Module Handbook

Module:	**Monitoring of Clinical Trials**
Semester:	**1st Semester Master**
Course Leader:	**Prof. Dr. Dr. Andreas Pfützner**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Compulsory Course in 1st Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 30 Exercise: 2 credit hours; group size: 30 Lab work: 2 credit hours; group size: 15
Students workload:	Contact hours / Private study Lecture: 22,5 / 22,5 Exercise: 22,5 / 67,5 Lab work: 22,5 / 45 Exam : 1,5 / 36 Sum: 69 / 171 Total Sum: 240 hours
Credits	8 ECTS
Prerequisites:	none
Recommendations:	Lecture Applied Clinical Research (4th semester Bachelor, Biology)
Learning outcomes:	After successfully completing the course, students should - know the international standards for clinical research - be able to compile the documents needed for a clinical trial - be able to monitor a clinical trial - be able to guarantee that the requirements for the correct analysis of the trial data are met - be able to draw up a final report.
Summary indicative content:	International clinical research for the approval of pharmaceuticals, legal and ethical framework, approach to planning clinical trials in accordance with the 12th amendment of the AMG (law on the use of pharmaceuticals), trial documents, licenses and notifications, choosing and training the trial centres, contracts and initiation of the trial, handling the medication of the trial, monitoring, reporting unwanted incidents, data processing, data management, database lock, statistical analysis, final report
Assessment:	Final examination 80 %, report on the practical training 20 %
Teaching style:	The module consists of a lecture accompanied by a tutorial on "Clinical research and its current practical implementation". In addition, the course includes a weekly four-hour practical training in which a clinical trial is simulated. The course is complemented by a half-day excursion to a company working in the field of clinical research. The content of the course is tested in a final examination.
Indicative	Chow, Liu: Design and Analysis of Clinical Trials, Wiley-

Bibliography/Sources:	Interscience 1998, ISBN: 047113404X Orfanos, Karger (eds) Recent Developments in Clinical Research, Verlag für Medizin und Naturwissenschaften, ISBN 3805539282

Module:	**Pharmacology and Toxicology**
Semester:	**1st Semester Master**
Course Leader:	**Prof. Dr. Ulrike Bartz**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Compulsory Course in 1st Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 30 Exercise: 2 credit hours; group size: 30 Lab work: 2 credit hours; group size: 15
Students workload:	Contact hours / Private study Lecture: 22,5 / 22,5 Exercise: 22,5 / 67,5 Lab work: 22,5 / 45 Oral Exam: 0,5 / 37 Sum: 68 / 172 Total Sum: 240 hours
Credits	8 ECTS
Prerequisites:	none
Recommendations:	none
Learning outcomes:	After successfully completing the module, students should be able to work out and understand a new medicinal product (new chemical entity or biological), its dosage form and the relevant clinical picture regarding pharmacokinetic and pharmacodynamic properties. This methodology can be directly applied for independently working out further medicinal products relevant in later worklife (clinical or biomedical research).
Summary indicative content:	Lecture: Drug actions, pharmacokinetics, (L)ADME, pharmacodynamics (mode of action), adverse effects, pharmaceutical interactions, toxicology, in particular: biotransformation, bioactivation, elimination, medical terminology, pharmacokinetic models, cumulation, bioavailability, prodrug concept, enterohepatic circulation, pharmacogenetics, preclinical and clinical trials/bioequivalence studies/regulations for drug approval. Seminars/tutorials: In small groups, students have to work on, present and dispute about a new medicinal product on the basis of an EPAR (European Product Assessment Report) and a SmPC (Summary of Product Characteristics). Moreover, students jointly work on a concept paper "Criteria for the evaluation of Drug Innovations" and provide a classification into radical/incremental/sham ("me too") innovation. Among other things, this approach includes the following aspects: new mechanisms of action, prodrug principle, selectivity of action, polypharmacy, modified release dosage forms, new administration routes, drug targeting.

	Lab course: 1. Several simulation experiments in small groups on pharmakokinectis (plasma samples) including the mathematical analysis (excel), one compartment model; oral input, intravenous dose such as or bolus dose or infusion, bolus multiple dose (cumulation); analysis of urinary data, calculation of the relevant pharmacokinetic parameters. 2. Analysis of metabolites (SPE/HPLC or GC/MS of a chosen urine sample).
Assessment:	Lab reports (30%), oral examination (70%), presentation: must be passed with sufficient quality; discussion sessions: active participation required. The mode of examinations and their share in grading will be announced by the beginning of the semester.
Teaching style:	Lecture, seminars with presentation of students on selected topics, practical course.
Indicative Bibliography/Sources:	- Drug actions - Basic Principles and therapeutic aspects E. Mutschler/H. Derendorf; MedPharm Scientific Publishers (ISBN 3-88763-021-1) - Pharmacokinetics Processes, mathematics and applications Peter G. Welling Wiley Science (ISBN 0-471-47814-8) - Applied Biopharmaceutics and Pharmacokinetics L. Shargel/A.Yu; McGraw-Hill Medical Publishing Division; (ISBN-0-8385-0278-4)

Module:	**Pathophysiology**
Semester:	**1st Semester Master**
Course Leader:	**Prof. Dr. Heinz-Joachim Häbler**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Compulsory Course in 1st Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 30 Exercise: 2 credit hours; group size: 30 Lab work: 2 credit hours; group size: 15
Students workload:	Contact hours / Private study Lecture: 22,5 / 22,5 Exercise: 22,5 / 67,5 Lab work: 22,5 / 45 Exam : 1,5 / 36 Sum: 69 / 171 Total Sum: 240 hours
Credits	8 ECTS
Prerequisites:	Basic knowledge in human or animal physiology acquired in a preceding Bachelor study programme
Recommendations:	none
Learning outcomes:	1) Knowledge of human diseases with a high incidence 2) Knowledge of the main principles of general and organ-specific pathophysiology on molecular, cellular and systems levels 3) Ability to comprehend physiological body functions as a result of a complex interaction between numerous variables and to make predictions about the changes of body functions upon changes of these variables 4) Ability to use the specific pathophysiological terminology 5) The study programme is intended to impart a basic competence in the field of biomedicine which requires solid knowledge in pathophysiology.
Summary indicative content:	Lecture: Basics of pathophysiology which are necessary for understanding the mechanisms of human disease. After an introduction into general pathophysiological concepts the pathophysiology of the most important organ systems will be discussed, e.g. the hematopoetic system, the cardiovascular system, the respiratory system, kidneys, gastrointestinal tract, endocrine system. Exercises: Recapitulation of subjects discussed in the lectures using appropriate test questions. Practical course: Part 1: Independent analysis using light microscopy of tissue sections showing typical pathological changes. Part 2: Simulation of the entire cardiovascular and

