UNIVERSITÄT ZU LÜBECK

Module Guide for the Study Path

Master Infection Biology

Version from 23. April 2019

1st semester

2nd or 4th semester

2nd semester

3rd semester

4th semester

arbitrary semester

LS4015-KP06 - Infection Biology 1 (InfBio1)

Duration:	Turnus of offer:	Credit points:	Max. group size:
1 Semester	each winter semester	6	20

Course of study, specific field and term:

- Master Infection Biology ab 2018 (compulsory), Infection Biology, 1st semester
- Master Infection Biology (compulsory), Infection Biology, 1st semester

Classes and lectures:

- Infection Biology 1 (lecture, 4 SWS)

Workload:

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

Contents of teaching:

- Introduction into the variety of infectious diseases and their respective causative pathogens (Viruses, bacteria, parasitic protozoa and helminths, fungi).
- The lectures will cover human and animal-pathogenic viruses, bacteria and fungi as well as parasites (protozoa, helminths).
- Important infectious agents and diseases will be covered in detail such as Influenza, HIV, HCV, herpes viruses, Papilloma, Pox viruses, Cholera, typhoid fever, E.coli/EHEC, Helicobacter, MRSA, Pneumococci, Tuberculosis, Candida, Malaria, Leishmaniasis, Trypanosoma, Schistosomiasis, Filariasis, Trichinella etc.

Qualification-goals/Competencies:

- The students have the infection-biological competency to apply their comprehensive basic and advanced knowledge of the biology of important human infectious agents and their diseases including viruses, bacteria, fungi, parasitic protozoa and helminths, their life cycles, vectors and reservoirs, epidemiology, treatment and prophylaxis to infection research. The students are technical and methodical competent to work in infection disease research based on their understanding of the complex host-pathogen interactions during the infectious process, they have the capacity to integrate the pathogen's virulence functions and the hosts defense strategies and the principles, how both evolved during co-evolution and how these interactions shape pathogenesis and disease outcome. The students have the competence in communication to employ principles of host-pathogen interactions in scientific discussions and to use them to approach theoretically and practically research questions.

Grading through:

- written exam

Is requisite for:

- Infection Biology 2 (LS4145-KP05)

Responsible for this module:

- Prof. Dr. Ulrich Schaible

Teacher:

- Institute of Virology and Cell Biology
- Department of Infectious Diseases and Microbiology
- Research Center Borstel

- Prof. Dr. Ulrich Schaible
- Prof. Ph.D. Tamás Laskay
- Prof. Dr. rer. nat. Stefan Taube
- Prof. Dr. med. Werner Solbach

Literature:

- :
- Richard Goering, Hazel Dockrell, Mark Zuckerman, Ivan Roitt von Saunders: Mims' Medical Microbiology + Student Consult Online Access - 2012
- 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
- :
- Michael T. Madigan, John M. Martinko: Brock Biology of Microorganisms - Pearson International Edition, ISBN 0-13-196893-9
- Mims, Nash, Stephen: Mim's Pathogenesis of Infectious Disease - 6th Edition

Language:

- offered only in English

Notes:

The module includes a written Test as the only form of examination.

The regular and successful participation in the teaching module (lecture), apart from the self-study, is strongly recommended as a solid preparation for the examination.

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

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%)

LS4021-KP06, LS4020-IB - Structural Biology of Infection (StrucBiol)

Duration:	Turnus of offer:	Credit points:
1 Semester	normally each year in the winter semester	6

Course of study, specific field and term:

- Master Infection Biology ab 2018 (compulsory), Interdisciplinary modules, 1st semester
- Master Infection Biology (compulsory), Interdisciplinary modules, 1st semester

Classes and lectures:

- See LS4020 A: Crystallography (lecture, 2 SWS)
- See LS4020 B: NMR Spectroscopy (lecture, 2 SWS)
- See LS4020 C: Single Molecule Methods (lecture, 2 SWS)
- See LS4020 D: Microscopy, Methods and Application (lecture, 2 SWS)
- See LS4020 E: Membrane Biophyics (lecture, 2 SWS)
- See LS4020 F: Protein-Biophysics (lecture, 2 SWS)

Workload:

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

Contents of teaching:

- See Modul parts LS4020 A bis F

Qualification-goals/Competencies:

- See Modul parts LS4020 A bis F

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Christian Hübner

Teacher:

- Institute for Biology
- Research Center Borstel
- Institute of Physics
- Institute of Biochemistry
- Institute of Chemistry and Metabolomics

- Prof. Dr. rer. nat. Thomas Peters
- Prof. Dr. rer. nat. Rolf Hilgenfeld
- Prof. Dr. rer. nat. Christian Hübner
- Prof. Dr. rer. nat. Thomas Gutsmann
- PD Dr. rer. nat. Andra Schromm
- Prof. Dr. rer nat. Rainer Duden
- PD Dr. rer. nat. Hauke Paulsen
- Dr. math. et dis. nat. Jeroen Mesters

Language:

- offered only in English

Notes:

Formerly Modul LS4020-IB

Compulsary: choice of two courses from LS 4020 A-F

The module parts A to F each include a written test as the only form of examination.

If more than 2 of the required module parts are taken and passed successfully, the two best intermediate results are averaged to calculate the final grade.

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

LS4025-KP03 - Clinical Aspects of Infection (ClinAsp)

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

Course of study, specific field and term:

- Master Infection Biology ab 2018 (compulsory), Clinical Aspects, 1st semester
- Master Infection Biology (compulsory), Clinical Aspects, 1st semester

Classes and lectures:

- Clinical Aspects of Infection (lecture, 2 SWS)

Workload:

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

Contents of teaching:

- Clinical background: Clinical characteristics and diagnostical approaches of the most important infectious diseases. Pathophysiological background on the occurence of systemic and local clinical symptoms and disease-specific clinical pictures. Introduction in the most relevant instrumental and laboratory techniques for the diagnosis of infections. Established and novel strategies in the treatment of infectious diseases with respect to the emergence of multi-drug resistant pathogens.
- Focus on: Gastrointestinal infections, Pneumonia, Colonization vs. infection, Hepatitis, Travel-associated infections, HIV/STDs, Fungal infections, Catheter-related infections, Tuberculosis
- Modern therapeutic approaches

Qualification-goals/Competencies:

- Students are able to integrate knowledge on immunological and pathogen- related entities in the context of clinical aspects of infections. They will obtain deeper insights in patient symptoms, clinical appearances and therapeutic needs of the most frequent infections worldwide.
- Difficulties in the clinical assessment of infectious disease severities, emergency and intensive care treatment options will be instructed.
- In addition student´s competence in discussing and questioning scientific achievements in the context of infectious diseases will be strengthened.

