

Focal Point Molecular Medicine



Coordinator: Prof. Dr. Stephan Hahn
(stephan.hahn@rub.de)

Molecular GI oncology
www.rub.de/mgo

Contact:

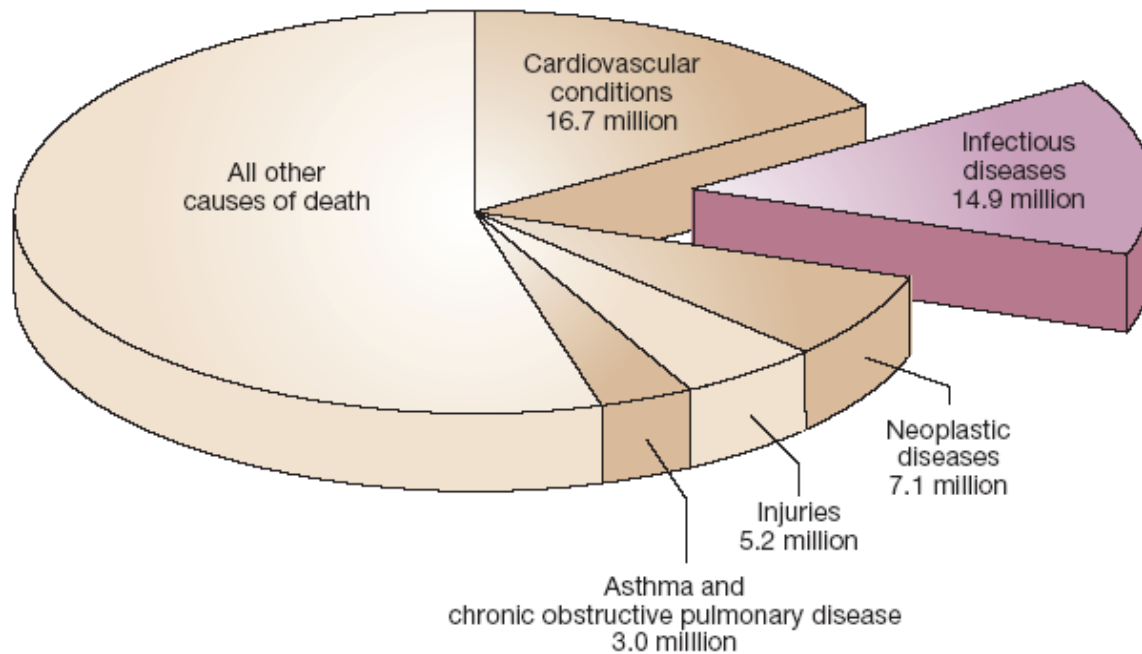
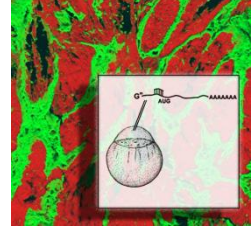
Tanja Behning

MA 2/146 (Süd)

