UNIVERSITÄT ZU LÜBECK

Module Guide for the Study Path

Master MLS starting 2018

Version from 1. April 2019

1st semester

2nd or 4th semester

2nd semester

3rd semester

4th semester

CS4440-KP05 - Molecular Bioinformatics-CP05 (MolBioInf5)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	5

Course of study, specific field and term:

- Master MLS starting 2016 (optional subject), interdisciplinary competence, 1st semester
- Master MLS starting 2018 (optional subject), interdisciplinary competence, 1st semester

Classes and lectures:

- Molecular Bioinformatics (lecture, 2 SWS)
- Molecular Bioinformatics (exercise, 1 SWS)

Workload:

- 85 Hours private studies
- 45 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Methods for fast genome comparison
- Analysis of data describing gene expression profiles and sequence variation
- Advanced usage of biological databases (for sequences, motifs, structures, gene regulation and interactions)

Qualification-goals/Competencies:

- The students can apply indexing based software to Next Generation sequence data.
- They can use and design databases for molecularbiological research.
- They are able to detect statistically significant changes in Microarray data.

Grading through:

- exam type depends on main module

Requires:

- Introduction to Bioinformatics (CS1400-KP04, CS1400)

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institute for Neuro- and Bioinformatics
- Prof. Dr. Bernhard Haubold
- Prof. Dr. rer. nat. Thomas Martinetz
- MitarbeiterInnen des Instituts

Literature:

- M. S. Waterman: Introduction to Computational Biology - London: Chapman and Hall 1995
- B. Haubold, T. Wiehe: Introduction to Computational Biology - Birkhäuser 2007
- R. Durbin, S. Eddy, A. Krogh, G. Mitchison: Biological sequence analysis. Probabilistic models - Cambridge, MA: Cambridge University Press
- J. Setubal, J. Meidanis: Introduction to computational molecular - Pacific Grove: PWS Publishing Company
- D. M. Mount: Bioinformatics - Sequence and Genome - New York: Cold Spring Harbor Press

Language:

- offered only in German

Notes:

This modul is for Master MLS with 5 credit points.

EW4170-KP05 - System Biology (SystBio)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	5

Course of study, specific field and term:

- Master MLS starting 2018 (optional subject), interdisciplinary competence, 1st semester
- Master MLS starting 2016 (optional subject), interdisciplinary competence, 1st semester
- Master Nutritional Medicine in planning (compulsory), life sciences, 1st semester

Classes and lectures:

- Introduction to classic and translational system biology (lecture, 2 SWS)
- Introduction to classic and translational system biology (exercise, 2 SWS)

Workload:

- 70 Hours private studies
- 60 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Introduction to the genome and proteome of cellular systems
- Networks: cellular, genetic, gene-regulatory networks, interactomes
- Analysis of dynamical systems: fixed points, bifurcations and feedback
- Bioinformatic analysis of Omics data
- Introduction to public databases: e.g. STRING, Gene Expression Omnibus, TCGA, KEGG, Reactome, MSigDB
- Exercises: computer lab for analysis of dynamical systems and cellular pathways in R
- Usage, analysis and visualization of high-dimensional data in R
- Exercises for the analysis of protein interaction networks
-

Qualification-goals/Competencies:

- The students can explain the principles of signal transduction in the cell
- The students can relate to the genome, transcriptome, interactome and proteome
- They can analyse and characterize dynamical systems
- They know common methods to analyse high-throughput data
- Lab work will enable the students to continue studying this subject on their own

Grading through:

- Exercises
- written exam

Responsible for this module:

- Prof. Dr. Hauke Busch

Teacher:

- LIED | Lübecker Institut für experimentelle Dermatologie (Lübeck Institute of Experimental Dermatology)
- Prof. Dr. Hauke Busch
- Dr. Axel Künstner
- MitarbeiterInnen des Instituts

Literature:

- Marian Walhout, Marc Vidal, Job Dekker: Handbook of Systems Biology: Concepts and Insights - (Englisch) Gebundene Ausgabe 15. November 2012
- Edda Klipp, Wolfram Liebermeister, Christoph Wierling, Axel Kowald;: Systems Biology: A Textbook - Englisch) Taschenbuch 20. April 2016
- Yoram Vodovotz and Gary: An Translational Systems Biology, Concepts and Practice for the Future of Biomedical Research

Language:

- offered only in English

LS4010 A - Module part LS4010 A: Cell Biology (ViroZB)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	3

Course of study, specific field and term:

- Master Biophysics (module part), advanced curriculum, 1st semester
- Master MLS starting 2018 (module part), cell biology, 1st semester
- Master MLS starting 2016 (module part), cell biology, 1st semester
- Master MLS (module part), cell biology, 1st semester

Classes and lectures:

- Cell Biology (lecture, 2 SWS)

Workload:

- 60 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Secretion in pro- and eukaryotes
- Structure and function of membraneouse compartments of eukaryotes
- Cellular fusion, cytokinesis and organellar inheritence
- RNA-metabolism

Qualification-goals/Competencies:

- Ability, to understand and reproduce detailled knowledge in cell biology in the areas listed under
- Ability, to recognize the connection between the cell biology of hosts and the molecular strategies of viral and other microbiological parasites

Grading through:

- written exam

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institute for Biology
- Prof. Dr. rer. nat. Enno Hartmann

Literature:

- Lodish: Molecular Cell Biology
- Alberts: Molecular Biology of the Cell

Language:

- English, except in case of only German-speaking participants

LS4010 B - Module part LS4010 B: Molecular Virology (ViroMV)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	3

Course of study, specific field and term:

- Master Biophysics (module part), advanced curriculum, 1st semester
- Master MLS starting 2018 (module part), cell biology, 1st semester
- Master MLS starting 2016 (module part), cell biology, 1st semester
- Master MLS (module part), cell biology, 1st semester

Classes and lectures:

- Molecular Virology (lecture, 2 SWS)

Workload:

- 60 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Viral and cellular receptors for virus-cell interaction as well as their inhibition by inhibitors
- Detailed molecular mechanisms of genome replication from selected virus families (focussed on RNA viruses)
- Host factors and their function in viral genome replication on the basis of selected examples
- Structural biology of viruses and its application for anti-viral therapy
- Basics of viral pathogenesis
- Viral strategies against the innate immune system

Qualification-goals/Competencies:

- Detailed knowledge on the interaction between viruses and their host cells
- Details on virus structure and replication mechanisms as well as on derived anti-viral strategies
- Pathogenic processes and virus-host interactions in virus infections

Grading through:

- written exam
- contributions to the discussion

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institute of Virology and Cell Biology
- Prof. Dr. rer. nat. Norbert Tautz
- Dr. rer. nat. Olaf Isken

Literature:

- S.J. Flint et al.: Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses - American Society Microbiology, February 2009, 3rd Ed., ISBN: 978-1-55581-443-4
- S.Modrow, D. Falke, U. Truyen, H. Schätzl: Molekulare Virologie - Spektrum, Heidelberg, 3. Aufl. 2010, ISBN 978-3-8274-1833-3
- : Grundlagen- und Übersichtsartikel

Language:

- English, except in case of only German-speaking participants

LS4010-KP06, LS4010 - Basics of Cell- and Molecular Biology for Virology (Viro)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	6

Course of study, specific field and term:

- Master MLS starting 2018 (compulsory), cell biology, 1st semester
- Master MLS starting 2016 (compulsory), cell biology, 1st semester
- Master MLS (compulsory), cell biology, 1st semester

Classes and lectures:

- Part of the module A: Cell Biology (lecture, 2 SWS)
- Part of the module B: Molecular Virology (lecture, 2 SWS)

Workload:

- 120 Hours private studies
- 60 Hours in-classroom work

Contents of teaching:

- See part of the modules A and B

Qualification-goals/Competencies:

- See part of the modules A and B

Grading through:

- written exam (test achievement)

Responsible for this module:

- Prof. Dr. rer. nat. Enno Hartmann

Teacher:

- Institute of Virology and Cell Biology
- Institute for Biology

- Prof. Dr. rer. nat. Enno Hartmann
- Prof. Dr. rer. nat. Norbert Tautz
- Dr. rer. nat. Olaf Isken

Language:

- English, except in case of only German-speaking participants

Notes:

Prerequisites: Bachelor degree in Molecular Life Sciences or in related fields.
One written examination on both parts (Cell Biology and Molecular Virology), each valued 50%.

LS4020 A - Module part LS4020A: Crystallography (StrAnaKris)

Duration:	Turnus of offer:	Credit points:	Max. group size:
1 Semester	each winter semester	3	60

Course of study, specific field and term:

- Master MLS starting 2018 (module part), structure biology, 1st semester
- Master Infection Biology ab 2018 (module part), Interdisciplinary modules, 1st semester
- Master Biophysics (module part), biophysics, 1st semester
- Master CLS starting 2016 (module part), MML with specialization in Life Science, 3rd semester
- Master MLS starting 2016 (module part), structure biology, 1st semester
- Master Infection Biology (module part), Interdisciplinary modules, 1st semester
- Master CLS (module part), computational life science / life sciences, 3rd semester
- Master MLS (module part), structure biology, 1st semester

Classes and lectures:

- Crystallography (lecture, 2 SWS)

Workload:

- 60 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Crystal growth, precipitant and phase diagram, crystal morphology, symmetry and space groups, crystallogenesis
- X-rays, X-ray sources, X-ray diffraction, Bragg's law, reciprocal lattice and Ewald-sphere construction
- X-ray diffraction by electrons, Fourier analysis and synthesis
- Protein structure determination by X-ray diffraction, crystallographic phase problem, Patterson map, molecular replacement (MR), multiple isomorphous replacement (MIR), multi-wavelength anomalous diffraction (MAD)
- Crystallography and the drug discovery process: studying protein-ligand interactions
- Practical exercises employing an X-ray generator (collection of a diffraction image) and the computer (MR; calculation and interpretation of electron density maps)
- Site visit at the Synchrotron DESY (Hamburg)

Qualification-goals/Competencies:

- They have a general scientific competence in macromolecular X-ray diffraction analysis
- They have the methodological competence to grow protein crystals by hanging or sitting drops
- They have the methodological competence to correctly interpret (salt or protein) the diffraction image of a crystal using the Ewald Sphere construction
- They have the methodological competence to tackle the phase problem either by MR, MIR or MAD
- They can calculate and interprete electron density maps
- They have the methodological competence, to apply structure- or fragment-based techniques for lead compound identification
- They have the communication competency to convey the principles of X-ray diffraction theory

Grading through:

- see Notes

Responsible for this module:

- Prof. Dr. rer. nat. Christian Hübner
- Prof. Dr. rer. nat. Thomas Peters

Teacher:

- Institute of Biochemistry
- Dr. math. et dis. nat. Jeroen Mesters
- Prof. Dr. rer. nat. Rolf Hilgenfeld

Literature:

- Jan Drenth: Principles of Protein X-ray Crystallography - Science+Business Media, LLC, New York

Language:

- offered only in English

Notes:

Is part of Module:
- LS4021-KP06 (former LS4020-IB) -> Prof. Hübner
- LS4020-KP06 (former LS4020-MLS) and LS4020-KP12 -> Prof. Peters

4 exercises, 2 hours each, are offered in addition to the lecture. Dates are given at the start of the semester.

