



UNIVERSITÄT ZU LÜBECK

Module Guide for the Study Path

# Bachelor Molecular Life Science 2024

Version from 1. October 2025



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**ME1025 - Exercises Physics 1 and Physics 2 (UePhy1u2)**
**Duration:**

2 Semester

**Turnus of offer:**

each semester

**Credit points:**

4

**Course of study, specific field and term:**

- Bachelor MLS 2018 (optional subject), physics, 1st and 2nd semester
- Bachelor Molecular Life Science 2024 (optional subject), physics, 1st and 2nd semester
- Bachelor MLS 2009 (optional subject), physics, 1st and 2nd semester

**Classes and lectures:**

- Exercises Physics 1 (exercise, 2 SWS)
- Exercises Physics 2 (exercise, 2 SWS)

**Workload:**

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

**Contents of teaching:**

- equivalent to content of the exercises of the modules ME1010 and ME1020

**Qualification-goals/Competencies:**

- You can name the basic laws of physics
- You can measure according to physics rules
- You can explain physical laws based on observations
- You can formally analyze physical problems
- You can judge which concept is best suited to solve a certain problem
- You can design novel physical experiments on your own

**Grading through:**

- participation in discussions

**Responsible for this module:**

- [Prof. Dr. rer. nat. Christian Hübner](#)
- [Prof. Dr. rer. nat. Martin Koch](#)
- [Prof. Dr.-Ing. Maik Rahlves](#)

**Teacher:**

- [Institute of Biomedical Optics](#)
- [Institute of Physics](#)
- [Institute of Medical Engineering](#)
- [Prof. Dr. rer. nat. Thorsten Buzug](#)
- [Prof. Dr. rer. nat. Christian Hübner](#)
- [PD Dr. rer. nat. Hauke Paulsen](#)
- [Prof. Dr. rer. nat. Alfred Vogel](#)

**Literature:**

- Douglas C. Giancoli: Physik

**Language:**

- offered only in German

**Notes:**

For MLS: When this module is selected, the exercises of Physics 1 and Physics 2 must be visited. (Ungraded B certificate)

**LS1000-KP08, LS1000-MLS - Biology 1 (Bio1KP08)**
**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

8

**Course of study, specific field and term:**

- Bachelor CLS 2023 (compulsory), life sciences, 1st semester
- Bachelor Nutritional Medicine 2024 (compulsory), life sciences, 1st semester
- Bachelor Molecular Life Science 2024 (compulsory), life sciences, 1st semester
- Bachelor MLS 2018 (compulsory), life sciences, 1st semester
- Bachelor Nutritional Medicine 2018 (compulsory), life sciences, 1st semester
- Bachelor CLS 2016 (compulsory), life sciences, 1st semester
- Bachelor Nutritional Medicine 2016 (compulsory), life sciences, 1st semester
- Bachelor MLS 2016 (compulsory), life sciences, 1st semester

**Classes and lectures:**

- Basic Biology (lecture, 4 SWS)
- Basic Biology (practical course, 2 SWS)

**Workload:**

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

**Contents of teaching:**

- Lectures:
- Introduction
- Structure and functions of the prokaryotic cell
- Structure of the eukaryotic cells
- Selected topics of multicellular organisation
- Storage, duplication and realization of the hereditary information
- Cell cycle
- Fertilization and development
- Formal and molecular genetics, evolution
- Practical course:
- Individual test Handling of light microscopes
- Structure of prokaryotic cells
- Structure of cells from metazoan
- Human chromosomes
- Cell cycle and mitosis
- Genetics
- Bacteria

**Qualification-goals/Competencies:**

- Improvement of basic knowledge for life-science education
- Ability to understand, reproduce and use in the further studies basics of all areas listed in
- Basal practical skills in light microscopy

**Grading through:**

- written exam (test achievement)

**Responsible for this module:**

- Prof. Dr. rer. nat. Enno Hartmann

**Teacher:**

- [Institute for Biology](#)
- Prof. Dr. rer. nat. Enno Hartmann
- [Prof. Dr. rer. nat. Rainer Duden](#)
- PD Dr. rer. nat. Kai-Uwe Kalies
- [PD Dr. rer. nat. Bärbel Kunze](#)

**Literature:**

- : Cambell Biology



**Language:**

- offered only in German

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**Notes:**

Admission requirements for taking the module:

- None

Admission requirements for participation in module examination(s):

- Successful participation in practical course

Module exam(s):

- LS1000-L1: Biology 1, written exam, 90 min, 100% of module grade

See also HM1-10050.

**LS1100-KP10, LS1100-MLS - General Chemistry (ACKP10)**

<b>Duration:</b>	<b>Turnus of offer:</b>	<b>Credit points:</b>	<b>Max. group size:</b>
1 Semester	each winter semester	10	40

**Course of study, specific field and term:**

- Bachelor Nutritional Medicine 2024 (compulsory), Chemistry, 1st semester
- Bachelor Molecular Life Science 2024 (compulsory), Chemistry, 1st semester
- Bachelor MLS 2018 (compulsory), life sciences, 1st semester
- Bachelor Nutritional Medicine 2018 (compulsory), life sciences, 1st semester
- Bachelor MLS 2016 (compulsory), life sciences, 1st semester
- Bachelor Nutritional Medicine 2016 (compulsory), life sciences, 1st semester

**Classes and lectures:**

- General Chemistry (lecture, 3 SWS)
- General Chemistry (exercise, 1 SWS)
- General Chemistry (practical course, 4 SWS)

**Workload:**

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

**Contents of teaching:**

- Lectures: Roles of Environmental and Health-Safety and the guidelines of the GSP
- The structure of atoms and the periodic table of the elements
- Chemical bonds, molecules and ions
- Reaction equations and stoichiometry
- The three-dimensional structure of molecules: From the VSEPR model to molecular orbitals
- Special properties of water
- Chemical equilibrium
- Acids and bases
- Redox reactions and electrochemistry
- Complexes and metal-ligand bonds
- Interactions between matter and radiation - Molecular spectroscopy
- Thermodynamics
- Chemical kinetics
- Exercises:
- Students discuss problems covering all topics of the lectures on the black board
- Practical course:
- Students work self-actingly and independently with respect to the environment and occupational health and safety in the handling of hazardous materials (according to the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) and with regard to the rules of GSP of the University of Lübeck and of the DFG-guidelines). Topics:
- Basics principles and laboratory techniques
- Salts and their aqueous solutions
- Acids, bases and buffer
- Redox reactions
- Catalysis, metal-ligand complexes and chemical equilibrium
- Laboratory test

**Qualification-goals/Competencies:**

- Students have a fundamental knowledge of general and inorganic chemistry, as well as a primary knowledge of the properties of inorganic materials.
- They understand the fundamental concepts of general and inorganic chemistry and can apply them to reactions and general scientific topics.
- Because of their self-acting and independent work in the practical course they have fundamental practical skills to perform simple experiments and analyzes in the chemical laboratory, with respect to the environment and occupational health and safety in the handling of hazardous materials (according to the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) and with regard to the rules of Good Scientific Practice (GSP) of the University of Lübeck and of the DFG-guidelines).
- Students are able to perform chemical calculations from all subareas of the course.
- They are able to observe, document, interpret and present results from basic chemical experiments and analyzes (laboratory notebook, written protocol, oral examination) with regard to the roles of GSP of the University of Lübeck and of the DFG-guidelines. This includes the self-dependent handling of scientific topics with regard to their chemical backgrounds.
- They have team competence in laboratory work as well as in writing and communication.

- Students can transfer the acquired knowledge to problems of other branches in chemistry and related sciences and are thus able to participate in continuative courses.

**Grading through:**

- written exam

**Is requisite for:**

- Organic Chemistry (LS1601-KP12)
- Organic Chemistry (LS1600-KP10, LS1600-MLS)

**Responsible for this module:**

- PD Dr. phil. nat. Thomas Weimar

**Teacher:**

- [Institute of Chemistry and Metabolomics](#)
- PD Dr. phil. nat. Thomas Weimar
- Prof. Dr. rer. nat. Karsten Seeger
- Dr. rer. nat. Thorsten Biet

**Literature:**

- Brown et.al.: Chemie studieren kompakt - Pearson Studium
- Binnewies et al.: Allgemeine und Anorganische Chemie - Spektrum Verlag

**Language:**

- offered only in German

**Notes:**

Prerequisites for the modul:  
- nothing

Prerequisites for admission to the written examination:  
- succesful participation in the practical course with all tests.

Modul exam:  
- LS1100-L1: General Chemistry, written exam, 90 min, 100% modul grade

Prerequisite for the participation in the practical course is  
the participation in the general health and safety briefing.

Everybody needs the physical conditions to work independently and self-acting in the chemical laboratory.  
See also HM1-10060.

<b>MA2000-KP09 - Analysis 1 (Ana1KP09)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter semester	<b>Credit points:</b> 9
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Molecular Life Science 2024 (compulsory), mathematics / computer science, 1st semester</li> <li>• Bachelor MLS 2018 (compulsory), life sciences, 1st semester</li> <li>• Bachelor MLS 2016 (compulsory), life sciences, 1st semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Analysis 1 (lecture, 4 SWS)</li> <li>• Analysis 1 (exercise, 3 SWS)</li> </ul>	<b>Workload:</b> <ul style="list-style-type: none"> <li>• 140 Hours private studies</li> <li>• 105 Hours in-classroom work</li> <li>• 25 Hours exam preparation</li> </ul>	
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Sequences and series</li> <li>• Functions and continuity</li> <li>• Differentiability, Taylor series</li> <li>• Metric and normalized spaces, basic topological concepts</li> <li>• Multivariate differential calculus</li> <li>• Basic knowledge of linear algebra</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• Students understand the basic terms of analysis, especially the concept of convergence.</li> <li>• Students understand the basic thoughts and proof techniques.</li> <li>• Students can explain basic relationships in analysis.</li> <li>• Students can apply the basic concepts and proof techniques.</li> <li>• Students have an understanding for abstract structures.</li> <li>• Interdisciplinary qualifications:</li> <li>• Students have a basic competence in modeling.</li> <li>• Students can transfer theoretical concepts to similar applications.</li> <li>• Students can work as a group on elementary mathematical problems.</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• written exam</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr. rer. nat. Jürgen Prestin</a></li> </ul> <b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute for Mathematics</a></li> <li>• <a href="#">Prof. Dr. rer. nat. Jürgen Prestin</a></li> <li>• <a href="#">PD Dr. rer. nat. Jörn Schnieder</a></li> <li>• <a href="#">PD Dr. rer. nat. Christian Bey</a></li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• K. Fritzsche: Grundkurs Analysis 1 + 2</li> <li>• H. Heuser: Lehrbuch der Analysis 1 + 2</li> <li>• K. Burg, H. Haf, F. Wille, A. Meister: Höhere Mathematik für Ingenieure</li> <li>• R. Lasser, F. Hofmaier: Analysis 1 + 2</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• offered only in German</li> </ul>		
<b>Notes:</b>		



Prerequisites for attending the module:

- None

Prerequisites for the written exam:

- Successful completion of homework assignments during the semester
- Successful completion of e-tests

Modul exam:

MA2000-L1: Analysis 1, written exam, 90 min, 100 % module grade

**ME1010-KP06, ME1010-MLS - Physics 1 (Physik1KP6)**
**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

6

**Course of study, specific field and term:**

- Bachelor Molecular Life Science 2024 (compulsory), physics, 1st semester
- Bachelor MLS 2018 (compulsory), life sciences, 1st semester
- Bachelor MLS 2016 (compulsory), life sciences, 1st semester
- Bachelor MLS 2009 (compulsory), life sciences, 1st semester

**Classes and lectures:**

- Physics 1 (lecture, 4 SWS)

**Workload:**

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

**Contents of teaching:**

- Physical values, units, accuracy, measurement errors
- Mathematical methods and notations
- Kinematics of point mass, Newton's Axioms, contact forces, modulus, virtual forces, Newton's equation of motion, differential equations
- Work and energy, power and efficiency, momentum, inertia, physical pendulum, momentum of rotation
- Conservation laws and symmetries
- Gravitation, oscillation, waves, acoustics, Doppler effect
- Resting and flowing gases and liquids, effects of surfaces and interfaces
- Temperature, thermometer, therm. expansion, state equations, kinetic gas theory
- Van-der-Waals state equation, heat capacity, heat conduction, 1st law of thermodynamics, volume work, p-V diagram
- Adiabatic processes, 2nd law of thermodynamics, thermal engines and Carnot cycle, efficiency, heat pump
- Entropy, disorder and probability, 3rd law of thermodynamics

**Qualification-goals/Competencies:**

- You can name the basic laws of physics
- You can measure according to physics rules
- You can explain physical laws based on observations
- You can formally analyze physical problems
- You can judge which concept is best suited to solve a certain problem
- You can design novel physical experiments on your own

**Grading through:**

- written exam

**Responsible for this module:**

- [Prof. Dr. rer. nat. Christian Hübner](#)

**Teacher:**

- [Institute of Biomedical Optics](#)
- [Institute of Medical Engineering](#)
- [Institute of Physics](#)
- [Prof. Dr. rer. nat. Robert Huber](#)
- [Prof. Dr. rer. nat. Christian Hübner](#)
- [PD Dr. rer. nat. Hauke Paulsen](#)
- [Prof. Dr. rer. nat. Martin Koch](#)
- [Prof. Dr.-Ing. Maik Rahlves](#)

**Literature:**

- Douglas C. Giancoli: Physik

**Language:**

- offered only in German



**Notes:**

Prerequisites for the modul:

- nothing

Prerequisites for admission to the written examination:

- nothing

Modul exam:

- ME1010-L1: Physics 1, written exam, 90 min, 100 % modul grade

<b>LS1500-KP06, LS1500 - Biology 2 (Bio2)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each summer semester	<b>Credit points:</b> 6
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Molecular Life Science 2024 (compulsory), life sciences, 2nd semester</li> <li>• Bachelor MLS 2018 (compulsory), life sciences, 2nd semester</li> <li>• Bachelor MLS 2016 (compulsory), life sciences, 2nd semester</li> <li>• Bachelor MLS 2009 (compulsory), life sciences, 2nd semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Genetics (lecture, 2 SWS)</li> <li>• Histology (lecture, 1 SWS)</li> <li>• Histology (practical course, 2 SWS)</li> </ul>	<b>Workload:</b> <ul style="list-style-type: none"> <li>• 105 Hours private studies</li> <li>• 75 Hours in-classroom work</li> </ul>	
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Part A Genetics: a) Bacterial Genetics The bacterial cell</li> <li>• Cell division and replication of the bacterial chromosome</li> <li>• Gene organization and gene expression</li> <li>• Bacterial pathogenicity factors</li> <li>• Mutations in bacteria</li> <li>• Accessory genetic elements and gene transfer mechanisms</li> <li>•</li> <li>• b) Human Genetics</li> <li>• Cytogenetics</li> <li>• Inheritances and definitions</li> <li>• Mutations</li> <li>• Trinucleotide repeat expansions (TRE)</li> <li>• Epigenetics</li> <li>• Molecular pathology</li> <li>• Part B Histology: Lecture: Preparation of tissue specimen</li> <li>• General microscopy</li> <li>• Epithelium, glands</li> <li>• Connective tissues</li> <li>• Cartilage and bone</li> <li>• Muscle</li> <li>• Neural tissue</li> <li>• Skin</li> <li>• Blood, vascular system and bone marrow</li> <li>• Lymphatic organs</li> <li>• Introduction in immunology</li> <li>• Practical course Microscopy, Histology: Microscopy of cell structure and cell size as taught in the histology lectures. Critical investigation under the microscope. Drawing of the corresponded tissues (from the histology lectures)</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• Part A Genetics: Understanding of the heredity</li> <li>• Mutations and verifc</li> <li>• Bacterial genetics</li> <li>• Part B Histology section:</li> <li>• They can identify different histological stainings</li> <li>• They can explain the structure of tissues containing site-specific cells and extracellular matrix molecules</li> <li>• They can determine the 4 basic tissues and explain their functions</li> <li>• They can explain the process of bone formation and remodeling</li> <li>• They can identify unmatue and mature blood cells</li> <li>• They can describe the structure of lymphatic organs</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• written exam</li> </ul>		



**Responsible for this module:**

- Prof. Dr. rer. nat. Kathrin Kalies

**Teacher:**

- Research Center Borstel, Leibniz Lung Center
- Institute of Human Genetics
- Institute of Anatomy
  
- Prof. Dr. rer. nat. Kathrin Kalies
- Prof. Dr. med. Malte Spielmann
- Prof. Dr. rer. nat. Martin Kircher
- Priv.-Doz. Dr. rer. nat. Sven Müller-Loennies

**Literature:**

- Lüllmann-Rauch: Histologie - Thieme Verlag, Stuttgart
- Jeremy W. Dale, Simon F. Park: Molecular Genetics of Bacteria - Wiley Blackwell
- Larry Snyder, Joseph E. Peters, Tina M. Henkin, Wendy Champness: Molecular Genetics of Bacteria - ASM Books

**Language:**

- offered only in German

**Notes:**

Prerequisites for attending the module:

- None

Prerequisites for the exam:

- Regular and successful participation in the internship, at least 80%

Modul exam:

- LS1500-L1: Biology 2, written exam, 90 min, 100 % module grade (arithmetic mean of the part Genetics and Histology)

**LS1600-KP10, LS1600-MLS - Organic Chemistry (OCKP10)**
**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

10

**Course of study, specific field and term:**

- Bachelor Nutritional Medicine 2024 (compulsory), Chemistry, 2nd semester
- Bachelor Molecular Life Science 2024 (compulsory), Chemistry, 2nd semester
- Bachelor MLS 2018 (compulsory), life sciences, 2nd semester
- Bachelor MLS 2016 (compulsory), life sciences, 2nd semester

**Classes and lectures:**

- Organic Chemistry for MLS (lecture, 3 SWS)
- Organic Chemistry for MLS (exercise, 1 SWS)
- Organic Chemistry for MLS (practical course, 4 SWS)

**Workload:**

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

**Contents of teaching:**

- Lectures:
- Alkanes, cycloalkanes, Alkenes and Alkynes
- Aromatics
- Stereochemistry
- Substitution and elimination reactions
- Alcohols, Phenols and Thiols
- Ether and Epoxides
- Aldehydes and ketones
- Carboxylic acids and derivativs
- Amines and derivativs
- NMR-Spectroscopy and structure analysis
- Heterocycles
- Lipids, Carbohydrates, Amino acids and peptides, Nucleotides and nucleic acids
- Exercises:
- Students discuss problems covering all topics of the lectures on the black board
- Practical course:
- Students work self-actingly and independently in a chemical laboratory with regard to the roles of GSP of the University of Lübeck and of the DFG-guidelines on the following topics:
- Equilibrium distributions and selected physico-chemical separation processes
- Threedimensional structures of organic molecules; Reaction mechanism
- Sytheses and analytical methods, e.g. ASS-Synthesis, analytics with HPLC, LC, melting-point and NMR-spectroscopy
- Different reactions of biologically relevant molecules
- Extraction of cholesterol from chickeneggs
- Quantitative determination of protein concentration with spectroscopic methods

**Qualification-goals/Competencies:**

- After successful completion of the course, students have a fundamental knowledge of organic chemistry. They are confident using structural formulas of substance classes and functional groups presented in the course. They are confident in the nomenclature and can correctly describe relative and absolute configurations of molecules.
- Students know the most important reactions, reaction types and reaction principles of organic chemistry. They understand the structural properties of functional groups and are able to formulate organic chemical reaction mechanisms of these groups.
- Students acquire the principles of techniques in organic chemistry and are able to independently and self-actingly carry out simple organic reactions by following published protocols. They have a basic understanding of how to purify and analyze their reaction mixtures in order to correctly isolate and identify the desired products.
- Students have a basic knowledge of NMR spectroscopy and understand which information can be extracted from basic one and two dimensional NMR spectra. They are able to interpret simple NMR spectra and to assign the signals to the functional groups of the molecules.
- Students are capable to document and evaluate the conducted experiments using technical terms in a structured fashion with regard to the roles of GSP of the University of Lübeck and of the DFG-guidelines.. The have learned the principles of presentations and are capable of presenting chemical issues in a scientifically correct and understandable way.
- Students can transfer and apply the acquired theoretical and practical skills to problems of other branches of chemistry and related sciences and are thus able to participate in continuative courses.

**Grading through:**

- written exam

**Requires:**

- General Chemistry (LS1100-KP10, LS1100-MLS)

**Responsible for this module:**

- PD Dr. phil. nat. Thomas Weimar

**Teacher:**

- [Institute of Chemistry and Metabolomics](#)
- PD Dr. phil. nat. Thomas Weimar
- Dr. rer. nat. Thorsten Biet
- Prof. Dr. rer. nat. Karsten Seeger

**Literature:**

- Buice, P.Y.: Organische Chemie - Pearson Studium
- Hart, H., L.E. Craine, D.J. Hart: Organische Chemie - Wiley-VCH
- Buddrus, J.: Organische Chemie - De Gruyter Verlag

**Language:**

- offered only in German

**Notes:**

Prerequisites for the modul:

- LS1100-KP10 has to be passed

Prerequisites for admission to the written examination:

- succesful participation in the practical course with all tests.

Modul exam:

- LS1600-L1: Organic Chemistry, written exam, 90 min, 100 % module grade

Everybody needs the physical conditions to work independently and self-actingly in the chemical laboratory.

**MA2500-KP05, MA2500-MLS - Analysis 2 (Ana2KP05)**
**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

5

**Course of study, specific field and term:**

- Bachelor Molecular Life Science 2024 (compulsory), mathematics / computer science, 2nd semester
- Bachelor MLS 2018 (compulsory), mathematics / computer science, 2nd semester
- Bachelor MLS 2016 (compulsory), mathematics / computer science, 2nd semester
- Bachelor MLS 2009 (compulsory), mathematics / computer science, 2nd semester

**Classes and lectures:**

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

**Workload:**

- 75 Hours private studies
- 60 Hours in-classroom work
- 15 Hours exam preparation

**Contents of teaching:**

- Integral calculus for functions of one real variable (indefinite integrals, antiderivatives, substitution, partial fractions, definite integrals, fundamental theorem of calculus)
- Sequences and series of functions
- Fourier series (trigonometric polynomials, convergence)

**Qualification-goals/Competencies:**

- Students understand the advanced terms of analysis, such as even convergence.
- Students understand the advanced thoughts and proof techniques.
- Students can explain advanced relationships in analysis.
- Interdisciplinary qualifications:
- Students can transfer advanced theoretical concepts to similar applications.
- Students can work as a group on complex mathematical problems.

**Grading through:**

- written exam

**Responsible for this module:**

- [Prof. Dr. rer. nat. Jürgen Prestin](#)

**Teacher:**

- [Institute for Mathematics](#)
- [Prof. Dr. rer. nat. Jürgen Prestin](#)
- [PD Dr. rer. nat. Christian Bey](#)

**Literature:**

- K. Fritzsche: Grundkurs Analysis 1 + 2
- H. Heuser: Lehrbuch der Analysis 2
- K. Burg, H. Haf, F. Wille, A. Meister: Höhere Mathematik für Ingenieure
- R. Lasser, F. Hofmaier: Analysis 1 + 2

**Language:**

- offered only in German

**Notes:**



Prerequisites for attending the module:

- None

Prerequisites for the exam:

- Successful completion of homework assignments during the semester.
- Successful completion of e-tests

Modul exam:

- MA2500-L1: Analysis 2, written examination, 90 min, 100 % module grade

ME1020-KP06, ME1020 - Physics 2 (Physik2KP6)		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each summer semester	<b>Credit points:</b> 6
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Molecular Life Science 2024 (compulsory), physics, 2nd semester</li> <li>• Bachelor MLS 2018 (compulsory), life sciences, 2nd semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Physics 2 (lecture, 4 SWS)</li> </ul>	<b>Workload:</b> <ul style="list-style-type: none"> <li>• 100 Hours private studies</li> <li>• 60 Hours in-classroom work</li> <li>• 20 Hours exam preparation</li> </ul>	
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Electric charge, Coulomb force, electric field, electric potential, capacity</li> <li>• Stationary electric current, resistor, Kirchhoff's laws</li> <li>• Magnetic field, magnetic dipole, electric current and magnetic field</li> <li>• Electromagnetic induction, resonant circuit</li> <li>• Nonstationary electric and magnetic fields, displacement current, Maxwell's equations</li> <li>• Refraction, reflexion</li> <li>• Geometrical optics, image generation, lenses, aberrations, optical instruments</li> <li>• Interference, diffraction, resolution power</li> <li>• Polarization, birefringence, Brewster's angle</li> <li>• Relativity theory</li> <li>• Bohr's atomic model, spectral lines, quantum mechanical atomic model</li> <li>• Molecules and solid bodies</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• You can name the basic laws of physics</li> <li>• You can measure according to physics rules</li> <li>• You can explain physical laws based on observations</li> <li>• You can formally analyze physical problems</li> <li>• You can judge which concept is best suited to solve a certain problem</li> <li>• You can design novel physical experiments on your own</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• written exam</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr. rer. nat. Christian Hübner</a></li> </ul> <b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute of Biomedical Optics</a></li> <li>• <a href="#">Institute of Physics</a></li> <li>• <a href="#">Institute of Medical Engineering</a></li> <li>• <a href="#">Prof. Dr. rer. nat. Martin Koch</a></li> <li>• <a href="#">Prof. Dr. rer. nat. Christian Hübner</a></li> <li>• <a href="#">Prof. Dr. rer. nat. Robert Huber</a></li> <li>• <a href="#">Prof. Dr.-Ing. Maik Rahlves</a></li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• Giancoli: Physics</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• offered only in German</li> </ul>		
<b>Notes:</b>		



Prerequisites for the modul:

- nothing

Prerequisites for admission to the written examination:

- nothing

Modul exam:

ME1020-L1: Physics 2, written exam, 90min, 100 % module grade

**LS2000-KP10 - Biochemistry 1 (Bioch1KP10)**
**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

10

**Course of study, specific field and term:**

- Bachelor Nutritional Medicine 2024 (compulsory), life sciences, 3rd semester
- Bachelor Molecular Life Science 2024 (compulsory), life sciences, 3rd semester
- Bachelor MLS 2018 (compulsory), life sciences, 3rd semester
- Bachelor Nutritional Medicine 2018 (compulsory), life sciences, 3rd semester
- Bachelor Nutritional Medicine 2016 (compulsory), life sciences, 3rd semester
- Bachelor MLS 2016 (compulsory), life sciences, 3rd semester

**Classes and lectures:**

- Biochemistry I (lecture, 4 SWS)
- Biochemistry I (practical course, 4 SWS)

**Workload:**

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

**Contents of teaching:**

- Lectures:
- Characteristics of biosystems
- Biomolecules
- Proteins: structure and dynamics
- Enzymes: structure, function, regulation
- Metabolism of carbohydrates: Properties of carbohydrates, Functions of carbohydrates, Metabolic pathways
- Citric acid cycle
- Membrane transport and cellular respiration
- Practical:
- Biological buffer systems
- Photometric methods / hemoglobin
- Enzymatic Catalysis
- Characterization of carbohydrates
- Bioenergetics