	respiratory pathophysiology using computer teaching programmes. Graphical analysis and discussion of results.
Assessment:	Written test 70 %, lab report 30 %
Teaching style:	Lectures involving active participation of students; exercises with test questions handed out to the students before; practical course using light microscopical analysis of histopathological specimens, computer simulation of cardiovascular and respiratory pathophysiology
Indicative Bibliography/Sources:	C.M. Porth: Pathophysiology, Concepts of Altered Health States, 7th ed., Lippincott Wilkins & Wilkins, 2005 C.A. Braun, C.M. Anderson: Pathophysiology, Functional Alterations in Human Health, Lippincott Wilkins & Wilkins, 2007 A. Stevens, J.S. Lowe, B. Young: Wheater´s Basic Histopathology, a Colour Atlas and Text, 4th ed., Churchill Livingstone, 2007 S.J. McPhee, W.F. Ganong: Pathophysiology of Disease. An Introduction to Clinical Medicine, 5th ed., McGraw-Hill, 2007 B.E. Gould: Pathophysiology for Health Professions, 3rd ed., Elsevier, 2006

Module:	**Virology**
Study Semester:	**2nd Semester Master**
Person in Charge of Module:	**Prof. Dr. Edda Tobiasch**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Compulsory Course in 2nd Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 30 Exercise: 2 credit hours; group size: 30 Lab work: 2 credit hours; group size: 15
Workload:	Contact hours / Private study Lecture: 22,5 / 22,5 Exercise: 22,5 / 67,5 Lab work: 22,5 / 45 Exam : 1,5 / 36 Sum: 69 / 171 Total Sum: 240 hours
Credits	8 ECTS
Requirements:	Previous knowledge in molecular genetics, general Safety Instructions for working in labs and safety instructions for working with L2 organisms
Recommendations:	Cell Culture
Course Objective:	At the end of the course, students are expected to to have the following knowledge and competences: 1. Taxonomy as well as structure and replication mechanisms of the most important human pathogenic viruses 2. Occurence and dissemination of viral diseases 3. Adaption of the virus to the host: host change, zoonosis, "shift and drift", evolution 4. Methods of detecting different viral diseases 5. Treatment of viral diseases and prevention measures and can use this comptetences to work in the corresponding laboratories in science and development in pharmaceutical industiers and universities (e.g. diagnostical laboratories for virus detection).
Content:	The course focuses on the different viral families with respect to the following aspects: Lecture: Worldwide infection, the different forms of hepatitis, childhood diseases, prion diseases, viruses and cancer, viruses and gene therapy, "emerging viruses", viral zoonoses, bio terrorism. Students are to develop an understanding of human and animal pathogenic viruses with respect to the following issues relevant to medicine and biology: taxonomy, history, morphology of virions, replication strategies (Baltimore classification), transmission, host and risk groups, symptoms, diagnostic methods, protection against the immune system, specific immune reactions, acute and

	chronic diseases, complications, medication. The cosmoplolitan and endemic occurence of viral diseases is discussed with respect to the following aspects: climatic and social factors of dissemination, epidemiology, eradication measures, prevention. Seminar/tutorial: The students have to work on their own and present a current scientific paper representing a specific question from virology. In the following discussion the student has to defend this paper and the group has to understand the relation of this paper in the context of the already gained knowledge. Laboratory: In the practical training, the students will lern to growth viruses and detect them by means of different methods of molecular biology.
Assessment:	Written examination: 100%
Teaching Method:	The module consists of a lecture as well as a reading course in which students present and discuss current articles about specific questions in virology. The module is complemented by a practical course in which students learn how to culture and detect viruses. The content of the module is checked in a written examination.
Recommended Literature	Fields Virology; D. M. Knipe and P. M. Howley; Lippincott Williams & Wilkins Principles of Viruses Molecular Biology, Pathogenesis and Control; S.J. Flint, L.W. Enquist, R.M. Krug, V.R. Racaniello and A.M. Skalka; ASM Press Lexikon der Infektionskrankheiten des Menschen; Erreger, Symptome, Diagnose, Therapie und Prophylaxe; G. Darai, M. Handermann, E. Hinz and H.-G. Sonntag; Springer

Module:	**Neurobiology**
Semester:	**2nd Semester Master**
Course Leader:	**Prof. Dr. Heinz-Joachim Häbler / Prof. Dr. Hans Weiher**
Lecturer:	Dito
Language:	English
Assignment in Curriculum	Compulsory Course in 2nd Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 30 Exercise: 2 credit hours; group size: 30 Lab work: 2 credit hours; group size: 15
Students workload:	Contact hours / Private study Lecture: 22,5 / 22,5 Exercise: 22,5 / 67,5 Lab work: 22,5 / 45 Exam : 1,5 / 36 Sum: 69 / 171 Total Sum: 240 hours
Credits	8 ECTS
Prerequisites:	none
Recommendations:	Basic knowledge in neuroanatomy und neurophysiology/biophysics from a former Bsc (or other basic) curriculum
Learning outcomes:	1) Detailed knowledge of the functional anatomy of the nervous system. 2) Knowledge of the basic principles of the function of the cerebral cortex, spinal cord, and peripheral nervous system 3) Knowledge of modern concepts to explain dysfunctions of the nervous system 4) Ability to carry out electrophysiological studies on test persons, and to interpret the results 5) Ability to implement the acquired knowledge and proficiencies in the biomedical field
Summary indicative content:	Lecture: Focus of the module is the function of the central nervous system. Subjects are: the function of the spinal cord (i.e. reflex mechanisms) and, covering selected issues (visual system, memory), the mode of function of the cortex. Integrative aspects between the different levels of hierarchy will be illustrated with respect to the somatosensoric and somatomotoric system. Based on the knowledge of the normal function, modern concepts of common diseases of the nervous system are discussed. Seminars: Presentations of the students to interesting topics in the field of neurobiology. Practical course: Part 1: Independent analysis of selected neurobiological topics (e.g. membrane, muscle) using computer teaching programmes.