For Master MLS with specialization Structure Biology the module is mandatory.

LS4020 B - Module part LS4020B: NMR Spectroscopy (StrAnaNMR)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	3

Course of study, specific field and term:

- Master Infection Biology ab 2018 (module part), Interdisciplinary modules, 1st semester
- Master Biophysics (module part), biophysics, 1st semester
- Master CLS starting 2016 (module part), MML with specialization in Life Science, 3rd semester
- Master MLS starting 2016 (module part), structure biology, 1st semester
- Master Infection Biology (module part), Interdisciplinary modules, 1st semester
- Master CLS (module part), computational life science / life sciences, 3rd semester
- Master MLS (module part), structure biology, 1st semester
- Master MLS starting 2018 (module part), structure biology, 1st semester

Classes and lectures:

- NMR-Spectroscopy (lecture, 2 SWS)

Workload:

- 60 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Lecture topics:
- Assignment of NMR spectra
- Description of the NOESY experiment using the vector model
- Chemical Exchange and Transfer-NOEs
- Multidimensional NMR spectroscopy
- Assignment strategy for peptides
- Introduction into the product operator formalism (POF)
- Description of the COSY and of the HSQC experiment using POF
- NMR experiments for the assignment of proteins
- NMR structural analysis of proteins
- Experiments to probe the motions of protein

Qualification-goals/Competencies:

- Advanced techniques to assign and analyze NMR spectra
- Understanding of NMR experiments based on the product operator formalism
- Basic knowledge about NMR experiments to analyze structure and dynamics of proteins

Grading through:

- see Notes

Responsible for this module:

- Prof. Dr. rer. nat. Thomas Peters

Teacher:

- Institute of Chemistry and Metabolomics

- Prof. Dr. rer. nat. Thomas Peters
- PD Dr. rer. nat. Karsten Seeger

Literature:

- James Keeler: Understanding NMR Spectroscopy - Wiley
- :
- Malcolm H. Levitt: Spin Dynamics - Basics of Nuclear Magnetic Resonance - Wiley-VCH
- D. Neuhaus & M. P. Williamson: The Nuclear Overhauser Effect in Structural and Conformational Analysis - Wiley-VCH
- Timothy Claridge: High-Resolution NMR Techniques in Organic Chemistry - Pergamon Press
- : Current scientific literature

Language:

- offered only in English

Notes:

This lecture is a part of modules:
- LS4021-KP06 (former LS4020-IB) -> Prof. Hübner
- LS4020-KP06 (former LS4020-MLS) and LS4020-KP12 -> Prof. Peters

Exercises are integrated into the lectures.
It is a compulsory module part for the Master MLS with a focus on structural biology.

LS4020 C - Module part LS4020C: Single Molecule Methods (Einzelstru)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	3

Course of study, specific field and term:

- Master MLS starting 2018 (module part), structure biology, 1st semester
- Master Infection Biology ab 2018 (module part), Interdisciplinary modules, 1st semester
- Master Biophysics (module part), biophysics, 1st semester
- Master CLS starting 2016 (module part), MML with specialization in Life Science, 3rd semester
- Master MLS starting 2016 (module part), structure biology, 1st semester
- Master Infection Biology (module part), Interdisciplinary modules, 1st semester
- Master CLS (module part), computational life science / life sciences, 3rd semester
- Master MLS (module part), structure biology, 1st semester

Classes and lectures:

- Single Molecule Methods (lecture, 2 SWS)

Workload:

- 60 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Physical basics of fluorescence
- Photo physics
- Microscopy techniques
- Protein labeling
- Fluorescence resonance energy transfer
- Single molecule enzymology
- Single molecule protein folding
- Physical basics of optical tweezers
- Protein folding with optical tweezers

Qualification-goals/Competencies:

- Understanding of the physical basics of single molecule methods
- Understanding of the benefits of single molecule methods
- Understanding of the limits of single molecule methods

Grading through:

- see Notes

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institute of Physics
- Prof. Dr. rer. nat. Christian Hübner

Literature:

- Lakowicz, Joseph R: Principles of Fluorescence Spectroscopy - ISBN 978-0-387-46312-4
- Markus Sauer, Johan Hofkens, Jörg Enderlein: Handbook of Fluorescence Spectroscopy and Imaging: From Ensemble to Single Molecules - ISBN: 978-3-527-31669-4

Language:

- offered only in English

Notes:

Is module part of:
- LS4021-KP06 (former LS4020-IB) -> Prof. Hübner
- LS4020-KP06 (former LS4020-MLS) and LS4020-KP12 -> Prof. Peters

This module part is identical to LS4020 C-MIW without seminar.
For Master MLS with specialization in structure biology the module is mandatory.

LS4020 D - Module part LS4020D: Microscopy: techniques and applications (StrAnaMikr)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	3

Course of study, specific field and term:

- Master Infection Biology ab 2018 (module part), Interdisciplinary modules, 1st semester
- Master Biophysics (module part), biophysics, 1st semester
- Master CLS starting 2016 (module part), MML with specialization in Life Science, 3rd semester
- Master MLS starting 2016 (module part), structure biology, 1st semester
- Master Infection Biology (module part), Interdisciplinary modules, 1st semester
- Master CLS (module part), computational life science / life sciences, 3rd semester
- Master MLS (module part), structure biology, 1st semester
- Master MLS starting 2018 (module part), structure biology, 1st semester

Classes and lectures:

- Microscopy: techniques and applications (lecture, 2 SWS)

Workload:

- 60 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Light microscopy
- Confocal microscopy
- 2-photon microscopy
- Light sources and detectors
- Fluorescent Dyes; GFP and genetically encoded fluorescence markers; Live Cell/tissue imaging: considerations/limitations
- Labelling/identifying cell components using fluorescence techniques
- Protein-protein Interactions in living cells: FRET, FLIM; Biosensors
- Photo-activatable/-switchable Fluorescent Proteins; Fluorescent Timers
- Advanced 3D-Fluoresence Microscopy, STED, PALM, STORM
- In vivo imaging in tissues and living animals
- Applications of Flow Cytometry & Fluorescence-activated Cell Sorting
- Electron Microscopy: TEM, Immunogold label; Survey of cell ultrastructure; Correlative EM/light microscopy; Scanning Electron Microscopy (SEM)
- Bioluminescence; high-content screening; outlook: emerging technologies
- Data storage/formats; Course discussion; and then: Cinema of the Cell

Qualification-goals/Competencies:

- Basics of light and fluorescence microscopy and electron microscopy
- Detailed knowledge of methods for labelling and visualization of proteins and subcellular compartments
- Applications of live cell imaging, in vivo imaging and quantitative fluorescence techniques

Grading through:

- see Notes

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institute for Biology
- Prof. Dr. rer nat. Rainer Duden

Literature:

- -: http://micro.magnet.fsu.edu/primer/index.html
- -: http://www.microscopyu.com/smallworld/
- -: http://www.olympusmicro.com/

Language:

- offered only in English

Notes:

Is module part of:
- LS4021-KP06 (former LS4020-IB) -> Prof. Hübner
- LS4020-KP06 (former LS4020-MLS) and LS4020-KP12 -> Prof. Peters

For Master MLS with specialization in Structure Biology the module is mandatory.

(Contribution to lecture, Biology 60%)
(Contribution to lecture, Biomedical Optics 40%)

LS4020-KP06 - Structure Analysis (StrAnaKP06)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	6

Course of study, specific field and term:

- Master MLS starting 2018 (compulsory), structure biology, 1st semester
- Master MLS starting 2016 (optional subject), structure biology, 1st semester

Classes and lectures:

- Part of the module A: Crystallography (lecture, 2 SWS)
- Part of the module B: NMR-Spectroscopy (lecture, 2 SWS)
- Part of the module C: Single Molecule Methods (lecture, 2 SWS)
- Part of the module D: Microscopy: techniques and applications (lecture, 2 SWS)

Workload:

- 120 Hours private studies
- 60 Hours in-classroom work

Contents of teaching:

- See module parts A to D

Qualification-goals/Competencies:

- See module parts A to D

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Thomas Peters

Teacher:

- Institute of Physics
- Institute for Biology
- Institute of Biochemistry
- Institute of Chemistry and Metabolomics

- Prof. Dr. rer. nat. Thomas Peters
- Prof. Dr. rer. nat. Rolf Hilgenfeld
- Dr. math. et dis. nat. Jeroen Mesters
- PD Dr. rer. nat. Karsten Seeger
- Prof. Dr. rer. nat. Christian Hübner
- Prof. Dr. rer nat. Rainer Duden

Language:

- English, except in case of only German-speaking participants

Notes:

This modul has 4 parts: LS4020A-D.
You have to choose one of A or B and one of A-D.
One written examination with two parts, each valued 50%.

