Georg-August-Universität
Göttingen

Modulverzeichnis

Master's degree programme "Molecular Medicine" - referring to: Prüfungs- und Studienordnung für den internationalen konsekutiven Master-Studiengang "Molecular Medicine" (Amtliche Mitteilungen I No. 38/2021 p. 829)

Module

Übersicht nach Modulgruppen

I. Master-Studiengang "Molecular Medicine"

Es müssen Leistungen im Umfang von 120 C erfolgreich absolviert werden.

1. Pflichtmodule

Es müssen folgende vier Module im Umfang von insgesamt 76 C erfolgreich absolviert werden:

2. Wahlmodule (Professionalisierung - Schlüsselkompetenzen)

Es müssen Wahlmodule zum weiteren Erwerb von Schlüsselkompetenzen im Umfang von insgesamt wenigstens 14 C erfolgreich absolviert werden. Es können folgende Module belegt werden:

a. Module der Medizinischen Fakultät

b. Schlüsselkompetenzen (universitätsweit)

Es können neben den o.g. Modulen der Medizinischen Fakultät auch Module aus dem Angebot des universitätsweiten Modulverzeichnisses für Schlüsselkompetenzen belegt werden, ferner Module im Umfang von höchstens 9 C aus dem Modulverzeichnis zur Prüfungsordnung für die Studienangebote der Zentralen Einrichtung für Sprachen und Schlüsselqualifikationen (ZESS) in der jeweils geltenden Fassung.

3. Masterarbeit

Durch die erfolgreiche Anfertigung der Masterarbeit werden 30 C erworben.

Georg-August-Universität Göttingen **Module M.MM.001: Epidemiology**	4 C 3 WLH

Learning outcome, core skills: After a successful completion of the course the student • knows the intersection between “Host“, “Environment” and “Agent“, the epidemiological triangle of the susceptibility to affection, • can compute epidemiological key figures (frequency measures: e.g. prevalence, incidence, incidence rate; standardized mortality rate; risk measures: e.g. relative and attributable risk, number needed to treat), • knows the requirements of international standards for epidemiological investigation („Good Epidemiological Practice“), • knows the significance of accuracy, reliability and validity in the measurement of exposures, • knows important elements for the evaluation of validity and causality of an association (e.g. bias, confounder, Bradford-Hill-Criteria) and can implement them, • knows a simple model of the spread of infectious diseases and understands the term “herd immunity”.	**Workload:** Attendance time: 42 h Self-study time: 78 h

Course: Epidemologie (Lecture)	2 WLH
Course: Epidemologie (Seminar)	1 WLH
Examination: Written examination (60 minutes) **Examination prerequisites:** Presentation	4 C

Examination requirements: Knowledge about the intersection between “Host“, “Environment” and “Agent“. Prevalence, incidence, incidence rate; standardized mortality rate; risk measures: e.g. relative and attributable risk, number needed to treat. „Good Epidemiological Practice“. Factors affecting accuracy, reliability and validity in the measurement of exposures. Validity and causality of an association. Spread of infectious diseases.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Heike Bickeböller
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.MM.005: English for Scientists**	4 C 2 WLH

Learning outcome, core skills:	**Workload:**
In the course "English for Scientists" the students extend their knowledge of the English language in a scientific context at an advanced level. The emphasis in the course for Masters students is on the skills required in positions of responsibility and leadership. The participants will learn to communicate in international situations successfully and with self-confidence in both spoken and written English. After completing the module, the students will be familiar with the fundamentals of: formal writing for the purpose of acquiring research partners and sponsors, telephoning internationally, meetings, and the planning of a visit by international partners. Linguistic abilities will also be promoted by discussion of further relevant themes such as "leadership" and "cultural differences in business" in English.	Attendance time: 28 h Self-study time: 92 h

