On-Line Summer Course

Embryology, Anatomy, Histology & the Anatomical Basis of Imaging

July 5th to 16th, 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 5th-16th, 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” presentional 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**. Deadline for applications is June 15th, 2021. Accepted participants will be informed by the end of June.

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### Monday, July 5\textsuperscript{th}

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<th>Time</th>
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| 9-10  | Welcome address and introductory remarks  
  \textit{J. Ruberte and G. Gràcia} |
| 10-11 | Animal transgenesis: from the classics to the CRISPR genome editing  
  \textit{A. Pujol} |
| 11-12 | Overview of mouse genetic nomenclature  
  \textit{J. Sundberg} |
| 12-13 | 3R’s principles for ethical use of mice: replacement, reduction and refinement  
  \textit{B. Pintado} |
| 14-15 | Lunch break |
| 14-15 | \textit{In vivo} phenotyping of laboratory mouse  
  \textit{K. Svenson} |
| 15-16 | Phenotyping and research reproducibility  
  \textit{C. Brayton} |
| 16-17 | Histology of skin, hair and nail  
  \textit{J. Sundberg} |
| 17-18 | Mouse models to study skin diseases  
  \textit{J. Sundberg} |

### Tuesday, July 6\textsuperscript{th}

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| 9-10  | General concepts in morphological mouse phenotyping.  
  Directional terms and planes of the mouse body  
  \textit{J. Ruberte} |
| 10-11 | Introduction to mouse development: segmentation, gastrulation, the embryonic period, and the foetal period  
  \textit{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 7th

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 8th**

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 9th**

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 12th

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 13th

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 14th

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
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<td>Basic developmental concepts and general morphology of the central nervous system</td>
<td>L. Puelles</td>
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<td>10-11</td>
<td>Spinal cord and rhombencephalon. Anatomy and imaging</td>
<td>J. Ruberte</td>
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<td>Survival of motoneurons and preservation of neuromuscular junctions, two hallmarks of amyotrophic lateral sclerosis treatment</td>
<td>A. Bosch</td>
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<td>Cerebellum and mesencephalon. Anatomy and imaging</td>
<td>J. Ruberte</td>
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<td>14-16</td>
<td>Diencephalon, hypothalamus, and telencephalon</td>
<td>L. Puelles</td>
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<td>16-16.30</td>
<td>Hypophysis and pineal gland. Anatomy, histology and ultrastructure</td>
<td>J. Ruberte</td>
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<td>16.30-17.30</td>
<td>Correction of the cerebellar pathology in mouse models of Megaloencephalic Leukoencephalopathy with subcortical Cysts (MLC)</td>
<td>A. Bosch</td>
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<td>Cranial nerves. Encephalic ventricles and brain vascularization</td>
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<td>On-line dissection of the central nervous system J. Ruberte and J. Pampalona</td>
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<td>10-11</td>
<td>Vestibulocochlear organ. Anatomy and imaging M. Navarro</td>
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<td>11-12</td>
<td>Mouse models to study deafness S. Murillo</td>
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<td>12-13</td>
<td>Eye and related structures: Anatomy and imaging J. Ruberte</td>
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<td>14-15</td>
<td>Retinal Vascularization. <em>In vivo</em> fluorescent angiography and scanning confocal microscopy analysis J. Ruberte</td>
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<td>15-16</td>
<td>Mouse models of allergy F. de Mora</td>
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<td>16-17</td>
<td>Mouse models of human cancer. F. J. Benavides</td>
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<td>Eye morphological and physiological phenotyping. On-line dissection of the eye A. Bonet</td>
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**CONCLUDING REMARKS**
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