UNIVERSITÄT ZU LÜBECK

Module Guide for the Study Path

Bachelor MLS 2009

Version from 1. October 2025

1st and 2nd semester

Exercises Physics 1 and Physics 2 (ME1025, UePhy1u2) 1

1st semester

Biology 1 (LS1000-MLS, Bio1) 2
Basic Chemistry (LS1100-MLS, AC) 3
Analysis 1 (MA2000-MLS, Ana1) 5
Physics 1 (ME1010-KP06, ME1010-MLS, Physik1KP6) 7

2nd semester

Biology 2 (LS1500-KP06, LS1500, Bio2) 9
Organic Chemistry (LS1600-MLS, OC) 11
Analysis 2 (MA2500-KP05, MA2500-MLS, Ana2KP05) 13
Physics 2 (ME1020-MLS, Phy2) 15

3rd and 4th semester

Introduction into Biophysics (LS2200-KP04, LS2200, EinBiophy) 16

3rd semester

Biochemistry 1 (LS2000-MLS, Biochem1) 18
Biological Chemistry (LS2600-KP06, LS2601, BiolChem06) 20
Physics Lab Course (ME2053-KP04, ME2053, PhysPrakt) 22

4th semester

Biophysical Chemistry (LS2300-KP08, LS2301, BPCKP08) 24
Biochemistry 2 (LS2510-MLS, Biochem2) 26
Cell biology (LS2700-MLS, ZellBio) 28
Optional Subject (OS) of Molecular Life Science (LS2800, WPBSc) 30
OS MLS: Part of the module A: Selected methods of nucleic acid biology (LS2800 A, WPBScNucls) 31
OS MLS: Part of the module C: Model organisms in molecular biology research (LS2800 C, WPBScBio) 32
OS MLS: Part of the module D: Experimentel Physiology (LS2800 D, WPBScPhysi) 33
OS MLS: Part of the module E: Experimental Biological Chemistry (LS2800 E, WPBScBiolC) 34
OS MLS: Part of the module F: Basics of Economics (LS2800 F, WPBScWl) 35
OS MLS: Part of the module G: Philosophy of Science (LS2800 G, WPBScWTh) 36

5th semester

Introduction to Computer Science 1 (CS1012-KP08, CS1012, EinInfo1) 38

Introduction to Bioinformatics (CS1400-KP04, CS1400, EinBioinfo) 40

Molecular Biology (LS3150, MolBio) 42

Part of module LS3250 A: Tissue Engineering (LS3250 A, TissEn) 44

Module part LS3250 B: Metabolic Medicine (LS3250 B, Metabol) 46

Applied MLS (LS3250-KP05, LS3250, AngMLS) 48

Microbiology (MZ3000-KP06, MZ3000, MikroBio) 50

6th semester

Introduction to Computer Science 2 (CS1013, EinInfo2) 52

Introduction into Structural Analysis (LS3500, EinStrukAn) 53

Bachelor Thesis (LS3990-KP12, LS3990, BScArbeit) 55

Biostatistics 1 (MA1600-KP04, MA1600, MA1600-MML, BioStat1) 56

Arbitrary semester

English for Bachelor and Master students MLS (PS1030-KP04, PS1030, Engl) 58

ME1025 - Exercises Physics 1 and Physics 2 (UePhy1u2)

Duration:	Turnus of offer:	Credit points:
2 Semester	each semester	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 suject), physics, 1st and 2nd semester

Classes and lectures:

- Exercises Physics I (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-MLS - Biology 1 (Bio1)

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

Course of study, specific field and term:

- Bachelor MLS 2009 (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 testHandling 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
- Understanding of Genetics and operate with the basic skills in the following semesters
- Basal practical skills in light microscopy

Grading through:

- written exam

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

LS1100-MLS - Basic Chemistry (AC)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	10

Course of study, specific field and term:

- Bachelor MLS 2009 (compulsory), life sciences, 1st semester

Classes and lectures:

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

Workload:

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

Contents of teaching:

- Lectures:
- Organisation of matter and the periodic table of the elements
- Chemical bonds, molecules and Ions
- Chemical formula and stoichiometry
- The threedimensional 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 mater and radiation - methods of Spectroscopy
- Thermodynamics
- Chemical Kinetics
- Exercises:
- Students explain problems on the blackboard of all themes of the lecture
- Practical course:
- the students work in groups of two. Themes:
- Basics and techniques
- Salt and their aqueous solutions
- Acids, Bases and Buffer
- Redox Reactions
- Catalyses, Metal complexes and Chemical Equilibria
- Lab test

Qualification-goals/Competencies:

- The students have the knowledge in basics of general and inorganic chemistry
- They understand basic general and inorganic chemical concepts and can adopt them on reactions
- They are able to do simple chemical anaysis with basic laboratory techniques by applying safety at work in chemical Laboratories (GHS)
- They are able to use tools for professional documentation, interpretation and presentation of data (lab journal, protocol, colloquium) of simple chemical analysis
- By practicing teamwork in small groups during the practical course and writing a collective protocols they got capacity of teamwork
-

Grading through:

- written exam

Is requisite for:

- Organic Chemistry (LS1600-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. Rosemarie Pulz

Literature:

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

Language:

- offered only in German

Notes:

Prerequisite for examination is the successful participation in the practical course with certified protocols and oral presentation; written examination

MA2000-MLS - Analysis 1 (Ana1)

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

Course of study, specific field and term:

- Bachelor MLS 2009 (compulsory), life sciences, 1st semester

Classes and lectures:

- Analysis 1 (lecture, 4 SWS)
- Analysis 1 (exercise, 3 SWS)

Workload:

- 140 Hours private studies
- 105 Hours in-classroom work
- 25 Hours exam preparation

Contents of teaching:

- Sequences and series
- Functions and continuity
- Differentiability, Taylor series
- Metric and normalized spaces, basic topological concepts
- Multivariate differential calculus

Qualification-goals/Competencies:

- Students understand the basic terms of analysis, especially the concept of convergence.
- Students understand the basic thoughts and proof techniques.
- Students can explain basic relationships in analysis.
- Students can apply the basic concepts and proof techniques.
- Students have an understanding for abstract structures.
- Interdisciplinary qualifications:
- Students have a basic competence in modeling.
- Students can transfer theoretical concepts to similar applications.
- Students can work as a group on elementary mathematical problems.