Course: English for Scientists (Seminar)	2 WLH
Examination: Written examination (60 minutes) **Examination requirements:** Composition of a research application in English. Carrying out telephone calls in English. Discussing confidently in English. Planning a visit by international partners.	4 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Mark Wigfall
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.MM.007: Inflammatory Response of the Liver**	2 C 1,5 WLH

Learning outcome, core skills: After completing the module, students have got an overview of inflammatory diseases of the liver. Students have knowledge about cytokines and chemokines; they got training in the cellular and molecular events that underline the development, progression and resolution of inflammatory response; to be able to differentiate between acute and chronic liver inflammation (acute- and chronic hepatitis), and between inflammatory and immune responses; to understand the role of inflammation and/or the immune response in diseased liver.	**Workload:** Attendance time: 21 h Self-study time: 39 h

Course: "Chronic inflammation of the liver" (Seminar)	0,5 WLH
Course: "Molecular diagnostics of chronic hepatitis" (Practical course)	1 WLH
Examination: written report (max. 5 pages), not graded **Examination prerequisites:** Regular attendance in the seminar and the practical course. **Examination requirements:** Cellular and molecular mechanisms which cause inflammatory processes in the liver. Molecular diagnostics of liver diseases. Adequate presentation of diagnostic results.	2 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. I. A. Malik
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: 5	

Georg-August-Universität Göttingen **Module M.MM.008: Organ Fibrosis**	2 C 1,5 WLH

Learning outcome, core skills: On completion of the module the students have an overview about the cellular and molecular processes of the origin of fibrosis in general and in particular within liver and kidney. knowledge of the epigenetic processes which are involved in fibrosis. an overview about experimental models for hepatitis. the ability to identify which knowledge is necessary for developing antifibrotic therapy approaches and new therapeutic concepts. knowledge about the basic experimental methods for investigation of organ fibrosis. Key competences: Literature search, presentation of results and scientific discussion.	**Workload:** Attendance time: 21 h Self-study time: 39 h

Course: "Organ Fibrosis" (Seminar)	0,5 WLH
Course: "Molecular causes of fibrogenesis" (Practical course)	1 WLH
Examination: schriftlicher Bericht (max. 5 pages), not graded **Examination prerequisites:** Regular attendance at the seminar and the practical course. **Examination requirements:** The cellular and molecular mechanisms which play a role in the origin and propagation of fibrosis in organs. DNA-Methylation. Molecular research approaches of organ fibrosis. Adequate presentation of the results.	2 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Michael Zeisberg Prof. Dr. Elisabeth Zeisberg
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: 5	

Georg-August-Universität Göttingen **Module M.MM.009: Molecular Imaging in Biomedical Research**	3 C 2 WLH

Learning outcome, core skills:	**Workload:**
Upon completion of the module, the student will be familiar with the basics, principles and possible applications of different imaging techniques, such as computed tomography (CT), optical imaging using fluorescent dyes or bioluminescence, positron emission tomography (PET), single photon emission computed tomography (SPECT) and magnetic resonance imaging (MRI) in preclinical research as well as in clinical application. Since extracting valid information from acquired images is crucial, fundamental concepts of image processing and data analysis will introduced as well. Key learning objectives are to be able to assess the advantages and limitations of each imaging method: Which imaging device can be used for which preclinical and clinical problem? What can be visualized with each individual method? By the end of the module, students are familiar with the procedures for developing new molecular imaging samples regarding specific problems. With this knowledge, students are able to demonstrate long-term perspectives that innovative imaging techniques bring to preclinical and clinical applications.	Attendance time: 28 h Self-study time: 62 h

Course: Molecular Imaging (Seminar)	2 WLH
Examination: Written examination (30 minutes) **Examination prerequisites:** Regular attendance at the seminar. **Examination requirements:** Principles and applications of imaging techniques in molecular medicine research.	3 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** apl. Prof. Dr. med. Frauke Alves PD. Dr. Christian Dullin
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: 10	

