



Version 1 - 2015

Module guide

International Master Program

Cardiovascular Science

University of Göttingen

Part 1

Theoretical modules

Synopsis

The Master program **Cardiovascular Science** contains four theoretical modules (M.CVS.101; M.CVS.102, M.CVS.201, M.CVS.301) with a consecutive curriculum covering basic knowledge on the organ and molecular level of the cardiovascular system, on cardiovascular diseases and therapies as well as on modern aspects of cardiovascular science. In addition, this curriculum is accompanied by the module M.CVS.004 which includes the training and attendance of presentations of recent topics in cardiovascular research.

M.CVS.101: Cardiovascular Basics I

M.CVS.101: Cardiovascular Basics II

M.CVS.001: Lab rotation I

M.CVS.201: Cardiovascular diseases and therapies

M.CVS.002: Lab rotation II

M.CVS.301: Cardiovascular research in academia and industry

M.CVS.003: Lab rotation III

M.CVS.004: Modern topics in CVS and clinical research

Georg-August-University Göttingen Module M.CVS.101: Cardiovascular basics I	9 ECTS 7 SWS
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Learning outcomes Students who have successfully finished this module have an advanced knowledge of: 1.) The anatomy of the heart, the vasculature, the lung, the kidney, the nervous system of humans, rodents and widely used experimental animals (e.g. zebra fish) 2.) The embryonic development in general and of the cardiovascular system 3.) The physiology of the heart, the circulation, the lung, the kidney, the autonomous nervous system including e.g. detailed knowledge on the control of cardiac contractility and function, the short and long term control of the blood pressure, important hemodynamic laws 4.) The hormonal control of the cardiovascular system e.g. by catecholamines, the RAAS, natriuretic peptides, sex hormones	Total hours Contact hours 98 h Self-study 172 h
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Courses 1. Cardiovascular basics I (Lectures, 70h) <i>Content</i> <ul style="list-style-type: none"> • Cardiovascular anatomy • Cardiovascular embryology • Cardiovascular physiology • Cardiovascular nervous system • Cardiovascular endocrinology 	5 SWS
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2. Cardiovascular basics I (Practical course, 28h) <i>Content</i> <ul style="list-style-type: none"> • The cardiovascular anatomy • Histology course of cardiovascular tissues • Cardiovascular Physiology 	2 SWS
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Examination: Written exam (180 min) about the development, physiology and anatomy of the heart and the cardiovascular system and its hormonal and nervous regulation.	
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Entry requirement None	Recommended pre-requisites None
Language English	Module coordinator Dr. Laura Zelarayan-Behrend
Frequency Each winter semester	Duration 7 weeks
Repeatability twice	Recommended semester of study 1
Maximal number of students 25	

Additional notes and regulations: - Teaching capacity provided by: Med-VK: 54h lecture, 28h practical work; Med-KT: 16h lecture; Med.-K:-
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Georg-August-University Göttingen		9 ECTS
Module M.CVS.102: Cardiovascular basics II		7 SWS
Learning outcomes Students who have successfully finished this module have an advanced knowledge of: <ol style="list-style-type: none"> 1.) The detailed structure of eukaryotic cells and especially of cardiovascular cells including cardiomyocytes, smooth muscle cells, endothelial cells, fibroblasts, epithelial cells, stem cells 2.) Important cellular processes e.g. proliferation, migration, contraction, apoptosis, necrosis 3.) Intracellular mechanisms e.g. transcription, translation, PTM, exo/endocytosis, protein degradation 4.) The regulation of action potentials, ion fluxes, transporters 5.) Thermodynamics, hydrodynamics, biomechanics 6.) The cellular metabolism including glucose, fatty acid and amino acid metabolism 7.) Protein composition and structures 8.) The genetic and epigenetic control of protein expression including the DNA architecture, replication, transcription, DNA modifications, histon modifications 9.) Import concepts of signal transduction including membrane and intracellular receptor-dependent signaling involving e.g. kinases-phosphatases, G proteins, second messengers, transcription factors, oxygen and redox signaling 		Total hours Contact hours 98 h Self-study 172 h
Courses 1. Cardiovascular basics II (Lectures, 84h) <i>Content</i> <ul style="list-style-type: none"> • Cardiovascular cell biology • Cardiovascular biophysics • Cardiovascular biochemistry • Cardiovascular (epi)genetic • Cardiovascular signal transduction 		6 SWS
Examination Written exam (180 min) about the function of different sources of cell types, important biochemical and biophysical cellular processes, signal transduction processes in the heart and basics of (epi)genetics		
2. Cardiovascular basics II (Seminar, 14h) <i>Content</i> Presentation of recent publications from the cardiovascular field.		1 SWS
Examination Seminar presentation (oral, 15 min): Short PowerPoint presentation about a given topic, including max. 5 minutes discussion		
Entry requirement	Recommended pre-requisites	
None	Passed examination in module M.CVS.101	
Language	Module coordinator	
English	Dr. Katrin Streckfuß-Bömeke	
Frequency	Duration	
Each winter semester	7 weeks	

