEN-TANNOUDJI**
Glenda COMAI
(Institut Pasteur - Paris)
- 13:45-15:45 **Theoretical training:** Pluripotent stem cells. **Michel COHEN-TANNOUDJI**
(Institut Pasteur - Paris)
- 14:45-16:15 **Theoretical training:** Transposable elements. **Déborah BOURC'HIS**
(INSERM U935, CNRS UMR 3212
Institut Curie - Paris)
- 17:30-18:30 Practical training report

Wednesday January 14 2026

- 9:00-10:30 **Theoretical training:** Genomic imprinting and X-inactivation. **Maud BORENSZTEIN**
(Institut de Génétique Moléculaire - Montpellier)
- 10:45-12:15 **Theoretical training:** The mouse and its reproduction. **Laurent TIRET**
(Ecole nationale vétérinaire d'Alfort
Maisons-Alfort- France)
- 13:30-13:45 **Group photo**
- 13:45-18:30 **Practical training 4:** Gene editing in mouse ES cells.
- Transfection of the CRISPR/Cas9 system in ES cells.
- Guillaume BURNET**
Michel COHEN-TANNOUDJI
Sandrine VANDORMAEL-POURNIN
Léo LECLERC
(Institut Pasteur - Paris)
- Practical training 5:** Reprogramming mouse fibroblasts into iPS.
- Observation of reprogrammable mouse embryonic fibroblasts.
- Jérôme ARTUS**
(Université Paris Saclay
Inserm U935 - Villejuif)
- Iva SIMEONOVA**
(Dynamique de la chromatine, Institut Curie - Paris)
- Practical training 6:** Manipulation of the Cre/loxP system and fluorescent proteins.
- Transfection of a Cre expression plasmid into Flox Fluo HEK cells.

Thursday January 15 2026

- 9:00-10:30 **Theoretical training:** Optogenetics: principles and applications in neuroscience and cell biology. **Alexandre MOUROT**
(ESPCI - Paris)

Mouse Genetics and Disease Modelling course 2025-2026

10:45-12:00 **Theoretical training:** Introduction to organoid culture

Aurélie CHICHE
Giulia NIGRO
(Institut Pasteur - Paris)
Aline STEDMAN
(Sorbonne Université- Paris)

13:00-17:30 **Practical training 10:** Intestinal and mammary gland organoid culture.
- Intestinal crypt and mammary epithelium recovery.
- Plating in matrigel with growth factors.

Aurélie CHICHE
Michel COHEN-TANNOUDJI
Glenda COMAI
Lamia DJOUAL
Giulia NIGRO
Sophie DULAUROY
(Institut Pasteur - Paris)
Aline STEDMAN
(Sorbonne Université- Paris)

17:30-18:30 Practical training report + questionnaire

Friday January 16 2026

9:00-10:30 **Theoretical training:** Mouse pathology.

Edouard REYES GOMEZ
*(Ecole nationale vétérinaire d'Alfort
Maisons-Alfort)*

10:45-12:30 **Practical training 3:** Pathology of rodents.
- Examination of virtual histological slides.

Edouard REYES GOMEZ
*(Ecole nationale vétérinaire d'Alfort
Maisons-Alfort)*

Mouse Genetics and Disease Modelling course 2025-2026

13:30-18:30

Practical training 7: Maintenance and differentiation of mouse ES cells.
- Observation and plating of mouse embryonic fibroblasts.

Practical training 5: Reprogramming mouse fibroblasts into iPS.
- Changing medium of reprogrammable mouse embryonic fibroblasts.

Practical training 6: Manipulation of the Cre/loxP system and fluorescent proteins.
- Plating Flox Fluo HEK cells for observation.

Practical training 4: Gene editing in mouse ES cells.
- Plating ES cells for observation.

Guillaume BURNET
Michel COHEN-TANNOUDJI
Sandrine VANDORMAEL-POURNIN
Léo LECLERC
(Institut Pasteur - Paris)
Jérôme ARTUS
*(Université Paris Saclay
Inserm U935 - Villejuif)*
Iva SIMEONOVA
*(Dynamique de la chromatine,
Institut Curie - Paris)*

Mouse Genetics and Disease Modelling course 2025-2026

Programme

- WEEK 3 -

THEORETICAL TRAINING: *Genetic and microbiological management of rodent colonies; Conditional mutagenesis; Mouse genetic reference populations; Behavioral adaptations; High-throughput phenotyping; Mouse models of addiction; Mouse models for cancer studies; Stem cell derived embryo models.*

PRACTICAL TRAINING: *Reporter genes in mouse embryos; In vitro fertilization and manipulation of early embryos; Maintenance and differentiation of mouse ES cells; Manipulation of Cre/loxP system and fluorescent proteins; Gene editing in mouse ES cells; Data mining in genomic resources; Intestinal and mammary gland organoid cultures; Gastruloids.*

Monday January 19 2026

9:00-10:00 **Theoretical training:** Genetic management and sanitary risk assessment in laboratory rodent facilities.

