

# Modulkatalog des Studiengangs Precision Medicine Diagnostics



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# Ziele des Studiengangs

## **Fachliche Qualifikationsziele**

Die Absolventinnen und Absolventen des Studiengangs ... ..

- comprehensive knowledge of medical and natural science issues as well as the current technologies utilised in these fields, particularly in molecular analytics
- provision of validated data allowing physicians to make diagnoses
- ability to gather, critically analyse and present complex data
- ability to assess and take into account the social, scientific and ethical consequences of findings, decisions and developments
- ability to independently acquire the use of new technologies
- utilisation of all diagnostic techniques available and evaluation of their diagnostic value
- interpretation of different performance parameters connected with molecular diagnostics as well as an insight into clinical utilisation and quality control

## **Überfachliche Qualifikationsziele**

Die Absolventinnen und Absolventen des Studiengangs ... ..

- ability to work as part of a team particularly in multi-discipline work and research groups
- ability to make scientifically sound decisions independently, taking into account social, scientific and ethical issues
- ability to independently develop scientific and technical expertise
- ability to present results to both an expert and non-expert audience
- problem-oriented thinking and independent problem-solving

## **Berufliche Qualifikationsziele**

Die Absolventinnen und Absolventen des Studiengangs ... ..

- optimization of professional qualification by fulfilling requirements of a number of job descriptions
- multi-disciplinary education at the interface of medical science, natural science and technology, filling the existing gap between these fields
- ability to take partial or complete responsibility for a project and / or a team

# Studiengangstruktur

Modul/ Semester	1	2	3	4	5
3	Thesis				
2	Diagnostics in Selected Fields of Medicine	Research Project	Functional Genomics	High-Throughput Technologies	Omics Technologies
1	Biometrics and Multiparameter Diagnostics	Molecular Diagnostics	Genomics	Management Skills	Techniques in Biomedicine

# 1. Semester

<b>Biometrics and Multiparameter Diagnostics</b>					
<b>Kennnummer</b>	<b>Workload</b> 180 Std.	<b>Credits/LP</b> 6	<b>Studiensemester</b> 1	<b>Häufigkeit des Angebots</b> Each semester	<b>Dauer</b> 1 Semester
<b>1</b>	<b>Lehrveranstaltungen</b> a) Biometrics and Multiparameter Diagnostics b) Design of Clinical Trials	<b>Sprache</b> a) English b) English	<b>Kontaktzeit</b> a) 33,75 Std. b) 22,5 Std.	<b>Selbststudium</b> a) 86,25 Std. b) 37,5 Std.	<b>Geplante Gruppengröße</b> a) 15 b) 15
<b>2</b>	<b>Lernergebnisse/Kompetenzen</b> After successful participation in the module the students  <b>Analyse (4)</b> ... plan a straightforward clinical trial ... analyse multivariate data with statistical machine learning techniques ... validate predictive models by resampling procedures  <b>Synthese (5)</b> ... write a report for a straightforward clinical trial  <b>Evaluation / Bewertung (6)</b> ... evaluate a clinical trial ... question the validity of the results of a clinical trial ... select appropriate methods for the statistical analysis				
<b>3</b>	<b>Inhalte</b> a) Statistical software R, supervised and unsupervised statistical learning, regression models, clustering, principal component analysis, multidimensional scaling, validation using resampling procedures, performance metrics b) Sample size estimation, randomization and blinding, statistical monitoring and data management, quality requirements, individual study designs, specificities e.g. in studies in surgery or drug trials				
<b>4</b>	<b>Lehrformen</b> a) Seminar b) Lecture				
<b>5</b>	<b>Teilnahmevoraussetzungen</b> Knowledge in mathematics and statistics				
<b>6</b>	<b>Prüfungsformen</b> a) Graded Assessment 1sbL (Laboratory) (4 LP) b) Graded Assessment 1K (Written Exam) (2 LP)				