	Part 2: Neuronal integration in the spinal cord: practical experiments analysing reflexes (tendon reflexes, Hoffmann reflex); integration in the cerebral cortex: analysis of evoked potentials.
Assessment:	Written test 70%, lab report 30%
Teaching style:	Lectures involving active participation of students; seminars with students giving presentations on selected topics; practical course focussing on neuronal integration in spinal cord and cortex, and on selected topics in neurobiology using computer teaching programmes.
Indicative Bibliography/Sources:	E.R. Kandel, J.H. Schwartz, T.M. Jessell, Principles of Neural Science, 4th ed., McGraw Hill, 2000

Module:	**Clinical Chemistry**
Semester:	**2nd Semester Master**
Course Leader:	**Prof. Dr. Annette Kaiser**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Compulsory Course in 2nd Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 30 Exercise: 2 credit hours; group size: 30 Lab work: 2 credit hours; group size: 15
Students workload:	Contact hours / Private study Lecture: 22,5 / 22,5 Exercise: 22,5 / 67,5 Lab work: 22,5 / 45 Exam : 1,5 / 36 Sum: 69 / 171 Total Sum: 240 hours
Credits	8 ECTS
Prerequisites:	none
Recommendations:	none
Learning outcomes:	At the end of the module, students should be able to explain the following contents and apply the following techniques: Pathobiochemistry (as far as it is relevant for laboratory diagnostics) and laboratory diagnostics for diseases of indivual organs and tissues (gastro-intestinal tract, pancreas, liver, kidney, heart and skeletal muscles, bones, lung, central nervous system) Special laboratory diagnostics for metabolic diseases (metabolism of lipids, glucose, uric acid) Special laboratory diagnostics for endocrinological diseases (thyroid gland, parathyroid gland, adrenal gland, reproductive system) Potential and limits of methods in laboratory diagnostics in comparison with methods in clinical diagnostics Clinical-chemical reactions for measuring the concentration of substrates and for measuring the activities of enzymes in biological specimens Microscopical diagnostics and quick diagnostics (dipstick) of urine samples.
Summary indicative content:	Methods in clinical chemistry and laboratory medicine Lecture: Role of laboratory analytics and other analytical methods in clinical diagnostics and differential diagnostics Pathomechanisms of diseases of individual organds and tissues Special laboratory diagnostics for diseases of individual organs and tissues (gastro-intestinal tract, pancreas, liver, kidney, heart and skeletal muscles, bones, lung, central

	nervous system) Special laboratory diagnostics for metabolic diseases (metabolism of lipids, glucose, uric acid) Special laboratory diagnostics for endocrinological diseases (thyroid gland, parathyroid gland, adrenal gland, reproductive system) Seminar: Interpretations of laboratory data , Introduction of new ventures in clinical research i.e. REAL TIME PCR Laboratory: Analysis of samples from patients with diabetes, increased uric acid levels, disturbances in fatty acid, iron and bilirubin metabolism
Assessment:	Written examination 50 %; 50% lab reports.
Teaching style:	The course consists of lectures and seminars in clinical chemistry (two hours per week per semestereach) and a practical course in the lab (two hours per week per semester) in which students learn how to apply clinical-chemical methods.
Indicative Bibliography/Sources:	Thomas L; Labor und Diagnose; TH-Books Verlagsgesellschaft; Ausgaben in deutscher und englischer Sprache. Greiling H., Gressner H.M.; Lehrbuch der Klinischen Chemie und Pathobiochemie; Schattauer, jeweils aktuelle Auflage

Module:	**Medical Proteomics**
Semester:	**3rd Semester Master**
Course Leader:	**Prof. Dr. Angelika Muscate-Magnussen bzw. in Vertretung Prof. Dr. Annette Kaiser**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Compulsory Course in 3rd Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 30 Exercise: 2 credit hours; group size: 30 Lab work: 2 credit hours; group size: 15
Students workload:	Contact hours / Private study Lecture: 22,5 / 22,5 Exercise: 22,5 / 67,5 Lab work: 22,5 / 45 Exam : 1,5 / 36 Sum: 69 / 171 Total Sum: 240 hours
Credits	8 ECTS
Prerequisites:	none
Recommendations:	Module Biochemistry
Learning outcomes:	After successfully completing the course, students are able to explain and apply the following methods and perform the following procedures: 1. Protein separation 2. Mass spectrometry analysis of proteins and peptides 3. Peptide analysis 4. Identification and quantification of proteins from cells and biological fluids .. .analysis of postranslational modifications and protein-protein interactions
Summary indicative content:	Lecture/Exercise: Preparation of samples: general properties, sampling, methods of cell disruption, handling of protein samples, protein digestion Separation methods for proteome analytics: principles of the 1D and 2D SDS-PAGE, preparative IEF, capillary electrophoresis, capillary gel electrophoresis and capillary isoelectrical focusing, HPLC (reversed phase, ion exchange, size exclusion chromatography), multidimensional LC, LC-MALDI Methods in proteome analytics based on mass spectrometry: basics, MALDI-TOF-MS, MALDI-TOF/TOF-MS, ESI-MS and ESI-MS/MS, analysers (ion trap, quadrupole, TOF), sequencing of peptides, SELDI, protein databases and search algorithms Applications: mining, peptide mass fingerprinting, 2D SDS PAGE linked with MALDI-TOF, LC-ESI-MS/MS, MALDI-TOF/TOF-MS; expression profiling, comparative 2D SDS PAGE analysis, isotope markers, protein-protein interactions,

	immune precipitation, Yeast-Two-Hybrid System, Shot Gun approach, Bait/Reverse Bait, posttranslational modifications Protein separation: affinity, hydrophobicity, gel filtration and ion exchange chromatography, ultrafiltration, protein precipitation, determination of purity, protein characterisation Laboratory Course: Purification and determination of the specific activity of a protein which is expressed in E.coli cells. 2D-gel analysis of a protein in induced and uninduced E. coli cells. Peptide cleavage of lysozyme with trypsin and analysis of the digested peptides by reverse phase HPLC.
Assessment:	Written examination: 50%; project report: 20%; lab report: 30%
Teaching style:	The module "Proteomics" consists of: 1. a weekly two-hour lecture on proteomics 2. a weekly two-hour seminar for consolidation and application purposes; review of the weekly homework; preparation for a project in the field of proteomics 3. a five-day intensive practical course, use of current methods in the field of proteomics, report writing 4. an excursion to a company working in the field of proteomics 5. a two-hour written examination
Indicative Bibliography/Sources:	Daniel C. Liebler, Introduction to Proteomics, Humana Press, 2002 Robert H. Abeles et al., Biochemistry, Jones und Bartlett Publishers, 1992 Hubert Rehm, Proteinbiochemie/Proteomics, Spektrum Akademischer Verlag Heidelberg Michael Kinter und Nicholas E. Sherman, Protein Sequencing and Identification using Tandem Mass Spectrometry, Wiley-Interscience, 2000