Grading through:

- written exam

Is requisite for:

- Analysis 2 (MA2500-KP05, MA2500-MLS)
- Analysis 2 (MA2500-KP08)
- Analysis 2 (MA2500-KP04, MA2500)
- Analysis 2 (MA2500-KP09)

Responsible for this module:

- Prof. Dr. rer. nat. Jürgen Prestin

Teacher:

- Institute for Mathematics

- Prof. Dr. rer. nat. Jürgen Prestin
- PD Dr. rer. nat. Jörn Schnieder

Literature:

- K. Fritzsche: Grundkurs Analysis 1 + 2
- H. Heuser: Lehrbuch der Analysis 1 + 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

ME1010-KP06, ME1010-MLS - Physics 1 (Physik1KP6)

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

LS1500-KP06, LS1500 - Biology 2 (Bio2)

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

Course of study, specific field and term:

- Bachelor Molecular Life Science 2024 (compulsory), life sciences, 2nd semester
- Bachelor MLS 2018 (compulsory), life sciences, 2nd semester
- Bachelor MLS 2016 (compulsory), life sciences, 2nd semester
- Bachelor MLS 2009 (compulsory), life sciences, 2nd semester

Classes and lectures:

- Genetics (lecture, 2 SWS)
- Histology (lecture, 1 SWS)
- Histology (practical course, 2 SWS)

Workload:

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

Contents of teaching:

- Part A Gnetics: a) Bacterial Genetics The bacterial cell
- Cell division and replication of the bacterial chromosome
- Gene organization and gene expression
- Bacterial pathogenicity factors
- Mutations in bacteria
- Accessory genetic elements and gene transfer mechanisms
-
- b) Human Genetics
- Cytogenetics
- Inheritances and definitions
- Mutations
- Trinucleotide repeat expansions (TRE)
- Epigenetics
- Molecular pathology
- Part B Histology:Lecture: Preparation of tissue specimen
- General microscopy
- Epithelium, glands
- Connective tissues
- Cartilage and bone
- Muscle
- Neural tissue
- Skin
- Blood, vascular system and bone marrow
- Lymphatic organs
- Introduction in immunology
- 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)

Qualification-goals/Competencies:

- Part A Genetics:Understanding of the heredity
- Mutations and verific
- Bacterial genetics
- Part B Histology section:
- They can identify different histological stainings
- They can explain the structure of tissues containing site-specific cells and extracellular matrix molecules
- They can determine the 4 basic tissues and explain their functions
- They can explain the process of bone formation and remodeling
- They can identify unmature and mature blood cells
- They can describe the structure of lymphatic organs

Grading through:

- written exam

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-MLS - Organic Chemistry (OC)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	10

Course of study, specific field and term:

- Bachelor MLS 2009 (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:
- Introduction
- Alkanes, Cycloalkanes
- Alkene and Alkynes
- Aromatic Compounds
- Stereoisomery
- Substitution and elimination reactions
- Alcohols, Phenols and Thiols
- Ether and Epoxides
- Aldehydes and ketones
- Carboxylic acids and derivates
- Amines and derivates
- NMR-Spectroscopy and structure analysis
- Heterocycles
- Lipids
- Carbohydrates
- Amino Acids and Peptides
- Nucleotides and nucleic acids
- Exercises:
- Exercises converning topics from the lectures and the practical course
- Practical course:
- 3 D-structure of organic compounds; Mechanismen in chemical reactions
- Synthesis and analysis
- Reaction of biological relevant molecules I
- Reaction of biological relevant molecules II
- Quantitative analytical destinations of proteins with spectroscopical methods
-

Qualification-goals/Competencies:

- Understanding the basics and the principles of organic chemistry
- Advanced training of laboratory techniques and safty (GHS). First steps into spectroscopy techniques (NMR, UV/VIS)
- Handling complex problems: synthesis, purification and analysis of compounds
- Acquiring tools for professional documentation and presentation of experimental data (lab journal, protocols, oral presentation with qualified feedback, colloquium)

Grading through:

- written exam

Requires:

- Basic Chemistry (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. Rosemarie Pulz
- Dr. phil. nat. Hannelore Peters

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:

Prerequisite for examination is the successful participation in the practical course with certified protocols, presentation and colloquiums is requirment for written examination

MA2500-KP05, MA2500-MLS - Analysis 2 (Ana2KP05)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	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-MLS - Physics 2 (Phy2)

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

Course of study, specific field and term:

- Bachelor MLS 2009 (compulsory), life sciences, 2nd semester

Classes and lectures:

- Physics 2 (lecture, 4 SWS)

Workload:

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

Contents of teaching:

- Electric charge, Coulomb force, electric field, electric potential, capacity
- Stationary electric current, resistor, Kirchhoff s laws
- Magnetic field, magnetic dipole, electric current and magnetic field
- Electromagnetic induction, resonant circuit
- Nonstationary electric and magnetic fields, displacement current, Maxwell s equations
- Refraction, reflexion
- Geometrical optics, image generation, lenses, aberrations, optical instruments
- Interference, diffraction, resolution power
- Polarization, birefringence, Brewster s angle
- Relativity theory
- Bohr s atomic model, spectral lines, quantum mechanical atomic model
- Molecules and solid bodies

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. Robert Huber
- Prof. Dr. rer. nat. Thorsten Buzug
- 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. Thorsten Buzug

Literature:

- Douglas C. Giancoli: Physik

Language:

- offered only in German

LS2200-KP04, LS2200 - Introduction into Biophysics (EinBiophy)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	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 (Excercise 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.

