HOCHSCHULE ANSBACH

Modulhandbuch

Applied Biotechnology (SPO WS 21/22)

Faculty Technology

Stand: 2025-01-23

Content

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 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: 30 h Self-study: 120 h Total: 150 h
Subjects of the module:	Food Product Development
Lecture types:	Seminar, Exercises, Pract. Training
Examinations:	Portfolio exam (seminar paper 3-5 pages, project work 10-15 pages and Kolloquium 20 min.) 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:

On successful completion of the subject the student …

Technical and methodological competence:

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

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

...can 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.

Competence to act:

...has 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.

...is able to describe and evaluate food developing processes.

Social skills:

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

...is able to discuss and evaluate work results systematically.

...contribute to the writing of a scientific report and make 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 - including biotechnological tools -, 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. Market analysis are carried out and a product strategy is developed. 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” for which each team member will have to give a short presentation on some aspects of the product concept.

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

Literature:

- VACLAVIK, Vickie, Elizabeth W. CHRISTIAN and Tad CAMPBELL, 2003. *Essentials of food science*. 2. edition. New York [u.a.]: Kluwer Academic/Plenum Publishers. ISBN 0-306-47363-1
- VACLAVIK, Vickie and Elizabeth W. CHRISTIAN, 2008. *Essentials of food science*. 3. edition. New York, NY: Springer. ISBN 978-0-387-69939-4, 0-387-69939-2
- And other current professional articles and literature …
- Internet sources: www.ift.org
- Journals: Trends in Food Science & Technology

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 (ABI-ProteinPurification) (ABI-ProteinPurification ZV)
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:	Protein Purification ZV Protein Purification
Lecture types:	Seminar, group work, Pract. Training
Examinations:	written exam, 90 minutes 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:	Quality Management
Lecture types:	Seminar, E pract. Training
Examinations:	written exam, 60 minutes 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, Christine
Lecturers:	Vhb Lecturer
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:	Statistics
Lecture types:	Seminar
Examinations:	written exam, 60 minutes 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:

Expertise and methodological skills:

Students learn how to handle the programming language R to conduct basic descriptive analyses with real data. 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 visualize 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 continuing 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 to answer business-related problems. The students apply basic statistical methods, such as regression analysis, and the programming language R and learn to distinguish between correlation and causality. Moreover, students learn how to visualize, document, and present the results of their data analysis comprehensively in a structured research paper.

The course comprises lectures and practical sessions. Throughout the course of the semester, they solve several problem sets to consolidate their skills. 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:

- Introduction to the programming language R
  - Data preparation
  - Data visualization
  - Descriptive data analysis
- Introduction to linear regression and statistical inference
- Structuring, documenting, and presenting results in a research paper/thesis
- Tipps for academic writing

Literature:

- Ismay, Chester and Kim, Albert Y. (2020): Statistical Inference via Data Science: A ModernDive into R and the Tidyverse. Available at: https://moderndive.netlify.app/index.html [accessed on September 29, 2021].
- Wickham, Hadley and Grolemund, Garrett (2017): R for Data Science: Import, Tidy, Transform, Visualize, and Model Data. Available at: https://r4ds.had.co.nz/ [accessed on September 29, 2021].

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: 18 h Self-study: 132 h Total: 150 h
Subjects of the module:	Bioeconomy and Technology Assessment
Lecture types:	Seminar (Blended learning)
Examinations:	Portfolio exam (2 presentations each 10 min. and scientific poster 10-20 pages with 10 min. presentation 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:
• THIEMAN, William J. and Michael A. PALLADINO, 2020. Introduction to Biotechnology. F. edition. Harlow: Pearson Education Limited. ISBN 978-1-292-26177-5 • FOWLER, Samantha et al. ,2013: Concepts of Biology. Open Textbook Library. Open Stax. ISBN 13: 9781938168116. https://open.umn.edu/opentextbooks/textbooks/168 • More literature will be specified at the beginning of the course

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; Dr. Grießinger, Julia
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:	Leadership and Research Management
Lecture types:	Seminar
Examinations:	participation and written exam, 60 minutes • Course "Leadership": participation in at least 80 % of seminar time (Block course). • Course "Scientific Writing": To receive a graded ECTS-certificate it is necessary to finish the online units of the course and to hand in an essay. In the first unit you will find more detailed information about the requirements 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:
By the end of the course, students…
… are aware of different personality types and how they influence various aspects of leadership.
Professional action competence:
… understand the importance of communication and know specific communication models.
Social skills
When finishing this course, students …
… will have reflected their own leadership mindset.
… 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 THE ARTICLE

