**Module Name**

Redox Metabolism

| Identification Number | Workload | Credit Points | Term | Offered Every | Start | Duration |
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| MN-B-SM (G3) | 360 h | 12 CP | 2nd term of studying | Summer term, 2nd half | Summer term only | 7 weeks |

| 1 | Course Types | Contact Time | Private Study |
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| | a) Lectures | 24 h | 90 h |
| | b) Practical/Lab | 154 h | 60 h |
| | c) Seminar | 6 h | 26 h |

**2 Module Objectives and Skills to be Acquired**

Redox reactions are at the center of most cellular processes: they are at the mechanistic heart of metabolic pathways, they contribute to proteostasis e.g. by the introduction and removal of disulfide bonds, and they drive the production of reactive oxygen species (ROS), which - with their Janus-faced character of being on the one hand toxic and on the other essential for signaling - impact heavily on cellular physiology. A number of diseases have been directly linked with dysregulated redox homeostasis, including cancer, neurological disorders, cardiovascular diseases, obesity and metabolic diseases, as well as aging.

Students who successfully completed this module

- have acquired detailed knowledge on cellular redox processes (e.g. redox reactions, oxidative protein folding, redox metabolism, sources of reactive oxygen species, antioxidative defence systems).
- have acquired detailed knowledge on and can employ techniques to investigate cellular redox processes (e.g. have learned to work with baker's yeast and mammalian tissue culture cells, know tools to assess small redox molecules [genetically encoded fluorescent protein sensors], tools for characterizing redox pathways in vitro [protein purification and enzymatic characterization] and in cells [redox western blots]).
- can independently design experiments for characterization of redox processes including planning of suitable controls, definition of expected outcomes and pitfalls.
- 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.
- are able to transfer skills acquired in this module to other fields of biochemistry and molecular biology.

**3 Module Content**

- Theory: e.g. redox processes, redox reactions in metabolism, redox signalling, origins of reactive oxygen species, antioxidative systems, cellular machineries for oxidative protein folding, the central role of NAD(P)H, redox modifications on biomolecules, consequences of cellular redox perturbations
- Practical methods: e.g. baker's yeast and mammalian tissue culture, genetically encoded fluorescent proteins as tools to measure small redox molecules, experiments to determine protein redox states in intact cells and in vitro, assessment of cellular behaviour upon redox stress (proliferation, cell death), redox stress response pathway analysis in cells, redox processes during cell differentiation

**4 Teaching Methods**

Lectures; Practical/Lab (Project work); Seminar; Guidance to independent research

**5 Prerequisites (for the Module)**

Enrollment in the Master´s degree course "Genetics and Biology of Aging and Regeneration"

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| **6** | **Type of Examination**<br>The final examination consists of two parts (Type BC4): Oral examination on topics of lectures, seminars and the practical/lab part (20-30 min; 50 % of the total module mark), written report on the practical/lab part (50 % of the total module mark) |
| **7** | **Credits Awarded**<br>Regular and active participation;<br>Each examination part at least "sufficient" (see appendix of the examination regulations for details) |
| **8** | **Compatibility with other Curricula***<br>Biochemical subject module in the Master's degree course "Biochemistry and Molecular Medicine" |
| **9** | **Proportion of Final Grade**<br>12.0 % |
| **10** | **Module Coordinator**<br>**Prof. Dr. Jan Riemer**, phone 470-7306, e-mail: jan.riemer@uni-koeln.de<br>Dr. Matthias Weith, phone 470-76826, email: mweith@uni-koeln.de |
| **11** | **Further Information**<br>**Subject module** of the Master's degree course "Genetics and Biology of Aging and Regeneration",<br><br>**Participating faculty**: Prof. Dr. J. Riemer, Dr. Matthias Weith<br>**Literature:** Information about textbooks and other reading material will be given on the ILIAS representation of the course and on the website of the Riemer group (https://riemerlab.uni-koeln.de/teaching/subject-module-redox-metabolism)<br>**General time schedule:** Week 1-5 (Mon.-Fri.): Lectures, preparations for practical work, practical work, and analysis and documentation of practical work; Week 6 (Mon.-Fri.): reading course seminar, and laboratory report; Week 7 (Mon.-Fri.): Preparation for the oral examination and oral examination<br>**Introduction to the module:** June, 8, 2026 at 08:00 a.m. tbd; for preparation to the module before this introduction see ILIAS link under literature.<br>**Written examination:** July 24, 2026, second/supplementary examination August 17, 2026; the latter date may vary if students and module coordinator agree. More details will be given at the beginning of the module. |