Circadian Rhythm. Organisms adapt their physiology and behavior to the time of the day in a circadian fashion. Such circadian rhythms have a profound influence on many functions including metabolism, sleep patterns, feeding behavior, hormone release, blood pressure and body temperature. The molecular mechanisms controlling the circadian rhythm have been elucidated using animal models. The Clock gene was first identified in the mouse leading to a better understanding of the circadian molecular clockwork.


The Nobel Prize in Physiology or Medicine 2017 was awarded jointly to Jeffrey C. Hall, Michael Rosbash and Michael W. Young "for their discoveries of molecular mechanisms controlling the circadian rhythm".
DESCRIPTION OF THE COURSE

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

The maximum number of participants is 18, which includes a selected number of Master 2 students from the Universities of Paris 6, Paris 7 and Paris 11 and foreign postgraduate students 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 expect to provide orientations and mentoring to help students in their future career.

The 2017-2018 course includes a number of practical sessions, focused respectively on mouse anatomy and pathology, embryology, genetic mapping of Mendelian and complex traits, behavioral studies, manipulation of the mouse genome, and phenotypic characterization.

More specifically, the attendees will:

- Map a recessive mutation,
- Study the genetics of the predisposition to systemic lupus erythematosus, a complex trait,
- Analyze deep sequencing data,
- Search candidate genes in critical intervals,
- Manipulate embryonic stem (ES) cells,
- Produce induced pluripotent stem (iPS) cells from fibroblasts,
- Examine the behavior of inbred mice,
- Characterize phenotypes associated with limb anomalies,
- Use reporter genes to track the expression of targeted genes in cultured cells and embryos,
- Perform in vitro fertilization experiment.
These hands-on experiences in the training laboratory will be completed by a series of lectures dealing with emerging topics and resources in mouse genetics, such as the importance of miRNA-directed gene regulation, 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 generate conditional mutations, large-scale standardized and comprehensive phenotypic programs, the analysis of predisposition to metabolic or infection diseases, and mouse genome-wide association and systems genetics to identify main players of metabolism regulation.

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 (4-5 pages) 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 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° 3 (Building 06)

Practical training : Ground floor - Pavillon Louis Martin (Building 09)
Programme
- WEEK 1 -

THEORETICAL TRAINING: Ethics and animal welfare; Formal genetics; Mouse genetic populations; Mouse anatomy; Mouse pathology; Early development of the mouse embryo; Physiology of reproduction; Analysis of mouse behaviour.

PRACTICAL TRAINING: Anatomy of rodents, necropsy of mutant mice; Pathology of rodents; Mapping a recessive mutation in the mouse; Analysis of behaviour in mice.

Monday January 8 2018

9:00-10:30 Welcome and introduction to the course.

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

13:30-14:00 Health and safety: rules. Murielle ALMOUSSA (Institut Pasteur - Paris)

14:00-15:30 Theoretical training: The mouse genetic populations. Jean JAUBERT (Institut Pasteur - Paris)

15:45-17:30 Theoretical training: Elements in formal genetics (part one). Xavier MONTAGUTELLI (Institut Pasteur - Paris)

Tuesday January 9 2018

9:00-10:30 Theoretical training: The mouse and its reproduction. Laurent TIRET (Ecole Nationale Vétérinaire d’Alfort Maisons-Alfort- France)

10:45-12:30 Theoretical training: Elements in formal genetics (part two). Xavier MONTAGUTELLI (Institut Pasteur - Paris)

13:30-17:00 Theoretical training: Anatomy of rodents. Practical training 1: Necropsy of mutant mice. Céline ROBERT (Ecole Nationale Vétérinaire d’Alfort Maisons-Alfort- France)
Michel COHEN-TANNOUDJI (Institut Pasteur - Paris)
17:00-17:45  Presentation of the attendees (15' talk, 5' questions)

*Lucie Coster*: Human cytogenetics in hematology.

*Rajaa Marouani*: Just remember how far you have come.