1. Introduction
2. Literature search
3. Literature management
4. Planning of the writing process

THE WRITING PROCESS

5. Language and Expression
6. Methods
7. Introduction and Aims
8. Results
9. Discussion and Conclusion
10. Title and Abstract
11. Visuals
12. Bibliography and Citation

PUBLISHING AND PRESENTING

13. Submission to the journal
14. Oral presentation
15. Poster presentation
16. Peer-reviewing

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 (ABI-BioprocessEngineering) (ABI-BioprocessEngineering ZV)
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:	Bioprocess Engineering ZV Bioprocess Engineering
Lecture types:	Seminar, Pract. Training
Examinations:	written exam, 90 minutes Prerequisite for the granting of credit points is the passing of the respective module examination in accordance with the SPO resp. study plan. • Exam achievement consists of a graded practical course report about contents and results of the course and a written test. • In the course report students answer questions on fermentation strategies and prove that they have understood the contents of the practical course. • The effective practical course and report are the preconditions for the written exam. • The effective practical course and report are the preconditions for the written exam.

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

None

Objectives:

Professional and methodical competences:

- The students will gain experience in laboratory skills, work group and report writing.
- Upon successful completion of the module, students will be familiar with the principles and relevant techniques of modern cell cultivation (batch, fed-batch and continuous culture).
- They are able to develop a concrete fermentation protocol based on the properties of the organism used.

Social and self-competence:

- The students have the ability to employ fermentation methods and to use them.
- to generally describe, study and analyse bioprocesses which are new to them.
- to address themselves in a team to a confronted field of activity, distribute tasks among each other and to make an agreement about contents.
- work team-orientated and based on the division of labour as well as presenting an 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:	Analytics
Lecture types:	Seminar, Exercises
Examinations:	written exam, 90 minutes 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 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: 33 h Self-study: 117 h Total: 150 h
Subjects of the module:	Applied Cell Biology
Lecture types:	Seminar, Pract. Training (Blended learning)
Examinations:	written exam, 90 minutes 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:

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, implement and interpret a series of experiments

Social skills:

The students effectively work together in teams during the practical training and protocol writing.

Content:

The lecture/seminar covers the following topics:

- Basics in mammalian cell culture
- Cell cultures as research tools
- Cell cultures as model systems for drug screening and biocompatibility testing
- 2D versus 3D cell culture
- Tissue engineering

- Cell cultures in the production of recombinant proteins

The practical training (blended learning and presence) covers the following topics:

- basic cell culture techniques
- PCR for the identification of cell lines
- Mycoplasma detection by DAPI staining
- MTT assay
- How to write a scientific protocol?

For successful completion of the practical training, students complete self-study course in Moodle and participate in at least 80 % of lab time. They hand in solved tasks and a report on time.

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:	Course management
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:	Master Thesis
Lecture types:	Thesis
Examinations:	master's thesis 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)	Elective modules	1

Responsible for module:		
Lecturers:		
Language of instruction:	English	
Credit points / SWS:	10 ECTS / 2 SWS	
Workload:	Contact hours: Self-study: Total:	12 h 288 h 300 h
Subjects of the module:	Big Project (Elective Course II + III)	
Lecture types:	Project	
Examinations:	project work (outside the examination period) 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

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)	Elective modules	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:	Cross-Cultural Management and Communication
Lecture types:	Seminar
Examinations:	written exam, 90 minutes and seminar paper 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:

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

Global Marketing

Module abbreviation:	ABI-GlobalMarketing	**Reg.no.:**	4
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	Elective modules	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:	Global Marketing
Lecture types:	Seminar
Examinations:	written exam, 90 minutes 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 SPO or curriculum

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

HCD-Fermentation: High Cell Density Fermentation

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

Responsible for module:	Fabritius, Dirk	
Lecturers:	Fabritius, Dirk	
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:	HCD-Fermentation: High Cell Density Fermentation	
Lecture types:	Seminar, Pract. Training	
Examinations:	written exam, 60 minutes 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 SPO- and study plan

Recommended prerequisites:

Basic knowledge in microbiology and biochemistry

Objectives:

Professional and methodical competences:

- The students will gain experience in laboratory skills, work group and report writing.
- Upon successful completion of the module, students will be familiar with the principles and relevant techniques of modern cell cultivation (batch, fed-batch and continuous culture).
- They are able to develop a concrete fermentation protocol based on the properties of the organism used.

Social and self-competence:

- The students have the ability to employ fermentation methods and to use them.
- to generally describe, study and analyse bioprocesses which are new to them.
- to address themselves in a team to a confronted field of activity, distribute tasks among each other and to make an agreement about contents.
- work team-orientated and based on the division of labour as well as presenting an documenting the data scientifically.