Aurélie JORY
(Janvier Labs, Le Genest St Isle)

10:15-12:30 **Theoretical training:** Reflections on the Cre/loxP system.

Michel COHEN-TANNOUDJI
(Institut Pasteur - Paris)

13:30-18:00 **Practical training 7:** Maintenance and differentiation of mouse ES cells.
- Differentiation of ES cells.
- Clonal growth of ES cells in various culture conditions.

Guillaume BURNET
Michel COHEN-TANNOUDJI
Sandrine VANDORMAEL-POURNIN
Léo LECLERC
(Institut Pasteur - Paris)
Jérôme ARTUS
(Université Paris Saclay
Inserm U935 - Villejuif)
Iva SIMEONOVA
(Dynamique de la chromatine,
Institut Curie - Paris)

Tuesday January 20 2026

9:00-12:15 **Practical training 8:** *In vitro* fertilization.
- Collection of sperm and artificial capacitation.
- Collection of oocytes.
- *In vitro* fertilization.

Franck BOURGADE
Céline DAVIAUD
Garvey PINTO MOREINA
Jean JAUBERT
(Institut Pasteur - Paris)

13:15-14:45 **Theoretical training:** Behavioral adaptation.

Philippe FAURE
(ESPCI - Paris)

Mouse Genetics and Disease Modelling course 2025-2026

- 15:00-16:15 **Practical training 8:** *In vitro* fertilization.
- Washing and culture of the fertilized mouse eggs.
Franck BOURGADE
Céline DAVIAUD
Garvey PINTO MOREINA
Jean JAUBERT
(Institut Pasteur - Paris)
- 16:30-18:00 **Theoretical training:** The mouse genetic reference populations.
Caroline MANET
(Institut Pasteur - Paris)

Wednesday January 21 2026

- 9:00-10:30 **Theoretical training:** The mouse as a model for cancer studies: the oncogenes.
Iva SIMEONOVA
(Dynamique de la chromatine, Institut Curie - Paris)
- 10:45-12:15 **Theoretical training:** The mouse as a model for cancer studies: the suppressor genes.
Franck TOLEDO
(Développement hématopoïétique et leucémique - Centre de Recherche Saint-Antoine - Paris)
- 12:30-13:30 **Practical training 8:** *In vitro* fertilization.
- Mouse eggs after fertilization: observation at the 2-cell stage, and further *in vitro* culture to the blastocyst stage.
Franck BOURGADE
Céline DAVIAUD
Garvey PINTO MOREINA
Jean JAUBERT
(Institut Pasteur - Paris)
- 14:15-19:00 **Practical training 7:** Maintenance and differentiation of mouse ES cells.
- Plating embryoid bodies for further differentiation.
- Observation of various embryo-derived stem cell lines.
Guillaume BURNET
Michel COHEN-TANNOUDJI
Sandrine VANDORMAEL-POURNIN
Léo LECLERC
(Institut Pasteur - Paris)
- Practical training 4:** Gene editing in mouse ES cells.
- Microscopic observation.
Jérôme ARTUS
(Université Paris Saclay Inserm U935 - Villejuif)
- Practical training 6:** Manipulation of the Cre/loxP system and fluorescent proteins.
- Microscopic observation.
Iva SIMEONOVA
(Dynamique de la chromatine, Institut Curie - Paris)

Mouse Genetics and Disease Modelling course 2025-2026

Thursday January 22 2026

- 9:00-11:00 **Practical training 9:** Data mining in on-line resources (part 1).
Jean JAUBERT
Caroline MANET
(Institut Pasteur - Paris)
- 10:45-12:45 **Practical training 9:** Data mining in on-line resources (part 2).
Jean JAUBERT
Caroline MANET
(Institut Pasteur - Paris)
- 13:45-15:45 **Theoretical training:** Rodent models for studying addiction.
Morgane BESSON
(Institut Pasteur - Paris)
- 16:00-17:00 **Practical training 10:** Intestinal organoid culture.
- Wrap up and interpretation.
Giulia NIGRO
Sophie DULAUROY
(Institut Pasteur - Paris)
- 17:00-18:00 Practical training report + questionnaire