Repeatability Twice	Recommended semester of study 1
Maximal number of students 25	

Additional notes and regulations:

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Teaching capacity provided by:

Med-VK: 20h lecture, 4h seminar; Med-KT: 30h lecture, 6h seminar; Med.-K: 34h, 4h seminar

Georg-August-Universität Göttingen		9 ECTS
Module M.CVS.201: Cardiovascular diseases and therapies		7 SWS
Learning outcomes Students who have successfully finished this module have an advanced knowledge of: <ol style="list-style-type: none"> 1.) Etiology and pathophysiology, signs and symptoms, diagnosis, classifications, management, prognosis of important cardiovascular diseases including e.g. coronary artery disease, load-dependent heart diseases, cardiomyopathies, myocarditis, pulmonary heart diseases (PAH and COPD), arrhythmia and their outcomes e.g. myocardial infarction, stroke, left and right heart failure 2.) Risk factors for heart diseases including diabetes, hypertension, metabolic syndrome 3.) Important molecular causes for cardiovascular diseases including involved gene mutations and disease-dependent molecular changes 4.) Important technologies in cardiovascular imaging including echocardiography, computed tomography, magnetic resonance imaging 5.) Treatment strategies and basic pharmacological principles including pharmacodynamics, pharmacokinetics, interference with the catecholamine, acetylcholine and RAA systems, diuretics, anti-arrhythmic drugs, vasodilators, lipid-lowering drugs, anti-thrombotic drugs, anti-diabetic drugs 6.) Modern (experimental) therapeutic approaches including gene therapy, cell-based therapy, tissue regeneration 7.) Interventional therapies including coronary catheterization, stent implantation 8.) Cardiac surgeries of acquired heart diseases, of the vasculature and congenital heart defects including heart and valve transplantation, by-pass surgery. 		Total hours Contact hours 98 h Self-study 172 h
Courses 1. Cardiovascular diseases and therapies (Lecture, 84h) <i>Content</i> <ul style="list-style-type: none"> • Clinical and molecular aspects of cardiovascular diseases in adults and children • Cardiovascular imaging • Interventional therapies • Cardiovascular surgery • Cardiovascular pharmacology 		6 SWS
2. Cardiovascular diseases and therapies (Practical course, 14h) <i>Content</i> <ul style="list-style-type: none"> • ECG reading • Case studies 		1 SWS
Examination Written exam (180 min) the diagnosis of cardiovascular diseases via imaging and their pharmacological and interventional therapies, clinical aspects of cardiovascular diseases in adults and children		
Entry requirement None	Recommended pre-requisites Passed examination in module M.CVS.101 and	

	M.CVS.102
Language English	Module coordinator Prof. Susanne Lutz
Frequency Each summer semester	Duration 7 weeks
Repeatability Twice	Recommended semester of study 2
Maximal number of students 25	

Additional notes and regulations:

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Teaching capacity provided by:

Med-VK: -; Med-KT: 28h lecture; Med.-K: 56h lecture, 14h practical work

Georg-August-Universität Göttingen Module M.CVS.301: Cardiovascular research in academia and industry	9 ECTS 7 SWS
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Learning outcomes Students who have successfully finished this module have an advanced knowledge of: 1.) Specified topics of current cardiovascular research 2.) State of the art methodology in cardiovascular research including e.g. animal models, imaging techniques, high throughput technologies, stem cell-based research, tissue engineering, system biology 3.) Biostatistics 4.) Research standards in industry 5.) The design and management of clinical trials	Total hours Contact hours 98 h Self-study 172 h
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Courses 1. Cardiovascular research in academia and industry (Lecture, 84h) <i>Content</i> <ul style="list-style-type: none"> • Scientific Aspects of cardiovascular diseases • State-of-the art research methods • Biostatistics • Design and management of clinical trials • Insights in research in industry 	6 SWS
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Examination Written exam (180 min) basics of biostatistical methods and the management and design of clinical trials, different state-of-the-art methods and high throughput technologies in cardiovascular research	
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2. Cardiovascular research in academia and industry (Seminar, 14h) <i>Content</i> Presentation of recent publications from the cardiovascular field.	1 SWS
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Examination Seminar presentation (oral, 15 min): Short PowerPoint presentation about a given topic, including max. 5 minutes discussion	
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Entry requirement None	Recommended pre-requisites Passed examinations in modules M.CVS.101, M.CVS.102 and M.CVS.201
Language English	Module coordinator Prof. Thomas Meyer
Frequency Each winter semester	Duration 7 weeks
Repeatability Twice	Recommended semester of study 3
Maximal number of students 25	

Additional notes and regulations: -Teaching capacity provided by: Med-VK: 10h lecture; Med-KT: 32h lecture, 10h seminar; Med.-K: 42h lecture, 4h seminar
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Georg-August-Universität Göttingen Module M.CVS.004: Modern topics in CVS and clinical research	6 ECTS 5 SWS
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Learning outcomes This course integrates the training and attendance of the presentations of recent publications in the cardiovascular field. Students who successfully finished this module have learnt to present and critically discuss scientific topics. In addition, the students will learn to design follow-up research projects to the presented topics.	Total hours Contact hours 70 h Self-study 110 h
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Course (Seminar) <ul style="list-style-type: none"> • Attendance of scientific presentations • Active presentation of recent publications of the field • Design of a potential research project 	5 SWS
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Examination Portfolio (contains summaries of the presented research topics with a maximum of 1 page per topic). Examination requirements Seminar presentation (oral, 30 min): Short PowerPoint presentation about a given research publication. Presentation should contain information about the scientific background, used methods and concluding data discussion	
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Entry requirement None	Recommended pre-requisites None
Language English	Module coordinator Prof. Wolfram Zimmermann/N.N.
Frequency Each semester	Duration 3 Semester
Repeatability Twice	Recommended semester of study 1-3
Maximal number of students 25	

Additional notes and regulations: - Teaching capacity provided by: Med-VK: -; Med-KT: 70h seminar; Med.-K: -

Part 2

Practical modules

Synopsis

The Master program **Cardiovascular Science** contains three practical modules (M.CVS.001; M.CVS.002, M.CVS.003) each with a duration of 8 weeks and a final module (M. CVS.401) in which the master thesis is performed over a period of 6 month.