Module:	**Human Genetics**
Semester:	**3rd Semester Master**
Course Leader:	**Prof. Dr. Hans Weiher**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Compulsory Course in 3rd Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 30 Exercise: 2 credit hours; group size: 30 Lab work: 2 credit hours; group size: 15
Students workload:	Contact hours / Private study Lecture: 22,5 / 22,5 Exercise: 22,5 / 67,5 Lab work: 22,5 / 45 Exam : 1,5 / 36 Sum: 69 / 171 Total Sum: 240 hours
Credits	8 ECTS
Prerequisites:	Basic knowledge in Molecular Biology/ Genetics from a former Bsc (or other basic) curriculum
Recommendations:	none
Learning outcomes:	At the end of this unit the students should be able to: 1. identify human gene variations using methods of molecular genetic analysis 2. apply hybridisation techniques in tumour diagnosis 3. analyse food products for their genetic properties 4. employ chromosome analyses in prenatal and tumour diagnosis 5. carry out genetic analyses in forensic applications
Summary indicative content:	Introduction to Human Genetics Lecture/Seminar: Mendelian Genetics, extensions to and exceptions from Mendelian Genetics, sexual development , sex chromosomes, X-chromosome inactivation, influence of sex on genetic properties, genomic imprinting, multifactorial traits, behavioural genetics, population genetics, human evolution, genetics of human cancer, gene therapy and genetic consulting, reproductive technologies, cloning of mammals, ethical issues, selected topics of human genetc research. Practical course: Cytogenetic and other human genetic analysis methods, karyotype analyses, identification of sex chromosomes, fluorescence in situ hybridisation (FISH). Analysis of karyotypes in unknown genetic and tumour samples. Experimental analysis of genetic polymorphisms.
Assessment:	Written test: 50%; written practical course report 50%
Teaching style:	The teaching unit consists of a lecture and exercises, in which either specific questions are addressed and discussed,

	or specific issues are presented by the students. In addition, the practical course offers the opportunity gain hands on experience on the techniques of human genetic analysis. The students produce a report on the results of the laboratory experiments. At the end of the course there is a written examination.
Indicative Bibliography/Sources:	Human Genetics by Ricky Lewis, Mc Graw Hill, 2006 (Vorlesung) Human Cytogenetics. A Practical Approach. Rooney DE, Czepulkowski BH; Eds. IRL Press Oxford 1992 Human chromosomes. Manual of basic techniques. Verma RS, Babu A, Pergamon Press New York 1989 Human chromosomes. Miller OJ, Therman E, 4th ed. Springer, New York, 2001 ISCN 1995 - An International System for Human Cytogenetic Nomenclature. Mitelman F, Karger, Basel 1995 In situ hybridization. Principles and Practice. Polak JM, McGee JO´D, Eds., Oxford University Press, Oxford 1990 In situ hybridization protocols. Methods in Molecular Biology. Andy Choo KH, eds, Humana Press, Totowa 1994 In situ Hybridisierung. Leitch AR, Schwarzacher AR, Jackson D, Leitch IJ, Spektrum 1994

Module:	**Advanced and Clinical Immunology**
Semester:	**3rd Semester Master**
Course Leader:	**Prof. Dr. Harald Illges**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Compulsory Course in 3rd Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 30 Exercise: 2 credit hours; group size: 30 Lab work: 2 credit hours; group size: 15
Students workload:	Contact hours / Private study Lecture: 22,5 / 22,5 Exercise: 22,5 / 67,5 Lab work: 22,5 / 45 Exam : 1,5 / 36 Sum: 69 / 171 Total Sum: 240 hours
Credits	8 ECTS
Prerequisites:	Knowledge in basic immunology, based on a previous course
Recommendations:	none
Learning outcomes:	The students will learn advanced immunology and experimental design and methods to perform immunological research. They will learn about immunological diseases and their molecular basis. In the seminar they will be enabled to write a scientific grant. During the practical course they will learn how to apply some of this techniques in a research project.
Summary indicative content:	Lecture/Seminar: The students will learn advanced immunology in particular in cellular and molecular immunology, based on knowledge from a previous course (failure of the immune system, allergy, autoimmunity, transplantation, manipulation of the immune system with chemical and biological drugs). The knowledge will also be explained along with the experiments, which led to such knowledge. This shall result in a deeper knowledge of the information taught during the course and a good understanding of scientific/experimental strategies to acquire such knowledge. The students will learn relevant and recent immunological techniques and applied methods (knock-out, knock-in, conditional knockout, regulatory T cells, antibodies and recombinant immunological molecules for therapy and experiments, adoptive transfer of cells). Further they will learn the basics of different immunological diseases and their molecular basis, in particular autoimmune diseases (see case studies in immunology). During the seminar the students will write a grant proposal based on a scientific subject taught during the seminar.

	Practical course: The students will apply some of the techniques learned in the theoretical part and perform experiments along current experimental work in the research laboratory of our group.
Assessment:	Written exam (60% of the final mark), Seminar (10% of the final mark) and protocol of the experimental work (30% of the final mark)
Teaching style:	The modul consists of 2 credit hours lecture, 2 credit hours seminar and 2 credit hours practical course.
Indicative Bibliography/Sources:	Immunobiology, Janeway, latest edition Fundamental Immunology, Paul, latest edition Case Studies in Immunology, Geha/Rosen, latest edition

Module:	**Final Thesis**
Semester:	4th Semester
Course Leader:	Course leaders of the department
Lecturer:	dito
Language:	English
Assignment in Curriculum	**Compulsory task in 4th Sem. MSc Biology**
Course Units/Credit hours	The Master thesis is done either in research groups of the department or in national or international research groups, that offer research activities which match the focus of the study programme. During the master thesis, the students are supervised by at least one professor from the department, who also evaluates the final thesis. Details can be found in the examination regulations.
Students workload:	Contact hours: 17,5 weeks, with a working load of 40 hours/week Private study (writing of thesis, preparing of oral presentation, learning for final exam): 5 weeks, with a working load of 40 hours/week **Total Sum: 900 hours**
Credits	30 ECTS
Prerequisites:	Admission to Master thesis, upon no more than two open compulsory courses and one open elective course. Admission to the Master thesis is regulated under §17 in the Examination Regulations.
Recommendations:	none
Learning outcomes:	The students are able to solve independently and in a given time complex scientific questions in their special fields of work. They are also able to present their results both literally and orally in an adequate manner. The Master thesis demonstrates the ability for independent scientific work, and the competence to use theoretical and analytical abilities for the solution of specific scientific questions. It also reveals social competence as well as the ability to solve complex problems.
Summary indicative content:	Theoretical and practical work to solve research-related questions using scientific methods. Practical application of knowledge and skills gained during the Master studies, and their accentuation in specific topics. The results have to be summarized in a scientific document, i.e. the Master thesis. The students present their results in a defined time-frame, and defend their results in a final oral examination.
Assessment:	Master-Thesis: marked

	Oral examination: marked
Teaching style:	According to need.
Indicative Bibliography/Sources:	According to need.