<b>7</b>	<p><b>Verwendung des Moduls</b></p> <p>Precision Medicine Diagnostics M.Sc. (PMD)</p>
<b>8</b>	<p><b>Modulbeauftragte/r und hauptamtlich Lehrende</b></p> <p>Prof. Dr. Matthias Kohl (Module Responsible)</p> <p>Prof. Dr. Matthias Kohl (Lecturer)</p>
<b>9</b>	<p><b>Literatur</b></p> <p>a) Hastie, Tibshirani and Friedman (2009). The Elements of Statistical Learning. Springer Verlag.  Izenman (2008). Modern Multivariate Statistical Techniques. Springer Verlag.  Venables and Ripley (2010). Modern Applied Statistics with S. Springer Verlag.</p> <p>b) Friedman LM, Furberg CD, DeMets DL (2010). Fundamentals of clinical trials. Springer Verlag.  Chow, Shao and Wang (2008). Sample size calculations in clinical research. Chapman &amp; Hall.  Higgins JPT, Green S (editors). Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Available from <a href="http://www.cochrane-handbook.org">www.cochrane-handbook.org</a>.</p>

<b>Molecular Diagnostics</b>					
<b>Kennnummer</b>	<b>Workload</b> 180 Std.	<b>Credits/LP</b> 6	<b>Studiensemester</b> 1	<b>Häufigkeit des Angebots</b> Each semester	<b>Dauer</b> 1 Semester
<b>1</b>	<b>Lehrveranstaltungen</b> a) Biomarkers in Diagnostics b) Immunological Techniques	<b>Sprache</b> a) English b) English	<b>Kontaktzeit</b> a) 22,5 Std. b) 22,5 Std.	<b>Selbststudium</b> a) 67,5 Std. b) 67,5 Std.	<b>Geplante Gruppengröße</b> a) 15 b) 15
<b>2</b>	<p><b>Lernergebnisse/Kompetenzen</b></p> <p>After successful participation in the module the students ...</p> <p><b>Analyse (4)</b>  ... apply selected high-throughput methods to quantify potential biomarkers  ... describe methods of transcriptomics, proteomics and metabolomics  ... distinguish between current methods in immunology  ... justify the use of different diagnostic methods  ... use immunological methods to determine immunological parameters  ... evaluate aspects of biomarker patents</p> <p><b>Evaluation / Bewertung (6)</b>  ... compare different applications of biomarkers  ... select suitable methods for biomarker identification and development  ... evaluate literature results</p>				
<b>3</b>	<p><b>Inhalte</b></p> <p>a) Methods in biomarker research and immunology, Examples of DNA/RNA sequencing and transcriptomics, proteomics, metabolomics and immunology, theoretical approaches and regulations for biomarker identification and validation, current applications of biomarkers in diagnosis and prognosis as well as for patient stratification and therapy control, analysis of practical case studies</p> <p>b) Immunological methods, immunological methods in diagnosis and prognosis, as well as patient stratification and therapy control, analysis of practical case studies</p>				
<b>4</b>	<p><b>Lehrformen</b></p> <p>a) Lecture b) Lecture</p>				
<b>5</b>	<p><b>Teilnahmevoraussetzungen</b></p> <p>Knowledge in biology, molecular biology, biochemistry and instrumental analytics</p>				



6	<p><b>Prüfungsformen</b></p> <p>a) Graded Assessment 1sbK (Written Exam) (3 LP)</p> <p>b) Graded Assessment 1K (Written Exam) (3 LP)</p>
7	<p><b>Verwendung des Moduls</b></p> <p>Precision Medicine Diagnostics M.Sc. (PMD)</p>
8	<p><b>Modulbeauftragte/r und hauptamtlich Lehrende</b></p> <p>Prof. Dr. Hans-Peter Deigner (Module Responsible)</p> <p>Prof. Dr. Hans-Peter Deigner (Lecturer)</p>
9	<p><b>Literatur</b></p> <p>a) Biomarkers: In Medicine, Drug Discovery, and Environmental Health. John Wiley &amp; Sons 2010, Editor(s): Vishal S. Vaidya, Joseph V. Bonventre, Lottspeich, Engels (Hrsg.) (2006), Bioanalytik, Spektrum Verlag, 2.Aufl.</p> <p>b) Carl A. Burtis et al. (2012), Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, Elsevier, 5. Aufl. Lela Buckingham and Maribeth L. Flaws (2007), Molecular Diagnostics: Fundamentals, Methods and Clinical Applications, F.A. Davis Company.</p>