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. med. Jan Rupp

Teacher:

- Institute of Nutrition Medicine
- Research Center Borstel
- Medical Clinic III
- Department of Infectious Diseases and Microbiology

- Prof. Dr. med. Jan Rupp
- Prof. Dr. Christoph Lange
- Dr. med. Claudia Jafari
- Prof. Dr. med. Christian Sina
- Dr. med. Barbara Kalsdorf
- Dr. med. Jan Heyckendorf
- Dr. med. Thierry Rolling

Literature:

- Mims, Nash, Stephen: Mims' Pathogenesis of Infectious Disease - 5th edition

Language:

- offered only in English

Notes:

The module includes a written Test as the only form of examination.

In addition to the self-study, the regular and successful participation in the teaching module (lecture) is an essential prerequisite for a solid preparation for the examination.

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

(Contribution Ernährungsmedizin to lecture is 13%)

LS4035-KP06 - Immunology (Immunol)

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

Course of study, specific field and term:

- Master Infection Biology ab 2018 (compulsory), Infection Biology, 1st semester
- Master Infection Biology (compulsory), Infection 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:

- History of Immunology.
- Hematopoiesis and hematopoietic stem cells.
- Cells of the innate immune system.
- Immune sensing by cell-bound pattern recognition systems.
- Immune sensing by soluble pattern recognition systems.
- B cells, gene rearrangement and antibodies.
- MHC, antigen presentation and T cell activation.
- T cell subsets, functions and regulation.
- Cytokine receptors and signaling.
- Soluble mediators and cell trafficking.
- Mucosal immunity.
- The immune response in allergy.
- The immune response in autoimmune diseases.
- Introduction: Basic mechanisms of immune defense against pathogens.
- The impact of the microbiome on innate and adaptive immune responses.
- Immune mechanisms in infection with extracellular bacteria.
- Immune mechanisms in infection with intracellular bacteria.
- Immune mechanisms in infection with pathogenic protozoa, nematodes, trematodes and cestodes.
- Immune mechanisms in infection with DNA and RNA viruses.
- The Sepsis syndrome.
- Vaccination strategies to prevent infections.
- Immune mechanisms related to fungal infections.

Qualification-goals/Competencies:

- Understanding the basics in Immunology
- Understanding the immune mechanisms in infection
- Employing principles of immunology for studies in infection-immunology

Grading through:

- written exam
- Marked presentation

Responsible for this module:

- Prof. Dr. Admar Verschoor

Teacher:

- Research Center Borstel
- Institute of Anatomy
- Abteilung Molekulare Infektiologie
- Department of Infectious Diseases and Microbiology
- Institute for Systemic Inflammation Research (ISEF)

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

- Prof. Ph.D. Tamás Laskay
- Dr. rer. nat. Christoph Hölscher
- PD Dr. rer. nat. Norbert Reiling
- PD Dr. rer. nat. Kathrin Kalies
- Prof. Dr. med. Jan Rupp
- Prof. Dr. med. Werner Solbach
- Dr. Christian Karsten
- Prof. Dr. med. Jörg Köhl
- Dr.rer.nat. Yves Laumonnier
- Ph.D. Kensuke Shima
- Dr. rer. nat. Inga Kaufhold
- Prof. Dr. Admar Verschoor

Literature:

- Kenneth Murphy: Janeway's Immunobiology

Language:

- offered only in English

Notes:

If both module parts are passed successfully, the final grade is calculated from the weighted partial grades as follows: 33.33% seminar, 66.67% written exam.

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

LS4045-KP06 - Diagnostical Methods in Microbiology and Pathology (DiagMiPath)

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

Course of study, specific field and term:

- Master Infection Biology (compulsory), Clinical Aspects, 1st semester

Classes and lectures:

- Diagnostical Methods in Microbiology and Pathology (lecture, 2 SWS)
- Diagnostical Methods in Microbiology and Pathology (practical course, 2 SWS)
- Diagnostical Methods in Microbiology and Pathology (seminar, 1 SWS)

Workload:

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

Contents of teaching:

- Lecture: Diagnosis/ Pathology of bacterial infectious; Diagnosis/ Pathology of viral infectious; Diagnosis/ Resistance of mycobacteria; Diagnosis of fungi and parasites; Nucleic acid-based techniques used in the diagnosis of infectious diseases; Serological techniques for the diagnosis of infectious diseases; Diagnosis of emerging infections
- Seminar: Selected topics concerning the diagnosis of infectious diseases (i.e. diagnostics of bacterial and viral infections, molecular diagnostics, resistance testing of bacteria and viruses, biomarkers as novel tools to detect infections, mass spectrometry in clinical microbiology, and application of next generation genome sequencing for infection diagnostics)
- Practical course: Basic laboratory rules and instructions for handling infectious organisms and materials; Techniques of bacteriology: Culture, media, preparation of slides, staining techniques; Characterization and identification of microbes (bacteria, fungi, protozoa, helminiths) by macroscopic and microscopic growth characteristics and morphology; Biochemical characterization of bacteria; Diagnostic immunology/serology: agglutination, precipitation, immunofluorescence; Diagnosis by the novel technique-MALDI-TOF/MS; Analysis of antibiotic susceptibility

Qualification-goals/Competencies:

- Students are able to list the different concepts for the diagnosis of infectious diseases (pathogenic bacteria, fungi, virus and parasites).
- In addition they will learn about prominent pathological entities of infectious diseases, on a macroscopic and histological level.
- They are able to illustrate and discuss these concepts with the aid of appropriate examples.
- They are able to assess the potential and the limitation of a given diagnostic concept and to propose alternative strategies.
- They do understand and are able to explain the underlying principles of a given technique.
- They are able to identify unknown pathogens from suspected infectious materials of respiratory, intestinal, urinary tract and blood infections by various diagnostic techniques.
- They acquire competences in presenting and discussing scientific results.

