UNIVERSITÄT ZU LÜBECK

Module Guide for the Study Path

Master Infection Biology 2018

Version from 1. April 2025

1st and 2nd semester

Applied Biostatistics and Epidemiology (MA1610-KP06, BiostatEp1) 1

1st semester

Infection Biology 1 (LS4015-KP06, InfBio1) 3
Module part LS4020A: Crystallography (LS4020 A, StrAnaKris) 5
Module part LS4020B: NMR Spectroscopy (LS4020 B, StrAnaNMR) 7
Module part LS4020C: Single Molecule Methods (LS4020 C, Einzelstru) 9
Module part LS4020D: Microscopy: Techniques and Applications (LS4020 D, StrAnaMikr) 11
Structural Biology of Infection (LS4021-KP06, LS4020-IB, StrucBiol) 13
Clinical Aspects of Infection (LS4025-KP03, ClinAsp) 15
Immunology (LS4035-KP06, Immunol) 17
Diagnostical Methods in Microbiology and Pathology (LS4045-KP05, DiagMiPat) 19

2nd and 3rd semester

Ethics in Sciences / Scientific Writing (PS4611-KP07, EthScWrIB) 21

2nd semester

Module part: Basic Membrane Biophysics (LS4020 E, MemBiophy) 23
Module part LS4020 F: Protein-Biophysics (LS4020 F, ProBioPhy2) 24
Infection Biology 2 (LS4145-KP05, InfBiol2) 25
Anti-Microbial Therapy and Prophylaxis (LS4155-KP06, AntTherPro) 27
Model Systems of Infection (LS4165-KP09, ModSysInf) 29
Module part: Molecular Virology (LS4175 A, MedMicroVi) 31
Module part: Mechanisms of Bacterial Pathogenicity (LS4175 B, MedMicroBa) 32
Module part: Pathogen Niches (LS4175 C, MedMicroNi) 34
Module part: Inflammation - Methods in Immunology (LS4175 D, MedMicroIn) 35
Medical Microbiology (LS4175-KP06, LS4175, MedMicro) 37
Module part LS4185A: Analysis of Host Pathogen Interaction (LS4185 A, AnalHPI) 39
Module part LS4185B: Rational Drug Design (LS4185 B, RatDruDes) 40
Host-Pathogen Interaction (LS4185-KP03, HostPatInt) 42

3rd and 4th semester

Master Thesis Infection Biology (LS5995-KP30, MScThesis) 43

3rd semester

Internship (LS4115-KP16, PC) 45

Consolidating in Infection Biology (LS5205-KP06, LS5205, ConsoleIB) 47

MA1610-KP06 - Applied Biostatistics and Epidemiology (BiostatEp1)

Duration:	Turnus of offer:	Credit points:
2 Semester	each year, can be started in winter or summer semester	6

Course of study, specific field and term:

- Master Infection Biology 2023 (compulsory), Interdisciplinary modules, 1st and 2nd semester
- Master Infection Biology 2018 (compulsory), Interdisciplinary modules, 1st and 2nd semester

Classes and lectures:

- Part A: Applied Biostatistics (lecture, 3 SWS)
- Part A: Applied Biostatistics (exercise, 1 SWS)
- Part B: Epidemiology (lecture, 2 SWS)

Workload:

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

Contents of teaching:

- Part A: Applied Biostatistics
- Descriptive statistics
- Inferential statistics (estimation and testing)
- Comparison of central tendencies
- Association and correlation
- Regression analysis (linear and logistic)
- Introduction to statistical programming
- Practical application of statistical methods
- Part B: Applied Epidemiology
- Introduction to epidemiology
- Measures of frequency (incidence, prevalence, etc.)
- Medical diagnosis (sensitivity and specificity, etc.)
- Epidemiology of infectious diseases
- Outbreak investigation
- Causality
- Study designs (randomised controlled trial, cohort study, case control study, cross sectional study)
- Random error, bias and confounding
- Critical appraisal

Qualification-goals/Competencies:

- Part A: Applied Biostatistics
- Students are able to understand, explain and interpret results from common statistical analyses
- Students are able to choose adequate statistical methods for a given research problem
- Students are able to conduct basic statistical analyses using pen-and-pencil and statistic software. They are able to write answer sentences by applying the definition of the calculated measure to their result.
- Part B: Epidemiology
- Students are able to understand, explain and interpret epidemiological measures and other results from epidemiological research
- Students are able to understand and explain technical terms used in epidemiology
- Students are able to choose adequate study designs for given research problems and discuss their advantages and limitations (including possible sources of error, bias and confounding) and
- Students are able to judge if results from a particular study are valid or biased and what can be concluded from them (for example in terms of causality)
- Part A and B
- Soft skills: The students' communication competencies and capacity to team work should be increased by means of small group discussions