Georg-August-Universität Göttingen **Module M.MM.010: State-of-the-art Methods in Biomedical Research**	2 C 1,5 WLH

Learning outcome, core skills: After successful completion of the module the students can/know … • the basics and the state of the art of mass spectrometry-based proteomic analysis • essential applications of proteomic analysis in the field of biomedical and clinical research and can understand and critically evaluate simple publications in this field • the basic factors of statistical analysis of clinical and experimental data • the most important applications of machine learning methods in the field of biomedical and clinical research • the relevant factors for the planning of experiments • describe the importance and added value of secondary use of data in medical care and research • explain the methodological prerequisites and challenges of data integration and cross-institutional data sharing; name and assess relevant aspects of data privacy and ethics • define the term „biospecimen science“ and provide two arguments for research in this area • describe how the Central Biobank can support research • the basics and the current status of modern MR techniques • the main applications of MR techniques in the field of biomedical and clinical research • read and understand simple publications using MR techniques • the basics and the current state of the art of NGS techniques and applications • the major applications of transcriptome and genome analyses in the field of biomedical and clinical research • NGS pipelines including QC analysis and data preprocessing	**Workload:** Attendance time: 21 h Self-study time: 39 h

Course: State-of-the-art Methods in Biomedical Research (Lecture, Seminar)	1,5 WLH
Examination: Minutes / Lab report (max. 5 pages), not graded **Examination prerequisites:** Regular attendance at the seminar.	2 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. Christof Lenz, Dr. Andreas Leha, PD Dr. Sara Nußbeck, Sabine Rey/Prof. U. Sax, PD Dr. Peter Dechent, Dr. Gabriela Salinas, Prof. Wulf
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2

Maximum number of students: 10	

Georg-August-Universität Göttingen **Module M.MM.011: Drug Discovery and Project Management in the Pharmaceutical Industry**	2 C 2 WLH

Learning outcome, core skills: Upon completion of the module students • know the principle of matrix organization as a management concept • have basic knowledge of project work in the private sector • know the processes of drug development: identification of targets, high throughput screening and alternative approaches for hit identification, drug optimization, cell based assay development, ADME, PK, PD, toxicology, in vivo models, clinical trial design, and risk management • have gained insight into industrial drug production	**Workload:** Attendance time: 28 h Self-study time: 32 h

Course: Drug Discovery and Project Management in the Pharmaceutical Industry (Seminar)	1,5 WLH
Course: Production of Medication (Excursion)	0,5 WLH
Examination: protocol (max. 5 pages), not graded **Examination prerequisites:** Complete attendance on all days, active participation in the workshop aspect of the seminar and the excursion.	2 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** PD Dr. Gunnar Dietz
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: 18	

Georg-August-Universität Göttingen **Module M.MM.012: Tumor Genetics**	2 C 1 WLH

Learning outcome, core skills: Using primary literature the students will obtain (i.a.): • an overview about the role of chromosomal aberrations, oncogenes and tumor suppressor genes during tumor initiation and tumor progression • insights into somatic gene therapy and prospects for the development of adequate therapeutic strategies • an overview about relevant and new techniques in molecular cytogenetics and molecular genetics • a new publication from the field of tumor genetics and the students will work out the relevant methods and results described therein • coaching how to present these methods and results to an audience using PowerPoint followed by a discussion	**Workload:** Attendance time: 14 h Self-study time: 46 h

Course: "Tumor Genetics" (Seminar)	1 WLH
Examination: Presentation (approx. 30 minutes) and discussion (approx. 15 minutes) **Examination prerequisites:** Regular attendance at the seminar. **Examination requirements:** Work out and adequate presentation of the methods, research results and procedures described in the primary literature. Discussion and questions for the understanding of the presented methods and results.	2 C

Admission requirements: Successful participation of module B.MM.106 (Molekulare Zellbiologie und Molekulare Genetik) or equivalent course	**Recommended previous knowledge:** Basic knowledge in molecular genetics, cell biology and tumor genetics
Language: English	**Person responsible for module:** Prof. Dr. rer. nat. Peter Burfeind PD Dr. rer. nat. Silke Kaulfuß
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: 14	

