Module Name
Mitochondria and Neurodegeneration

Type of Module	**Module Code**
o Advanced Module	Mitochondria and Neurodegeneration

Identification Number	**Workload**	**Credit Points**	**Term**	**Offered Every**	**Start**	**Duration**
MN-B-SM (A 1)	360 h	12 CP	2nd term of studying	Summer term, 1st half	Summer term only	7 weeks

1	**Course Types**	**Contact Time**	**Private Study**
	a) Lectures	12 h	80 h
	b) Practical/Lab	150 h	70 h
	c) Seminar	10 h	50 h

2 Module Objectives and Skills to be Acquired

Students who successfully completed this module

- have gained in-depth knowledge in mitochondrial research and the role of mitochondrial dysfunction in neurodegeneration and aging.
- have acquired experimental skills in state-of-the art methodologies in cell biology and molecular biology and can independently carry out small scientific projects related to the topic of the module.
- have learned how to present research results in oral and written form and to critically discuss scientific publications related to the topic of the module on a professional level.
- are able to transfer skills acquired in this module to other fields of biology.

3 Module Content

- Principles of mitochondrial biology including protein and membrane biogenesis, mitochondrial dynamics and inheritance, and mitochondrial genetics
- The role of mitochondrial dysfunction for aging and disease
- Mechanisms of mitochondrial quality control
- The role of mitochondria for neuronal activities and survival
- Mitochondrial DNA mutations and human disease
- Mitochondria and neurodegenerative diseases including Parkinson disease, amyotrophic lateral sclerosis, hereditary spastic paraplegia, spinocerebellar ataxia, and peripheral neuropathies
- Analysis of subcellular localization of proteins using fluorescence microscopy and cellular fractionation
- Molecular cloning (cloning of PCR fragments into plasmids, transfections, etc.)
- Cell culture technology (working with human and murine cell lines)
- Immunohistochemistry

3	**Module Content** (continued) • Protein analysis and protein-interaction methods (Western blotting, co-immunoprecipitation of proteins, pull-down, etc.) • Analysis of knock-out and transgenic mice *Explanatory note:* The list above comprises techniques that are commonly used in the participating groups. Thus, 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.
4	**Teaching Methods** • Lectures; Practical/Lab (Project work); Seminar; Guidance to independent research; Training on presentation techniques in oral and written form
5	**Prerequisites (for the Module)** Enrollment in the Master's of Science degree course "Genetics and Biology of Aging and Regeneration" or in the Master's degree course "Biochemistry and Molecular Medicine" **Additional academic requirements** Previous attendance of the lecture module Principles of Molecular Genetics, Development and Aging
6	**Type of Examination** The final examination consists of two parts: One hour written examination on topics of lectures and seminars (50 % of the total module mark), poster presentation (20-30 min; 50 % of the total module mark)
7	**Credits Awarded** Regular and active participation; Each examination part at least "sufficient" (see appendix of the examination regulations for details)
8	**Compatibility with other Curricula*** Optional compulsory module in the Master's degree course "Biochemistry"
9	**Proportion of Final Grade** 12.0 %
10	**Module Coordinator** Prof. Dr. Elena Rugarli, phone 478 84244, e-mail: elena.rugarli@uni-koeln.de
11	**Further Information** **Participating faculty:** Prof. Dr. M. Bergami, Dr. M. Escobar, Prof. Dr. T. Langer, Dr. E. Motori, Dr. V. Piano, Prof. Dr. J. Riemer, Prof. Dr. E. Rugarli, Dr. H. Scheiblich; Dr. H-G. Sprenger, Prof. Dr. A. Trifunovic. **Literature:** • 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) **General time schedule:** Week 1-5 (Mon.-Fri.): Lectures, practical/lab and preparation for the oral presentation (topic and date will be arranged individually); Week 6 (Mon.-Fri.): Oral presentation of individual research results; Week 7 (Mon.-Fri.): Preparation for the written examination

11	**Further Information** (continued) **Note:** The module contains hands-on laboratory work conducted individually and is taught in research laboratories. The module does not contain computer-based practicals/research as a main component. **Introduction to the module:** April 10 2026 at 14:00 a.m. (CECAD Research Center, room will be communicated on the ILIAS link) 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. **Written examination:** June 05, 2026, second/supplementary examination August 14, 2026; the latter date may vary if students and module coordinator agree. More details will be given at the beginning of the module.