Grading through:

- Oral examination

Responsible for this module:

- Prof. Dr. med. Alexander Katalinic

Teacher:

- Institute for Social Medicine and Epidemiology

- Dr. rer. hum. biol. Nora Eisemann

Literature:

- Bland: An Introduction to Medical Statistics - 4th edition - Oup Oxford, 2015
- Field, Miles: Discovering Statistics Using R. - Sage Publications, 2012
- Fletcher & Fletcher: Clinical Epidemiology. The Essentials. 5th edition - Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins, 2014

Language:

- offered only in English

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- None

Module Exam(s):
If both partial examinations have been successfully passed, the final grade will be awarded based on the total percentage of points achieved
- MA1610-L1: Applied Biostatistics, oral exam (winter semester), 30 min, 50% of final module grade
- MA1610-L2: Epidemiology, oral exam (summer term), 30 min, 50% of final module grade

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 2023 (compulsory), Infection Biology, 1st semester
- Master Infection Biology 2018 (compulsory), Infection Biology, 1st semester
- Master Infection Biology 2012 (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 with with regardto the rules of GSP of the University of Lübeck and of the DFG-guidelines .
- 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:

- Department of Infectiology
- Institute of Virology and Cell Biology
- Research Center Borstel, Leibniz Lung Center
- Institute of Medical Microbiology

- Prof. Dr. Ulrich Schaible
- Dr. rer. nat. Dirk Friedrich
- Prof. Dr. rer. nat. Stefan Taube
- Dr. rer. nat. Tobias Dallenga
- Dr. Katarzyna Duda
- Dr. rer. nat. Christoph Hölscher

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:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- None. Regular and successful participation in the teaching module (lecture), apart from self-study, is strongly recommended as a solid preparation for the exam.

Module Exam(s):
- LS4015-L1 Infection Biology 1, written exam, 90 min, 100% of module grade.

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 CLS 2023 (Module part of a compulsory module), MML with specialization in Life Science, 3rd semester
- Master Infection Biology 2018 (Module part of a compulsory module), Infection Biology, 1st semester
- Master Infection Biology 2012 (Module part of a compulsory module), Infection Biology, 1st semester
- Master Biophysics 2019 (Module part of a compulsory module), biophysics, 1st semester
- Master CLS 2016 (Module part of a compulsory module), MML with specialization in Life Science, 3rd semester
- Master MLS 2018 (Module part of a compulsory module), life sciences, 1st semester
- Master MLS 2016 (Module part of a compulsory module), life sciences, 1st semester

Classes and lectures:

- LS4021-V: 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:

- Siehe Hauptmodul

Teacher:

- Institute of Biochemistry
- Dr. math. et dis. nat. Jeroen Mesters

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
- LS4026-KP06 start in 2023

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

It is a compulsory module part for the Master MLS with a focus on structural biology.

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 CLS 2023 (Module part of a compulsory module), MML with specialization in Life Science, 3rd semester
- Master MLS 2018 (Module part of a compulsory module), structure biology, 1st semester
- Master Infection Biology 2018 (Module part of a compulsory module), Interdisciplinary modules, 1st semester
- Master Biophysics 2019 (Module part of a compulsory module), biophysics, 1st semester
- Master CLS 2016 (Module part of a compulsory module), MML with specialization in Life Science, 3rd semester
- Master MLS 2016 (Module part of a compulsory module), structure biology, 1st semester
- Master Infection Biology 2012 (Module part of a compulsory module), Interdisciplinary modules, 1st semester
- Master CLS 2010 (module part), computational life science / life sciences, 3rd semester
- Master MLS 2009 (Module part of a compulsory module), 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:

- Students are able to assign and analyze complex NMR spectra
- Understanding of NMR experiments based on the product operator formalism
- Students are able to analyze structure and dynamics of proteins through NMR experiments

Grading through:

- see Notes

Responsible for this module:

- Prof. Dr. rer. nat. Ulrich Günther

Teacher:

- Institute of Chemistry and Metabolomics
- Prof. Dr. rer. nat. Ulrich Günther
- Dr. Alvaro Mallagaray