Georg-August-Universität Göttingen **Module M.MM.015: Human Genetics in Research and Diagnostic**	4 C 2 WLH

Learning outcome, core skills: Molecular genetics • Basics in genetic counselling • Isolation of genomic DNA from blood • Performing PCR, Sequencing, fragment analysis, MLPA • Interpretation of results • Handling of gene databases NGS • Introduction to Next-Generation-Sequencing technologies and their application for identifying disease-causing genes • Analysis of NGS dataset of patients with different congenital diseases and data interpretation using different gene/population/mutation databases	**Workload:** Attendance time: 30 h Self-study time: 90 h

Course: "Theoretical basics and practical application of techniques in Human Genetic" (Practical course, Seminar)	1,5 WLH
Course: "Human Genetics" (Seminar)	0,5 WLH
Examination: written protocol (max. 15 pages) **Examination prerequisites:** Active participation **Examination requirements:** Regular attendance in seminars and practical courses	4 C

Admission requirements: knowledge of genetic basics	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** PD Dr. rer. nat. Anja Uhmann
Course frequency: each winter semester	**Duration:** 6 weeks
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: 6	

Georg-August-Universität Göttingen **Module M.MM.017: Auditory Neuroscience**	3 C 2,5 WLH

Learning outcome, core skills:	**Workload:**
The group leaders of the Göttingen Inner Ear Lab will offer seminar lecture to introduce the different scientific approaches they undertake to investigate sensory processing in the ear and hearing rehabilitation. Extensive practical training will comprise lab tours and own experiments: dissection of mouse organs of Corti, immunohistochemistry, patch clamp experiments, superresolution and electron microscopy, hearing tests. After completion of the module, the students will be able to • understand auditory function from the sound wave to the auditory cortex with a focus on synaptic transmission in sensory inner hair cells • Understand how standard tests of hearing function are done both in the clinical assessment of human patients and in the laboratory assessment of rodents • have basic knowledge on the pathophysiology of human hearing loss and rehabilitation strategies • understand how novel animal models could bridge the gap between basic research and clinical practice • understand the general AAV methodology and gene delivery techniques • understand the concept of an optogenetic cochlear implant • perform immunohistochemical labeling of inner ear tissue under supervision • perform patch clamp electrophysiology experiments on inner hair cells under supervision	Attendance time: 31 h Self-study time: 59 h

Course: Auditory Neuroscience (Practical course, Seminar)	2,5 WLH
Examination: Written test (45 minutes), not graded **Examination prerequisites:** Regular attendance at the seminar and the practical course.	3 C

Admission requirements:	**Recommended previous knowledge:**
none	• General knowledge of the anatomy and normal function of the Inner Ear, as laid out in standard textbooks of Neuroscience (e.g. Kandel Principles of Neuroscience) or Physiology (E.g. Schmidt/Thews Physiology) or taught in the Göttingen Bachelor program of Molecular Medicine • General knowledge of synaptic structure and function • General knowledge of molecular biology and gene therapy
Language: English	**Person responsible for module:** Prof. Dr. Nicola Strenzke

	Prof. Dr. Tobias Moser
Course frequency: once a year	**Duration:** Approx. 2 weeks
Number of repeat examinations permitted: twice	**Recommended semester:** 1
Maximum number of students: 16	

Georg-August-Universität Göttingen **Module M.MM.018: Modelling and Targeting Pancreatic Cancer Subtypes**	4 C 3 WLH

