

Module Name Epithelia and Stem Cells in Development, Homeostasis and Disease						
Type of Module ○ Advanced Module				Module Code Epithelia and Stem Cells		
Identification Number MN-B-SM (A 3)	Workload 360 h	Credit Points 12 CP	Term 2 nd term of studying	Offered Every Summer term, 2 nd half	Start Summer term only	Duration 7 weeks
1	Course Types a) Lectures b) Practical/Lab c) Seminar		Contact Time 20 h 154 h 6 h		Private Study 30 h 126 h 24 h	
2	Module Objectives and Skills to be Acquired Students who successfully completed this module: <ul style="list-style-type: none"> • 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 across different model systems, including cultured cells, <i>C. elegans</i>, <i>Drosophila</i>, Zebrafish, and mouse. • have acquired practical skills in the state-of-the-art techniques of molecular, cell and developmental biology, imaging, data processing and analysis. • are able to formulate hypotheses and design experimental strategies on how to approach and solve scientific questions related to the topic of the module. • have learned how to analyze and critically discuss scientific problems related to the subject of the module and independently carry out small scientific projects related to the module topics. • have learned how to present research results in oral and written form on a professional level. • are able to transfer and apply knowledge and skills acquired in this module to related fields of biology. 					
3	Module Content Epithelia are a defining tissue type in multicellular organism. Their proper development, maintenance, regeneration - governed by progenitors and tissue stem cells- are essential for the survival and healthspan of an organism. In contrast, epithelial dysfunction is linked to premature aging and various diseases, including inflammation, and cancer. <u>Theory:</u> Principles governing development, physiology and homeostatic maintenance of different epithelial tissues in invertebrate and vertebrate animal models. 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, inter-organ communication, metabolism, immunity. Mechanisms underlying epithelial aging, disease development, and progression such as cancer The role of stem cells in development, homeostatic maintenance, regeneration, wound healing, and aging of epithelial tissues. Intrinsic and extrinsic mechanisms controlling stemness, stem cell maintenance, and functions. Programming and reprogramming of cellular identity during development and regeneration. Role of stem cells in disease initiation, stem cell-specific surveillance mechanisms, cancer stem cells, and cancer relapse					

<p>3</p>	<p>Module Content (continued)</p> <p><u>Methods:</u></p> <p>Functional genetics in model organisms, analysis of knock-out, transgenic knock-down, and overexpressing lines. Genetic and chemical models of epithelial tissue regeneration</p> <p>Molecular cloning, genome engineering, manipulation of gene expression (CRISPR-Cas, RNAi)</p> <p>DNA, RNA, and protein analyses (PCR, quantitative RT-PCR, Western blotting, Immunoprecipitation of proteins, RNA, in-situ hybridization, <i>in-vivo</i> reporter assays)</p> <p>Cell culture methods working with stable cell lines and primary cells, including basic human pluripotent stem cell biology and differentiation methods</p> <p>Cell and tissue immunohistochemistry, knock-in reporters, lineage analyses, and microscopy techniques (light and fluorescent microscopy, live-imaging)</p> <p><i>Explanatory note:</i> The list above comprises techniques that are commonly used in the participating groups. The exact content, however, will depend on the tutor and the research project the student will work on.</p>
<p>4</p>	<p>Teaching Methods</p> <ul style="list-style-type: none"> Lectures; Practical/Lab (Project work); Seminar; Guidance to independent research; Training on presentation techniques in oral and written form
<p>5</p>	<p>Prerequisites (for the Module)</p> <p>Enrolment in the Master's of Science degree course "Genetics and Biology of Aging and Regeneration" or in the Master's degree course "Biochemistry".</p> <p>Additional academic requirements</p> <p>Previous attendance of the lecture module Principles of Molecular Genetics, Development and Aging</p>
<p>6</p>	<p>Type of Examination</p> <p>The final examination consists of two parts: Oral presentation (20-30 min; 50 % of the total module mark), written report (50 % of the total module mark)</p>
<p>7</p>	<p>Credits Awarded</p> <p>Regular and active participation; Each examination part at least "sufficient" (see appendix of the examination regulations for details)</p>
<p>8</p>	<p>Compatibility with other Curricula*</p> <p>Optional compulsory module in the Master's degree course "Biochemistry"</p>
<p>9</p>	<p>Proportion of Final Grade</p> <p>12.0 %</p>
<p>10</p>	<p>Module Coordinator</p> <p>Prof. Dr. Mirka Uhlirova, phone 478 84334, e-mail: mirka.uhlirova@uni-koeln.de</p>
<p>11</p>	<p>Further Information</p> <p>Participating faculty: Prof. Dr. M. Hammerschmidt, Dr. C. Niemann, Prof. Dr. C. Niessen, Prof. Dr. B. Schermer, Prof. Dr. M. Uhlirova, Prof. Dr. D. Vilchez, Prof. Dr. A. Wodarz</p> <p>Literature:</p> <ul style="list-style-type: none"> Information on recommended textbooks and other reading material will be given on the ILIAS representation of the course (see https://www.ilias.uni-koeln.de/ilias/goto_uk_cat_2815610.html)

11	<p>Further Information (continued)</p> <p>Literature:</p> <ul style="list-style-type: none">• Information on recommended textbooks and other reading material will be given on the ILIAS representation of the course (see https://www.ilias.uni-koeln.de/ilias/goto_uk_cat_2815610.html) <p>General time schedule: Week 1-5 (Mon.-Fri.): Lectures/Seminars, practical/lab and preparation for the oral presentation (topic and date will be arranged individually); Week 6 (Mon.-Fri.) practical/lab and oral presentation, Week 7 (Mon.-Fri.): Writing the project report</p> <p>Note: 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>Introduction to the module: May 19, 2025, at 10:30 a.m., CECAD Research Center, Seminar room 0.037/0.038 (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>Oral examination: July 10 – July 11, 2025 oral presentations. More details will be given at the beginning of the module.</p>
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