<b>Genomics</b>						
<b>Kennnummer</b>	<b>Workload</b> 180 Std.	<b>Credits/LP</b> 6	<b>Studiensemester</b> 1	<b>Häufigkeit des Angebots</b> Each semester	<b>Dauer</b> 1 Semester	
<b>1</b>	<b>Lehrveranstaltungen</b>		<b>Sprache</b>	<b>Kontaktzeit</b>	<b>Selbststudium</b>	<b>Geplante Gruppengröße</b>
	a) Molecular Human Genetics		a) English	a) 22,5 Std.	a) 67,5 Std.	a) 15
	b) Molecular Mechanisms		b) English	b) 22,5 Std.	b) 67,5 Std.	b) 15
<b>2</b>	<p><b>Lernergebnisse/Kompetenzen</b></p> <p>After successful participation in the module the students ...</p> <p><b>Verständnis (2)</b> ... Characterisation of patterns of inheritance in man ... Understanding of human genetic diseases</p> <p><b>Anwendung (3)</b> ... Perform of diagnostical methods to analyse genetic diseases ... Characterisation of genetic causes of human tumors</p> <p><b>Analyse (4)</b> ... Gene therapy: Estimation of chances and risks ... Evaluation of diagnostic results</p> <p><b>Synthese (5)</b> ... Analysis and interpretation of modifications in human genomes ... Reasonable application of gene therapeutical approaches</p> <p><b>Evaluation / Bewertung (6)</b> ... Correlation of genesis and diagnosis of human genetic diseases ... Application of disease specific therapies</p>					
<b>3</b>	<p><b>Inhalte</b></p> <p>a) Human genome, inheritance patterns, genetic diseases, mutations and polymorphisms, genetic diagnostics and consulting, monogenetic, polygenetic and multifactorial diseases (syndromes), methods of diagnostics in human genetics, rare genetic diseases and therapeutical approaches, gene therapy, viral and non-viral gene shuttling</p> <p>b) Origin and therapy of human tumors, single nucleotide polymorphisms, pharmacogenetics, genetics and effects of pharmaceuticals, epigenetics, signal transduction</p>					
<b>4</b>	<p><b>Lehrformen</b></p> <p>a) Seminar</p> <p>b) Seminar</p>					

5	<p><b>Teilnahmevoraussetzungen</b></p> <p>Knowledge in biology, molecular biology and biochemistry</p>
6	<p><b>Prüfungsformen</b></p> <p>a) Graded Assessment 1sbPN (Presentation) (3 LP)</p> <p>b) Graded Assessment 1K (Written Exam) (3 LP)</p>
7	<p><b>Verwendung des Moduls</b></p> <p>Precision Medicine Diagnostics M.Sc. (PMD)</p>
8	<p><b>Modulbeauftragte/r und hauptamtlich Lehrende</b></p> <p>Prof. Dr. Ulrike Salat (Module Responsible)</p> <p>Robert Lukowski (Lecturer)</p> <p>Sebastian Raimundo (Lecturer)</p> <p>Prof. Dr. Ulrike Salat (Lecturer)</p>
9	<p><b>Literatur</b></p> <p>a) Tariverdian, Buselmaier: Humangenetik (Springer Verlag)</p> <p>b) Alberts et al.: Molecular Biology of the Cell (Garland Science)</p>