Learning outcome, core skills: After completing the module, students have gained an overview on current pancreatic cancer research with a particular focus on molecular pancreatic cancer subtypes. Students • have basic knowledge of the impact of pancreatic cancer subtypes on the tumour biology and the clinical course of the disease • understand the definition of pancreatic cancer subtypes from multiple angles (genetically/transcriptionally/metabolically) • know the chances and pitfalls of *in vivo* modelling of pancreatic cancer subtypes • can assess pancreatic cancer immune heterogeneity and epithelial pancreatic cancer subtypes by multiplex immunofluorescence • understand the challenges in primary tissue extraction from the surgical perspective • have trained in orthotopic transplantation on pancreatic cancer cells into mice • have knowledge of functional *in vitro* assays for studying pancreatic cancer progression • have trained in modelling therapeutic responses in pancreatic cancer via mouse ultrasound	**Workload:** Attendance time: 45 h Self-study time: 75 h

Course: Modelling and Targeting Pancreatic Cancer Subtypes (Seminar)	2 WLH
Course: Modelling and Targeting Pancreatic Cancer Subtypes (Practical course)	1 WLH
Examination: Written protocol. (max. 5 pages) **Examination prerequisites:** Regular attendance and active participation in the seminar and practical course.	4 C

Admission requirements: none	**Recommended previous knowledge:** Participation in module M.MM.102.
Language: English	**Person responsible for module:** Prof. Dr. Elisabeth Heßmann
Course frequency: once a year	**Duration:** Approx. 4 weeks
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: 6	

Georg-August-Universität Göttingen **Module M.MM.019: Modern Aspects of Human Genetics**	2 C 1 WLH

Learning outcome, core skills: Using primary literature the students will obtain (i.a.): • an overview about established and novel, state-of-the-art methods used in the field of human genetics • insights into the main research focus including new techniques used for identification of mutations and characterization of their effects using different cellular and animal models • insights into the development of novel therapeutic strategies including CRISPR/ Cas- and iPSCs-based (genome editing) approaches • a new publication from the field of human genetics that the students will use to work out the relevant methods and results described therein • coaching how to present these methods and results to an audience using PowerPoint followed by a discussion	**Workload:** Attendance time: 12 h Self-study time: 48 h

Course: "Modern Aspects of Human Genetics" (Seminar)	1 WLH
Examination: Presentation (approx. 30 minutes) and discussion (approx. 15 minutes) **Examination prerequisites:** Regular attendance at the seminar. **Examination requirements:** Work out and adequate presentation of the methods, research results and procedures described in the primary literature. Discussion and questions for the understanding of the presented methods and results.	2 C

Admission requirements: Successful participation of module B.MM.106 (Molekulare Zellbiologie und Molekulare Genetik) or equivalent course	**Recommended previous knowledge:** Basic knowledge in molecular genetics, cell biology and tumor genetics
Language: English	**Person responsible for module:** Dr. rer. nat. Gökhan Yigit
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** from 1
Maximum number of students: 12	

Georg-August-Universität Göttingen **Module M.MM.020: Genetic Epidemiology**	2 C 2 WLH

Learning outcome, core skills: Studies in molecular / genetic epidemiology are investigating possible genetic components that are contributing to a disease or, more general, to a phenotype. The studies include population studies and family studies. The difference with classical epidemiology is mainly given by the incorporation of correlations of the genetic structures and of family members or close populations and by the highdimensionality of many studies. The course will discuss the most important study types and statistical and epidemiological methods. The lecture will also give necessary introductions to genetics as well as epidemiology. The students learn about the description of genetically co-determined phenotypes for diseases in populations and families, the discovery of risk faktors that are on one hand associated with the phenotype in the population or on the other hand provoke familial aggregations, the modelling of the role of genetic risk factors for diseases on the population and family level, and the prediction or risk calculation based on populations or families.	**Workload:** Attendance time: 24 h Self-study time: 36 h

