



# On-Line Summer Course

**Embryology, Anatomy, Histology  
& the Anatomical Basis of Imaging**



**July 5<sup>th</sup> to 16<sup>th</sup>, 2021**

**PATHBIO** ([www.pathbio.org](http://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 on-line teaching material for mouse embryology and anatomy, mouse pathology, and for mouse imaging.

In July 5<sup>th</sup>-16<sup>th</sup>, 2021, the third course on **Mouse Embryology, Anatomy, Histology, and Anatomical Basis of Imaging** will take place **ON-LINE**. The aim is to provide graduate, master, 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 and the US will give lectures and discuss with the participants different aspects of mouse morphological phenotyping, including examples of mouse models for the major human diseases.

Hands on teaching is a very important phase for learning morphological sciences. However, due to COVID-19 pandemic a “classical” presential dissection room teaching is not possible. During this course lectures will be followed by on-line dissections of the different regions and organs of the mouse body. Recorded videos and preprint material will be available for participants to improve the on-line learning experience. Furthermore, radiographs, images from TEM, micro-CT, and MRI, as well as, digital slides will be used for teaching during the course.

The technological platform to set the on-line course will be TEAMS (Microsoft). The local organizers will host the sessions and will lead the discussions.

There is no fee for this course. Interested participants should apply with CV and letter of motivation to [jesus.ruberte@uab.es](mailto:jesus.ruberte@uab.es). Deadline for applications is June 15<sup>th</sup>, 2021. Accepted participants will be informed by the end of June.

*The information and views set out in this publication/website/study/report are those of the authors and do not necessarily reflect the official opinion of the European Union. Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein.*



Co-funded by the  
Erasmus+ Programme  
of the European Union



## Monday, July 5<sup>th</sup>

- 9-10** Welcome address and introductory remarks  
**J. Ruberte and G. Gràcia**
- 10-11** Animal transgenesis: from the classics to the CRISPR genome editing  
**A. Pujol**
- 11-12** Overview of mouse genetic nomenclature  
**J. Sundberg**
- 12-13** 3R's principles for ethical use of mice: replacement, reduction and refinement  
**B. Pintado**

## Lunch break

- 14-15** *In vivo* phenotyping of laboratory mouse  
**K. Svenson**
- 15-16** Phenotyping and research reproducibility  
**C. Brayton**
- 16-17** Histology of skin, hair and nail  
**J. Sundberg**
- 17-18** Mouse models to study skin diseases  
**J. Sundberg**

## Tuesday, July 6<sup>th</sup>

- 9-10** General concepts in morphological mouse phenotyping. Directional terms and planes of the mouse body  
**J. Ruberte**
- 10-11** Introduction to mouse development: segmentation, gastrulation, the embryonic period, and the foetal period  
**H. Jacobs**



**11-12** Development of extraembryonic lineages. The placenta  
**O. Wendling**

**12-13** Determining the window of lethality of mutant mice  
*in utero*  
**O. Wendling**

### Lunch break

**14-15** Collection and fixation of mouse embryos and placentas  
**O. Wendling**

**15-16:30** Bone Ontogeny. Skeletal Nomenclature. Bone histology, immunohistochemistry and ultrastructure. Strain, gender and age differences  
**J. Ruberte**

**16:30-18:30** Skeleton of thoracic limb: scapula, clavicle, humerus, ulna, carpal, metacarpal, and digital bones. On-line identification of main anatomical features in isolated bones, X-ray and microCT images  
**L. Mendes-Jorge**

### Wednesday, July 7<sup>th</sup>

**9-11** Skeleton of pelvic limb: coxal, femur, tibia, fibula, tarsal, and metatarsal bones. On-line Identification of main anatomical features in isolated bones, X-ray and microCT images  
**M. Navarro**

**11-13** Skeleton of the head: skull and mandible. On-line identification of main anatomical features in isolated bones, X-ray and microCT images  
**J. Ruberte**

### Lunch break



- 14-16** Skeleton of the trunk: vertebral column, ribs and sternum. On-line identification of main anatomical features in isolated bones, X-ray and microCT images  
**V. Nacher**
- 16-17** Molecular Imaging Techniques in GEMM with bone diseases  
**F. Mulero**
- 17-18** Arthrology: shoulder, elbow, hip, and stifle joints. Myology: types of muscles, histology, histochemistry, immunohistochemistry and ultrastructure  
**M. Navarro**
- 18-19** Myology of limbs  
**H. Jacobs**