Tel.: 32 29113

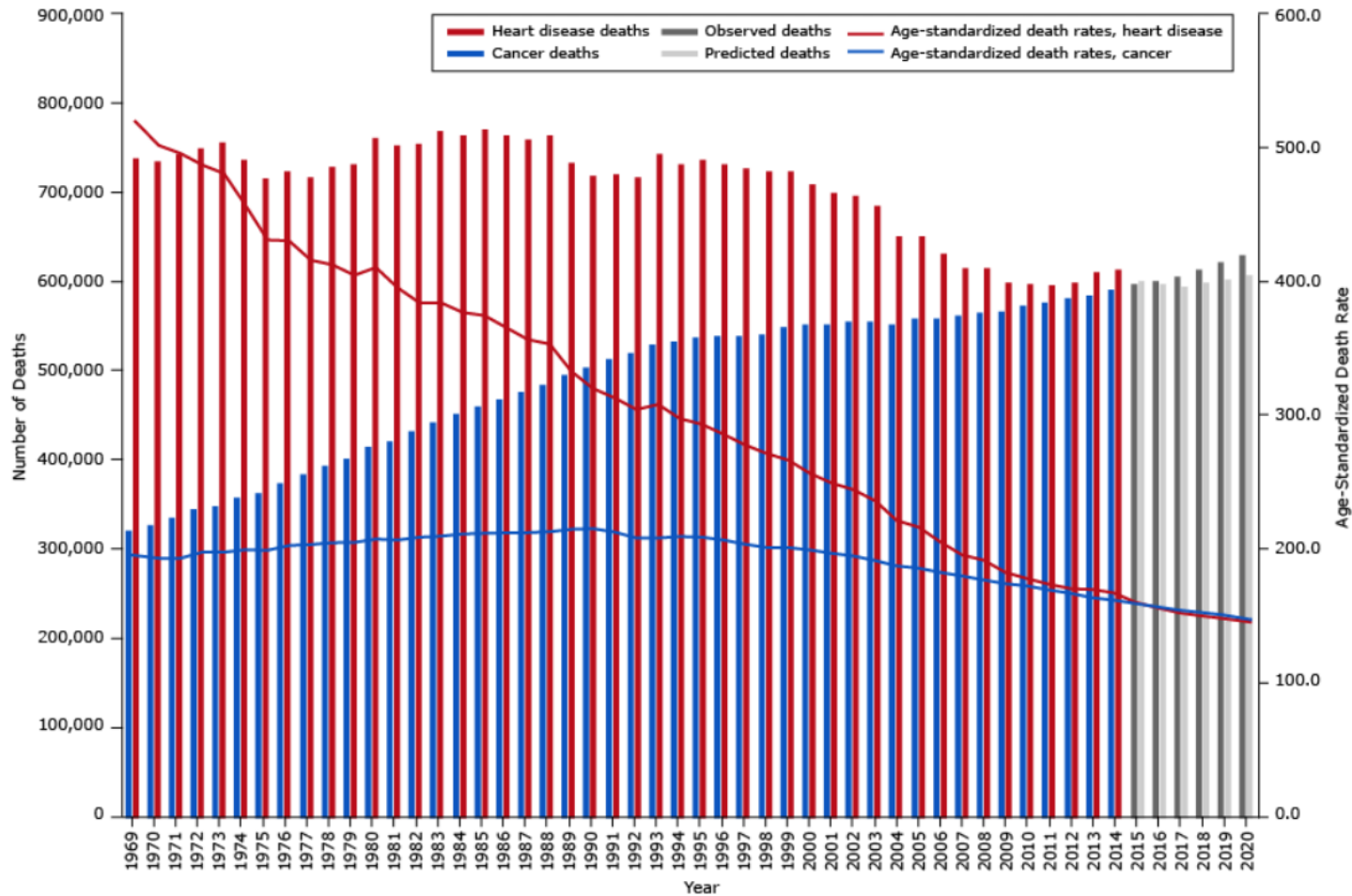
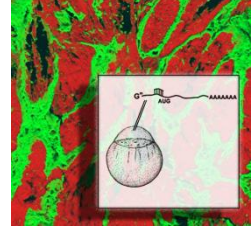
E-Mail: lehre-physiologie@rub.de

The most common causes of death



Infectious diseases	Annual deaths (million)
Respiratory infections	3.96
HIV/AIDS	2.77
Diarrhoeal diseases	1.80
Tuberculosis	1.56
Vaccine-preventable childhood diseases	1.12
Malaria	1.27
STDs (other than HIV)	0.18
Meningitis	0.17
Hepatitis B and C	0.16
Tropical parasitic diseases	0.13
Dengue	0.02
Other infectious diseases	1.76

Mortality from heart and cancer diseases



Risk of death declined more steeply for heart disease than cancer, offset the increase in heart disease deaths, and partially offset the increase in cancer deaths resulting from demographic changes over the past 4 decades. If current trends continue, cancer will become the leading cause of death by 2020.