LS4030-KP06 - Molecular Pathomechanisms and Strategies for Therapy (Pathom)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	6

Course of study, specific field and term:

- Master MLS starting 2016 (compulsory), cell biology, 1st semester
- Master MLS (compulsory), life sciences, 1st semester
- Master MLS starting 2018 (compulsory), cell biology, 1st semester

Classes and lectures:

- Molecular Pathomechanisms and Strategies for Therapy (lecture, 4 SWS)

Workload:

- 120 Hours private studies
- 60 Hours in-classroom work

Contents of teaching:

- Oncogenic viruses (selected mammalian RNA and DNA viruses)
- Correlation of tumour development and DNA repair defects
- Pathways, regulation and pathological relevant deregulation of apoptosis
- Mechanisms of tumour development and progression
- microRNA: a new player in cancer development
- Tumour diagnostic
- Therapeutic concepts (chemotherapy, gene therapy, alternative strategies)

Qualification-goals/Competencies:

- Students are able to list the different general mechanisms of tumorgenesis including mechanisms of viral carcinogenesis (especially retroviruses and DNA tumor viruses), tumor progression, correlation between RNA interference and cancer, and correlation between apoptosis and tumour development. They are able to illustrate in detail afore mentioned terms and definitions with the aid of different examples. They are able to discuss the listed terms and definitions in the general context of tumor biology and to apply it to a given question. They are able to assess which concepts of cancer diagnosis and therapy are realistic in a given situation and can rationalize if alternative therapeutic concepts are applicable and where the limits of such approaches are. Moreover, they are able to judge to what extent ethic aspects limit the application of molecular medicine.

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Tobias Restle

Teacher:

- Institute of Molecular Medicine
- Prof. Dr. rer. nat. Tobias Restle
- Dr. rer. nat. Rosel Kretschmer-Kazemi Far

Literature:

- S.J. Flint et al.: Principles of Virology: 2 Volume - Set, John Wiley & Sons, 2/2009, ISBN-13: 978-1555814434
- G. Löffler et al.: Biochemie und Pathobiochemie - Berlin, 11/2006, ISBN 978-3540326809
- C. Wagener & O. Müller: Molekulare Onkologie: Entstehung, Progression, klinische Aspekte - Stuttgart, 10/2009, ISBN-13: 978-3131035134
- R. A. Weinberg: The Biology of Cancer - Garland Publishing Inc, 7/2006, ISBN-13: 978-0815340782
- : Current research and review articles

Languages:

- offered only in German
- English, except in case of only German-speaking participants

Notes:

BSc in Molecular Life Science or related fields

LS4040-KP04 - General virology and biosafety (AllgeViro)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	4

Course of study, specific field and term:

- Master MLS starting 2016 (compulsory), interdisciplinary competence, 1st semester
- Master MLS (compulsory), life sciences, 1st semester
- Master MLS starting 2018 (compulsory), interdisciplinary competence, 1st semester

Classes and lectures:

- General virology and biosafety (lecture, 2 SWS)
- General virology and biosafety (practical course as compact course, 1 SWS)

Workload:

- 60 Hours private studies
- 60 Hours in-classroom work

Contents of teaching:

- Lecture: History of virology
- Virus taxonomy and structure
- Virus morphology in overview
- Viral life cycles (entry, assembly, budding)
- Replication mechanisms
- Viral evolution
- Basic techniques in virology and methods of virus diagnostics
- Blood-borne viruses and safety of blood products
- Biosafety classification of viruses according to Gentechnikrecht and Biostoffverordnung
- Exercises with regard to the topics of the lecture

Qualification-goals/Competencies:

- They can categorize viruses systematically
- They can explain and compare viral life cycles and replication strategies
- They can explain and exercise basic virological techniques in research and virus diagnostics
- They can list basic practices and protocols for the virological safety of blood products
- They can apply basics knowledge according to Gentechnikrecht and Biostoffverordnung
- They can use scientific termini of molecular virology in English
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Grading through:

- certificates and protocols
- continuous, successful participation in practical course
- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Norbert Tautz

Teacher:

- Institute of Biochemistry
- Institute of Virology and Cell Biology

- Prof. Dr. rer. nat. Norbert Tautz
- Dr. math. et dis. nat. Jeroen Mesters
- Dr. rer. nat. Olaf Isken

Literature:

- S.J. Flint et al.: Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses - American Society Microbiology, February 2009, 3rd Ed., ISBN: 978-1-55581-443-4
- S.Modrow, D. Falke, U. Truyen, H. Schätzl: Molekulare Virologie - Spektrum, Heidelberg, 3. Aufl. 2010, ISBN 978-3-8274-1833-3

Language:

- English, except in case of only German-speaking participants

Notes:

Requirements: BSc in Molecular Life Science or related fields.
Note: The first written exam takes place after X-mas holiday season.

MA3400-KP05 - Biomathematics (BioMaKP05)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	5

Course of study, specific field and term:

- Bachelor Computer Science since 2016 (optional subject), advanced curriculum, arbitrary semester
- Bachelor Computer Science since 2016 (compulsory), Canonical Specialization Bioinformatics, 5th semester
- Master MLS starting 2016 (optional subject), interdisciplinary competence, 1st semester
- Bachelor CLS starting 2016 (compulsory), mathematics, 3rd semester
- Bachelor Biophysics (compulsory), mathematics, 3rd semester
- Master MLS starting 2018 (optional subject), interdisciplinary competence, 1st semester

Classes and lectures:

- Biomathematics (lecture, 2 SWS)
- Biomathematics (exercise, 2 SWS)

Workload:

- 70 Hours private studies and exercises
- 60 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Basics of differential equations
- Differential equations of first order
- Linear differential equations of n-th order
- Systems of linear differential equations with constant coefficients
- Notes on numerics and qualitative analysis; the prey-predator model

Qualification-goals/Competencies:

- Learning the basics of ordinary differential equations
- Ability to apply differential equations
- Learning by means of examples how to use differential equations for models in biology, chemistry and medicine
- Basic understanding of simple numerical methods

Grading through:

- Exercises
- written exam

Responsible for this module:

- PD Dr. rer. nat. Hanns-Martin Teichert

Teacher:

- Institute for Mathematics
- PD Dr. rer. nat. Hanns-Martin Teichert

Literature:

- J. D. Murray: Mathematical Biology - Springer
- H. Heuser: Gewöhnliche Differentialgleichungen - Teubner Verlag 2009 (6th edition)
- R. Schuster: Biomathematik - Teubner Studienbücher 1995
- S. Handrock-Meyer: Differenzialgleichungen für Einsteiger - Hanser 2007

Language:

- offered only in German

Notes:

Prerequisites for admission to the examination can be determined at the beginning of the semester. If such prerequisites are defined, they must have been fulfilled prior to the first attempt at the examination and must have been rated as positive.

MZ5111-KP06 - Immunology (Immuno)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	6

Course of study, specific field and term:

- Master Nutritional Medicine in planning (module part), life sciences, 1st semester
- Master MLS starting 2016 (optional subject), cell biology, 1st semester
- Master MLS starting 2018 (optional subject), cell biology, 1st semester

Classes and lectures:

- Immunology (lecture, 2 SWS)
- Immunology (seminar, 2 SWS)

Workload:

- 120 Hours private studies
- 60 Hours in-classroom work

Contents of teaching:

- Lecture: Introduction to immunology
- Cells of the innate immune system
- Innate immune system: pathogen recognition
- Complement and inflammation
- Introduction into the adaptive immune system
- Antigen-presentation and T cell activation
- Immunological memory
- Immune system and infektion I: bacteria, worms, fungi
- Immune system and infektion II: Viruses
- Signal transduktion in immune cells
- Organs and tissues of the immune system, homing
- Immunpathogenesis I: allergy and asthma
- Immunpathogenesis II: autoimmune diseases
- Immunprivileged Organs
- Hematopoiesis and hematopoietic stem cells
- Experimental and clinically applied biologicals
- Seminar: PCR
-
- ELISA/ELISPOT
- Flow cytometry I: FACS-Analysis
- Flow cytometry II: MACS, FACS-Sort
- Flow cytometry III: Practical course at the ISEF (MACS, Analysis, Sort)
- Conventional and confocal microscopy
- Methods in signal transduction
- Migration: transwell assay; adhesion test etc.
- 2-Photon microscopy
- Animal models in life science
- Genetically modified mice I: conventional transgenics and KO mice
- Genetically modified mice II: conditional KO und Knock In Mice

Qualification-goals/Competencies:

- Students are able to:
- Name cells of the immune system and allocate their functions
- Name organs that belong to the immune system and allocate their functions
- Name mechanisms, cells and molecules of the innate and adaptive immune system and allocate their functions during bacterial, viral and fungal infections
- Name and allocate functions of molecules important for B cell -T cell co-cooperation
- Name and allocate the functions of molecules and antigen-presenting cells important for T cell activation and differentiation
- Name molecules of the complement system and allocate their functions for immune protection and immune diseases
- Name structure and function of the distinct antibody classes
- Name and allocate functions of molecules important for homing and migration of immune cells
- Name and allocate functions of molecules important for the initiation and resolution of inflammation
- Name the functions of immunological memory
- Name molecules and mechanisms involved in the development of B cell and T cell memory

- Describe the principal sequence of an immune reaction during infection and after vaccination
- Name genetic, molecular and cellular disturbances of the immune system relevant for immune deficiency, autoimmune and allergic diseases
- Describe the basic mechanisms of signal transduction in immune cells
- Name mechanisms and molecules involved in hematopoiesis
- Name and explain immunological methods
- Present and discuss scientific data

Grading through:

- presentation
- continuous, successful participation in course
- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Rudolf Manz

Teacher:

- Institute for Systemic Inflammation Research (ISEF)

- Prof. Dr. rer. nat. Rudolf Manz
- Prof. Dr. med. Jörg Köhl
- Prof. Dr. rer. nat. Marc Ehlers

Literature:

- Janeway, Travers, Walport, Shlomchik: Janeway's Immunobiology - Routledge Chapman Hall
- : original and review articles

Language:

- offered only in English

Notes:

(MZ5112)
Within the Master program Molecular Life Science for the focus on Clinical Immunology it is a mandatory module
Within the Master program Nutritional Medicine it is a mandatory module

MZ5115-KP06 - Neuroscience 1 (Neur1)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	6

Course of study, specific field and term:

- Master MLS starting 2016 (optional subject), neuroscience, 1st semester
- Master MLS starting 2018 (optional subject), neuroscience, 1st semester

Classes and lectures:

- Neuroscience 1 (lecture, 2 SWS)
- Neuroscience 1 (seminar, 2 SWS)

Workload:

- 120 Hours private studies
- 60 Hours in-classroom work

Contents of teaching:

- Micro- and macroscopic anatomy of the CNS
- Electrical activity of neurons
- Channels and transporters in neurons
- Synaptic transmission
- Neurotransmitters and their receptors
- Intracellular signaling in neurons
- Plasticity and memory
- Circadian rhythms and sleep
- The visual system
- Development of the nervous system

Qualification-goals/Competencies:

- Understanding basics of neuroscience
- Understanding the structure and development of the brain
- Understanding neuronal excitation and signal transmission
- Introduction to examples of behavior and plasticity

Grading through:

- presentation
- continuous, successful participation in course
- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Olaf Jöhren

Teacher:

- Department of Neurosurgery
- Institut of Physiology
- Institute of Experimental and Clinical Pharmacology and Toxicology
- Institute of Neurobiology

- Prof. Dr. rer. nat. Olaf Jöhren
- Prof. Dr. med. Cor de Wit
- Prof. Dr. rer. nat. Henrik Oster
- Prof. Dr. med. Markus Schwaninger
- PD Dr. rer. nat. Christina Zechel

Literature:

- Nicholls: From Neuron to Brain: A Cellular and Molecular Approach to the Function of the Nervous System - ISBN-10: 0878936092, 679 Seiten, Palgrave Macmillan; 5th edition (2012
- Purves: Neuroscience - ISBN-10: 0878936955, 858 Seiten, Palgrave Macmillan; 5th edition. (2011)
- Brady: Basic Neurochemistry: Principles of Molecular, Cellular, and Medical Neurobiology - ISBN-10: 0123749476, 1096 Seiten, Academic Press; 8th Edition (2011)
- : Original publications and Reviews

Language:

- English, except in case of only German-speaking participants

Notes:

MZ5115
Master MLS: focus on neuroscience it is a mandatory modul

MZ5117-KP06 - Frontiers in Metabolic Medicine Research (FronMet)

Duration:	Turnus of offer:	Credit points:	Max. group size:
1 Semester	each winter semester	6	10

Course of study, specific field and term:

- Master MLS starting 2016 (optional subject), cell biology, 1st semester
- Master MLS starting 2018 (optional subject), cell biology, 1st semester

Classes and lectures:

- Frontiers in Metabolic Medicine Research (lecture, 2 SWS)
- Frontiers in Metabolic Medicine Research (seminar, 2 SWS)

Workload:

- 120 Hours private studies
- 60 Hours in-classroom work

Contents of teaching:

- Central adipose regulation
- Thyroid hormones
- Central adipokine action
- Cancer metabolism
- Chronometabolism
- Nutrient barriers

Qualification-goals/Competencies:

- Students know some current themes in metabolic physiology and medicine
- Students know experimental approaches to studying metabolic processes
- Students understand the molecular basics of metabolic diseases and can devise strategies of experimental design in this field

Grading through:

- presentation
- continuous, successful participation in course
- written exam

Requires:

- Module part LS3250 B: Metabolic Medicine (LS3250 B)

Responsible for this module:

- Prof. Dr. rer. nat. Henrik Oster

Teacher:

- Institute of Neurobiology

- Prof. Dr. med. Sebastian Schmid
- Prof. Dr. Jens Mittag
- Dr. rer. nat. Carla Schulz
- Dr. Stefanie Fliedner
- Prof. Dr. rer. nat. Henrik Oster
- Prof. Dr. med. Christian Sina

Literature:

- Keith N. Frayn: Metabolic Regulation: A Human Perspective - Wiley-Blackwell, ISBN:978-1-4051-8359-8
- : Research and review papers

Languages:

- German and English skills required
- English, except in case of only German-speaking participants

Notes:

Seminar can be organized as a block.

PS4610 A - Module part: Ethics in Sciences (Ethics)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	3

Course of study, specific field and term:

- Master MLS starting 2018 (module part), interdisciplinary competence, 2nd or 4th semester
- Master MLS starting 2016 (module part), interdisciplinary competence, 2nd or 4th semester
- Master MLS (module part), interdisciplinary competence, 4th semester
- Master Infection Biology (module part), Clinical Aspects, 2nd semester

Classes and lectures:

- Ethics in Sciences (lecture, 2 SWS)

Workload:

- 55 Hours private studies
- 30 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Societal and ethical implications of research in biomedical sciences and technologies
- Basics of philosophy and sociology of science
- Good scientific practice
- Basics of bioethics: duties of investigators, obligations to colleagues,
- Ethics of human subjects research and animal experim. Environmental ethicsentation. Control and governance of technology. Risk assessement
- Use and implications of images in science

Qualification-goals/Competencies:

- You can explain the methodology of the physical sciences and their philosophical basis
- You can recognize ethical dimensions of practice and deciding
- You can understand relevant laws in Germany
- You can participate in current discussions in bioethics and research ethics
- You can reflect on ethical dimensions of biomedical sciences
- You can write a structured ethics paper about a self-chosen topic

Grading through:

- see Notes

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institute for the History of Medicine and Science Studies
- Prof. Dr. phil. Christoph Rehmann-Sutter

Literature:

- Daniel A. Vallero: Biomedical Ethics for Engineers. Ethics and Decision Making in Biomedical and Biosystem Engineering - Amsterdam: Elsevier 2007
- Ben Mepham: Bioethics. An Introduction for the Biosciences - Oxford: Oxford University Press 2008
- Sergio Sismondo: An introduction to science and technology studies - Chichester: Wiley-Blackwell 2010

Language:

- offered only in English

Notes:

Part of PS4610-KP07

This module part is graded by means of an oral presentation (seminar) including an essay.

PS4610 B - Module part: Scientific Writing (SciWrit)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	3

Course of study, specific field and term:

- Master MLS starting 2018 (module part), interdisciplinary competence, 2nd or 4th semester
- Master MLS starting 2016 (module part), interdisciplinary competence, 2nd or 4th semester
- Master MLS (module part), interdisciplinary competence, 4th semester
- Master Infection Biology (module part), Clinical Aspects, 2nd semester

Classes and lectures:

- Scientific Writing (seminar, 2 SWS)

Workload:

- 75 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Basics of ethics and moral philosophy
- The ethical structure of experiments with tissue, animals and human subjects
- Principles of the most important laws and guidelines regulating research
- Basic issues of research ethics and cases from recent debates
- Key topics of research ethics in the biomedical sciences
- Introduction into categories of scientific presentations
- Analysis of scientific manuscripts and rules for their presentation
- Preparation and presentation of scientific posters
- Preparing a project proposal

Qualification-goals/Competencies:

- Understanding of basic ethical dimensions of human actions and decisions
- Understanding of ethical implication of experimental scientific research
- Knowledge of relevant legal regulations in Germany and internationally
- Knowledge of key debates in bioethics and research ethics
- Basic skills for an autonomous ethical reflection about issues in biomedical sciences
- Analysis of the logical and formal structure of scientific publications. Analysis of a specific original publication. Introduction into the ´peer-review process´
- Understanding the criteria underlying scientific posters. Preparation and presentation of a poster based on given experimental data
- Introduction into the writing of ´grant applications´ and the funding process of research projects. Writing a grant application on the basis of specified prior-work and scientific aims

Grading through:

- see Notes

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institute of Molecular Medicine
- Prof. Dr. rer. nat. Georg Sczakiel

Literature:

- -: Current scientific literature

Languages:

- offered only in English
- English, except in case of only German-speaking participants

Notes:

Is part of PS4610-KP07.

Grading of the module part through
- written exam
- seminar
- regular participation in seminars (85%)

The total amount of time allocated to a written examination is usually between 60 and 180 minutes (Examination Regulations).

LS4101 A - Module part: Molecular Oncology (AMolOnk)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	2,67

Course of study, specific field and term:

- Master MLS starting 2018 (module part), cell biology, 2nd semester
- Master Nutritional Medicine in planning (module part), advanced curriculum, 2nd semester
- Master MLS starting 2016 (module part), cell biology, 2nd semester

Classes and lectures:

- Molecular Oncology (lecture, 2 SWS)

Workload:

- 50 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Oncology from the view of the pathologist; early and recent concepts in oncology; tumour stem cells; defects in DNA-repair systems as a cause for tumorigenesis
- Biochemical, as well as cellular and molecular characteristics and features of tumours (melanoma, glioma, hematopoetic tumours)
- Concepts of prevention and therapy of tumours (melanoma, glioma, hematopoetic tumours)
- Chromatin: Mutations, translocations, methylation, telomere and mitosis defects Epidemiology and Lifestyle in the carciogenesis of lymphoma

Qualification-goals/Competencies:

- Understanding the concepts in oncoclogy; principles in tumour initiation, tumour progression and relapse
- Understanding the significance of repair mechanisms for tumour formation and therapy
- Understanding the molecular and cellular features of tumours (selected examples such as glioma, melanoma, leukemia and lymphoma)

Grading through:

- written exam

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Department of Neurosurgery
- Department of Pathology

- Prof. Dr. hum. biol. Hans-Werner Stürzbecher
- PD Dr. rer. nat. Christina Zechel

Literature:

- Schlegel et al.: Neuroonkologie
- : Original publications and Reviews
- Thieme; Knippers: Molekulare Genetik
- Thieme; Passarge und Wirth: Taschenatlas Humangenetik, Thieme

Language:

- offered only in English

Notes:

MLS: see main module LS4101-KP08 for details.
Nutritional Medicine: see main module EW4200-KP08 for details.
Part of LS4101-KP08, EW4200-KP08.

