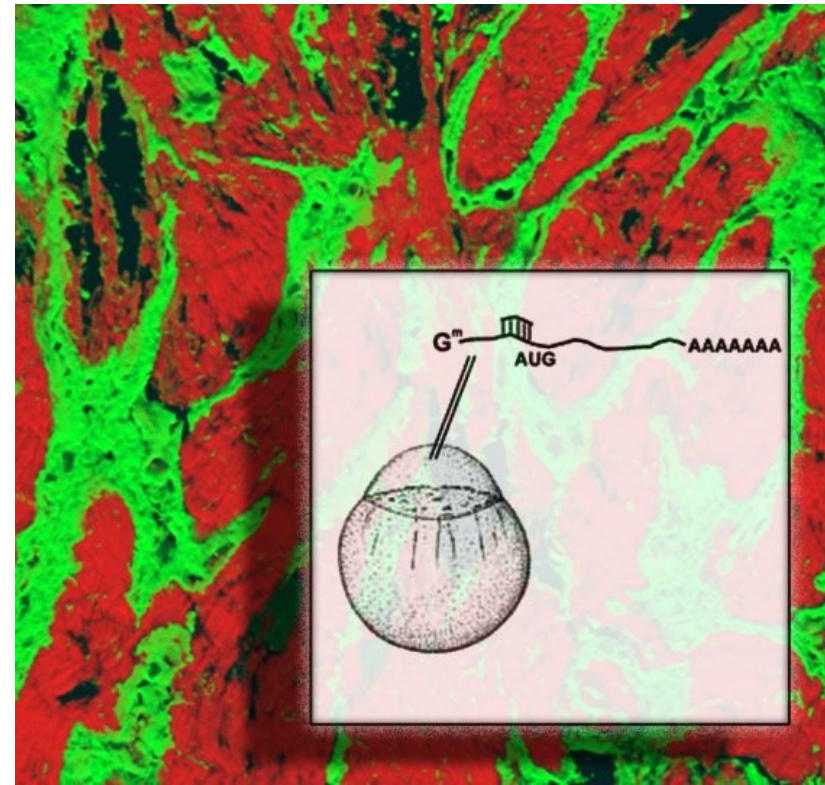


# Focal Point Molecular Medicine



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

Molecular GI oncology  
[www.rub.de/mgo](http://www.rub.de/mgo)

**Contact:**

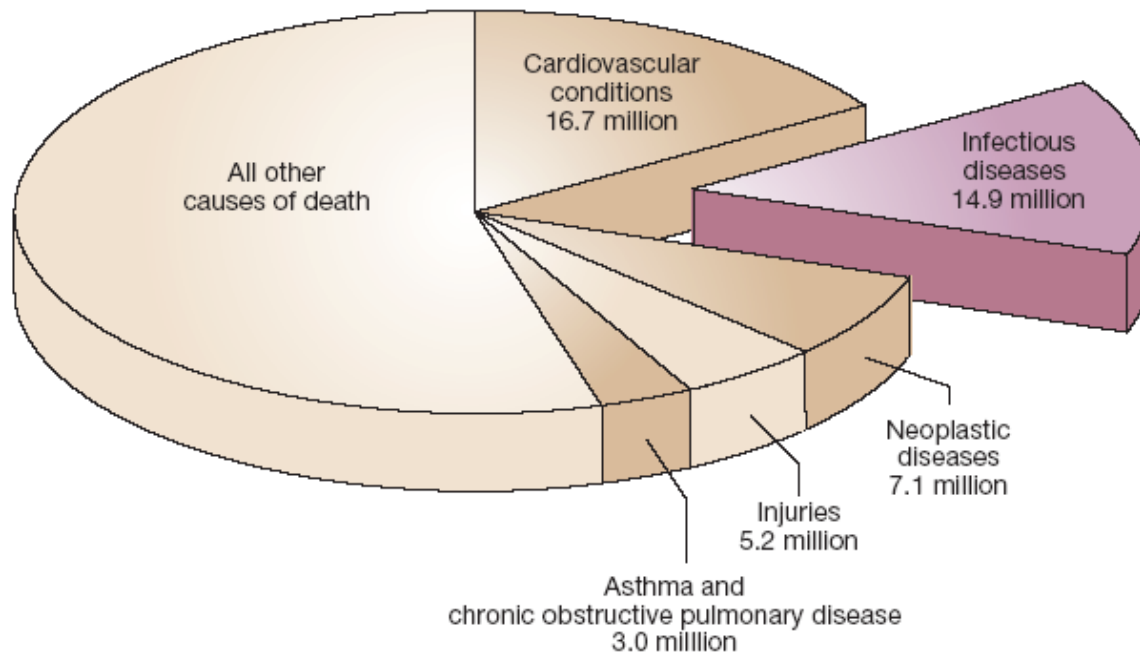
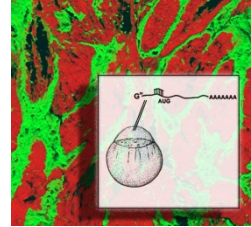
Tanja Behning