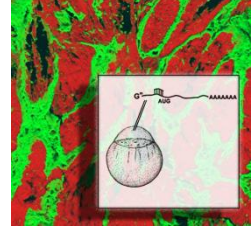
Weir, Hannah K. (2016): Heart Disease and Cancer Deaths — Trends and Projections in the United States, 1969–2020. In: *Prev. Chronic Dis.* 13.

Focal Point Topics



- Molecular Regulation and Pharmacology of the Cardiovascular and Pulmonary Systems
- Virology for Scientists
- Molecular Oncology
- Molecular Immunology
- Molecular Surgery and Orthopedics

Molecular Regulation and Pharmacology of the Cardiovascular and Pulmonary Systems



Lecturers: Prof. K. Jaquet, Prof. D. Wenzel, Prof. MC Kienitz, Dr. D. Cimiotti, Dr. N. Hamdani, Prof. A. Mügge

Topics:

- Physiology and pathophysiology of the cardiovascular and pulmonary systems
- Heart and smooth muscle
- Muscle: mechanisms of contraction and contraction regulation
- Sympathetic and parasympathetic nervous system
- Pharmacodynamics and kinetics
- Heart disease

Virology for Scientists



Lecturers: Prof. Dr. E. Steinmann, Jun. Prof. Dr. S. Pfänder, Dr. A. Stang, Dr. Daniel Todt

Topics:

- Virus structure, pathogenesis, working methods, clinical diagnostics
- Respiratory infections (Influenza, RSV, Adenovirus)
- Herpesviruses / viral immune escape strategies
- Viral hepatitis
- Ecology and evolution of viruses
- Intestinal infections (Rotavirus, Adenovirus, Calicivirus, Norwalk)
- Viral diseases of children
- Viral oncogenesis
- Viral zoonoses / Hemorrhagic viruses
- HIV part 1
- HIV part 2
- Prions and security of blood products

Molecular Oncology



Lecturers: Prof. S. Hahn, Prof. T. Brüning, Dr. G. Johnen, Dr. K. Lang,
Dr. H.P. Rihs, Dr. G. Westphal, Prof. D. Bausch

Also available by S. Hahn during the Winter Semester Mo 15.15-16.45, ZKF 01/144 (Seminarraum), LV-Nr 205743

Topics:

- Cell cycle regulation, apoptosis
- Oncogenes + tumor suppressor genes
- genetic tumor progression models, chromosomal instability
- Angiogenesis, invasion and metastasis
- important monogenic hereditary tumor syndromes
- Diagnosis, principles of therapy, prevention

Molecular Immunology



Lecturers: Prof. I. Schmitz, Prof. M. Raulf, PD Dr. M. Peters

Topics:

- Introduction to the functioning of the immune system
- Mechanisms of innate immunity
- Antigen presentation
- How the adaptive immune system works: T cells
- How the adaptive immune system works: B cells and antibodies
- Complement system
- Immunopathologies: autoimmunity, immunological methods, infection immunology
- Manipulation of the immune response as a therapeutic strategy
- Immunopathologies: allergy, signal transduction in immune cells

Cellular and Systems Immunology

only available in winter semester

Wednesday, 14:00 – 15:30 in HMA40



Lecturers: Mühlen, Schmitz, Plaza Sirvent

Topics:

Introduction to the immune system

T helper cell differentiation

Cell mediated cytotoxicity

Unusual lymphocytes - gd T cells, iNKT, MAIT etc.

NK cells and innate lymphoid cells

Biology of infection I

Biology of infection II

Infection immunity

Immune subversion by bacterial pathogens

Autoimmunity I

Autoimmunity II

Tumor immunology

Systems Immunology – flow, CyTOF

Systems Immunology – NGS

Systems Immunology - bioinformatics

Molecular Surgery & Orthopedics



This topic sheds light on the molecular and cellular foundations of clinically relevant questions in surgery and orthopaedics with a focus on the molecular regulation of Tissue-implant or cell-biomaterial interaction

Lecturer: Dr. J. Salber (Chemist & Surgeon)

Topics:

- Clinical necessity of biomaterials
- Physicochemical properties of biomaterials
- Biocompatibility – Repair versus Restitutio ad integrum
- Hemocompatible biomaterials for vascular prostheses or stents
- Immunomodulative biomaterials for wound healing
- Molecular basis of the foreign body reaction
- Aseptic and septic endoprosthesis loosening
- Biomaterials for personalized organ breeding

Courses 6th Semester Bachelor



5 special lectures, of which the students choose one:

- **"Molecular Immunology"** (Organisation: Schmitz) Wednesday, 14.00-15.30, HMA 30
- **"Molecular Oncology"** (Organisation: Hahn) Wednesday, 12.30-14.00, HMA 30
- **"Molecular Surgery and Orthopaedics"** (Organisation: Salber) Thursday, 17.00-18:30, HMA 40
- **"Molecular Regulation and Pharmacology of the Cardiovascular and Pulmonary System"** (Organisation: Jaquet) Wednesday, 14.00-15.30, HMA 40
- **"Virology for Scientists"** (Organisation: Steinmann) Wednesday, 15.30-17.00, Lecture Hall MABF 01/599

Success monitoring: At the end of the semester, an examination takes place with an examiner from the special lecture chosen by the student (written examination in virology).

Preparatory practical (3 weeks) + Bachelor's thesis (2 weeks):

laboratory practical; each lecturer supervises only one bachelor thesis!

Organisation: Students

Courses 1st Term Master Programme (7th Semester)



Advanced Modular practical:

4 x 2 weeks practical in 4 different focus areas with 1 week in between for follow-up and preparation to get to know the focal points.

No laboratory cooperation but training with clearly defined experiments, e.g. transfection of cells, FACS analysis of transfected cells, protein preparation, western blot, cell adhesion assay, etc.

Each lecturer undertakes to offer the module internship for one group (3 students) per semester.

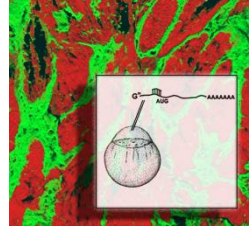
Organisation: Biochemistry

At the end of the semester, the student decides on a specialisation.

Courses 1st Semester Master

Offers Modular advanced practicals

(Current semester offers can be found within the Moodle course)

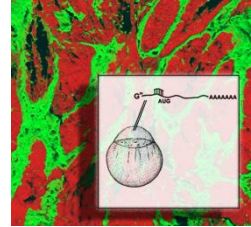


Lecturer	Title and content
Schmitz /Peters	Interaction of dendritic cells with T-lymphocytes. Generation of dendritic cells in vitro; Purification of T-helper cells from whole spleen cells by magnetic sorting; Flow cytometry; Cell culture; ELISA
Erdmann	Characterization of proteins isolated from peroxisomes and peroxisomal membranes of the yeast <i>Saccharomyces cerevisiae</i>. After completion of the course, students will have acquired basic practical skills in biochemical, microbiological and molecular biological methods. The students will learn how to isolate protein complexes by affinity chromatography and how to characterize these complexes according to their size (size-exclusion chromatography) and constituents (SDS-PAGE, immunoblotting).
Steinmann	Current methods in Virology. The module focuses on molecular virology techniques. Specific content will be announced.

Courses 1st Term Master Programme

Offers Modular advanced practicals

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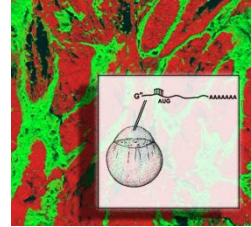


Lecturer	Title and content
Hahn	PCR and primer design, vector cloning. Principles of PCR technology, Primer design for PCR, Vector cloning , Plasmid preparation, DNA sequencing
Hamdani	Inflammation and Oxidative Stress in Heart Failure. The project will exploit human HFpEF biopsies and HFpEF animal models with various comorbidities. Methods: Mass spectrometry; Site-directed mutagenesis for in vitro validation; confocal and electron microscopy; Western blot analysis; Force measurements on single skinned cardiomyocytes as well as in intact cells; interaction assays
Tatzelt	Protein misfolding and neurodegeneration. Gene transfer into mammalian cells; Protein-protein interactions; Mechanism of cell death; Intracellular trafficking of protein; Import into the endoplasmic reticulum