Friday January 23 2026

- 9:00-10:30 **Theoretical training:** Mouse Phenotyping: High throughput to new innovations.
Sara WELLS
*(Mary Lyon Centre
MRC Harwell - Oxford
United Kingdom)*
- 10:45-12:15 **Theoretical training:** Using Boolean logic and recombinase tools to make better mouse models.
Paula CLARK
*(MRC Laboratory of Molecular
Biology, Cambridge, United
Kingdom)*
- 13:15-14:00 **Practical training 8:** *In vitro* fertilization.
- Observation of the blastocysts obtained by *in vitro* fertilization.
Franck BOURGADE
Céline DAVIAUD
Garvey PINTO MOREINA
Jean JAUBERT
(Institut Pasteur - Paris)
- 14:00-15:30 **Theoretical training:** Studying patterning and morphogenesis using stem cell derived embryo models.
Alexandre MAYRAN
(Institut Cochin - Paris)
- 15:30-18:00 **Practical training 7:** Maintenance and differentiation of mouse ES cells.
- Plating embryoid bodies for further differentiation.
- Observation of cells.
- Change medium.
Guillaume BURNET
Michel COHEN-TANNOUDJI
(Institut Pasteur - Paris)
Alexandre MAYRAN
(Institut Cochin - Paris)
Iva SIMEONOVA
*(Dynamique de la chromatine,
Institut Curie - Paris)*

Mouse Genetics and Disease Modelling course 2025-2026

18:00-18:30 Practical training report

Programme - WEEK 4 -

THEORETICAL TRAINING: *Genetic analysis of complex traits; Population genetics; Genome maintenance; Cell lineage analysis; System biology approaches to metabolic diseases; GnRH and cognition; Optogenetics; Skeletal muscle development and Physiopathology; Development and function of the Adrenal gland cortex; Mouse models of Friedreich ataxia; Mineralocorticoid receptor and therapeutic opportunities.*

PRACTICAL TRAINING: *Analysis of quantitative traits; Maintenance and differentiation of mouse ES cells; Reprogramming mouse fibroblast into iPS; Intestinal and mammary gland organoid cultures; Reporter genes in mouse embryos.*

Monday January 26 2026

9:00-11:00 **Theoretical training:** Introduction to quantitative genetics. **Caroline MANET**
(Institut Pasteur - Paris)

11:15-12:45 **Practical training 11:** Analysis of quantitative traits in crosses between inbred strains of mice. **Caroline MANET**
(Institut Pasteur - Paris)

13:45-18:00 **Practical training 7:** Maintenance and differentiation of mouse ES cells.
- Observation of differentiated ES cells.
- Alkaline phosphatase staining of ES cell clones.
- Gastruloids: changing medium. **Guillaume BURNET**
Michel COHEN-TANNOUDJI
Sandrine VANDORMAEL-POURNIN
Léo LECLERC
(Institut Pasteur - Paris)

Practical training 5: Reprogramming mouse fibroblasts into iPS.
- Picking and subculturing iPS clones.
- Alkaline phosphatase staining of iPS cell clones. **Jérôme ARTUS**
(Université Paris Saclay
Inserm U935 - Villejuif)

Iva SIMEONOVA
(Dynamique de la chromatine,
Institut Curie - Paris)

Practical training 10: Intestinal organoid culture.
- Changing medium.
- Observation of intestinal organoids. **Alexandre MAYRAN**
(Institut Cochin - Paris)

18:00-18:30 Practical training report

Tuesday January 27 2026

Mouse Genetics and Disease Modelling course 2025-2026

- 9:00-10:30 **Theoretical training:** Mechanisms of genome maintenance during antigen receptor gene diversification
Ludovic DERIANO
(Institut Pasteur - Paris)
- 10:45-12:15 **Theoretical training:** Methods for lineage tracing in the mouse.
Elisa GOMEZ PERDIGUERO
(Institut Pasteur - Paris)
- 13:30-15:00 **Theoretical training:** Muscle heterogeneity in development, evolution and disease.
Glenda COMAI
(Cellules souches et Développement Institut Pasteur - Paris)
- 15:15-16:15 **Practical training 7:** Maintenance and differentiation of mouse ES cells.
- Gastruloids: changing medium.
- Observation of differentiated ES cells.
- Observation of picked iPS and ES clones.
Practical training 10: Mammary gland organoid culture.
- Observation of mammary gland organoids.
Guillaume BURNET
Michel COHEN-TANNOUDJI
Sandrine VANDORMAEL-POURNIN
Léo LECLERC
(Institut Pasteur - Paris)
Alexandre MAYRAN
(Institut Cochin - Paris)
Iva SIMEONOVA
(Dynamique de la chromatine, Institut Curie - Paris)
- 16:30-18:00 **Theoretical training:** Transgenic and optical approaches to image cells *in situ* : application to neural circuits structure and development.
Jean LIVET
(Institut de la vision - Paris)

