UNIVERSITÄT HOHENHEIM

Modulhandbuch

für den Studiengang

Master of Science Food Science and Engineering

Stand Oktober 2023

Inhaltsverzeichnis

Modul: Advanced Flavor Chemistry (1508-410)

Modulverantwortung	Yanyan Zhang
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Scientific background in chemistry and biotechnology
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 1)
Studiengänge	Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Systems (Master, PO vom 01.10.2019) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	60
Selbststudium (in Stunden)	165
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	This course will offer students the knowledge on flavour legislation, flavour analysis, aroma retention & release, flavour generation, flavour biotechnology, and the roles of flavour compounds on food process & storage. The students: • know the various analytical measurements of flavour compounds, correlated instrument and data analysis • arrange instrumental analyse and sensory evaluation on flavor compounds of food and drink using the proper methods and equipment • be familiar with presenting their work through written reports and oral presentations.
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Written exam (80%), seminar (20%), practical course (passed)

Studienleistung und Gewichtung	Participation in lecture, seminar (presentation & report), and practice course (protocol)
Advanced Flavor Chemistry (1508-411)	
Person(en) verantwortlich	Yanyan Zhang
Lehrform	Vorlesung mit Übung
SWS	5
Inhalt	Lecture: Basic information on flavor property, individual aroma compounds and corresponding non-enzymatic or enzymatic pathways, flavor biotechnology, principles of analytical instruments involved in aroma analysis, sources of off-flavor compounds in raw materials, food processing and storage. Lab exercise: Perceiving and distinguishing the different odorants by sniffin sticks & Gas chromatography-olfactometry (GC-O) & data analysis of MS fragmentation & semi-quantification of odourants & bioflavor generation by submerged cultivation of edible basidiomycetes
Literatur	Belitz, H.D., Grosch, W., Schieberle, P.: Food Chemistry. Springer, 2009. Berger, R.G.: Flavours and Fragrances. Springer, 2007.
Anmerkungen	-

Modul: Advanced Meat Science and Technology (1507-500)

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Admission to a Master’s program
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 1)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl Food Systems (Master, PO vom 01.10.2019) 1. Semester, Wahl
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	60
Selbststudium (in Stunden)	165
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The aim of the course is that after completion of the course, students are able to recall knowledge of fundamental biochemical properties of animal-based raw materials. They understand various industrial processes used to convert these specific raw materials into various meat products. They generate self-reliantly the most popular and commonly manufactured meat products in teamwork. They perform the required process operations on a pilot plant scale to generate those products. They know and recognize the function and role of various additives and ingredients used to manufacture industrial meat products. They analyze and calculate the most important quality parameters for meat and meat products and know the legal framework. The students restructure raw material and technological elements according to a specific task into new products. They understand scale up issues and topics surrounding hygiene and safety of meat-based products.

	Furthermore, students are able to have advanced knowledge in key unit operations. Participants apply critical problem assessments and discriminate tasks and targets with analytical thinking. They evaluate the results for evaluation of known quality criteria. They develop their creative potential, their ability to communicate and cooperate in teamwork. They represent scientific results in an appropriate manner and improve their verbal skills.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 16 Registration: Ilias 150g, please provide the name of your master program upon registration in Ilias. Registration period: Registration opens 4 weeks prior to the start of the semester Criteria according to which places are allocated: Students of the Food Science and Engineering program will be preferred in order of registration in Ilias (first come first served). Maximum number of participants: 16
Modulprüfung und Gewichtung	Written exam 80% and oral presentation 20%; oral or online exam optional
Studienleistung und Gewichtung	oral presentation
Advanced Meat Science and Techology (1507-501)	
Person(en) verantwortlich	Jochen Weiss Monika Gibis Kurt Herrmann
Lehrform	Vorlesung
SWS	4
Inhalt	A focus of the course is to introduce students to modern industrial processes used to generate the most popular and commonly manufactured meat products, i.e. boiled, cooked or raw, fermented sausages and cooked or raw hams. Students will learn about the properties of raw materials used and issues surrounding their provisioning (e.g. slaughtering, cutting, conditioning or confectioning). The course features various guest speakers from industry that will introduce students to specific aspects of this industrial sector (e.g. encasing of products, smoking and drying of products, use of starter cultures). The course will allow an insight into key analytical methods that are required to comply with regulatory aspects of the meat products, such as method to analyze meat product quality and safety. In the course the lecturers demonstrate in a practical way the manufacturing of different kind of meat products like (emulsified, cooked and raw

	fermented sausages as well as cooked and raw ham). These products will get tested by a sensory during the course.
Literatur	Script to the module
Anmerkungen	Registration opens 4 weeks prior to the start of the semester and closes at the beginning of the semester. First preference will be given to students enrolled in the M.Sc. Food Science and Engineering and then M.Sc. Food Biotechnology. Remaining free slots will then be given to students enrolled in other M.Sc. degree programs. Lectures and part of the demonstrations will be held online.
Advanced Meat Science and Technology (1507-502)	
Person(en) verantwortlich	Jochen Weiss Monika Gibis Kurt Herrmann
Lehrform	Praktikum
SWS	2
Inhalt	A focus of the course is to introduce students to modern industrial processes used to generate the most popular and commonly manufactured meat products, i.e. boiled, cooked or raw, fermented sausages and cooked or raw hams. Students will participate in daily pilot plant exercises where they will have the opportunity to manufacture boiled, cooked or raw, fermented sausages and cooked or raw hams products themselves. The course will allow an insight into key analytical methods and will analyze the most important analytical methods for meat products that are required to comply with regulatory aspects of the meat products. They will present their group exercise in a presentation.
Literatur	Script to the module
Anmerkungen	Registration opens 4 weeks prior to the start of the semester and closes at the beginning of the semester. First preference will be given to students enrolled in the M.Sc. Food Science and Engineering and then M.Sc. Food Biotechnology. Remaining free slots will then be given to students enrolled in other M.Sc. degree programs.
Advanced Meat Science and Technology (1507-503)	
Person(en) verantwortlich	Jochen Weiss Monika Gibis Kurt Herrmann

Lehrform	Exkursion
SWS	1
Inhalt	The participants of the module will have the opportunity to visit one or more industrial meat product manufacturing facilities.
Literatur	Script to the module
Anmerkungen	Depending on availability of industrial partners, this part of the course might be transformed into another learning material.