LS2000-MLS - Biochemistry 1 (Biochem1)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	10

Course of study, specific field and term:

- Bachelor MLS 2009 (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
- Oxidative phosphorylation
- Lipid metabolism- I
- Lipid metabolism- II
- Amino acid oxidation and the urea cycle
- Practical course groups of 2: Biological buffer systems
- Photometric methods / hemoglobin
- Protein separation I:
- Enzymatic Catalysis
- Characterization of carbohydrates

Qualification-goals/Competencies:

- Understanding structures and functions of biochemical important biomolecules
- Understanding biochemical interrelations and their importance for cellular metabolism
- Estimation of the biotechnological potential of biomolecules
- Studying of biochemical separation and analysis procedures
- Practicing
- Quantitave evaluation, protocolling and discussion of outcomes of biochemical experiments
-
-

Grading through:

- written exam

Requires:

- Organic Chemistry (LS1600-MLS)

Responsible for this module:

- Prof. Dr. rer. nat. Rolf Hilgenfeld

Teacher:

- Department of Neurosurgery
- Institute of Biochemistry

- Prof. Dr. rer. nat. Rolf Hilgenfeld
- Prof. Dr. rer. nat. Stefan Anemüller
- Prof. Dr. Lars Redecke
- Dr. math. et dis. nat. Jeroen Mesters
- PD Dr. rer. nat. Christina Zechel

Literature:

- Voet/Voet: Biochemistry - 4th edition, 2011, Wiley
- Lehninger: Principles of Biochemistry - 6th edition, 2013, Freeman
- Stryer: Biochemistry - 7th edition, 2012, Freeman
- Lodish et al.: Molecular Cell Biology - 7th edition, 2013, Freeman
- Alberts et al.: Molecular Biology of the Cell - 5th edition, 2008, Garland Science

Language:

- offered only in English

Notes:

Successful participation in the practical course: Prerequisite for examination: each student needs a minimum of 2 certificates during the practical course and marked protocols.

LS2600-KP06, LS2601 - Biological Chemistry (BiolChem06)

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

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. 2013ISBN: 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:	Turnus of offer:	Credit points:
1 Semester	each winter semester	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

Literature:

- Giancoli: Physik

Language:

- offered only in German

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

LS2300-KP08, LS2301 - Biophysical Chemistry (BPCKP08)

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

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-MLS - Biochemistry 2 (Biochem2)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	10

Course of study, specific field and term:

- Bachelor MLS 2009 (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
- Amino acid metabolism
- Signal transduction and ho
- Biochemical methods
- Practical course groups of 2:Cell respiration and biological oxidation
- Protein biosynthesis
- Polymerase chain reaction (PCR) and DNA
- Immunological methods

Qualification-goals/Competencies:

- Understanding structures and functions of biochemical important biomolecules
- Understanding biochemical interrelations and their importance for cellular metabolism
- Estimation of the biotechnological potential of biomolecules
- Studying of biochemical separation and analysis procedures
- Practicing
- Quantitave evaluation, protocolling and discussion of outcomes of biochemical experiments
-

Grading through:

- written exam

Requires:

- Organic Chemistry (LS1600-MLS)

Responsible for this module:

- Prof. Dr. rer. nat. Rolf Hilgenfeld

Teacher:

- Institute of Biochemistry

- Prof. Dr. rer. nat. Rolf Hilgenfeld
- Prof. Dr. rer. nat. Stefan Anemüller

Literature:

- Voet/Voet: Principles of Biochemistry - 4th edition, 2011, Wiley
- Lehninger: Principles of Biochemistry - 6th edition, 2013, Freeman
- Stryer: Biochemistry - 7th edition, 2012, Freeman
- Lodish et al.: Molecular Cell Biology - 7th edition, 2013, Freeman
- Alberts et al.: Molecular Biology of the Cell - 5th edition, 2008, Garland Science

Language:

- offered only in English

Notes:

Prerequisite for the lab course: certificate in Organic Chemistry, knowledge in Biochemistry 1.
Successful participation in the practical course: each student needs a minimum of 2 certificates during the practical course and marked protocols.