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
- LS4027-KP06 start 2023

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 CLS 2023 (Module part of a compulsory module), computational life science / life sciences, 3rd semester
- Master MLS 2018 (Module part of a compulsory module), structure biology, 1st semester
- Master Infection Biology 2018 (Module part of a compulsory module), Interdisciplinary modules, 1st semester
- Master Biophysics 2019 (Module part of a compulsory module), biophysics, 1st semester
- Master CLS 2016 (Module part of a compulsory module), MML with specialization in Life Science, 3rd semester
- Master MLS 2016 (Module part of a compulsory module), structure biology, 1st semester
- Master Infection Biology 2012 (Module part of a compulsory module), Interdisciplinary modules, 1st semester
- Master CLS 2010 (module part), computational life science / life sciences, 3rd semester
- Master MLS 2009 (Module part of a compulsory module), 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
- LS4027-KP06 start 2023

This module part is identical to LS4020 C-MIW without seminar.

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 CLS 2023 (Module part of a compulsory module), MML with specialization in Life Science, 3rd semester
- Master MLS 2018 (Module part of a compulsory module), structure biology, 1st semester
- Master Infection Biology 2018 (Module part of a compulsory module), Interdisciplinary modules, 1st semester
- Master Biophysics 2019 (Module part of a compulsory module), biophysics, 1st semester
- Master CLS 2016 (Module part of a compulsory module), MML with specialization in Life Science, 3rd semester
- Master MLS 2016 (Module part of a compulsory module), structure biology, 1st semester
- Master Infection Biology 2012 (Module part of a compulsory module), Interdisciplinary modules, 1st semester
- Master CLS 2010 (module part), computational life science / life sciences, 3rd semester

Classes and lectures:

- LS4027-V Optical Methods (lecture, 2 SWS)

Workload:

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

Contents of teaching:

- Basic principles of optics
- Light sources and detectors
- Classical light microscopy
- Photophysics, fluorescence microscopy
- Confocal microscopy
- Nonlinear microscopy
- Fluorescent dyes; GFP and genetically encoded fluorescent markers; live cell/intravital imaging: important experimental parameters
- Protein-protein interactions in living cells: FRET, FLIM; biosensors
- Photoactivatable/switchable fluorescent proteins; fluorescent timers
- Optogenetics: Cell manipulation by light
- Super-resolution 3D fluorescence microscopy: STED, PALM, STORM
- Optical tweezers as instrument for nanomanipulation
- Visualization and quantitative evaluation; data format and data storage media
- In vivo imaging in tissues and living animals
- Bioluminescence and optoacoustic imaging
- Flow cytometry & fluorescence activated cell sorting
- High-content screening; optical sensor technology
- Technologies under development

Qualification-goals/Competencies:

- Students acquire professional competence in basic principles and concepts of optics.
- Students know the basics of light and fluorescence microscopy.
- They know and understand the most important methods for marking and microscopic visualization of proteins and sub-cellular structures.
- Students know the possible applications of live cell microscopy, intravital imaging, and quantitative fluorescence techniques in biological questions.
- They know basic techniques of 3-dimensional optical imaging of tissues and animals.
- Student are familiar with current research topics in the field of optical methods in the life sciences and are able to evaluate them in terms of their application maturity and potential.
- Students can classify optical methods according to their complexity and outline possible applications.
- The students have the social and communication skills to discuss given questions within group work for lecture preparation and lecture follow-up.

Grading through:

- written exam

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institute of Biomedical Optics

- Prof. Dr. rer. nat. Gereon Hüttmann
- Prof. Dr. rer. nat. Sebastian Karpf
- Dr. rer. nat. Norbert Linz
- Prof. Dr. rer. nat. Robert Huber

Literature:

- J. B. Pawley, ed.: Handbook of Biological Confocal Microscopy, Springer
- V. V. Tučin: Handbook of optical biomedical diagnostics, SPIE Press
- L. V. Wang, and H.-i. Wu: Biomedical optics principles and imaging, Wiley
- :
- :
- :

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
- LS4026-KP06 start 2023

(Share of Institute of Biomedical Optics to this lecture is 100%)

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 2023 (compulsory), Interdisciplinary modules, 1st semester
- Master Infection Biology 2018 (compulsory), Interdisciplinary modules, 1st semester
- Master Infection Biology 2012 (compulsory), Interdisciplinary modules, 1st semester

Classes and lectures:

- LS4021-V: Crystallography (lecture, 2 SWS)
- LS4022-V: Single Molecule Methods (lecture, 2 SWS)
- LS4024-V: NMR-Spectroscopy (lecture, 2 SWS)
- LS4027-V: Optical Methods (lecture, 2 SWS)
- LS4131-V: Basics of Membrane Biophysics (lecture, 2 SWS)
- LS4135-V: Physics of Proteins (lecture, 2 SWS)