**Qualification-goals/Competencies:**

- Students can understand structures and functions of basic biomolecules
- They can understand biochemical interrelations and their importance for cellular metabolism
- They have acquired basic knowledge of medical aspects of biochemistry
- They have acquired the basic ability to experiment independently and autonomously, taking into account environmental protection and occupational safety and the handling of hazardous substances (according to Globally Harmonized System of Classification and Labeling of Chemicals (GHS)) and the GWP guideline of the University of Lübeck in accordance with the DFG guidelines
- They can understand and apply biochemical separation and analysis methods
- They can record, interpret, quantitatively evaluate and interpret results from biochemical experiments
- They can estimate the biotechnological potential of biomolecules

**Grading through:**

- colloquiums and protocols
- written exam

**Requires:**

- Organic Chemistry (LS1600-KP10, LS1600-MLS)

**Responsible for this module:**

- Prof. Dr. Thomas Krey

**Teacher:**

- [Institute of Biochemistry](#)
- Prof. Dr. Thomas Krey
- Dr. Mariana Grieben



- Prof. Dr. Lars Redecke
- Dr. math. et dis. nat. Jeroen Mesters
- Dr. rer. nat. Janna Bigalke
- PD Dr. rer. nat. Guido Hansen
- Dr. rer. nat. Ksenia Pumpor

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**Literature:**

- Voet/Voet: Biochemistry - 5th edition, 2018, Wiley
- Lehninger: Principles of Biochemistry - 7th edition, 2017, Freeman
- Stryer: Biochemistry - 9th edition, 2019, Freeman
- Lodish et al.: Molecular Cell Biology - 9th edition, 2021, Freeman
- Alberts et al.: Molecular Biology of the Cell - 6th edition, 2015, Garland Science

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**Language:**

- German and English skills required

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**Notes:**

Prerequisites for the module:

- LS1600-L1 Organic Chemistry

Prerequisites for admission to the written examination:

- None

Module exam:

- LS2000-L1: Biochemistra 1, written exam, 180 min, 70 % module grade
- LS2000-L2: Protocolle and Colloquien 30 % module grade

**LS2200-KP04, LS2200 - Introduction into Biophysics (EinBiophy)**
**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

4

**Course of study, specific field and term:**

- Bachelor CLS 2023 (optional subject), life sciences, 5th semester
- Bachelor Biophysics 2024 (compulsory), biophysics, 3rd semester
- Bachelor Molecular Life Science 2024 (compulsory), life sciences, 3rd semester
- Bachelor MES 2020 (optional subject), mathematics / natural sciences, 3rd semester at the earliest
- Bachelor MLS 2018 (compulsory), life sciences, 3rd semester
- Bachelor MLS 2016 (compulsory), life sciences, 3rd and 4th semester
- Bachelor CLS 2016 (optional subject), life sciences, 5th semester
- Bachelor Nutritional Medicine 2016 (compulsory), biophysics, 3rd semester
- Bachelor Biophysics 2016 (compulsory), biophysics, 3rd semester
- Bachelor MES 2014 (optional subject), mathematics / natural sciences, 3rd or 5th semester
- Bachelor MLS 2009 (compulsory), life sciences, 3rd and 4th semester
- Bachelor CLS 2010 (optional subject), life sciences, 5th semester
- Bachelor MES 2011 (compulsory), medical engineering science, 5th semester

**Classes and lectures:**

- Introduction into Biophysics (lecture, 2 SWS)
- Biophysics (Exercise or practical course, 1 SWS)

**Workload:**

- 50 Hours private studies
- 45 Hours in-classroom work
- 15 Hours written report
- 10 Hours exam preparation

**Contents of teaching:**

- Biological macro molecules, structure, forces
- Proteins, structure, properties
- Biomembranes, structure, properties
- Mechanical properties of cells
- Thermo dynamics of biological processes

**Qualification-goals/Competencies:**

- You can assign forces in biological systems
- You become familiar with the basic aspects of living matter
- You gain the expertise to simplify complex living systems
- You can choose and apply appropriate experimental methods for the study of living matter

**Grading through:**

- written exam

**Responsible for this module:**

- [Dr. Young-Hwa Song](#)

**Teacher:**

- [Institute of Physics](#)
- [Dr. Young-Hwa Song](#)
- [Prof. Dr. rer. nat. Christian Hübner](#)

**Literature:**

- Volker Schünemann: Biophysik: Eine Einführung
- Werner Mäntele: Biophysik

**Language:**

- offered only in German

**Notes:**



Prerequisites for the module:

- None

Prerequisites for admission to the written examination:

- Successful participation in the exercises as specified at the beginning of the semester

Module exam:

- LS2200-L1: Introduction into Biophysics, written exam, 120 min, 100 % of module grade

The lecture and exercises take place in the winter semester, the practical course in the summer semester.

Whether exercises or a practical course take place is specified in the SGO of the respective study program.

Prerequisite for the understanding of the lecture is the knowledge of the basics of inorganic and organic chemistry.

**LS2600-KP06, LS2601 - Biological Chemistry (BiolChem06)**
**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

6

**Course of study, specific field and term:**

- Master CLS 2023 (compulsory), MML with specialization in Life Science, 1st semester
- Bachelor Molecular Life Science 2024 (compulsory), Chemistry, 3rd semester
- Bachelor MLS 2018 (compulsory), Chemistry, 3rd semester
- Bachelor MLS 2016 (compulsory), life sciences, 3rd semester
- Master CLS 2016 (compulsory), MML with specialization in Life Science, 1st semester
- Bachelor MLS 2009 (compulsory), life sciences, 3rd semester

**Classes and lectures:**

- Biological Chemistry (lecture, 4 SWS)

**Workload:**

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

**Contents of teaching:**

- Lecture topics:
- What is Biological Chemistry?
- The nature of chemical bonds
- Chemical reactions to modify proteins
- Synthesis of peptides
- Chemical analytics - MS and NMR
- Metabolic labeling
- Chemical reactions to follow the fate of molecules in cells and whole organisms

**Qualification-goals/Competencies:**

- The nature of chemical bonds - an in depth treatment based on quantum mechanical principles
- How to use synthetic organic chemistry to solve biological questions
- In-depth treatment of reaction mechanisms of chemical reactions important in biological systems
- Analytical techniques to identify and characterize compounds
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**Grading through:**

- written exam

**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](#)
- Prof. Dr. rer. nat. Karsten Seeger
- PD Dr. phil. nat. Thomas Weimar

**Literature:**

- Paula Y. Bruice: Organic Chemistry - Pearson Verlag
- James Keeler and Peter Wothers: Chemical Structure and Reactivity: An integrated approach - Oxford University Press, 2008; second ed. 2013 ISBN: 978-0-19-928930-1

**Language:**

- offered only in German

**Notes:**



Prerequisites for the module:

- None

Prerequisites for admission to the written examination:

- None

Modul exam(s):

- LS2600-L1: Biological Chemistry, written exam, 90 min, 100 % of module grade

**ME2053-KP04, ME2053 - Physics Lab Course (PhysPrakt)**
**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

4

**Course of study, specific field and term:**

- Bachelor Biophysics 2024 (compulsory), physics, 3rd semester
- Bachelor Molecular Life Science 2024 (compulsory), physics, 3rd semester
- Bachelor MES 2020 (compulsory), physics, 3rd semester
- Bachelor MLS 2018 (compulsory), life sciences, 3rd semester
- Bachelor Biophysics 2016 (compulsory), physics, 3rd semester
- Bachelor MES 2014 (compulsory), physics, 3rd semester
- Bachelor MLS 2009 (compulsory), life sciences, 3rd semester
- Bachelor MES 2011 (compulsory), physics, 3rd semester

**Classes and lectures:**

- Physics Lab Course (practical course, 3 SWS)

**Workload:**

- 55 Hours written report
- 45 Hours in-classroom work
- 20 Hours exam preparation

**Contents of teaching:**

- Experiment 1: fluid dynamics
- Experiment 2: heat
- Experiment 3: non stationary current
- Experiment 4: stationary current
- Experiment 5: spectrometer
- Experiment 6: diffusion
- Experiment 7: wave optics
- Experiment 8: geometrical optics
- Experiment 9: radio activity
- Experiment 10: sound and ultrasound

**Qualification-goals/Competencies:**

- The students can practically work out the physical connections to the mentioned contents of the practical course with regard to the roles of GSP of the University of Lübeck and of the DFG-guidelines..
- They can use measuring instruments correctly.
- They can display measurement results graphically.
- They can analyze collected data quantitatively.
- They can estimate and evaluate the accuracy of the measurement data and the results of the analysis.
- They can document measurement results correctly.
- They can draw meaningful conclusions from measurement data.
- They can name the principles of occupational health and safety in physical laboratories and comply with them at work.

**Grading through:**

- certificates and protocols

**Responsible for this module:**

- [Prof. Dr. rer. nat. Christian Hübner](#)

**Teacher:**

- [Institute of Biomedical Optics](#)
- [Institute of Medical Engineering](#)
- [Institute of Physics](#)
- [Prof. Dr. rer. nat. Christian Hübner](#)
- [Prof. Dr. rer. nat. Thorsten Buzug](#)
- [PD Dr. rer. nat. Hauke Paulsen](#)
- Dr. rer. nat. Norbert Linz
- MitarbeiterInnen des Instituts



- Prof. Dr. rer. nat. Robert Huber
- Dr. rer. nat. Verena Hirschfeld

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**Literature:**

- Giancoli: Physik

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**Language:**

- offered only in German

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**Notes:**

Prerequisites for attending the module:

- Prerequisite for participation in the internship is physics 1 or 2.

Prerequisites for the exam:

- Certificates and protocols

Modul exam:

- ME2053-L1: Practical Course Physics, course, ungraded practical course, 0 % module grade, has to be passed

<b>MZ2200-KP06 - Physiology (PhysioKP06)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter semester	<b>Credit points:</b> 6
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Biophysics 2024 (compulsory), life sciences, 5th semester</li> <li>• Bachelor Nutritional Medicine 2024 (compulsory), life sciences, 3rd semester</li> <li>• Bachelor Molecular Life Science 2024 (compulsory), life sciences, 3rd semester</li> <li>• Bachelor MLS 2018 (compulsory), life sciences, 3rd semester</li> <li>• Bachelor Nutritional Medicine 2018 (compulsory), life sciences, 3rd semester</li> <li>• Bachelor MLS 2016 (compulsory), life sciences, 3rd semester</li> <li>• Bachelor Nutritional Medicine 2016 (compulsory), life sciences, 3rd semester</li> <li>• Bachelor Biophysics 2016 (compulsory), life sciences, 5th semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Physiology (lecture, 4 SWS)</li> <li>• Physiology (seminar, 1 SWS)</li> </ul>		<b>Workload:</b> <ul style="list-style-type: none"> <li>• 120 Hours private studies</li> <li>• 60 Hours in-classroom work</li> </ul>
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Cell physiology &amp; cell-to-cell communication</li> <li>• Sensory &amp; neuronal physiology</li> <li>• Motor systems and respiration</li> <li>• Cardiovascular and immune system</li> <li>• Kidney physiology, electrolyte homeostasis and pH regulation</li> <li>• Energy metabolism and homeostasis</li> <li>• Endocrine system</li> <li>• Circadian rhythms and sleep</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• The students understand the cellular and molecular processes in living organisms.</li> <li>• They understand the integrative processes in healthy humans.</li> <li>• They are capable to interpret the physiological functions in a scientific way.</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• written exam</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr. rer. nat. Henrik Oster</a></li> </ul>		
<b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute of Neurobiology</a></li> <li>• <a href="#">Prof. Dr. rer. nat. Henrik Oster</a></li> <li>• Dr. rer. nat. Isabel Heyde</li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• Schmidt et al.: Physiologie des Menschen - Springer, Heidelberg</li> <li>• Rhoades et al.: Medical Physiology - Lippincott Raven, Philadelphia</li> <li>• Speckmann et al.: Physiologie - Elsevier, Amsterdam</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• offered only in German</li> </ul>		
<b>Notes:</b>		



Prerequisites for the modul:

- nothing

Prerequisites for admission to the written examination:

- succesful participation in the seminar

Modul exam:

- MZ2200-L1: Physiologie, written exam, 60 min, 100 % module grade

**LS2801-KP04 - Selected methods of nucleic acid biology (MethNukIS)**

<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each summer semester	<b>Credit points:</b> 4	<b>Max. group size:</b> 9
<b>Course of study, specific field and term:</b>			
<ul style="list-style-type: none"> <li>• Bachelor Biophysics 2024 (optional subject), life sciences, 6th semester</li> <li>• Bachelor Molecular Life Science 2024 (optional subject), life sciences, 4th or 6th semester</li> <li>• Bachelor MLS 2018 (optional subject), life sciences, 4th semester</li> <li>• Bachelor MLS 2016 (optional subject), life sciences, 4th semester</li> </ul>			
<b>Classes and lectures:</b>		<b>Workload:</b>	
<ul style="list-style-type: none"> <li>• Selected methods of nucleic acid biology (practical course as compact course, 3 SWS)</li> </ul>		<ul style="list-style-type: none"> <li>• 70 Hours private studies</li> <li>• 45 Hours in-classroom work</li> </ul>	
<b>Contents of teaching:</b>			
<ul style="list-style-type: none"> <li>• Studying nucleic acid/protein interactions</li> <li>• Isolation and analysis of total RNA from eukaryotic cells</li> <li>• Automated Sanger-Sequencing</li> </ul>			
<b>Qualification-goals/Competencies:</b>			
<ul style="list-style-type: none"> <li>• Students learn basic molecular methods for handling nucleic acids and proteins</li> <li>• Students are able to translate theoretical contexts into independent and autonomous experimental work</li> </ul>			
<b>Grading through:</b>			
<ul style="list-style-type: none"> <li>• continuous, successful participation in practical course</li> </ul>			
<b>Responsible for this module:</b>			
<ul style="list-style-type: none"> <li>• Dr. rer. nat. Rosel Kretschmer-Kazemi Far</li> </ul>			
<b>Teacher:</b>			
<ul style="list-style-type: none"> <li>• <a href="#">Institute of Molecular Medicine</a></li> <li>• Dr. rer. nat. Ralf Werner</li> <li>• Dr. rer. nat. Rosel Kretschmer-Kazemi Far</li> </ul>			
<b>Literature:</b>			
<ul style="list-style-type: none"> <li>• :- Work instructions, scientific publications</li> </ul>			
<b>Language:</b>			
<ul style="list-style-type: none"> <li>• offered only in German</li> </ul>			
<b>Notes:</b>			
Maximal group size: 9			
Prerequisites for attending the module:			
- None			
Prerequisites for the exam:			
- Successful completion of protocols during the semester.			