MA 2/146 (Süd)

Tel.: 32 29113

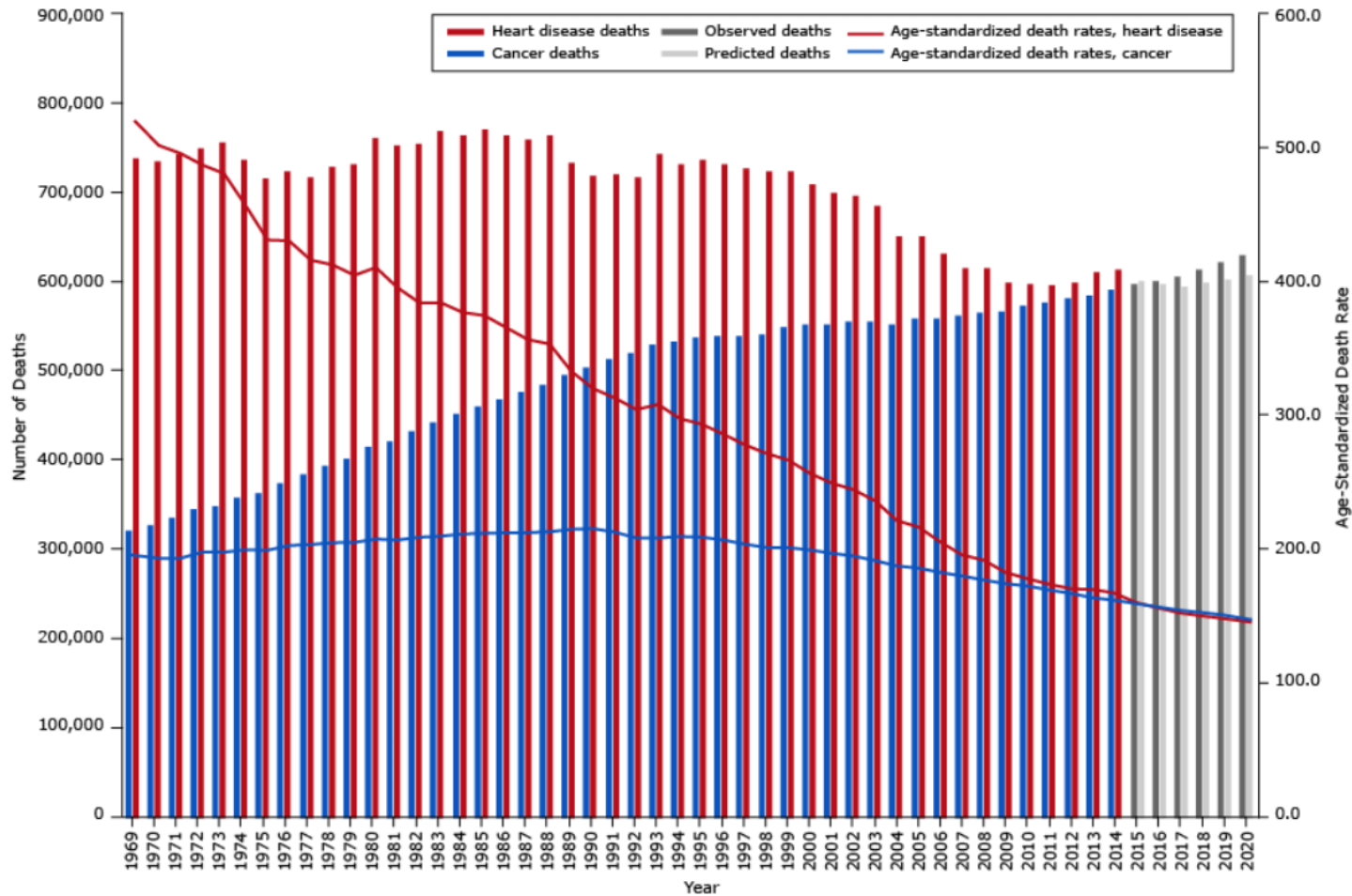
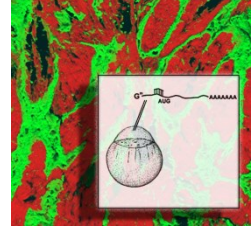
E-Mail: [lehre-physiologie@rub.de](mailto:lehre-physiologie@rub.de)