**Wednesday January 10 2018**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker(s)</th>
</tr>
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<tbody>
<tr>
<td>9:00-11:00</td>
<td>Theoretical training: Genetic analysis in the mouse.</td>
<td><strong>Xavier MONTAGUTELLI</strong> (Institut Pasteur - Paris)</td>
</tr>
<tr>
<td>11:15-12:45</td>
<td>Theoretical training: The early development of the mouse embryo.</td>
<td><strong>Jérôme ARTUS</strong> (Université Paris Sud —Inserm U935 Villejuif - France)</td>
</tr>
<tr>
<td>14:00-15:15</td>
<td>Practical training 3: Mapping a recessive mutation in the mouse.</td>
<td><strong>Xavier MONTAGUTELLI</strong> (Institut Pasteur - Paris), <strong>Lucie CHEVALLIER</strong> (École Nationale Vétérinaire d'Alfort Maisons-Alfort- France)</td>
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<tr>
<td></td>
<td>- Objectives and strategies.</td>
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<tr>
<td>15:30-17:15</td>
<td>Theoretical training: Mouse pathology.</td>
<td><strong>Gregory JOUVION</strong> (Institut Pasteur - Paris)</td>
</tr>
<tr>
<td>17:30-19:00</td>
<td>Presentation of the attendees (15' talk, 5' questions)</td>
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<td><em>Grégoire Haouy</em>: Cell mapping of the olfactory bulb: a transcriptome analysis.</td>
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<td><em>Mathieu Schulz</em>: Development, gene regulation and epigenetic.</td>
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<td><em>Marina Maletic</em>: Génétique de l'épilepsie.</td>
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<td><em>Léa Chicoisne</em>: Characterization of trophoblastes and lymphocytes in the cervix.</td>
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**Thursday January 11 2018**

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<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00-10:00</td>
<td>Practical training 3: Mapping a recessive mutation in the mouse.</td>
<td><strong>Xavier MONTAGUTELLI</strong> (Institut Pasteur - Paris), <strong>Lucie CHEVALLIER</strong> (École Nationale Vétérinaire d'Alfort Maisons-Alfort- France)</td>
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<td></td>
<td>- Discussion on the mapping strategy of the patchwork mutation.</td>
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</tbody>
</table>
10:00-12:00 Practical training 3: Mapping a recessive mutation in the mouse (step 1).
- Microsatellites PCR amplification from DNA of backcross mice.
- Agarose gel electrophoresis: preparation of the gels.

14:00-15:30 Visit to the museum and in the Louis Pasteur apartment and crypt.

15:45-18:15 Practical training 3: Mapping a recessive mutation in the mouse (step 1).
- Migration of the PCR products.
- Analysis of mapping data using Gene-Link.

Friday January 12 2018

9:45-11:15 Theoretical training: The analysis of behaviour in mice.
Sylvie GRANON-CRESSANT
(Université Paris Sud XI CNRS UMR 8195 Orsay - France)

11:15-11:45 Practical training 4: Presentation of the alternate sessions of the afternoon.
Format of the data to be recorded.
Sylvie GRANON-CRESSANT
(Université Paris Sud XI CNRS UMR 8195 Orsay - France)

Afternoon
Practical training switching between genetic mapping and behaviour testing (pairs 1 to 4 / pairs 5 to 8).

13:00-15:00 or 15:15-17:15 Practical training 3: Mapping a recessive mutation in the mouse (step 2).
- Microsatellites PCR amplification.
- Agarose gel electrophoresis: preparation of the gels.
Xavier MONTAGUTELLI
Murielle ALMOUSSA
(Institut Pasteur - Paris)
Lucie CHEVALLIER
(Ecole Nationale Vétérinaire d'Alfort Maisons-Alfort - France)

13:00-15:00 or 15:15-17:15 Practical training 4: Behaviour analysis in inbred mice.
- General monitoring and locomotion test (1st session).
Sylvie GRANON-CRESSANT
(Morgane BESSON
(Institut Pasteur - Paris)
THEORETICAL TRAINING: Regulation of gene expression; Epigenetics and genomic imprinting; Techniques of transgenesis and genome editing; Phenotypic analysis; Pluripotent stem cells; Optogenetics; Mouse models of addiction.

PRACTICAL TRAINING: Maintenance and differentiation of mouse ES cells; Reprogramming mouse fibroblast into iPS; Manipulation of Cre/loxP system and fluorescent proteins; Mapping a recessive mutation in the mouse; Analysis of behaviour in mice.