LS2700-MLS - Cell biology (ZellBio)

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

Course of study, specific field and term:

- Bachelor MLS 2009 (compulsory), life sciences, 4th semester

Classes and lectures:

- Cell biology (lecture, 3 SWS)
- Cell biology (practical course, 4 SWS)

Workload:

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

Contents of teaching:

- Lectures:
- Special structure of cells
- Cell cycle and apoptosis
- Introduction into developmental biology
- 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:

- Principle of the basic function of the eukaryotic cells
- Detailed knowledge in all areas of cell biology covered by the lecture (see
- Handling of basic cell biology techniques
- Improving the ability to document results correctly and to work in a team
-

Grading through:

- written exam

Requires:

- Biology 1 (LS1000-MLS)

Responsible for this module:

- Prof. Dr. rer. nat. Enno Hartmann

Teacher:

- Institute of Virology and Cell Biology
- Institute for Biology
- Institute of Medical and Marine Biotechnology

- Prof. Dr. rer. nat. Enno Hartmann
- PD Dr. rer. nat. Kai-Uwe Kalies
- Prof. Dr. rer. nat. Charli Kruse
- Prof. Dr. rer. nat. Stefan Taube

Literature:

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

Language:

- offered only in German

Notes:

Knowledge in Biology 1 and 2 and Biochemistry 1 is a prerequisite for this course. Entrance requirement for the practical course: Certificate of the course Biology 1 and Biochemistry 1

LS2800 - Optional Subject (OS) of Molecular Life Science (WPBSc)

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

Course of study, specific field and term:

- Bachelor MLS 2009 (compulsory), life sciences, 4th semester

Classes and lectures:

- See the course catalog on the website MLS (lecture with exercises or seminar, 3 SWS)

Workload:

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

Contents of teaching:

- see the course catalog on the website MLS

Qualification-goals/Competencies:

- see the course catalog on the website MLS

Grading through:

- as announced by examiner

Responsible for this module:

- Prof. Dr. rer. nat. Enno Hartmann

Teacher:

- All institutes of the University of Lübeck
- Alle Dozentinnen/Dozenten der UzL

Language:

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

Notes:

Each has to choose one of the optional course catalog MLS of the website MLS

LS2800 A - OS MLS: Part of the module A: Selected methods of nucleic acid biology (WPBScNucls)

Duration:	Turnus of offer:	Credit points:	Max. group size:
1 Semester	each summer semester	4	9

Course of study, specific field and term:

- Bachelor MLS 2009 (Module part of a compulsory module), life sciences, 4th semester

Classes and lectures:

- Selected methods of nucleic acid biology (lecture, 2 SWS)
- Selected methods of nucleic acid biology (practical course, 1 SWS)

Workload:

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

Contents of teaching:

- Annealing of complementary RNA: a kinetic analysis
- Synthesis of Nucleid acids
- Steady state and pre-steady state kinetic analyses of protein/nucleic acid interactions

Qualification-goals/Competencies:

- Studying basic of the molecular biology of nucleic acids and interacting proteins
- Transfer of theoretical models to experimental studies

Grading through:

- participation in discussions

Responsible for this module:

- Dr. rer. nat. Rosel Kretschmer-Kazemi Far

Teacher:

- Institute of Molecular Medicine

- Dr. rer. nat. Rosel Kretschmer-Kazemi Far
- Prof. Dr. rer. nat. Georg Sczakiel
- Prof. Dr. rer. nat. Tobias Restle
- Dr.rer.nat Sonja Petkovic

Literature:

- : - Arbeitsvorschriften, Originalliteratur

Language:

- offered only in German

Notes:

Part of the module LS2800

LS2800 C - OS MLS: Part of the module C: Model organisms in molecular biology research (WPBScBio)

Duration:	Turnus of offer:	Credit points:	Max. group size:
1 Semester	each summer semester	4	16

Course of study, specific field and term:

- Bachelor MLS 2009 (Module part of a compulsory module), life sciences, 4th semester

Classes and lectures:

- Model organisms in molecular biology research (lecture, 1 SWS)
- Model organisms in molecular biology research (exercise, 2 SWS)

Workload:

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

Contents of teaching:

- Microorganisms Saccharomyces cerevisae
- Green plants Arabidopsis thaliana
- Invertebrates I Caenorhabditis elegans
- Invertebrates II Drosophila melanogaster
- Vertebrates Mus musculus
- Phylogeny of model organisms

Qualification-goals/Competencies:

- basic understanding of the biology of the organisms presented
- basic understanding of the advantages and disadvantages of the different model organisms for biological research
- basic practical abilities in handling these organisms

Grading through:

- continuous, successful participation in course

Requires:

- Biology 1 (LS1000-MLS)

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institute for Biology
- Prof. Dr. rer. nat. Enno Hartmann
- Prof. Dr. rer nat. Rainer Duden
- Prof. Dr. rer. nat. Christian Schmidt
- Prof. Dr. rer. nat. Walther Traut

Literature:

- : - zur Einführung: Campbell Allgemeine Biologie die entsprechenden Kapitel

Language:

- offered only in German

Notes:

Part of the module LS2800

LS2800 D - OS MLS: Part of the module D: Experimentel Physiology (WPBScPhysi)

Duration:	Turnus of offer:	Credit points:	Max. group size:
1 Semester	each summer semester	4	12

Course of study, specific field and term:

- Bachelor MLS 2009 (Module part of a compulsory module), life sciences, 4th semester

Classes and lectures:

- Experimentel Physiology (lecture, 2 SWS)
- Experimentel Physiology (seminar, 1 SWS)

Workload:

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

Contents of teaching:

- Experiments on isolated organs and physiological studies in humans:
- Practical course for the isolation of organs from frog, mouse and rat
- Study of isolated nerves and skeletal muscle to characterize organ physiology
- Determination of blood groups, hemolysis, and coagulation in human blood
- Study of isolated gut, blood vessels, and uterus to characterize the function of smooth muscle
- Practical course on sensory physiology exemplified on the eye
- Study on the circulatory regulation in humans

Qualification-goals/Competencies:

- Acquiring knowledge on experimental procedures in physiology and pharmacology

Grading through:

- presentation and experiments

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institut of Physiology
- Prof. Dr. med. Cor de Wit

Literature:

- : - Lehrbücher der Physiologie

Language:

- offered only in German

Notes:

Part of the module LS2800

LS2800 E - OS MLS: Part of the module E: Experimental Biological Chemistry (WPBScBiolC)

Duration:	Turnus of offer:	Credit points:	Max. group size:
1 Semester	each summer semester	4	6

Course of study, specific field and term:

- Bachelor MLS 2009 (Module part of a compulsory module), life sciences, 4th semester

Classes and lectures:

- Practical course Biological Chemistry (lecture, 2 SWS)
- Practical course Biological Chemistry (exercise, 1 SWS)

Workload:

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

Contents of teaching:

- 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.

