

Epithelia and Stem Cells in Development, Homeostasis and Disease					
Identification number	Workload	Credit points	Term of studying	Frequency of occurrence	Duration
MN-B-SM (AG 1)	360 h	12 CP	1 <sup>st</sup> or 2 <sup>nd</sup> term of studying	Summer term, 2 <sup>nd</sup> half	7 weeks
<b>1</b>	<b>Type of lessons</b> a) Lectures b) Practical/Lab c) Seminar	<b>Contact times</b> 20 h 154 h 6 h	<b>Self-study times</b> 30 h 126 h 24 h	<b>Intended group size</b> max. 14 max. 14 max. 14	
<b>2</b>	<b>Aims of the module and acquired skills</b> Students who successfully completed this module ... <ul style="list-style-type: none"> <li>• have gained in-depth knowledge about development, physiology, and homeostatic maintenance of epithelial tissues and the role of stem cells in epithelial regeneration, wound healing, aging, and disease states across different model systems, including cultured cells, <i>C. elegans</i>, <i>Drosophila</i>, Zebrafish, and mouse.</li> <li>• have acquired practical skills in the state-of-the-art techniques of molecular, cell and developmental biology, imaging, data processing and analysis (see contents of the module) to independently carry out small scientific projects related to the module topics.</li> <li>• are able to formulate hypotheses and design experimental strategies on how to approach and solve scientific questions related to the topic of the module.</li> <li>• have learned how to analyze and critically discuss scientific problems related to the subject of the module.</li> <li>• have learned how to present research results in oral and written form on a professional level.</li> <li>• are able to transfer and apply knowledge and skills acquired in this module to related scientific fields.</li> </ul>				
<b>3</b>	<b>Contents of the module</b> <ul style="list-style-type: none"> <li>• Principles governing development, physiology and homeostatic maintenance of different epithelial tissues in invertebrate and vertebrate animal models.</li> <li>• Intrinsic and extrinsic signaling and regulatory mechanisms controlling epithelial tissue morphogenesis, tissue and cell polarity, fate decisions, and functions. The role of cell and tissue mechanics, cytoskeletal organization, centrosomes and cilia, inter-organ communication, metabolism, immunity.</li> <li>• Mechanisms underlying epithelial aging, disease development, and progression such as cancer.</li> <li>• The role of stem cells in development, homeostatic maintenance, regeneration, wound healing, and aging of epithelial tissues.</li> <li>• Intrinsic and extrinsic mechanisms controlling stemness, stem cell maintenance, and functions.</li> <li>• Programming and reprogramming of cellular identity during development and regeneration.</li> <li>• Role of stem cells in disease initiation, stem cell-specific surveillance mechanisms, cancer stem cells, and cancer relapse.</li> </ul> <u>Methods:</u> <ul style="list-style-type: none"> <li>• Functional genetics in model organisms, analysis of knock-out, transgenic knock-down, and overexpressing lines. Genetic and chemical models of epithelial tissue regeneration.</li> <li>• Molecular cloning, genome engineering, manipulation of gene expression (CRISPR-Cas, RNAi...)</li> <li>• DNA, RNA, and protein analyses (PCR, quantitative RT-PCR, Western blotting, Immunoprecipitation of proteins, RNA, in-situ hybridization, <i>in-vivo</i> reporter assays...).</li> <li>• Cell culture methods working with stable cell lines and primary cells, including basic human pluripotent stem cell biology and differentiation methods.</li> <li>• Cell and tissue Immunohistochemistry, knock-in reporters, lineage analyses, and microscopy techniques (light and fluorescent microscopy, live-imaging...).</li> </ul> <p><i>Explanatory note:</i> The list above comprises techniques that are commonly used in the participating groups. Every student will be confronted with a large subset of it. The exact content, however, will depend on the tutor and the research project the student will work on.</p>				

<b>4</b>	<p><b>Teaching/Learning methods</b></p> <ul style="list-style-type: none"> <li>Lectures; Practical/Lab (Project work); Seminar; Guidance to independent research; Training on presentation techniques in oral and written form</li> </ul>
<b>5</b>	<p><b>Requirements for participation</b></p> <p>Enrollment in the Master´s degree course "Biological Sciences"</p> <p>In depth knowledge and understanding of the content of the theory module "Principles of Molecular Genetics, Development and Aging (A/D/G)" are required for participation in the course. In cases of doubt, please contact the module coordinator (see 10).</p>
<b>6</b>	<p><b>Type of module examinations</b></p> <p>The final examination consists of three parts: Two hours written examination about topics of the lectures and the practical/lab part (50 % of the total module mark), oral presentation (25 % of the total module mark) and seminar paper (25 % of the total module mark)</p>
<b>7</b>	<p><b>Requisites for the allocation of credits</b></p> <p>Regular and active participation; Each examination part at least "sufficient" (see appendix of the examination regulations for details)</p>
<b>8</b>	<p><b>Compatibility with other Curricula</b></p> <p>None</p>
<b>9</b>	<p><b>Significance of the module mark for the overall grade</b></p> <p>15 % of the overall grade (see also appendix of the examination regulations)</p>
<b>10</b>	<p><b>Module coordinator</b></p> <p>Prof. Dr. Mirka Uhlirova, phone 478-84334, e-mail: mirka.uhlirova@uni-koeln.de</p>
<b>11</b>	<p><b>Additional information</b></p> <p><b>Subject module</b> of the Master´s degree course "Biological Sciences", <b>Specialization:</b> (A) Mechanisms of Aging and Aging Associated Diseases, (G) Molecular and Developmental Genetics</p> <p><b>Participating faculty:</b> Dr. H. Bazzi, Dr. M. Denzel, Prof. Dr. M. Hammerschmidt, Dr. L. Kurian, Dr. C. Niemann, Prof. Dr. C. Niessen, Prof. Dr. S. Roth, Prof. Dr. B. Schermer, Dr. G. Storelli, Prof. Dr. M. Uhlirova, Prof. Dr. A. Wodarz, Prof. Dr. T. Wunderlich</p> <p><b>Literature:</b></p> <ul style="list-style-type: none"> <li>Information about textbooks and other reading material will be given on the ILIAS representation of the course (<a href="https://www.ilias.uni-koeln.de/ilias/goto_uk_cat_2815610.html">https://www.ilias.uni-koeln.de/ilias/goto_uk_cat_2815610.html</a>)</li> </ul> <p><b>General time schedule:</b> Week 1-5 (Mon.-Fri.): Lectures, practical/lab and preparation for the seminar talk (topic and date will be arranged individually); Week 6 (Mon.-Fri.): Writing seminar paper; Week 7 (Mon.-Fri.): Preparation for the written examination</p> <p><b>Note:</b> The module contains hand-on laboratory work conducted individually and is taught in research laboratories. The module does not contain computer-based practicals/research as a main component.</p> <p><b>Introduction to the module:</b> June 7, 2021 at 9:00 a.m., CECAD Research Center, Seminar room 0.037/0.038 (ground floor) or online (in this case, further information/link will be sent to your Smail-Account); for preparation to the module before this introduction see ILIAS link under literature.</p> <p><b>Written examination:</b> July 23, 2021, second/supplementary examination August 06, 2021; the latter date may vary if students and module coordinator agree. More details will be given at the beginning of the module.</p>

**Corona note!** Depending on the Corona situation during the summer term, practical work may be skipped either totally or partly. In this case, some or all practical parts will be replaced by adequate alternatives, so that (i) the workload and (ii) the content of the modules remained unchanged.