Course: Genetic Epidemiology (Lecture, Seminar)	2 WLH
Examination: Oral Report (approx. 40 minutes) **Examination prerequisites:** Regular attendance at the seminar. **Examination requirements:** 1st part examination (20 minutes): In the oral presentation together with a 3-8 pages write-up the students demonstrate that they can apply their knowledge and understanding in the context of a scientific article by demonstrating an understanding of the study goals, the recruitment, the study design, the materials, the methods and the results. An understanding of why investigators took certain choices and why certain aspects are good or bad are expected in the critique. It is also expected that basic principles of the methods will be understood and looked up even if they are extensions of the material directly covered in class. 2nd part examination (20 minutes): The students demonstrate their general understanding of genetic and statistical models and designs. They know about the advantages and disadvantages of the different research questions and designs. They know the general properties of the statistical approaches and can critically assess the appropriateness for specific problems and apply them.	2 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in statistics.
Language: English	**Person responsible for module:** Prof. Dr. Heike Bickeböller
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted:	**Recommended semester:**

twice	1 - 2
Maximum number of students: 10	

Georg-August-Universität Göttingen **Module M.MM.021: Experimental, epidemiological and clinical approaches in dermatology**	3 C 2 WLH

Learning outcome, core skills: After completing the module, students: • are familiar with the structure, function and immunology of the skin • have an overview of immunological, cellular and molecular mechanisms of different skin disorders such as atopic dermatits, contact dermatitis, skin fibrosis and skin cancer • have gained insights into experimental models of dermatology (*in vivo* mouse models, *in vitro* cell culture) and different analytical tools • know the most important contact sensitizers, their distribution in environment and occupation, and are familiar with patch testing and corresponding epidemiological research (including the design of an epidemiological questionnaire) • can describe how the IVDK (Information Network of Departments of Dermatology) contributes to disease surveillance and prevention • obtained practical expertise in planning, conducting and interpreting epidemiological and laboratory experiments, including literature interpretation and presentation	**Workload:** Attendance time: 30 h Self-study time: 60 h

Course: "Skin biology: from homeostasis to diseases'" (Lecture)	1 WLH
Course: "Revising research data for presentation'" (Seminar)	0,5 WLH
Course: "Current approaches in dermatology" (Practical course)	0,5 WLH
Examination: Oral Presentation (30 minutes) **Examination prerequisites:** Regular attendance in seminars and courses (80%) **Examination requirements:** Basic knowledge of dermatological research approaches, adequate work out and presentation of methods and research results.	3 C

Admission requirements: Bachelor's degree in Molecular Medicine or a related field of study	**Recommended previous knowledge:** Basic knowledge in immunology, molecular biology and statistics
Language: English	**Person responsible for module:** Prof. Dr. med. Timo Buhl Dr. Andrea Braun
Course frequency: once a year	**Duration:** 3 weeks
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: 6	

Georg-August-Universität Göttingen **Module M.MM.101: Biomolecules and Pathogens**	24 C 23 WLH

Learning outcome, core skills: In the course of the module the students will aquire deepened molecular knowledge of the interplay between pathogens and host defense, immunological diseases and pharmacological approaches to interfere with various disorders. The graduates know current immunological questions and methods, and are able to explain the mechanism and therapy of related diseases. They know the function and regulation of microbial virulence factors and understand their role in the pathogenesis of infectious diseases. In addition, they have extensive insight into the taxonomy and structure of viruses. The graduates know the principles of pharmacological research and current therapeutic strategies. They can apply concepts of pharmacology to practical examples and name effects of selected toxic substances. The graduates have the ability to work under supervision on a small defined scientific project using experimental methods of the field, and to analyze and interpret the obtained data. They are able to present and discuss them in written form similar to a scientific publication.	**Workload:** Attendance time: 322 h Self-study time: 398 h

Course: "Biomolecules and Pathogens" (Lecture, Seminar)	8 WLH
Examination: Written examination (180 minutes) **Examination prerequisites:** Regular attendance at the seminar. **Examination requirements:** Deepened knowledge of clinically relevant pathogens and their mechanisms, basic concepts of immune responses and their failure, and current principles of pharmacological therapy of selected diseases.	12 C