<b>Management Skills</b>					
<b>Kennnummer</b>	<b>Workload</b> 180 Std.	<b>Credits/LP</b> 6	<b>Studiensemester</b> 1	<b>Häufigkeit des Angebots</b> Each semester	<b>Dauer</b> 1 Semester
<b>1</b>	<b>Lehrveranstaltungen</b>	<b>Sprache</b>	<b>Kontaktzeit</b>	<b>Selbststudium</b>	<b>Geplante Gruppengröße</b>
	a) QM and GxP	a) Deutsch	a) 22,5 Std.	a) 37,5 Std.	a) 15
	b) Patent and Trademark Law	b) Deutsch	b) 22,5 Std.	b) 37,5 Std.	b) 15
	c) Laboratory and Project Management	c) Deutsch	c) 22,5 Std.	c) 37,5 Std.	c) 15
<b>2</b>	<b>Lernergebnisse/Kompetenzen</b> After successful participation in the module the students  <b>Wissen (1)</b> ... name the major HR management process concepts and techniques ... explain the basic principles of quality management (QM), good working practices (GxP) as well as patent and trademark law  <b>Verständnis (2)</b> ... accept that HRM is one core competence in the future of their job description  <b>Anwendung (3)</b> ... build their own leadership competence ... use different techniques like coaching, motivating and training and know how to use psychometric methods for leading people				
<b>3</b>	<b>Inhalte</b> a) Intellectual property rights in Europe and Germany: <ul style="list-style-type: none"> <li>- Major parts/steps of a patent application: request for grant, description of the invention, claims, drawings, abstract.</li> <li>- European Patent Office, European Patent Convention (EPC), Patent Cooperation Treaty (PCT).</li> <li>- Patent searching strategies: International Patent Classification (IPC), Cooperative Patent Classification (CPC).</li> </ul>				
<b>4</b>	<b>Lehrformen</b> a) Lecture b) Lecture c) Seminar				
<b>5</b>	<b>Teilnahmevoraussetzungen</b> none				

6	<p><b>Prüfungsformen</b></p> <p>a) Graded Assessment 1K (Written Exam) (2 LP)</p> <p>b) Graded Assessment 1sbH (Written Elaboration) (2 LP)</p> <p>c) Graded Assessment 1sbL (Laboratory) (2 LP)</p>
7	<p><b>Verwendung des Moduls</b></p> <p>Precision Medicine Diagnostics M.Sc. (PMD)</p>
8	<p><b>Modulbeauftragte/r und hauptamtlich Lehrende</b></p>
9	<p><b>Literatur</b></p> <p>a) A Handbook on Good Laboratory Practice (GLP) - By World Health Organization.  Good Laboratory Practice Regulations. Third Edition, Revised and Expanded. By - Sandy Weinberg.  Good Clinical Practice (GCP) - ICH Guidelines for European Community and ICH Regions.  Guidance for Industry. E6 Good Clinical Practice: Consolidated Guidance. By - ICH - for European Community and ICH Regions.</p>