Grading through:

- Regular attendance of all compulsory courses of the teaching module
- protocols
- Oral examination
- written exam
- Marked presentation

Is requisite for:

- Infection Biology 2 (LS4145-KP05)

Responsible for this module:

- Prof. Dr. med. Jan Rupp

Teacher:

- LADR GmbH Geesthacht
- Department of Pathology
- Berhard Nocht Institute, Hamburg
- Department of Dermatology, Allergology and Venerology
- Research Center Borstel
- Institute of Molecular Medicine

- Department of Infectious Diseases and Microbiology

- Prof. Dr. med. Jan Rupp
- Prof. Dr. rer. nat. Tobias Restle
- Prof. Dr. med. Sven Perner
- Prof. Dr. rer. nat. Stefan Niemann
- Prof. Dr. rer. nat. Georg Sczakiel
- Dr. rer. nat. Martina Behnen-Haerer
- Ph.D. Kensuke Shima
- Prof. Dr. rer. nat. Stefan Taube
- Prof. Dr. rer. nat. Marc Ehlers
- Dr. math. et dis. nat. Jeroen Mesters
- Dr. med. Waltraud Anemüller
- PD Dr. med. Jan Kramer
- Dr. med. Thierry Rolling
- Dr. med. Katharina Kranzer
- Prof. Dr. rer. nat. Torsten Goldmann
- Dr. med. Rosemarie Krupar

Literature:

- n.n.: Current scientific literature

Language:

- offered only in English

Notes:

The final grade is calculated from weighted partial grades as follows: 20% seminar, 40% lecture (exam) and 40% practical course (protocol & oral examination).

The module Diagnostical Methods in Microbiology and Pathology is required for the participation in Infection Biology 2 .

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

MA1610-KP05 - Biostatistics and Epidemiology (BiostatEpi)

Duration:	Turnus of offer:	Credit points:
2 Semester	starts every winter semester	5

Course of study, specific field and term:

- Master Infection Biology (compulsory), Interdisciplinary modules, 1st semester

Classes and lectures:

- Part A: Applied Biostatistic (lecture, 2 SWS)
- Part B: Applied Epidemiology (lecture and exercise, 2 SWS)

Workload:

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

Contents of teaching:

- Part A: Applied Biostatistic
- Introduction to biostatistics; Descriptive statistics; Probability calculation; Inferential statistics: Test of statistical significance, association, correlation; Multivariate testing; Regression analysis; Time-to-event analysis.
- Introduction to EpiInfo®
- Part B: Applied Epidemiology
- Introduction to epidemiology; What is normal? Diagnosis; Frequencies; Registers and data sources; Geographical epidemiology; Study designs (RCT, cohort study, case control study, cross sectional study); Effect measures; Causality; Chance, bias and confounding; Control of errors.
- Assessment of scientific articles on the basis of clinical epidemiology

Qualification-goals/Competencies:

- Part A: Applied Biostatistic
- Overall goal: Students are able to reasonably interpret results of statistical analysis.
- Students are able to explain, to compute and to interpret descriptive statistics and elementary inferential tests (t-test, Chi²-test).
- Students are able to explain, the basic principles of statistical testing, the meaning of 95% confidence intervals.
- Students are able to explain the basic idea of multivariate analysis, regression analysis, time-to-event analysis and to interpret results of a given example.
- Students are able to judge if the statistics that were used in a particular example are appropriate or not.
- Students are able to use EpiInfo for statistical analysis.
- Part B: Applied Epidemiology
- Students are able to explain technical terms such as disease register, incidence, prevalence, mortality, lethality and to interpret epidemiological measures.
- Students are able explain which study design is appropriate for which specific study question.
- Students are able to judge if the methods that were used in a particular study will result in valid or biased results.
- Students are able to formally and critically appraise the internal and external validity and the reporting quality of a scientific paper by means of checklists.
- Soft Skills: By means of small group discussions students' communication competencies and capacity to team work are increased.

Grading through:

- written exam

Responsible for this module:

- Dr. rer. nat. Nora Eisemann

Teacher:

- Institute for Social Medicine and Epidemiology
- Prof. Dr. med. Alexander Katalinic
- Prof. Dr. phil. Matthias Bethge
- Dr. rer. nat. Nora Eisemann

Literature:

- Motulsky, Harvey: Intuitive biostatistics: a nonmathematical guide to statistical thinking. 3rd edition - New York: Oxford Univ. Press, 2014.
- Banerjee, Ashis: Medical statistics made clear. An introduction to basic concepts. - The Royal Society of Medicine Press, 2003.
- Fletcher, Fletcher & Fletcher: Clinical Epidemiology. The Essentials. 5th edition - Philadelphia: Wolters Kluwer/Lippincott Williams &

Wilkins, 2014

Language:

- offered only in English

Notes:

The module includes a written Test as the only form of examination.

The regular and successful participation in the teaching module, apart from self-study, is strongly recommended as a solid preparation for the exam.

Participation in the exercises is mandatory and a prerequisite for admission to the exam. Part A, Applied Biostatistics, takes place in the winter semester and Part B, Applied Epidemiology, in the summer semester.

If both module parts A and B have been succesfully completed, the module grade is calculated from the total sum of points achieved, weighting 50:50.

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

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).

LS4020 E - Module part LS4020E: Basic Membrane Biophysics (MemBiophy)

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

Course of study, specific field and term:

- Master Infection Biology ab 2018 (module part), Interdisciplinary modules, 2nd semester
- Master Infection Biology (module part), Interdisciplinary modules, 2nd semester

Classes and lectures:

- Basics of Membrane Biophysics (lecture, 2 SWS)

Workload:

- 60 Hours private studies
- 30 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:

- Knowing the constituents and composition of biological membranes
- Understanding the physical role and function of membrane lipids and proteins
- Knowing the mechanical and electrical properties of membranes
- Competence in various methods to investigate reconstituted and natural membranes

Grading through:

- see Notes

Responsible for this module:

- Prof. Dr. rer. nat. Christian Hübner

Teacher:

- Research Center Borstel
- Prof. Dr. rer. nat. Thomas Gutsmann
- PD Dr. rer. nat. Andra Schromm

Literature:

- O.G. Mouritzen: Life - As a Matter of Fat - Springer ISBN: 987-3-540-23248-3
- T. Heimburg: Thermal Biophysics of Membranes - John Wiley & Sons, 2007; ISBN-10: 3527404716

Language:

- offered only in English

Notes:

Is module part of LS4021-KP06 (formerly LS4020-IB) -> Prof. Hübner

LS4020 F - Module part LS4020F: Protein-Biophysics (ProBioPhy2)

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

Course of study, specific field and term:

- Master Infection Biology ab 2018 (module part), Interdisciplinary modules, 2nd semester
- Master Infection Biology (module part), Interdisciplinary modules, 2nd semester

Classes and lectures:

- Physics of Proteins (lecture, 2 SWS)

Workload:

- 60 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:

- see Notes

Responsible for this module:

- Prof. Dr. rer. nat. Christian Hübner

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)

Language:

- offered only in English

Notes:

Is module part of LS4021-KP06 (former LS4020-IB) -> Prof. Hübner.