#### **Thursday, July 8<sup>th</sup>**

- 9-10** Anatomy and histology of limb nerves  
**H. Jacobs**
- 10-12** On-line dissection of main muscular groups and peripheral nerves  
**H. Jacobs and M. Navarro**
- 12-13** Mouse models to study muscle diseases  
**A. Serrano**

#### **Lunch break**

- 14-15** Anatomical basis of cardiovascular development  
**J. Ruberte**
- 15-16** Heart: topography, structure and vascularization  
**J. Ruberte**



**16-17** Animal models to study cardiac diseases: physiological and pathological interventions

**A. Planavila**

**17-18** Blood: cellular morphology and clinical analysis

**E. José-Cunilleras**

### Friday, July 9<sup>th</sup>

**9-10** Localization, disposition and topography of main vessel trunks. Identification by X-ray angiography, CT and MRI

**M. Navarro**

**10-11** Structure of blood and lymphatic vessels. Components of the vascular wall

**J. Ruberte**

**11-12** Mouse models to study the lymphatic system

**S. Ortega**

**12-13** Topography and histology of lymphatic nodes.

**J. Ruberte and G. Gràcia**

### **Lunch break**

**14-15** On-line demonstration of lymphatic nodes and thoracic duct by Evan's blue injection and lipid ingesta

**J. Ruberte and G. Gràcia**

**15-16** Histology of thymus and spleen: pathological findings of the lymphoid and hematopoietic system

**J. Calzada-Wack**

**16-17** Students tutoring. Questions and answers. Students autoevaluation



## Monday, July 12<sup>th</sup>

- 10-11** Anatomical basis of gastropulmonar development  
**J. Ruberte**
- 11-12** Respiratory apparatus: nasal cavities, larynx, trachea and lungs. Anatomy and Imaging  
**M. Navarro**
- 12-13** Histopathology of mouse models to study pulmonary diseases  
**N. Prats**

### Lunch break

- 14-15** On-line dissection of the thorax  
**M. Navarro and R. Bernardini**
- 15-16** Oral cavity, pharynx, esophagus, and stomach. Anatomy and Imaging  
**V. Nacher**
- 16-17** Imaging teeth. Mouse models to study tooth diseases  
**J. Prochazka**

## Tuesday, July 13<sup>th</sup>

- 9-10** Intestine and liver. Anatomy and Imaging  
**L. d'Angelo**
- 10-11** Mouse models to study intestinal visceral sensitivity  
**V. Martinez**
- 11-12** Animal models to study human chronic liver disease: an update  
**A. Fernandez**
- 12-13** Anatomical basis of urogenital development  
**M. Mark**



## Lunch break

- 14-15** Urinary organs. Anatomy, histology, and imaging  
**L. d'Angelo**
- 15-16** Male and female genital organs. Anatomy, histology, and imaging  
**A. Carretero**
- 16-17** Modelling mammalian sperm function: is this possible?  
**J. E. Rodríguez**

## Wednesday, July 14<sup>th</sup>

- 9-11** On-line dissection of male and female abdominal and pelvic cavities  
**A. Carretero and L. Mendes-Jorge**
- 11-12** The fat organ. Morphology, physiology and imaging  
**J. Rozman**
- 12-13** Mouse models to study obesity  
**M. Peyrou**

## Lunch break

- 14-15** Pancreas. Anatomy, histology and imaging  
**V. Nacher**
- 15-16** Mouse models to study diabetes  
**A. Casellas**
- 16-17** Thyroid, parathyroid and adrenal glands  
**V. Nacher**





## Thursday, July 15<sup>th</sup>

- 9-10** Basic developmental concepts and general morphology of the central nervous system  
**L. Puellas**
- 10-11** Spinal cord and rhombencephalon. Anatomy and imaging  
**J. Ruberte**
- 11-12** Survival of motoneurons and preservation of neuromuscular junctions, two hallmarks of amyotrophic lateral sclerosis treatment  
**A. Bosch**
- 12-13** Cerebellum and mesencephalon. Anatomy and imaging  
**J. Ruberte**
- Lunch break**
- 14-16** Diencephalon, hypothalamus, and telencephalon  
**L. Puellas**
- 16-16.30** Hypophysis and pineal gland. Anatomy, histology and ultrastructure  
**J. Ruberte**
- 16.30-17.30** Correction of the cerebellar pathology in mouse models of Megaloencephalic Leukoencephalopathy with subcortical Cysts (MLC)  
**A. Bosch**
- 17.30-18.30** Cranial nerves. Encephalic ventricles and brain vascularization  
**J. Ruberte**