Monday January 15 2018

| Time     | Theoretical training: Transgenic models to study the regulation of gene expression. | Sophie VAULONT  
(Institut Cochin - INSERM U1016 CNRS UMR 8104 - Paris) |
|----------|-----------------------------------------------------------------------------------|-------------------------------------------------------------|
| 10:45-12:15 | Theoretical training: Long-distance relationships and gene regulation during development | François SPITZ  
(Institut Pasteur - Paris) |
15:45-17:45 | Xavier MONTAGUTELLI  
Murielle ALMOUSSA  
Lucie CHEVALLIER  
(Ecole Nationale Vétérinaire d'Alfort Maisons-Alfort- France) |
| 13:30-15:30 | Practical training 4: Behaviour analysis in inbred mice.  
15:45-17:45 | Sylvie GRANON-CRESSANT  
Morgane BESSON  
(Institut Pasteur - Paris) |
| 18:00-18:30 | Practical training 3: Mapping a recessive mutation in the mouse (step 2).  
- Data analysis. | Xavier MONTAGUTELLI  
Murielle ALMOUSSA  
Lucie CHEVALLIER  
(Ecole Nationale Vétérinaire d'Alfort Maisons-Alfort- France) |
Tuesday January 16 2018

9:00-10:45 **Practical training 3**: Mapping a recessive mutation in the mouse (step 3).
- Microsatellites PCR amplification.
- Agarose gel electrophoresis: preparation of the gels.

Xavier MONTAGUTELLI
Murielle ALMOUSSA
(Institut Pasteur - Paris)
Lucie CHEVALLIER
(Ecole Nationale Vétérinaire d'Alfort Maisons-Alfort - France)

11:00-13:00 **Theoretical training**: Pluripotent stem cells, from the teratocarcinomas to the perspectives in regenerative medicine in man.

Michel COHEN-TANNOUDJI
(Institut Pasteur - Paris)

14:00-14:45 **Practical training 3**: Mapping a recessive mutation in the mouse (step 3).
- Migration of PCR products.

Xavier MONTAGUTELLI
Murielle ALMOUSSA
(Institut Pasteur - Paris)
Lucie CHEVALLIER
(Ecole Nationale Vétérinaire d'Alfort Maisons-Alfort - France)

15:00-17:00 **Practical training 2**: Pathology of rodents.
- Examination of histological virtual slides.

Gregory JOUVION
(Institut Pasteur - Paris)

17:15-18:00 **Practical training 3**: Mapping a recessive mutation in the mouse (step 3).
- Photos of the agarose gels.

Xavier MONTAGUTELLI
Murielle ALMOUSSA
(Institut Pasteur - Paris)
Lucie CHEVALLIER
(Ecole Nationale Vétérinaire d'Alfort Maisons-Alfort - France)

18:15-19:15 Presentation of the attendees (15’ talk, 5’ questions)

**Jessica Madaoui**: Chronique Kidney Disease (CKD).

**Marion Poteau**: Aurora-A kinase deregulations, consequences on the control of transition in mitosis.

**Cécilia Domrane**: Research of heterodimerization partners of ARNT2 involved in the control of tumorigenicity of Glioblastoma cells.
Wednesday January 17 2018

9:00-10:30  Presentation of the attendees (15' talk, 5' questions)
            **Fabien Boudia:** Study of the ETO2-GLIS2 oncogene and its impact on different stages of hematopoietic development.
            **Quentin Hardy:** Medicine and Paramecium.
            **Manon Josserand:** Identification and role of epigenetic modifiers in regulation of drosophila intestinal adult stem cells.
            **Laure Chardin:** New therapies in ovarian cancers.

10:30-12:30  **Practical training 4:** Behaviour analysis in inbred mice.  
             - Statistical analysis and discussion.
             **Sylvie GRANON-CRESSANT**  
             (Université Paris Sud XI - CNRS UMR 8195, Orsay - France)

13:30-15:30  **Theoretical training:** Genome editing by homologous recombination and CRISPR-Cas9  
             **Michel COHEN-TANNOUDJI**  
             (Institut Pasteur - Paris)

15:45-17:45  **Theoretical training:** “Genomic imprinting”  
             **Déborah BOURC'HIS**  
             (INSERM U935, CNRS UMR 3212 Institut Curie - Paris)

17:45-19:00  Presentation of the attendees (15' talk, 5' questions)
            **Jean-Baptiste Lopez:** To identify the regulating pathways of a new collective invasion mode in colorectal-cancers.
            **Ségalène Ladaigue:** Impact of ionizing radiations on adhesives interactions between endothelial cells and monocytes in a normal or tumoral context.
            **Romina Via y Rada:** Epigenetic reprogramming of the pre-implantation embryo in diabetic situation.
Thursday January 18 2018

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

11:00-12:30 *Discussion: The scientific project for the final examination.*

13:30-14:00 **Practical training**: Presentation of cell culture practices.