# 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.**

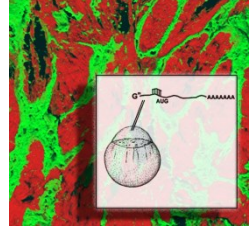
Weir, Hannah K. (2016): Heart Disease and Cancer Deaths — Trends and Projections in the United States, 1969–2020. In: *Prev. Chronic Dis.* 13.

# 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. D. Wenzel, Prof. MC Kienitz, Prof. N. Hamdani, Prof. R. Benndorf

(only available in summer term)

## 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

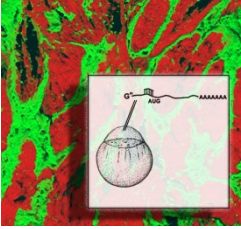


**Lecturers:** Prof. Dr. E. Steinmann, Dr. A. Stang, Dr. Daniel Todt

## 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



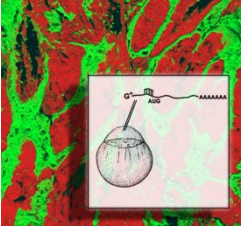
**Lecturers:** Prof. S. Hahn, Prof. T. Brüning, Dr. G. Johnen, Dr. K. Lang,  
Dr. G. Westphal, Prof. D. Bausch

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



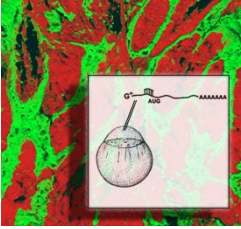
This topic sheds light on the molecular and cellular foundations of clinically relevant questions in surgery and orthopaedics with a focus on the molecular regulation of Tissue-implant or cell-biomaterial interaction

**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: Hamdani) Wednesday, 14.00-15.30, HMA 40
- **"Virology for Scientists"** (Organisation: Steinmann) Wednesday, 15.30-17.00, Lecture Hall MABF 01/599

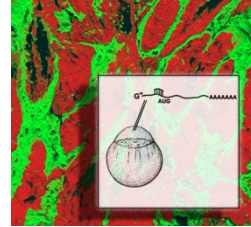
**Success monitoring:** At the end of the semester, an examination takes place with an examiner from the special lecture chosen by the student (written examination in virology).

**Preparatory practical (4 weeks) + Bachelor's thesis (2 months):**

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.

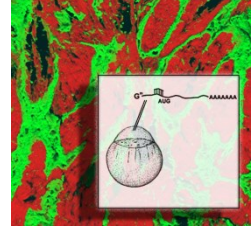
Organisation: Biochemistry

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)

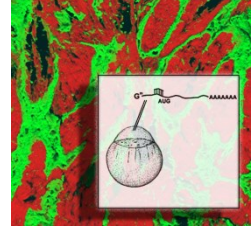


Lecturer	Title and content
Schmitz /Peters	<b>Interaction of dendritic cells with T-lymphocytes.</b> Generation of dendritic cells in vitro; Purification of T-helper cells from whole spleen cells by magnetic sorting; Flow cytometry; Cell culture; ELISA
Erdmann	<b>Characterization of proteins isolated from peroxisomes and peroxisomal membranes of the yeast <i>Saccharomyces cerevisiae</i>.</b> 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	<b>Current methods in Virology.</b> The module focuses on molecular virology techniques. Specific content will be announced.