Module:	**Practical Elective: Mammalian genome analysis**
Semester:	**1st Semester Master**
Course Leader:	**Prof. Dr. Hans Weiher**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Elective Course in 1st Semester MSc Biology
Course Units/Credit hours	Lecture: 0 credit hours; Exercise: 0 credit hours; Lab work: 6 credit hours; group size: 10
Students workload:	Contact hours / Private study Lecture: 0 / 0 Exercise: 0 / 0 Lab work: 67,5 / 112,5 Sum: 67,5 / 112,5 Total Sum: 180 hours
Credits	6 ECTS
Prerequisites:	none
Recommendations:	none
Learning outcomes:	After finishing this unit the students should be able to: - prepare DNA samples from mammalian tissue for genetic analyses - carry out and interprete PCR genetic analyses of mammalian samples. - design and prepare gene constructs for specific inhibition of gene expression in mammalian cells, so called knock down constructs
Summary indicative content:	The students purify DNA from murine tissue samples. They then carry out a PCR analysis with respect to a disease relevant genetic polymorphism. Furthermore, in the context of investigating the underlying pathomechanisms, so called "knock down" gene constructs are prepared, which in future experiments will be used to inhibit the expression of several candidate genes, supposedly involved in the disease developent. The theoretic background of the work is subject of seminars, held in parallel, in which the students present the corresponding original papers.
Assessment:	The mode of examination is announced by the beginning of the semester. No grading in this course.
Teaching style:	The teaching unit consists of a credit hours practical course with accompanying theoretical work on the scientific background.
Indicative Bibliography/Sources:	- Sambrook J., Russell D.W. Molecular Cloning (2001) - selected original publications on the issue - laboratory protocols

Module:	**Practical Elective: FACS**
Semester:	**1. Semester Master**
Course Leader:	**Prof. Dr. Harald Illges**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Elective Course in 1st Semester MSc Biology
Course Units/Credit hours	Lecture: 0 credit hours; Exercise: 0 credit hours; Lab work: 6 credit hours; group size: 8
Students workload:	Contact hours / Private study Lecture: 0 / 0 Exercise: 0 / 0 Lab work: 67,5 / 112,5 Sum: 67,5 / 112,5 Total Sum: 180 hours
Credits	6 ECTS
Prerequisites:	none
Recommendations:	none
Learning outcomes:	The modul will enable the students: -to perform measurements using the FACS (fluorescence activated cell sorting) - to perform daily routine work - to acquire, store and evaluate FACS data - to perform statistical evaluation of FACS data and cortically analyze them
Summary indicative content:	The students will be introduced into the basics of the FACS technology. They will learn how the machine is build up and about the basic principles of the technology, separated into the fluidics/cells, optics/laser and electronics. To run the machine the program Cell Quest Pro is used and taught to the students. They will learn the basics of data management on Apple computers and the Cell Quest Pro program. They will be enabled to steer the machine using the program, to calibrate and acquire data, perform 4-color multiparameter analysis and statistical evaluation of populations of single or multiple stained cells, dot blot and histogram analysis as well as DNA/cell cycle experiments. The students will be enabled to run the machine and evaluate data on their own.
Assessment:	The mode of examination is announced by the beginning of the semester. No grading in this course.
Teaching style:	The modul consist of 6 SWS practical course combined with a theoretical introduction into the machine an the Cell Quest Pro program
Indicative Bibliography/Sources:	- Handbook of the modul - -Handbook of flow cytometry methods, Robinson (Editor)

	- -A guide to Fluorescent Probes and Labelling Technologies, 10. Editon, Molecular Probes

Module:	**Practical Elective: Advanced Patch Clamp**
Semester:	**1. Semester Master**
Course Leader:	**Prof. Dr. Silke Draber**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Elective Course in 1st Semester MSc Biology
Course Units/Credit hours	Lecture: 0 credit hours; Exercise: 0 credit hours; Lab work: 6 credit hours; group size: 8
Students workload:	Contact hours / Private study Lecture: 0 / 0 Exercise: 0 / 0 Lab work: 67,5 / 112,5 Sum: 67,5 / 112,5 Total Sum: 180 hours
Credits	6 ECTS
Prerequisites:	none
Recommendations:	none
Learning outcomes:	The students are able to perform patch-clamp experiments on their own. They can analyse the data and are familiar with the biological background (e.g. biological membranes, channel proteins). They are able to use state of the art software for analysing single channel data in time series, in amplitude histograms as well as in dwell time histograms. Students are able to handle a patch clamp setup with a computerized patch clamp amplifier and control the stimulus-input-signal.
Summary indicative content:	Presentation: Biophysical background; channels in biological membranes; technique of obtaining single-channel measurements; amplitude histograms and dwell-time histograms; modelling and simulation the current through channels (Markov model); spectrum of noise; filtering and sampling; reconstruction of noise-free time series by jump-detection algorythyms. Practical course: Monte-Carlo simulation of time series of single-channel gating; patch-clamp measurements and subsequent data analysis, determination of single channel current from amplitude histograms and rate constants from dwell-time histograms; comparing the measured data with simulated data
Assessment:	Laboratory report and presentation of own data and data from literature. The mode of examination is announced by the beginning of the semester. No grading in this course.
Teaching style:	The unit consists of a laboratory course with the patch clamp apparatus, accompanied by presentations of the students and an introductory unit by the lecturer.
Indicative Bibliography/Sources:	Single-channel Recording, Edited by Bert Sakmann und Erwin Neher, 1983 Plenum Press, ISBN 0-306-41419-8

	Patch Clamping: An Introductory Guide to Patch Clamp Electrophysiology , Areles Molleman, Wiley & Sons; 2002, ISBN: 9780471486855