Wednesday January 28 2026

- 9:00-13:00 **Practical training 12:** The use of *lacZ* and GFP reporter genes in embryology.
- Isolation of the embryos and fetuses at E9 - E12 stages.
- Fixation and X-Gal staining.
Michel COHEN-TANNOUDJI
Glenda COMAI
Léo LECLERC
Priscilla LOPES
(Institut Pasteur - Paris)
- 14:00-15:30 **Theoretical training:** Uncovering the role of GnRH in cognition: from neurodevelopmental disease modeling in mice to therapy translation in humans
Vincent PREVOT
(Neuroscience et Cognition - Lille)

Mouse Genetics and Disease Modelling course 2025-2026

15:45-17:15 **Practical training 7:** Gastruloids.
- Wrap up and interpretation.

Guillaume BURNET
Michel COHEN-TANNOUDJI
(Institut Pasteur - Paris)
Alexandre MAYRAN
(Institut Cochin - Paris)
Iva SIMEONOVA
*(Dynamique de la chromatine,
Institut Curie - Paris)*

17:30-18:00 Practical training report

Thursday January 29 2026

9:00-10:30 **Theoretical training:** Stem cells, sex and signaling: building and maintaining the adrenal cortex.

Andreas SCHEDL
(Institut de Biologie Valrose - Nice)

10:45-12:15 **Theoretical training:** Animal models to understand the pathophysiology of the mineralocorticoid receptor and related therapeutic innovations

Frédéric JAISSE
*(Centre de Recherche des Cordeliers,
INSERM U.872 - Paris)*

13:15-16:00 **Practical training 12:** The use of *lacZ* and GFP reporter genes in embryology
- Observation and description of the X-Gal staining in embryos.

Michel COHEN-TANNOUDJI
Glenda COMAI
Léo LECLERC
Priscilla LOPES
(Institut Pasteur - Paris)

16:00-17:00 **Practical training 10:** Mammary gland organoid culture.
- Observation of mammary gland organoids.
- Debrief and potential applications

Guillaume BURNET
Aurélie CHICHE
Michel COHEN-TANNOUDJI
Glenda COMAI
Lamia DJOUAL
Sandrine VANDORMAEL-POURNIN
Léo LECLERC
(Institut Pasteur - Paris)

17:00-17:15 **Practical training:** Final observations and clean-up.

17:15-18:30 Practical training report and questionnaire

Friday January 30 2026

Mouse Genetics and Disease Modelling course 2025-2026

- 9:00-10:30 **Theoretical training:** Duchenne Muscular Dystrophy models for preclinical studies and deciphering tissue repair mechanisms **Frédéric RELAIX**
(Université Paris Est - Créteil)
- 10:45-12:15 **Theoretical training:** How did mouse models help understanding the pathophysiology of Friedreich ataxia and contributed to the development of therapeutic approaches? **Hélène PUCCIO**
(Institut NeuroMyoGène - Lyon)
- 13:30-16:00 Hercule Poirot in mouse genetics. **Michel COHEN-TANNOUDJI**
Glenda COMAI
Caroline MANET
(Institut Pasteur - Paris)
- 16:00 **End of the Course – Farewell party**

Mouse Genetics and Disease Modelling course 2025-2026

Programme

- WEEK 5 -

Tuesday February 3 2026

- 10:00-13:00 **Practical training 13:** Visit of the Mouse Genetics Engineering Center.
Pairs 1, 2, 3, 4. **Francina LANGA-VIVES**
(Institut Pasteur - Paris)
- 14:30-17:30 **Practical training 13:** Visit of the Mouse Genetics Engineering Center.
Pairs 5, 6, 7, 8. **Francina LANGA-VIVES**
(Institut Pasteur - Paris)

Friday February 6 2026

- 15:00 Deadline for submitting research projects

Programme
- WEEK 6 -

Tuesday February 10 2026

9:00-18:00 **Oral examination:** 13 minutes slide presentation, followed by 7 minutes for questions.