LS2803-KP04 - Model organisms in molecular biology research (BioModOrg)			
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each summer semester	<b>Credit points:</b> 4	<b>Max. group size:</b> 16
<b>Course of study, specific field and term:</b>			
<ul style="list-style-type: none"> <li>• Bachelor Biophysics 2024 (optional subject), life sciences, 6th semester</li> <li>• Bachelor Molecular Life Science 2024 (optional subject), life sciences, 4th or 6th semester</li> <li>• Bachelor MLS 2018 (optional subject), life sciences, 4th semester</li> <li>• Bachelor MLS 2016 (optional subject), life sciences, 4th semester</li> <li>• Bachelor Biophysics 2016 (optional subject), life sciences, 6th semester</li> </ul>			
<b>Classes and lectures:</b>		<b>Workload:</b>	
<ul style="list-style-type: none"> <li>• Model organisms in molecular biology research (lecture, 1 SWS)</li> <li>• Model organisms in molecular biology research (exercise, 2 SWS)</li> </ul>		<ul style="list-style-type: none"> <li>• 70 Hours private studies</li> <li>• 45 Hours in-classroom work</li> </ul>	
<b>Contents of teaching:</b>			
<ul style="list-style-type: none"> <li>• Microorganisms Saccharomyces cerevisiae</li> <li>• Green plants Arabidopsis thaliana</li> <li>• Invertebrates I Caenorhabditis elegans</li> <li>• Invertebrates II Drosophila melanogaster</li> <li>• Vertebrates II Danio rerio</li> <li>• Vertebrates II Mus musculus</li> <li>• Phylogeny of model organisms</li> </ul>			
<b>Qualification-goals/Competencies:</b>			
<ul style="list-style-type: none"> <li>• basic understanding of the biology of the organisms presented</li> <li>• basic understanding of the advantages and disadvantages of the different model organisms for biological research</li> <li>• basic practical abilities in self-acting handling these organisms</li> </ul>			
<b>Grading through:</b>			
<ul style="list-style-type: none"> <li>• Active participation in all course days</li> </ul>			
<b>Requires:</b>			
<ul style="list-style-type: none"> <li>• Biology 1 (LS1000-KP06)</li> </ul>			
<b>Responsible for this module:</b>			
<ul style="list-style-type: none"> <li>• Dr. rer. nat. Alexandra Schatt</li> </ul>			
<b>Teacher:</b>			
<ul style="list-style-type: none"> <li>• <a href="#">Institute for Biology</a></li> <li>• Prof. Dr. rer. nat. Enno Hartmann</li> <li>• Dr. rer. nat. Nicole Sommer</li> <li>• Prof. Dr. rer. nat. Christian Schmidt</li> <li>• <a href="#">Dr. rer. nat. Carla Schulz</a></li> <li>• Dr. rer. nat. Alexandra Schatt</li> <li>• Priv.-Doz. Dr. rer. nat. Aleksander Rakovic</li> </ul>			
<b>Literature:</b>			
<ul style="list-style-type: none"> <li>• :- zur Einführung: Campbell Allgemeine Biologie die entsprechenden Kapitel</li> </ul>			
<b>Language:</b>			
<ul style="list-style-type: none"> <li>• offered only in German</li> </ul>			

<b>LS2804-KP04 - Experimental Physiology (ExpPhysio)</b>			
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each summer semester	<b>Credit points:</b> 4	<b>Max. group size:</b> 12
<b>Course of study, specific field and term:</b>			
<ul style="list-style-type: none"> <li>• Bachelor Biophysics 2024 (optional subject), life sciences, 6th semester</li> <li>• Bachelor Molecular Life Science 2024 (optional subject), life sciences, 4th or 6th semester</li> <li>• Bachelor MLS 2018 (optional subject), life sciences, 4th semester</li> <li>• Bachelor MLS 2016 (optional subject), life sciences, 4th semester</li> </ul>			
<b>Classes and lectures:</b>		<b>Workload:</b>	
<ul style="list-style-type: none"> <li>• Experimentel Physiology (lecture, 2 SWS)</li> <li>• Experimentel Physiology (seminar, 1 SWS)</li> </ul>		<ul style="list-style-type: none"> <li>• 70 Hours private studies</li> <li>• 45 Hours in-classroom work</li> </ul>	
<b>Contents of teaching:</b>			
<ul style="list-style-type: none"> <li>• Experiments on isolated organs and physiological studies in humans:</li> <li>• Practical course for the isolation of organs from frog, mouse and rat</li> <li>• Study of isolated nerves and skeletal muscle to characterize organ physiology</li> <li>• Determination of blood groups, hemolysis, and coagulation in human blood</li> <li>• Study of isolated gut, blood vessels, and uterus to characterize the function of smooth muscle</li> <li>• Practical course on sensory physiology exemplified on the eye</li> <li>• Study on the circulatory regulation in humans</li> </ul>			
<b>Qualification-goals/Competencies:</b>			
<ul style="list-style-type: none"> <li>• Acquiring knowledge on experimental procedures in physiology and pharmacology</li> </ul>			
<b>Grading through:</b>			
<ul style="list-style-type: none"> <li>• presentation and experiments</li> </ul>			
<b>Requires:</b>			
<ul style="list-style-type: none"> <li>• Physiology (MZ2200-KP06)</li> </ul>			
<b>Responsible for this module:</b>			
<ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr. med. Cor de Wit</a></li> </ul>			
<b>Teacher:</b>			
<ul style="list-style-type: none"> <li>• <a href="#">Institut of Physiology</a></li> <li>• <a href="#">Prof. Dr. med. Cor de Wit</a></li> </ul>			
<b>Literature:</b>			
<ul style="list-style-type: none"> <li>• :- Lehrbücher der Physiologie</li> </ul>			
<b>Language:</b>			
<ul style="list-style-type: none"> <li>• offered only in German</li> </ul>			

LS2805-KP04 - Experimental Biological Chemistry (ExpBiolCh)			
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each summer semester	<b>Credit points:</b> 4	<b>Max. group size:</b> 6
<b>Course of study, specific field and term:</b>			
<ul style="list-style-type: none"> <li>• Bachelor Molecular Life Science 2024 (optional subject), life sciences, 4th or 6th semester</li> <li>• Bachelor MLS 2018 (optional subject), life sciences, 4th semester</li> <li>• Bachelor MLS 2016 (optional subject), life sciences, 4th semester</li> </ul>			
<b>Classes and lectures:</b>		<b>Workload:</b>	
<ul style="list-style-type: none"> <li>• Practical course Biological Chemistry (lecture, 2 SWS)</li> <li>• Practical course Biological Chemistry (exercise, 1 SWS)</li> </ul>		<ul style="list-style-type: none"> <li>• 70 Hours private studies</li> <li>• 45 Hours in-classroom work</li> </ul>	
<b>Contents of teaching:</b>			
<ul style="list-style-type: none"> <li>• Recombinant protein synthesis often requires affinity chromatography. This step involves immobilization of a ligand that specifically binds to the protein to be purified. As an example a ligand for human blood group B galactosyltransferase will be synthesized and immobilized.</li> </ul>			
<b>Qualification-goals/Competencies:</b>			
<ul style="list-style-type: none"> <li>• Simple organic synthesis</li> <li>• Independent planning of a simple synthesis</li> <li>• Purification and characterization of synthesis products employing MS and NMR</li> <li>• Acquisition of skills to work independently and self-determined in the laboratory</li> </ul>			
<b>Grading through:</b>			
<ul style="list-style-type: none"> <li>• presentation</li> </ul>			
<b>Requires:</b>			
<ul style="list-style-type: none"> <li>• Organic Chemistry (LS1600-KP04)</li> </ul>			
<b>Responsible for this module:</b>			
<ul style="list-style-type: none"> <li>• <a href="#">Dr. Alvaro Mallagaray</a></li> </ul>			
<b>Teacher:</b>			
<ul style="list-style-type: none"> <li>• <a href="#">Institute of Chemistry and Metabolomics</a></li> <li>• <a href="#">Dr. Alvaro Mallagaray</a></li> </ul>			
<b>Literature:</b>			
<ul style="list-style-type: none"> <li>• : Scientific publications</li> </ul>			
<b>Language:</b>			
<ul style="list-style-type: none"> <li>•</li> </ul>			
<b>Notes:</b>			
Scheduling and timing of experiments is up to the students. Therefore, a maximum of six students will be allowed per course.			

<b>LS2807-KP04 - Philosophy of Science (WissTheo)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> every summer semester	<b>Credit points:</b> 4
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Molecular Life Science 2024 (optional subject), interdisciplinary competence, 4th or 6th semester</li> <li>• Bachelor Interdisciplinary Courses for health sciences (optional subject), interdisciplinary competence, Arbitrary semester</li> <li>• Bachelor MLS 2018 (optional subject), life sciences, 4th semester</li> <li>• Master Interdisciplinary Courses (optional subject), Interdisciplinary modules, Arbitrary semester</li> <li>• Bachelor Interdisciplinary Courses (optional subject), Interdisciplinary modules, Arbitrary semester</li> <li>• Bachelor MLS 2016 (optional subject), life sciences, 4th semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Basic of evolution theory: Historical and phylosophical perspectives (lecture, 2 SWS)</li> <li>• Basic of evolution theory: Historical and phylosophical perspectives (seminar, 1 SWS)</li> </ul>		<b>Workload:</b> <ul style="list-style-type: none"> <li>• 75 Hours private studies</li> <li>• 45 Hours in-classroom work</li> </ul>
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> <li>•</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• oral presentation and essay</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• Dr. phil. Staffan Müller-Wille</li> </ul>		
<b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute for History of Medicine and Science Studies</a></li> <li>• Dr. phil. Staffan Müller-Wille</li> <li>• <a href="#">Prof. Dr. med. Cornelius Borck</a></li> <li>• <a href="#">Prof. Dr. rer. nat. Burghard Weiss</a></li> <li>• <a href="#">Prof. Dr. phil. Christoph Rehmann-Sutter</a></li> <li>• <a href="#">Prof. Dr. phil Christina Schües</a></li> <li>• Dr. phil. Leonhard Menges</li> <li>• Dr. rer. nat. Schult</li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• S. Shapin: Die wissenschaftliche Revolution - Frankfurt a.M. 1998</li> <li>• M. Hagner: Ansichten der Wissenschaftsgeschichte - Frankfurt a.M., 2001</li> <li>• I. Hacking: Einführung in die Philosophie der Naturwissenschaften - Stuttgart 1983</li> <li>• Rheinberger, Hans-Jörg: Historische Epistemologie zur Einführung - Hamburg 2007</li> <li>• U. Krohs und G. Toepfer: Philosophie der Biologie: Eine Einführung - Frankfurt a.M. 2005.</li> <li>• I. Jahn: Grundzüge der Biologiegeschichte - Jena 1990</li> <li>• K. Köchy: Biophilosophie zur Einführung - Hamburg 2008</li> <li>• A. Brenner: Leben. Grundwissen Philosophie - Stuttgart 2009</li> </ul>		



**Language:**

- offered only in German

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**Notes:**

Part of the module LS2800

Basics understanding of molecular Biology; Interest in philosophical-ethical questions in the life sciences

LS2808-KP04 - Developmental biology in vivo and in vitro (EntwBio)			
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each summer semester	<b>Credit points:</b> 4	<b>Max. group size:</b> 5
<b>Course of study, specific field and term:</b>			
<ul style="list-style-type: none"> <li>• Bachelor Biophysics 2024 (optional subject), life sciences, 6th semester</li> <li>• Bachelor Molecular Life Science 2024 (optional subject), life sciences, 4th or 6th semester</li> <li>• Bachelor MLS 2018 (optional subject), life sciences, 4th semester</li> <li>• Bachelor MLS 2016 (optional subject), life sciences, 4th semester</li> </ul>			
<b>Classes and lectures:</b>		<b>Workload:</b>	
<ul style="list-style-type: none"> <li>• Entwicklungsbiologie in vitro und in vivo (seminar / exercises, 3 SWS)</li> </ul>		<ul style="list-style-type: none"> <li>• 75 Hours private studies</li> <li>• 45 Hours in-classroom work</li> </ul>	
<b>Contents of teaching:</b>			
<ul style="list-style-type: none"> <li>• Cultivation of adult stem cells from various vertebrates (subject to availability)</li> <li>• Differentiation of adult stem cells by cultivation modification and their analysis</li> <li>• Characterization of differentiated cell types by expression analysis of marker genes</li> <li>• Comparison of in vitro cell differentiation with differentiated cells in adult tissue</li> </ul>			
<b>Qualification-goals/Competencies:</b>			
<ul style="list-style-type: none"> <li>• Students are able to list basic principles of cell differentiation and to explain how to characterize differentiated cells</li> <li>• Students are able to explain what stem cells are and which differences exist between somatic and embryonic stem cells</li> </ul>			
<b>Grading through:</b>			
<ul style="list-style-type: none"> <li>• protocols</li> </ul>			
<b>Responsible for this module:</b>			
<ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr. rer. nat. Charli Kruse</a></li> </ul>			
<b>Teacher:</b>			
<ul style="list-style-type: none"> <li>• <a href="#">Institute of Medical and Marine Biotechnology</a></li> <li>• <a href="#">Prof. Dr. rer. nat. Charli Kruse</a></li> <li>• <a href="#">Dr. rer. nat. Anna Emilia Matthießen</a></li> </ul>			
<b>Literature:</b>			
<ul style="list-style-type: none"> <li>• Wolpert: Principles of Development</li> </ul>			
<b>Language:</b>			
<ul style="list-style-type: none"> <li>• offered only in German</li> </ul>			