Modul: Advanced Process Engineering Techniques for Cereal Processing (1509-500)

Modulverantwortung	Mario Jekle
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	English language skills
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 2)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Food Systems (Master, PO vom 01.10.2019) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	60
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	In the module advanced techniques and methods of the processing of cereals on their way to food will be presented. Process measurement, analysis, evaluation as well as optimization techniques will be discussed. After the module the participant knows: - Fundamentals of advanced process engineering techniques - The diversity of cereals as raw material - Milling, fermenting and baking techniques - Functional ingredients - Molecular reactions that occur during cereal processing, The advanced process analytics and monitoring methods (like NIR-, fluorescence spectroscopy, image analysis),

	Different kinds of models to describe important processing steps, Process optimization procedures.
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	a written exam
Studienleistung und Gewichtung	Passing the practical course
Advanced Process Engineering Techniques for Cereal Processing (1509-501)	
Person(en) verantwortlich	Mario Jekle
Lehrform	Vorlesung mit Exkursion und Praktikum
SWS	4
Inhalt	In the module advanced techniques and methods of the processing of cereals on their way to food will be presented. The topics are : -Process analysis technology of cereal processing, -Breeding and growing aspects, -Storage, cleaning and milling techniques, -Cereal products, -Functional ingredients and molecular reactions, -NIR-, fluorescence, image analysis, -Mixing, kneading, proving, baking techniques -Modeling techniques of processing steps
Literatur	Burns, D.A.; Ciurczak, E.W.: Handbook of Near-Infrared Analysis, CRC Press, Boca Raton, 2008; Cauvain, S.P.: Bread making, Woodhead Publishing Limited, Cambridge 2003; Gobbetti, M.; Gänzle, M. (Eds.): Handbook on Sourdough Biotechnology, Springer, New York, 2013; MacRitchie, F.: Concepts in Cereal Chemistry, CRC Press, Boca Raton, 2010
Anmerkungen	-

Modul: Advanced Technologies for Dairy Products and Alternatives (1505-530)

Modulverantwortung	Jörg Hinrichs
Bezug zu anderen Modulen	The module complements analytically or process-engineering oriented modules with the background of processing of milk and plant based raw material to sophisticated milk products and alternative, e.g. milk and plant-based concentrates, isolates and their application up to powders.
Teilnahmevoraussetzung	Scientific background and basics in food microbiology, chemistry, engineering, and soft matter science.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester (Block 2)
Studiengänge	M.Sc. Food Biotechnology, 2. Semester (Wahl) M.Sc. Food Science and Engineering, 2. Semester (Wahl) M.Sc. Food Systems, 4. Semester (Wahl) M.Sc. Lebensmittelchemie, 4. Semester (Wahl) M.Sc. Bioeconomy, 2. Semester (Wahl)
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	84
Selbststudium (in Stunden)	96
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The students learn to understand the advanced processing of milk and plant-based raw material in relation to the physical, chemical and microbiological properties of the raw material and the final product properties. Thereby analytical tools to characterize composition and structure of products thereof are studied in order to understand material-process-function relationships. It also teaches the concept of mass and energy balance, the estimation of microbiological risk of products and the hazard associated with the various processing steps. The students develop their ability to work independently through practical exercises. In addition, they are expected to work in teams for some exercises, e.g. practical tasks, trouble shooting. Knowledge is deepened in composition, analytics, hygiene and aseptic, and processing by means

	of membrane filtration/fractionation, evaporation, powder processing. Finally, trouble shooting on practical issue will be done in groups and an outlook will be given to running research projects addressed on future developments and innovations.
empfohlene Vorkenntnisse	-
Anmerkungen	Anzahl Teilnehmerplätze: 25 Registration via ILIAS („First come, first served“) Students who have a contagious disease according to the Federal Epidemics Act are not allowed to participate!
Modulprüfung und Gewichtung	exam (90%), protocol (10%)
Studienleistung und Gewichtung	-

Science and Engineering of Advanced Processing (1505-531)

Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Vorlesung
SWS	2
Inhalt	The topics are: 1. Physics, chemistry milk and plant based raw material 2. Chemical and physical analytics 3. Hygiene and Aseptic processing 4. Vacuum evaporation and concentrates 5. Membrane materials and processing 6. Drying basics 7. Drying 8. Trouble shooting methods 9. Research innovations and outlook
Literatur	Scientific literature, doctoral theses, publications from the department, textbooks in the departmental library. Encyclopedia of Dairy Science, 3rd Edition, 2021 Elsevier Verlag, Editor John W. Fu-quay, P. F Fox, Hubert Roginski, ISBN: 978-0-12818-767-8

	Kessler H.G.: Food & Bio-Process Engineering – Dairy Technology. Verlag A. Kessler, München 2011 Belitz H.D., Grosch W., Schieberle P. Food Chemistry.3rd Edition. 2004, Springer Verlag Lecture handouts
Anmerkungen	-
Seminar in advanced processing (1505-532)	
Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Seminar
SWS	2
Inhalt	Rework lecture and questions, evaluation, discussion and deepening knowledge of the lecture.
Literatur	Scientific literature, doctoral theses, publications from the department, textbooks in the departmental library. Lecture handout
Anmerkungen	-
Pilot plant experiments in advanced processing (1505-533)	
Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Übung mit Exkursion
SWS	2
Inhalt	Training in processing, analytics and sensory (from raw material to the final product) using membrane filtration, e. g. reverse osmosis and ultrafiltration in processing of raw material, fouling & cleaning, consumer milk and analogs & sensory, ice cream Excursion in processing companies (the latter cannot be guaranteed, as legal requirements/contact persons in companies can change rapidly).
Literatur	Lecture handout and exercise handout
Anmerkungen	Students who have a contagious disease according to the Federal Epidemics Act are not allowed to participate! Participation in the experiments in the pilot plant of the Hohenheim Research and Teaching Dairy is only permitted with appropriate protective clothing.