Content:

The module gives a fundamental introduction in advanced bioprocessing methods.

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, M.: Biochemical engineering. Reprint from Ullmann´s Encyclopedia of Industrial Chemistry. Bioengineering AG
- Shuler, M.L.: Bioprocess Engineering – Basic Concepts. Prentice Hall
- Komives, C.; Zhou, W. : Bioprocessing Technology for Production of Biopharmaceuticals and Bioproducts. Wiley
- Chmiel, H.: Bioprozesstechnik, Spektrum Akdemischer Verlag
- Hass, V.C.; Pörtner, R.: Praxis der Bioprozesstechnik. Spektrum Akdemischer Verlag
- Storhas, W.: Bioreaktoren und periphere Einrichtungen, Vieweg Verlag,
- Korz, D.J.; Rinas, U.; Hellmuth, K.; Sanders, E.A.; Deckwer, W.-D. (1995): Simple fed-batch technique for high cell density cultivation of Escherichia coli. Journal of Biotechnology, 39, 59-65

Hackathon

Module abbreviation:	Hackathon	**Reg.no.:**	4
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	Elective modules	3

Responsible for module:	Walter, Michael
Lecturers:	Durst, Carolin; Walter, Michael
Language of instruction:	German
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 75 h Self-study: 75 h Total: 150 h
Subjects of the module:	Hackathon
Lecture types:	Seminar
Examinations:	project work, 15-20 pages (outside the examination period) The prerequisite for the awarding of credit points is the passing of the respective module examination in accordance with the SPO or curriculum.

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

None

Objectives:

Professional and methodological competence

- During the course, students go through a realistic innovation and product development process
- This initially includes the basic composition of an interdisciplinary team
- This is followed by the development and application of problem-solving strategies using the design thinking method
- Students also learn methods for generating product or service ideas.
- In addition, students receive targeted pitch training and improve their presentation skills.

Action competence

- Students learn and deepen key skills in the areas of project management, problem-solving methods, business sub-disciplines, team and communication skills and presentation techniques.
- By attending the course, students are also able to assess an innovation process and go through it themselves in appropriate project teams.

Social skills

- Building, structuring and coordinating the work of interdisciplinary teams
- Students apply team-oriented work and content-related division of labor
- Focused and goal-oriented work under time pressure, focusing on the essential elements of product development

- Students must demonstrate and apply presentation skills through interim presentations and live pitches

Content:

With its origins in the IT industry, the hackathon is now an innovative approach that is used in many industries both nationally and internationally to solve challenges and develop new innovative products and services. Creative minds come together temporarily to work on a given problem and jointly develop innovative solutions in the form of new concepts, prototypes or business models. Finding solutions in a team combines the different knowledge, experience and intuitive approaches of the participants to create a unique method for developing new, forward-looking ideas in a focused manner.
By participating in the "Hackathon" module, students acquire concrete and practice-relevant specialist knowledge as well as contemporary methods for overcoming a given technical, economic or organizational challenge. Within 3 full days of attendance, the participating students work almost around the clock in interdisciplinary teams on a challenge set by practice partners (companies from the region).

The event is designed as a practice-oriented workshop format in which the participating students can apply the methods and specialist knowledge taught directly to their own project work in a team and successively develop their own product idea and a prototype. In terms of methodology, the hackathon is based on the "design thinking" concept and other agile project management methods.
Finally, the teams must present their solution concept and prototype to an expert jury at a final event ("live pitch") and then concretize and submit it in a written student research project.

Contents:

- Team building
- Problem-solving strategies
- ideation
- design thinking
- Business Design
- Research & Development
- validation
- Prototyping
- Pitching

Literature:

- Erik H. Trainer, Arun Kalyanasundaram, Chalalai Chaihirunkarn, and James D. Herbsleb. 2016. How to Hacka-thon: Socio-technical Tradeoffs in Brief, Intensive Collocation. In Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing (CSCW '16). Association for Computing Ma-chinery, New York, NY, USA, 1118–1130. DOI: 10.1145/2818048.2819946
- K. Gama, B. Alencar, F. Calegario, A. Neves and P. Alessio, "A Hackathon Methodology for Undergraduate Course Projects," 2018 IEEE Frontiers in Education Conference (FIE), San Jose, CA, USA, 2018, pp. 1-9, doi: 10.1109/FIE.2018.8659264.
- Andreas Kohne, Volker Wehmeier. Hackathons - Von der Idee zur erfolgreichen Umsetzung. Wiesbaden: Springer, 1. Auflage, 2019.10.1145/2818048.2819946

How to Startup

Module abbreviation:	How to Startup	**Reg.no.:**	4
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	Elective modules	3

Responsible for module:	Hähnlein, Johannes
Lecturers:	Ramona Grimm/Michael Fried
Language of instruction:	German
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 75 h Self-study: 75 h Total: 150 h
Subjects of the module:	How to Startup
Lecture types:	Seminar
Examinations:	seminar Paper and presentation (outside the examination period) The prerequisite for the awarding of credit points is the passing of the respective module examination in accordance with the SPO or curriculum.

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

None

Objectives:

Professional competence and methodological competence

- During the course, students go through a realistic start-up development process using state-of-the-art methods and skills.
- This initially includes the basic composition of an interdisciplinary team
- This is followed by the identification and systematization of methods and tools in the areas of trend and innovation management and market research.
- Students also learn methods for generating product or service ideas, identifying fields of application, validation and business modeling.

Personal and social skills

- Independent work on the basis of digital self-study units
- Setting up, structuring and coordinating the work of interdisciplinary teams
- Students apply team-oriented work and content-related division of labor
- Focused and goal-oriented work under time pressure while focusing on the essential elements of the business idea
- Students must demonstrate and apply presentation skills through interim presentations and live pitches

Action competence

- Students learn and deepen key skills in the areas of project management, problem-solving methods, business management sub-disciplines, team and communication skills and presentation techniques.
- By attending the course, students can also assess the process of founding a company and go through it themselves in appropriate founding teams.

Content:

By participating in the blended learning course, students acquire concrete and practice-relevant specialist knowledge as well as contemporary methods for developing and founding their own start-up. This includes the core areas of trend identification, idea generation, business design and go-to-market.

The event is designed as a practice-oriented workshop format in which participants can apply digitally taught specialist knowledge (Moodle learning platform) directly to their own project work in a team and successively develop their own start-up idea and a corresponding business concept.

The aim of the event is for the participants to develop their own start-up concept in start-up teams of 3-5 people each and present this to an expert jury at a final event ("live pitch").

Contents

- Team building
- trend management
- ideation
- Business Design
- Research & Development
- validation
- Prototyping
- Startup Finance
- Marketing & Communications
- Pitching

Literature:

- Faltin, G. (2017). Kopf schlägt Kapital: Die ganz andere Art, ein Unternehmen zu gründen Von der Lust, ein Entrepreneur zu sein. dtv Verlagsgesellschaft.
- Freiling, J.; Harima, J. (2019). Entrepreneurship: Gründung und Skalierung von Startups. Springer Fachmeiden Wiesbaden.
- Kim, W.C.; Mauborgne, R. (2015). Blue Ocean Strategy, Expanded Edition: How to Create Uncontested Market Space and Make the Competition Irrelevant. Harvard Business Review Press.
- Osterwalder, A.; Pigneur, Y. (2011). Business Model Generation: Ein Handbuch für Visionäre, Spielveränderer und Herausforderer. Campus Verlag.
- Osterwalder, A. et al. (2014). Value Proposition Design: How to create products and services customer want. Wiley.
- Parker, D. (2021). Trajectory: Startup: Ideation to Product/Market Fit. Matt Holt Books.
- Ries, E. (2014). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Redline Verlag.
- Further materials will be provided during the event

Impact-Entrepreneurship

Module abbreviation:	NIW-Impact Entrepreneurship	**Reg.no.:**	4
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	Elective modules	3

Responsible for module:	Beckmann, Markus
Lecturers:	Beckmann, Markus
Language of instruction:	German
Credit points / SWS:	5 ECTS / 4 SWS
Workload:	Contact hours: 18 h Self-study: 132 h Total: 150 h
Subjects of the module:	Impact Entrepreneurship
Lecture types:	Seminar, Exercises
Examinations:	project work, 15 pages and presentation, 10 minutes (outside the examination period) Academic achievement: Attendance on 8 of the 12 dates. Examination performance: • Term paper: Weekly submissions on 8 of the 12 dates (length: ~1.5 pages per lecture): Interfaces between the relevant academic disciplines, sustainability and entrepreneurship reflected and entrepreneurial fields of action outlined • Start-up pitch: Video submission or written elaboration of a start-up pitch of your own business idea (scope: ~ 5 minutes pitch or ~ 7 pages of elaboration, can be based on the content of one or more of the lectures, submission deadline two weeks after the last lecture) • Oral contribution: Discussion contributions in at least 8 of the 12 sessions. The prerequisite for the awarding of credit points is the passing of the respective module examination in accordance with the SPO or curriculum.

