HOCHSCHULE ANSBACH

Modulhandbuch

Applied Biotechnology (SPO WS 21/22)

Faculty of Technology

Stand: 2023-02-08

Inhalt

1 Introduction to the course of studies

Applied Biotechnology			
Short form:	ABI	**SPO no.:**	HSAN-20212
Program Director:	Prof. Dr.-Ing. Anke Knoblauch		
Study Counseling:	Prof. Dr. Sibylle Gaisser		
ECTS:	90 points		
Normal period:	3 semesters		
Prerequisite for participation:	Degree with basic background in bioanalytic, biotechnology, bioprocess engineering, food technology, medical technology, molecular biology or comparable content with a minimum of 180 ECTS credit points, knowledge of English language at level B2 and German language at level A2		
Usability:	Master Applied Biotechnology		

Learning outcomes:

The general goal of the master's program in Applied Biotechnology is to provide engineers and scientists with biotechnological knowledge with the specialist, methodological and social skills that they need to apply scientific knowledge and processes and to act responsibly in business and society in their area of expertise.

It is important to prepare the students for future work as managers in the field of biotechnology and related industries. Based on their previous studies, the students develop skills in order to meet the work requirements of the biotechnology environment, which is characterized by innovations and legal requirements. This also includes the ability to shape social processes critically, with reflection and with a sense of responsibility and in a democratic common sense, and to successfully meet the challenges of an international world. Regional, national and international requirements are taken into account as well as global sustainability goals.

Graduates have comprehensive skills in the areas of biotechnological production, development and analytics as well as quality and laboratory management, supplemented by individual knowledge-broadening and deepening skills from economics, scientific, procedural or linguistic areas. In addition to the biotechnological specialist skills, social and methodical skills are also focused on to promote personality development with regard to later management functions. The course takes into account theoretical and practical content in a balanced way, which is taught in an application-oriented manner.

The course enables graduates to work in professional areas, including activities related to biotechnology in international corporations, small and medium-sized companies, NGOs and authorities through to start-ups, which act more and more globally.

Content:

The standard period of study is 3 semesters and comprises 90 credit points.

Students with a degree of 180 credit points must complete an additional bridging semester comprising 30 credit points within the first year of study.

The study program is divided into the following module groups:

- Mandatory modules (45 credit points):
  Food Product Development
  Protein Purification
  Quality Management
  Statistics
  Bioeconomy and Technology Assessment
  Leadership and Research Management
  Bioprocess Engineering
  Analytics
  Applied Cell Biology

- Electives (15 credit points):
  freely selectable from the modules offered at the master's level at Ansbach University of Ap-plied Sciences and the Virtual University of Bavaria

- Master thesis (30 credit points)

The modules are usually offered once a year and can accordingly be chosen either in the winter or summer semester.
The master thesis can be completed in either the winter or summer semester or across semesters.

Graduation / Academic degree:

Master of Science (M.Sc.)

2 Description of Modules

2.1 General compulsory modules

Food Product Development

Module abbreviation:	ABI-FoodProductDevelopment	**Reg.no.:**	1
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	compulsory module	1

Responsible for module:	Knoblauch, Anke
Lecturers:	Knoblauch, Anke
Language of instruction:	English
Credit points / SWS:	5 ECTS / 3 SWS
Workload:	Contact hours: 34 h Self-study: 116 h Total: 150 h
Subjects of the module:	1: Food Product Development (ABI-FoodProductDevelopment)
Lecture types:	Seminar, practical training
Examinations:	1: seminar paper, 20 pages (ABI-FoodProductDevelopment) Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan.

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

None

Objectives:

Technical and methodological competence

By the end of the course, students…

… understand trends and food development processes, can discuss and analyse them from different points of view.

… are able to control the product development process from ideation to concept to prototypes to market.

… can partially conceptualize and formulate a new food product, determine processing and packaging requirements for the product, prepare product specifications, packaging and labelling for the product.

… consider aspects of sustainability in food product development.

Professional action competence

By the end of the course, students…

… have the competence to design and develop a new food product based on defined requirements.

… can apply time management and project management skills.

… synthesize information from a wide range of reliable sources using library and web resources.

… are able to describe and evaluate food developing processes.

Social skills

By the end of the course, students…

… can work effectively and collaboratively with others as a member of a team on a major project.

… are able to discuss and evaluate work results systematically.

… contribute to the writing of a scientific report and give an effective presentation.

Content:

The aim of this module is to provide the learner with a theoretical and practical knowledge of new food product development, from devising the initial idea through the various steps to developing a prototype product. The module starts with seminaristic teaching covering an overview of topics relevant to food product development:

- Food trends
- Types of innovation
- Product development processes: From the idea to the product – step by step
- Food production, including processing, packaging, hygiene and preservation
- Food quality, including sensory analysis, hygiene and nutritional aspects
- Sustainability
- Legislative requirements

The lectures are followed by exercises and practical work. The students work in small teams to develop a food product under the guidance of a supervisor. During exercises and practicals, completed by independent work, each group develop an idea for a new innovative food product:

The students define the target group(s) for their product and describe the new food from the raw material to the product, ideally from cradle to cradle. Market analyses are carried out and a product strategy is developed. Usually, production processes as well as quality, hygiene, packaging, legislative requirements and sustainability aspects are taken into account. As far as laboratory capacities allow, prototypes are produced for demonstration purposes and analytical methods are applied.

The module will conclude with a “product launch” at which each member of the team will have to make a brief presentation on some aspect of their product concept.

Note: Participation in the hygiene instruction is required for practical training in the food lab.

Literature:

- PORRETTA, Sebastiano, Howard R. MOSKOWITZ and Attila GERE, 2021. *Consumer-based new product development for the food industry*. Cambridge: Royal Society of Chemistry. ISBN 978-1-83916-139-1
- VACLAVIK, Vickie, Elizabeth W. CHRISTIAN and Tad CAMPBELL, 2021. *Essentials of Food Science*. 5. edition. Cham: Springer. ISBN 978-3-030-46813-2
- Without author. *United Nations - Department of Economic and Social Affairs / Sustainable Development* [online]. [Accessed on: 24.02.2022]. Available via: https://sdgs.un.org/goals
- Without author. *the Institute of Food Technologists (IFT)* [online]. [Accessed on: 24.02.2022]. Available via: https://www.ift.org/
- , 1990-. *Trends in food science & technology*. Cambridge: Elsevier.

Protein Purification

Module abbreviation:	ABI-ProteinPurification	**Reg.no.:**	2
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	compulsory module	1

Responsible for module:	Fabritius, Dirk
Lecturers:	Fabritius, Dirk
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 45 h Self-study: 105 h Total: 150 h
Subjects of the module:	2: Protein Purification (ABI-ProteinPurification)
Lecture types:	Seminar, E-learning
Examinations:	2: written exam, 90 minutes (ABI-ProteinPurification) Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan.

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

Basic knowledge in protein biochemistry and chromatography

Objectives:

Technical and methodological competence

By the end of the course, students…

… will gain experience in laboratory and group work, report writing and in presentation.

… will be familiar with the principles and relevant techniques of protein isolation and purification in theory and practice.

… are able to develop a concrete purification protocol based on the properties of a protein of interest.

Professional action competence

By the end of the course, students…

… how to assess if a protein is pure and to determine its molecular size and composition.

… by drawing up a written protocol for the laboratory tests carried out, the students demonstrate that they can carry out a selected fermentation process and describe it quantitatively.

Social skills

By the end of the course, students…

… will have the ability to employ purification methods and to use them.

… will be able to generally describe, study and analyse purification processes which are new to them.

… will be able to address themselves in a team to a confronted field of activity, distribute tasks among each other and to make an agreement about contents.

… will be in a position to frame their own position statement for a specific approach and to complete the argument with additional, objective relevant facts.

Content:

The module gives a fundamental introduction in advanced technologies for the isolation and purification of proteins. The module consists of presentations by the students and a practical course.

The topics of the presentations are:

- Strategies for protein purification
- The structure and stability of proteins (posttranslational modifications)
- Expression systems and localization of product (e.g. inclusion bodies)
- Stabilization and preservation of enzymatic activity
- Cell disruption and separation of proteins
- Filtration and centrifugation
- Chromatographic methods
- Crystallization and precipitation
- Analytical methods

The practical course consists of a complete process for the isolation and purification of an enzyme. Part of the practical course demands the preparation of instructions for the separation steps by the students. The separation steps are:

- Mechanic cell disruption and separation of cell debris
- Concentrating and diafiltration using membrane filtration (cross flow)
- Immobilized metal affinity chromatography (IMAC) and size exclusion filtration (GF)
- Desalting using size exclusion filtration

For analyses of the samples: Chromatographic methods, SDS-Page, determination of protein concentration and enzymatic assays are performed.

Literature:

- ASENJO, Juan A., 1990. *Separation processes in biotechnology*. New York u.a.: Dekker. ISBN 0-8247-8270-4
- REHM, Hans-Jürgen, REED, Gerald, STEPHANOPOULOS, G., 1993. *Biotechnology, Volume 3, Bioprocessing: a multi-volume comprehensive treatise* [online]. Weinheim [Germany]: VCH PDF e-Book. ISBN 978-3-527-62084-5, 3-527-62084-2. Available via: https://onlinelibrary.wiley.com/doi/book/10.1002/9783527620845.
- WHEELWRIGHT, Scott M., 1991. *Protein purification: design and scale up of downstream processing*. Munich [u.a.]: Hanser. ISBN 3-446-15703-4
- , . *GE Healthcare Handbooks, current editions*.
- , . *Manuals Biorad, GE Healthcare, Repligen and Sartorius Stedim, current editions*.

Quality Management

Module abbreviation:	ABI-QualityManagement	**Reg.no.:**	3
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	compulsory module	1

Responsible for module:	Fabritius, Dirk
Lecturers:	Alex, Marco
Language of instruction:	English
Credit points / SWS:	5 ECTS / 3 SWS
Workload:	Contact hours: 34 h Self-study: 116 h Total: 150 h
Subjects of the module:	3: Quality Management (ABI-QualityManagement)
Lecture types:	Seminar, Practical training PowerPoint and black/white boards, overhead, Zoom, Moodle
Examinations:	3: presentation, 20 minutes (ABI-QualityManagement) Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan.

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

None

Objectives:

Technical and methodological competence

By the end of the course, students…

… will understand which targets are pursued by quality management in a project.

… know which processes are involved in project management and quality management. They learn the context of how the ISO 9001, ISO 21500, ISO 10005 and ISO 10006 standards are implemented in practice.

Professional action competence

By the end of the course, students…

… recognize that project management and quality management are interdisciplinary tasks and must be applied by all members of the project organization.

… do understand the meaning and content of the documents "project management plan", "project quality plan", "inspection and test plans" and "quality records", in which project phase they are required and who in the project organization is responsible for their creation and implementation.

Social skills

After finishing the course, students will be aware that a well-integrated quality mgmt. is crucial for a successful project management.

Content:

Unit 1 – Project management

- Project management. norms / standards & definition of terms "project", "project types", "project objectives" & "project management";
- Project management. processes according to DIN ISO 21500 at a glance & practical examples;
- Project phases, phase gate process, interaction of project management processes & project phases;
- Project execution models, project organization for owner's & for EPC contractor execution model;
- Project management plan: meaning, content & practical examples.

Unit 2 – Quality management system (QMS)

- QMS norms & definition of terms "Quality", "Quality management", "QMS" & "PDCA-cycle";
- ISO 9001: quality management principles, QMS requirements & certification;
- QMS: what it can do / what it cannot do & QMS practical example;
- Customer/contractor/supplier – which QMS applies in the project.

Unit 3 – Quality management (QM) in the project

- QMS norms & definition of terms "QM", "QA", "QC" & "quality improvement";
- Quality planning process in the project phases, quality plan, inspection and test plans & risk-based quality assurance & practical examples;
- QA/QC in the project phases, practical examples (apparatus manufacturing /-field erection & pipeline manufacturing / -field erection); control of changes in requirements & control of nonconforming outputs;
- Quality improvement: Lessons Learned process in project phases & continual improvement of the QMS.

Literature:

- , 2015. *Qualitätsmanagementsysteme - Anforderungen (ISO 9001:2015): = Quality management systems - reqirements (ISO 9001:2015) = Systèmes de management de la qualité - exigences (ISO 9001:2015)*. Deutsche und englische Fassung EN ISO 9001:2015. edition. Berlin: Beuth.
- , October 2020. *Quality management - Guidelines for quality plans (ISO 10005:2018): English translation of DIN ISO 10005:2020-10 = Qualitätsmanagement - Leitfaden für Qualitätsmanagementpläne (ISO 10005:2018) : Englische Übersetzung von DIN ISO 10005:2020-10 = Management de la qualité - Lignes directrices pour les plans qualité (ISO 10005:2018) : Traduction anglaise de DIN ISO 10005:2020-10*. October 2020. edition. Berlin: Beuth Verlag.
- , October 2020. *Quality management - Guidelines for quality management in projects (ISO 10006:2017): English translation of DIN ISO 10006:2020-10 = Qualitätsmanagement - Leitfaden für Qualitätsmanagement in Projekten (ISO 10006:2017) : Englische Übersetzung von DIN ISO 10006:2020-10 = Management de la qualité - Lignes directrices pour le management de la qualité dans les projets (ISO 10006:2017) : Traduction anglaise de DIN ISO 10006:2020-10*. October 2020. edition. Berlin: Beuth Verlag.
- , 2016. *Guidance on project management (ISO 21500:2012): English translation of DIN ISO 21500:2016-02 = Leitlinien Projektmanagement (ISO 21500:2012) : Englische Übersetzung von DIN ISO 21500:2016-02 =*

Lignes directrieces sur le management de projet (ISO 21500:2012) : Traduction anglaise de DIN ISO 21500:2016-02. February 2016. edition. Berlin: Beuth.

- , . *GLP/GMP-Richtlinien*.

Statistics

Module abbreviation:	ABI-Statistics	**Reg.no.:**	7
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	compulsory module	1

Responsible for module:	Dauth, Heinz
Lecturers:	
Language of instruction:	English
Credit points / SWS:	5 ECTS / 2 SWS
Workload:	Contact hours: 23 h Self-study: 127 h Total: 150 h
Subjects of the module:	7: Statistics (ABI-Statistics)
Lecture types:	Seminar
Examinations:	7: written exam, 90 minutes (ABI-Statistics) The requirements for the award of credit points are the passing of the respective module examination according to the SPO or the curriculum.

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

None

Objectives:

Technical and methodological competence

With finishing this course, students acquire basic knowledge of statistics and the confidence that statistical ideas and methods are not pure theories, but work factually with real data from the natural sciences and engineering and, above all, have a comprehensible logical background. Transferability of this basic knowledge to applied subjects and professional practice will be given.

Professional action competence

By the end of the course, students are capable of solving elementary problems of parametric statistics arithmetically. They understand the basic problems and the consequences and limitations that can be derived from the results.

Social skills

Students learn to deal with a problem using the fundamentals taught and to work together with other students in small groups to solve an issue.

Content:

In this course, central aspects of applied statistics will be explained. The module consists of seminar-based teaching and exercises.

- Normal distribution, standard error of a difference of two means, standard error of a difference of means (SFDM).

- T-test, standard t-test, t-test for means with unequal variances, one-sided or two-sided
- F-test
- Variance analysis.

In the exercises, students learn to solve simple as well as practical statistical problems by means of application-oriented examples (arithmetical exercises) and to apply the theoretical principles in a problem-oriented manner.

Literature:

Will be specified at the beginning

Bioeconomy and Technology Assessment			
Module abbreviation:	ABI-BioeconomyTechnologAssessm	**Reg.no.:**	8
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	compulsory module	1

Responsible for module:	Gaisser, Sibylle
Lecturers:	Gaisser, Sibylle
Language of instruction:	English
Credit points / SWS:	5 ECTS / 3 SWS
Workload:	Contact hours: 23 h Self-study: 127 h Total: 150 h
Subjects of the module:	8: Bioeconomy and Technology Assessment (ABI-BioeconomyTechnologAssessm)
Lecture types:	Seminar
Examinations:	8: seminar paper, 10-20 pages (ABI-BioeconomyTechnologAssessm) Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan.

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

None

Objectives:

Technical and methodological competence

By the end of the course, students know approaches and methods for bio-based production and the procedure of technology assessment.

Professional action competence

Students can evaluate the applied bio-based processes with regard to their ecological, social, ethical, economic and legal implications.

Social skills

With finishing this course students successfully develop their own concepts in a team and represent them externally.

Content:

- Bioeconomy is the transformation from a mineral-oil based economy to an economy in which fossil resources are replaced by various renewable raw materials. In the module, approaches, methods and process examples for a successful bioeconomy are discussed and evaluated.
- This is achieved with the help of technology assessment (TA) methods. The students get to know the ideal-typical procedure of a TA, the various quantitative and qualitative methods such as brainstorming,

literature research, document analysis, expert interviews, case studies, development of scenarios and procedures of citizen participation and apply these to their own case study.
Literature:
• LEWANDOWSKI, Iris, 2018. *Bioeconomy: shaping the transition to a sustainable, biobased economy* [online]. Cham: Springer Open PDF e-Book. ISBN 978-3-319-68152-8. Available via: https://doi.org/10.1007/978-3-319-68152-8. • GRUNWALD, Armin. *Technology assessment: concepts and methods* [online]. PDF e-Book. Available via: https://avaliacaotecnologia.files.wordpress.com/2012/10/artigo-grunwald.pdf.

Leadership and Research Management

Module abbreviation:	ABI-LeadershipResearchManagem	**Reg.no.:**	9
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	compulsory module	1

Responsible for module:	Martin, Annette
Lecturers:	Hartmann, Karin; Radon, Katja
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 45 h Self-study: 105 h Total: 150 h
Subjects of the module:	9: Leadership and Research Management (ABI-LeadershipResearchManagem)
Lecture types:	Seminar, practical training
Examinations:	9: participation and seminar paper (ABI-LeadershipResearchManagem) The requirements for the award of credit points are the passing of the respective module examination ac-cording to the SPO or the curriculum.

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

Technical and methodological competence

By the end of the course, students…

… are aware of different personality types and how they influence various aspects of leadership.

… understand the importance of communication and know specific communication models.

Professional action competence

When finishing this course, students will have reflected their own leadership mindset.

Social skills

Students are able to prepare, publish and present a scientific publication.

Content:

The seminar “Leadership” covers the following topics:

- Own leadership mindset
- First 100 days of being a new leader
- Understanding people
- Communication
- Situational leadership

• Making decisions in teams • Basics in change management The online course “Scientific Writing” covers the following topics: • Preparation of an article • Writing processes • Publishing and presenting
Literature:
Will be specified at the beginning

Bioprocess Engineering

Module abbreviation:	ABI-BioprocessEngineering	**Reg.no.:**	10
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	compulsory module	1

Responsible for module:	Fabritius, Dirk
Lecturers:	Fabritius, Dirk
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 45 h Self-study: 105 h Total: 150 h
Subjects of the module:	10: Bioprocess Engineering (ABI-BioprocessEngineering)
Lecture types:	Seminar, E-learning
Examinations:	10: written exam, 90 minutes (ABI-BioprocessEngineering) Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan.

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

Basic knowledge in microbiology and biochemistry

Objectives:

Technical and methodological competence

By the end of the course, students…

… will gain experience in laboratory skills, work group and report writing.

… will be familiar with the principles and relevant techniques of modern cell cultivation (batch, fed-batch and continuous culture).

… are able to develop a concrete fermentation protocol based on the properties of the organism used.

Professional action competence

By the end of the course, students…

… have the ability to employ fermentation methods and to use them.

… to generally describe, study and analyse bioprocesses which are new to them.

Social skills

By the end of the course, students…

… to address themselves in a team to a confronted field of activity, distribute tasks among each other and to make an agreement about contents.

… or team-orientated and based on the division of labour as well as presenting and documenting the data scientifically.

Content:

The module gives a fundamental introduction in advanced bioprocessing methods. Lectures and presentations of the students will cover the following topics:

- Upstream processing and sterilization
- Types of bioreactor and geometry
- Mixing and agitation (stirrer)
- Power input (newton number)
- Aeration (kLa, OTR, OUR)
- Fermentation strategies (chemo-/turbidostat)
- Calculations (mass balances) and kinetics of a fermentation process

The practical course consists of a complete fed-batch high cell density fermentation process:

- Sterilization methods (SIP)
- Pre-culturing and medium preparation
- Preparation and calibration of probes (oxygen, pH, Blue-sens technology)
- Monitoring and adjustment of the fed-batch fermentation process (e.g. oxygen supply)
- Determination of biomass (photo- and gravimetric)
- Calculations of feed rate, substrate consumption, growth yields, mass balances

Literature:

- KRAHE, Martin, . *Biochemical engineering. Reprint from Ullmann´s Encyclopedia of Industrial Chemistry.* . Wald, Schweiz: Bioengineering AG.
- SHULER, Michael L., Fikret KARGI and Matthew P. DELISA, 2017. *Bioprocess engineering: basic concepts*. T. edition. Boston: Prentice Hall. ISBN 978-0-13-706270-6
- KOMIVES, Claire and Weichang ZHOU, 2019. *Bioprocessing technology for production of biopharmaceuticals and bioproducts*. Hoboken, NJ: Wiley. ISBN 978-1-118-36198-6
- CHMIEL, Horst, Ralf TAKORS and Dirk WEUSTER-BOTZ, 2018. *Bioprozesstechnik*. 4. edition. Berlin: Springer Spektrum. ISBN 978-3-662-54041-1
- HASS, Volker C. and Ralf PÖRTNER, 2011. *Praxis der Bioprozesstechnik: mit virtuellem Praktikum*. 2. edition. Heidelberg: Spektrum, Akad. Verl.. ISBN 978-3-8274-2828-8, 3-8274-2828-9
- STORHAS, Winfried, 1994. *Bioreaktoren und periphere Einrichtungen: ein Leitfaden für die Hochschulausbildung, für Hersteller und Anwender ; mit 57 Tabellen*. Braunschweig [u.a.]: Vieweg. ISBN 3-528-06510-9, 978-3-642-63422-2
- D.J., Korz, U., Rinas, K., Hellmuth, E.A., Sanders, W.-D., Deckwer, 1995. Simple fed-batch technique for high cell density cultivation of Escherichia coli. In: *Journal of Biotechnology*. (39), p.59-65.

Analytics

Module abbreviation:	ABI-Analytics	**Reg.no.:**	11
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	compulsory module	1

Responsible for module:	Künzel, Sebastian
Lecturers:	Künzel, Sebastian
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 45 h Self-study: 105 h Total: 150 h
Subjects of the module:	11: Analytics (ABI-Analytics)
Lecture types:	Seminar
Examinations:	11: written exam, 90 minutes (ABI-Analytics) Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan.

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

Technical and methodological competence
By the end of the course, students should acquire solid expertise in methods used in instrumental analysis and be able to identify and critically discuss advantages and limitations of these methods.

Professional action competence

Students should be able to transfer that knowledge to the formal processes of analytical method validation and equipment qualification.

Social skills

After finishing the course, students will be able to work in teams on a validation project, which will strengthen social competences.

Content:

The module covers the following topics:

- Chromatographic, spectroscopic and special analytical methods
- Analytical method validation
- Instrument qualification

Literature:

- SKOOG, Douglas A., F. James HOLLER and Stanley R. CROUCH, 2018. *Principles of instrumental analysis*. S. edition. Boston, MA: Cengage Learning. ISBN 978-1-305-57721-3, 1-305-57721-3

Applied Cell Biology

Module abbreviation:	ABI-AppliedCellBiology	**Reg.no.:**	12
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	compulsory module	1

Responsible for module:	Martin, Annette
Lecturers:	Martin, Annette
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 45 h Self-study: 105 h Total: 150 h
Subjects of the module:	12: Applied Cell Biology (ABI-AppliedCellBiology)
Lecture types:	Lecture, practical training
Examinations:	12: written exam, 90 minutes and presentation (ABI-AppliedCellBiology) Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan.

Prerequisites according examination regulation:

Biological safety instruction

Recommended prerequisites:

Knowledge of basic cell biology and cell culture techniques, e.g. as taught in IBT Bachelor's course "Molekularbiologie der Eukaryoten"

Objectives:

Technical and methodological competence

After finishing the course, the students will have a broad overview of cell cultures systems and their applications in both, research and industry.

Professional action competence

By the end of the course, students…

… know basic cell culture techniques and typical equipment.

… are able to plan and implement a complex series of experiments to answer a scientific question.

Social skills

The students are able to present their results during a poster session.

Content:

The lecture covers the following topics:

- Basics in mammalian cell culture (repetition)
- Cell cultures as research tools

- Cell cultures as model systems for the qualification of materials and active ingredients
- 2D versus 3D cell culture
- Tissue engineering
- Cell cultures in the production of recombinant proteins
- Plant cell culture.

The lab course covers the following topics:

- Monitoring the differentiation of adipocytes by qPCR and fluorescence microscopy

Literature:

- ALBERTS, Bruce and others, 2019. *Essential cell biology*. F. edition. New York ; London: W. W. Norton & Company. ISBN 978-0-393-68039-3
- KASPER, Cornelia, Verena CHARWAT and Antonina LAVRENTIEVA, 2018. *Cell culture technology*. Cham: Springer. ISBN 978-3-319-74853-5
- GSTRAUNTHALER, Gerhard and Toni LINDL, 2021. *Zell- und Gewebekultur: allgemeine Grundlagen und spezielle Anwendungen*. 8. edition. Berlin: Springer Spektrum. ISBN 978-3-662-62605-4

Master Thesis

Module abbreviation:	ABI-MasterThesis	**Reg.no.:**	13
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	compulsory module	3

Responsible for module:	Künzel, Sebastian
Lecturers:	
Language of instruction:	English
Credit points / SWS:	30 ECTS / 0 SWS
Workload:	Contact hours: 0 h Self-study: 900 h Total: 900 h
Subjects of the module:	13: Master Thesis (ABI-MasterThesis)
Lecture types:	ABI-Master's thesis
Examinations:	13: master's thesis (ABI-MasterThesis) Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan.

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

None

Objectives:

Technical and methodological competence

By the end of the course, students…

… are familiar with the methodologies of biotechnology.

... are able to use biological and chemical lab equipment, can structure a scientific task and formulate a professional thesis with the found results.

Professional action competence

By the end of the course, students…

... are able to meet deadlines and stick to cost requirements.

… are capable of learning previously unknown scientific methodologies.

Social skills

By the end of the course, students…

… are capable of integration into the social and hierarchical structures of a previously unknown team/company.

... are able to find solutions for application- or research orientated tasks using appropriate resources and applying previously gained knowledge

Content:
A supervising professor will provide a topic and accompany and support the work on the thesis. The workload should include following steps: • Analysis and structuring of the problem • Embedding of the problem into scientific context in the field of biotechnology • Formulation and implementation of a solution • Design, execution and evaluation of suitable experiments • Documentation, discussion and presentation of the results
Literature:
Will be specified at the beginning

2.2 Elective modules

Big Project (Elective Course II + III)

Module abbreviation:	ABI-BigProjekt	**Reg.no.:**	
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)		1

Responsible for module:	Künzel, Sebastian	
Lecturers:		
Language of instruction:	English	
Credit points / SWS:	10 ECTS / 2 SWS	
Workload:	Contact hours:	23 h
	Self-study:	277 h
	Total:	300 h
Subjects of the module:	Big Project (Elective Course II + III) (ABI-BigProjekt)	
Lecture types:	Practical training	
Examinations:	project work (ABI-BigProjekt) Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan.	

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

Background knowledge covering the project's topic

Objectives:

Technical and methodological competence

The students will be able to apply theoretical and practical knowledge gained during their preceding studies.

Professional action competence

By the end of the course, students…

… will be able to independently plan, execute and document a medium sized scientific project in the field of biotechnology

… will be able to independently learn new technologies and/or applications.

… will gain experience in report writing and in presentation skills.

… master team skills in the case of team projects, self-organization in case of individual projects.

Content:

- Students will be given a task by a professor or can suggest a topic, which has to be closely related to the field of biotechnology and has to be evaluated by a professor
- The students will independently work on a medium sized project in working area strongly related to applied biotechnology under professional supervision by a professor.

- Individual or team projects are possible.
- The students present the project and face the scientific discussion.

Important criteria are:

- Time and project management
- Management of knowledge
- Quality of documentation, presentation and discussion

Literature:

Will be specified at the beginning

Cross-Cultural Management and Communication

Module abbreviation:	ABI-Cross-CulturalManagCommu-nic	**Reg.no.:**	4
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)		1

Responsible for module:	Schugk, Michael
Lecturers:	Schugk, Michael
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 45 h Self-study: 105 h Total: 150 h
Subjects of the module:	4: Cross-Cultural Management and Communication (ABI-Cross-CulturalMa-nagCommunic)
Lecture types:	Seminar
Examinations:	4: written exam, 90 minutes and seminar paper (ABI-Cross-CulturalManagCom-munic) Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan.

Prerequisites according examination regulation:

According to the study and examination regulations and the study plan

Recommended prerequisites:

None

Objectives:

Knowledge:

- Knowledge of extensive theoretical basics for identification of intercultural differences and management practices

Professional Skills:

- Capability to select situation specifically the relevant theoretical basics for different situations in business practice
- Capability to apply situation specifically the relevant theoretical basics in the field of cross-cultural management for problem-solving

Social Skills:

- Development of intercultural (communication) competence

Content:
• Definition and models in regard to the culture term • Intercultural manifestations and instruments for interpersonal intercultural communication • Culture-comparing studies according to Kluckhohn and Strodtbeck, Hall, Hofstede, Trompenaars and House • Cultural neuroscience • Intercultural communication psychology
Literature:
Will be specified at the beginning

Data science and empirical research in business and economics			
Module abbreviation:	Data science and empirical research	**Reg.no.:**	4
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)		1

Responsible for module:	Dauth, Christine
Lecturers:	Dauth, Christine
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 45 h Self-study: 105 h Total: 150 h
Subjects of the module:	4: Data science and empirical research in business and economics (Data science and empirical research)
Lecture types:	Seminar
Examinations:	4: seminar paper (Data science and empirical research) Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan.

Prerequisites according examination regulation:

None

Recommended prerequisites:

Basic statistics

Objectives:

Expertise and methodological skills:

Students become familiar with different data types and with one data set, the Linked Personnel Panel, in particular. They learn how to handle the programming language R in order to conduct basic descriptive analyses. They learn how to write and structure an empirical research paper and know the major guidelines of academic writing.

Practical skills:

This course enables students to conduct basic data analyses. They can critically assess the validity of other empirical results that they are confronted with in corporate environments and can distinguish between correlation and causation. They will create value-added for firms with their ability to familiarize themselves quickly with new complex tasks, sort information, and comprehensively vizualize and present results. In the short run, this course prepares the students to write an (empirical) master thesis and makes them more attractive for firms who look for interns or employees. In the medium run, this course is a good preparation for continuouing courses in data analysis, and in the long run, this course prepares students for a career in data science-related jobs.

Social skills:

Working in groups, students practice their communication and team working skills. They learn to self-organize their workload and train their skills in time management to successfully and jointly finish the project. This will improve their self-esteem.

Content:

The progressing digitization implies that institutions and firms collect more and more data, for example, on production processes, employees, and customers. Firms can use these data to better forecast business developments or to analyze the impact of management decisions.

In this practical course, students learn hands-on how to handle and exploit real data in order to answer business-related problems. The students apply basic statistical methods and the programming language R and learn to distinguish between correlation and causality. Moreover, students learn how to vizualize, document, and present the results of their data analysis comprehensively in a structured research paper.

The course comprises lectures and practical sessions. Moreover, groups of students analyze data themselves to answer a given research question. Grading is based on a five page thesis (excluding tables and figures) that summarizes the results of the group work.

The major outline of the course:

- Why conduct empirical research?
- Introduction to the Linked Personnel Panel (LPP) and the programming language R
- Dealing with complex data (data management, data preparation, data analysis)
- Structuring a research paper/thesis
- Tipps for academic writing

Literature:

- KRONTHALER, Franz and Silke ZÖLLNER, 2021. *Data analysis with RStudio: an easygoing introduction*. Berlin, Germany: Springer Spektrum. ISBN 978-3-662-62517-0, 3-662-62517-2

Global Marketing

Module abbreviation:	ABI-GlobalMarketing	**Reg.no.:**	4
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)		1

Responsible for module:	Schugk, Michael
Lecturers:	Schugk, Michael
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 45 h Self-study: 105 h Total: 150 h
Subjects of the module:	4: Global Marketing (ABI-GlobalMarketing)
Lecture types:	Seminar
Examinations:	4: written exam, 90 minutes (ABI-GlobalMarketing) Requirements for the award of credit points, are the passing of the respective module examination according to the study and examination regulations and the study plan.

Prerequisites according examination regulation:

According to the study and examination regulations and the study plan

Recommended prerequisites:

None

Objectives:

Knowledge:

- Competence and applicability in the learned theoretical contents with an orientation towards problems which arrive when coordinating
- The ability to use one's learned problem solving skills in all parts of International Marketing

Professional Skills:

- Complete overview over the approach towards International Marketing according to Backhaus et al
- Expertise in Going international and Being international as fundamental topics of International Marketing
- Understanding of the special features of International Marketing

Soft Skills:

- Recognition of international and intercultural differences
- Development of soft skills in an international context

Content:
Going international: • Problem of coordination concerning International Marketing • Evaluation and selection of markets • Strategies for market entry Being international: • Problem of coordination on markets growing together • Coordination strategies on markets growing together • Strategies for market entry • Coordination demand covering strategies • Coordination demand reducing strategies Coordination problems with markets breaking apart
Literature:
Will be specified at the beginning

Introduction to Quality Management

Module abbreviation:	IPM - Introduction to Quality Management	**Reg.no.:**	
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)		1

Responsible for module:	Wilisch, Christian
Lecturers:	Wilisch, Christian
Language of instruction:	English
Credit points / SWS:	5 ECTS / 3 SWS
Workload:	Contact hours: 34 h Self-study: 116 h Total: 150 h
Subjects of the module:	Introduction to Quality Management (IPM - Introduction to Quality Management)
Lecture types:	Seminar
Examinations:	seminar paper and presentation (IPM - Introduction to Quality Management) The requirements for the award of credit points are the passing of the respective module examination ac-cording to the SPO or the curriculum.