<b>Techniques in Biomedicine</b>					
<b>Kennnummer</b>	<b>Workload</b> 180 Std.	<b>Credits/LP</b> 6	<b>Studiensemester</b> 1	<b>Häufigkeit des Angebots</b> Each semester	<b>Dauer</b> 1 Semester
<b>1</b>	<b>Lehrveranstaltungen</b> a) Diagnostics of Microorganisms b) Model Systems	<b>Sprache</b> a) English b) English	<b>Kontaktzeit</b> a) 22,5 Std. b) 22,5 Std.	<b>Selbststudium</b> a) 67,5 Std. b) 67,5 Std.	<b>Geplante Gruppengröße</b> a) 15 b) 15
<b>2</b>	<p><b>Lernergebnisse/Kompetenzen</b></p> <p>After successful participation in the module the students ...</p> <p><b>Verständnis (2)</b> ... get knowledge of different model systems, their advantages, disadvantages and limits in research, medicine and testing. ... explain the advantages and disadvantages of a variety of state-of-the-art techniques used in the diagnostics of microorganisms.</p> <p><b>Anwendung (3)</b> ... plan experiments or tests with appropriate model organisms answering specific questions. ... choose appropriate diagnostic methods for a given research question in microbiology.</p> <p><b>Evaluation / Bewertung (6)</b> ... evaluate the strength and weaknesses of published studies with respect to the methods used.</p>				
<b>3</b>	<p><b>Inhalte</b></p> <p>a) overview on the variety of state-of-the-art-methods to isolate, quantify and identify microorganisms and their physiological properties from medically important samples, e.g., aerobic and anaerobic cultivation techniques, PCR, qPCR, molecular fingerprinting techniques, FACS, FISH, MALDI-TOF, FT-IR spectroscopy, NGS, SIP, Metatechnologies etc.</p> <p>b) overview on different types of frequently used models systems, e.g. mice, zebrafish, drosophila, stem cells, yeast, as well as new developed methods (bioengineering) and rare used models; discussion on limits by law, ethics and comparability to humans.</p>				
<b>4</b>	<p><b>Lehrformen</b></p> <p>a) Seminar b) Seminar</p>				
<b>5</b>	<p><b>Teilnahmevoraussetzungen</b></p> <p>B.Sc.-level based-knowledge in (human) biology, molecular biology, biochemistry and (clinical) microbiology</p>				

6	<p><b>Prüfungsformen</b></p> <p>a) Graded Assessment 1sbR (Review) (3 LP)</p> <p>b) Graded Assessment 1sbPN (Presentation) (3 LP)</p>
7	<p><b>Verwendung des Moduls</b></p> <p>Precision Medicine Diagnostics M.Sc. (PMD)</p>
8	<p><b>Modulbeauftragte/r und hauptamtlich Lehrende</b></p> <p>Prof. Dr. Markus Egert (Module Responsible)</p>
9	<p><b>Literatur</b></p> <p>a) textbooks on Microbiology; scientific papers (review, original articles) dealing with the respective methods</p> <p>b) scientific papers (review, original articles) dealing with model organisms; textbooks on cell culture, bioengineering, animal models; legal texts (TierSchG, TierSchVerV, ESchG)</p>

## 2. Semester



<b>Diagnostics in Selected Fields of Medicine</b>						
<b>Kennnummer</b>	<b>Workload</b> 180 Std.	<b>Credits/LP</b> 6	<b>Studiensemester</b> 2	<b>Häufigkeit des Angebots</b> Each semester	<b>Dauer</b> 1 Semester	
<b>1</b>	<b>Lehrveranstaltungen</b>		<b>Sprache</b>	<b>Kontaktzeit</b>	<b>Selbststudium</b>	<b>Geplante Gruppengröße</b>
	a) Internal Medicine / General Medicine		a) English	a) 22,5 Std.	a) 67,5 Std.	a) 15
	b) Pathology		b) English	b) 22,5 Std.	b) 67,5 Std.	b) 15
<b>2</b>	<b>Lernergebnisse/Kompetenzen</b> After successful participation in the module the students ...  <b>Analyse (4)</b> ... classify diagnostic techniques by their application in particular fields of medicine ... distinguish between various disease areas in 1)internal medicine 2)general medicine 3)neurology ... identify pathological processes  <b>Evaluation / Bewertung (6)</b> ... evaluate diagnostic techniques with respect to their diagnostic value					
<b>3</b>	<b>Inhalte</b> a) Pathogenesis, pathology and clinical diagnostics of various diseases from the fields of internal and general medicine b) Pathology: methods and clinical diagnostics in pathology, typical application areas and findings					
<b>4</b>	<b>Lehrformen</b> a) Seminar b) Lecture					
<b>5</b>	<b>Teilnahmevoraussetzungen</b> Knowledge in pathophysiology and physiology basic knowledge in electrophysiology (development of actionpotential, function of cell membrane, ionchannels) laboratory diagnostics and imaging methods					
<b>6</b>	<b>Prüfungsformen</b> a) Graded Assessment 1sbL (Laboratory) (3 LP) b) Graded Assessment 1K (Written Exam) (3 LP)					
<b>7</b>	<b>Verwendung des Moduls</b> Precision Medicine Diagnostics M.Sc. (PMD)					