Modul: AgFoodTech (1507-450)

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	The module is taught directly following the introductory SPOC, which introduces students to the food system. In the module, students focus on the AgriFood subsegment of this system, from the combined perspectives of agrarian technology and food science. The module enables them to take a systemic-integrative perspective on this subsegment of the Food System. This perspective will be further enriched and fleshed out in two further modules chosen from the pool of electives.
Teilnahmevoraussetzung	Students have to be enrolled in the first semester of the Food Systems master program.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	4 Wochen (Block 2)
Studiengänge	M.Sc. Food Systems, 1. Semester, Pflicht M.Sc. Bioeconomy, 2./4. Semester, Wahl (Profil: Transforming Food Systems) M.Sc. Food Science & Engineering, 3. Semester, Wahl M.Sc. Lebensmittelchemie, 3. Semester, Wahl M.Sc. Ernährungsmedizin, 3. Semester, Wahl M.Sc. Medizinische Ernährungswissenschaft, 3. Semester, Wahl M.Sc. Molekulare Ernährungswissenschaft, 3. Semester, Wahl M.Sc. Molekulare Ernährungswissenschaft (ab Studienbeginn WS 23/24), 3. Semester, Wahl M.Sc. Agrarbiologie, 3. Semester, Wahl
Prüfungsdauer (in Minuten)	90
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	- Students can organize individual field, post-harvest, and food processing technologies into sequential transformation chains - Students can appraise the functionalities of sequential transformation chains

	- Students can investigate and quantitatively assess key process outcomes of select chains based on given input parameters (e.g. energy, mass, properties of raw materials etc.) - Students can classify and explain key agriculture and food technologies that transform raw material into value added foods - Students can define the role of AgFoodTech in the food system - Making value judgments and sustainability competencies - Creativity skills and competencies - Research skills and competencies - Intellectual transforming skills and competencies
empfohlene Vorkenntnisse	-
Anmerkungen	Sign-up for module: in ILIAS The lectures of this course might be held online. Maximum of participants 15.
Modulprüfung und Gewichtung	Written exam. Oral or online exam optional.
Studienleistung und Gewichtung	-
AgFoodTech (1507-451)	
Person(en) verantwortlich	Jochen Weiss
Lehrform	Vorlesung mit Übung, Praktikum und Exkursion
SWS	4
Inhalt	AgFoodTech combines knowledge and skill from the fields of agrarian technology and food processing. For this, the module reviews the basics of different areas of food and agricultural science. The obtained knowledge is finally merged into a self-learning project.
Literatur	-
Anmerkungen	Please bote, this module is intended for first semester Master of Food Systems students, and includes laboratories and practical exercises in fulfillment of the requirement for their degree. Preference will be given to them, but remaining spaces may be taken by for example incoming guest

	students of other semesters in the Master degree of Food Systems.

Modul: Analysis and Quality Assurance in the Food Production (1504-500)

Modulverantwortung	Mario Jekle
Bezug zu anderen Modulen	Module "Chemische Prinzipien der Lebensmittelverarbeitung" (1504-220)
Teilnahmevoraussetzung	Good scientific basics in organic chemistry, laboratory practice
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 1)
Studiengänge	M.Sc. Food Science and Engineering, 1. Semester, Pflicht M.Sc. Bioeconomy, 3. Semester, Wahl (Profil: Transforming Food Systems)
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Students acquire knowledge on food analytical methods commonly used for quality control during food processing. Reaction mechanisms being essential for the understanding of the corresponding analytical methods, will be studied in detail. Students will acquire advanced laboratory skills, and analytical data obtained will be evaluated with regard to the processing technology.
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Exam, colloquium
Studienleistung und Gewichtung	Regular attendance, analytical reports
Theoretical Introduction to the Practical „Analysis and Quality Assurance in Food Production“ (1504-501)	
Person(en) verantwortlich	Mario Jekle
Lehrform	Vorlesung
SWS	1
Inhalt	Students acquire knowledge on food analytical methods, which are be-ing used for quality control during food processing. Reaction mecha-nisms, which are essential for understanding of the

	corresponding ana-lytical methods, will be studied in detail.
Literatur	Notes with recommendations for further literature will be distributed.
Anmerkungen	-
Analysis and Quality Assurance in the Food Production (1504-502)	
Person(en) verantwortlich	Mario Jekle
Lehrform	Praktikum
SWS	3
Inhalt	The students will acquire knowledge on instrumental, chemical, and enzymatic analyses on major and minor food constituents, e.g., lipids, proteins, carbohydrates, water, minerals, vitamins, secondary plant metabolites and others. Students will acquire advanced laboratory skills, and analytical data obtained will be evaluated with regard to the processing technology
Literatur	-
Anmerkungen	-

Modul: Applied Mathematics for the Life Sciences (1101-400)

Modulverantwortung	Philipp Kügler
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Knowledge of the contents of the modul "Mathematik für Biowissenschaften" as part of the B.Sc.-programme “Lebensmittelwissenschaft und Biotechnologie” at the University of Hohenheim.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 2)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 1. Semester, Pflicht Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl Biologie (Master, PO vom 01.10.2010) 3. Semester, Wahl
Prüfungsdauer (in Minuten)	90
Präsenzstudium (in Stunden)	84
Selbststudium (in Stunden)	141
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Students will learn the basic principles of modeling and simulation with ordinary and partial differential equations in the life sciences. They will be able to classify and formulate mathematical models of processes in food science and engineering and use the software packages MATLAB to implement and numerically analyze them. Furthermore, students will know basic concepts of parameter identification and model control.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 50
Modulprüfung und Gewichtung	computer exam
Studienleistung und Gewichtung	Regular attendance and active software programming

Applied Mathematics for the Life Sciences (1101-401)