Workload:

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

Contents of teaching:

- See module parts LS4020 A bis FStarting 2023, see module LS4026 and LS4027

Qualification-goals/Competencies:

- See module parts LS4020 A bis FStarting 2023, see module LS4026 and LS4027

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Christian Hübner

Teacher:

- Institute of Biomedical Optics
- Research Center Borstel, Leibniz Lung Center
- Institute of Physics
- Institute of Biochemistry
- Institute of Chemistry and Metabolomics

- Dr. math. et dis. nat. Jeroen Mesters
- Prof. Dr. rer. nat. Thomas Peters
- Prof. Dr. rer. nat. Ulrich Günther
- Dr. Alvaro Mallagaray
- Prof. Dr. rer. nat. Christian Hübner
- Prof. Dr. rer. nat. Gereon Hüttmann
- Prof. Dr. rer. nat. Sebastian Karpf
- Dr. rer. nat. Norbert Linz
- Dr. rer. nat. Fred Reinholz
- Prof. Dr. rer. nat. Robert Huber
- Prof. Dr. rer. nat. Thomas Gutsmann
- Prof. Dr. rer. nat. Andra Schromm
- PD Dr. rer. nat. Hauke Paulsen

Language:

- offered only in English

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- None

Elective:
- 2 courses in total from LS4021-V, LS4022-V, LS4024-V, LS4027-V, LS4131-V, LS4135-V

Module Exam(s):
- LS4021-L1: Structure Analysis, written exam, 120 min, 100% of module grade
- If more than 2 of the required module parts are taken and passed, the two best intermediate results are averaged to calculate the overall module grade

4 Exercises in crystallography, 2 hours each, will be offered in addition to the lecture. Dates will be assigned at the beginning of the semester.

Formerly module LS4020-IB

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 2018 (compulsory), Clinical Aspects, 1st semester
- Master Infection Biology 2012 (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:

- Research Center Borstel, Leibniz Lung Center
- Medical Clinic I
- Institute of Medical Microbiology
- Department of Infectiology

- Prof. Dr. med. Jan Rupp
- Prof. Dr. med. Dennis Nurjadi
- Dr. rer. nat. Dirk Friedrich
- Dr. rer. nat. Sebastien Boutin
- Dr. med. Frederike Waldeck
- Dr. med. Benjamin Gebel
- PD Dr. med. Philipp Solbach
- Dr. med. Christian Herzmann
- Dr. med. Claudia Jafari

Literature:

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

Language:

- offered only in English

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- Regular and successful participation in the teaching module (lecture)

Module Exam(s):
- LS4025-L1: Clinical Aspects of Infection, written exam, 60 min, 100% of the module grade

(Share of Klinik für Infektiologie und Mikrobiologie in V is 60%)
(Share of Medizinische Klinik I in V is 20%)
(Share of Borstel in V is 20%)

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 2018 (compulsory), Infection Biology, 1st semester
- Master Infection Biology 2012 (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. rer. nat. Christian Karsten

Teacher:

- Institute of Virology and Cell Biology
- Institute of Medical Microbiology
- Department of Infectiology
- Institute for Systemic Inflammation Research (ISEF)
- Research Center Borstel, Leibniz Lung Center

- Prof. Dr. rer. nat. Christian Karsten
- Prof. Dr. rer. nat. Rudolf Manz
- PD Dr. rer. nat. Yves Laumonnier

- Prof. Dr. med. Jörg Köhl
- PD Dr. rer. nat. Norbert Reiling
- Prof. Dr. rer. nat. Norbert Tautz
- Prof. Dr. rer. nat. Stefan Taube
- Dr. rer. nat. Christoph Hölscher
- Dr. rer. nat. Dirk Friedrich

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-KP05 - Diagnostical Methods in Microbiology and Pathology (DiagMiPat)

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

Course of study, specific field and term:

- Master Infection Biology 2023 (compulsory), Clinical Aspects, 1st semester
- Master Infection Biology 2018 (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)

Workload:

- 90 Hours private studies
- 60 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
- 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:

- written exam

Is requisite for:

- Infection Biology 2 (LS4145-KP05)

Responsible for this module:

- Prof. Dr. med. Jan Rupp

Teacher:

- Department of Pathology
- Institute of Virology and Cell Biology
- Institute of Nutrition Medicine
- Institute of Medical Microbiology
- Department of Infectiology
- Research Center Borstel, Leibniz Lung Center