<b>8</b>	<b>Modulbeauftragte/r und hauptamtlich Lehrende</b> Prof. Dr. Meike Burger (Module Responsible) Prof. Dr. Meike Burger (Lecturer) Prof. Dr. Katja Kumle (Lecturer)
<b>9</b>	<b>Literatur</b> a) Herold G: Innere Medizin 2013 Comber und Klimm: Allgemeinmedizin, Thieme Verlag b) Siegfried Schwarz: Pathophysiologie: Molekulare, zelluläre, systemische Grundlagen von Krankheiten, Maudrich Verlag Riede, Werner, Freudenberg: Basiswissen Allgemeine und Spezielle Pathologie, Springer Verlag

<b>Research Project</b>						
<b>Kennnummer</b>	<b>Workload</b> 180 Std.	<b>Credits/LP</b> 6	<b>Studiensemester</b> 2	<b>Häufigkeit des Angebots</b> Each semester	<b>Dauer</b> 1 Semester	
<b>1</b>	<b>Lehrveranstaltungen</b>		<b>Sprache</b>	<b>Kontaktzeit</b>	<b>Selbststudium</b>	<b>Geplante Gruppengröße</b>
	a) Research Project		a) Deutsch	a) 4,5 Std.	a) 145,5 Std.	a) 15
	b) Research Seminar		b) Deutsch	b) 11,25 Std.	b) 18,75 Std.	b) 15
<b>2</b>	<p><b>Lernergebnisse/Kompetenzen</b></p> <p>After successful participation in the module the students ...</p> <p><b>Analyse (4)</b> ... execute a small research project ... present the results of a research project</p> <p><b>Synthese (5)</b> ... write a scientific report for a research project ... report on a scientific project and its results</p> <p><b>Evaluation / Bewertung (6)</b> ... question the results of a scientific project</p>					
<b>3</b>	<p><b>Inhalte</b></p> <p>a) The students will work in small groups independently on various small projects in the field of medical diagnostics</p> <p>b) Instruction and supervision of the research projects, Presentation of the results of the individual projects</p>					
<b>4</b>	<p><b>Lehrformen</b></p> <p>a) Project</p> <p>b) Seminar</p>					
<b>5</b>	<p><b>Teilnahmevoraussetzungen</b></p> <p>Depends on the chosen research project</p> <p>The modules Management Skills, Molecular Diagnostics and Biometrics and Multiparameter Diagnostics should be successfully completed</p>					
<b>6</b>	<p><b>Prüfungsformen</b></p> <p>a) Graded Assessment 1sbA (Practical Work) (5 LP)</p> <p>b) Graded Assessment 1PN (Presentation) (1 LP)</p>					

7	<p><b>Verwendung des Moduls</b></p> <p>Precision Medicine Diagnostics M.Sc. (PMD)</p>
8	<p><b>Modulbeauftragte/r und hauptamtlich Lehrende</b></p> <p>Prof. Dr. Matthias Kohl (Module Responsible)</p>
9	<p><b>Literatur</b></p> <p>a) Depends on the chosen research project</p> <p>b) Thomas A. Lang (2009). How to Write, Publish, and Present in the Health Sciences: A Guide for Physicians and Laboratory Researchers. American College of Physicians.</p> <p>Michael Jay Katz (2009). From Research to Manuscript: A Guide to Scientific Writing. Springer Verlag.</p>