Person(en) verantwortlich	Philipp Kügler
Lehrform	Vorlesung mit Übung
SWS	6

Inhalt	ordinary differential equations, Initial value problems, boundary value problems, numerical Integration, finite difference methods, parameter identification problems, control of ordinary differential equations, MATLAB
Literatur	M.S. Gockenbach, Partial Differential Equations: Analytical and Numerical Methods, SIAM, Philadelphia, 2010 R.J LeVeque, Finite Difference Methods for Ordinary and Partial Differential Equations, SIAM, 2007 L. Edsberg, Introduction to Computation and Modeling for Differ-ential Equations, Wiley, 2008 B.R. Hunt, R.L. Lipsman, J.E. Osborn, J.M. Rosenberg, Differential Equations with MATLAB, Wiley, 2012
Anmerkungen	-

Modul: Applied Mathematics for the Life Sciences II (1101-410)

Modulverantwortung	Philipp Kügler
Bezug zu anderen Modulen	builds on the module "Applied Mathematics for the Life Sciences (1101-400)"
Teilnahmevoraussetzung	successful completion of the module "Applied Mathematics for the Life Sciences (1101-400)"
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 2)
Studiengänge	Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Biologie (Master, PO vom 01.10.2010) 2. Semester, Wahl Nachwachsende Rohstoffe und Bioenergie (Studienbeginn WS 2018/19) (Master, PO vom 01.10.2014) 2. Semester, Wahl Ernährungsmedizin (Master, PO vom 01.10.2010) 2. Semester, Wahl Molekulare Ernährungswissenschaft (Master, PO vom 01.10.2010) 2. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Nachwachsende Rohstoffe und Bioenergie (Studienbeginn SS 2019) (Master, PO vom 01.04.2019) 2. Semester, Wahl Nachwachsende Rohstoffe und Bioenergie (ab Studienbeginn WS 19/20) (Master, PO vom 01.10.2019) 2. Semester, Wahl Agrarbiologie (Master, PO vom 19.04.2021), 2. Semester, Wahlpflicht
Prüfungsdauer (in Minuten)	90
Präsenzstudium (in Stunden)	84
Selbststudium (in Stunden)	141
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Upon completion of the module students are able to: - classify and numerically solve common partial differential equations, - formulate optimization tasks and solve them numerically,

	- use simulation software. - independently solve simple simulation taks in research and development, - enter a dialogue with simulation experts in the context of interdisciplinary cooperation, - analyze scientific problems in a structured manner.
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	computer exam
Studienleistung und Gewichtung	Active participation in the lecture and exercise sessions
Applied Mathematics for the Life Sciences II (1101-411)	
Person(en) verantwortlich	Philipp Kügler
Lehrform	Vorlesung mit Übung
SWS	6
Inhalt	- classification of partial differential equations - finite difference method and finite element method - classification of optimization tasks - ways to solve constant optimization problems - control and parameter identification tasks
Literatur	M.S. Gockenbach, Partial Differential Equations: Analytical and Numerical Methods, SIAM, Philadelphia, 2010 R.J. LeVeque, Finite Difference Methods for Ordinary and Partial Differ-ential Equations, SIAM, 2007 L. Edsberg, Introduction to Computation and Modeling for Differential Equations, Wiley, 2008
Anmerkungen	-

Modul: Arzneistoffe & Ernährung (1402-460)

Modulverantwortung	Sascha Venturelli
Bezug zu anderen Modulen	Das Modul baut auf der Grundlagenvorlesung Biochemie der Ernährung auf
Teilnahmevoraussetzung	Grundlagen der Biochemie, Deutsch- und Englischkenntnisse, Kenntnisse im Umgang mit Literaturdatenbanken
Lehrsprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	4 Wochen (Block 2 im Sommer, Block 3 im Winter)
Studiengänge	M.Sc. Molekulare Ernährungswissenschaft, 2./3. Semester, Wahlpflicht oder Wahl M.Sc. Molekulare Ernährungswissenschaft (ab Studienbeginn WS23/24), 2./3. Semester, Wahl M.Sc. Ernährungsmedizin, 2./3. Semester, Wahlpflicht M.Sc. Medizinische Ernährungswissenschaft, 2/3. Semester Wahl M.Sc. Food Biotechnology, 2. Semester, Wahl M.Sc. Food Science and Engineering, 2. Semester, Wahl M.Sc. Agrarbiologie, 2. Semester, Wahlpflicht
Prüfungsdauer (in Minuten)	90
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Ziel des Moduls ist, dass die Studierenden nach dessen Abschluss in der Lage sind, die wichtigsten biochemischen Grundlagen bedeutender Krankheitsbilder zu beherrschen und auch wiederzugeben zu können. Zusätzlich sollen die Studierenden auch darüber Bescheid wissen, welche Arzneistoffe für die entsprechenden Krankheitsbilder eingesetzt werden und wie diese biochemisch wirken. Darüber hinaus soll auch der Einfluss einer geeigneten Ernährung beziehungsweise Diät im Hinblick auf Prävention und Therapie dieser Erkrankungen erörtert werden. Abschließend sollen die Studierenden auch über mögliche Einflüsse falscher Ernährung bei der Entstehung dieser Krankheitsbilder Bescheid wissen und