Module:	**Practical Elective: Antibody Technology**
Semester:	**1. Semester Master**
Course Leader:	**Prof. Dr. Harald Illges**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Elective Course in 1st Semester MSc Biology
Course Units/Credit hours	Lecture: 0 credit hours; Exercise: 0 credit hours; Lab work: 6 credit hours; group size: 8
Students workload:	Contact hours / Private study Lecture: 0 / 0 Exercise: 0 / 0 Lab work: 67,5 / 112,5 Sum: 67,5 / 112,5 Total Sum: 180 hours
Credits	6 ECTS
Prerequisites:	none
Recommendations:	Bachelor Immunology course
Learning outcomes:	The students will learn: - to purify antibodies - to keep hybridoma in tissue culture and expand them - to label and to test antibodies - to produce monoclonal antibodies in hollow fiber and other cell culture systems
Summary indicative content:	The students will be introduced into the current application of monoclonal antibodies. They will learns how to maintain and expand hybridoma in hollow fiber and other tissue culture systems. They learn how to purify antibodies and label them with different methods. Finally they apply these antibodies and test them in Western blots and FACS.
Assessment:	The mode of examination is announced by the beginning of the semester. No grading in this course.
Teaching style:	The modul consist of 6 SWS practical part with a theoretical introduction.
Indicative Bibliography/Sources:	-Protocols in Immunology, Editor: Colligan et al -A guide to Fluorescent Probes and Labelling Technologies, 10. Editon, Molecular Probes

Module:	**Elective A1 + A2: Environmental Chemistry and Ecotoxicology**
Semester:	**2. Semester Master**
Course Leader:	**Prof. Dr. Gerd Knupp**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Elective Course in 2nd Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 10 Exercise: 2 credit hours; group size: 10 Lab work: 2 credit hours; group size: 10
Students workload:	Contact hours / Private study Lecture: 22,5 / 20 Exercise: 22,5 / 40 Lab work: 22,5 / 30 Seminar: 1,5 / 21 Sum: 69 / 111 Total Sum: 180 hours
Credits	6 ECTS; this course can only be taken as a 6 ECTS course
Prerequisites:	none
Recommendations:	none
Learning outcomes:	At the end of the course, students are expected to have the following knowledge and competencies: - be familiar with the chemistry of the most common environmental chemicals and pollutants, - understand the main features of the chemistry of the environmental compartments air, water and soil - understand ecotoxicology as a modern multidisciplinary natural science - understand the implications of direct and indirect effects of chemicals on all biological levels of the ecosystem - be familiar with the basic ecotoxocologic concepts and methods - have practical skills in environmental and ecotoxicologic laboratory work
Summary indicative content:	Lecture: basic concepts of environmental chemistry, major classes and properties of important environmental chemicals, pollutants and toxins, chemistry of the air, the soil and of water; description of an ecosystem, fundamentals of ecotoxicology, the fate of pollutants in ecosystems, analytical methods in environmental chemistry and ecotoxicology, toxicity testing, ecological risk assessment Exercise: Calculating ADI-values from NOEL, statistical evaluation of environmental data, atomic economy calculation; student´s oral presentation of an environmental or ecotoxicologic topic of choice

	Laboratory Course: GC/MS-analysis of VOCs from synthetic polymers; HPLC-analysis of PAHs in soil; determination of important parameters for water and waste water control (e.g.: P, N, COD, BOD, AOX, TOC), heavy metals in sewage sludge, experimental design for a toxicity test for the estimation of acute toxicity of a heavy metal loaded water (e.g. OECD terrestrial plants growth test), visiting a waste water treatment plant
Assessment:	Oral examination and course work. The mode of examination is announced by the beginning of the semester. No grading in this course.
Teaching style:	The course consists of a series of lectures, exercises and student presentations, excursions and practical training.
Indicative Bibliography/Sources:	Baird, C., Cann, M. Environmental Chemistry, W. H. Freemann and Company, New York, 3rd ed., 2005 Wayne G.L., Ming-Ho Y., Introduction to Environmental Toxicology, CRC Press, 2004 Newman, M.C. et al., Fundamentals of Ecotoxicology,CRC Press, 2002 Fent K., Ökotoxikologie, Thieme, Stuttgart, 2003

Module:	**Elective A1 + A2: Molecular Modelling**
Semester:	**2. Semester Master**
Course Leader:	**Prof. Dr. Christina Oligschleger**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Elective Course in 2nd Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 10 Exercise: 2 credit hours; group size: 10 Lab work: 2 credit hours; group size: 10
Students workload:	Contact hours / Private study Lecture: 22,5 / 20 Exercise: 22,5 / 40 Lab work: 22,5 / 30 Exam : 1,5 / 21 Sum: 69 / 111 Total Sum: 180 hours
Credits	6 ECTS; this course can only be taken as a 6 ECTS course
Prerequisites:	none
Recommendations:	Chemistry lectures from the Bachelor degree course
Learning outcomes:	At the end of the module, students should be able to decide which of the approaches and simulation methods mentioned above are suited for simulation purposes as well as how to interpret and analyse results. They should gain proficiency in using the most current software packages.
Summary indicative content:	Introduction to quantum theory, potentials, force fields, structure determination (diffraction methods, scanning electron microscope), dynamics (Monte Carlo methods, simulations on molecular dynamics), thermodynamics (fraction simulation, propagation of sound and heat, folding, recrystallization, introduction to the semi-empirical software package MOPAC, Z-matrices), calculation of molecules (basic state, oscillation, reactions), use of freeware software for visualising the results.
Assessment:	Presentation on the performed simulations or on relevant research methods for structure determination or a paper on the chosen project or a written examination. The mode of examination is announced by the beginning of the semester. No grading in this course.
Teaching style:	The course consists of a two-hour seminar, a two-hour tutorial and a two-hour practical course including a project which is supervised and later presented. The seminar focuses on practical applications (pharmaceutics, organic chemistry, biological modelling, etc.). In the tutorial, students are to consolidate the calculation methods. In the practical training, students calculate molecules and choose their own project.
Indicative Bibliography/Sources:	Kutzelnigg, Einführung in die Theoretische Chemie (Bd. 1 und 2)