<b>Functional Genomics</b>					
<b>Kennnummer</b>	<b>Workload</b> 180 Std.	<b>Credits/LP</b> 6	<b>Studiensemester</b> 2	<b>Häufigkeit des Angebots</b> Each semester	<b>Dauer</b> 1 Semester
<b>1</b>	<b>Lehrveranstaltungen</b> a) Functional Genomics and Instrumental Analytics b) Bioinformatics	<b>Sprache</b> a) English b) English	<b>Kontaktzeit</b> a) 22,5 Std. b) 22,5 Std.	<b>Selbststudium</b> a) 67,5 Std. b) 67,5 Std.	<b>Geplante Gruppengröße</b> a) 15 b) 15
<b>2</b>	<p><b>Lernergebnisse/Kompetenzen</b></p> <p>After successful participation in the module the students ...</p> <p><b>Analyse (4)</b> ... solve theoretical and practical problems in the field of 1) functional genomics and 2) systems biology ... methods of bioinformatic analysis ... identification and quantification of biopolymers like DNA, RNA as well as endogenous metabolites ... select an area of application, identify implementation problems and present an approach to solve potential problems</p> <p><b>Evaluation / Bewertung (6)</b> ... describe and evaluate technologies of instrumental analytics ... select and execute required technologies and approaches for a given analysis ... design a problem-solving approach for applications in diagnosis and therapy control based on methods of functional genomics</p>				
<b>3</b>	<p><b>Inhalte</b></p> <p>a) Methods and analytical approaches in transcriptomics, proteomics, metabolomics and pharmacogenomics; current instrumental methods in sequencing, hybridization and mass spectrometry.</p> <p>b) Applications and data analysis to characterize biological systems and particular biological conditions like diseases and disease stages. Applications in patient stratification, therapy controlling and diagnosis with a focus on individualized therapy as well as case studies.</p>				
<b>4</b>	<p><b>Lehrformen</b></p> <p>a) Lecture b) Lecture</p>				
<b>5</b>	<p><b>Teilnahmevoraussetzungen</b></p> <p>The modules Molecular Diagnostics, Genomics, as well as Biometrics and Multiparameter Diagnostics should be successfully completed</p>				

6	<p><b>Prüfungsformen</b></p> <p>a) Graded Assessment 1sbK (Written Exam) (3 LP)</p> <p>b) Graded Assessment 1K (Written Exam) (3 LP)</p>
7	<p><b>Verwendung des Moduls</b></p> <p>Precision Medicine Diagnostics M.Sc. (PMD)</p>
8	<p><b>Modulbeauftragte/r und hauptamtlich Lehrende</b></p> <p>Prof. Dr. Hans-Peter Deigner (Module Responsible)</p> <p>Prof. Dr. Hans-Peter Deigner (Lecturer)</p>
9	<p><b>Literatur</b></p> <p>a) Jonathan Pevsner (2009), Bioinformatics and Functional Genomics, Wiley, 2. Aufl. Michael Kaufmann and Claudia Klinger (Eds.) (2012), Functional Genomics: Methods and Protocols, Humana Press, 2. Aufl.</p> <p>b) Edda Klipp et al. (2009), Systems Biology, Wiley-VCH. Eberhard Voit (2012), A First Course in Systems Biology, Garland Science</p>