	gegenüber bestimmten Wechselwirkungen zwischen Arzneistoffen und Ernährung sensibilisiert werden. Darüber hinaus sind Studierende in der Lage, sich eigenständig aktuelle Informationen zu Krankheitsbildern, den zugehörigen Arzneimitteln und Ernährungsempfehlungen zu beschaffen und diese auch kritisch zu bewerten sowie vor den anderen Modulteilnehmern zu präsentieren. Darüber hinaus lernen die Studierenden auch den Inhalt von aktueller Fachliteratur kritisch zu diskutieren und einzuordnen. Insbesondere sollen die Studierenden in die Lage versetzt werden Studiendaten zu interpretieren und Vernetzungsmöglichkeiten verschiedener Disziplinen im Kontext der Therapie von Krankheiten zu erkennen.
empfohlene Vorkenntnisse	-
Anmerkungen	Anzahl Teilnehmerplätze: 15 Anmeldung zum Modul über ILIAS Bevorzugt werden die Studierenden aus ernährungswissenschaftlichen Masterstudiengängen zugelassen.
Modulprüfung und Gewichtung	Präsentation
Studienleistung und Gewichtung	-
Arzneistoffe und Ernährung (1402-461)	
Person(en) verantwortlich	Sascha Venturelli
Lehrform	Vorlesung mit Seminar
SWS	4
Inhalt	Inhalt des Moduls sind die biochemischen Grundlagen zum Verständnis unterschiedlicher Krankheitsbilder sowie die wichtigsten pharmakologischen Eingriffsmöglichkeiten. Basierend auf diesen Grundlagen wird dann der Einfluss der Ernährung auf die Therapie und Prävention dieser Krankheitsbilder sowie auf die Wirkung unterschiedlicher Arzneistoffe behandelt und analysiert. Wichtige Krankheitsbilder, die besprochen werden, sind u.a. Diabetes mellitus Typ 1 und 2, Krebserkrankungen und Herz-Kreislauferkrankungen.

Literatur	Löffler Petrides: Biochemie und Pathobiochemie, Springer-Verlag Berlin Heidelberg 9. 2014 Auflage
Anmerkungen	15 Teilnehmer

Modul: Bioethanol and Distilled Spirits (1506-500)

Modulverantwortung	Ralf Kölling-Paternoga
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 4)
Studiengänge	Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	70
Selbststudium (in Stunden)	155
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	On successful completion of the module you are familiar with the basic concepts of bioethanol and distilled spirits production. You are acquainted with the raw materials used in ethanol production. You know the methods and procedures used to convert the sugar present in the raw materials into ethanol and you have learned to apply this theoretical knowledge in practice. Furthermore, you know how some of the popular distilled spirits are made. You improved your skills in recognizing problems in the manufacturing process of food or beverages and to find goal-oriented solutions to these problems. You enhanced your understanding of the basic concepts in food technology and learned how to apply these concepts in practice.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 20
Modulprüfung und Gewichtung	Written exam
Studienleistung und Gewichtung	Regular attendance and active participation. Practical report.
Bioethanol and Distilled Spirits, Lecture (1506-501)	

Person(en) verantwortlich	Ralf Kölling-Paternoga
Lehrform	Vorlesung
SWS	2
Inhalt	In the lecture, the different steps in the manufacturing process of fermentation ethanol from feedstock preparation to mashing process, fermentation and distillation are presented. The different feedstocks are discussed with respect to their properties and suitability for ethanol production. Also, the production process of some popular distilled spirits will be examined in detail. In addition, we talk about the basics of sensory testing of distilled spirits.
Literatur	Alcohol Textbook, Lyons, Kelsall, Murtagh (Eds.), Nottingham University Press (2004) Sprituosen-Technologie, Kolb, Behr Verlag (2004) The Biotechnology of Ethanol, Rohr (Ed.), Wiley-VCH (2001)
Anmerkungen	Alcohol Textbook, Lyons, Kelsall, Murtagh (Eds.), Nottingham University Press (2004) Sprituosen-Technologie, Kolb, Behr Verlag (2004) The Biotechnology of Ethanol, Rohr (Ed.), Wiley-VCH (2001)
Bioethanol and Distilled Spirits, Seminar (1506-502)	
Person(en) verantwortlich	Ralf Kölling-Paternoga Daniel Einfalt
Lehrform	Seminar
SWS	1
Inhalt	In the seminar, you will deepen certain aspects brought up in the lecture, like e.g. specific problems with different feedstocks in starch to sugar conversion. You learn about herbal drugs used in distilled spirits production. You practice alcoholometric calculations. Finally, you will apply your sensory expertise acquired in the lecture to organoleptic testing of whiskies.
Literatur	-
Anmerkungen	-
Bioethanol and Distilled Spirits, Practical (1506-503)	
Person(en) verantwortlich	Ralf Kölling-Paternoga Daniel Einfalt
Lehrform	Praktikum
SWS	2
Inhalt	In the practical, you will put your theoretical knowledge gained in the lecture into practice. You will

	perform the mashing process of starchy feedstock in lab scale and pilot plant scale at our university distillery and analyze the process parameters. You will examine in detail the distillation process on our 48-stage rectification column. You will make use of fractioned distillation on a "birectificator" to evaluate the quality of different cognacs or brandies.
Literatur	-
Anmerkungen	-

Modul: Biology of Aging and the Impact of Nutrition (1403-500)

Modulverantwortung	Jan Frank
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	B. Sc. education with toxicology, biofunctionality, biochemistry or similar.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 2)
Studiengänge	M.Sc. Agrarbiologie, 2. Semester, Wahlpflicht M.Sc. Ernährungsmedizin, 2. Semester, Wahlpflicht oder Wahl M.Sc. Medizinische Ernährungswissenschaft, 2. Semester, Wahlpflicht M.Sc. Molekulare Ernährungswissenschaft, 2. Semester, Wahlpflicht oder Wahl M.Sc. Molekulare Ernährungswissenschaft (ab Studienbeginn WS2/24), 2. Semester, Wahlpflicht M.Sc. Food Biotechnology, 2. Semester, Wahl M.Sc. Food Science and Engineering, 2. Semester, Wahl
Prüfungsdauer (in Minuten)	60
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The students - understand the basics of the ageing process. - understand the pathomechanism of age-related diseases. - understand the potentials and limitations of nutritional interventions in the ageing process and the pathophysiology of age-related diseases.
empfohlene Vorkenntnisse	-
Anmerkungen	Registration: via ILIAS, at the latest four weeks before the start of the module
Modulprüfung und Gewichtung	Written examination (100%)
Studienleistung und Gewichtung	-