Courses 1st Term Master Programme

Offers Modular advanced practicals

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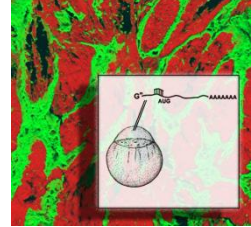


Lecturer	Title and content
Joachim	Analysis of cell death mechanisms in retinal diseases. Immunohistochemistry; Western blot; Organ culture
Rassow	Import of bacterial and viral proteins into mitochondria. Isolation of mitochondria from yeast, or, optional, from rat liver. Synthesis of radio-labeled model proteins in reticulocyte lysate (in small volumes of up to 0.2 ml). Optional: Construction of plasmids encoding new model proteins. Import of radio-labeled proteins into isolated mitochondria, SDS-PAGE, BN-PAGE, assessment of the import efficiency using a phosphorimager. Subfractionation of mitochondria for detection of proteins in distinct mitochondrial compartments.
Leichert	Redox Biology. Basics in experimental design, good laboratory practice, insights into protein redox biology, introduction to a variety of redox biology methods. Physiological stress experiments with E. coli; □ Cell culture of immune cell lines; Co-cultivation of immune cells and bacteria; Characterization of redox-active proteins with UV-VIS, CD, mass spectrometry, SDS PAGE, Western blot, HPLC; Molecular biology, rational mutagenesis of proteins; Protein purification.

Courses 1st Term Master Programme

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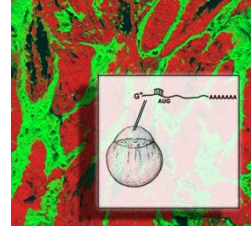


Lecturer	Title and content
Raulf	Allergy research – from the production of allergen extract to allergen characterization. Preparation of protein extract by using different protein extraction procedures, protein determination by different methods, SDS-PAGE, electrophoresis, silver-staining, IgE immunoblotting (allergogram with sera from sensitized patients), IgG immunoblotting with sera from immunized rabbits, inhibition immunoblot, performance of ELISA measurements, characterization of cross-reactivity, allergen quantification in of allergens in processed extracts.
Brüning / Rihs	HLA-D typing and LightCycler applications. Genomic DNA isolation of own buccal swabs; Genomic DNA isolation of own white blood cells ; Agarose gel electrophoresis; HLA-D typing for <i>DRB1</i> and <i>DQB1</i> genes by PCR with sequence-specific primers (SSP-PCR) and other methods (i.e. non-radioactive sequencing); SNP analyses of certain genes like <i>GSTM1</i> , <i>GSTT1</i> and <i>GSTP1</i> using two different techniques (PCR-RFLP and Real-time PCR) and two different DNA sources (buccal swabs and EDTA blood); Deduction of the acetylation status by analysis of seven SNPs in the <i>NAT2</i> gene by a combination of sequencing and LightCycler analyses.

Courses 1st Term Master Programme

Offers Modular advanced practicals

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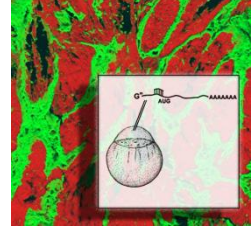


Lecturer	Title and content
Tannapfel	Molecular pathology. DNA extraction; Mutation analysis: HRM analysis, Sanger sequencing, Pyrosequencing; Promotor methylation analysis: Pyrosequencing, MSP analysis
Winklhofer	Analysis of protein ubiquitination. Gene transfer into mammalian cells; Protein-protein interactions; Mechanism of ubiquitination: E1, E2, and E3 enzymes; Different modes of ubiquitination; Functional consequences of ubiquitination
Strumberg	Cancer stem cells and molecular oncology. Molecular, biochemical, and cell biological experimental techniques to study stem cells in cancer - and in leukemia cell lines as well as in cells with stem-cell like phenotypes. Methods to be learned: <ol style="list-style-type: none">1. Cell culture and isolation of CD34+ cells from whole blood and leukemia cell lines2. Phenotypic characterization of cancer stem cells by FACS analysis3. Characterization of cancer stem cells by immunocytochemical methods (ICC)

