Module Name
Molecular Genetics

Identification Number	Workload	Credit Points	Term	Offered Every	Start	Duration
MN-BC-BSM11	360 h	12 CP	1st or 2nd term of studying	Summer term	summer term only	7 weeks

1	Course Types	Contact Time	Private Study	Planned Group Size*
	a) Lectures	20 h	40 h	max. 8
	b) Practical/Lab	150 h	118 h	max. 2
	c) Seminar	8 h	24 h	max. 8

2 Module Objectives and Skills to be Acquired

Students who successfully completed this module

- have acquired detailed knowledge of molecular genetics, the function of RNA-binding proteins and the different steps of eukaryotic gene expression, including pre-mRNA processing, RNA export, translation and RNA degradation.
- have acquired experimental skills in state-of-the art methods in molecular biology and can independently design and perform small scientific projects related to the topics 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

- Project planning
- Analysis of co- and post-transcriptional steps of human gene expression, with focus on regulation conferred by RNA-binding proteins
- Evaluation of potential protein-protein interactions involving the analysis of published structural information or the prediction via computational approaches such as AlphaFold.
- Applying recombinant DNA technologies, e.g. cloning, DNA preparation, etc.
- Cell culture using immortalized human cell lines, transfection of plasmid DNA, expression of gene products (RNA/protein) and stable cell line generation
- Functional characterization of RNA-binding proteins by knockdown, knockout or degron-induced protein depletion
- Extraction of nucleic acid and protein samples from cultured cells
- Analysis of abundance and sub-cellular localization of proteins using immunofluorescence and/or western blotting
- Techniques for monitoring alternative splicing and RNA degradation (RT-PCR, etc.)
- Basic workflows for producing, analyzing and interpreting high-throughput RNA-sequencing data
- Addressing and solving scientific problems

Explanatory note: The list above comprises state-of-the art molecular methods with emphasis on RNA biology that are commonly used in the field of molecular cell biology. Every student participating in this module will apply a subset of it. The exact content will depend on 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 degree course “Biological Sciences” or in the Master´s degree course “Biochemistry”. **Additional academic requirements** The RNA-related lessons of the lecture “Principles of Molecular Genetics, Development and Aging (A/D/G)” are a prerequisite for the theoretical and practical work in the module and the exam. These are provided via Ilias for self-study. For Students of Master “Biological Sciences”: Previous attendance of the lecture module “Principles of Molecular Genetics, Development and Aging (A/D/G)”.
6	**Type of Examination** The final examination consists of two parts Written examination on topics of lectures, seminars and the practical/lab part (1 hour; 50 % of the total module mark), oral 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*** Biological subject module in the Master´s degree course “Biological Sciences”
9	**Proportion of Final Grade** In the Master´s degree course “Biochemistry”: 10 % of the overall grade (see also appendix of the examination regulations)
10	**Module Coordinator** Prof. Dr. Niels Gehring, phone 470-3873, e-mail: ngehring@uni-koeln.de
11	**Further Information** **Participating faculty**: Prof. Dr. N. Gehring, Dr. V. Boehm, Prof. Dr. D. Mörsdorf **Literature:** Information about textbooks and other reading material will be given on the ILIAS representation of the course (https://www.ilias.uni-koeln.de/ilias/goto_uk_cat_2815610.html) **General time schedule:** Week 1-6 (Mon.-Fri.): Lectures, Practical/Lab (Project work); (daily from approximately 9 a.m. to 5 p.m. including lunch break, times may vary depending on project’s tasks) as well as preparation for the seminar talk (held at the end of week 6); Week 7 (Mon.-Thu.): Preparation for the written examination **Note:** The module contains hand-on laboratory work conducted individually or by small groups of students and is taught mainly in course rooms. The module does contain computer-based practicals/research. **Introduction to the module:** April 3, 2023 at 10:15 a.m., Center for Molecular Biosciences (COMB, Zülpicher Str. 47a), seminar room 0.46 (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. **Written examination:** May 19, 2023, second/supplementary examination August 4, 2023; the latter date may vary if students and module coordinator agree. More details will be given at the beginning of the module.

* 6 students from the Master´s degree course “Biological Sciences” and 2 students from the Master´s degree course “Biochemistry”.