- Prof. Dr. med. Jan Rupp
- PD Dr. Kensuke Shima
- Prof. Dr. rer. nat. Stefan Taube
- Prof. Dr. rer. nat. Marc Ehlers
- Dr. rer. nat. Simon Graspeuntner
- Dr. rer. nat. Dirk Friedrich
- Prof. Dr. rer. nat. Torsten Goldmann

- Dr. med. Rosemarie Krupar
- Prof. Dr. med. Florian Maurer
- Dr. Sönke Andres
- Prof. Dr. med. Dennis Nurjadi
- Dr. rer. nat. Sebastien Boutin

Literature:

- n.n.: Current scientific literature

Language:

- offered only in English

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- LS4045-P: Regular participation (85%) in the pratical

Module Exam(s):
- LS4045-L1: Diagnostical Methods in Microbiology and Pathology, written exam, 90 min, 50% of module grade
- LS4045-L2: Diagnostical Methods in Microbiology and Pathology, graded protocol plus written exam, 90 min, 50% of module grade

If both parts are passed successfully, the final grade is calculated

PS4611-KP07 - Ethics in Sciences / Scientific Writing (EthScWrIB)

Duration:	Turnus of offer:	Credit points:
1 Semester	on request	7

Course of study, specific field and term:

- Master Infection Biology 2023 (compulsory), interdisciplinary, 2nd and 3rd semester
- Master Infection Biology 2018 (compulsory), interdisciplinary, 2nd and 3rd semester

Classes and lectures:

- PS4621-S: Ethics in Infection Biology and Public Health (only offered in the SS) (seminar and project work, 2 SWS)
- PS4611-S Scientific Writing (only offered in the WS) (seminar and project work, 2 SWS)

Workload:

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

Contents of teaching:

- Societal and ethical implications of research and practice in infection biology and public health
- Basics of philosophy and sociology of science: Basic concepts, methods, models of theory dynamics
- Good scientific practice
- Basics of bioethics: duties of investigators, obligations to colleagues, ethics of clinical research
- Ethics of human subjects research and of animal experiments. Environmental ethics. Governance of technology. Risk assessement
- Use and implications of images in science
- Fundamentals of ethics: basic terms, concepts, aspects of metaethics.
- Basic issues of research ethics and cases from recent debates
- Publication of scientific studies, including structuring and writing of a scientific article, scientific journals and their procedures
- Design of scientific studies from an ethical and statistical viewpoint, ethical approval for animal and human studies
- Peer review process, including critical analysis of publications and studies, post publication peer review
- Scientific misconduct, the legal framework of research, good scientific practice, retractions
- Different forms of scientific writing, including poster and power point presentations or grant applications

Qualification-goals/Competencies:

- You will be able to explain the methodology of the natural sciences in terms of their philosophy of science and theories of science
- You can recognize ethical dimensions of practice and dcision-making.
- You can understand the rules of Good Scientific Practice (GSP) of the University of Lübeck and of the DFG-guidelines and the relevant laws in Germany and abroad.
- You can participate in current discussions in bioethics and research ethics
- You can reflect on ethical dimensions of biomedical sciences, especially of infection biology and of public health
- You can write a structured ethics paper about a self-chosen topic
- The students will be able to critically assess the design of scientific studies, including the ethical, statistical and legal framework
- They can critically assess published work of other authors and discuss the scientific content.
- They can assemble data for a scientific publication and draft the written framework for such a manuscript.

Grading through:

- Essay, talk and written exam

Responsible for this module:

- Prof. Dr. phil. Christoph Rehmann-Sutter

Teacher:

- Institute for Experimental Endocrinology
- Institute for History of Medicine and Science Studies

- Prof. Dr. phil. Christoph Rehmann-Sutter
- Prof. Dr. Jens Mittag

Literature:

- M. J. Selgelid, M. P. Battin, & C. B. Smith (Eds.): Ethics and infectious disease - Oxford, Blackwell 2006
- Ben Mepham: Bioethics. An Introduction for the Biosciences - Oxford: Oxford University Press 2008
- Margaret P. Battin, Leslie P. Francis, Jay A. Jacobson, and Charles B. Smith: The Patient as Victim and Vector: Ethics and Infectious

Disease - Oxford: University Press 2011, 2nd ed.

