PATHBIO (www.pathbio.org) is an EU-funded ERASMUS+ Knowledge Alliance for “Precision Pathobiology for Disease Models”, including major European Universities, 5 European “Mouse clinics” for high-throughput phenotyping of mice, major mouse providers (Charles River, JAX, TCP), as well as associated partners worldwide (KMPC, APN, UATE, UCT). This Knowledge Alliance will provide courses and online teaching material for mouse embryology and anatomy, mouse pathology, and for mouse imaging.

In September 21\textsuperscript{st}-29\textsuperscript{th}, 2020, the second course on Mouse Imaging, will be organized by PHENOMIN-ICS (PHENOMIN- Institut Clinique de la Souris) as virtual classes. The aim is to provide Master’s students, PhD and postdoc students with basic and expert knowledge to phenotype morphologically mouse models of human diseases. At this course, expert mouse embryologists, anatomists, pathologists and researchers from Europe, Asia, and Canada will give lectures and discuss with the participants different aspects of mouse imaging technologies providing powerful tools to understand and follow the progress of diseases in humans as well as in mouse models.

It gives the opportunity to learn more about image-based phenotyping using a wide variety of methods to characterize morphologically and functionally disease models. This PATHBIO module covered the “state of art” for the most relevant imaging techniques used in mice, such as X-ray, microCT, MRI, OPT, HREM, optoacoustic imaging, echography, intravital microscopy, as well as the basis for image analysis and 3D rendering. Most of these are translational from the human clinic as the technologies were initially developed for assessing human patients and later adapted to mouse models.

The course teaching will combine lectures and workshop in which participants will learn how to use Image J for analysis, discern and discuss the processing and the analyzing methods between OPT, HREM, micro-CT & MRI, and finally understand how to take advantage of these imaging methods to answer your scientific questions, specifically focusing on the 3’R criteria (Refinement, Replacement and Reduction), ethics and animal welfare.

There is not fee for this course. Interested participants should apply online with CV and letter of motivation. Deadline for applications is August 20\textsuperscript{th}, 2020. Accepted participants will be informed early in September.
Monday September 21st

Introduction & image analysis

10:00-10:15 Welcome

10:15-10:25 Introduction to PATHBIO and PATHBIO summer course
Yann HERAULT

10:25-11:00 Quick Overview of the imaging principles technics
used in mouse pathology analysis
Hugues JACOBS

Break 15’

11:15-12:05 Integrated morphological mouse phenotyping:
synergies between pathology and imaging
Jesus RUBERTE

Lunch

14:00-16:30 Workshop: Image analysis with IMAGE J
(Break included)
Bertrand VERNAY
Hugues JACOBS

An advanced workshop on your own samples is scheduled on Tuesday 29th
(Not mandatory – under registration)
Tuesday September 22nd

Optical imaging, X-rays and µCT imaging

9:00-09:50  Bone imaging: from X-Rays, passing through CT, to specialized microscopical imaging
Jesus RUBERTE

Break 5’

09:55-10:30  Application of microCT analysis with a specific focus on Teeth
Jan PROCHAZKA

Break 15’

10:45-11:20  Intravital Microscopy : Introduction and applications of Multi-photon Microscopy
Nicolas RECEVEUR

11:20-11:55  In vivo mechanisms of (pro)platelet formation
Catherine LEON

Lunch

14:00-14:50  Embryo phenotyping and HREM
Olivia WENDLING

Break 5’

14:55-15:45  Embryo phenotyping and X-rays OPT
Rosie BUNTON-STASYSYN

Workshop tomography- scheduled on Monday 28th (Mandatory)
**Wednesday September 23rd**

**Optical imaging, Echography, Opto-acoustic imaging**

09:00-09:50  Introduction to Micro-ultrasound for preclinical imaging  
Ghina BOUABOUT

**Break 5’**

09:55-10:45  Short overview of applications and the next evolution of ultrasound  
Dieter FUCHS/ Philippe DAVAULT

**Break 15’**

11:00-11:50  Opto-acoustic imaging for oncology  
Stéphanie LERONDEL

**Lunch**

13:30-14:20  High-resolution ultrasound and Photoacoustic imaging in embryology, neurovascular and cardiovascular diseases  
Pierre SICARD

**Break 15’**

14:35-15:35  Workshop: echography (heart, Abdominal)  
Ghina BOUABOUT  
Philippe DAVAULT

An advanced workshop to analyze echography imaging is scheduled on Tuesday 29th (Not mandatory – under registration)
Thursday September 24th

Nuclear imaging and Magnetic Resonance Imaging (MRI)

09:00-09:30  Introduction to Magnetic Resonance Imaging  
Markus KRAIGER

09:30-10:00  MRI and image analysis  
Christelle PO

Break 15’

10:15-10:45  In vivo molecular imaging from pathology to clinic: illustrations  
Ho-Young LEE

Break 5’

10:50-11:40  Nuclear Imaging Spect-CT/PET and Bioluminescence experience at the PHENOMIN-TAAM  
Stéphanie LERONDEL

Lunch

14:00-14:50  Nuclear Imaging in animal research at ImAbio: micro PET-TEMP and microCT and recent application for diagnos  
David BRASSE
Friday September 25th

Imaging analysis, tissue sampling, dedicated case studies in mouse pathology

11:00-11:50  Ontologies for imaging analysis in Mouse Pathology
             Paul SCHOFIELD

Lunch

14:00-14:50  Gross Pathology & Routine Histology; It all starts with a good necropsy and a good tissue section
             Colin McKERLIE

Break 5'

14:55-15:45  Histopathology; Common “normal” histopathology in laboratory mice (spontaneous, strain-related, and incidental) AND the value of histopathology phenotyping to model human disease
             Colin McKERLIE

15:45-16:00  Conclusions- End of the first week
             Yann HERAULT
Monday September 28th

Animal research workshop

10:00: 12:30 Workshop on good practices in animal research: ethical and regulatory aspects, and how imaging supports 3’Rs
(Break included)
Isabelle GONCALVES
Stéphanie LERONDEL

Lunch

Tomography workshop

14:00: 16:30 Demonstration and workshop: HREM, CT and OPT
(Break included)
Olivia WENDLING
Hugues JACOBS
Tuesday September 29th

Optical clearing

09:30-10:20  Immunolabeling followed by optical clearing with solvents (3DISCO) and light-sheet microscopy reveals morphological phenotyping
Alain CHEDOTAL

10:20-10:45  Conclusions- Questions - feedback
Yann HERAULT

End of the school & Workshops which are not mandatory

Break 15’

11:00: 12:00  Image analysis in echography
Ghina BOUABOUT
Philippe DAVAULT

Lunch

14:00: 16:00  Advanced Image analysis with Image J
Your own sample analysis
Bertrand VERNAY

This course is also sponsored by

INFRAFRONTIER
mouse disease models

IMPC
INTERNATIONAL MOUSE PHENOTYPING CONSORTIUM
# List of speakers

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