14:00-19:00 **Practical training 5**: Maintenance and differentiation of mouse ES cells.
- Observation and plating of mouse embryonic fibroblasts.

**Practical training 6**: Reprogramming mouse fibroblasts into iPS.
- Observation and plating of reprogrammable mouse embryonic fibroblasts.

**Practical training 7**: Manipulation of the Cre/loxP system and fluorescent proteins.
- Transfection of a Cre expression plasmid into Flox Fluo HEK cells.
Friday January 19 2018

9:00-10:30  **Theoretical training**: Mutagenesis and high throughput phenotyping of the mouse - in search of new genes and new gene functions.

Sara WELLS
(MRC Harwell - Oxford United Kingdom)

10:45-12:15  **Theoretical training**: Rodent models for studying addiction.

Morgane BESSON
(Institut Pasteur - Paris)

13:15-19:00  **Practical training 5**: Maintenance and differentiation of mouse ES cells.
- Differentiation of ES cells.
- Clonal growth of ES cells in various culture conditions.

**Practical training 6**: Reprogramming mouse fibroblasts into iPS.
- Changing medium of reprogrammable mouse embryonic fibroblasts.

**Practical training 7**: Manipulation of the Cre/loxP system and fluorescent proteins.
- Flox Fluo HEK cell subculturing.

Michel COHEN-TANNOUDJI
Sandrine VANDORMAEL-POURNIN
Murielle ALMOUSSA
(Institut Pasteur - Paris)

Jérôme ARTUS
(Université Paris Sud – Inserm U935 - Villejuif - France)

Boris BARDOT
(UMR 7147 CNRS/Institut Curie - Paris)
THEORETICAL TRAINING: Conditional mutagenesis; Multicolored transgenic mice; Optical in vivo imaging; Deep sequencing analysis; Mammalian small RNAs biology; Mouse models for cancer studies; Structural variants. Mouse genetic reference populations.

PRACTICAL TRAINING: Phenotypic analysis of skeleton mouse mutants in E9.5-E13.5 embryos; Reporter genes in mouse embryos; Manipulation of early embryos and in vitro fertilization; Maintenance and differentiation of mouse ES cells; Manipulation of Cre/loxP system and fluorescent proteins.

Monday January 22 2018

9:00-10:30  **Theoretical training**: Reflections on the Cre/loxP system.  
Michel COHEN-TANNOUDJI  
*Institut Pasteur - Paris*

10:45-12:15  **Theoretical training**: Biogenesis of mammalian small RNAs.  
Constance CIAUDO  
*Swiss Federal Institute of Technology - Zurich - Switzerland*

13:30-15:00  **Theoretical training**: Small animal optical *in vivo* imaging.  
Régis TOURNEBIZE  
*Institut Pasteur - Paris*

15:00-18:00  **Practical training 8**: Phenotypic analysis of skeleton mouse mutants  
Effects of mutations at *Sonic hedgehog* (*Shh*) and *Extra-toes/Gli3* loci.  
- Dissection of foetuses at E14.5, fixation in 4% PFA.  
- Yolk sac sampling and freezing to genotype the foetuses.  
Yvan LALLEMAND  
Murielle ALMOUSSA  
*Institut Pasteur - Paris*

18:00  **Practical training**: Change medium and observe ES/iPS/EB.

Tuesday January 23 2018

9:00-9:45  **Practical training 8**: Effects of mutations at *Sonic hedgehog* (*Shh*) and *Extra-toes/Gli3* loci.  
- Post fix washings of the embryos in 1× PBS.  
Yvan LALLEMAND  
Murielle ALMOUSSA  
*Institut Pasteur - Paris*
10:00-12:00 **Theoretical training:** DeepSeq data analysis.

Christophe ANTONIEWSKI  
(Drosophila Genetics and Epigenetics - Université Pierre et Marie Curie - Paris)

13:00-18:30 **Practical training 5:** Maintenance and differentiation of mouse ES cells.  
- Plating embryoid bodies for further differentiation.  
- Observation of various embryo-derived stem cell lines.