LS4101 B - Module part: Molecular Endocrinology (BMolEndo)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	2,67

Course of study, specific field and term:

- Master MLS starting 2018 (module part), cell biology, 2nd semester
- Master Nutritional Medicine in planning (module part), advanced curriculum, 2nd semester
- Master MLS starting 2016 (module part), cell biology, 2nd semester

Classes and lectures:

- Molecular Endocrinology (lecture, 2 SWS)

Workload:

- 50 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Hormone-secreting glands and tissues
- The prime hormonal axes
- Principples of hormone structure and function
- Hormone receptors and signal transduction
- Endocrine disorders and therapies (diabetes mellitus, hypo- and hyperthyreosis, adrenal hyper- and hypofunction, disruption of the reproductive axis)

Qualification-goals/Competencies:

- Understanding how hormone production is regulated according to selected examples (pancreas, thyroid, adrenal, adipocytes etc.)
- Understanding the mechanisms of hormonal action
- Knowing established and novel strategies of treating function disorders of endocrine tissues

Grading through:

- written exam

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institute of Neurobiology
- Prof. Dr. rer. nat. Henrik Oster
- Dr. rer. nat. Christiane Koch
- Ph.D. Mariana Astiz

Literature:

- : Williams Textbook of Endocrinology - Elsevier Ltd, Oxford; Auflage: 13th Edition. (31. Dezember 2

Language:

- offered only in English

Notes:

Part of LS4101-KP04, LS4101-KP08, EW4200-KP08)

MLS: for details see module LS4101-KP04 or LS4101-KP08.
Nutritional Medicine: for details see module EW4200-KP08.

LS4101 C - Module part: Molecular biology of the cardiovascular system (CMolkard)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	2,67

Course of study, specific field and term:

- Master MLS starting 2018 (module part), cell biology, 2nd semester
- Master Nutritional Medicine in planning (module part), advanced curriculum, 2nd semester
- Master MLS starting 2016 (module part), cell biology, 2nd semester

Classes and lectures:

- Molecular biology of the cardiovascular system (lecture, 2 SWS)

Workload:

- 50 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Introduction in anatomy, physiology, and pathophysiology of the heart
- Molecular pathomechanisms and genetics of heart failure
- Molecular pathomechanisms and genetics of atherosclerosis
- Animal models in cardiovascular diseases
- Personalized medicine in cardiology

Qualification-goals/Competencies:

- Basic knowledge of cardiovascular medicine
- Understanding the pathopyhsiological and molecular mechanisms of cardiovascular diseases

Grading through:

- written exam

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Medical Clinic II
- Institute of Cardiogenetics

- Prof. Dr. rer. nat. Jeanette Erdmann
- Prof. Dr. med. Joachim Weil
- Dr. med. Tobias Graf
- Dr. Zouhair Aherrahou
- Dr. rer. nat. Stephanie Stölting
- Dr. rer. nat. Anita Bhandari
- Ph.D. Krishan Vishnolia
- Dr. Jan-Christian Reil

Literature:

- Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine: ISBN 1416041060 / 9781416041061 · 2304 Pages · 1500 Illustrations, Saunders · 8th edition published November 2007
- Baars, H.F., Doevendans, P.A.F.M., Houweling, A., van Tintelen, J.P.: Clinical Cardiogenetics - ISBN 978-3-319-44203-7 (2016)

Language:

- offered only in English

Notes:

MLS: see main module LS4101-KP08 for details.
Nutritional Medicine: see main module EW4200-KP08 for details.
Part of LS4101-KP08, EW4200-KP08

LS4101 D - Part of the module D: Tissue regeneration (DGewebre)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	2,66

Course of study, specific field and term:

- Master MLS starting 2018 (module part), cell biology, 2nd semester
- Master MLS starting 2016 (module part), Clinical Immunology, 2nd semester

Classes and lectures:

- Tissue regeneration (lecture, 2 SWS)

Workload:

- 50 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Introduction / Morphological structures
- Biosynthesis and function of matrix proteins (collagens, non-collagenous proteins)
- Tissue regeneration (embryonic, adult) and fibrosis
- Tissue substitutes

Qualification-goals/Competencies:

- Understanding of molecular and morphological entities in the assembly of extracellular matrix of different origins
- Understanding of (patho)physiological mechanisms in tissue regeneration

Grading through:

- written exam

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Department of Dermatology, Allergology and Venerology
- Prof. Dr. med. Jürgen Brinckmann

Literature:

- : Recommendations at the beginning of each lecture

Language:

- German: slides, English: Notes

Notes:

See main module LS4101-KP08 for details.
Part of LS4101-KP08.

LS4101 E - Part of the module E: Molecular Neuromedicine (EMolNeur)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	2,66

Course of study, specific field and term:

- Master MLS starting 2018 (module part), cell biology, 2nd semester
- Master MLS starting 2016 (module part), neuroscience, 2nd semester

Classes and lectures:

- Molecular Neurobiomedicine (lecture, 2 SWS)

Workload:

- 50 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Introduction into neuroanatomy
- Modern methods of structural, functional and metabolic neuroimaging
- Electrophysiology in diagnostics of neurological diseases and understanding basic neurobiologic mechanisms (EEG, EMG, TMS)
- Linkage analyses, genetic association, molecular neurobiology, applied stem cell biology
- Selecting neurogenetic diseases: dystonia-parkinsonism syndromes, repeat disorders

Qualification-goals/Competencies:

- Acquiring basic skills in neuroanatomy, neuroimaging, electrophysiology and neurogenetics
- Understanding pathophysiology in the context of selected examples of neurogenetic diseases

Grading through:

- written exam

Responsible for this module:

- Siehe Hauptmodul

Teacher:

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- Prof. Dr. med. Christine Klein
- Dr. Philip Seibler

Literature:

- Beal, Lang, Ludolph: Neurodegenerative Diseases. Neurobiology, Pathogenesis and Therapeutic - Cambridge University Press, 2005
- : u.a. Lehrbücher

Language:

- offered only in English

Notes:

See main module LS4101-KP08 for details.
Part of LS4101-KP08.

LS4101 F - Part F of the module: Clinical Immunology 2 (FClinIm2)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	2,66

Course of study, specific field and term:

- Master MLS starting 2018 (module part), Clinical Immunology, 2nd semester
- Master MLS (module part), cell biology, 2nd semester
- Master MLS starting 2016 (module part), Clinical Immunology, 2nd semester

Classes and lectures:

- Special topics of clinical immunology (lecture, 2 SWS)

Workload:

- 50 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- The students get basic knowledge of various branches and aspects of clinical immunology
- The students get an insight into the interdisciplinary clinical-immunological aspects of dermatological and allergological diseases
- The students get to know immunopathogenesis, diagnosis and treatment of selected diseases (contact dermatitis, Hymenoptera allergy, food allergy, psoriasis, atopic dermatitis, lichen planus), in context of the involved immune system (especially immunodeficiencies, allergic diseases and chronic inflammation)

Qualification-goals/Competencies:

- Students are able to explain the immune response of the innate and adaptive immune system in the context of diagnostic and therapeutic issues
- The students can describe the current knowledge for the development of different types of allergies, Lichen planus or Psoriasis and can explain the basic mechanisms causing these diseases
- They can provide examples of genetic defects leading to primary immunodeficiencies and allergy

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. med. Jürgen Brinckmann

Teacher:

- Institute of Nutrition Medicine
- LIED | Lübecker Institut für experimentelle Dermatologie (Lübeck Institute of Experimental Dermatology)
- Department of Dermatology, Allergology and Venerology

- Dr. Torsten Schröder
- Dr. med. Andreas Recke
- Prof. Dr. med. Ralf Ludwig
- Dr. rer. physiol. Katja Bieber
- Priv.-Doz. Dr. med. vet. Jennifer Hundt

Literature:

- Kenneth M. Murphy, Paul Travers, Mark Walport: Janeway Immunologie
- Robert R. Rich, Thomas A Fleisher, William T. Shearer, Harry Schroeder, Anthony J. Frew, Cornelia M. Weyand: Clinical Immunology: Principles and Practice, 4th Edition

Language:

- English, except in case of only German-speaking participants

Notes:

See main module LS4101-KP08 for details.
Part of the module LS4101-KP08

LS4101 G - Module part: Neuroendocrinology (GNeuroend)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	2,67

Course of study, specific field and term:

- Master MLS starting 2018 (module part), cell biology, 2nd semester
- Master Nutritional Medicine in planning (module part), advanced curriculum, 2nd semester
- Master MLS starting 2016 (module part), neuroscience, 2nd semester

Classes and lectures:

- Neuroendocrinology (seminar, 2 SWS)

Workload:

- 50 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- introduction into neuroendocrinology
- hypothalamo-pituitary-system
- adrenal glands/glucocorticoids
- animal experimental methodology
- thyroid hormones centralnervous aspects
- corticotropin releasing factor and other neuropeptides in the CNS
- adipokines interactions of peripheral signals with the CNS
- endocrine rhythms
- energy homeostasis

Qualification-goals/Competencies:

- students will acquire basic knowledge of neuroendocrinology
- they understand the interaction of selected central nervous and peripheral (neuro)endocrine systems (energy homeostasis, adrenals/glucocorticoids) and can transfer this knowledge to practical applications
- they recall and understand experimental methods and are able to apply them in experiments
- they can analyse and interpret research results and publications

Grading through:

- written exam

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Medical Clinic I
- Dr. rer. nat. Carla Schulz
- Prof. Dr. rer. nat. Henrik Oster
- Prof. Dr. Jens Mittag

Literature:

- David O. Norris and James A. Carr.: Vertebrate Endocrinology - Academic Press; 5 edition
- : additional literature will be supplied in the course of the seminar

Language:

- German, except in case of only English-speaking participants

Notes:

MLS: see main module LS4101-KP08 for details.
Nutritional Medicine: see main module EW4200-KP08 for details.
Part of LS4101-KP08, EW4200-KP08

LS4101-KP08 - Molecular Biomedicine (MolBiom08)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	8

Course of study, specific field and term:

- Master MLS starting 2018 (compulsory), cell biology, 2nd semester
- Master MLS starting 2016 (optional subject), cell biology, 2nd semester

Classes and lectures:

- See LS4101 A to G (seminar, 2 SWS)

Workload:

- 150 Hours private studies
- 90 Hours in-classroom work

Contents of teaching:

- See part of the modules LS4101 A to G

Qualification-goals/Competencies:

- See part of the modules LS4101 A to G

Grading through:

- written exam

Requires:

- Bachelor Thesis (LS3990-KP12, LS3990)

Responsible for this module:

- Prof. Dr. med. Jürgen Brinckmann

Teacher:

- LIED | Lübecker Institut für experimentelle Dermatologie (Lübeck Institute of Experimental Dermatology)
- Medical Clinic I
- Institute of Neurobiology
- Department of Pathology
- Department of Neurology
- Medical Clinic II
- Department of Neurosurgery
- Department of Dermatology, Allergology and Venerology

- PD Dr. rer. nat. Christina Zechel
- Prof. Dr. hum. biol. Hans-Werner Stürzbecher
- Dr. Philip Seibler
- Prof. Dr. rer. nat. Jeanette Erdmann
- Prof. Dr. med. Christine Klein
- Dr. rer. nat. Susanne Lemcke
- Prof. Dr. med. Jürgen Brinckmann
- Dr. rer. nat. Carla Schulz
- Prof. Dr. rer. nat. Henrik Oster

Language:

- depends on the chosen courses

Notes:

Prerequisite for the certificate is the attendance of 3 courses of LS 4100A-G. The choice of the courses is free. Each course valued 33.33 % for the grade. The attendance of further presentations is optional. A registration for optional courses is not mandatory. Four weeks after the start of the semester, the selection of the courses is obligatory (Registration via moodle). These courses are then subject of the written test. A written
registration is required for the written test. The determination of the date (1st or 2nd written test) is mandatory (Registration via moodle). (Consists of LS4101 A, LS4101 B, LS4101 C, LS4101 D, LS4101 E, LS4101 F, LS4101 G) (Choice 3 of all)

LS4110 A - Part of the module LS4110A: Pharmacology and Toxicology (WiFoPharma)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	3

Course of study, specific field and term:

- Master Biophysics (module part), advanced curriculum, 2nd semester
- Master MLS starting 2018 (module part), cell biology, 2nd semester
- Master MLS starting 2016 (module part), cell biology, 2nd semester
- Master MLS (module part), structure biology, 2nd semester

Classes and lectures:

- Pharmacology and Toxicology (lecture, 2 SWS)

Workload:

- 60 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Introduction into Pharmacology
- Pharmacodynamic
- Pharmacokinetics
- Oral Antidiabetics
- Pharmacology of the Renin-Angiotensin-Aldosterone-System
- Cerebrovascular Pharmacology
- Reverse Pharmacology
- Pharmacology of the Blood-Brain-Barrier
- Pharmacology of Thyroid Homones
- Sleep and Hypnotics
- Antiepileptic Drugs
- Gene Therapy
- Pain physiology and analgetic therapies

Qualification-goals/Competencies:

- Effects of therapeutic drugs on the organism (Pharmacodynamics)
- Time course of therapeutic drug concentrations in the organism (Pharmacokinetics)
- Mechanisms of action of various substance classes
- Experimental methods in pharmacology

Grading through:

- written exam

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institute of Experimental and Clinical Pharmacology and Toxicology

- Prof. Dr. rer. nat. Olaf Jöhren
- Prof. Dr. rer. medic. Lisa Marshall
- Prof. Dr. rer. nat. Walter Raasch
- Dr. rer. nat. Dipl.-Psych. Sonja Binder
- Prof. Dr. med. Markus Schwaninger
- Dr. rer. nat. Jan Wenzel
- Prof. Dr. rer. nat. Enrico Leipold
- Dr. rer. nat. Sivaraj Mohana Sundaram
- Dr. rer. nat. Marietta Zille

Literature:

- Goodman & Gilman's: The Pharmacologic Basis of Therapeutics - von Brunton L, Lazo J, Parker K, - 12th Ed., McGraw-Hill 2011, ISBN 0071422803
- Lüllmann H. Mohr K. Hein L.: Pocket Atlas of Pharmacology - 4th Ed., Thieme 2011, ISBN 9783131503114

Language:

- English, except in case of only German-speaking participants

Notes:

Part of the module LS4110

LS4110 B - Part of the module LS4110B: Drug Design (WiFoDrug)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	3

Course of study, specific field and term:

- Master MLS starting 2018 (module part), cell biology, 2nd semester
- Master MLS starting 2016 (module part), cell biology, 2nd semester
- Master MLS (module part), structure biology, 2nd semester
- Master Biophysics (module part), advanced curriculum, 2nd semester

Classes and lectures:

- Drug Design (lecture, 2 SWS)

Workload:

- 60 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Concepts in Drug Design
- NMR experiments for Drug Design
- Case Study: Omeprazole vs. Tamiflu
- Chemical Synthesis of Drugs - Combinatorial Approaches
- Drug Discovery - An Overview
- Target Identification and Validation
- X-ray Crystallography in Drug Design
- Structure-based drug design - Principles and Methods

Qualification-goals/Competencies:

- Basic strategies of Drug Design
- The way from the target discovery to the drug. Techniques of rational Drug Design
- NMR and X-ray Crystallography as important tools for target monitoring and optimization
- The relationship between chemical structure and effect and the techniques for theoretical prognosis and experimental tests, particular x-ray crystallography and NMR-experiments
- The students should know the borders of x-ray crystallography and NMR-experiments

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Thomas Peters

Teacher:

- Institute of Biochemistry
- Institute of Molecular Medicine
- Institute of Chemistry and Metabolomics

- Prof. Dr. rer. nat. Thomas Peters
- Prof. Dr. rer. nat. Tobias Restle
- Dr.rer.nat Sonja Petkovic
- Prof. Dr. rer. nat. Rolf Hilgenfeld
- Dr. Lars Redecke

Literature:

- G. Klebe: Wirkstoffdesign - Spektrum-Verlag Heidelberg, 2009. ISBN 978-3-8274-2046-6
- A. Hillisch & R. Hilgenfeld, Birkhäuser: Modern Methods in Drug Discovery - Basel, Boston, Berlin 2003, ISBN 3-7643-6081-X
- : Grundlagen- und Übersichtsartikel für beide Veranstaltungen

Language:

- English, except in case of only German-speaking participants

Notes:

Part of the module LS4110

LS4110-KP06 - Drug Research (WiFo)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	6

Course of study, specific field and term:

- Master MLS starting 2018 (compulsory), cell biology, 2nd semester
- Master MLS starting 2016 (compulsory), cell biology, 2nd semester
- Master MLS (compulsory), life sciences, 2nd semester

Classes and lectures:

- Part of the module A: Pharmacology and Toxicology (lecture, 2 SWS)
- Part of the module B: Rational Drug Design (lecture, 2 SWS)

Workload:

- 120 Hours private studies
- 60 Hours in-classroom work

Contents of teaching:

- See part of the modules A and B

Qualification-goals/Competencies:

- See part of the modules A and B

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Thomas Peters

Teacher:

- Institute of Biochemistry
- Institute of Molecular Medicine
- Institute of Experimental and Clinical Pharmacology and Toxicology
- Institute of Chemistry and Metabolomics

- Prof. Dr. rer. nat. Thomas Peters
- Prof. Dr. rer. nat. Olaf Jöhren
- Dr. rer. nat. Sivaraj Mohana Sundaram
- Dr. rer. nat. Jan Wenzel
- Prof. Dr. rer. nat. Tobias Restle
- Dr. rer. nat. Alessandra Mescalchin
- Prof. Dr. rer. nat. Rolf Hilgenfeld
- Prof. Dr. med. Markus Schwaninger
- Prof. Dr. rer. nat. Enrico Leipold
- Prof. Dr. rer. nat. Walter Raasch
- Dr. rer. nat. Marietta Zille

Language:

- English, except in case of only German-speaking participants

Notes:

BSc in Molecular Life Science or related fields.
One written examination with on both parts (Pharmacology and Toxicology, Drug Design), each valued 50%.

LS4131-KP04 - Basics of Membrane Biophysics (Membiop04)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	4

Course of study, specific field and term:

- Master MLS starting 2018 (optional subject), structure biology, 2nd semester
- Master MLS starting 2016 (optional subject), structure biology, 2nd semester

Classes and lectures:

- Basics of Membrane Biophysics (lecture, 2 SWS)
- Basics of Membrane Biophysics (exercise, 1 SWS)

Workload:

- 75 Hours private studies
- 45 Hours in-classroom work

Contents of teaching:

- Importance and function of cell membranes: structure, physical function and dynamic models
- Basics of the membrane components
- Thermodynamic self-assembling of lipids and reconstitution techniques
- Transmembrane and intrinsic membrane potentials
- Mechanical properties of lipid membranes
- Physical basics of membrane transport mechanisms
- Investigations using lipid monolayer
- Electrical and optical experiments using planar lipid bilayers
- Examples for interaction mechanisms between peptides/ proteins and planar membranes
- Spectroscopic methods on membranes and membrane proteins
- Light and force microscopy on membranes and membrane proteins
-

Qualification-goals/Competencies:

- Constituents and composition of biological membranes
- Physical role and function of membrane lipids and proteins
- Mechanical and electrical properties of membranes
- Various methods to investigate reconstituted and natural membranes

Grading through:

- written exam

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Research Center Borstel

- Prof. Dr. rer. nat. Thomas Gutsmann
- PD Dr. rer. nat. Andra Schromm
- Dr. Christian Nehls

Literature:

- Adam, P. Läuger, G. Stark: Physikalische Chemie und Biophysik - Springer-Verlag, 4. Auflage 2003
- W. Hanke, R. Hanke: Methoden der Membranphysiologie - Spektrum Akademischer Verlag, Auflage 1997

Language:

- English, except in case of only German-speaking participants

LS4135-KP04 - Protein-Biophysics (ProtBiop04)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	4

Course of study, specific field and term:

- Master MLS starting 2016 (optional subject), structure biology, 2nd semester
- Master MLS starting 2018 (optional subject), structure biology, 2nd semester

Classes and lectures:

- Physics of Proteins (lecture, 2 SWS)
- Physics of Proteins (exercise, 1 SWS)

Workload:

- 90 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Protein structure
- Energy landscapes
- Thermodynamics of protein folding
- Kinetics of protein folding
- Thermodynamics of enzymatic reactions
- Kinetics of enzymatic reactions

Qualification-goals/Competencies:

- Understanding of physical principles of:
- protein folding
- protein dynamics
- protein interactions

Grading through:

- written exam

Requires:

- Introduction into Biophysics (LS2200-KP04, LS2200)