Qualification-goals/Competencies:

- Simple organic synthesis
- Independent planning of a simple synthesis
- Purification and characterization of synthesis products employing MS and NMR

Grading through:

- presentation

Requires:

- Biological Chemistry (LS2600-KP06, LS2601)
- Organic Chemistry (LS1600-MLS)

Responsible for this module:

- Siehe Hauptmodul

Teacher:

- Institute of Chemistry and Metabolomics
- Prof. Dr. rer. nat. Thomas Peters
- Dr. Alvaro Mallagaray

Literature:

- : Scientific publications

Language:

- offered only in German

Notes:

Part of the module LS2800
Scheduling and timing of experiments is up to the students. Therefore, a maximum of six students will be allowed per course.

LS2800 F - OS MLS: Part of the module F: Basics of Economics (WPBScWl)

Duration:	Turnus of offer:	Credit points:	Max. group size:
1 Semester	each summer semester	4	20

Course of study, specific field and term:

- Bachelor MLS 2009 (Module part of a compulsory module), life sciences, 4th semester

Classes and lectures:

- Business and Economics (lecture, 2 SWS)
- Business and Economics (exercise, 1 SWS)

Workload:

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

Contents of teaching:

- Basics of market economy
- Three actual problems of economy (like globalisation...)
- Structure, organisation and production model of a company
- Product and price policy
- Human Ressource Management: men as a central part

Qualification-goals/Competencies:

- Introduction to basic concept of economics
- Knowing of structure and devision of work in a company
- Understanding of economic interrelation and compliance

Grading through:

- continuous, successful participation in course

Responsible for this module:

- Prof. Dr. rer. nat. Enno Hartmann

Teacher:

-
- Dipl.- Ökonom Jürgen Spiekermann

Literature:

- Hutzschenreuter, T.: Allgemeine Betriebswirtschaftslehre - Wiesbaden, 2007
- Olfert, K., Rahn, H.-J.: Einführung in die Betriebswirtschaftslehre - Ludwigshafen, 2005, 8. Auflage
- Wöhe, G.: Einführung in die Allgemeine Betriebswirtschaftslehre - München, 2010, 24. Auflage
- : - daneben: Wirtschaftswoche, The Economist, Die Zeit, Frankfurter Allgemeine Zeitung, Der Spiegel, ...

Language:

- offered only in German

Notes:

Part of the module LS2800

LS2800 G - OS MLS: Part of the module G: Philosophy of Science (WPBScWTh)

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

Course of study, specific field and term:

- Bachelor MLS 2009 (Module part of a compulsory module), life sciences, 4th semester

Classes and lectures:

- Philosophy of Science (lecture with exercises or seminar, 3 SWS)

Workload:

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

Contents of teaching:

- Science, technology and medicine permeate modern societies to increasing degrees. But what distinguishes science from other forms of knowledge, and how does its application impact our way of life? This module will introduce you to the foundations of philosophy of science through a lecture and a compact seminar in which we will discuss recent developments in the biosciences. You will learn to apply conceptual analysis and arguments in order to elucidate and evaluate such developments with regard to their philosophical, ethical, historical and social concequences. For this purpose, the compact seminar will turn to a theme that is currently hotly debated under the catchword Big Data . This is actually not a recent theme in the biosciences. Many biological disciplines including botany, biogeography or ecology -- but also medical disciplines like pathology or epidemiology have always been data-driven rather than hypothesis-driven. While these disciplines were pushed into the background by molecular biology in the twentieth century, they experienced a renaissance in the last two decades associated with the rise of new research programmes such as biodiversity research, evidence based medicine or precision medicine. In the seminar we will discuss on the basis of historical sources, select scientific papers and documents from popular media how the life sciences collect, process and communicate data, which roles classifications, algorithms and models play in these processes, and which new ethical problems data-intensive research faces.
-
-
-

Qualification-goals/Competencies:

- Students are able to recall and contextualise important dates, persons, and ideas in the history of concepts of life.
- They can formulate, explain and discuss important philosophical aspects of biology, especially synthetic biology.
- They can evaluate and critisize ethical standpoints in public debates of contemporary biology.

Grading through:

- oral presentation and essay

Responsible for this module:

- Dr. phil. Staffan Müller-Wille

Teacher:

- Institute for History of Medicine and Science Studies

- Dr. phil. Staffan Müller-Wille
- Prof. Dr. med. Cornelius Borck
- Prof. Dr. rer. nat. Burghard Weiss

Literature:

- : Special Section Synthetic Biology - Science 333(2011): 1235-1256
- J. Boldt, O. Müller, G. Maio: Synthetische Biologie - Bern 2009
- M. A. Bedau / E. C. Parke: The Ethics of Protocells. Moral and Social Implications of Creating Life in the Laboratory - Cambridge, Mass: MIT Press 2009
- K. Köchy: Biophilosophie zur Einführung - Hamburg 2008
- A. Brenner: Leben. Grundwissen Philosophie - Stuttgart: Reclam 2009
- Martin G. Weiß (Hg.): Bios und Zoe. Die menschliche Natur im Zeitalter ihrer technischen Reproduzierbarkeit - Frankfurt a.M.: Suhrkamp 2009
- J. Schummer: Das Gotteshandwerk. Die künstliche Herstellung von Leben im Labor - Frankfurt/M. 2009.