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

Interest in sustainable solutions through entrepreneurial action from all academic disciplines

Objectives:

The students learn

- How the United Nations' Sustainable Development Goals can be addressed in their entirety through entrepreneurship.
- Recognize interfaces between different academic disciplines, sustainability and entrepreneurship and derive fields of action from them.
- To exchange views on socially relevant problems in an interdisciplinary environment and to sharpen their own disciplinary focus in the process.

Content:
• This lecture series is open to students from all faculties and anyone interested in impact entrepreneurship and is part of the Impact E³ project. The event provides a compact insight into the sustainability aspects of various academic disciplines and the challenges that arise from them. Following on from these insights, entrepreneurial solutions will be discussed. An integral part of the lecture series and complement to the specialist lectures are contributions from impact start-ups that are working entrepreneurially to solve ecological and social challenges. The lecture series thus provides basic and applied knowledge on the question of how the United Nations' Sustainable Development Goals can be addressed through impact entrepreneurship, i.e. an interdisciplinary understanding of the ecological and social challenges of our time. The spectrum ranges from sustainable entrepreneurship and intrapreneurship to social entrepreneurship, ecological and digital innovations and the circular economy. The content of this event is organized in cooperation with different faculties of the participating universities and start-ups.
Literature:
• Further materials will be provided via StudOn and in the course.

Introduction to General and Organic Chemistry			
Module abbreviation:	ABI-Int.Gen.Org.Chem. (Bridge module)	**Reg.no.:**	4
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	Elective modules	

Responsible for module:	Künzel, Sebastian	
Lecturers:	Künzel, Sebastian	
Language of instruction:	English	
Credit points / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours: Self-study: Total:	45 h 105 h 150 h
Subjects of the module:	Introduction to General and Organic Chemistry	
Lecture types:	Seminar, Exercises	
Examinations:	written exam, 90 minutes 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:

Students will acquire basic knowledge in general and organic chemistry, with a focus on topics that are pre-requisite to instrumental analysis. The lectures are accompanied by a series of exercise sessions that are done in a group work format.

Content:

Atoms, Bonds, Molecules, Gases, Thermodynamics, Chemical Equilibrium, Acids and Bases, Redox Reactions, Complexes, Organic Molecules, Reaction Mechanisms, Functional Groups and their properties, Important Reactions

Literature:

- Burrows et al., Chemistry3, Oxford University Press, 4th ed., 2021

Introduction to Quality Management

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

Responsible for module:	Wilisch, Christian	
Lecturers:	Wilisch, Christian	
Language of instruction:	English	
Credit points / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	34 h
	Self-study:	116 h
	Total:	150 h
Subjects of the module:	Introduction to Quality Management	
Lecture types:	Seminar	
Examinations:	presentation, 15 minutes (outside the examination period) 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:

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

This course aims to provide students with basic knowledge about QM in general, as well as some QM techniques and their applications.

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

Lean Production – Manufacturing Excellence

Module abbreviation:	IPM - Lean Production – Manufacturing Excellence	**Reg.no.:**	
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	Elective modules	1

Responsible for module:	Slama, Stefan	
Lecturers:	Slama, Stefan	
Language of instruction:	English	
Credit points / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours: Self-study: Total:	45 h 105 h 150 h
Subjects of the module:	Lean Production – Manufacturing Excellence	
Lecture types:	Seminar	
Examinations:	seminar Paper and presentation (outside the examination period) 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:

- Students are becoming familiar with expert knowledge and scientific concepts and methods in the field of Lean Production and Manufacturing Excellence. They understand the most important aims of production without waste of resources, lean thinking in processes and organization, helpful tools and they will know methods and tasks to solve problems in efficiency.

Professional Skills:

- Students are able to solve tasks autonomous and are able to asses problems in the field of Lean Production

Social Skills:

- The students are able to discuss case study results in groups, achieve consensus by critical but constructive discussions and present final work results as a team, also their research study project

Content:

- Definition, Meaning, Opportunities, Method Overview and Structure of Lean Production
- Team Work, 55, Standards
- Muda Elimination, TPM (Total Productive Maintenance), JIT (Just In Time)
- Employee Involvement, Quality First, etc .