Language:

- offered only in English

Notes:

PS4621-S Ethics in the Life Sciences only takes place in the SS.
PS4611-S Scientific Writing only takes place in the WS

Prerequisites for the module:
- nothing

Prerequisites for admission to the written examination:
- PS4621-L1: nothing
- PS4611-L1: nothing

Module exam:
- PS4621-L1: Ethics in Infection Biology and Pulic Health, oral presentation (seminar) including an essay, 0 % module grade
- PS4611-L1: Scientific Writing,, term paper must be passed, ungraded

LS4020 E - Module part: 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 2018 (Module part of a compulsory module), Interdisciplinary modules, 2nd semester
- Master Infection Biology 2012 (Module part of a compulsory module), 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, Leibniz Lung Center
- Prof. Dr. rer. nat. Thomas Gutsmann
- Prof. 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 LS4020 F: 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 2018 (Module part of a compulsory module), Interdisciplinary modules, 2nd semester
- Master Infection Biology 2012 (Module part of a compulsory module), 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 2023 (compulsory), Infection Biology, 2nd semester
- Master Infection Biology 2018 (compulsory), Infection Biology, 2nd semester
- Master Infection Biology 2012 (compulsory), Infection Biology, 2nd semester

Classes and lectures:

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

Workload:

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

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)
- Aseptic techniques
- Basic knowledge in genetic engineering and legislation, in Good Scientific Practis with regards to teh rules of the UzL.
- Laboratory safety (GHS)
- 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 with regards to teh rules of Good Scientific Practise of the UzL.
- 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:

- Oral examination

Is requisite for:

- Internship (LS4115-KP16)

Requires:

- Diagnostical Methods in Microbiology and Pathology (LS4045-KP05)
- Infection Biology 1 (LS4015-KP06)

Responsible for this module:

- Prof. Dr. rer. nat. Stefan Taube

Teacher:

- Department of Infectiology
- Institute for Systemic Inflammation Research (ISEF)
- Institute of Virology and Cell Biology
- Research Center Borstel, Leibniz Lung Center
- Institute of Medical Microbiology

- Prof. Dr. Ulrich Schaible
- Prof. Ph.D. Tamás Laskay
- Prof. Dr. rer. nat. Christian Karsten
- PD Dr. rer. nat. Norbert Reiling
- Prof. Dr. rer. nat. Stefan Taube
- Dr. math. et dis. nat. Jeroen Mesters
- Dr. rer. nat. Tobias Dallenga

Literature:

- S.J. Flint: Principles of Virology Vol I and II - ASM Press, Washington DC
- Mims' Pathogenesis of Infectious Disease.: Academic Press. Ed. Nash, Dalziel, Fitzgerald
- Carter, J., & Saunders, V. A.: Virology: principles and applications. 2007 - John Wiley & Sons.

Language:

- offered only in English

Notes:

Prerequisites for the module:
- LS4045-KP05 Diagnostical Methods in Microbiology and Pathology
- LS4015-KP06 Infection Biology 1
- Participation in the Biological Safety Instruction is mandatory

Prerequisites for admission to the examination:
- Regular and successful attendance is strongly recommended in addition to independent study as solid preparation for the oral examination.

Module Exam(s):
- LS4145-L1 Infection Biology 2: The module will be graded by means of a 30-minute oral examination at the end of the practical, where students will present their own data. Both theoretical and practical knowledge will be assessed. 100% of the module grade.

If the oral examination is not passed succesfully, he/she will have to repeat the whole 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 2023 (compulsory), Clinical Aspects, 2nd semester
- Master Infection Biology 2018 (compulsory), Clinical Aspects, 2nd semester
- Master Infection Biology 2012 (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 including potential and limitations
- Concepts in drug design and alternative strategies
- The problem of drug resistance and future challenges
- Selected examples: antibacterials (antibiotics), antivirals (e.g., targeting HCV, HIV or Herpes viruses), antifungals (e.g. antimycotics and Candida albicans).
- Vaccination strategies: pathogen niches and immunity
- Types of vaccines / examples of vaccines
- Epitopes, vaccine carriers, adjuvants

Qualification-goals/Competencies:

- Students obtain competence in the different concepts of antimicrobial therapies and prophylaxes (directed against: bacteria, viruses, fungi)
- Students learn to illustrate these approaches with the aid of appropriate examples
- Students are able to assess the potential and the limitation of a given therapy concept
- Students can critically discuss alternative strategies
- Students acquire the competence to present and critically discuss the general concepts of anti-microbial prophylaxis and relevant examples for infectious diseases (e.g., vaccination).