Courses 1st Term Master Programme

Offers Modular advanced practicals

(Current semester offers can be found within the Moodle course)

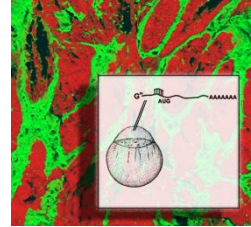


Lecturer	Title and content
Bausch	Molecular oncology- <i>In vitro</i> drug effects on the transcriptome. Molecular, biochemical and cell biological experimental techniques to study cancer cell reaction to drug treatment. Cell culture of cancer cell lines of various origin. Cell viability assays (SRB/MTT). Determination of IC_{50} values. Preparation of cells for comparative transcriptome analysis <i>via</i> qPCR and Western Blot
Wenzel	Current methods in animal physiology. The module focuses on methods in animal physiology: isolation of organs and blood vessels, bronchialalveolar lavage, generation of paraffin and cryosections, histological stainings, functional measurements, data analysis
Salber	Biocompatibility assessment and biomanufacturing of 3D tissue constructs: Testing according DIN EN ISO 10993 norms and beyond: Qualitative and quantitative analysis of cell viability, toxicity and apoptosis of cells on electro-spun, surface-functionalised biomaterials; 3D bioprinting of cells mixed in tissue-specific bioinks, subsequent culture, biochemical and -mechanical analysis

Courses 1st Term Master Programme

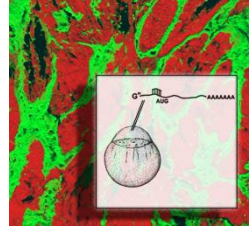
Offers Modular advanced practicals

(Current semester offers can be found within the Moodle course)



Lecturer	Title and content
Pfänder	<p>Quantification of SARS-CoV-2 Neutralizing Antibodies with Propagation-Defective VSV Pseudotypes.</p> <p>This practical course is dedicated towards working under sterile conditions and to get familiar with the basics of cell culture and the handling of viruses. It covers the cultivation of different cell lines and the production of propagation-defective vesicular stomatitis virus (VSV) pseudotypes. The participants will be able to analyze their own status of neutralizing antibodies, if they wish, against SARS-CoV-2 wildtype and variants of concern.</p>
Nguyen	<p>Single nucleotide polymorphism (SNP) genotyping.</p> <p>This practical course is dedicated to methods of SNP genotyping in human molecular genetics for diagnostic and research purposes. It covers different methodologies for SNP genotyping, -DNA isolation and quality control, -Sample preparation, -Optimization and run of PCR reactions, -Genotyping using different PCR-methodologies, -Data analysis</p>

Courses 2nd Term Master Programme (8th Semester)



5 special lectures, of which the students choose one:

"Molecular Immunology" (Organisation: Schmitz) Wednesday, 14.00-15.30, HMA 30

"Molecular Oncology" (Organisation: Hahn) Wednesday, 12.30-14.00, HMA 30

"Molecular Surgery and Orthopaedics" (Organisation: Salber) Thursday, 17.00-18:30, HMA 40

"Molecular Regulation and Pharmacology of the Cardiovascular and Pulmonary System"

(Organisation: Jaquet) Wednesday, 14.00-15.30, HMA 40

"Virology for Scientists" (Organisation: Steinmann) Wednesday, 15.30-17.00, Lecture Hall MABF

01/599

Success monitoring: At the end of the semester, an oral examination takes place with an examiner from the special lecture chosen by the student. In the exam, **students also present an article on the topic selected by one of the examiners for 10 minutes.**

Courses 2nd Term Master Programme (8. Semester)



Lecture Series: Molecular Medicine

The aim of the lecture series is to give students an insight into current topics of the focus. Lecturers of the research area and invited guest speakers introduce the students to their current field of research.