## Friday, July 16<sup>th</sup>

**9-10** On-line dissection of the central nervous system  
**J. Ruberte and J. Pampalona**

**10-11** Vestibulocochlear organ. Anatomy and imaging  
**M. Navarro**

**11-12** Mouse models to study deafness  
**S. Murillo**

**12-13** Eye and related structures: Anatomy and imaging  
**J. Ruberte**

### Lunch break

**14-15** Retinal Vascularization. *In vivo* fluorescent angiography and scanning confocal microscopy analysis  
**J. Ruberte**

**15-16** Mouse models of allergy  
**F. de Mora**

**16-17** Mouse models of human cancer.  
**F. J. Benavides**

**17-18** Eye morphological and physiological phenotyping.  
On-line dissection of the eye.  
**A. Bonet**













**18-18.30** Course Evaluation

**CONCLUDING REMARKS**

## List of speakers

SPEAKER	INSTITUTION
Benavides, Fernando José	<p>THE UNIVERSITY OF TEXAS  </p>
Bernardini, Roberta	<p>Università di Roma              Tor Vergata</p>
Bosch, Assumpció	<p></p>
Bonet, Aina	<p><b>UAB</b>            Universitat Autònoma            de Barcelona</p>
Brayton, Cory	<p></p>
Calzada-Wack, Julia	<p></p>
Carretero, Ana	<p><b>UAB</b>            Universitat Autònoma            de Barcelona</p>
Casellas, Alba	<p><i>ciberdem isciüü</i></p>
d'Angelo, Livia	<p> UNIVERSITÀ DEGLI STUDI DI NAPOLI  <b>FEDERICO II</b></p>
de Mora, Fernando	<p><b>UAB</b>            Universitat Autònoma            de Barcelona</p>
Fernandez, Anabel	<p><b>IDIBAPS</b><sup>B</sup></p>
Gràcia, Guillem	<p><b>UAB</b>            Universitat Autònoma            de Barcelona</p>

Jacobs, Hugues	
José Cunilleras, Eduard	 Universitat Autònoma de Barcelona
Mark, Manuel	
Martinez, Vicente	 Universitat Autònoma de Barcelona
Mendes-Jorge, Luísa	 UNIVERSIDADE DE LISBOA
Mulero, Francisca	 Centro Nacional de Investigaciones Oncológicas
Murillo, Silvia	
Nacher, Víctor	 Universitat Autònoma de Barcelona
Navarro, Marc	 Universitat Autònoma de Barcelona
Ortega, Sagrario	 Centro Nacional de Investigaciones Oncológicas
Pampalona, Judit	 Universitat Autònoma de Barcelona
Peyrou, Marion	 UNIVERSITAT DE BARCELONA
Planavila, Anna	 UNIVERSITAT DE BARCELONA
Pintado, Belén	 CENTRO NACIONAL DE BIOFENECOLOGIA 

Prats, Neus	 IRB BARCELONA INSTITUTE FOR RESEARCH IN BIOMEDICINE
Prochazka, Jan	 Czech Centre for Phenogenomics <small>hosted by the Institute of Molecular Genetics of the ASCR, v.v.i.</small>
Puelles, Luis	 UNIVERSIDAD DE MURCIA
Pujol, Anna	 UAB Universitat Autònoma de Barcelona
Rodríguez, Juan Enrique	 UAB Universitat Autònoma de Barcelona
Rozman, Jan	 Czech Centre for Phenogenomics <small>hosted by the Institute of Molecular Genetics of the ASCR, v.v.i.</small>
Ruberte, Jesús	 UAB Universitat Autònoma de Barcelona
Serrano, Antonio	 <b>upf.</b> <i>Universitat Pompeu Fabra Barcelona</i>
Sundberg, John	 The Jackson Laboratory  VANDERBILT UNIVERSITY
Svenson, Karen	 The Jackson Laboratory
Wendling, Olivia	

This course is also sponsored by:

