

Module name	Molecular biology			
In semester	BTB 4			
Module number	403			
Credits (30 Stunden)	8			
Workload / hours	Sum 240	Contact hours 90	Self study 100	Exam preparation 50
Prerequisites	Module Biology 2, Biochemistry 2			
Total target, integration in the course of studies	<p>Total target:</p> <p><u>Knowledge:</u></p> <ul style="list-style-type: none"> - Profound knowledge of life sciences (biochemistry, microbiology, cell biology, molecular biology, medical biotechnology, bioanalytics) and the engineering sciences (basics in bioprocess technology, instrumental analytics, bioprocess engineering and downstream processing) - Intensified knowledge in one of the two elective courses areas of bioprocess and systems engineering or molecular biotechnology - Appreciation of the context within the biotechnology and related disciplines. <p><u>Skills:</u></p> <ul style="list-style-type: none"> - Competence of the correct choice and use of the suitable methods, instruments and techniques to solve problems in biotechnology. - Ability for handling of bio substances and cells, their analysis, preparation and cultivation. <p><u>The following modules and subjects contribute to accomplishing the complete goal:</u></p> <ul style="list-style-type: none"> - Analytical chemistry - Microbiology and cell biology - Biochemistry 2 - Measurement and control technology - Enzyme kinetics - Instrumental analytics - Bioprocess engineering - Molecular biology - Bioinformatics - Immunology and pharmacology - Quality management and patent law - Downstream processing - Cell culture technology - Bioanalytics <p><u>Acquisition of skills:</u></p> <ul style="list-style-type: none"> - Laboratory instr. analytics - Laboratory bioprocess engineering - Laboratory microbiology - Laboratory molecular biology - Laboratory cell culture technology - Laboratory bioanalytics - Laboratory downstream processing - Industrial internship <p><u>Aims of the module:</u></p> <p>The aim of the lecture is the teaching of advanced theoretical knowledge and practical methods in molecular biology and bioinformatics.</p>			
Module content	<p><u>Lecture Molecular biology</u></p> <ul style="list-style-type: none"> - Molecular mechanisms of recombination (homologous recombination, site specific recombination, transposition) - Regulation of transcription in pro- and eukaryotes - Introduction in methods of gene technology (Cloning, PCR, DNA-sequencing) - Characterization of model organisms, genome analysis <p><u>Laboratory Molecular biology</u></p> <ul style="list-style-type: none"> - Polymerase chain reaction (PCR) using the example of phylogenetic characterisation of microorganisms via 16S rRNA analysis 			

	<ul style="list-style-type: none"> - DNA-sequence analysis (theory + bioinformatics analysis) - Gene cloning (DNA transfer methods, DNA preparation, agarose gel electrophoresis) - Applying of restriction endonucleases and restriction analysis of DNA - Transposon mutagenesis <p><u>Lecture Bioinformatics</u></p> <p>The lecture consists of both a theoretical and a practical part comprising the following subjects:</p> <ul style="list-style-type: none"> - Biological databases at the National Center for Biological Information (NCBI) and at the European Bioinformatics Institute (EBI) (DNA-, protein-, structure-, motif-, genome- and taxonomy- databases) - Sequence analysis (identification of genes and homology search via BLAST analysis) - Multiple sequence alignments and phylogenetic analysis - Gene prediction methods
Literature	<ul style="list-style-type: none"> - Lecture scripts and laboratory script - J.D. Watson, T.A. Baker, S.P. Bell, A. Gann, M. Levine, R. Losick, Molecular Biology of the Gene, Pearson Benjamin Cummings, Cold Spring Harbor Laboratory Press, 2003. - R. Knippers, Molekulare Genetik. Thieme Verlag, 2006. - B. Albers, A. Johnson, J. Lewis, Lehrbuch der Molekularen Zellbiologie., Wiley-VCH Verlag, 2003 - A. Hansen, Bioinformatik: Ein Leitfaden für Naturwissenschaftler, Birkhäuser Verlag, 2004. - P. M. Selzer, R. J. Marhöfer, A. Rohwer, Angewandte Bioinformatik: Eine Einführung, Springer Verlag, 2003.
Module responsibility	D. Schwartz
Language of instruction	German (lecture scripts) / English (laboratory script)

Submodules and assessment:

Type of instruction	Quota SWS	Aims, learning outcomes	Type of assessment	Estimated student workload / hours
Lecture Molecular biology with post processing and exam preparation	2	<ul style="list-style-type: none"> - Advanced knowledge of molecular biological mechanisms - methods in gene technology 	Written exam part 70 min (combined with exam bioinformatics)	60
Lecture Bioinformatics with post processing and exam preparation	2	<ul style="list-style-type: none"> - Knowledge of fundamental methods of analysis in bioinformatics - Practical experience in characterization of DNA- and protein sequences by bioinformatics tools and methods. 	Written exam part 20 min (combined with exam molecular biology), marked homework	90
Laboratory Molecular biology	3	<ul style="list-style-type: none"> - Practical experience and skills in molecular biological methods 	All experiments passed with report	90
Sum	7			240