<b>High-Throughput Technologies</b>					
<b>Kennnummer</b>	<b>Workload</b> 180 Std.	<b>Credits/LP</b> 6	<b>Studiensemester</b> 2	<b>Häufigkeit des Angebots</b> Each semester	<b>Dauer</b> 1 Semester
<b>1</b>	<b>Lehrveranstaltungen</b> a) Bioanalytical Surfaces b) Epigenetics	<b>Sprache</b> a) English b) English	<b>Kontaktzeit</b> a) 22,5 Std. b) 22,5 Std.	<b>Selbststudium</b> a) 67,5 Std. b) 67,5 Std.	<b>Geplante Gruppengröße</b> a) 15 b) 15
<b>2</b>	<b>Lernergebnisse/Kompetenzen</b> After successful participation in the module the students ...				
<b>3</b>	<b>Inhalte</b>				
<b>4</b>	<b>Lehrformen</b> a) Seminar b) Lecture				
<b>5</b>	<b>Teilnahmevoraussetzungen</b> Keine Eingabe vorhanden				
<b>6</b>	<b>Prüfungsformen</b> a) Graded Assessment 1sbL (Laboratory) (3 LP) b) Graded Assessment 1K (Written Exam) (3 LP)				
<b>7</b>	<b>Verwendung des Moduls</b> Precision Medicine Diagnostics M.Sc. (PMD)				
<b>8</b>	<b>Modulbeauftragte/r und hauptamtlich Lehrende</b>				
<b>9</b>	<b>Literatur</b>				

<b>Omics Technologies</b>					
<b>Kennnummer</b>	<b>Workload</b> 180 Std.	<b>Credits/LP</b> 6	<b>Studiensemester</b> 2	<b>Häufigkeit des Angebots</b> Each semester	<b>Dauer</b> 1 Semester
<b>1</b>	<b>Lehrveranstaltungen</b> a) Practical Course b) Data Analysis and Interpretation	<b>Sprache</b> a) English b) English	<b>Kontaktzeit</b> a) 22,5 Std. b) 22,5 Std.	<b>Selbststudium</b> a) 67,5 Std. b) 67,5 Std.	<b>Geplante Gruppengröße</b> a) 15 b) 15
<b>2</b>	<b>Lernergebnisse/Kompetenzen</b> After successful participation in the module the students ...				
<b>3</b>	<b>Inhalte</b>				
<b>4</b>	<b>Lehrformen</b> a) Practical / Lab b) Seminar				
<b>5</b>	<b>Teilnahmevoraussetzungen</b> Keine Eingabe vorhanden				
<b>6</b>	<b>Prüfungsformen</b> a) Non Graded Assessment 1sbL (Laboratory) (3 LP) b) Graded Assessment 1sbA (Practical Work) (3 LP)				
<b>7</b>	<b>Verwendung des Moduls</b> Precision Medicine Diagnostics M.Sc. (PMD)				
<b>8</b>	<b>Modulbeauftragte/r und hauptamtlich Lehrende</b>				
<b>9</b>	<b>Literatur</b>				



# 3. Semester

<b>Thesis</b>					
<b>Kennnummer</b>	<b>Workload</b> 900 Std.	<b>Credits/LP</b> 30	<b>Studiensemester</b> 3	<b>Häufigkeit des Angebots</b> Each semester	<b>Dauer</b> 1 Semester
<b>1</b>	<b>Lehrveranstaltungen</b> a) Master's Thesis b) Thesis Seminar	<b>Sprache</b> a) English b) English	<b>Kontaktzeit</b> a) 0 Std. b) 0 Std.	<b>Selbststudium</b> a) 810 Std. b) 90 Std.	<b>Geplante Gruppengröße</b> a) 15 b) 15
<b>2</b>	<b>Lernergebnisse/Kompetenzen</b> After successful participation in the module the students ...				
<b>3</b>	<b>Inhalte</b>				
<b>4</b>	<b>Lehrformen</b> a) b) Seminar				
<b>5</b>	<b>Teilnahmevoraussetzungen</b> Keine Eingabe vorhanden				
<b>6</b>	<b>Prüfungsformen</b> a) Graded Assessment 1T (Thesis) (27 LP) b) Non Graded Assessment 1PN (Presentation) (3 LP)				
<b>7</b>	<b>Verwendung des Moduls</b> Precision Medicine Diagnostics M.Sc. (PMD)				
<b>8</b>	<b>Modulbeauftragte/r und hauptamtlich Lehrende</b>				
<b>9</b>	<b>Literatur</b>				