• Strengthening of key aspects with additional trainings and exercises in team-work, critically considerations of effects/needs and presentation of results
Literature:
• Will be specified at the beginning

Multidimensional Chromatography

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

Responsible for module:	Fabritius, Dirk	
Lecturers:	Fabritius, Dirk	
Language of instruction:	German	
Credit points / SWS:	5 ECTS / 3 SWS	
Workload:	Contact hours: Self-study: Total:	45 h 105 h 150 h
Subjects of the module:	Multidimensional Chromatography	
Lecture types:	Seminar, Pract. Training	
Examinations:	written exam, 60 minutes None	

Prerequisites according examination regulation:

According to SPO or curriculum

Recommended prerequisites:

None

Objectives:

Professional and methodical competences

- The students will gain experience in laboratory skills, work group and report writing.
- Upon successful completion of the module, students will be familiar with the principles and relevant techniques of chromatographic purification methods for proteins (affinity, ion exchange and size exclusion).
- They are able to develop a concept for protein purification based on the properties of the protein of interest.

Social and self-competence

- The students have the ability to employ chromatographic methods and to use them.
- to generally describe, study and analyse purification methods which are new to them.
- to address themselves in a team to a confronted field of activity, distribute tasks among each other and to make an agreement about contents.
- work team-orientated and based on the division of labour as well as presenting an documenting the data scientifically.

Content:

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

- build a chromatography
- parts of a chromatography (e.g. mixer, detector, pumps)
- principles of affinity chromatography
- principles of ion exchange chromatography
- principles of size exclusion chromatography
- methods for quantification and analyses of proteins
- calculation of protein yields

Literature:

- Bio-Rad Laboratories Bulletin 5342A, Hercules, USA
- Bio-Rad Laboratories Biologic Duoflow Instruction Manual_4006229, Hercules, USA
- Handbook Recombinant Protein Purification, GE Healthcare, USA
- Handbook Strategies for Protein Purification. GE Healthcare, USA

Peptide Chemistry

Module abbreviation:	ABI-PeptideChemistry	**Reg.no.:**	4
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	Elective modules	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:	Peptide Chemistry
Lecture types:	Seminar, Pract. Training
Examinations:	written exam, 90 minutes 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 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)	Elective modules	1

Responsible for module:	
Lecturers:	
Language of instruction:	English
Credit points / SWS:	5 ECTS / 2 SWS
Workload:	Contact hours: 12 h Self-study: 138 h Total: 150 h
Subjects of the module:	Project (Elective Course I)
Lecture types:	Project
Examinations:	project work (outside the examination period) 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

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 bio-technology 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

Digital entrepreneurial Impact

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

Responsible for module:	Prof. Dr. Carolin Durst
Lecturers:	Prof. Dr. Carolin Durst
Language of instruction:	german
Credit points / SWS:	2.5 ECTS / 2 SWS
Workload:	Contact hours: 45 h Self-study: 30 h Total: 75 h
Subjects of the module:	Digital entrepreneurial Impact
Lecture types:	Seminar
Examinations:	Portfolioprüfung (außerhalb Prüfungszeitraum) Note for non-NIW students: Approval of the module for ECTS crediting by the head of degree program required. Must be obtained independently. Notes / information • Workshop day: Deep Dive - Sustainability Management • Workshop day: Deep Dive - Artificial Intelligence • Workshop day: Development of the problem-solution-fit • Final presentation & networking event 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:

Brief description

The module provides in-depth expert knowledge on impact entrepreneurship with a focus on artificial intelligence (AI) and sustainability management/corporate social responsibility (CSR). It explores the question of how artificial intelligence can promote sustainability and be used in the context of impact/social entrepreneurship.

The early discussion in the field of tension between AI and CSR offers a wide range of strategic opportunities and a high innovation potential for start-ups. The event is divided into 3 workshop days and a final presentation of results on the following

topics:

Basics of sustainability management/corporate social responsibility and artificial intelligence

Teaching basic methods and software solutions in innovation management and corporate foresight

Identification of future opportunities and risks

Developing innovation strategies and scenarios, establishing and using them in the company

Interactive group work on the development of business models and innovations

innovations in the context of a case study (software-supported)Qualification objectives.

Professional competence and methodological competence

Research competence

Students acquire comprehensive and up-to-date specialist knowledge in the fields of sustainability management and artificial intelligence.

Apply various methods in the areas of strategic foresight, innovation field development and ideation.<<7p>

They can independently identify potential problem areas in these fields and develop solutions based on various options for action.

Digital Entrepreneurial Impact

Using practical examples, students learn methods for generating digital product or service ideas in the AI & CSR environment.

Personal and social skills

Building, structuring and coordinating teams

Students must demonstrate and apply presentation skills in the final pitches

Students acquire argumentation skills and critical reflection on socially relevant issues through discussions during the seminar and in dealing with the results to be developed Action skills

Students learn and deepen key skills in the field of AI / CSR as well as project management, problem-solving methods, business sub-disciplines, teamwork and communication skills and presentation techniques.

By attending the course, students can also assess an innovation process and go through it themselves in corresponding project teams.