Biology of Aging and the Impact of Nutrition (1403-501)	
Person(en) verantwortlich	Jan Frank
Lehrform	Vorlesung
SWS	4
Inhalt	- Mechanistic changes in the ageing process - Social, demographic changes in old age - Ageing and nutrition (supply situation, intervention) - Pathophysiology of selected diseases - Role of the supply of nutrients and micronutrients in pathology
Literatur	Aging: Facts and Theories (Interdisciplinary Topics in Gerontology) Robert, L.,Fulop, T. (Karger) 2014 Masoro, Austad: Handbook of the Biology of Aging, Academic Press, 2001
Anmerkungen	-

Modul: Biotechnology (1502-450)

Modulverantwortung	Lutz Fischer
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester (Block 2)
Studiengänge	M.Sc. Food Biotechnology (1. Semester, Pflicht) M.Sc. Food Science and Engineering (1./3. Semester, Wahl) M.Sc. Lebensmittelchemie (3. Semester, Wahl)
Prüfungsdauer (in Minuten)	30
Präsenzstudium (in Stunden)	90
Selbststudium (in Stunden)	135
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	After this module, the students have knowledge about enzymatic analysis, especially in using enzymes for the determination of food ingredients. In addition, they have learned how to produce an enzyme recombinantly in the bacterium Escherichia coli. This includes molecular biology methods such as plasmid isolation and transformation as well as media and buffer compositions, E. coli cultivation and its evaluation. Finally, after this module the students can perfom and evaluate biotransformation processes. The students have knowledge about different immobilisation methods of enzymes after this modul Upon completion of this module the students are able to plan and work in a laboratory independently. They will be able to interpret their results and to compare them with known data from literature. In addition, they will be able to present and discuss their results in front of an audience.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 24
Modulprüfung und Gewichtung	Protocol (40%), Presentation of Results and Oral Exam (60%)

Studienleistung und Gewichtung	Lab book and seminar & lab experiments
Biotechnology (1502-451)	
Person(en) verantwortlich	Lutz Fischer
Lehrform	Vorlesung mit Praktikum
SWS	4
Inhalt	In interactive lessons the students will learn the principles of enzymatic determinations of food ingredients, the methods used for the recombinant production of enzymes in Escherichia coli as well as using enzymes in biotransformation and enzyme immobilization techniques for biotransformation. In the practical part of this module the students use the theoretical knowledge to plan and carry out the experiments. They will determine for example the glucose or citrate content in juice and wine using enzymatic methods. In addition, the students will produce an enzyme recombinantly in E. coli, determine the enzyme activity and protein content. Moreover, they will immobilize an enzyme, use it for biotransformation and further analyze the samples using thin layer chromatography. The analysis of the results and their interpretation will be discussed and evaluated.
Literatur	-
Anmerkungen	-

Modul: Cellular Microbiology (1909-430)

Modulverantwortung	Julia Fritz-Steuber
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 2)
Studiengänge	Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Biologie (Master, PO vom 01.10.2010) 2. Semester, Wahlpflicht
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The students know different strategies of bacterial pathogens to manipulate the host. They understand the mechanism of action of virulence factors on a molecular level. They understand the importance of environmental factors for the morphology of a bacterial cell, for example during biofilm formation. The students are encouraged to work as independent as possible in a team solving a current problem in research. They analyse their data and discuss their results with respect to existing theories in the field. They write a scientific report of their research
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 6 Registration: via ILIAS Registration period: from March 18 to April 5

	Module code until summer term 2022: 2502-430
Modulprüfung und Gewichtung	Oral presentation (50%) and protocol (50%)
Studienleistung und Gewichtung	Regular and active participation
Cellular Microbiology, Lecture (formerly 2502-431) (1909-431)	
Person(en) verantwortlich	Julia Fritz-Steuber
Lehrform	Vorlesung
SWS	1
Inhalt	The students know different strategies of bacterial pathogens to manipulate the host. They understand the mechanism of action of virulence factors on a molecular level. They understand the importance of environmental factors for the morphology of a bacterial cell, for example during biofilm formation.
Literatur	Michael Wilson, Rod McNab, Brian Henderson: "Bacterial Disease Mechanisms: An Introduction to Cellular Microbiology", Cambridge University Press, 2002 Pascale Cossart, Patrice Boquet, Staffan Normark, Rino Rappuoli: "Cellular Microbiology", ASM Press, 2004
Anmerkungen	Maximum of 6 participants | Requirement for participation: Regular and active participation of the course “Cellular Microbiology, Research Internship” (1909-432)
Cellular Microbiology, Research Internship (formerly 2502-432) (1909-432)	
Person(en) verantwortlich	Julia Fritz-Steuber
Lehrform	Praktikum
SWS	3
Inhalt	The students are encouraged to work as independent as possible in a team solving a current problem in research. They analyse their data and discuss their results with respect to existing theories in the field. They write a scientific report of their research project according to the rules for scientific writing. They present their results in a lecture.
Literatur	Kathleen McMillan, Jonathan Weyers: "How to Write Dissertations & Project Reports" Pearson Education, 2007
Anmerkungen	Maximum of 6 participants | Requirement for participation: Regular and active participation of the course “Cellular Microbiology, Lecture” (1909-431)

Modul: Computational Thinking (1511-400)

Modulverantwortung	Christian Krupitzer
Bezug zu anderen Modulen	No previous knowledge is expected for this module.
Teilnahmevoraussetzung	
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester
Studiengänge	M.Sc. Food Biotechnology, 3. Semester, Wahl M.Sc. Food Science and Engineering, 3. Semester, Wahl M.Sc. Lebensmittelchemie, 3. Semester, Wahl M.Sc. Food Systems, 3. Semester, Wahl M.Sc. Bioeconomy, 3. Semester, Wahl (Profil: Transforming Food Systems | Data Science and Artificial Intelligence)
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	63
Selbststudium (in Stunden)	162
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	This module will provide essential knowledge of the technological foundations of information systems. Based on this, students will be able to assess technology but also to develop software and acquire fundamentals for learning machine learning techniques. The students will learn basic concepts of computer hardware (von Neumann architecture) and system software (operating systems concepts), programming fundamentals (Java or Python), as well as algorithms and data structures (searching, sorting, lists, hash-tables, trees). This includes an understanding of the basic architectures of modern information systems, software implementation, and how to model problems in algorithms/software and how solve them using modern programming languages.
empfohlene Vorkenntnisse	-
Anmerkungen	-
Modulprüfung und Gewichtung	Written examination: 100%