Course: "Lab Rotation" (Practical course)	15 WLH
Examination: Presentation (approx. 30 min.) with written draft (max. 20 pages) **Examination prerequisites:** Regular attendance at the lab rotation. Completion of the course "Good Scientific Practice". Attendance at the occupational health and safety briefing and medical prevention. **Examination requirements:** Practical application of typical experimental methods to elucidate molecular, cellular and pathophysiological processes, and conclusive presentation of the obtained research results.	12 C

Admission requirements: Bachelor’s degree in a related study program.	**Recommended previous knowledge:** Basic lectures in microbiology, virology, immunology, and pharmacology.
Language: English	**Person responsible for module:** Prof. Dr. rer. nat. Holger Reichardt
Course frequency: once a year	**Duration:** 1 semester[s]

Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.MM.102: From Cells to Disease Mechanism**	24 C 24 WLH

Learning outcome, core skills: After successfully finishing this module the students should be familiar with molecular processes within the cell and corresponding aspects associated with pathological changes and pathological tissues. They are able to describe qualitatively genetic and metabolic diseases as well as inflammatory and cancerous processes. The students are familiar with tools, concepts and methods of cell biology, pathology, human genetics and mol. & experim. oncology and thus are able to describe causes and consequences of changes within genetic and cellular processes by using typical examples. Furthermore, fundamental mechanisms in pathology, genetics and cell biology are deduced including scientific paper discussions. In addition, under qualified supervision students acquire the ability to perform experimental work within the lab covering a clear cut topic or highly sophisticated method. The results of this practical course will be presented within the corresponding scientific group and written down in corresponding scientific style.	**Workload:** Attendance time: 336 h Self-study time: 384 h

Course: "From Cells to Disease Mechanism – selected topics in cell biology, oncology, pathology and human genetics" (Lecture, Seminar)	9 WLH
Examination: Written examination (180 minutes) **Examination prerequisites:** Regular attendance at the seminar. **Examination requirements:** Knowledge and understanding about fundamental mechanisms in gene regulation, about principles in cell communications and intracellular signaling processes, mechanisms of feedback/-forward regulatory circuits in cell signaling, hallmarks of cancer, criteria of cell transformation in in vitro und in vivo assays, models of tumor develoment and therapy, tools to investigate cancer cells, current concepts in cancer therapy, tumorsuppressor genes and oncogenes, proteomics, epigenetics, tumor genetics, modern concepts and mode of action, mechanisms, regulation of cell cycle phases, cell cycle check-points, posttranslational modifications as ubiquitination and phosphorylation, regulation of mitosis and chromosome segregation, genetic instability in cancer and chromsomal aberrations, DNA-damage responses, stem cell concepts, molecular pathology of carcinogenesis, colorectal cancer, lung cancer, pancreatic cancer and soft tissue sarcoma, concepts about the genetics of inflammatory reactions/ diseases and, selected topic of molecular and translational oncology and hematological neoplasias, knowledge about current methods to analyse DNA, RNA and proteins as well as cell metabolism for molecular medicine and different in vivo models.	12 C

Course: "Lab Rotation" (Practical course)	15 WLH
Examination: Presentation (approx. 30 min.) with written draft (max. 20 pages) **Examination prerequisites:** Regular attendance at the lab rotation. **Examination requirements:**	12 C

Characteristic tools, concepts and methods to analyse molecular processes within cells and in vivo models, use methods of diagnostics, coherent and conclusive presentation of experimental data established within the lab rotation.	