Grading through:

- written exam
- Marked presentation

Responsible for this module:

- Prof. Dr. Thomas Krey

Teacher:

- Institute of Biochemistry
- Research Center Borstel, Leibniz Lung Center

- Prof. Dr. Thomas Krey
- PD Dr. rer. nat. Guido Hansen
- Dr. rer. nat. Nicolas Gisch
- Dr. rer. nat. Tobias Dallenga

Literature:

- n.n.: Recent review articles

Language:

- offered only in English

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- LS4155: Regular participation in seminars (85%)

Module Examination(s):
- LS4155-L1: Anti-microbial therapies, written exam, 90 min, 67% of module grade
- LS4155-L2: Vaccination strategies, graded seminar presentation, 30 min, 33% of module grade

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 2023 (compulsory), Infection Biology, 2nd semester
- Master Infection Biology 2018 (compulsory), Infection Biology, 2nd semester
- Master Infection Biology 2012 (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:

- written exam

Responsible for this module:

- Dr. rer. nat. Christoph Hölscher

Teacher:

- Department of Infectiology
- Institute for Systemic Inflammation Research (ISEF)
- Institute of Virology and Cell Biology
- Research Center Borstel, Leibniz Lung Center
- Institute of Medical Microbiology

- Dr. rer. nat. Christoph Hölscher
- Prof. Ph.D. Tamás Laskay
- Prof. Dr. rer. nat. Stefan Taube
- PD Dr. rer. nat. Norbert Reiling
- Dr. rer. nat. Bianca Schneider
- Dr. Kerstin Walter
- Dr.rer.nat. Christian Karsten
- Dr. rer. nat. Matthias Hauptmann
- Dr. rer. nat. Kristina Ritter
- Dr. rer. nat. Anke Osterloh

Language:

- offered only in English

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- Regular (85%) and successful participation in seminar and lab.

Module Examination(s):
- LS4165-L1: Model Systems of Infection, written exam, 90 min, 50% of the module grade; seminar paper and practical each 25% of the module grade.

Regular attendance of the lecture, apart from self-study, is strongly recommended as a solid preparation for the written exam.

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 2018 (Module part of a compulsory module), Microbiology, 2nd semester
- Master Infection Biology 2012 (Module part of a compulsory module), Microbiology, 2nd semester
- Master Infection Biology 2023 (Module part of a compulsory module), 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 2018 (Module part of a compulsory module), Microbiology, 2nd semester
- Master Infection Biology 2012 (Module part of a compulsory module), Microbiology, 2nd semester
- Master Infection Biology 2023 (Module part of a compulsory module), 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, Leibniz Lung Center

- 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 2018 (Module part of a compulsory module), Microbiology, 2nd semester
- Master Infection Biology 2012 (Module part of a compulsory module), Microbiology, 2nd semester
- Master Infection Biology 2023 (Module part of a compulsory module), 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, Leibniz Lung Center
- 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 2018 (Module part of a compulsory module), Microbiology, 2nd semester
- Master Infection Biology 2012 (Module part of a compulsory module), Microbiology, 2nd semester
- Master Infection Biology 2023 (Module part of a compulsory module), 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:

- LIED | Lübecker Institut für experimentelle Dermatologie (Lübeck Institute of Experimental Dermatology)
- 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
- PD 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 2023 (optional subject), Microbiology, 2nd semester
- Master Infection Biology 2018 (compulsory), Microbiology, 2nd semester
- Master Infection Biology 2012 (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:

- Department of Infectiology
- Research Center Borstel, Leibniz Lung Center
- Institute for Systemic Inflammation Research (ISEF)
- Institute of Virology and Cell Biology
- Institute of Medical Microbiology

- Prof. Dr. rer. nat. Stefan Taube
- Priv.-Doz. Dr. rer. nat. Sven Müller-Loennies
- Dr. rer. nat. Bianca Schneider
- Dr. rer. nat. Matthias Hauptmann
- Prof. Dr. rer. nat. Christian Karsten
- PD Dr. rer. nat. Yves Laumonnier
- Prof. Dr. rer. nat. Marc Ehlers
- Prof. Dr. Admar Verschoor
- Prof. Dr. rer. nat. Rudolf Manz
- Dr. rer. nat. Anke Fähnrich

Literature:

- Recent scientific papers: 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.

Prerequisites for the module:
- nothing

Prerequisites for admission to the written examination:
- Regular (85%) and succesful participation in two of the modulparts.