Michel COHEN-TANNOUDJI  
Sandrine VANDORMAEL-POURNIN  
Murielle ALMOUSSA  
(Institut Pasteur - Paris)

**Practical training 7:** Manipulation of the Cre/loxP system and fluorescent proteins.  
- Microscopic observation.

Jérôme ARTUS  
(Université Paris Sud Inserm U935 - Villejuif - France)

**Practical training 10:** Observation of fluorescent proteins in Transgenic ovaries.  
- Dissection and observation at the stereomicroscope.

Boris BARDOT  
(UMR 7147 CNRS/Institut Curie - Paris)

**Practical training 8:** Effects of mutations at **Sonic hedgehog** (**Shh**) and **Extra-toes/Gli3** loci.  
- Fixation of the embryos in 70% ethanol.

Yvan LALLEMAND  
Murielle ALMOUSSA  
(Institut Pasteur - Paris)

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**Wednesday January 24 2018**

9:00-10:30 **Theoretical training:** The mouse as a model for cancer studies: the oncogenes.

Boris BARDOT  
(UMR 7147 CNRS/Institut Curie - Paris)

10:45-12:15 **Theoretical training:** The mouse as a model for cancer studies: the suppressor genes.

Franck TOLEDO  
(UMR 7147 CNRS/UPMC-Institut Curie - Paris)

13:15-18:30 **Practical training 8:** Effects of mutations at **Sonic hedgehog** (**Shh**) and **Extra-toes/Gli3** loci.  
- Alcian blue staining.  
- DNA extraction from the frozen foetuses.  
- PCR reaction using specific primers.  
- Migration of the PCR products and assessment of the genotypes.

Yvan LALLEMAND  
Murielle ALMOUSSA  
(Institut Pasteur - Paris)

18:30 **Practical training:** Change medium and observe ES/iPS/EB.
### Thursday January 25 2018

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Instructor(s)</th>
<th>Location</th>
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</table>
| 9:00-12:00 | **Practical training 11:** In vitro fertilization.  
- Collection of sperm and artificial capacitation.  
- Collection of oocytes.  
- In vitro fertilization. | Franck BOURGADE  
Angélique VINCENT  
Jean JAUBERT  
(Institut Pasteur - Paris) |                                             |
| 12:00-12:30| **Practical training 8:** Effects of mutations at Sonic hedgehog (Shh) and Extra-toes/Gli3 loci.  
- Washing of the embryo in 70% Ethanol, 1% HCl. | Yvan LALLEMAND  
Murielle ALMOUSSA  
(Institut Pasteur - Paris) |                                             |
| 13:30-15:30| **Theoretical training:** Conditional mutagenesis in the Mouse. | Frédéric JAIMSER  
(Institut Pasteur - Paris) | Centre de Recherche des Cordeliers, INSERM U.872 - Paris |
| 15:30-18:00| **Practical training 11:** In vitro fertilization.  
- Washing and culture of the fertilized mouse eggs.  
- Electroporation of mouse zygotes (demo). | Franck BOURGADE  
Angélique VINCENT  
Jean JAUBERT  
Sandrine VANDORMAEL-POURNIN  
(Institut Pasteur - Paris) |                                             |
| 18:00-18:30| **Practical training 8:** Effects of mutations at Sonic hedgehog (Shh) and Extra-toes/Gli3 loci.  
- Transfer overnight in 70% Ethanol, 1% HCl. | Yvan LALLEMAND  
Murielle ALMOUSSA  
(Institut Pasteur - Paris) |                                             |

### Friday January 26 2018

<table>
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<tr>
<th>Time</th>
<th>Session</th>
<th>Instructor(s)</th>
<th>Location</th>
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</table>
| 9:00-11:00 | **Theoretical training:** Structural variant analysis in the mouse genome. | Binnaz YALCIN  
(Institute of Genetics and Molecular and Cellular Biology - Illkirch - France) |                                             |
| 11:00-12:30| **Theoretical training:** The mouse genetic reference populations. | Xavier MONTAGUTELLI  
(Institut Pasteur - Paris) |                                             |
| 13:30-15:30| **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) |                                             |
15:45-16:00 **Practical training 8**: Effects of mutations at *Sonic hedgehog (Shh)* and *Extra-toes/Gli3* loci.  
- Transfer embryos in 0.1% NaOH.  