# Courses 1st Term Master Programme

## Offers Modular advanced practicals

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

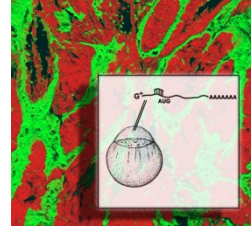


Lecturer	Title and content
Hahn	<b>PCR and primer design, vector cloning.</b> Principles of PCR technology, Primer design for PCR, Vector cloning , Plasmid preparation, DNA sequencing
Hamdani	<b>Inflammation and Oxidative Stress in Heart Failure.</b> The project will exploit human HFpEF biopsies and 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	<b>Protein misfolding and neurodegeneration.</b> 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

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

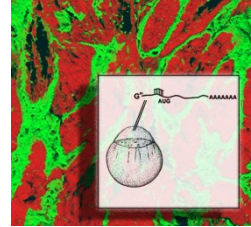


Lecturer	Title and content
Joachim	<b>Analysis of cell death mechanisms in retinal diseases.</b> Immunohistochemistry; Western blot; Organ culture
Rassow	<b>Import of bacterial and viral proteins into mitochondria.</b> Isolation of mitochondria from yeast, or, optional, from rat liver. Synthesis of radio-labeled 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	<b>Redox Biology.</b> Basics in experimental design, good laboratory practice, insights into protein redox biology, introduction to a variety of redox biology methods. Physiological stress experiments with <i>E. coli</i> ; □ 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

## Offers Modular advanced practicals

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



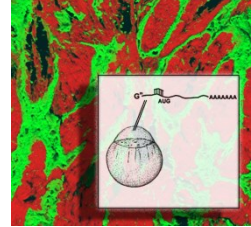
Lecturer	Title and content
Raulf	<b>Allergy research – from the production of allergen extract to allergen characterization.</b> Preparation of protein extract by using different protein extraction procedures, protein determination by different methods, SDS-PAGE, electrophoresis, silver-staining, IgE 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	<b>HLA-D typing and LightCycler applications.</b> 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

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

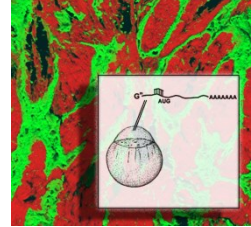


Lecturer	Title and content
<b>Tannapfel</b>	<b>Molecular pathology.</b> DNA extraction; Mutation analysis: HRM analysis, Sanger sequencing, Pyrosequencing; Promotor methylation analysis: Pyrosequencing, MSP analysis
<b>Winklhofer</b>	<b>Analysis of protein ubiquitination.</b> Gene transfer into mammalian cells; Protein-protein interactions; Mechanism of ubiquitination: E1, E2, and E3 enzymes; Different modes of ubiquitination; Functional consequences of ubiquitination
<b>Strumberg</b>	<b>Cancer stem cells and molecular oncology.</b> 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"><li>1. Cell culture and isolation of CD34+ cells from whole blood and leukemia cell lines</li><li>2. Phenotypic characterization of cancer stem cells by FACS analysis</li><li>3. Characterization of cancer stem cells by immunocytochemical methods (ICC)</li></ol>

# Courses 1st Term Master Programme

## Offers Modular advanced practicals

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

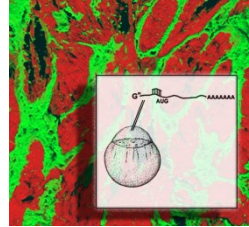


Lecturer	Title and content
<b>Bausch</b>	<b>Molecular oncology- <i>In vitro</i> drug effects on the transcriptome.</b> Molecular, biochemical and cell biological experimental techniques to study cancer cell reaction to drug treatment. Cell culture of cancer cell lines of various origin. Cell viability assays (SRB/MTT). Determination of $IC_{50}$ values. Preparation of cells for comparative transcriptome analysis <i>via</i> qPCR and Western Blot
<b>Wenzel</b>	<b>Current methods in animal physiology.</b> The module focuses on methods in animal physiology: isolation of organs and blood vessels, broncholalveolar lavage, generation of paraffin and cryosections, histological stainings, functional measurements, data analysis
<b>Salber</b>	<b>Biocompatibility assessment and biomanufacturing of 3D tissue constructs:</b> 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