Language:

- offered only in German

Notes:

Part of the module LS2800
Basics understanding of molecular Biology; Interest in philosophical-ethical questions in the life sciences

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

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	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:
- succesful 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)

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

Course of study, specific field and term:

- Bachelor IT-Security 2016 (optional subject), interdisciplinary, Arbitrary semester
- Bachelor Nutritional Medicine 2024 (compulsory), mathematics / computer science, 5th semester
- Bachelor Molecular Life Science 2024 (compulsory), mathematics / computer science, 5th semester
- Bachelor MES 2020 (optional subject), computer science / electrical engineering, 3rd semester at the earliest
- Bachelor Computer Science 2019 (compulsory), Canonical Specialization Bioinformatics and Systems Biology, 1st semester
- Bachelor Computer Science 2019 (optional subject), Introductory Module Computer Science, 1st semester
- Bachelor MLS 2018 (compulsory), life sciences, 5th semester
- Bachelor MES 2014 (optional subject), computer science / electrical engineering, 3rd semester at the earliest
- Bachelor Computer Science 2016 (optional subject), Introductory Module Computer Science, 1st semester
- Bachelor Computer Science 2016 (compulsory), Canonical Specialization Bioinformatics, 1st semester
- Bachelor MLS 2016 (compulsory), life sciences, 5th semester
- Bachelor Medical Informatics 2014 (compulsory), medical computer science, 3rd semester
- Bachelor Computer Science 2014 (compulsory), specialization field bioinformatics, 1st semester
- Bachelor Medical Informatics 2011 (compulsory), medical computer science, 3rd semester
- Bachelor MLS 2009 (compulsory), life sciences, 5th semester
- Bachelor CLS 2010 (compulsory), specialization field bioinformatics, 5th semester
- Bachelor MES 2011 (optional subject), medical engineering science, 3rd or 5th semester
- Bachelor Computer Science 2012 (compulsory), specialization field bioinformatics, 1st semester
- Bachelor Biophysics 2024 (optional subject), computer science, 5th semester

Classes and lectures:

- Introduction to Bioinformatics (lecture, 2 SWS)
- Introduction to Bioinformatics (exercise, 1 SWS)

Workload:

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

Contents of teaching:

- Life, Evolution & the Genome
- Sequence assembly - Industrial reading of genetic information
- DNA sequence models & hidden markov models
- Viterbi-Algoritm
- Sequence alignment & dynamic programming
- Unsupervised data analysis (k-means, PCA, ICA)
- DNA microarrays & GeneChip technologies

Qualification-goals/Competencies:

- Students are able to explain the basic concepts of coding, transcription and translation of information in living beings.
- They are able to explain how a solution of the shortest common superstring problem can be estimated with a simple greedy algorithm.
- They are able to create a Markov chain or a Hidden Markov Model (HMM) for a given modelling problem.
- They are able to give examples on how to solve a problem using dynamic programming.
- They are able to implement the introduced algorithms (in Matlab)
- They are able to use unsupervised learning methods and they are able to interpret the results.
- They are able to explain basic Microarray-and DNA-Chip-Technologies.

Grading through:

- portfolio exam

Responsible for this module:

- Prof. Dr. rer. nat. Amir Madany Mamlouk

Teacher:

- Institute for Neuro- and Bioinformatics
- Prof. Dr. rer. nat. Amir Madany Mamlouk

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.

LS3150 - Molecular Biology (MolBio)

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

Course of study, specific field and term:

- Bachelor MLS 2009 (compulsory), life sciences, 5th semester

Classes and lectures:

- Molecular Biology (lecture, 2 SWS)
- Molecular Biology (seminar, 2 SWS)

Workload:

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

Contents of teaching:

- Lectures:Lectures will be oriented with respect to chosen cases of eminent pathophysical, agricultural, technological and methodological conditions. Typically, 5 coherent blocks will be lectured.
- Basics: genetic engineering and gene regulation
- Growth and aging: molecular processes during ontogenetic differentiation, maintenance and loss of function during aging of cells and organisms
- Nucleic-acids: molecular basis, polymorphism, RNA-regulation. Diagnostic and possible therapeutic aspects
- Molecular biology of plants: molecular basis as well as economic and ecological aspects of transgenic plants and herbicide resistance
- Gene-therapeutic approaches and recombinant vaccines
- Exercises:Reading of scientific articles and oral presentation
- Conceptual design of publications
- English as lingua franca in science

Qualification-goals/Competencies:

- Students are able to present basic steps of genetic engineering
- They can explain basic mechanisms of gene expression
- They are able to formulate basic mechanisms of RNA-regulated biological systems
- They can present examples for the relationship between pathophysiological processes and their molecular basis
- They are able to explain principles of gene therapy
- They acquire the competence to handle english literature and to present it in a scientific oral presentation

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Norbert Tautz

Teacher:

- Institute of Molecular Medicine
- Medical Clinic II
- Department of Neurosurgery
- Institute of Virology and Cell Biology