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

Quality management (QM) is an indispensable tool not only in production environments but in all aspects of commerce.

Content:

- What is 'quality'?
- Historical context of quality management
- Financial aspects of quality management
- Quality techniques and their applications
- Process control techniques
- Critical assessment of QM approaches

Literature:

- IMAI, Masaaki, 2012. *Gemba kaizen: a commonsense approach to a continuous improvement strategy*. 2. edition. New York, NY [u.a.]: McGraw Hill. ISBN 0-07-179035-7, 978-0-07-179035-2

- CHALKIADAKIS, Ioannis , 2019. *New Product Development with the use of Quality Function*. ISBN 978-3330344181
- MONTGOMERY, Douglas C., 2019. *Introduction to statistical quality control*. E. edition. Hoboken, NJ: Wiley. ISBN 978-1-119-65711-8, 978-1-118-98915-9

Peptide Chemistry

Module abbreviation:	ABI-PeptideChemistry	**Reg.no.:**	4
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)		1

Responsible for module:	Künzel, Sebastian
Lecturers:	Künzel, Sebastian
Language of instruction:	English
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 45 h Self-study: 105 h Total: 150 h
Subjects of the module:	4: Peptide Chemistry (ABI-PeptideChemistry)
Lecture types:	Seminar, Practical training
Examinations:	4: written exam, 90 minutes (ABI-PeptideChemistry) Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan.

Prerequisites according examination regulation:

None

Recommended prerequisites:

Solid foundation in Organic Chemistry

Objectives:

Technical and methodological competence

By the end of the course, students should acquire solid expertise in methods used in the chemical synthesis of peptides and their purification.

Professional action competence

Students should be able to synthesize peptides on solid support and in solution, deal with sequence specific difficulties and purify them, mostly by HPLC.

Content:

The module covers the following topics:

- Protecting groups and coupling methods in SPPS and SIS
- Side reactions and difficult sequences
- Purification
- Selected topics of peptide biology

Literature:

- Seewald, Jakubke, Peptides: Chemistry and Biology, 2nd ed., WILEY-VCH 2009

Project (Elective Course I)

Module abbreviation:	ABI-Projekt	**Reg.no.:**	
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)		1

Responsible for module:	Künzel, Sebastian
Lecturers:	
Language of instruction:	English
Credit points / SWS:	5 ECTS / 2 SWS
Workload:	Contact hours: 23 h Self-study: 127 h Total: 150 h
Subjects of the module:	Project (Elective Course I) (ABI-Projekt)
Lecture types:	Practical training
Examinations:	project work (ABI-Projekt) Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan.

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

Background knowledge covering the project's topic

Objectives:

Technical and methodological competence

The students will be able to apply theoretical and practical knowledge gained during their preceding studies.

Professional action competence

By the end of the course, students…

… will be able to independently plan, execute and document a small scientific project in the field of biotechnology.

… will be able to independently learn new technologies and/or applications.

… will gain experience in report writing and in presentation skills.

… master team skills in the case of team projects, self-organization in case of individual projects.

Content:

- Students will be given a task by a professor or can suggest a topic, which has to be closely related to the field of biotechnology and has to be evaluated by a professor.

- The student will independently work on a small project in working area strongly related to applied biotechnology under professional supervision by a professor.
- Individual or team projects are possible.
- The students present the project and face the scientific discussion.

Important criteria are:

- Time and project management
- Management of knowledge
- Quality of documentation, presentation and discussion

Literature:

Will be specified at the beginning

Research Project (Elective Course I + II + III)			
Module abbreviation:	ABI-ResearchProject	**Reg.no.:**	
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)		1

Responsible for module:	Künzel, Sebastian	
Lecturers:		
Language of instruction:	English	
Credit points / SWS:	15 ECTS / 2 SWS	
Workload:	Contact hours:	23 h
	Self-study:	427 h
	Total:	450 h
Subjects of the module:	Research Project (Elective Course I + II + III) (ABI-ResearchProject)	
Lecture types:	Practical training	
Examinations:	project work (ABI-ResearchProject) Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan.	

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

Background knowledge covering the project's topic

Objectives:

Technical and methodological competence

The students will be able to apply theoretical and practical knowledge gained during their preceding studies.

Professional action competence

By the end of the course, students…

… will be able to independently plan, execute and document a medium sized scientific project in the field of biotechnology.

… will be able to independently learn new technologies and/or applications.

… will gain experience in report writing and in presentation skills.

… master team skills in the case of team projects, self-organization in case of individual projects.

Content:

- Students will be given a task by a professor or can suggest a topic, which has to be closely related to the field of biotechnology and has to be evaluated by a professor.
- The student will independently work on a big project in working area strongly related to applied biotechnology under professional supervision by a professor.

• Individual or team projects are possible. • The students present the project and face the scientific discussion. Important criteria are: • Time and project management • Management of knowledge • Quality of documentation, presentation and discussion
Literature:
Will be specified at the beginning