Content:

Workshop 1: Deep Dive - Sustainability Management

Teaching the basics of "Corporate Social

Responsibility"

Deep Dive I: Circular Economy, Deep Dive II: CSRD materiality analysis & toolbox

Discussion of current challenges

Presentation of the "Grand Challenges"

Group division and deep dive on the respective Grand Challenge

Environment and trend analysis for each grand challenge

Workshop 2: Deep Dive - Artificial Intelligence

Introduction to the topic of artificial intelligence and teaching the basics for understanding artificial intelligence

Deep Dive I Resource-saving AI, Deep Dive II Language models, assistant writing (e.g.) for CSRD

Discussion of current opportunities, challenges and risks of artificial intelligence

General application examples as inspiration for the Grand Challenges Identification of concrete application examples in the field of Grand Challenges and related areas

Workshop 3: Development of the problem-solution fit

Development of possible fields of innovation as an ideation starting pointIdeation phase with iterative idea development (e.g. using brainwriting or World Café methods, Walt Disney method)

Development of the business case (rough) - what impact does the concept have on the Grand Challenge

Final presentation #svhs#amp## Networking event:

Presentation, discussion and evaluation of the final concepts

Literature:

- Rohrbeck, R., & Gemünden, H. G. (2008). Strategic Foresight in Multinational Enterprises: Building a Best-Practice Framework from Case Studies. In R&D Management Conference 2008 “Emerging methods in R&D management” (pp. 10–20)..
- KRYSTEK, U. , 2007. Strategische Früherkennung. ZfCM Controlling & Management, 2, 50–59..
- Von der Gracht, H. a., Vennemann, C. R., & Darkow, I.-L. (2010). Corporate foresight and innovation management: A portfolio-approach in evaluating organizational development. Futures, 42(4), 380–393. doi:10.1016/j.futures.2009.11.023.
- Schatzmann, J., Schäfer, R., & Eichelbaum, F. (2013). Foresight 2.0 - Definition, overview & evaluation. European Journal of Futures Research, 1(1), 15. doi:10.1007/s40309-013-0015-4.
- • Saritas, O., & Smith, J. E. (2011). The Big Picture – trends, drivers, wild cards, discontinuities and weak signals. Futures, 43(3), 292–312. doi:10.1016/j.futures.2010.11.007.

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

Responsible for module:		
Lecturers:		
Language of instruction:	English	
Credit points / SWS:	15 ECTS / 2 SWS	
Workload:	Contact hours: Self-study: Total:	12 h 438 h 450 h
Subjects of the module:	Research Project (Elective Course I + II + III)	
Lecture types:	Project	
Examinations:	project work (outside the examination period) 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

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

ABI-Basics in Biotechnology (Bridge module)

Module abbreviation:	ABI-Basics in Biot. (Bridge module)	**Reg.no.:**	
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	Elective modules	

Responsible for module:	Gaisser, Sibylle
Lecturers:	Gaisser, Sibylle; Loos, Simone
Language of instruction:	English
Credit points / SWS:	5 ECTS / 3 SWS
Workload:	Contact hours: 15 h Self-study: 135 h Total: 150 h
Subjects of the module:	ABI-Basics in Biotechnology (Bridge module)
Lecture types:	Blended Learning (online seminar plus online self learning course)
Examinations:	participation (outside the examination period) 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 understanding of biology and chemistry

Objectives:

Knowledge: The students have knowledge about the application and the potential of microorganisms and eucaryotic cell systems in fermentation and processing processes in industrial production.

Professional Skills: The students are able to solve theoretical and practical tasks in the field of biotechnology individually and in small groups and to work on them in an application-oriented manner.

Social Skills: The students are able to understand the effects of industrial, biotechnological production processes and assess the societal and economic relevance.

Content:

The course covers the following topics:

- Applications of biotechnology with a focus on “white biotechnology”. classification of microorganisms. Biotechnological products and manufacturing processes.
- Fermentation techniques: Growth kinetics of microorganisms in batches. Fed batch and continuous fermentation, fermenter systems, agitation and mixing, scale-up.
- Downstream Processing: basic processing procedures (cell disruption, filter systems, centrifugation, chromatography), yields
- Introduction to genetic modification of organisms as basis for improved productivity

Literature:

- THIEMAN, William J. and Michael A. PALLADINO, 2020. Introduction to Biotechnology. F. edition. Harlow: Pearson Education Limited. ISBN 978-1-292-26177-5
- FOWLER, Samantha et al. ,2013: Concepts of Biology. Open Textbook Library. Open Stax. ISBN 13: 9781938168116. https://open.umn.edu/opentextbooks/textbooks/168