<b>LS2810-KP04 - Stem Cell Technology (PluStamZel)</b>			
<b>Duration:</b>	<b>Turnus of offer:</b>	<b>Credit points:</b>	<b>Max. group size:</b>
1 Semester	each summer semester	4	6
<b>Course of study, specific field and term:</b>			
<ul style="list-style-type: none"> <li>• Bachelor Molecular Life Science 2024 (optional subject), life sciences, 4th or 6th semester</li> <li>• Bachelor MLS 2016 (optional subject), life sciences, 4th semester</li> <li>• Bachelor MLS 2018 (optional subject), life sciences, 4th semester</li> </ul>			
<b>Classes and lectures:</b>		<b>Workload:</b>	
<ul style="list-style-type: none"> <li>• Stem Cell Technology Seminar (seminar, 1 SWS)</li> <li>• Stem Cell Technology Seminar (practical course, 2 SWS)</li> </ul>		<ul style="list-style-type: none"> <li>• 75 Hours private studies</li> <li>• 45 Hours in-classroom work</li> </ul>	
<b>Contents of teaching:</b>			
<ul style="list-style-type: none"> <li>• This seminar, offered in the cell culture labs at the Institute of Neurogenetics, provides inside and practical experience of the generation/application of human induced pluripotent stem cells (iPSC):Seminar:</li> <li>• Basics of stem cell and developmental biology</li> <li>• Basics of cell culture techniques</li> <li>• Introduction to the reprogramming of somatic cells into iPSCs</li> <li>• Introduction to the differentiation of stem cells / Application for disease modeling</li> <li>• Presentation of CRISPR/Cas9 technology as a tool to genome edit iPSCs</li> <li>• Practical part:</li> <li>• Cultivation of iPSCs (Freezing, thawing, passaging)</li> <li>• Characterization of iPSCs by immunostaining and live cell assays</li> <li>• Plating and immunostaining of cortical iPSC-derived neurons followed by confocal microscopy analysis</li> <li>• Design of gRNAs for CRISPR knockout, CRISPRa, and CRISPRi</li> <li>• Presentation of a relevant publication regarding iPSC and CRISPR/Cas9 technologies in form of a 10-minute talk</li> </ul>			
<b>Qualification-goals/Competencies:</b>			
<ul style="list-style-type: none"> <li>• The students know the basics of cell culture using the example of iPSCs</li> <li>• They can perform an immunostaining of cells and know how to analyze cellular structures by using confocal microscopy software</li> <li>• They can describe the basics of the new technologies iPSCs and CRISPR/Cas9</li> </ul>			
<b>Grading through:</b>			
<ul style="list-style-type: none"> <li>• participation in discussions</li> </ul>			
<b>Responsible for this module:</b>			
<ul style="list-style-type: none"> <li>• Prof. Dr. Philip Seibler</li> </ul>			
<b>Teacher:</b>			
<ul style="list-style-type: none"> <li>• Prof. Dr. Philip Seibler</li> </ul>			
<b>Literature:</b>			
<ul style="list-style-type: none"> <li>• :</li> </ul>			
<b>Language:</b>			
<ul style="list-style-type: none"> <li>• offered only in German</li> </ul>			
<b>Notes:</b>			
without grades			

**LS2300-KP08, LS2301 - Biophysical Chemistry (BPCKP08)**
**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

8

**Course of study, specific field and term:**

- Master CLS 2023 (compulsory), MML with specialization in Life Science, 2nd semester
- Bachelor Biophysics 2024 (compulsory), biophysics, 4th semester
- Bachelor Molecular Life Science 2024 (compulsory), Chemistry, 4th semester
- Bachelor MLS 2018 (compulsory), Chemistry, 4th semester
- Bachelor MLS 2016 (compulsory), Chemistry, 4th semester
- Master CLS 2016 (compulsory), MML with specialization in Life Science, 2nd semester
- Bachelor Biophysics 2016 (compulsory), biophysics, 4th semester
- Master CLS 2010 (optional subject), computational life science / life sciences, 2nd semester
- Bachelor MLS 2009 (compulsory), life sciences, 4th semester

**Classes and lectures:**

- Biophysical Chemistry (lecture, 3 SWS)
- Biophysical Chemistry (exercise, 1 SWS)
- Biophysical Chemistry (practical course, 3 SWS)

**Workload:**

- 160 Hours private studies
- 80 Hours in-classroom work

**Contents of teaching:**

- Lecture topics:
  - What is Biophysical Chemistry?
  - Basics of NMR spectroscopy
  - Basics of mass spectrometry
  - Theoretical calculation of molecules - Quantum mechanics or molecular mechanics?
  - Basics of chemical thermodynamics
  - Thermodynamics of ligand binding
  - Basics of chemical kinetics
  - Basics of enzyme kinetics
  - Molecular Mechanics
- Practical works:
  - NMR, Molecular Modeling, experiments with a focus on thermodynamics and kinetics

**Qualification-goals/Competencies:**

- Acquire basic knowledge on spectroscopic techniques to analyze (bio)molecules. Focus is on NMR and mass spectrometry techniques
- Insight into properties (e.g. structure, dynamics, spectroscopic properties) of molecules employing theoretical models. Acquisition of basic knowledge to compute molecules
- Application of laws of thermodynamics to describe chemical reactions and biological processes with a focus on binding and recognition reactions in biological systems
- Acquire basic knowledge to analyze time courses of chemical reactions and biological processes
- Acquisition of skills to work independently and self-determined in the laboratory with regard to the roles of GSP of the University of Lübeck and of the DFG-guidelines.
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**Grading through:**

- written exam

**Requires:**

- Organic Chemistry (LS1600-KP10, LS1600-MLS)

**Responsible for this module:**

- Prof. Dr. rer. nat. Ulrich Günther

**Teacher:**

- [Institute of Chemistry and Metabolomics](#)
- Prof. Dr. rer. nat. Ulrich Günther

- PD Dr. phil. nat. Thomas Weimar

**Literature:**

- Peter Atkins and Julio de Paula: Physical Chemistry for the Life Sciences - Oxford, University Press, Freeman and Company, 2006, ISBN 0-1992-8095-9
- Thomas Engel und Philip Reid: Physikalische Chemie - Pearson Studium, 2006, ISBN 13: 978-3-8273-7200-0
- van Holde, Johnson & HoPrentice Hall: Principles of Physical Biochemistry - New Jersey, 1998, 2006, ISBN 0-13-720459-0
- Atkins: Physical Chemistry - Oxford University Press, Oxford Mel-bourne Tokyo, 1998, ISBN 0-19-850101-3 Paperback, Deutsche Ausgabe (dritte Auflage) bei Wiley VCH, 2002: ISBN 3-527-30236-0 Wiley-VCH, Weinheim
- Fersht, W. H.: Structure and Mechanism in Protein Science - New York, 1999, ISBN 0-7167-3268-8
- Cantor & Schimmel: Biophysical Chemistry, Parts I-III - Freeman and Company, New York, 1980, ISBN 0-71671188-5 Paperback
- H. Friebolin: Ein- und zweidimensionale NMR-Spektroskopie - Wiley-VCH
- [James Keeler and Peter Wothers: Chemical Structure and Reactivity: An integrated approach - Oxford University Press, 2008; second ed. 2013](#)

**Language:**

- offered only in German

**Notes:**

Prerequisites for the modul:

- None

Prerequisites for admission to the written examination:

- Successful completion of the excercises as specified at the beginning of the semester

Modul exam(s):

- LS2300-L1: Biophysical Chemistry, written exam, 90 min, 100 % of module grade
- LS2300-L2: Practical course Biophysical Chemistry, ungraded practical course, 0 % of module grade, has to be passed

MML: Optional course in the 2nd semester master program with specialisation in Life Science

Biophysics: some specific practicals

The practical course takes place in September as compact course. Prerequisite LS1600 and LS2600

The module is better understandable if the modules Physics 1 or 2 have been attended before.

(Share of Institute of Physics in practical course is 25%.)

**LS2510-KP10 - Biochemistry 2 (Bioch2KP10)**
**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

10

**Course of study, specific field and term:**

- Bachelor Nutritional Medicine 2024 (compulsory), life sciences, 4th semester
- Bachelor Molecular Life Science 2024 (compulsory), life sciences, 4th semester
- Bachelor MLS 2018 (compulsory), life sciences, 4th semester
- Bachelor Nutritional Medicine 2018 (compulsory), life sciences, 4th semester
- Bachelor Nutritional Medicine 2016 (compulsory), life sciences, 4th semester
- Bachelor MLS 2016 (compulsory), life sciences, 4th semester

**Classes and lectures:**

- Biochemistry 2 (lecture, 4 SWS)
- Biochemistry 2 (practical course, 4 SWS)

**Workload:**

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

**Contents of teaching:**

- Lectures:
- Structure and function of DNA and RNA
- Immunology
- N metabolism
- Amino acid metabolism
- Lipid metabolism
- Signal transduction and ho
- Practical course
- Proteins: General properties and separation methods
- Protein biosynthesis
- Polymerase chain reaction (PCR) and DNA
- Immunological methods

**Qualification-goals/Competencies:**

- Students can understand structures and functions of basic biomolecules
- They can understand biochemical relationships and their importance for cellular metabolism
- They can understand complex cell biological relationships
- They will be able to experiment independently and autonomously, taking into account environmental protection and occupational safety and the handling of hazardous substances (according to Globally Harmonized System of Classification and Labeling of Chemicals (GHS)) and the GWP guideline of the University of Lübeck in accordance with the DFG guidelines.
- They can understand and apply biochemical separation and analysis methods
- They can record, quantitatively evaluate and interpret results from biochemical experiments.
- They can correctly document and act with English technical literature
- They can estimate biotechnological potential of biomolecules

**Grading through:**

- written exam

**Requires:**

- Organic Chemistry (LS1600-KP10, LS1600-MLS)

**Responsible for this module:**

- Prof. Dr. Thomas Krey

**Teacher:**

- [Institute of Biochemistry](#)
- Prof. Dr. Thomas Krey
- Dr. Mariana Grieben
- PD Dr. rer. nat. Guido Hansen
- Dr. rer. nat. Janna Bigalke

- Dr. math. et dis. nat. Jeroen Mesters
- Prof. Dr. Lars Redecke
- Dr. rer. nat. Ksenia Pumpor

**Literature:**

- Voet/Voet: Biochemistry - 5th edition, 2018, Wiley
- Lehninger: Principles of Biochemistry - 7th edition, 2017, Freeman
- Stryer: Biochemistry - 7th edition, 2012, Freeman
- Stryer: Biochemistry - 9th edition, 2019, Freeman
- Lodish et al.: Molecular Cell Biology - 9th edition, 2021, Freeman
- Alberts et al.: Molecular Biology of the Cell - 6th edition, 2015, Garland Science

**Language:**

- German and English skills required

**Notes:**

Prerequisites for the module:

- LS1600-L1 Organic Chemistry

Prerequisites for admission to the written examination:

- None

Module exam:

- LS2510-L1: Biochemistry 2, written exam, 120 min, 70 % module grade
- LS2510-L2: Protocols and Colloquium 30 % module grade

<b>LS2700-KP06 - Cell biology (ZellBioKP6)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each summer semester	<b>Credit points:</b> 6
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Molecular Life Science 2024 (compulsory), life sciences, 4th semester</li> <li>• Bachelor Nutritional Medicine 2024 (compulsory), life sciences, 4th semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Cell biology (lecture, 4 SWS)</li> </ul>	<b>Workload:</b> <ul style="list-style-type: none"> <li>• 120 Hours private studies</li> <li>• 60 Hours in-classroom work</li> </ul>	
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Special structure of cells</li> <li>• Cell cycle and apoptosis</li> <li>• Introduction into developmental biology</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• Principle of the basic function of the eukaryotic cells</li> <li>• Detailed knowledge in all areas of cell biology covered by the lecture (see</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• written exam</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• Prof. Dr. rer. nat. Enno Hartmann</li> </ul>		
<b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute of Medical and Marine Biotechnology</a></li> <li>• <a href="#">Institute for Biology</a></li> <li>• Prof. Dr. rer. nat. Enno Hartmann</li> <li>• PD Dr. rer. nat. Kai-Uwe Kalies</li> <li>• <a href="#">Prof. Dr. rer. nat. Charli Kruse</a></li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• Lodish: Molecular Cell Biology</li> <li>• Pollard: Cell Biology</li> <li>• Wolpert: Principles of Development</li> <li>• Alberts: Molecular Biology of the Cell</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• offered only in German</li> </ul>		
<b>Notes:</b> <p>Prerequisites for the modul: - nothing</p> <p>Prerequisites for admission to the written examination: -nothing</p> <p>Modul exam: - LS2700-L1: Cellbiology, written exam, 90 min, 100 % module grade</p> <p>Knowledge in Biology 1 and 2 and Biochemistry 1 is a prerequisite for this course.</p>		