This module part is identical to LS4020 MIW F but without seminar.

LS4145-KP05 - Infection Biology 2 (InfBiol2)

Duration:	Turnus of offer:	Credit points:	Max. group size:
1 Semester	each summer semester	5	20

Course of study, specific field and term:

- Master Infection Biology ab 2018 (compulsory), Infection Biology, 2nd semester
- Master Infection Biology (compulsory), Infection Biology, 2nd semester

Classes and lectures:

- Infection Biology 2 (lecture, 2 SWS)
- Infection Biology 2 (practical course, 3 SWS)

Workload:

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

Contents of teaching:

- Cellular and molecular mechanisms of infections
- Interaction of pathogens with cells of the innate and adaptive immune system, antimicrobial effector mechanisms
- Extra- and intracellular pathogens, molecular mechanisms of intracellular survival
- Host cell death and its consequences
- Innate and adaptive immune functions and practical applications
- Background and practical application of cell culture, virus cultivation, and virus quantification (Endpoint titration and plaque assay)
- Sterile techniques
- Basic knowledge in genetic engineering and legislation
- Laboratory safety
- Basic laboratory calculations

Qualification-goals/Competencies:

- The students have the scientific competency to implement their detailed knowledge of infectious agents, infectious diseases and their pathomechanisms, their detailed understanding of antimicrobial defense mechanisms at the cellular and molecular level.
- They are competent in theory and in practical skills in laboratory techniques to approach infectious disease research projects in a successful manner.
- They know the principles of virus cultivation and titration and can apply this practically.
- They know the principles of tissue culture and can apply this practically.
- They can perform standard laboratory calculations and unit conversions.
- They have the methodological competence, to use flow cytometric approaches addressing the host-pathogen interaction at single cell level (phagocytosis, cell activation, cell death, cytokine formation).
- They can process and interpret data and can communicate it to peers
- They have the communication competency to convey the underlying principles of techniques of infection research.
- They understand laboratory safety procedures and can apply them practically

Grading through:

- see Notes
- continuous, successful participation in course, >90%
- Oral examination

Is requisite for:

- Internship (LS4115-KP16)

Requires:

- Diagnostical Methods in Microbiology and Pathology (LS4045-KP06)
- Diagnosis of Infectious Diseases (LS4045 (ALT))
- Infection Biology 1 (LS4015-KP06)

Responsible for this module:

- Prof. Dr. rer. nat. Stefan Taube

Teacher:

- Institute for Systemic Inflammation Research (ISEF)
- Department of Infectious Diseases and Microbiology
- Institute of Virology and Cell Biology

- Research Center Borstel

- Prof. Dr. Ulrich Schaible
- Prof. Ph.D. Tamás Laskay
- Prof. Dr. Admar Verschoor
- PD Dr. rer. nat. Norbert Reiling
- Prof. Dr. rer. nat. Stefan Taube
- Dr. math. et dis. nat. Jeroen Mesters

Literature:

- S.J. Flint: Principles of Virology Vol I and II - ASM Press, Washington DC
- : Current Literature; Practical script

Language:

- offered only in English

Notes:

The regular and successful participation in the teaching module, apart from the self-study, is strongly recommended as a solid preparation for the oral examination.

Participation in the Biosafety instruction is mandatory.

The module will be graded by a 30-minute oral exam at the end of the practical, during which students will present their own data: Both the theoretical and practical knowledge will be tested and scrutized.

In case a student does not pass the oral examination, she/he has to re-atake the entire Module one year later.

LS4155-KP06 - Anti-Microbial Therapy and Prophylaxis (AntTherPro)

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

Course of study, specific field and term:

- Master Infection Biology (compulsory), Clinical Aspects, 2nd semester
- Master Infection Biology ab 2018 (compulsory), Clinical Aspects, 2nd semester

Classes and lectures:

- Anti-Microbial Therapies (lecture, 2 SWS)
- Vaccination Strategies (seminar, 2 SWS)

Workload:

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

Contents of teaching:

- General concepts of anti-microbial therapies; potentials and limitations, Concepts in drug design, Alternative strategies, The problem of drug resistance, Future challenges,
- Selected examples: antibacterial (antibiotics), antiviral (e.g. polymerase and protease inhibitors of HIV, Herpes), antifungal (e.g. antimycotics and Candida albicans), antiprotozoal (e.g. chloroquine and Malaria) and drugs against multicellular eukaryotes (e.g. anthelmintics and fox-tapeworm).
- Vaccination strategies:Pathogen niches and immunity, Determine vaccine types, Vaccine types (live attenuated, killed, subunit, recombinant live and examples), Epitopes, Vaccine carriers, Adjuvants

Qualification-goals/Competencies:

- Students are competent in the different concepts of antimicrobial therapies and prophylaxes (directed against: bacteria, viruses, fungi, worms and protozoa) and are able illustrate these approaches with the aid of appropriate examples. They are competent to assess the potential and the limitation of a given therapy concept and to propose alternative strategies. They have the competency to present and critically discuss the general concepts of anti-microbial prophylaxis as well as relevant examples for important infectious diseases (i.e. vaccination). They have competences in presenting and discussing scientific results.

Grading through:

- written exam
- Marked presentation

Responsible for this module:

- Prof. Dr. rer. nat. Tobias Restle

Teacher:

- Institute of Biochemistry
- Research Center Borstel
- Institute of Molecular Medicine

- Prof. Dr. rer. nat. Tobias Restle
- Prof. Dr. rer. nat. Rolf Hilgenfeld
- Prof. Dr. Ulrich Schaible
- Prof. Dr. med. Andreas Paech

Literature:

- n.n.: Recent review articles

Language:

- offered only in English

Notes:

The final grade is calculated from weighted partial grades as follows: 50% seminar (oral presentation), 50% written exam.