Yvan LALLEMAND  
Murielle ALMOUSSA  
(Institut Pasteur - Paris)

16:00-17:30 **Practical training 11**: In vitro fertilization.  
- Mouse eggs after fertilization: observation at the 2-cell stage, and further in vitro culture to the blastocyst stage.  

Franck BOURGADE  
Angélique VINCENT  
Jean JAUBERT  
(Institut Pasteur - Paris)

17:30-18:00 **Practical training 8**: Effects of mutations at *Sonic hedgehog (Shh)* and *Extra-toes/Gli3* loci.  
- Transfer embryos in 0.1% NaOH.  

Yvan LALLEMAND  
Murielle ALMOUSSA  
(Institut Pasteur - Paris)

18:00 **Practical training**: Change medium and observe ES/iPS/EB.
THEORETICAL TRAINING: Genetic analysis of complex traits; Cell lineage analysis; Systems genetics of metabolism.

PRACTICAL TRAINING: Genetic analysis of complex traits; Mining genomic databases; Maintenance and differentiation of mouse ES cells; Reprogramming mouse fibroblast into iPS; Intestinal organoid culture; DeepSeq data analysis; Phenotypic analysis of skeleton mouse mutants.

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<tr>
<th>Day</th>
<th>Time</th>
<th>Activity</th>
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<tr>
<td><strong>Monday January 29 2018</strong></td>
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<tr>
<td>9:00-11:00</td>
<td>Theoretical training: Introduction to Quantitative Genetics.</td>
<td>Xavier MONTAGUTELLI (Institut Pasteur - Paris)</td>
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<tr>
<td>11:00-12:30</td>
<td>Practical training 11: In vitro fertilization.</td>
<td>Franck BOURGADE, Angélique VINCENT, Jean JAUBERT (Institut Pasteur - Paris)</td>
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<td>- Observation the blastocysts obtained by in vitro fertilization.</td>
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<td>- Non-surgical embryo transfer (demo).</td>
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<tr>
<td>13:30-19:00</td>
<td>Practical training 12: Intestinal organoid culture.</td>
<td>Michel COHEN-TANNOUDJI, Aurélien RAVEUX, Aline STEDMAN, Béatrice ROMAGNOLO,</td>
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<td>- Intestinal crypt isolation.</td>
<td>Guillaume JACQUEMIN, Mathilde HUYGHE (Institut Curie - Paris)</td>
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<td>- Plating in matrigel with growth factors.</td>
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<td><strong>Tuesday January 30 2018</strong></td>
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<td>9:00-12:30</td>
<td>Practical training 13: Genetic predisposition to systemic lupus erythematosus: analysis of crosses between inbred strains of mice.</td>
<td>Xavier MONTAGUTELLI (Institut Pasteur - Paris)</td>
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</tbody>
</table>
13:45-18:00  **Practical training 5**: Maintenance and differentiation of mouse ES cells.
- Observation of differentiated ES cells.
- Alkaline phosphatase staining of ES cell clones.

**Practical training 6**: Reprogramming mouse fibroblasts into iPS.
- Picking and subculturing iPS clones.
- Alkaline phosphatase staining of iPS cell clones.

**Practical training 12**: Intestinal organoid culture.
- Observation of intestinal organoids.

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**Wednesday January 31 2018**

9:00-12:30  **Practical training 9**: The use of lacZ and GFP reporter genes in embryology.
- Isolation of the embryos and foetuses at E9, E10, E11 and E12 stages.
- Fixation and X-Gal staining.

13:30-17:30  **Practical training 14**: Data mining in on-line resources.
- Critical search for information in genetic databases.
- Identification of candidate genes for the patchwork mutation using the genetic mapping data.

17:30  **Practical training**: Change medium and observe EB/Minigut.

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**Thursday February 1 2018**

9:00-10:45  **Theoretical training**: Cell lineage analysis methods in the mouse.