Success control: Written exam. A total of 14 questions; each of the lecturers presenting in the semester or hosts of the invitees asks a question about his lecture with 5 points each: The students answer 9 of the 14 questions; each lecturer evaluates the answers to his questions.

Organisation: S. Hahn

Courses 2nd Term Master Programme (8. Semester)



Advanced Practical:

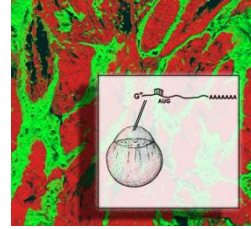
- 2 x 5 weeks all day
- Laboratory practical with two different lecturers of the department Molecular Medicine.
- Each lecturer is committed to offer at least one focus internship per semester.
- Organisation: Students

Courses 3rd + 4th Term Master Programme (9th + 10th Semester)



- **Research practical (3 months)**
- **Master Thesis (6 months)**
- Organisation: Students

!! Rules for practicals / Master's Thesis in the Focal Point Molecular Medicine



1) All internships with a focus on molecular medicine should first be completed by the students in the laboratories of the members of the focus!

The current list of participating lecturers of the Faculty of Medicine can be found at Lecturer Information in the Moodle course "Focus Point Molecular Medicine"

2) If students want to carry out a practical (or the master's thesis) in another laboratory (e.g. also by lecturers of the RUB Faculty of Medicine who are not listed in the focus), at another location or in another country, this is possible **if the approval of the head of the focus (Prof. Stephan Hahn) is obtained in advance.**

For this purpose, a maximum of 1 DinA4 page should be prepared to describe the practical/master the topic

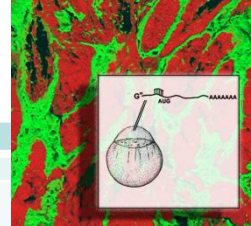
- the supervising person(s)
- the planned methods and objectives of the practical/master as well as
- the reference to molecular medicine.

The head of the focus then issues the written approval.

3) Retrospectively, practicals will no longer be recognized for lecturers who are not listed as members of the focus.

Lecturer information in the focal point molecular medicine

(to be found in the Moodle course Focal Point Molecular Medicine)