- Prof. Dr. rer. nat. Norbert Tautz
- PD Dr. rer. nat. Christina Zechel
- Dr. rer. nat. Rosel Kretschmer-Kazemi Far
- Dr. rer. nat. Olaf Isken

Literature:

- Alberts et al.: Molecular Biology of Cells - Garland Science
- Lodish et al.: Molecular Cell Biology - Freeman
- Buchanan et al.: Biochemistry and Molecular Biology of Plants - Wiley Verlag
- : Versuchsanleitungen
- :

Language:

- offered only in German

LS3250 A - Part of module LS3250 A: Tissue Engineering (TissEn)

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

Course of study, specific field and term:

- Bachelor MLS 2018 (Module part of a compulsory module), life sciences, 5th semester
- Bachelor MLS 2016 (Module part of a compulsory module), life sciences, 5th semester
- Bachelor MLS 2009 (Module part of a compulsory module), life sciences, 5th semester

Classes and lectures:

- Tissue Engineering (seminar with practical exercises, 2 SWS)
- Tissue Engineering (lecture, 2 SWS)

Workload:

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

Contents of teaching:

- Lectures:Mamalia cells in their natural environment and under in vitro culture as an example of industrial application.
- Aging of cells in vitro
- Established cell lines
- Diverse in vitro culturing conditions
- Proliferation and differentiation under in vitro conditions
- Stem cell biology
- Materials for medical applications
- Fermentors, bioreactors and protein purification
- Home work e. g. Tissue transplantation and rejection
- Practical course (in groups of 2):Principles of aseptic manipulations, working in sterile containments, object and selfprotection, use of autoclaves
- Preparation of sterile media, additives and other reagents
- Slicing of tissue samples, transfer into tissue culture flasks for explant cultures
- Microscopy and documentation of growing cells
- Cell count, passaging by trypsinisation
- Viability test, freezing of cells and reseeding after thawing
- Adherence of cells to various matrices
- Immunohistochemistry of intracellular and extracellular proteins
-
-

Qualification-goals/Competencies:

- Students are able to explain principles of cell- and tissue culture to generate biocomposites from differentiated and pluripotent cells
- They are able to explain basic principles of pro- and eukaryotic gene expression systems
- They are able to explain basic principles of matrix biology
- They can reproduce the aspects of stem cell biology
- They acquire the ability to assess ethical aspects of tissue engineering
- They improve their competence for correct documentation (within regards to the rules of GSP of the UzL) and team working skills
-

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Charli Kruse

Teacher:

-
- Department of Dermatology, Allergology and Venerology
- Institute of Virology and Cell Biology
- Institute of Medical and Marine Biotechnology

- Prof. Dr. rer. nat. Charli Kruse
- Dr. rer. nat. Daniel Hans Rapoport

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

Literature:

- Lanza, Langer, Vacanti: Principles of Tissue Engineering

Language:

- offered only in German

Notes:

Knowledge in Cell biology is a prerequisite for this course. Entrance requirement for the seminar with practical parts: certificate of the course Biochemistry 1 or 2 (LS2000-KP10 or LS2510-KP10), practical Cell Biology (LS2700-P).

See module LS3250-KP05

(Is part of LS3250)

(Share of Marine Biotechnology in V is 43%)
(Share of Virology in V is 29%)
(Share of Dermatology in V is 21%)
(Share of Ophthalmology in V is 7%)
(Share of Virology in S is 100%)

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

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

Course of study, specific field and term:

- Bachelor MLS 2018 (Module part of a compulsory module), life sciences, 5th semester
- Bachelor MLS 2016 (Module part of a compulsory module), life sciences, 5th semester
- Bachelor MLS 2009 (Module part of a compulsory module), life sciences, 5th semester

Classes and lectures:

- Metabolic Medicine (lecture, 2 SWS)
- Tissue Engineering (seminar with practical exercises, 2 SWS)

Workload:

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

Contents of teaching:

- Metabolic physiology
- glucose metabolism & diabetes
- lipid metabolism & obesity, adipokines
- gastroenterology
- thyroid
- central appetite regulation
- circadian clocks & metabolism
- sleep & metabolism
- Seminar TE: see LS3250-KP05

Qualification-goals/Competencies:

- Understanding the principles of energy homeostasis
- Understanding physiological interactions of different compartments in the context of energy metabolism
- Students know the symptoms of major metabolic disorders and their pathophysiological causes

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Henrik Oster

Teacher:

- Institute for Experimental Endocrinology
- Institute of Neurobiology
- Medical Clinic I

- Prof. Dr. rer. nat. Henrik Oster
- Dr. rer. nat. Carla Schulz
- Prof. Dr. rer. nat. Jens Mittag
- Dr. rer. nat. Violetta Pilorz
- Dr. rer. nat. Isabel Heyde
- Dr. rer. nat. Rebecca Ölkrug
- PD Dr. Britta Wilms
- PD Dr. Misa Hirose

Literature:

- Keith N. Frayn: Metabolic Regulation: A Human Perspective - Wiley & Blackwell, 2010

Language:

- German and English skills required

Notes:

Prerequisites for the module:
- LS2000-L1 Biochemstry 1 or LS2510-L1 Biochemstry 2
- LS2700-P Practical Cell Biology (for practical parts of LS3251-S)

Prerequisites for admission to the written examination:
- succesful participation in the seminar LS3250-S Tissue Engineering

Module exam:
- LS3252-L1:Metabolic Medicin, written exam, 90 min, 100 % module grade

Principle knowldege in physiology and biochemistry required.