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institute of Physics

- Prof. Dr. rer. nat. Christian Hübner
- PD Dr. rer. nat. Hauke Paulsen

Literature:

- Hans Frauenfelder, Shirley Chan und Winnie Chan: Physics of Proteins: An Introduction to Molecular Biophysics (Biological and Medical Physics, Biomedical Engineering) - von Springer, Berlin (Gebundene Ausgabe - 30. Dezember 2010)
- Alan Fersht: Structure & Mechanism in Protein Science: Guide to Enzyme Catalysis and Protein Folding - W H Freeman & Co (Gebundene Ausgabe - 15. Februar 1999)
- Meyer B. Jackson: Molecular and Cellular Biophysics - ISBN: 978-0-521-62470-1

Language:

- English, except in case of only German-speaking participants

ME5050-KP05 - Biophysics of Ionizing Radiation and Radiation Safety (StrahlenSk)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	5

Course of study, specific field and term:

- Bachelor Biophysics (compulsory), life sciences, 5th semester
- Master MLS starting 2016 (optional subject), interdisciplinary competence, 1st or 2nd semester
- Master MLS starting 2018 (optional subject), interdisciplinary competence, 2nd semester

Classes and lectures:

- Biophysics of Ionizing Radiation and Radiation Safety (lecture, 2 SWS)
- Biophysics of Ionizing Radiation and Radiation Safety (practical course, 2 SWS)

Workload:

- 60 Hours in-classroom work
- 60 Hours private studies
- 30 Hours exam preparation

Contents of teaching:

- Physics of ionizing radiation
- Basic principles of dosimetry
- Introduction to methods of radiation measurement
- Radiation biology: principles of radiation damage, deterministic and stochastic effects, health risks caused by ionizing radiation
- Radiation chemistry, handling of open and enclosed radioactive materials
- Safety requirements in radionuclide laboratories
- Application of radionuclides in research and medicine
- German and international laws and regulations dealing with radiation safety
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Qualification-goals/Competencies:

- The students will have acquired in depth knowledge of the legal regulations concerning the work with radioactive materials and are able to implement these regulations in all relevant situations: Purchase, transport, storage, experimental use, disposal and decontamination
- They are able to safely handle open and enclosed radioactive compounds
- They are able to work in radiation protection areas in compliance with legal regulations
- They are able to measure radioactivity, calculate radiation doses and evaluate the results with respect to legal thresholds and biological impact
- They are able design experiments using radioactive materials, identify and meet the necessary safety precautions and establish a suitable workplace
- The students will acquire the requisite qualification (Fachkunde) according to German law (RöV and StrlSchV). This will qualify them (upon fulfillment of other regulatory requirements) to perform as a radiation safety officer according to German law.

Grading through:

- continuous, successful participation in course, >90%
- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Christian Schmidt

Teacher:

- Institute of Medical Engineering
- Institute of Biochemistry
- Institute for Biology
- Institute of Physics
- Isotopes laboratory

- Prof. Dr. rer. nat. Christian Schmidt
- Prof. Dr. rer. nat. Christian Hübner
- Dipl.-Ing. Henning Schönwald
- Prof. Dr. rer. nat. Magdalena Rafecas

- Dr. math. et dis. nat. Jeroen Mesters
- Dr. Lars Redecke

Language:

- offered only in German

Notes:

Each winter semester preferential for students of Biophysics and MIW, every summer semester preferential for MLS students.
The module certificate will be graded for Biophysics students and non-graded for MLS students.
The attendance of the radiation protection briefing is a prerequisite for the participation in the course.
The module certificate will be issued if a student has attended at least 90% of the practical training and achieved at least a score of 50% of the points in the written exam.
If the minimum score of 50% is not reached, a written or oral examination will be offered at the discretion of the module administrator.
The Fachkundebescheinigungen according to the German radiation safety regulations will be issued if a student has attended the entire course (a maximum absence during 10% of the lectures is permissible in exceptional cases) and has achieved a score of at least 70% in the written exam.
If a student has achieved less than 70% but more than 50% of the points in the written exam, a written or oral examination will be offered at the discretion of the module administrator.
Upon passing this examination the Fachkundebescheinigungen will be issued.
In this case, the decisive factor for the grade in the module certificate remains the result of the first examination.
Decisive for the realization of this course and the issuance of the Fachkundebescheinigungen are the Richtlinie über die im Strahlenschutz erforderliche Fachkunde (Fachkunde-Richtlinie Technik nach Strahlenschutzverordnung) in the currently valid version.

ME5055-KP05 - Animal models and animal saftey (TiermTsch)

Duration:	Turnus of offer:	Credit points:	Max. group size:
1 Semester	each summer semester	5	12

Course of study, specific field and term:

- Master MLS starting 2016 (optional subject), interdisciplinary competence, 1st or 2nd semester
- Master MLS starting 2018 (optional subject), interdisciplinary competence, 2nd semester

Classes and lectures:

- Animal models and animal saftey (lecture, 2 SWS)
- Practical course (practical course, 2 SWS)
- Seminar (seminar, 1 SWS)

Workload:

- 60 Hours private studies
- 30 Hours Practical course
- 30 Hours in-classroom work
- 10 Hours group work

Contents of teaching:

- see the German discription - it is German law
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Qualification-goals/Competencies:

- see the German discription - it is German law
-
-
-

Grading through:

- continuous, successful participation in course, >90%
- written exam

Responsible for this module:

- Dr. med. vet. Ph.D. Barthel Schmelting

Teacher:

- Medical Clinic I
- Institute of Medical Biometry and Statistics
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- Dr. med. vet. Ph.D. Barthel Schmelting
- Dr. rer. nat. Michael Niehaus

Language:

- English, except in case of only German-speaking participants

Notes:

The lessions takes place in the summer semester and the practical course takes place at the end of September.

MZ4121-KP06 - Biology of Infections (Infek)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	6

Course of study, specific field and term:

- Master MLS starting 2018 (optional subject), cell biology, 2nd semester
- Master MLS starting 2016 (optional subject), cell biology, 2nd semester

Classes and lectures:

- Specific Topics of Infection Biology (lecture, 2 SWS)
- Specific Topics of Infection Biology (seminar, 2 SWS)

Workload:

- 120 Hours private studies
- 60 Hours in-classroom work

Contents of teaching:

- Infectious diseases, viral, prokaryotic and eukaryotic infectious agents, parasites, zoonotic diseases
- Molecular mechanisms of antimicrobial chemotherapy, mechanisms of resistance against antiviral and antibacterial drugs
- Intracellular pathogens, molecular mechanisms of intracellular survival, Mycobacteria
- Antimicrobial immune mechanisms, compartments and regulation of antimicrobial defence, allergy
- Immune therapy and vaccination, mechanisms of the induction of specific T-cell and B-cell mediated protective immunity, adjuvants, DNA vaccines
- Experimental techniques in the infection biology, in vitro and ex vivo methods, experimental animal models of infectious diseases, gene knock-out mice, gene manipulated infectious agents
- Immune deficiencies, immunosuppressive chemotherapy and its consequences, retroviruses, HIV-AIDS
- Epidemiology of infectious diseases, zoonoses

Qualification-goals/Competencies:

- Detailed knowledge of infectious agents, infectious diseases and their pathomechanisms
- Detailed understanding of antimicrobial defence mechanisms at the cellular and molecular level. Understanding the mechanisms of vaccination and immune deficiencies.
- Knowledge of in vivo and in vitro techniques of infection biology.
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Grading through:

- presentation
- written exam

Responsible for this module:

- Prof. Ph.D. Tamás Laskay

Teacher:

- Research Center Borstel
- Department of Infectious Diseases and Microbiology

- Prof. Ph.D. Tamás Laskay
- Prof. Dr. med. Werner Solbach
- Dr. rer. nat. Christoph Hölscher
- PD Dr. rer. nat. Norbert Reiling
- Prof. Dr. med. Johannes Knobloch
- Prof. Dr. rer. nat. Ulrike Seitzer
- Prof. Dr. rer. nat. Stefan Niemann
- Prof. Dr. Ulrich Schaible

Literature:

- : - Lehrbücher, Grundlagen- und Übersichtsartikel

Language:

- English, except in case of only German-speaking participants

Notes:

BSc in Molecular Life Science or in related fields

MZ4125-KP06 - Neuroscience 2 (Neuro2)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	6

Course of study, specific field and term:

- Master MLS starting 2018 (optional subject), neuroscience, 2nd semester
- Master MLS starting 2016 (optional subject), neuroscience, 2nd semester

Classes and lectures:

- Neuroscience 2 (lecture, 2 SWS)
- Neuroscience 2 (seminar, 2 SWS)

Workload:

- 120 Hours private studies
- 60 Hours in-classroom work

Contents of teaching:

- Alzheimer s disease
- Infections of the CNS
- Neural stem cells and neurodegenerative disease
- Neural stem cells and tumor stem cells in brain tumors
- Neurobiology of cerebral ischemia
- Neurobiology of epileptic disorders
- Neurogenetic disorders
- Neuroimmunology of multiplesclerosis
- Neurometabolic disorders
- Neuropathies
- Parkinson disease and other movement disorders
- Schizophrenia

Qualification-goals/Competencies:

- Introduction to neuronal stem cells
- Introduction to various neuropathological diseases
- Understanding molecular mechanisms of neuropathological diseases

Grading through:

- presentation
- continuous, successful participation in course, >80%
- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Olaf Jöhren

Teacher:

- Department of Neurosurgery
- Department of Neurology
- Institute of Experimental and Clinical Pharmacology and Toxicology

- Prof. Dr. med. Markus Schwaninger
- PD Dr. rer. nat. Christina Zechel
- Prof. Dr. rer. nat. Katja Lohmann
- PD Dr. Sc. Ana Westenberger

Literature:

- Purves: Neuroscience - ISBN-10: 0878936955, Palgrave Macmillan; 5th edition. (2011)
- : Original publications and Reviews

Language:

- English, except in case of only German-speaking participants

Notes:

BSc in Molecular Life Science or in related fields

MZ4127-KP06 - Clinical Immunology 1 (ClinImmu1)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	6

Course of study, specific field and term:

- Master MLS (optional suject), Clinical Immunology, 2nd semester
- Master MLS starting 2016 (optional subject), Clinical Immunology, 2nd semester
- Master MLS starting 2018 (optional subject), Clinical Immunology, 2nd semester