Module exam:
- LS4175-L1: Medical Microbiology: seminar presentations and discussion of two modulparts; each 50 % module grade

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

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 2018 (Module part of a compulsory module), Microbiology, 2nd semester
- Master Infection Biology 2012 (Module part of a compulsory module), Microbiology, 2nd semester

Classes and lectures:

- Analysis of Host Pathogen Interaction (seminar, 1 SWS)
- Analysis of Host Pathogen Interaction (practical course, 1 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, Leibniz Lung Center

- 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 and LS4037-KP06.

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 2018 (Module part of a compulsory module), Microbiology, 2nd semester
- Master Infection Biology 2012 (Module part of a compulsory module), 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
- Prof. 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 2018 (compulsory), Microbiology, 2nd semester
- Master Infection Biology 2012 (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:

- 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, Leibniz Lung Center
- 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).

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 2023 (compulsory), Infection Biology, 3rd and 4th semester
- Master Infection Biology 2018 (compulsory), Infection Biology, 3rd and 4th semester
- Master Infection Biology 2012 (compulsory), Infection Biology, 3rd and 4th semester

Classes and lectures:

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

Workload:

- 900 Hours research for and write up of a thesis

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, Leibniz Lung Center
- Alle prüfungsberechtigten Dozentinnen/Dozenten des Studienganges

Literature:

- Topical literature about the subject:

Language:

- offered only in English

Notes:

Prerequisites for the module:
- Minimum of 70 ECTS
- At least one out of the three courses, block internship 1, block internship 2 and the master's thesis, must be carried out at the University of Lübeck, The University Clinic (UKSH), the Research Center Borstel, or the Frauenhofer IMTE.

Prerequisites for admission to the written examination:
- succesful work on the subject

Module exam:
- LS5995-L1: Master Thesis in IB, written thesis, 66,66 % module grade
- LS5995-L2: Colloquium about the thesis in IB, oral defend, 60 min (20 min oral presentation), 33,33 % module grade (the arithmetic mean of the two examinators)

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.

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 2023 (optional subject), Microbiology, 3rd semester
- Master Infection Biology 2018 (optional subject), Microbiology, 3rd semester
- Master Infection Biology 2012 (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 the two parts of the block internship, two different skills from the listed competencies are to be acquired. One part of the internship parts must cover at least 12 weeks, the second part can last 8 to 10 weeks. A total of 22 weeks of full-time practical work must be completed.
- 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
- Students work hands on and with minor supervision obliging legal regulations and safety guidelines including o laboratory safety and hygieneo hazardous substances o biological agents o genetically modified agents

Grading through:

- oral presentation
- Poster

Is requisite for:

- Master Thesis Infection Biology (LS5995-KP30)

Requires:

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

Responsible for this module:

- Prof. Dr. rer. nat. Stefan Taube

Teacher:

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

Literature:

- provided scientific papaeer: Self-study, independent literature search

Language:

- offered only in English

Notes:

Admission requirements for taking the module:
- LS4015-KP06
- LS4145-KP05
- LS4045-KP05

Admission requirements for taking module examination(s):
- Block practicals must be approved by Prof. Taube 4 weeks prior to commencement.
- Regular participation (85%) in block practicals which may be carried out at the University of Lübeck, other universities in Germany and abroad, research institutions or industrial companies.
- At least one out of the three courses, block internship 1, block internship 2 and the master's thesis, must be carried out at the University of Lübeck, The University Clinic (UKSH), the Research Center Borstel, or the Frauenhofer IMTE.

Module Exam(s):
- LS4115-L1 Block practical: one oral presentation for one of the internships with two examinators ; 30 min; 50% of final grade
-LS4115-L2 Block practical: one poster presentation for one of the internships; 2 examinators, each 30 min, each examinator 25 % of final grade

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 2023 (compulsory), Interdisciplinary modules, 3rd semester
- Master Infection Biology 2018 (compulsory), Interdisciplinary modules, 3rd semester
- Master Infection Biology 2012 (compulsory), Interdisciplinary modules, 3rd semester

Classes and lectures:

- Consolidation Course 1 (seminar, 1 SWS)
- Consolidation Course 1 (practical course, 1 SWS)
- Consolidation Course 2 (seminar, 1 SWS)
- Consolidation Course 2 (practical course, 1 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, Leibniz Lung Center
- All institutes of the University of Lübeck
- Alle Dozentinnen/Dozenten der UzL

Literature:

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

Language:

- offered only in English

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- None

Module examination(s):
- LS5205-L1: Regular and successful participation (min. 85%) in 2 consolidation courses is a prerequisite for obtaining the B certificate.

Ungraded module.