Studienleistung und Gewichtung	-
Computational Thinking (1511-401)	
Person(en) verantwortlich	Christian Krupitzer
Lehrform	Vorlesung mit Übung
SWS	6
Inhalt	The students will learn basic concepts of computer hardware (von Neumann architecture) and system software (operating systems concepts), programming fundamentals (Java or Python), as well as algorithms and data structures (searching, sorting, lists, hash-tables, trees). This includes an understanding of the basic architectures of modern information systems, software implementation, and how to model problems in algorithms/software and how solve them using modern programming languages.
Literatur	List of English literature will be provided at start of course.
Anmerkungen	No previous knowledge is expected for this module.

Modul: Current Topics in Food Material Sciences (1507-630)

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	1 Semester
Studiengänge	M.Sc. Agrarbiologie, 3. Semester, Wahl M.Sc. Lebensmittelchemie, 3. Semester, Wahl M.Sc. Food Systems, 1. Semester, Wahl M.Sc. Food Science and Engineering, 3. Semester Wahl
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The aim of the module is that the students are able to … - to understand and solve problems in the field of food materials science. - to work out experimental design and conception based on a research question in the field of food material science. - to be able to carry out practical, scientific work in the laboratory and pilot plant. - to evaluate and present scientific results.
empfohlene Vorkenntnisse	-
Anmerkungen	Anzahl Teilnehmerplätze: 15 Anmeldung zum Modul: ILIAS Anmeldezeitraum: bis 4 Wochen vor Modulbeginn Kriterien, nach denen Studienplätze vergeben werden: Reihenfolge der Anmeldung
Modulprüfung und Gewichtung	protocol and oral presentation
Studienleistung und Gewichtung	-

Current Topics in Food Material Sciences (1507-631)	
Person(en) verantwortlich	Jochen Weiss
Lehrform	Seminar mit Übung
SWS	4
Inhalt	Design, performance, evaluation, and interpretation of real scientific experiments in current food materials science research projects under the guidance of an experienced scientist.
Literatur	Will be announced during the course.
Anmerkungen	-

Modul: Drying, Granulation and Instantisation (1503-540)

Modulverantwortung	Reinhard Kohlus
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Knowledge of equivalent to Food Process Design I, e.g. Basics of fluid mechanics, mass and heat transfer, unit operations in food processing.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 4)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Food Systems (Master, PO vom 01.10.2019) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The students will learn to model drying problems. Starting at the physical basics of drying up to equipment design. They know key quality parameter and degradation mechanism for dry / low aw food. The learned skills focus on applicable knowledge which is based on strong basic / theoretical foundations allowing to apply it in a wide context. The application of computer based methods is trained by working on application case studies.

	Key competencies addressed in this module are critical problem assessment and analytical thinking.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 20 Registration via ILIAS until 2 weeks before the course starts.
Modulprüfung und Gewichtung	Written exam (60 minutes), oral exam (30 minutes).
Studienleistung und Gewichtung	-

Drying, Granulation and Instantisation (1503-541)

Person(en) verantwortlich	Reinhard Kohlus
Lehrform	Vorlesung mit Praktikum
SWS	4
Inhalt	Selection and lay out (dimensioning) of drying equipment for tasks in food processing. Scientific description of dryer, typical equipment used in food drying: i.e. spray dryer, belt drier, roller drier, freeze drier Analysis and modelling of temperature-moisture behaviour of foods. Fundamentals of Agglomeration / granulation. Design, Scale up and operation (Process lay out) of granulators and agglomerators (Fluid bed and High shear mixer). Computation of relevant problems related to dry food. Fundamental approach to problems in drying and dealing with low aw foods. Selected examples of recipe effects in drying and instantisation of food. Quality parameter of dry foods, interactions and storage effects. Characterisation, functionality and quality of food powders and related property functions, importance of amorphous state mechanism and parameter determining the quality of low aw food and their relation to the drying process.
Literatur	Trocknungstechnik in der Lebensmittelindustrie , Gehrmann, Esper, Schuchmann, Behrs-Verlag 2009; Die wissenschaftlichen Grundlagen der Trocknungstechnik Band 1, , O. Krischer, W. Kast Springer Verlag 1992
Anmerkungen	List of English literature will be provided at start of course

Modul: Encapsulation of Functional Food Components (1507-410)

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Admission to a Master's program of Food Science & Engineering or the Doctoral degree program at the Faculty of Natural Sciences. This advanced module requires basic knowledge of food structures.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 3)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Wahl Promotionsstudiengang Naturwissenschaften (Promotionsstudiengänge, PO vom 14.02.2015) 1. Semester, Wahl Food Systems (Master, PO vom 01.10.2019) 1. Semester, Wahl
Prüfungsdauer (in Minuten)	20
Präsenzstudium (in Stunden)	70
Selbststudium (in Stunden)	155
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Upon completion of this (partly online) module, students are expected to have gained an overview of the importance of encapsulation, and encapsulants for applications in food and related fields. The students are able to demonstrate an understanding of (i) the physicochemical properties of functional ingredients, (ii) the fundamental physical and chemical processes governing the behavior and stability of the encapsulation systems, and (iii) principles of encapsulation technologies and key processing parameters, and apply this knowledge to encapsulation-related challenges. Furthermore, the students are able to explain, evaluate, and communicate their findings/solutions to their peers and professionals.