Classes and lectures:

- Special topics of clinical immunology (lecture, 2 SWS)
- Special topics of clinical immunology (seminar, 2 SWS)

Workload:

- 120 Hours private studies
- 60 Hours in-classroom work

Contents of teaching:

- The students get advanced knowledge of various branches and aspects of clinical immunology
- The students get an insight into the interdisciplinary clinical-immunological aspects of dermatological, gastroenterological, hematological and rheumatologic disorders
- The students get to know immunopathogenesis, diagnosis and treatment of selected diseases, (pemphigus, pemphigoid, connective tissue diseases, ANCA-associated vasculitis, inflammatory bowel disease, multiple sclerosis), in context of the involved immune system (especially immunodeficiencies, autoimmune diseases and chronic inflammation)
- Gender differences of the immune system
- Epigenetic changes in the context of clinical immunology

Qualification-goals/Competencies:

- Students are able to explain the immune response of the innate and adaptive immune system in the context of diagnostic and therapeutic issues
- Students are able to explain common features of primary immunodeficiencies affecting humoral immune response or T cell function
- The students can describe the current knowledge for the development of autoimmune diseases like multiple sclerosis, rheumatoid arthritis, systemic lupus erythematosus and bullous autoimmune skin diseases.
- They can provide examples of genetic defects and epigenetic modification leading to primary immunodeficiencies and autoimmunity
- They know gender differences of the immune system
- The students can critically evaluate scientific content of recent scientific publications in the field of clinical immunology
- The students can give didactically good presentations

Grading through:

- presentation
- written exam

Responsible for this module:

- Prof. Dr. med. Dr. rer. nat. Enno Schmidt

Teacher:

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- Comprehensive Center for Inflammation Medicine (CCIM)
- Department of Dermatology, Allergology and Venerology
- LIED | Lübecker Institut für experimentelle Dermatologie (Lübeck Institute of Experimental Dermatology)

- Prof. Dr. med. Dr. rer. nat. Enno Schmidt
- Prof. Dr. med. Ralf Ludwig
- Dr. rer. nat. Susanne Lemcke
- Dr. Stephanie Goletz
- Dr. Ingolf Karl
- Prof. Christian Sadik
- PD Michael Kasperkiewicz
- Prof. Diamant Thaci
- Prof. Dr. med. Gabriela Riemekasten
- Prof. Peter Lamprecht

- Prof. Dr. med. Christian Sina
- Dr. med. vet. Jennifer Kloepper

Literature:

- Kenneth M. Murphy, Paul Travers, Mark Walport: Janeway Immunologie
- Hans-Hartmut Peter / Werner J. Pichler / Ulf Müller-Ladner: Immunologie - ISBN: 978-3-437-23256-5
- Robert R. Rich, Thomas A Fleisher, William T. Shearer, Harry Schroeder, Anthony J. Frew, Cornelia M. Weyand: Clinical Immunology: Principles and Practice, 4th Edition

Language:

- English, except in case of only German-speaking participants

Notes:

MZ4127
BSc in Molecular Life Science or in related fields
For Master MLS: focus on Clinical Immunology it is a mandatory modul

LS5111-KP16 - Practical Course MLS (BP16)

Duration:	Turnus of offer:	Credit points:
1 Semester	each semester	16

Course of study, specific field and term:

- Master MLS starting 2016 (compulsory), advanced curriculum, 3rd semester
- Master MLS starting 2018 (compulsory), advanced curriculum, 3rd semester

Classes and lectures:

- Practical Course (block practical course, 24 SWS)

Workload:

- 360 Hours in-classroom work
- 120 Hours private studies

Contents of teaching:

- Two practical courses with 2 different skills of the following list are to acquire. One term must have 3 month (12 weeks) labwork, the other 8 to 12 weeks labwork.
- Structural biology:
- S 1: Structure analytics of macromolecules
- S 2: Proteinexpression- and cleaning
- S 3: Membranbiophysics
- S 4: RNA-Technologies
- S 5: Computer aided methods
- Cell biology:
- Z 1: Tissue culture/ Cell culture
- Z 2: Cellphysiology and Cellbiochemistry
- Z 3: Classical and moleculare Genetics
- Z 4: Infection and Immunology
- Z 5: Microscopic Techniques
- Z 6: Neuroscience

Qualification-goals/Competencies:

- Ability to applicate knowledge of the first ans second semester of the master course in practice
- Absorbing knowledge in documentation and presentation of scientific data (poster presentation and talk)
- Ability to work in a team
- Getting lab experiences by working on real research projects
- Basic skills to design and perform their own experiments

Grading through:

- presentation
- Poster
- grading by the reviewer

Requires:

- Molecular Pathomechanisms and Strategies for Therapy (LS4030-KP06)
- Basics of Cell- and Molecular Biology for Virology (LS4010-KP06, LS4010)

Responsible for this module:

- Prof. Dr. rer. nat. Enno Hartmann

Teacher:

- Institutes and hospitals of the University of Lübeck
- Dozentinnen/Dozenten der UzL

Literature:

- : - Lehrbücher, Methodenanleitungen, Grundlagen- und Übersichtsartikel

Language:

- English, except in case of only German-speaking participants

Notes:

Prerequisite 44 ECTS from the first and second semester of the master program MLS including LS4010 and LS4030. The practical course can run at the University of Lübeck, at other Universities in Germany or foreign countries, at research center or at companies. The Minimum of one of the three practical parts (PC 1, 2 or Master Thesis) must pass at the University of Lübeck.

LS5200-KP06 - Consolidation in MLS (VTMLSKP06)

Duration:	Turnus of offer:	Credit points:	Max. group size:
1 Semester	each winter semester	6	10

Course of study, specific field and term:

- Master MLS starting 2018 (compulsory), advanced curriculum, 3rd semester
- Master MLS starting 2016 (compulsory), advanced curriculum, 3rd semester

Classes and lectures:

- See the list of 20 different courses on the website (seminar, 2 SWS)
- See the list of 20 different courses on the website (seminar, 2 SWS)

Workload:

- 120 Hours private studies
- 60 Hours in-classroom work

Contents of teaching:

- 20 different courses with topics of molecular cellbiology, structure biology, neurosciences or clinical immunology. Everybody has to choose two of it. See special plan of the courses located on the MLS website.

Qualification-goals/Competencies:

- Extended knowledge in two special topics of molecular cellbiology, structure biology, neurosciences or clinical immunology
- Detailed knowledge of actual research projects
- Working with specialist literature
- Ability, to understand and reproduce the specific knowledge of the topics
- Improving special practical skills

Grading through:

- as announced by examiner

Requires:

- Molecular Pathomechanisms and Strategies for Therapy (LS4030-KP06)
- Basics of Cell- and Molecular Biology for Virology (LS4010-KP06, LS4010)

Responsible for this module:

- Prof. Dr. rer. nat. Enno Hartmann

Teacher:

- Universitätsklinikum S-H
- Research Center Borstel
- All institutes of the University of Lübeck
- Alle Dozentinnen/Dozenten der UzL

Literature:

- see special course:

Language:

- English, except in case of only German-speaking participants

Notes:

The seminars must run at the University of Lübeck. The list is located on the website of the Master Program MLS. The certificate is without grades.

LS5990-KP30 - Master Thesis (MScArbeit)

Duration:	Turnus of offer:	Credit points:	Max. group size:
1 Semester	each semester	30	1

Course of study, specific field and term:

- Master MLS starting 2016 (compulsory), advanced curriculum, 4th semester
- Master MLS (compulsory), advanced curriculum, 4th semester
- Master MLS starting 2018 (compulsory), advanced curriculum, 4th semester

Classes and lectures:

- Practical work (practical course, 39 SWS)
- Authoring of the Master Thesis (self-study, 5 SWS)
- Colloquium (presentation (incl. preparation), 1 SWS)

Workload:

- 900 Hours in-classroom work

Contents of teaching:

- Scientific project in the field of molecular life sciences

Qualification-goals/Competencies:

- Ability to solve a preformulated more complex scientific problem in a defined period of time and to present and defende the experimental results
- Basic skills to design and perform their own experiments

Grading through:

- written exam, oral presentation, and defence of the experiment´s results

Responsible for this module:

- Studiengangsleitung MLS

Teacher:

- Institutes of natural science
- Alle prüfungsberechtigten Dozentinnen/Dozenten des Studienganges

Literature:

- : - will be announced by the lecturer

Language:

- English, except in case of only German-speaking participants

Notes:

Prerequisites: Minimum of 82 ECTS.
If the Master thesis is done externally (outside our university) the student has to choose a licensed lecturer (see PO) of our university as a second instructor who will be First Examiner in the examination.

PS4610-KP06 - Ethics in Sciences / Scientific Writing (EthScWr)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	6 (Typ B)

Course of study, specific field and term:

- Master MLS starting 2016 (compulsory), interdisciplinary competence, 4th semester
- Master MLS (compulsory), interdisciplinary competence, 4th semester
- Master Infection Biology (compulsory), Interdisciplinary modules, 2nd or 4th semester
- Master MLS starting 2018 (compulsory), interdisciplinary competence, 4th semester

Classes and lectures:

- Ethics in Sciences (lecture with seminar, 2 SWS)
- Scientific Writing (seminar and project work, 2 SWS)

Workload:

- 120 Hours private studies
- 60 Hours in-classroom work

Contents of teaching:

- See module parts

Qualification-goals/Competencies:

- See module parts

Grading through:

- Oral presentation and written report
- written exam
- Marked presentation with written report
- B-Certificate (not graded)

Responsible for this module:

- Prof. Dr. rer. nat. Georg Sczakiel

Teacher:

- Institute for the History of Medicine and Science Studies
- Institute of Molecular Medicine

- Prof. Dr. rer. nat. Georg Sczakiel
- Prof. Dr. phil. Christoph Rehmann-Sutter

Language:

- offered only in English

Notes:

Consists of module parts PS4610 A and PS4610 B.

For the acquisition of the B-certificate both module parts must be successfully passed.

The total amount of time allocated to a written examination is usually between 60 and 180 minutes (Examination Regulations).