	Rapaport, The Art of Molecular Dynamics

Module:	**Elective A1 + A2: Sports Doping**
Semester:	**2. Semester Master**
Course Leader:	**Prof. Dr. Ulrike Bartz**
Lecturer:	Dr. M. Parr
Language:	English
Assignment in Curriculum	Elective Course in 2nd Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 10 Exercise: 2 credit hours; group size: 10 Lab work: 2 credit hours; group size: 10
Students workload:	Contact hours / Private study Lecture: 22,5 / 20 Exercise: 22,5 / 40 Lab work: 22,5 / 30 Presentation: 0,5 / 22 Sum: 68 / 112 Total Sum: 180 hours
Credits	6 ECTS; this course can only be taken as a 6 ECTS course
Prerequisites:	none
Recommendations:	Successful completion of the modules Pharmacology and Toxicology (1st semester), basic knowledge of instrumental analytics.
Learning outcomes:	After successfully completing the module, students have an overview on sports doping: doping methods and prohibited drugs for enhancing performance, analytical methods applied for doping control, anti-doping rules, legal background.
Summary indicative content:	Lecture/Seminar: Doping, methods for improving performance in different sports, doping list, legal framework, WADA, NOC, doping control, pharmacodynamics and pharmacokinetics of doping agents (androgenic and anabolic steroids amongst others), masking of doping, food supplements, positive doping results due to contaminations, analytical methods applied for doping control, biological samples (urine samples in particular). - group presentation (2-3 students) on topics with relevance to sports doping Laboratory Course (partly in the course of the excursion): - excursion to the NOC-accredited doping laboratory at the German Sport University Cologne (working group Prof. Schänzer, doping lab)
Assessment:	Successful completion is based on continuous active participation in the course, the excursion and the experiments (lab reports), successful presentation and disputation of the selected subject. The mode of examination is announced by the beginning of the

	semester. No grading in this course.
Teaching style:	The module consists of lectures and seminars. This is complemented by group presentations on selected topics in the field of doping and doping analytics. An excursion and lab experiments (urine analysis in particular) are also included. The mode of examination is announced by the beginning of the semester. No grading in this course.
Indicative Bibliography/Sources:	- Doping im Sport Feiden, Blasius, WVG Stuttgart, ISBN: 3-8047-1919-8 - Doping und seine Wirkstoffe – Dirk Klasing, Spitta Verlag Balingen, ISBN: 3-934211-73-9 - Bioanalytik, F. Lottspeich, J.W. Engels 2. Auflage Sepktrum Verlag ISBN 3-8274-1520-9 - Textbook of Biochemistry with Clinical Correlations 6th edition, Th. Devlin, Wiley; ISBN 0-471-67808-2

Module:	**Elective A1 + A2: Bioanalytics**
Semester:	**2. Semester Master**
Course Leader:	**Prof. Dr. Ulrike Bartz**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Elective Course in 2nd Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 10 Exercise: 2 credit hours; group size: 10 Lab work: 2 credit hours; group size: 10
Students workload:	Contact hours / Private study Lecture: 22,5 / 20 Exercise: 22,5 / 40 Lab work: 22,5 / 30 Presentation: 0,5 / 22 Sum: 68 / 112 Total Sum: 180 hours
Credits	6 ECTS; this course can only be taken as a 6 ECTS course
Prerequisites:	none
Recommendations:	Successful completion of the module Pharmacology and Toxicology (1st semester).
Learning outcomes:	After successful completion of the module, students have gained an overview of the variety of modern bioanalytical methods which are relevant in the field of biomedicine as well as in pharmaceutical R&D.
Summary indicative content:	Lecture/Seminar: Bioanalytical methods, instrumental analytics including coupled methods, analysis of drug substances and their metabolites, analytics of biological samples, biomolecular interaction analysis, e.g. SPR, ITC, drug screening, testing for drug affinity, inhibitory potential of drugs, techniques such as FRET, FP, radioligand and fluorescent based assays, immunoassays, FPIA, cell based assays, functional screening methods. Analytics of classical and modern dosage forms such as TTS, oral films (biopharmaceutics). - presentation on a selected bioanalytical topic in the field of biomedicine (e.g. biomarkers, target evaluation) Laboratory Course (partly on excursion): Bioanalytics 1 and 2: excursion (options: NOC-accredited doping lab, CRO with focus on bioanalytics, MPC Medical Proteom Center, Bochum (protein identification of a digest by means of MALDI-TOF/MS or nano-LC-ESI-MS/MS; sample preparation SDS-PAGE & excision in the lab at campus Rheinbach), HTS laboratory or a department section "Enabling Techology" in a pharmaceutical company).

Assessment:	In order to successfully complete the course, students are required to actively participate in the module and the excursion/lab experiments (lab reports) and to deliver a successful presentation followed by a disputation.
Teaching style:	Each of the modules 1 and 2 (each 3 ECTS) consists of lectures and seminars. In addition, students are required to deliver a group presentation about selected bioanalytical topics. An excursion and a lab experiment is included in each of both modules. The mode of examination is announced by the beginning of the semester. No grading in this course.
Indicative Bibliography/Sources:	- Bioanalytik, F. Lottspeich, J.W. Engels 2. Auflage Spektrum Verlag ISBN 3-8274-1520-9 - Textbook of Biochemistry with Clinical Correlations 6th edition, Th. Devlin, Wiley; ISBN 0-471-67808-2 - Biomedical Applications of Proteomics; JC Sanchez, Corthals, Hochstrasser, Wiley CH; ISBN3-527-30807-5 - Doping und seine Wirkstoffe - Clasing, Spitta Verlag, ISBN 3-934211-73-9

Module:	**Special Fields in Biology1 + 2: Forensic Analytics**
Semester:	**3. Semester Master**
Course Leader:	**Prof. Dr. Angelika Muscate-Magnussen**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Elective Course in 2nd Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 10 Exercise: 2 credit hours; group size: 10 Lab work: 2 credit hours; group size: 10
Students workload:	Contact hours / Private study Lecture: 22,5 / 20 Exercise: 22,5 / 40 Lab work: 22,5 / 30 Exam : 1,5 / 21 Sum: 69 / 111 Total Sum: 180 hours
Credits	6 ECTS; this course can only be taken as a 6 ECTS course
Prerequisites:	none
Recommendations:	none
Learning outcomes:	After completing the course successfully, students are familiar with the procedures and the methods of crime scene work. They can master the basics of trace analysis, understand the methods of preparing and analysing forensic samples and have used these skills in selected case studies. They know the basic terminology of medical forensics and relevant ethical and legal aspects of forensic analytics.
Summary indicative content:	Lecture: Basics of forensic analytics, forensic toxicology, biological and physical traces, casts, DNA technologies, methods and technologies in forensic analytics, crime scene work, medical forensics, ethical and legal aspects. Exercise: Questions about the content of the lecture, which require internet or literature searches. Discussion of the exercises in the study group. Forensic case study. Aspects of quality assurance in forensic analysis. Laboratory Course: Sample preparation in unconventional matrices (saliva, hair) for drug analysis, detection of doping substances in human and animal sport, DNA-fingerprints, detection of toxins from living organisms (e.g. mushroom, cyanobacteria) .
Assessment:	Passing of exam and laboratory report; The mode of examination is announced by the beginning of the semester. No grading in this course.
Teaching style:	The module "Forensic Analytics" consists of: 1. a weekly two-hour lecture on forensic analytics