M.CVS.101: Cardiovascular Basics I

M.CVS.101: Cardiovascular Basics II

M.CVS.001: Lab rotation I

M.CVS.201: Cardiovascular diseases and therapies

M.CVS.002: Lab rotation II

M.CVS.301: Cardiovascular research in academia and industry

M.CVS.003: Lab rotation III

M.CVS.004: Modern topics in CVS and clinical research

Master Thesis

Georg-August-Universität Göttingen Module M.CVS.001: Lab rotation I	12 ECTS 18 SWS
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Learning outcomes The practical work will be performed in a group with an expertise in cardiovascular research under direct one-to-one supervision. By working in a research project the students will learn 1.) Answering scientific questions with state-of-the-art techniques 2.) Analyzing the obtained data critically 3.) Managing time and resources in a scientific project 4.) Presenting and discussing the data in an appropriate scientific written form 5.) Presenting the data in an oral presentation.	Total hours Contact hours 252 h Self-study 108 h
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Course 1. Lab rotation I (Practical course, 238h)	17 SWS
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Examination Scoring of the personal performance, clarity and completeness of the lab book and the lab report (max. 20 pages). Lab report should be build up like a scientific publication containing Introduction, Materials & Methods, Results and Discussion.	
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Course Lab rotation experience I (Seminar, 14h)	1 SWS
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Examination Oral presentation (30 min): PowerPoint presentation about the own lab rotation containing: short information about the institution, topic of the lab rotation, short scientific background, used methods and concluding data discussion.	
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Entry requirement None	Recommended pre-requisites None
Language English	Module coordinator Prof. Ralf Dressel
Frequency Each semester	Duration 8 weeks
Repeatability Once	Recommended semester of study 1
Maximal number of students 1	

Georg-August-Universität Göttingen Module M.CVS.002: Lab rotation II	12 ECTS 18 SWS
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Learning outcomes The practical work will be performed in a group with an expertise in cardiovascular research under direct one-to-one supervision. By working in a research project the students will learn 1.) Answering scientific questions with state-of-the-art techniques 2.) Analyzing the obtained data critically 3.) Managing time and resources in a scientific project 4.) Presenting and discussing the data in an appropriate scientific written form 5.) Presenting the data in an oral presentation.	Total hours Contact hours 252 h Self-study 108 h
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Course 1. Lab rotation II (Practical course, 238h)	17 SWS
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Examination Scoring of the personal performance, clarity and completeness of the lab book and the lab report (max. 20 pages). Lab report should be build up like a scientific publication containing Introduction, Materials & Methods, Results and Discussion.	
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Course Lab rotation experience II (Seminar, 14h)	1 SWS
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Examination Oral presentation (30 min): PowerPoint presentation about the own lab rotation containing: short information about the institution, topic of the lab rotation, short scientific background, used methods and concluding data discussion.	
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Entry requirement None	Recommended pre-requisites None
Language English	Module coordinator Prof. Ralf Dressel
Frequency Each semester	Duration 8 weeks
Repeatability Once	Recommended semester of study 2
Maximal number of students 1	

Georg-August-Universität Göttingen Module M.CVS.003: Lab rotation III	11 ECTS 17 SWS
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Learning outcomes The practical work will be performed in a group with an expertise in cardiovascular research under direct one-to-one supervision. By working in a research project the students will learn 1.) Answering scientific questions with state-of-the-art techniques 2.) Analyzing the obtained data critically 3.) Managing time and resources in a scientific project 4.) Presenting and discussing the data in an appropriate scientific written form	Total hours Contact hours 238 h Self-study 92 h
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Course 1. Lab rotation II (Practical course, 238h)	17 SWS
Examination Scoring of the personal performance, clarity and completeness of the lab book and the lab report (max. 20 pages). Lab report should be build up like a scientific publication containing Introduction, Materials & Methods, Results and Discussion.	

Entry requirement None	Recommended pre-requisites None
Language English	Module coordinator Prof. Ralf Dressel
Frequency Each semester	Duration 8 weeks
Repeatability Once	Recommended semester of study 3
Maximal number of students 1	

Georg-August-Universität Göttingen Master thesis	30 ECTS
Learning outcomes The practical work will be performed in a group with an expertise in cardiovascular research under direct one-to-one supervision. By working in a research project the students will learn 1.) Answering scientific questions with state-of-the-art techniques 2.) Analyzing the obtained data critically 3.) Managing time and resources in a scientific project 4.) Presenting and discussing the data in an appropriate scientific written form 5.) Presenting the data in an oral presentation.	
Course Master thesis	
Examination The Master thesis will be judged by two reviewers according to common scientific standards and rules	30 ECTS
Entry requirement 67ECTS Passed theoretical modules M.CVS.101, M.CVS.102; M.CVS.201, M.CVS.301 Passed practical modules M.CVS.001, M.CVS.002	Recommended pre-requisites 90 ECTS
Language English	Module coordinator None
Frequency Every time	Duration 6 months
Repeatability Once	Recommended semester of study 4
Maximal number of students	