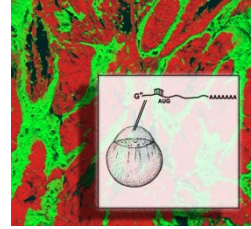
## Offers Modular advanced practicals

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



Lecturer	Title and content
Nguyen	<p><b>Single nucleotide polymorphism (SNP) genotyping.</b> 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: Hamdani) Wednesday, 14.00-15.30, HMA 40

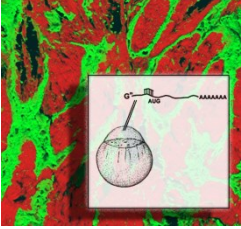
**"Virology for Scientists"** (Organisation: Steinmann) Wednesday, 15.30-17.00, Lecture Hall MABF

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.**

**CPs: 5**

# Courses 2nd Term Master Programme (8. Semester)



All students who choose Mol Med as their focal point have to take place in this lecture series as well as  
to pass the exam!

## 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.

**CPs: 5**

**Organisation:** S. Hahn

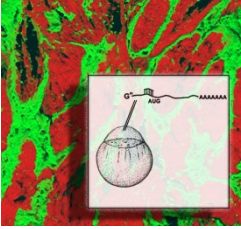
# Courses 2nd Term Master Programme (8. Semester)



## Advanced Practical:

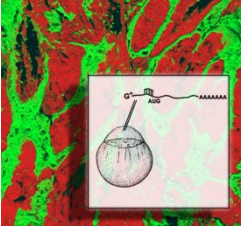
- 2 x 5 weeks all day
- Laboratory practical with two different lecturers of the department Molecular Medicine.
- Each lecturer is committed to offer at least one focus internship per semester.
- Organisation: Students