ABI-Common Techniques in Molecular Biology (Bridge module)

Module abbreviation:	ABI-CommonTech.in Molecular Bio.(Bridge module)	**Reg.no.:**	
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	Bridge module	

Responsible for module:	Martin, Annette	
Lecturers:	Martin, Annette	
Language of instruction:	English	
Credit points / SWS:	5 ECTS / 3 SWS	
Workload:	Contact hours: Self-study: Total:	12 h 138 h 150 h
Subjects of the module:	ABI-Common Techniques in Molecular Biology (Bridge module)	
Lecture types:	Blended Learning	
Examinations:	participation (outside the examination period) 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:

Recommended prerequisites: basic knowledge in molecular biology

Objectives:

ABI Bridging Course "Common Techniques in Molecular Biology" gives an overview about standard techniques that are often used in the molecular biology laboratory.

Technical and methodological competence:

After finishing the course, the students will have an overview of molecular biological standard methods. They know how to plan and implement standard methods like DNA extraction, PCR and gel electrophoresis.

Professional action competence:

By the end of the course, students…

… know basic molecular biology techniques and what they are used for.

… are able to interpret results

Social skills:

Students work in teams on subject-specific tasks.

Content:

The online course covers the following topics:

- Isolation of nucleic acids
- Nucleic acid gel electrophoresis
- PCR and real-time PCR

- DNA sequencing technologies
- Cloning and expression of genes
- Protein electrophoresis
- How to write a scientific protocol

Literature:

- Buckingham, L. Molecular Diagnostics. 3rd edition, FA Davis Company This textbook is available as an e-book in the university library with the following link:https://fantp20.bib-bvb.de/Touch-Point/perma.do?q=+1035%3D%22BV049431496%22+IN+%5B2%5D&v=fan&l=deAccess works from the campus network without any further intermediate steps. If you are not on the university network but are working from home, for example, you must have installed and activated eduVPN in advance so that you can access our e-books via the university IP.

ABI-Introduction to General and Organic Chemistry (Bridge module)			
Module abbreviation:	ABI-Int.Gen.Org.Chem. (Bridge module)	**Reg.no.:**	
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	Bridge module	

Responsible for module:	Künzel, Sebastian	
Lecturers:	Künzel, Sebastian	
Language of instruction:	English	
Credit points / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours: Self-study: Total:	45 h 105 h 150 h
Subjects of the module:	ABI-Introduction to General and Organic Chemistry (Bridge module)	
Lecture types:	Seminar, exercises	
Examinations:	participation (outside the examination period) 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:

Students will acquire basic knowledge in general and organic chemistry, with a focus on topics that are pre-requisite to instrumental analysis. The lectures are accompanied by a series of exercise sessions that are done in a group work format.

Content:

Atoms, Bonds, Molecules, Gases, Thermodynamics, Chemical Equilibrium, Acids and Bases, Redox Reactions, Complexes, Organic Molecules, Reaction Mechanisms, Functional Groups and their properties, Important Reactions.

Literature:

- Burrows et al., Chemistry3, Oxford University Press, 4th ed., 2021

ABI-Operational Practice (Bridge module)

Module abbreviation:	ABI-Operational Practice (Bridge module)	**Reg.no.:**	
Curriculum:	**Programme**	**Module type**	**Semester**
	Applied Biotechnology (SPO WS 21/22)	Bridge module	

Responsible for module:	Gaisser, Sibylle	
Lecturers:	Gaisser, Sibylle	
Language of instruction:	English	
Credit points / SWS:	30 ECTS / 1 SWS	
Workload:	Contact hours: Self-study: Total:	10 h 890 h 900 h
Subjects of the module:	ABI-Operational Practice (Bridge module)	
Lecture types:	Seminar	
Examinations:	presentation, 30 minutes 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:

Previous or recent employment contract for a job in the biotechnological in-dustry of at least 5 months

Recommended prerequisites:

Profound knowledge of the field of activity of the chosen company.

Objectives:

Technical and methodological competence:

The students know structures and processes in a company. They acquire a basic understanding of industrial project management. They know procedures of data reporting.

Professional action competence:

The students are able to familiarize themselves with new subject areas and work on a project inde-pendently. They succeed in putting the technical and methodological skills acquired during their studies into the practice. They know how to document their results, evaluate them and present scientific results of their project.

Social skills:

The students integrate themselves into a new social environment. They get to know existing hierarchical structures and improve their communication skills.

Content:

The students work independently on a project in a field related to biotechnology.

Outside of Ansbach University of Applied Sciences. The "Operational Practice" module includes at least 16 weeks in the company.

Literature:

none