**LS2701-KP04 - Practical Course Cell biology (ZellBioPra)**
**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

4

**Course of study, specific field and term:**

- Bachelor Molecular Life Science 2024 (compulsory), life sciences, 4th semester
- Bachelor Nutritional Medicine 2024 (compulsory), life sciences, 4th semester

**Classes and lectures:**

- Practical course in Cell biology (practical course, 4 SWS)

**Workload:**

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

**Contents of teaching:**

- Practical course (groups of 2):
- Basics in cell culture techniques
- Staining of cellular structures
- Cell fractionation and functional analysis of organelles
- Behaviour of cells during stress
- Protein pattern of apoptotic cells
- Differentiation of cells

**Qualification-goals/Competencies:**

- Basic skills to design and perform their own experiments in the area of cell biology Handling of basic cell biology techniques
- Handling of basic cell biology techniques
- Improving the ability to document results correctly (within the roles of GSP of the UzL) and to work in a team

**Grading through:**

- continuous, successful participation in practical course

**Requires:**

- Biochemistry 1 (LS2000-KP10)
- Biology 1 (LS1000-KP08, LS1000-MLS)

**Responsible for this module:**

- Prof. Dr. rer. nat. Stefan Taube

**Teacher:**

- [Institute of Medical and Marine Biotechnology](#)
- [Institute of Virology and Cell Biology](#)
- [Prof. Dr. rer. nat. Charli Kruse](#)

**Literature:**

- Lodish: Molecular Cell Biology
- Pollard: Cell Biology
- Wolpert: Principles of Development
- Alberts: Molecular Biology of the Cell

**Language:**

- offered only in German

**Notes:**



**Prerequisites for the modul:**

- LS1000-L1 Biology 1, LS200-L1 Biochemistry 1 or LS2510-L1 Biochemistry 2

**Prerequisites for admission to the written examination:**

- succesful participation in the practical course Cell Bology

**Modul exam:**

-LS2700-L2: Practical course in Cell biology, ungraded practical course, 0 % module grade, has to be passed

**MA1600-KP04, MA1600, MA1600-MML - Biostatistics 1 (BioStat1)**

<b>Duration:</b>	<b>Turnus of offer:</b>	<b>Credit points:</b>
1 Semester	each summer semester	4

**Course of study, specific field and term:**

- Bachelor CLS 2023 (compulsory), mathematics, 2nd semester
- Bachelor Biophysics 2024 (compulsory), Elective Computer Science, 4th semester
- Bachelor Nutritional Medicine 2024 (compulsory), mathematics / natural sciences, 4th semester
- Bachelor MES 2014 (optional subject), mathematics / natural sciences, 3rd semester at the earliest
- Bachelor Computer Science 2019 (optional subject), Extended optional subjects, Arbitrary semester
- Bachelor Computer Science 2019 (compulsory), Canonical Specialization Bioinformatics and Systems Biology, 6th semester
- Bachelor Medical Informatics 2019 (compulsory), medical computer science, 6th semester
- Bachelor MLS 2018 (compulsory), life sciences, 6th semester
- Bachelor Nutritional Medicine 2018 (compulsory), mathematics / computer science, 6th semester
- Bachelor CLS 2016 (compulsory), mathematics, 2nd semester
- Bachelor CLS 2010 (compulsory), mathematics, 2nd semester
- Bachelor Computer Science 2016 (optional subject), advanced curriculum, Arbitrary semester
- Bachelor Computer Science 2016 (compulsory), Canonical Specialization Bioinformatics, 4th semester
- Bachelor MLS 2016 (compulsory), life sciences, 6th semester
- Bachelor Biophysics 2016 (compulsory), Elective Computer Science, 4th semester
- Bachelor Nutritional Medicine 2016 (compulsory), mathematics / computer science, 6th semester
- Bachelor Medical Informatics 2014 (compulsory), medical computer science, 4th semester
- Bachelor Computer Science 2014 (compulsory), specialization field bioinformatics, 6th semester
- Master MES 2011 (advanced curriculum), biophysics and biomedical optics, 2nd semester
- Bachelor Medical Informatics 2011 (compulsory), medical computer science, 4th semester
- Master Computer Science 2012 (optional subject), specialization field bioinformatics, 2nd or 3rd semester
- Master Computer Science 2012 (compulsory), advanced curriculum stochastics, 2nd semester
- Bachelor Computer Science 2012 (optional subject), specialization field bioinformatics, 6th semester
- Bachelor MLS 2009 (compulsory), life sciences, 6th semester
- Bachelor MES 2011 (optional subject), medical engineering science, 6th semester
- Bachelor Molecular Life Science 2024 (compulsory), mathematics / computer science, 4th semester

**Classes and lectures:**

- Biostatistics 1 (lecture, 2 SWS)
- Biostatistics 1 (exercise, 1 SWS)

**Workload:**

- 66 Hours private studies
- 39 Hours in-classroom work
- 15 Hours exam preparation

**Contents of teaching:**

- Descriptive statistics
- Probability theory, including random variables, density, and cumulative distribution function
- Normal distribution, other distributions
- Diagnostic tests, reference range, normal range, coefficient of variation
- Statistical testing
- Sample size calculations
- Confidence intervals
- Selected statistical tests I
- Selected statistical tests II
- Linear simple regression
- Analysis of variance (one-way-classification)
- Clinical trials
- Multiple Testing: Bonferroni, Bonferroni-Holm, Bonferroni-Holm-Shaffer, Wiens, hierarchical Testing

**Qualification-goals/Competencies:**

- With regard to the roles of GSP of the University of Lübeck and of the DFG-guidelines the student were able to work with the following statistical methods: The students are able to calculate descriptive statistics.
- They are able to calculate quantiles and surfaces of the normal distribution.
- They are able to explain terms of diagnostic testing, such as sensitivity or specificity.
- They are able to list the basic principles of statistical testing, sample size calculation and confidence interval construction.

- They are able to carry out a set of elementary statistical tests, such as t-test, test of proportions, X<sup>2</sup> independence test, and to interpret the results.
- They are able to explain the basic principles of linear regression.
- They are able to apply the linear simple regression.
- They are able to explain the basic idea for the one-way analysis of variance (ANOVA).
- They are able to explain the results table for the one-way and two-way ANOVA.
- They are able to interpret the results of the ANOVA.
- They know the basic principles of clinical therapeutic studies.
- They know the assumptions that need to be fulfilled for the application of specific statistical tests.
- They are able to calculate simple adjustments for multiple comparisons.

**Grading through:**

- written exam

**Is requisite for:**

- Module part: Biostatistics 2 (MA2600 T)
- Biostatistics 2 (MA2600-KP07)
- Biostatistics 2 (MA2600-KP04, MA2600)

**Responsible for this module:**

- Prof. Dr. rer. biol. hum. Inke König

**Teacher:**

- [Institute of Medical Biometry and Statistics](#)
- Prof. Dr. rer. biol. hum. Inke König
- MitarbeiterInnen des Instituts

**Literature:**

- Matthias Rudolf, Wiltrud Kuhlisch: Biostatistik: Eine Einführung für Biowissenschaftler - 1. Auflage, Pearson: Deutschland
- Lothar Sachs, Jürgen Hedderich: Angewandte Statistik: Methodensammlung mit R - 15. Auflage, Springer: Heidelberg

**Language:**

- offered only in German

**Notes:**

Prerequisites for attending the module:

- None

Prerequisites for the exam:

- Active and regular participation in the exercise groups as specified at the beginning of the semester.

Module exam:

-MA1600-L1: Biostatistics 1, written exam, 90 min, 100 % of module grade

LS2806-KP04 - Basics of Economics (WPBWL)			
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter- and each summersemester	<b>Credit points:</b> 4	<b>Max. group size:</b> 5
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Molecular Life Science 2024 (optional subject), Interdisciplinary modules, 4th to 6th semester</li> <li>• Bachelor MLS 2016 (optional subject), no specific field, 4th semester</li> <li>• Bachelor MLS 2018 (optional subject), interdisciplinary competence, 4th and 5th semester</li> </ul>			
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Basic of economy, spec. personal management (lecture, 2 SWS)</li> <li>• Basic of economy (exercise, 1 SWS)</li> </ul>		<b>Workload:</b> <ul style="list-style-type: none"> <li>• 60 Hours private studies</li> <li>• 45 Hours in-classroom work</li> </ul>	
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Basics of economy, spec. personal management</li> </ul>			
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• s. Modul EC4001T</li> </ul>			
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• B-Certificate (not graded)</li> </ul>			
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• Dr. rer. nat. Rosemarie Pulz</li> </ul>			
<b>Teacher:</b> <ul style="list-style-type: none"> <li>• Institute for Entrepreneurship and Business Development</li> <li>• <a href="#">Prof. Dr. Christian Scheiner</a></li> </ul>			
<b>Language:</b> <ul style="list-style-type: none"> <li>• offered only in German</li> </ul>			
<b>Notes:</b> <ul style="list-style-type: none"> <li>• only im WS</li> </ul>			

**CS1012-KP08, CS1012 - Introduction to Computer Science 1 (EinInfo1)**
**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

8

**Course of study, specific field and term:**

- Bachelor Molecular Life Science 2024 (compulsory), mathematics / computer science, 5th semester
- Bachelor MLS 2018 (compulsory), mathematics / computer science, 5th semester
- Bachelor MLS 2016 (compulsory), computer science, 5th semester
- Bachelor MLS 2009 (compulsory), computer science, 5th semester

**Classes and lectures:**

- Introduction to Computer Science 1 (lecture, 4 SWS)
- Introduction to Computer Science 1 (exercise, 3 SWS)

**Workload:**

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

**Contents of teaching:**

- Information and data
- Computer hardware
- Computer software
- The concept of algorithms
- Imperative programming
- The Java programming language
- Elementary data structures
- Strings
- Arrays
- Small-scale and large-scale modularization
- Recursion
- Searching and sorting
- Lists
- Trees and search trees
- OO-programming
- Page description languages

**Qualification-goals/Competencies:**

- Students are able to describe how information processing systems are designed and implemented.
- Furthermore, they can apply IT-systems in research and development projects
- They are able to adapt algorithms and data structures to special-purpose applications.
- They can familiarize themselves easily with new areas of computed science, when lead in advanced courses.

**Grading through:**

- written exam

**Is requisite for:**

- Introduction to Computer Science 2 (CS1013)

**Responsible for this module:**

- [Prof. Dr. rer. nat. Till Tantau](#)

**Teacher:**

- [Institute for Theoretical Computer Science](#)
- [Prof. Dr. rer. nat. Till Tantau](#)

**Literature:**

- [Heinz-Peter Gumm, Manfred Sommer: Einführung in die Informatik - Oldenbourg Verlag, 6. Auflage, 2006](#)

**Language:**

- offered only in German



**Notes:**

Prerequisites for the module:

- nothing

Prerequisites for admission to the written examination:

- successful participation in the exercises

Module exam:

- CS1012-L1: Introduction into Informatics 1, written exam, 90min, 100% module grade

**CS1400-KP04, CS1400 - Introduction to Bioinformatics (EinBioinfo)**

<b>Duration:</b>	<b>Turnus of offer:</b>	<b>Credit points:</b>
1 Semester	each winter semester	4
<b>Course of study, specific field and term:</b>		
<ul style="list-style-type: none"> <li>• Bachelor IT-Security 2016 (optional subject), interdisciplinary, Arbitrary semester</li> <li>• Bachelor Nutritional Medicine 2024 (compulsory), mathematics / computer science, 5th semester</li> <li>• Bachelor Molecular Life Science 2024 (compulsory), mathematics / computer science, 5th semester</li> <li>• Bachelor MES 2020 (optional subject), computer science / electrical engineering, 3rd semester at the earliest</li> <li>• Bachelor Computer Science 2019 (compulsory), Canonical Specialization Bioinformatics and Systems Biology, 1st semester</li> <li>• Bachelor Computer Science 2019 (optional subject), Introductory Module Computer Science, 1st semester</li> <li>• Bachelor MLS 2018 (compulsory), life sciences, 5th semester</li> <li>• Bachelor MES 2014 (optional subject), computer science / electrical engineering, 3rd semester at the earliest</li> <li>• Bachelor Computer Science 2016 (optional subject), Introductory Module Computer Science, 1st semester</li> <li>• Bachelor Computer Science 2016 (compulsory), Canonical Specialization Bioinformatics, 1st semester</li> <li>• Bachelor MLS 2016 (compulsory), life sciences, 5th semester</li> <li>• Bachelor Medical Informatics 2014 (compulsory), medical computer science, 3rd semester</li> <li>• Bachelor Computer Science 2014 (compulsory), specialization field bioinformatics, 1st semester</li> <li>• Bachelor Medical Informatics 2011 (compulsory), medical computer science, 3rd semester</li> <li>• Bachelor MLS 2009 (compulsory), life sciences, 5th semester</li> <li>• Bachelor CLS 2010 (compulsory), specialization field bioinformatics, 5th semester</li> <li>• Bachelor MES 2011 (optional subject), medical engineering science, 3rd or 5th semester</li> <li>• Bachelor Computer Science 2012 (compulsory), specialization field bioinformatics, 1st semester</li> <li>• Bachelor Biophysics 2024 (optional subject), computer science, 5th semester</li> </ul>		
<b>Classes and lectures:</b>		<b>Workload:</b>
<ul style="list-style-type: none"> <li>• Introduction to Bioinformatics (lecture, 2 SWS)</li> <li>• Introduction to Bioinformatics (exercise, 1 SWS)</li> </ul>		<ul style="list-style-type: none"> <li>• 55 Hours private studies</li> <li>• 45 Hours in-classroom work</li> <li>• 20 Hours exam preparation</li> </ul>
<b>Contents of teaching:</b>		
<ul style="list-style-type: none"> <li>• Life, Evolution &amp; the Genome</li> <li>• Sequence assembly - Industrial reading of genetic information</li> <li>• DNA sequence models &amp; hidden markov models</li> <li>• Viterbi-Algorithm</li> <li>• Sequence alignment &amp; dynamic programming</li> <li>• Unsupervised data analysis (k-means, PCA, ICA)</li> <li>• DNA microarrays &amp; GeneChip technologies</li> </ul>		
<b>Qualification-goals/Competencies:</b>		
<ul style="list-style-type: none"> <li>• Students are able to explain the basic concepts of coding, transcription and translation of information in living beings.</li> <li>• They are able to explain how a solution of the shortest common superstring problem can be estimated with a simple greedy algorithm.</li> <li>• They are able to create a Markov chain or a Hidden Markov Model (HMM) for a given modelling problem.</li> <li>• They are able to give examples on how to solve a problem using dynamic programming.</li> <li>• They are able to implement the introduced algorithms (in Matlab)</li> <li>• They are able to use unsupervised learning methods and they are able to interpret the results.</li> <li>• They are able to explain basic Microarray-and DNA-Chip-Technologies.</li> </ul>		
<b>Grading through:</b>		
<ul style="list-style-type: none"> <li>• portfolio exam</li> </ul>		
<b>Responsible for this module:</b>		
<ul style="list-style-type: none"> <li>• Prof. Dr. rer. nat. Amir Madany Mamlouk</li> </ul>		
<b>Teacher:</b>		
<ul style="list-style-type: none"> <li>• <a href="#">Institute for Neuro- and Bioinformatics</a></li> <li>• Prof. Dr. rer. nat. Amir Madany Mamlouk</li> </ul>		