11:00-13:00  **Practical training 9**: The use of lacZ and GFP reporter genes in embryology
- Observation and description of the X-Gal staining in embryos.
<table>
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<tr>
<th>Time</th>
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<tbody>
<tr>
<td>14:00-16:30</td>
<td><strong>Practical training</strong>: DeepSeq data analysis.</td>
<td>Christophe ANTONIEWSKI (Drosophila Genetics and Epigenetics - Université Pierre et Marie Curie - Paris)</td>
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<tr>
<td>16:45-18h30</td>
<td><strong>Practical training 8</strong>: Effects of mutations at Sonic hedgehog (Shh) and Extra-toes/Gli3 loci. - Data analysis, final discussion.</td>
<td>Benoît ROBERT Yvan LALLEMAND Murielle ALMOUSSA (Institut Pasteur - Paris)</td>
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<tr>
<td>18:00</td>
<td><strong>Practical training 4</strong>: Change medium and observe minigut organoid.</td>
<td></td>
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</tbody>
</table>

**Friday February 2 2018**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:30-10:30</td>
<td><strong>Practical training</strong>: Observe minigut organoid.</td>
<td>Michel COHEN-TANNOUDEJ (Institut Pasteur - Paris)</td>
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<tr>
<td>10:45-12:15</td>
<td><strong>Theoretical training</strong>: Systems Genetics of Metabolism.</td>
<td>Ewan WILLIAMS (ETH Zürich - Switzerland)</td>
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<td>13:30-15:30</td>
<td>Hercule Poirot in mouse genetics.</td>
<td>Michel COHEN-TANNOUDEJ Xavier MONTAGUTELLI (Institut Pasteur - Paris)</td>
</tr>
<tr>
<td>16:00</td>
<td>Farewell snack: cakes, petit fours and drinks.</td>
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</tbody>
</table>
# Programme
## WEEK 5

**Tuesday February 6 2018**

10:00-13:00  **Practical training 15**: Visit of the Mouse Genetics Engineering Center. Pairs 1, 2, 3, 4.  
**Francina LANGA-VIVES**  
(Institut Pasteur - Paris)

14:30-17:30  **Practical training 15**: Visit of the Mouse Genetics Engineering Center. Pairs 5, 6, 7, 8.  
**Francina LANGA-VIVES**  
(Institut Pasteur - Paris)

**Friday February 9 2018**

15:00  Deadline for submitting research projects
Programme
- WEEK 6 -

Tuesday February 13 2018

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

**JURY**:
Jérôme ARTUS, Université Paris-Sud  
Lucie CHEVALLIER, Ecole Nationale Vétérinaire d'Alfort  
Sylvie GRANON-CRESSANT, Université Paris-Sud  
Alexis LALOUETTE, Université Paris 7  
Sigolène MEILHAC, Institut Pasteur and Institut Imagine  
Mélanie PACES-FESSY, Université Paris 6  
Laurent TIRET, Ecole Nationale Vétérinaire d'Alfort  
Franck TOLEDO, Université Paris 6  
Michel COHEN-TANNOUDJI, Institut Pasteur  
Xavier MONTAGUTELLI, Institut Pasteur

Friday February 16 2018

Deadline for submitting practical trainings reports
Mouse Genetics course 2017-2018

ORGANIZATION OF EXAMINATIONS

• First oral exam

Presentation of the past and current scientific project.
The presentation should last 15 mn, followed by 10 to 15 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 workbook.
Mark on a 1-20 scale, coefficient 2

• Final written and oral examination

Presentation of an imaginary 3-year research project.

  o Written project

  Fictional project in a 4/5 page document that should be submitted to the members of the jury no later than Friday 9th at 3:00 pm.
  This document should include:
  - Project title, and 5 key-words
  - Introduction and Objectives (max 1 page)
  - Working hypothesis (max 1 page).
  - Description of the project (max 2 pages). The planned experiments should be presented in a logical order, with their specific aims and justification. It is not necessary to give a detailed description of the methods and techniques. A short justification of the chosen methods and techniques is expected.
  - Expected results and impact (1/2 page)
  - Appendices:
    - Most significant state of art references (max 20), fully formatted
    - Figures

  The project must incorporate knowledge acquired in the Mouse Genetics Course. It is only limited by your imagination, therefore all the technical and scientific means are available.

  o Organization of the oral presentation

  The presentation is open to the public.
  Slides (Powerpoint or other supported format).
  The presentation should last 13 minutes, followed by 7 minutes for questions.

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

During most practical trainings, 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 trainings n° 1, 2, 14 and 15 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 all the details provided in the handout;
• a concise description 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 presentation of the experiment which produced it;
• data with no clear and complete 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 16