LS3250-KP05, LS3250 - Applied MLS (AngMLS)

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

Course of study, specific field and term:

- Bachelor MLS 2018 (optional subject), life sciences, 5th semester
- Bachelor MLS 2016 (compulsory), life sciences, 5th semester
- Bachelor MLS 2009 (compulsory), life sciences, 5th semester

Classes and lectures:

- Tissue Engineering (seminar with practical exercises, 2 SWS)
- See LS3250 A: Tissue Engineering (lecture, 2 SWS)
- See LS3250 B: Metabolic Medicine (lecture, 2 SWS)

Workload:

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

Contents of teaching:

- Lecture: see LS3250-A and LS3250-B

Qualification-goals/Competencies:

- see LS3250-A and LS3250-B

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Charli Kruse

Teacher:

-
- Institute of Neurobiology
- Medical Clinic I
- Institute of Medical and Marine Biotechnology
- Institute for Experimental Endocrinology
- Department of Dermatology, Allergology and Venerology
- Institute of Virology and Cell Biology

- Prof. Dr. rer. nat. Charli Kruse
- Prof. Dr. rer. nat. Henrik Oster
- Dr. rer. nat. Daniel Hans Rapoport
- Dr. rer. nat. Philipp Ciba
- Prof. Dr. rer. nat. Markus Hoffmann, Dr. med.
- Prof. Dr. med. vet. Jennifer Hundt
- Prof. Dr. med. Ralf Ludwig
- Dr. rer. nat. Olaf Isken
- Dr. med. Dipl. Biol. Judith Sewing

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- LS200-L1 Biochemistry 1 oder LS2510-L1 Biochemistry 2
- LS2700-P Practical Cell Biology (for practical parts of LS3251-S)

Admission requirements for participation in module examination(s):
- succesful participation in the seminar TE

Module exam(s):
- LS3251-L1: Tissue Engineering (LS3250 A) resp. Metabolic Medicine (LS3250 B), written exam per Field of specialisatoin 60 min, 100 % of the module grade

Knowledge of cell biology is a prerequisite.

One of the lectures LS3250 A or B must be chosen, the seminar TE is compulsory.

Compulsory registration is required for the written examination, where the date and elective subject will be determined.

(Consists of LS3250 A, LS3250 B)
(Choose 1 from all)

MZ3000-KP06, MZ3000 - Microbiology (MikroBio)

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

Course of study, specific field and term:

- Bachelor MLS 2016 (compulsory), life sciences, 5th semester
- Bachelor MLS 2009 (compulsory), life sciences, 5th semester

Classes and lectures:

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

Workload:

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

Contents of teaching:

- Systematics of microorganisms
-
- Bacterial cell wall
- Bacterial growth
- Bacterial toxins
-
- Medical microbiology
-
- Immunology
- Decomposition of natural substances
- Industrial microbiology
- Practical course: General bacteriology, bacteriological techniques
- Differentiation of bacteria
- Bacterial growth and how we can inhibit it
- Biochemistry

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:

- written exam

Requires:

- Biology 1 (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 Graspeuntner
- Dr. rer. nat. Dirk Friedrich

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

Literature:

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

Language:

- offered only in German

CS1013 - Introduction to Computer Science 2 (EinInfo2)

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

Course of study, specific field and term:

- Bachelor MLS 2009 (compulsory), computer science, 6th semester

Classes and lectures:

- Introduction to Computer Science 2 (lecture, 2 SWS)
- Introduciton to Computer Science 2 (exercise, 1 SWS)

Workload:

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

Contents of teaching:

- Complexity of problems and algorithms
- Optimization problems
- Approximation and heuristics
- Databases
- IT-Security
- Encryption

Qualification-goals/Competencies:

- Students can assess the computational complexity of problems and can apply appropriate methods for solving them.
- They can create databases, manage them and create complex database queries.
- They can name basic questions of IT-security as well as solutions to basic security problems.

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Till Tantau

Teacher:

- Institute for Theoretical Computer Science
- Prof. Dr. rer. nat. Till Tantau

Literature:

- Gumm, Sommer: Einführung in die Informatik - Oldenbourg Verlag, 2005

Language:

- offered only in German

LS3500 - Introduction into Structural Analysis (EinStrukAn)

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

Course of study, specific field and term:

- Master CLS 2010 (compulsory), computational life science / life sciences, 2nd semester
- Bachelor MLS 2009 (compulsory), life sciences, 6th semester

Classes and lectures:

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

Workload:

- 120 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:Indroduction 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
-

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. rer. nat. Thomas Peters
- Prof. Dr. rer. nat. Rolf Hilgenfeld
- Dr. math. et dis. nat. Jeroen Mesters
- Prof. Dr. rer. nat. Karsten Seeger
- Dr. Dominik Schwudke

Literature:

- Wird den aktuellen Gegebenheiten angepasst und in der Vorlesung angegeben. Siehe auch in den entsprechenden Skripten:
- Teil B: Horst Friebolin: Ein- und zweidimensionale NMR-Spektroskopie. Eine Einführung - Wiley-VCH
- Alexander Mc Pherson: Introduction to Macromolecular Crystallography - 1st edition, 2003, Wiley

Language:

- offered only in German

LS3990-KP12, LS3990 - Bachelor Thesis (BScArbeit)

Duration:	Turnus of offer:	Credit points:
1 Semester	each semester	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 simpel scientific problem mostly independent in a defined period of time and to present and defende the experimental results with regardto 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:
- succesful 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 examinator is an English nativ speaker.

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

Duration:	Turnus of offer:	Credit points:
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, X2 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

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

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	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 suject), 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:

-

- 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.