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

LS4165-KP09 - Model Systems of Infection (ModSysInf)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	9

Course of study, specific field and term:

- Master Infection Biology (compulsory), Infection Biology, 2nd semester
- Master Infection Biology ab 2018 (compulsory), Infection Biology, 2nd semester

Classes and lectures:

- Lectures In vivo Models (lecture, 3 SWS)
- Excercises In vivo Models (seminar, 2 SWS)
- Practical course In vivo Models (practical course, 2 SWS)

Workload:

- 165 Hours private studies
- 105 Hours in-classroom work

Contents of teaching:

- (1) Animal experimentation and biological safety; Lecture: (a) animal protection laws, animal experimentation application, documentationof animal experiments, anatomy and physiology of the mouse, breeding methods and nomenclature, transgenic mice, anesthetics,analgesia, methods of anesthesia, criteria for animal burden and experiment abortion, ethics, alternative and additional methods,biological and gene technological safety. (b) Practicals: biology and handling of mouse, handling and behaviour of mouse, health and gender controling, applicationmethods, blood sampling and animal protection appropriate sacrifice, sectioning mouse, working under biological safety levels,transgenic technology
- (2) Clinic-near model systems in infection biology: principles of animal experimentation in infection biology, infections of the skin(leishmaniasis), lung (tuberculosis, influenza), intestinal (helminths, salmonella), intracerebral (toxoplasmosis) and systemic infections(trypanosomis, malaria, sepsis), humanized animal experimental models, comparison of scientific results from animal experimentationand the situation in humans

Qualification-goals/Competencies:

- Basic knowledge of laws regulating animal experimentaion; theoretical and practical basics in handling of experimental animals; basicknowledge on aspects of biological and gene technological safety; basic knowledge on the generation of transgenic animals
- Basic knowledge based on experimental examples; consolidation of knowledge in seminar
- Knowing how to handle the model systems; Competence in protocol writing

Grading through:

- Regular attendance of all compulsory courses of the teaching module
- written exam

Responsible for this module:

- Dr. rer. nat. Christoph Hölscher

Teacher:

- Institute for Systemic Inflammation Research (ISEF)
- Department of Infectious Diseases and Microbiology
- Research Center Borstel

- Dr. rer. nat. Christoph Hölscher
- Prof. Ph.D. Tamás Laskay
- Prof. Dr. rer. nat. Stefan Taube
- Dr. rer.nat. Hanna Erdmann
- PD Dr. rer. nat. Norbert Reiling
- Dr. rer. nat. Bianca Schneider
- Prof. Dr. Guntram Grassl Grassl
- Dr. Kerstin Walter
- Dr.rer.nat. Christian Karsten

Language:

- offered only in English

Notes:

The regular and successful participation in the lecture, apart from the self-study, is strongly recommended as a solid preparation for the examination.

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

LS4175 A - Module part: Molecular Virology (MedMicroVi)

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

Course of study, specific field and term:

- Master Infection Biology (module part), Microbiology, 2nd semester
- Master Infection Biology ab 2018 (module part), Microbiology, 2nd semester

Classes and lectures:

- Molecular Virology (seminar, 2 SWS)

Workload:

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

Contents of teaching:

- Background and seminal research in human pathogenic virusesi.e. Influenza, Hepatitis C, Ebola Virus, Zika Virus, Measles Virus, Human Immunodeficiency Virus (HIV), Human Coronavirus (SARS, MERS)
- State-of-the art techniques in virology and molecular biology
- The peer review process
- Data analysis and interpretation, how to discuss a scientific research paper
- How to present a scientific research paper in a journal club format

Qualification-goals/Competencies:

- Competence in critical reading, discussing and presenting research articles
- Student knows recent developments in molecular virology and related techniques
- Student can present a research paper / topic in a journal club setting
- Student can conduct literature researches i.e. Pubmed

Grading through:

- see Notes

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institute of Virology and Cell Biology
- Prof. Dr. rer. nat. Stefan Taube
- MitarbeiterInnen des Instituts

Literature:

- n.n.: Provided research articles and own literature research

Language:

- offered only in English

Notes:

Is module part of LS4175-KP06

Grading of the module part through
- at least two oral presentations (20 min plus discussion)
- regular in-class assessments
- contribution to discussions
- regular participation in seminars (85%)

LS4175 B - Module part: Mechanisms of Bacterial Pathogenicity (MedMicroBa)

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

Course of study, specific field and term:

- Master Infection Biology (module part), Microbiology, 2nd semester
- Master Infection Biology ab 2018 (module part), Microbiology, 2nd semester

Classes and lectures:

- Mechanisms of Bacterial Pathogenicity (seminar, 2 SWS)

Workload:

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

Contents of teaching:

- Historical background: Milestones in the discovery of the factors involved in microbial virulence
- Invasiveness, toxigenesis, colonization, specific adherence
- Structure of bacterial cell membrane, cell wall and cell surface: Gram-positive and Gram-negative bacteria, mycobacteria, virulence factors
- Structure and biosynthesis of lipopolysaccharides
- Structure and biosynthesis of lipoarabinomannan
- Structure, biosynthesis and functions of mycobacterial lipids
- Recognition of microbial virulence factors by pattern recognition receptors
- Recognition of lipids by immune cells, the role of CD1 presentation
- Microbial toxins (e.g., leucocidin, hemolysin, botulinum toxin, diphtheria toxin, anthrax toxin, tetanus toxin, pertussis toxin, cholera enterotoxin, adenylate cyclase, Staphylococcus aureus enterotoxin, TSST, superantigen, shiga toxin, Escherichia coli LT toxin, ST toxin)

Qualification-goals/Competencies:

- Competence in critical reading, discussing and presenting research articles
- Student can explain structures and biosynthetic pathways of microbial constituents responsible for microbial virulence
- Student can explain virulence mechanisms of pathogenic microorganisms
- Student can evaluate the quality of experimental data
- Student can present a research paper / topic in a seminar setting
- Student can conduct literature researches using Pubmed

Grading through:

- see Notes

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Research Center Borstel

- Prof. Dr. rer. nat. Otto Holst
- Priv.-Doz. Dr. rer. nat. Sven Müller-Loennies

Literature:

- n.n.: Provided research articles and own literature research

Language:

- offered only in English

Notes:

Is module part of LS4175-KP06

Grading of the module part through
- at least two oral presentations (20 min plus discussion)
- regular in-class assessments
- contribution to discussions
- regular participation in seminars (85%)

LS4175 C - Module part: Pathogen Niches (MedMicroNi)

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

Course of study, specific field and term:

- Master Infection Biology (module part), Microbiology, 2nd semester
- Master Infection Biology ab 2018 (module part), Microbiology, 2nd semester

Classes and lectures:

- Pathogen Niches (seminar, 2 SWS)

Workload:

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

Contents of teaching:

- Intracellular vs. extracellular pathogens and their niches blood vs. tissue, extracellular matrix
- Metabolic adaptations of pathogenic microbes and competition with host
- Immunoprivileged tissue/organ sites niches for immune escape of pathogens
- The physiology and cell biology of intracellular microbes
- Erythrocytes as host cells phagocytes and non-phagocytes as host cells
- Microbial biofilms and consortia niches formed by immunity and toxins

Qualification-goals/Competencies:

- Competence in critical reading, discussing and presenting research articles
- Student knows niches pathogens occupy in the host and can explain how they influence immunity and therapy
- Student can explain physiological benefits for the pathogens
- Student can interpret an experimental setup and evaluate the correct use of controls and quality of experimental data
- Student can present a research paper / topic in a seminar setting
- Student can conduct literature researches using Pubmed

Grading through:

- see Notes

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Research Center Borstel
- Dr. rer. nat. Bianca Schneider

Literature:

- Ulrich E. Schaible, Albert Haas: Intracellular Niches of Microbes: A Pathogens Guide Through the Host Cell - Wiley-VCH 2009
- Pascale Cossart, Patrice Boquet, Staffan Normark: Cellular Microbiology - Asm Pr

Language:

- offered only in English

Notes:

Is module part of LS4175-KP06

Grading of the module part through
- at least two oral presentations (20 min plus discussion)
- regular in-class assessments
- contribution to discussions
- regular participation in seminars (85%)

This course will be held over two full days at the Research Center Borstel

LS4175 D - Module part: Inflammation - Methods in Immunology (MedMicroIn)

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

Course of study, specific field and term:

- Master Infection Biology (module part), Microbiology, 2nd semester
- Master Infection Biology ab 2018 (module part), Microbiology, 2nd semester

Classes and lectures:

- Methods in Immunology (seminar, 2 SWS)

Workload:

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

Contents of teaching:

- Flow Cytometry (FACS, MACS, FACS-sort)
- Phage display
- Recombinant antibodies
- Experimental and therapeutic Biologica
- Conventional, confocal and 2-photon Microscopy
- SNPs Analysis
- Signaltransduction analysis
- Migration Assays
- Generation of transgenic, knock-out and knock-in mice
- Animal models in Life Science
- Microbiome analysis
- Data analysis and interpretation
- How to discuss and present a scientific research paper

Qualification-goals/Competencies:

- Competence in critical reading, discussing and presenting research articles.
- Student can explain principle methods and their applications in immunology
- Student can give examples of recent developments in immunology
- Student can interpret an experimental setup and evaluate the correct use of controls
- Student can evaluate the quality of experimental data
- Student can present an immunology based paper in a journal club format
- Student can conduct literature researches using Pubmed

Grading through:

- see Notes

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Department of Infectious Diseases and Microbiology
- Institute for Systemic Inflammation Research (ISEF)

- Prof. Dr. Admar Verschoor
- Prof. Dr. med. Jörg Köhl
- Prof. Dr. rer. nat. Rudolf Manz
- Prof. Dr. med. Peter König
- Dr.rer.nat. Christian Karsten
- Prof. Dr. med. Saleh Ibrahim
- Dr.rer.nat. Yves Laumonnier

Literature:

- n.n.: Provided research articles and own literature research

Language:

- offered only in English

Notes:

Is module part of LS4175-KP06

Grading of the module part through
- at least two oral presentations (20 min plus discussion)
- regular in-class assessments
- contribution to discussions
- regular participation in seminars (85%)

LS4175-KP06, LS4175 - Medical Microbiology (MedMicro)

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

Course of study, specific field and term:

- Master Infection Biology ab 2018 (compulsory), Microbiology, 2nd semester
- Master Infection Biology (compulsory), Microbiology, 2nd semester

Classes and lectures:

- See LS4175 A: Molecular Virology (seminar, 2 SWS)
- See LS4175 B: Mechanisms of Bacterial Pathogenicity (seminar, 2 SWS)
- See LS4175 C: Pathogen Niches (seminar, 2 SWS)
- See LS4175 D: Inflammation - Methods in Immunology (seminar, 2 SWS)

Workload:

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

Contents of teaching:

- See LS4175 module parts A to D

Qualification-goals/Competencies:

- Competence in critical reading, discussing and preseting of research articles.More details see LS4175 module parts A to D

Grading through:

- presentation

Responsible for this module:

- Prof. Dr. rer. nat. Stefan Taube

Teacher:

- Institute for Systemic Inflammation Research (ISEF)
- Research Center Borstel
- Department of Infectious Diseases and Microbiology
- Institute of Virology and Cell Biology

- Prof. Dr. rer. nat. Stefan Taube
- Prof. Dr. med. Jan Rupp
- Prof. Dr. rer. nat. Otto Holst
- Dr. rer. nat. Bianca Schneider
- Prof. Dr. Admar Verschoor
- Prof. Dr. med. Jörg Köhl
- Prof. Dr. rer. nat. Rudolf Manz
- Prof. Dr. med. Peter König
- Priv.-Doz. Dr. rer. nat. Sven Müller-Loennies

Literature:

- n.n.: Provided research papers

Language:

- offered only in English

Notes:

The student must select and pass at least two of the module parts offered. Module parts only take place with a minimum of four participants.

Grading of the single module part through
- at least two oral presentations (20 min plus discussion)
- regular in-class assessments
- contribution to discussions
- regular participation in seminars (85%)

If more than 2 of the required module parts are taken and passed successfully, the two best intermediate results are averaged to calculate the final grade. Additional module parts are entered in the transcripts of records (Diploma Supplement).