JURY:

Jérôme ARTUS, Université Paris Saclay

Caroline MANET, Institut Pasteur

Mélanie PACES-FESSY, Sorbonne Université

Délara SABERAN-DJONEIDI, Université de Paris

Iva SIMEONOVA, Institut Curie

Aline STEDMAN, Sorbonne Université

Laurent TIRET, Ecole nationale vétérinaire d'Alfort

Franck TOLEDO, Sorbonne Université

Michel COHEN-TANNOUDJI, Institut Pasteur

Glenda COMAI, Institut Pasteur

Friday February 13 2026

Deadline for submitting practical training reports

ORGANIZATION OF EXAMINATIONS

• **First oral exam**

Presentation of the past and current scientific projects.

15 minutes slide presentation followed by 5 minutes for questions.

Mark on a 1-20 scale, coefficient 1

• **Continuous student assessment during the practical training**

Based on the results and conclusions of the experiments as presented in the practical training report. Each pair of student writes a report. Both students of the pair get the same mark.

Mark on a 1-20 scale, coefficient 2

• **Final written and oral examination**

Presentation of an imaginary 3-year research project.

○ **Written project**

This document must include:

- A cover page with your project title, and 5 keywords and mentioning your master 2 internship details (laboratory, supervisor and subject)
- Introduction and Objectives (max 1 page)
- Working hypothesis (max 1 page).
- Description of the project (max 3 pages). The planned experiments should be presented in a logical order, with their specific aims and justification. The chosen methods and techniques must be justified and only briefly described.
- Expected results and impact (1/2 page)
- Appendices:
 - Most significant state of art references (max 20), fully formatted according to the "Genetics" journal guidelines (<https://www.genetics.org/content/prep-manuscript#references>). List the references according to citation's order and not to alphabetical order. Include all author's names. Example: Saez L, Derasmo M, Meyer P, Stieglitz J, Young MW. 2011. A key temporal delay in the circadian cycle of *Drosophila* is mediated by a nuclear localization signal in the timeless protein. *Genetics*. 188:591–600.
 - Figures. Include a title and a legend to all figures. Mention the origin of images and graphics taken from publications or websites.

The project must incorporate knowledge acquired in the Mouse Genetics Course and be based on a genetic strategy to address a specific scientific question. You must use the correct nomenclature of mouse strains, genes and alleles, and specify the genotype (homozygous, heterozygous). When multiple genetic modifications are used, provide details on the crossing scheme (genotypes, expected ratio of animals of interest, ...). Provide also details of constructs used to make genetic modifications, and of unusual experimental techniques.

The written project must be emailed as a single PDF document to the two Course Directors by

Friday, February 6 at 3:00 pm.

Mouse Genetics and Disease Modelling course 2025-2026

○ Oral presentation

The presentation should last 13 minutes, followed by 7 minutes for questions.

Slides must be in Powerpoint or PDF format.

Students must attend all presentations.

The oral examination session is open to the public.

The Final oral and written examination will be marked on a 1-20 scale, coefficient 7.

THE PRACTICAL TRAINING REPORT

During most practical training sessions, you will generate experimental data which must be recorded and properly analysed and interpreted in a practical training report. This is part of the teaching objectives. This report will be reviewed by the instructors, and it will provide 2/10 of your final score for the course.

Format of the report

The report in its final format is a single PDF file for each student pair. It must contain one chapter for each practical training, except practical training n° 1 (necropsy), 3 (virtual slides), 9 (data mining) and 11 (quantitative traits) for which no report is expected.

What is expected

Each chapter of the report must contain:

- a brief description of the main objectives of the practical training (5 lines max); do not include the details provided in the handout;
- a description of the aim of each experiment;
- pictures, diagrams, tables, screenshots, etc... featuring the data produced with relevant legends;
- when appropriate, adaptations and modifications from the protocol provided in the handout;
- a description of the results obtained (what worked and what did not, what can be seen), interpretation and analysis (meaning of the data, statistical analysis -when appropriate-, conclusions regarding the objectives, hypotheses if experiment failed).
- when appropriate, comparison or integration with data obtained by the other pairs.

The report must clearly demonstrate that the students:

- have understood the objectives of the practical training,
- have understood the nature and the meaning of the data they have produced,
- are able to interpret the data and conclude with respect to the objectives.

What should NOT be done

The report should NOT contain:

- extensive repetition of the detailed protocols;
- data with no clear description of the materials, reagents and conditions which produced it;
- data with unclear or incomplete legend;
- data with incomplete or vague interpretation;
- conclusions not supported by data.

The report must be sent by email as a single PDF file to both course directors by

Friday, February 13