	2. a weekly two-hour seminar for practice, consolidation and application purposes; review of the weekly homework 3. a five-day intensive practical course, use of current methods in the field of forensic analytics, report writing 4. an excursion to the Landeskriminalamt (State Investigation Department) 5. a two-hour written examination
Indicative Bibliography/Sources:	- S. H. James and J.J. Nordby, Forensic Science — An Introduction to Scientific and Investigative Techniques, CRC Press, Boca Raton, 2003 - R. Saferstein, Criminalistics — An Introduction to Forensic Science, Prentice Hall, 2001 - M. Bogusz (ed.), Handbook of Analytical Separations, Elsevier, 2000 - B. Brinkmann and P. Wiegand, DNA-Technologie in der Medizinischen Kriminalistik, Schmidt, 1997 - J. Robertson and Michael Grieve (ed.), Forensic Examination of Fibres, Taylor & Francis, 1999

Module:	**Special Fields in Biology 1 + 2: Parasitology**
Semester:	**3rd Semester Master**
Course Leader:	**Prof. Dr. Dieter Reinscheid**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Elective Course in 2nd Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 10 Exercise: 2 credit hours; group size: 10 Lab work: 2 credit hours; group size: 10
Students workload:	Contact hours / Private study Lecture: 22,5 / 20 Exercise: 22,5 / 40 Lab work: 22,5 / 30 Exam : 1,5 / 21 Sum: 69 / 111 Total Sum: 180 hours
Credits	6 ECTS; this course can only be taken as a 6 ECTS course
Prerequisites:	none
Recommendations:	Knowlege in microbiology from a previous study course
Learning outcomes:	At the end of the study unit, the students are able 1. to obtain and evaluate epidemilogical data about the origin and spread of parasitic infections 2. to diagnose parasitic infections 3. to develop stategies for the treatment of parasitic infections 4. to develop prophylactic measurements against parasitic infections 5. to develop strategies to fight parasites and their vectors
Summary indicative content:	Lecture: Understanding human and animal parasites in respect to the following medical aspects: Structures involved in host attachment, damage to host tissue or penetration of host barriers; Structure and function of species-specific organelles or organs; Protection from the immune system; Origin of epidemic or endemic spread of parasitic infections; Socioeconomic consequences of parasitic infections; Environmenal resistant forms; Developmental and larval stages; Anamnesis, Diagnostic techniques; Drug and surgical treatment; Strategies for the eradication of parasites and their vectors. Exercise: Exercise questions about the content of the lecture, which require internet or literature searches. Discussion of the exercises in the study group. Laboratory Course: Identification of parasites in stained specimens, feces, and

	tissues; Detection of parasitic infections by ELISA and PCR; Dissection of an annelid.
Assessment:	Passing of exam and laboratory report. The mode of examination is announced by the beginning of the semester. No grading in this course.
Teaching style:	The module "Parasitology" consists of: 1. a weekly two-hour lecture on parasitology topics 2. a weekly two-hour exercise about the topics covered in the lecture, review of the weekly homework 3. a four-day intensive practical course, use of current methods in the field of parasitology, report writing 4. a two-hour written examination.
Indicative Bibliography/Sources:	Diagnostic Medical Parasitology, LS Garcia, American Society for Microbiology Press, Washington, 2001 Foundations of Parasitology, LS Roberts & J Janovy, McGraw Hill Higher Education, Boston, 2004 Practiacal Exercises in Parasitology, DW Halton, JM Behnke and I Marschall, Cambridge University Press, 2001 Human Parasitology, BJ Bogitsch, Academic Press, 1999

Module:	**Special Fields in Biology 1 + 2: Stem Cells**
Semester:	**3rd Semester Master**
Course Leader:	**Prof. Dr. Edda Tobiasch**
Lecturer:	dito
Language:	English
Assignment in Curriculum	Elective Course in 2nd Semester MSc Biology
Course Units/Credit hours	Lecture: 2 credit hours; group size: 10 Exercise: 2 credit hours; group size: 10 Lab work: 2 credit hours; group size: 10
Students workload:	Contact hours / Private study Lecture: 22,5 / 20 Exercise: 22,5 / 40 Lab work: 22,5 / 30 Poster: 1,5 / 21 Sum: 69 / 111 Total Sum: 180 hours
Credits	6 ECTS; this course can only be taken as a 6 ECTS course
Prerequisites:	none
Recommendations:	Cell Culture
Learning outcomes:	At the end of the course, students are able to work independent in scientific projects and students are expected to be familiar with 1. the differences between embryonic and adult stem cells 2. the sources for stem cells 3. markers for differentiation lines 4. detection methods of various differentiation lines 5. ethical aspects of working with stem cells Thus they should be able to work in laboratories of industries and universities which focus on the development of stem cell theapies with only a short training period for adjustment.
Summary indicative content:	Seminar/tutorial: The seminar focuses on the following questions and aspects: stem cells vs. progenitor cells, embryonic vs. adult stem cells: advantages and disadvantages, sources for stem cells, plasticity and potency, differentiation and trans-differentiation, isolation and purification, differentiation lines and markers, line-specific staining, ethical aspects Each student has to present a paper which is related to his/her specific project and discuss the content with respect to their own current data and adjust the project, if applicable. The data will be presented at an international conference if enough scientific results can be achieved. Laboratory Course: Each student will have an own part of a scientific project to work on. This subproject will be part of a doctoral thesis of

	will partially overlap with the other subprojects. All components together will be a complete scientific project.
Assessment:	The mode of examination is announced by the beginning of the semester. No grading in this course.
Teaching style:	The module consists of a lecture and a practical part in which each student will work on a subproject of a scientific project. The module is complemented by a seminar in which the students present paper to a specific subjects.
Indicative Bibliography/Sources:	Turksen, Kursad: Adult stem cells, Humana Press Sell Stewart: Stem cells handbook, Humana Press Chiu, Arlene Y.: Human embryonic stem cells, Humana Press