Module parts B and C (LS4175 B Mechanisms of Bacterial Pathogenicity; LS4175 C Pathogen Niches) are offered as a two-day symposium at the Research Center Borstel
Module parts A and D (LS4175 A Molecular Virology, LS4175 D Inflammation - Methods of Immunology) will be offered during the semester in Lübeck
Students must choose at least one module part offered in Lübeck (LS4175 A Molecular Virology; LS4175 D Inflammation - Methods of Immunology).

LS4185 A - Module part LS4185A: Analysis of Host Pathogen Interaction (AnalHPI)

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

Course of study, specific field and term:

- Master Infection Biology (module part), Microbiology, 2nd semester
- Master Infection Biology ab 2018 (module part), Microbiology, 2nd semester

Classes and lectures:

- Analysis of Host Pathogen Interaction (Seminar and practical course, 2 SWS)

Workload:

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

Contents of teaching:

- Introduction to host-pathogen interaction using different examples
- Importance of commensal colonization
- Introduction to methods used for the analysis of host-pathogen interaction with focus on omics methods to analyze genes, proteins and lipids and imaging methods to visualize host-pathogen interaction

Qualification-goals/Competencies:

- Understanding of different approaches to investigate how host and pathogen can interact and its impact on disease
- Knowledge of in vivo and in vitro methods to analyze pathogen-host interaction
- Insight into experimental design and data analysis of imaging and omics experiments

Grading through:

- see Notes

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Berhard Nocht Institute, Hamburg
- Ernst-Moritz-Arndt-University of Greifswald
- Institute of Anatomy
- Research Center Borstel

- Prof. Dr. med. Peter König
- Prof. Dr. Ulrich Schaible
- Dr. Frank Schmidt
- Dr.rer.nat. Monica Hagedorn
- Prof. Dr. rer. nat. Stefan Niemann
- Dr. Dominik Schwudke
- Dr. Silke Feuerriegel
- Dr. Susanne Homolka

Literature:

- n.n.: Current scientific literature

Language:

- offered only in English

Notes:

Is part of LS4185-KP03.

Grading of module part by presenting and discussing a scientific publication, max. 30 min.

LS4185 B - Module part LS4185B: Rational Drug Design (RatDruDes)

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

Course of study, specific field and term:

- Master Infection Biology (module part), Microbiology, 2nd semester
- Master Infection Biology ab 2018 (module part), Microbiology, 2nd semester

Classes and lectures:

- Rational Drug Design (lecture, 2 SWS)

Workload:

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

Contents of teaching:

- Drug development an overview
- Target identification and validation
- Role of x-ray crystallography in drug development
- Structure-based drug design Principles and methods
- Case studies of structure-based drug development
- Combinatorial approach for nucleic acid therapeutics identification
- Oligomeric nucleic acid therapeutics
- Cellular applications of nucleic acid therapeutics via non-viral carrier systems

Qualification-goals/Competencies:

- Basic strategies of drug design
- The path from the discovery of an active principle to a marketable product. Rational drug design
- NMR and crystallography as fundamental tools for finding and optimizing active agents
- Structure and effect relationships will be demonstrated using examples, techniques used for theoretical prediction and experimental proof will be introduced, especially the complementary approach using crystallographic methods and NMR experiments
- Students will critically evaluate these methods and perceive their limits

Grading through:

- see Notes

Responsible for this module:

- Siehe Hauptmodul

Teacher:

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

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

Literature:

- -: Current scientific literature

Language:

- offered only in English

Notes:

Part of module LS4185-KP03.

The module part includes a written Test as the only form of examination.

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

LS4185-KP03 - Host-Pathogen Interaction (HostPatInt)

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

Course of study, specific field and term:

- Master Infection Biology (compulsory), Microbiology, 2nd semester
- Master Infection Biology ab 2018 (compulsory), Microbiology, 2nd semester

Classes and lectures:

- See LS4185 A: Analysis of Host-Pathogen Interaction (Seminar and practical course, 2 SWS)
- See LS4185 B: Rational Drug Design (lecture, 2 SWS)

Workload:

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

Contents of teaching:

- See LS4185 module parts A or B

Qualification-goals/Competencies:

- More details see LS4185 module parts A or B

Grading through:

- presentation of original research papers
- written exam

Responsible for this module:

- Prof. Dr. med. Peter König

Teacher:

- Institute of Biochemistry
- Ernst-Moritz-Arndt-University of Greifswald
- Berhard Nocht Institute, Hamburg
- Research Center Borstel
- Institute of Chemistry and Metabolomics
- Institute of Anatomy

Literature:

- n.n.: current scientific literature

Language:

- offered only in English

Notes:

Choice of one course, either LS4185A or B

For more details see LS4185A or B

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

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).

LS4115-KP16 - Internship (PC)

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

Course of study, specific field and term:

- Master Infection Biology ab 2018 (compulsory), Microbiology, 3rd semester
- Master Infection Biology (compulsory), Microbiology, 3rd semester

Classes and lectures:

- Practical Courses (block practical course, 24 SWS)

Workload:

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

Contents of teaching:

- In two practicals, 2 of the different skills described below have to be acquired, respectively. One of the two practicals must have a duration of at least 12 weeks, the second one can last 8 to 10 weeks, totaling a minimum of 22 weeks of full-time practical work.
- Molecular microbiology:M 1: Genomics/ transcriptomicsM 2: Proteomics/ lipidomicsM 3: Structure analytics of macromoleculesM 4: Protein expression and -purificationM 5: Membrane biophysicsM 6: RNA/ siRNA-TechnologiesM 7: Molecular Genetics of microbes/pathogens
- Cellular microbiology: C 1: Tissue culture/ Cell cultureC 2: Microbe-infected cell/ tissue modelsC 3: In vivo infection modelsC 4: Cell tracing/ Cell sorting/ Cellular biochemistryC 5: ImmunologyC 6: Microscopic Techniques/ Ultrastructure
- Medical Microbiology Me1: Diagnostic tools in microbiology and serologyMe2: Tropical medicineMe3: Infection-epidemiology

Qualification-goals/Competencies:

- Extension and application of the acquired theory to the experimental work in two fields of Cellular- and Molecular microbiology (called competences) in each course;Acquisition of practical knowledge in documentation and presentation (including discussion) of scientific data;ability to work in a team;getting lab experiences by working on real research projects.
- Live long learning competence

Grading through:

- continuous, successful participation in practical course
- presentation in English
- Poster

Is requisite for:

- Master Thesis Infection Biology (LS5995-KP30)

Requires:

- Diagnosis of Infectious Diseases (LS4045 (ALT))
- Infection Biology 2 (LS4145-KP05)
- Infection Biology 1 (LS4015-KP06)

Responsible for this module:

- Prof. Dr. Ulrich Schaible

Teacher:

- All institutes of the University of Lübeck
- MitarbeiterInnen des Instituts

Literature:

- n.n.: Self-study, independent literature search

Language:

- offered only in English

Notes:

All practical courses must be approved by Prof. Schaible 4 weeks (!) in advance.