**Literature:**

- H. Lodish, A. Berk, S. L. Zipursky and J. Darnell: Molekulare Zellbiologie - Spektrum Akademischer Verlag, 4. Auflage, 2001, ISBN-13: 978-3827410771
- A. M. Lesk: Introduction to Bioinformatics - Oxford University Press, 3. Auflage, 2008, ISBN-13: 978-0199208043
- R. Merkl and S. Waack: Bioinformatik Interaktiv: Grundlagen, Algorithmen, Anwendungen - Wiley-VCH Verlag, 2. Auflage, 2009, ISBN-13: 978-3527325948
- M. S. Waterman: Introduction to Computational Biology - Chapman and Hall, 1995

**Language:**

- offered only in German

**Notes:**

For students of the master programme Infection Biology, this is not a stand-alone module, but rather part of the module CS4011.

Prerequisites for attending the module:

- None

Computer Science students get a B certificate.

LS2802-KP04 - Introduction into anatomy (WPAnat)			
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter semester	<b>Credit points:</b> 4	<b>Max. group size:</b> 10
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Molecular Life Science 2024 (optional subject), life sciences, 5th semester</li> <li>• Bachelor MLS 2018 (optional subject), life sciences, 5th semester</li> <li>• Bachelor MLS 2016 (optional subject), life sciences, 4th semester</li> </ul>			
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Anatomie for technical study programs MZ2100A (lecture, 2 SWS)</li> </ul>		<b>Workload:</b> <ul style="list-style-type: none"> <li>• 75 Hours private studies</li> <li>• 30 Hours in-classroom work</li> <li>• 15 Hours exam preparation</li> </ul>	
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> </ul>			
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> </ul>			
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• written exam</li> <li>• B-Certificate (not graded)</li> </ul>			
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr. rer. nat. Kathrin Kalies</a></li> </ul>			
<b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute of Anatomy</a></li> <li>• <a href="#">Prof. Dr. rer. nat. Kathrin Kalies</a></li> </ul>			
<b>Language:</b> <ul style="list-style-type: none"> <li>• offered only in German</li> </ul>			

<b>LS3150-KP06 - Molecular Biology (MolBioKP06)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter semester	<b>Credit points:</b> 6
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Nutritional Medicine 2024 (compulsory), life sciences, 5th semester</li> <li>• Bachelor Molecular Life Science 2024 (compulsory), life sciences, 5th semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Lecture Molecular Biology (lecture, 2 SWS)</li> <li>• Seminar Molecular Biology (seminar, 2 SWS)</li> </ul>		<b>Workload:</b> <ul style="list-style-type: none"> <li>• 120 Hours private studies</li> <li>• 60 Hours in-classroom work</li> </ul>
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Lectures: Typically, 5 coherent blocks will be lectured.</li> <li>• Basics: genetic engineering and gene regulation</li> <li>• Growth and aging: molecular processes during ontogenetic differentiation, maintenance and loss of function during aging of cells and organisms</li> <li>• Nucleic-acids: molecular basis, polymorphism, RNA-regulation. Diagnostic and possible therapeutic aspects</li> <li>• Molecular biology of plants: molecular basis as well as economic and ecological aspects of transgenic plants and herbicide resistance</li> <li>• Gene-therapeutic approaches and recombinant vaccines</li> <li>• Exercises: Reading of scientific articles and oral presentation</li> <li>• Conceptual design of publications</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• Students are able to present basic steps of genetic engineering</li> <li>• They can explain basic mechanisms of gene expression</li> <li>• They are able to formulate basic mechanisms of RNA-regulated biological systems</li> <li>• They can present examples for the relationship between pathophysiological processes and their molecular basis</li> <li>• They are able to explain principles of gene therapy</li> <li>• They acquire the competence to handle english literature and to present it in a scientific oral presentation</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• written exam</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• Prof. Dr. rer. nat. Norbert Tautz</li> </ul>		
<b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Department of Neurosurgery</a></li> <li>• <a href="#">Institute of Virology and Cell Biology</a></li> <li>• <a href="#">Institute of Medical and Marine Biotechnology</a></li> <li>• Dr. rer. nat. Olaf Isken</li> <li>• Prof. Dr. rer. nat. Norbert Tautz</li> <li>• PD Dr. rer. nat. Christina Zechel</li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• Alberts et al.: Molecular Biology of Cells - Garland Science</li> <li>• Lodish et al.: Molecular Cell Biology - Freeman</li> <li>• Buchanan et al.: Biochemistry and Molecular Biology of Plants - Wiley Verlag</li> <li>• : Versuchsanleitungen</li> <li>• : Course script</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• offered only in German</li> </ul>		
<b>Notes:</b>		



Prerequisites for the module:

- nothing

Prerequisites for admission to the written examination:

- successful participation in the seminar LS3150-S

Module exam:

- LS3150-L1: Molekular Biology, written exam, 90 min, 100 % module grade

<b>LS3160-KP04 - Practical Course Molecular Biology (PrakMolBio)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter semester	<b>Credit points:</b> 4
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Nutritional Medicine 2024 (compulsory), life sciences, 5th semester</li> <li>• Bachelor Molecular Life Science 2024 (compulsory), life sciences, 5th semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Practical Course Molecular Biology (practical course, 3 SWS)</li> <li>• Exercises Molecular Biology (exercise, 1 SWS)</li> </ul>		<b>Workload:</b> <ul style="list-style-type: none"> <li>• 60 Hours private studies</li> <li>• 60 Hours in-classroom work</li> </ul>
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Practical course (in groups of 2): Safe handling of DNA and RNA</li> <li>• Detection of gene expression at the level of mRNA, ligation and transformation of plasmid DNA</li> <li>• Prokaryotic expression of protein and identification of isolated proteins</li> <li>• Design of PCR-primers; specialized PCR techniques and identification of PCR products by electrophoresis</li> <li>• Exercises: Work with databanks; using IT-program for molecular biology; forming restriction cards</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• They have skills in basic molecular-biological techniques</li> <li>• They have the basic knowledge of safety at work in molecular-biological labs</li> <li>• They know the basics of scientific documentation techniques and can work in a team within the rules for GSP of the UzL.</li> <li>•</li> <li>•</li> <li>•</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• continuous, successful participation in practical course</li> </ul>		
<b>Requires:</b> <ul style="list-style-type: none"> <li>• Molecular Biology (LS3150)</li> <li>• Biochemistry 2 (LS2510-MLS)</li> <li>• Biochemistry 1 (LS2000-MLS)</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• Prof. Dr. rer. nat. Norbert Tautz</li> </ul>		
<b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute of Virology and Cell Biology</a></li> <li>• Prof. Dr. rer. nat. Norbert Tautz</li> <li>• Dr. rer. nat. Olaf Isken</li> <li>• MSc Danilo Dubrau</li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• :- Course script</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• offered only in German</li> </ul>		
<b>Notes:</b>		



**Prerequisites for the module:**

- LS2000-L1 Biochemistry 1 oder LS2510-L1 Biochemistry 2

**Prerequisites for admission to the written examination:**

- succesful participation in the practical course.

**Module exam:**

- LS3160-L1: Practical course Molekularbiology, ungraded practical course, 0 % module grade, has to be passed

<b>LS3251-KP05 - Tissue Engineering (TissueEng)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter semester	<b>Credit points:</b> 5
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Molecular Life Science 2024 (optional subject), life sciences, 5th semester</li> <li>• Bachelor Biophysics 2016 (optional subject), life sciences, 5th semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Tissue Engineering (seminar with practical exercises, 2 SWS)</li> <li>• Tissue Engineering (lecture, 2 SWS)</li> </ul>		<b>Workload:</b> <ul style="list-style-type: none"> <li>• 90 Hours private studies</li> <li>• 60 Hours in-classroom work</li> </ul>
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Lectures: Mamalia cells in their natural environment and under in vitro culture as an example of industrial application.</li> <li>• Aging of cells in vitro</li> <li>• Established cell lines</li> <li>• Diverse in vitro culturing conditions</li> <li>• Proliferation and differentiation under in vitro conditions</li> <li>• Stem cell biology</li> <li>• Materials for medical applications and biotechnology</li> <li>• Fermentors, bioreactors and protein purification</li> <li>• Home work e. g. Tissue transplantation and rejection</li> <li>• Practical course (in groups of 2): Principles of aseptic manipulations, working in sterile containments, object and selfprotection, use of autoclaves</li> <li>• Preparation of sterile media, additives and other reagents</li> <li>• Slicing of tissue samples, transfer into tissue culture flasks for explant cultures</li> <li>• Microscopy and documentation of growing cells</li> <li>• Cell count, passaging by trypsinisation</li> <li>• Viability test, freezing of cells and reseeding after thawing</li> <li>• Adherence of cells to various matrices</li> <li>•</li> <li>•</li> <li>• Immunohistochemistry of intracellular and extracellular proteins</li> <li>•</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• Students are able to explain principles of cell- and tissue culture to generate biocomposites from differentiated and pluripotent cells</li> <li>• They are able to explain basic principles of pro- and eukaryotic gene expression systems</li> <li>• They are able to explain basic principles of organoid biology</li> <li>• They can reproduce the aspects of stem cell biology</li> <li>• They acquire the ability to assess ethical aspects of tissue engineering</li> <li>• They improve their competence for correct documentation and team working skills</li> <li>•</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• written exam</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr. rer. nat. Charli Kruse</a></li> </ul>		
<b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute of Medical and Marine Biotechnology</a></li> <li>•</li> <li>• <a href="#">Department of Dermatology, Allergology and Venerology</a></li> <li>• <a href="#">Institute of Virology and Cell Biology</a></li> <li>• <a href="#">Prof. Dr. rer. nat. Charli Kruse</a></li> <li>• <a href="#">Dr. rer. nat. Daniel Hans Rapoport</a></li> </ul>		



- Dr. rer. nat. Philipp Ciba
- Prof. Dr. med. vet. Jennifer Hundt
- Prof. Dr. med. Ralf Ludwig
- Dr. rer. nat. Olaf Isken
- Dr. med. Dipl. Biol. Judith Sewing

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**Literature:**

- Lanza, Langer, Vacanti: Principles of Tissue Engineering

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**Language:**

- offered only in German

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**Notes:**

Knowledge in Cell biology is a prerequisite for this course. Entrance requirement for the practical course: certificate of the course Biochemistry 1 or 2.