# 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	<a href="mailto:dirk.bausch@rub.de">dirk.bausch@rub.de</a>	Chirurg. Klinik, Marienhospital Herne	<a href="http://www.marienhospital-herne.de">www.marienhospital-herne.de</a>
Prof. Dr. Ralf Benndorf		<a href="mailto:ralf.benndorf@ruhr-uni-bochum.de">ralf.benndorf@ruhr-uni-bochum.de</a>	Institut für Pharmakologie und Toxikologie	<a href="http://www.pharm-tox.ruhr-uni-bochum.de/">www.pharm-tox.ruhr-uni-bochum.de/</a>
PD Dr. Martina Bröcker-Preuß	Oncology	<a href="mailto:martina.broecker-preuss@rub.de">martina.broecker-preuss@rub.de</a>	Klinische Chemie, KKH/ZKF	-
Prof. Thomas Brüning	Oncology	<a href="mailto:bruening@ipa-dguv.de">bruening@ipa-dguv.de</a>	IPA - Institut für Prävention und Arbeitsmedizin der Deutschen Gesetzlichen Unfallversicherung	<a href="http://www.ipa.rub.de">www.ipa.rub.de</a>
Dr. Elif Dagdan	Oncology	<a href="mailto:elif.dagdan@rub.de">elif.dagdan@rub.de</a>	Pathologie	<a href="http://www.rub.de/pathologie/">www.rub.de/pathologie/</a>
Prof. Ralf Erdmann		<a href="mailto:ralf.erdmann@rub.de">ralf.erdmann@rub.de</a>	Systembiochemie	<a href="http://www.rub.de/physiolchem/system/">www.rub.de/physiolchem/system/</a>
Dr. Wolfgang Girzalsky		<a href="mailto:wolfgang.girzalsky@rub.de">wolfgang.girzalsky@rub.de</a>	Systembiochemie	<a href="http://www.rub.de/physiolchem/system/">www.rub.de/physiolchem/system/</a>
Prof. Stephan Hahn Head of the focal point	Oncology	<a href="mailto:stephan.hahn@rub.de">stephan.hahn@rub.de</a>	Molekulare gastro-enterologische Onkologie	<a href="http://www.rub.de/mgo">www.rub.de/mgo</a>
Prof. Nazha Hamdani	Cardiology	<a href="mailto:nazha.hamdani@rub.de">nazha.hamdani@rub.de</a>	Molekulare und experimentelle Kardiologie	<a href="https://www.zellphys.ruhr-uni-bochum.de/">https://www.zellphys.ruhr-uni-bochum.de/</a>
PD Dr. Stephanie Joachim	Immunology	<a href="mailto:stephanie.joachim@rub.de">stephanie.joachim@rub.de</a>	Augenklinik, KKL	<a href="http://www.rub.de/eeri">www.rub.de/eeri</a>
Dr. Georg Johnen	Oncology	<a href="mailto:johnen@ipa-dguv.de">johnen@ipa-dguv.de</a>	IPA	<a href="http://www.ipa.rub.de">www.ipa.rub.de</a>
Prof. MC Kienitz	Cardiology	<a href="mailto:cecile.kienitz@rub.de">cecile.kienitz@rub.de</a>	Zelluläre Physiologie	<a href="https://www.zellphys.ruhr-uni-bochum.de/">https://www.zellphys.ruhr-uni-bochum.de/</a>
PD Dr. rer. nat. Björn Koos	Immunology	<a href="mailto:bjorn.koos@rub.de">bjorn.koos@rub.de</a>	Anästhesiologie, Intensivmedizin und Schmerztherapie	<a href="http://anaesthesie.rub.de/index.php?article=68">http://anaesthesie.rub.de/index.php?article=68</a>
Prof. Lars Leichert	Immunology	<a href="mailto:lars.leichert@rub.de">lars.leichert@rub.de</a>	Biochemie der Mikroorganismen	<a href="http://www.rub.de/biochem/microbiochem">www.rub.de/biochem/microbiochem</a>
Dr. Michaela Matthey	Cardiology	<a href="mailto:michaela.matthey@rub.de">michaela.matthey@rub.de</a>	Systemphysiologie	<a href="http://www.py.rub.de/sysp/Index.html.de">www.py.rub.de/sysp/Index.html.de</a>
Dr. Sabrina Mühlen	Immunology	<a href="mailto:muehls14@ruhr-uni-bochum.de">muehls14@ruhr-uni-bochum.de</a>	Zelluläre Mikrobiologie	<a href="http://virologie-bochum.de/">http://virologie-bochum.de/</a>
Dr. Huu Phuc Nguyen		<a href="mailto:huu.nguyen-r7w@rub.de">huu.nguyen-r7w@rub.de</a>	Humangenetik	<a href="http://www.rub.de/mhg/">www.rub.de/mhg/</a>
PD Dr. Marcus Peters	Immunology	<a href="mailto:marcus.peters@rub.de">marcus.peters@rub.de</a>	Molekulare Immunologie	
Dr. Carlos Plaza-Sirvent	Immunology	<a href="mailto:Carlos.PlazaSirvent@rub.de">Carlos.PlazaSirvent@rub.de</a>	Molekulare Immunologie	
Prof. Joachim Rassow		<a href="mailto:joachim.rassow@rub.de">joachim.rassow@rub.de</a>	Zellbiochemie	<a href="http://www.rub.de/physiolchem/zellbiochemie/">www.rub.de/physiolchem/zellbiochemie/</a>
Prof. Monika Raulf	Immunology	<a href="mailto:raulf@ipa-dguv.de">raulf@ipa-dguv.de</a>	IPA	<a href="http://www.ipa.rub.de">www.ipa.rub.de</a>
Dr. Jochen Salber		<a href="mailto:jochen.salber@rub.de">jochen.salber@rub.de</a>	Experimentelle Chirurgie	<a href="https://www.kk-bochum.de/">https://www.kk-bochum.de/</a>
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# Overview Focal Points Biochemistry:

[https://www.ruhr-uni-bochum.de/bc-schwerpunkte/SPBioChem\\_en.htm](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