The results are presented by means of one poster and one short oral presentation. Poster and oral presentation will be graded individually and, if both practical courses are passed successfully, the grades will be averaged.

LS5205-KP06, LS5205 - Consolidating in Infection Biology (ConsoleIB)

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

Course of study, specific field and term:

- Master Infection Biology ab 2018 (compulsory), Interdisciplinary modules, 3rd semester
- Master Infection Biology (compulsory), Interdisciplinary modules, 3rd semester

Classes and lectures:

- Consolidation Course 1 (Seminar and practical course, 2 SWS)
- Consolidation Course 2 (Seminar and practical course, 2 SWS)

Workload:

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

Contents of teaching:

- See special plan of the course located on the IB website.

Qualification-goals/Competencies:

- Ability to understand and reproduce the specialized knowledge imparted in the teaching content.

Grading through:

- B-Certificate (not graded)

Responsible for this module:

- Prof. Dr. Ulrich Schaible

Teacher:

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

Language:

- offered only in English

Notes:

The regular and successful participation (min. 85 %) in the teaching module (practical work), apart from self-study, is a prerequisite for the acquisition of the B-certificate.

LS5995-KP30 - Master Thesis Infection Biology (MScThesis)

Duration:	Turnus of offer:	Credit points:
1 Semester	each semester	30

Course of study, specific field and term:

- Master Infection Biology ab 2018 (compulsory), Infection Biology, 4th semester
- Master Infection Biology (compulsory), Infection Biology, 4th semester

Classes and lectures:

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

Workload:

- 900 Hours in-classroom work

Contents of teaching:

- Scientific project in the field of infection biology

Qualification-goals/Competencies:

- Competence and ability to solve a preformulated more complex scientific problem in a defined period of time and to document with respect to good scientific practice and present and critically defend the experimental results.

Grading through:

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

Requires:

- Diagnostical Methods in Microbiology and Pathology (LS4045-KP06)
- Infection Biology 2 (LS4145-KP05)
- Infection Biology 1 (LS4015-KP06)
- Internship (LS4115-KP16)

Responsible for this module:

- Prof. Dr. Ulrich Schaible

Teacher:

- Institutes and hospitals of the University of Lübeck
- Research Center Borstel
- Alle prüfungsberechtigten Dozentinnen/Dozenten des Studienganges

Language:

- offered only in English

Notes:

The module grade is calculated from weighted partial grades of the written thesis and its oral presentation and defense (60 min) by two reviewers as follows: 33.33% oral presentation, 66.67% written thesis.

Prerequisite: At least 70 ECTS credits have been achieved and both block internships successfully completed before starting the practical work.

If the master thesis is conducted outside the University of Lübeck (UzL), a lecturer of the UzL must be appointed as supervisor before the work is commensed (see PVO), and who is also the first examiner of the thesis.

CS4020-KP06, CS4020SJ14 - Specification and Modelling (SpezMod14)

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

Course of study, specific field and term:

- Master Infection Biology (optional subject), computer science, arbitrary semester
- Master Computer Science since 2019 (basic module), theoretical computer science, 1st or 2nd semester
- Master Medical Informatics since 2019 in planing (optional subject), theoretical computer science, 1st or 2nd semester
- Master IT-Security (compulsory), computer science, 1st or 2nd semester
- Master Medical Informatics (basic module), computer science, 1st or 2nd semester
- Master Media Informatics (optional subject), computer science, arbitrary semester
- Master Entrepreneurship in Digital Technologies (basic module), technology field computer science, 1st or 2nd semester
- Master Computer Science 2014 till 2018 (optional subject), specialization field IT security and safety, 2nd or 3rd semester
- Master Computer Science 2014 till 2018 (basic module), theoretical computer science, 1st or 2nd semester
- Master Entrepreneurship in Digital Technologies since 2020 (advanced module), technology field computer science, arbitrary semester

Classes and lectures:

- Specification and Modelling (lecture, 2 SWS)
- Specification and Modelling (exercise, 2 SWS)

Workload:

- 80 Hours private studies and exercises
- 60 Hours in-classroom work
- 20 Hours exam preparation
- 20 Hours work on project

Contents of teaching:

- Introduction to modelling and specification
- Modelling concepts (data, streams, traces, diagrams, tables)
- Modelling software components (state, behaviour, structure, interface)
- Modelling concurrency
- Algebraic specification
- Composing, refining, analysing and transforming specifications and models
- Specification languages and tools for specification and modelling

Qualification-goals/Competencies:

- The students can argue on the importance of specifications and models for software development.
- They can characterize, apply, adapt and extent important specification and modelling techniques.
- They can model and specify simple software/hardware system in an adequate way.
- They can describe a system from different views and on different levels of abstraction.
- They can apply specifications and modelsin software development.
- They can analyse specifications and models.

Grading through:

- Exercises
- Written or oral exam as announced by the examiner
- successful addressing of the project goals

Responsible for this module:

- Prof. Dr. Martin Leucker

Teacher:

- Institute of Software Technology and Programming Languages
- Dr. Annette Stümpel
- Prof. Dr. Martin Leucker

Literature:

- V.S. Alagar, K. Periyasamy: Specification of Software Systems - Springer 2013
- M. Broy, K. Stølen: Specification and Development of Interactive Systems - Springer 2001
- J. Loeckx, H.-D. Ehrich, M. Wolf: Specification of Abstract Data Types - John Wiley & Sons 1997
- D. Bjorner: Software Enginneering 1-3 - Springer 2006

- U. Kastens, H. Kleine Büning: Modellierung - Grundlagen und formale Methoden - Hanser 2005

Language:

- German and English skills required