Lecturer	SP Topic	E-Mail	Department	Homepage
Prof. Dirk Bausch	Oncology	dirk.bausch@rub.de	Chirurg. Klinik, Marienhospital Herne	www.marienhospital-herne.de
Prof. Thomas Brüning	Oncology	bruening@ipa-dguv.de	IPA - Institut für Prävention und Arbeitsmedizin der Deutschen Gesetzlichen Unfallversicherung	www.ipa.rub.de
Dr. Elif Dagdan	Oncology	elif.dagdan@rub.de	Pathologie	www.rub.de/pathologie/
Prof. Ralf Erdmann		ralf.erdmann@rub.de	Systembiochemie	www.rub.de/physiolchem/system/
Dr. Wolfgang Girzalsky		wolfgang.girzalsky@rub.de	Systembiochemie	www.rub.de/physiolchem/system/
Prof. Stephan Hahn Head of the focal point	Oncology	stephan.hahn@rub.de	Molekulare gastro-enterologische Onkologie	www.rub.de/mgo
Dr. Nazha Hamdani	Cardiology	nazha.hamdani@rub.de	Zelluläre und Translationale Physiologie	www.zellphys.ruhr-uni-bochum.de/
Prof. Kornelia Jaquet	Cardiology	kornelia.jaquet@rub.de	Molekulare und experimentelle Kardiologie	
PD Dr. Stephanie Joachim	Immunology	stephanie.joachim@rub.de	Augenklinik, KKL	www.rub.de/eeri
Dr. Georg Johnen	Oncology	johnen@ipa-dguv.de	IPA	www.ipa.rub.de
Prof. MC Kienitz	Cardiology	cecile.kienitz@rub.de	Zelluläre und Translationale Physiologie	www.zellphys.ruhr-uni-bochum.de/
PD Dr. Björn Koos	Immunology	bjoern.koos@rub.de	Department Anästhesiologie, Intensivmedizin und Schmerztherapie	http://anaesthesie.rub.de/index.php?article=68
Prof. Lars Leichert	Immunology	lars.leichert@rub.de	Biochemie der Mikroorganismen	www.rub.de/biochem/microbiochem
Dr. Michaela Matthey	Cardiology	michaela.matthey@rub.de	Systemphysiologie	www.py.rub.de/syssp/Index.html.de
Prof. Andreas Mügge	Cardiology	andreas.muegge@rub.de	Kardiologie	https://bergmannsheil-bg-kliniken.de/behandlungsspektrum/kardiologie-und-angiologie/ www.rub.de/virologie
Dr. Sabrina Mühlen	Immunology	muehls14@ruhr-uni-bochum.de	Zelluläre Mikrobiologie	www.rub.de/mhg/
Dr. Huu Phuc Nguyen		huu.nguyen-r7w@rub.de	Humangenetik	www.rub.de/mhg/
PD Dr. Marcus Peters	Immunology	marcus.peters@rub.de	Molekulare Immunologie	
Jun.Prof. Stephanie Pfänder	Virology	stephanie.pfaender@rub.de	Molekulare & Medizinische Virologie	www.rub.de/virologie
Dr. Carlos Plaza-Sirvent	Immunology	Carlos.PlazaSirvent@rub.de	Molekulare Immunologie	
Prof. Joachim Rassow		joachim.rassow@rub.de	Zellbiochemie	www.rub.de/physiolchem/zellbiochemie/
Prof. Monika Raulf	Immunology	raulf@ipa-dguv.de	IPA	www.ipa.rub.de
Dr. Hans-Peter Rihs	Oncology	rihs@ipa-dguv.de	IPA	www.ipa.rub.de
Dr. Jochen Salber		jochen.salber@rub.de	Experimentelle Chirurgie	www.kk-bochum.de/
Prof. Ingo Schmitz	Immunology	ingo.schmitz@rub.de	Molekulare Immunologie	
Prof. Barbara Sitek		barbara.sitek@rub.de	Clinical Proteomics	http://www.anaesthesie.ruhr-uni-bochum.de/index.php?id=6 www.rub.de/virologie
Dr. Alexander Stang	Virology	alexander.stang@rub.de	Molekulare & Medizinische Virologie	www.rub.de/virologie
Prof. Eike Steinmann	Virology	eike.steinmann@rub.de	Molekulare & Medizinische Virologie	www.rub.de/virologie
Prof. Dirk Strumberg		dirk.strumberg@elisabethgruppe.de	Med. Klinik III, Marien Hospital Herne	www.marienhospital-herne.de
Prof. Andrea Tannapfel	Oncology	andrea.tannapfel@rub.de	Pathologie	www.rub.de/pathologie/
Prof. Jörg Tatzelt		joerg.tatzelt@rub.de	Biochemie neurodegenerativer Erkrankungen	www.rub.de/biochem/neurodeg/
Dr. Daniel Todt	Virology	daniel.todt@rub.de	Molekulare & Medizinische Virologie	www.rub.de/virologie
Dr. Berlinda Verdoodt	Oncology	berlinda.verdoodt@rub.de	Pathologie	www.rub.de/pathologie/
Dr. Daniel Weber	Oncology	weber@ipa-dguv.de	IPA	www.ipa.rub.de
Prof. Daniela Wenzel	Cardiology	daniela.wenzel@rub.de	Systemphysiologie	www.py.rub.de/syssp/Index.html.de
Prof. Konstanze Winkhofer		konstanze.winkhofer@rub.de	Molekulare Zellbiologie	www.rub.de/biochem/zellbio/



Overview Focal Points Biochemistry:

https://www.ruhr-uni-bochum.de/bc-schwerpunkte/SPBioChem_en.htm

Overview and contact addresses of lecturers in the Moodle courses:

1. Modular Advanced Practicals / Modulpraktika Biochemie

2. Focus Point Molecular Medicine

Access code: Achtsemester