<b>LS3252-KP05 - Metabolic Medicine (MetabolMed)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter semester	<b>Credit points:</b> 5
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Molecular Life Science 2024 (optional subject), life sciences, 5th semester</li> <li>• Bachelor Biophysics 2024 (optional subject), life sciences, 5th semester</li> <li>• Bachelor Biophysics 2016 (optional subject), life sciences, 5th semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Metabolic Medicine (lecture, 2 SWS)</li> <li>• Tissue Engineering (seminar with practical exercises, 2 SWS)</li> </ul>	<b>Workload:</b> <ul style="list-style-type: none"> <li>• 90 Hours private studies</li> <li>• 60 Hours in-classroom work</li> </ul>	
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Metabolic physiology</li> <li>• glucose metabolism &amp; diabetes</li> <li>• lipid metabolism &amp; obesity, adipokines</li> <li>• gastroenterology</li> <li>• thyroid</li> <li>• central appetite regulation</li> <li>• circadian clocks &amp; metabolism</li> <li>• sleep &amp; metabolism</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• Understanding the principles of energy homeostasis</li> <li>• Understanding physiological interactions of different compartments in the context of energy metabolism</li> <li>• Students know the symptoms of major metabolic disorders and their pathophysiological causes</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• written exam</li> </ul>		
<b>Requires:</b> <ul style="list-style-type: none"> <li>• Biochemistry 1 (LS2000-KP06)</li> <li>• Physiology (MZ2200-KP06)</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr. rer. nat. Henrik Oster</a></li> </ul>		
<b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Medical Clinic I</a></li> <li>• <a href="#">Institute of Neurobiology</a></li> <li>• <a href="#">Institute for Experimental Endocrinology</a></li> <li>• <a href="#">Prof. Dr. rer. nat. Henrik Oster</a></li> <li>• <a href="#">Dr. rer. nat. Violetta Pilorz</a></li> <li>• <a href="#">Dr. rer. nat. Isabel Heyde</a></li> <li>• <a href="#">Dr. rer. nat. Carla Schulz</a></li> <li>• <a href="#">Prof. Dr. rer. nat. Jens Mittag</a></li> <li>• <a href="#">PD Dr. Britta Wilms</a></li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• Keith N. Frayn: Metabolic Regulation: A Human Perspective - Wiley &amp; Blackwell, 2010</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• German and English skills required</li> </ul>		
<b>Notes:</b>		



Admission requirements for enrolling in the module:

- LS2000-L1 Biochemistry 1 or LS2510-L1 Biochemistry 2
- Basic knowledge of physiology and biochemistry is required

Admission requirements for participating in module exam(s):

- Successful participation in the LS3250-S Tissue Engineering seminar

Module exam(s):

- LS3252-L1: Metabolic Medicine, written exam, 90 min, 100% of the module grade

**MZ3000-KP05, MZ3000 - Microbiology (MikroBioP5)**
**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

5

**Course of study, specific field and term:**

- Bachelor Molecular Life Science 2024 (compulsory), life sciences, 5th semester
- Bachelor MLS 2018 (compulsory), life sciences, 5th semester

**Classes and lectures:**

- Microbiology (lecture, 2 SWS)
- Microbiology (practical course, 2 SWS)

**Workload:**

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

**Contents of teaching:**

- Systematics of microorganisms
- 
- 
- Bacterial growth
- 
- 
- Medical microbiology
- 
- Immunology
- Microbiology of the Environment
- Industrial microbiology
- Practical course: General bacteriology, bacteriological techniques
- Differentiation of bacteria
- Bacterial growth and how we can inhibit it

**Qualification-goals/Competencies:**

- Studying major groups of microorganisms, understanding of basic microbiological concepts
- Learning of basic microbiological lab techniques
- Studying major infectious diseases and the causative organisms
- Studying basic mechanisms of the immune response
- Acquiring basic knowledge of safety at work by handling with microorganisms
- Improving the ability of scientific documentation techniques, presentation of data and working in a team
- Basic skills to design and perform their own experiments

**Grading through:**

- 

**Requires:**

- Biology 1 (LS1000-KP08, LS1000-MLS)

**Responsible for this module:**

- Prof. Dr. med. Jan Rupp

**Teacher:**

- Department of Infectiology
- [Research Center Borstel, Leibniz Lung Center](#)
- Institute of Medical Microbiology
- Prof. Dr. med. Jan Rupp
- Prof. Dr. rer. nat. Stefan Niemann
- Dr. Katarzyna Duda
- Dr. med. Susanne Hauswaldt
- Dr. rer. nat. Simon Graspentner
- Dr. rer. nat. Dirk Friedrich
- Dr. rer. nat. Tobias Dallenga



- Prof. Dr. rer. nat. Matthias Merker
- Prof. Dr. med. Dennis Nurjadi
- Prof. Dr. med. Tanja Lange
- PD Dr. med. Thomas Bollinger

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**Literature:**

- Michael T. Madigan, u. a. (2020): Brock Mikrobiologie - Pearson Studium 15. Auflage

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**Language:**

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**Notes:**

Prerequisites for the module:

- LS1000-L1 Basic Biology

Prerequisites for admission to the written examination:

- succesful participation in the practical course.

Module exam:

- MZ3000-L1: Microbiology, written exam, 90 min, 100 % module grade

**CS1020-KP05 - Introduction Into Databases and Systems Biology (EinfDBSB)**
**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

5

**Course of study, specific field and term:**

- Bachelor Biophysics 2024 (compulsory), bioinformatics, 6th semester
- Bachelor Nutritional Medicine 2024 (compulsory), life sciences, 6th semester
- Bachelor Molecular Life Science 2024 (compulsory), life sciences, 6th semester
- Bachelor MLS 2018 (compulsory), computer science, 6th semester
- Bachelor Nutritional Medicine 2018 (compulsory), computer science, 6th semester
- Bachelor MLS 2016 (compulsory), computer science, 6th semester
- Bachelor Biophysics 2016 (compulsory), bioinformatics, 6th semester
- Bachelor Nutritional Medicine 2016 (compulsory), computer science, 6th semester

**Classes and lectures:**

- Introduction into databases and system biology (lecture, 2 SWS)
- Introduction into databases and system biology (exercise, 1 SWS)
- Introduction into databases and system biology (practical course, 1 SWS)

**Workload:**

- 75 Hours private studies
- 45 Hours in-classroom work
- 30 Hours exam preparation

**Contents of teaching:**

- Entity-Relationship-Models
- Relation algebras
- Database systems
- Structured query language
- bio-databases
- Basic terms of system biology
- Cellular networks

**Qualification-goals/Competencies:**

- Students can create databases, manage them and create complex database queries.
- They can explain the basic terms of system biology and classify them correctly.
- Students know different bio-databases and can use and access them to solve problems from bioinformatics and system biology.

**Grading through:**

- written exam

**Responsible for this module:**

- [Prof. Dr. rer. nat. Till Tantau](#)

**Teacher:**

- [LIED | Lübecker Institut für experimentelle Dermatologie \(Lübeck Institute of Experimental Dermatology\)](#)
- [Institute for Theoretical Computer Science](#)
- [Prof. Dr. rer. nat. Till Tantau](#)
- [Prof. Dr. Hauke Busch](#)

**Literature:**

- Edda Klipp et al.: Systems Biology - A Textbook - Weinheim Wiley-VCH Verlag GmbH & Co. KGaA [2016]
- Sarah E Hunt et al.: Ensembl variation resources , Database Volume 2018 - doi.org/10.1093/database/bay119 T. Hubbard et al. The Ensembl genome database project., Nucleic Acids Research 2002 30(1):38-41.
- Gumm, Sommer: Einführung in die Informatik - 2012, De Gruyter Studium Kemper
- Kemper, Eickler: Datenbanksysteme: Eine Einführung - 2015, De Gruyter Studium

**Language:**

- offered only in German



**Notes:**

Prerequisites for the module:

- nothing

Prerequisites for admission to the written examination:

- succesful work on the exercises

Module exam:

- CS1020-L1: Introduction into databases and system biology, written exam, 90 min, 100 % module grade

**LS3500-KP05, LS3500 - Introduction into Structural Analysis (EinStruA05)**
**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

5

**Course of study, specific field and term:**

- Bachelor Biophysics 2024 (compulsory), life sciences, 6th semester
- Bachelor Molecular Life Science 2024 (compulsory), life sciences, 6th semester
- Bachelor MLS 2018 (compulsory), life sciences, 6th semester
- Bachelor Biophysics 2016 (compulsory), life sciences, 6th semester
- Bachelor MLS 2016 (compulsory), life sciences, 6th semester

**Classes and lectures:**

- Introduction into Structural Analysis (lecture, 2 SWS)
- Introduction into Structural Analysis (seminar / exercises, 2 SWS)

**Workload:**

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

**Contents of teaching:**

- Part A: Protein structure analysis by crystal X-ray diffraction:
- Crystal growth: precipitant and phasediagram
- Crystal morphology: symmetry and space groups
- X-ray diffraction: Bragg's law, reciprocal lattice and the Ewald-sphere construction
- Phase determination: Patterson map and molecular replacement
- Part B: Basic NMR spectroscopy for the investigation of biomolecular structures: Basics of NMR spectroscopy: NMR experiments, Spin systems, the classical vector model
- The nuclear Overhauser effect
- Identification and characterisation of protein-ligand interactions: The transfer nOe, the STD-NMR-experiment, the HSQC experiment, the cross-saturation experiment
- Building blocks for NMR experiments
- Part C: Basics of mass spectrometry: Introduction and basics
- Ion sources and their fields of application
- Mass analysers
- Structural analysis of biomolecules

**Qualification-goals/Competencies:**

- The students will acquire basic skills in selected biophysical techniques to analyze the structure and dynamics of biological macromolecules. The emphasis is on understanding the concepts behind these techniques.
- Furthermore, the students will learn how to elucidate the structure of small organic molecules
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**Grading through:**

- written exam

**Responsible for this module:**

- [Dr. Alvaro Mallagaray](#)

**Teacher:**

- [Research Center Borstel, Leibniz Lung Center](#)
- [Institute of Biochemistry](#)
- [Institute of Chemistry and Metabolomics](#)
- Prof. Dr. Thomas Krey
- Dr. math. et dis. nat. Jeroen Mesters
- [Dr. Alvaro Mallagaray](#)
- Dr. Dominik Schwudke

**Literature:**

- actual papers:
- Teil B: Horst Friebolin: Ein- und zweidimensionale NMR-Spektroskopie. Eine Einführung - Wiley-VCH



- Alexander Mc Pherson: Introduction to Macromolecular Crystallography - 1st edition, 2003, Wiley

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**Language:**

- offered only in German

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**Notes:**

Prerequisites for the module:

- nothing

Prerequisites for admission to the written examination:

- nothing

Module exam:

- LS3500-L1: Introduction into Structural Analysis, written exam, 90 min, 100 % module grade

**LS3990-KP12, LS3990 - Bachelor Thesis (BScArbeit)**
**Duration:**

1 Semester

**Turnus of offer:**

each semester

**Credit points:**

12

**Course of study, specific field and term:**

- Bachelor Molecular Life Science 2024 (compulsory), interdisciplinary, 6th semester
- Bachelor MLS 2018 (compulsory), life sciences, 6th semester
- Bachelor MLS 2016 (compulsory), life sciences, 6th semester
- Bachelor MLS 2009 (compulsory), life sciences, 6th semester

**Classes and lectures:**

- Practical work (practical course, 2 SWS)
- Authoring of the Bachelor Thesis (autonomous practical studies, 1 SWS)
- Colloquium (presentation (incl. preparation), 1 SWS)

**Workload:**

- 360 Hours in-classroom work

**Contents of teaching:**

- Research in the range of molecular biosciences

**Qualification-goals/Competencies:**

- Ability to solve a preformulated simple scientific problem mostly independent in a defined period of time and to present and defend the experimental results with regard to the roles of Good Scientific Practice (GSP) of the University of Lübeck and of the DFG-guidelines.
- Basic skills to design and perform their own experiments

**Grading through:**

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

**Responsible for this module:**

- Studiengangsleitung MLS

**Teacher:**

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

**Literature:**

- Topical literature about the subject: - will be announced by the lecturer

**Language:**

- thesis can be written in German or English

**Notes:**

Prerequisites for the module:

- Minimum of 120 ECTS

Prerequisites for admission to the written examination:

- successful work on a topic of MLS

Module exam:

- LS3990-L1: Bachelor Thesis MLS, written documentation of the practical work of an MLS topic and colloquium, 60 min, 100 % module grade

If the Bachelor Thesis is done externally (outside our university) the student has to choose a licensed lecturer (see PO) of our university as a second instructor who will be first Examiner in the examination.

Thesis must be written in German. Exception: if the examiner is an English native speaker.

**PS1030-KP04, PS1030 - English for Bachelor and Master students MLS (Engl)**
**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

4

**Course of study, specific field and term:**

- Bachelor Molecular Life Science 2024 (optional subject), interdisciplinary competence, Arbitrary semester
- Master MES 2020 (optional subject), interdisciplinary, Arbitrary semester
- Bachelor MES 2020 (optional subject), interdisciplinary, Arbitrary semester
- Bachelor MLS 2018 (optional subject), interdisciplinary competence, Arbitrary semester
- Bachelor MLS 2016 (optional subject), interdisciplinary competence, Arbitrary semester
- Bachelor Biophysics 2016 (optional subject), no specific field, 6th semester
- Master MES 2014 (optional subject), no specific field, 2nd semester
- Bachelor MES 2014 (optional subject), no specific field, 4th or 6th semester
- Master MLS 2009 (optional subject), interdisciplinary competence, Arbitrary semester
- Bachelor MES 2011 (optional subject), medical engineering science, Arbitrary semester
- Master CLS 2010 (optional subject), interdisciplinary competence, Arbitrary semester
- Bachelor MLS 2009 (optional subject), interdisciplinary competence, Arbitrary semester

**Classes and lectures:**

- English for Bachelor and Master students MLS (exercise, 4 SWS)

**Workload:**

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

**Contents of teaching:**

- Exercise: The content follows a curriculum, modified depending on the given skills and the thematic interests of the participants.
- Creating a CV in English

**Qualification-goals/Competencies:**

- Students acquire basic knowledge of the English language in word and writing.
- They improve their communication in English.
- They improve their skills in reading and writing English texts, including specialist literature.

**Grading through:**

- written exam

**Responsible for this module:**

- M. Sc. Sara Meitner

**Teacher:**

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- M. Sc. Sara Meitner

**Literature:**

- :- Up-to-date publications and articles

**Language:**

- offered only in English

**Notes:**

Prerequisites for attending the module:  
- None

Prerequisites for the exam:  
- Preliminary examinations can be determined at the beginning of the semester. If preliminary work has been defined, it must have been completed and positively assessed before the initial examination.