Admission requirements: Bachelor’s degree in a related study program or successfully passed first exam in human medicine.	**Recommended previous knowledge:** Basic lectures in oncology, biochemistry, pathology, cell biology, molecular biology, dermatology und human genetics.
Language: English	**Person responsible for module:** Prof. Dr. Dieter Kube
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.MM.103: The Disease-Affected Organism**	24 C 23 WLH

Learning outcome, core skills: After successfully finishing this module the students should be familiar with molecular aspects of urological diseases including urological tumors and prostate cancer and with mechanisms playing a role in different kidney diseases like polycystic kidney disease, diabetic nephropathy as well as with mechanisms leading to renal fibrosis. Moreover, the students should be familiar with mechanisms playing a role in neurodegenerative diseases resulting from protein misfolding like Alzheimer's and Parkinson's disease and other prionopathies. Understanding molecular mechanisms of motor neuronal diseases, cerebral vascular diseases and neuronal autoimmune diseases is a further goal of this module. In molecular cardiology the student become familiar with mechanisms of different forms of heart failure, mechanisms of arrhythmia and myocarditis and the role of stem cells in tissue regeneration. In pharmacology, this knowledge is supplemented with pharmacotherapeutic strategies in the treatment of hypertension, heart failure, arrhythmia, the metabolic syndrome and of thromboembolic events. An outlook on potential future therapies of cardiovascular diseases is given including gene therapy, stem-cell based therapies and tissue engineering. The students have the ability to work under supervision on a small defined scientific project using experimental methods, and to analyze and interpret the obtained data. They are able to present their results in a seminar, and to discuss and document them in written form similar to a scientific publication.	**Workload:** Attendance time: 322 h Self-study time: 398 h

Course: "The Disease-Affected Organism" (Lecture, Seminar)	8 WLH
Examination: Written examination (180 minutes) **Examination prerequisites:** Regular attendance at the seminar. **Examination requirements:** Profound knowledge on molecular mechanisms of the in the module discussed diseases in the fields of urology, nephrology, neurology, neuropathology and cardiology Basic knowledge of signs and symptoms of the respective diseases Knowledge in options of pharmacotherapeutical strategies in cardiovascular diseases.	12 C

Course: "Lab Rotation" (Practical course)	15 WLH
Examination: Presentation (approx. 30 min.) with written draft (max. 20 pages) **Examination prerequisites:** Regular attendance at the lab rotation. **Examination requirements:** In the presentation the student has to demonstrate that she/he has gained deeper insights in the molecular mechanism of a certain disease by working on a respective scientific question. Suitable methods and the obtained results should be critically discussed. In the written report, which should follow the format of a thesis, the necessary introduction, material and methods and the results has to be concisely described and in the discussion carefully set in the literature context.	12 C

Admission requirements: Bachelor’s degree in a related study program or successfully passed first exam in human medicine.	**Recommended previous knowledge:** Basic lectures in pharmacology, physiology, nephrology, cardiology, neurology and neuropathology.
Language: English	**Person responsible for module:** Prof. Dr. Susanne Lutz
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.MM.104: Current Topics in Molecular Medicine**	4 C 3 WLH

Learning outcome, core skills: After completion of the module, the participant is capable of communicating his own scientific projects to a broader audience of scientists. Furthermore, she/he is capable of introducing such an audience to a general topic of molecular medicine. She/He can summarize primary scientific literature and review articles in an overview talk. The participants will be capable of following seminar talks about a topic that they are not immediately familiar with. They are asking meaningful questions and have become able to discuss methodological approaches and scientific conclusions in a critical and constructive manner.	**Workload:** Attendance time: 42 h Self-study time: 78 h

Course: "Current Topics in Molecular Medicine" (Seminar)	3 WLH
Examination: Oral Presentation (approx. 30 minutes) **Examination prerequisites:** Regular attendance at the seminar. **Examination requirements:** The seminar talk must be understandable and clearly structured. It should reflect broad knowledge regarding the scientific background. The questions behind the project should be derived from this background. Methods and results should be outlined understandably, and the conclusions should be presented in a way that the audience can follow. The participants are also required to actively contribute to the discussion, to ask questions, and to evaluate the above-mentioned aspects of the presentation.	4 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. med. Matthias Dobbelstein
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: 20	