	Furthermore, students are able to work as a part of a team, and develop stronger communication skills by completing assignments and designing clear and well-organized presentations. The students are expected to apply critical and analytical thinking to solve encapsulation-related challenges. Furthermore, the students are required to demonstrate their critical and analytical thinking skills by asking critical questions during the student presentations of other students' assignments. Students are able to improve their written and oral English skills.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 16 Sign-up for module: in Ilias. The places in the module are given as „First come, first served basis". Some parts of the module may be held online as synchronous and/or asynchronous learning elements.
Modulprüfung und Gewichtung	Oral exam (75%). Development project and its presentation (25%).
Studienleistung und Gewichtung	Laboratory work, Presentation of laboratory work.
Encapsulation of Functional Food Components with Excercises (1507-411)	
Person(en) verantwortlich	Jochen Weiss
Lehrform	Vorlesung mit Übung und Praktikum
SWS	4
Inhalt	This module reviews the principles of encapsulation and aims to deliver knowledge of encapsulation systems and encapsulation processes. The goal of this module is to develop skills needed in encapsulating functional components in food or related indus-tries. Industry-hosted lectures give insights into encapsulation from an industrial point-of-view. Student assignments aim to promote knowledge transfer and enable the students to apply scientific concepts and scientific literature. These assignments involve, for example, a literature-based

	development project and a laboratory study. Both assingments will be also orally presented during the module.
Literatur	Encapsulation Technologies for Active Ingredients and Food Processing, Verlag Springer, Berlin, 2009, ISBN: 978-1441910073 Encapsulation and Controlled Release Technologies in Food Systems. Blackwell Publishers, New York, 2007, ISBN: 978-0813828558 Encapsulation and Controlled Release. Woodhead Publishers, New York, 1993, ISBN: 978-1855738201
Anmerkungen	Maximum number of participants: 12 Basic knowledge in food structures required

Modul: Enzymatic Reactions (1502-410)

Modulverantwortung	Lutz Fischer
Bezug zu anderen Modulen	The module is part of the series Enzyme Biotechnology .
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 4)
Studiengänge	M.Sc. Food Biotechnology, 3. Semester, Wahl M.Sc. Food Science and Engineering, 3. Semester, Wahl M.Sc. Biologie, 3. Semester, Wahl M.Sc. Molekulare Ernährungswissenschaft, 3. Semester, Wahl M.Sc. Molekulare Ernährungswissenschaft (ab Studienbeginn WS23/24), 3. Semester, Wahl
Prüfungsdauer (in Minuten)	30
Präsenzstudium (in Stunden)	90
Selbststudium (in Stunden)	135
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Upon completion students are able to determine the enzyme activity of different kinds of enzymes. In addition, students are able to plan, perform and evaluate scientific experiments to characterize enzymes using different biochemical methods on their own. The students are able to plan and performe a gene transformation and express an enzyme recombinantly in a microorganism. The aim of this module is that students are able to plan and work in a laboratory indepedently. They will be able to interpret their results and to compare them with known data from literature. In addition, they will be able to present their results in front of an audience.
empfohlene Vorkenntnisse	-
Anmerkungen	Minimum number of participants: 6 Maximum number of participants: 12

	Registration: via ILIAS
Modulprüfung und Gewichtung	oral examinations (50%), protocol (50%) (oral examinations are about the theory and results of the practical parts which will be presented by the student in seminars)
Studienleistung und Gewichtung	Attendance and active participation in seminars and practical course, protocol
Enzymatic Reactions | Lectures and Seminar (1502-411)	
Person(en) verantwortlich	Sabine Lutz-Wahl Timo Stressler Lutz Fischer
Lehrform	Vorlesung mit Seminar
SWS	1,5
Inhalt	Students will learn the theoretical backgrounds for enzyme activity determination, enzyme process development and they will gain knowledge about enzyme applications in the industry. The students will learn to examine and use current scientific literature about certain enzyme classes. Key words: - Screening for suitable and/or new enzymes - Enzymes in non-conventional media - Enzymes modified by bioimprinting methodology - Immobilisation of biocatalysts - HPLC and CGC Analaysis to quantify enzyme activities Besides the students will present their own results, evalutate and discuss them (will be marked).
Literatur	Current original papers about enzymes, text books for laboratory work, General Literatur: Bisswanger, H.: Practical Enzymology, 2. ed., Wiley-Blackwell Buchholz, K., Kasche V., Bornscheuer U.: Biocatalysts and Enzyme Technology, 2. ed., Wiley-Blackwell Current scientific publications (will be provided)
Anmerkungen	-
Enzymatic Reactions | Practical course (1502-412)	
Person(en) verantwortlich	Lutz Fischer
Lehrform	Praktikum
SWS	6
Inhalt	Students will learn to apply knowledge from the literature and text books by itself. By doing so, They will learn to determine the enzyme activity of a particular enzyme class with suitable methods. In addition, the enzymes will be partrly characterized

	biochemically (e.g. pH-profile, temperature profile, inhibitors,...).
Literatur	Current literature about particular enzyme classes, original articles and reviews (will be discussed with supervisor) General text books: Bisswanger, H.: Practical Enzymology, 2. ed., Wiley-Blackwell Buchholz, K., Kasche V., Bornscheuer U.: Biocatalysts and Enzyme Technology, 2. ed., Wiley-Blackwell
Anmerkungen	-

Modul: Food Microbiology (1501-440)

Modulverantwortung	Herbert Schmidt
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Bachelor's degree in a natural science degree programme in Life Sciences
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 1)
Studiengänge	M.Sc. Food Biotechnology (1. Semester, Pflicht)
Prüfungsdauer (in Minuten)	45
Präsenzstudium (in Stunden)	96
Selbststudium (in Stunden)	129
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The aim of the module is that upon completion students will be able to - understand and explain basic principles of scientific operation - present various principles of diagnostics and taxonomy of food-associated microorganisms - conceptualise, prepare and discuss presentations in microbiology based on original publications - discuss and apply new experimental, analytical methods in the field of food microbiology - independently plan, prepare and carry out practical laboratory experiments in the field of isolation and characterisation of lactic acid bacteria from fermented milk products. - understand and apply laboratory record keeping and scientific documentation. - apply bioinformatic sequence analysis of 16S rRNA genes. - understand and discuss ethical principles in science. - work independently and acquire knowledge

	- read and discuss technical literature critically - use technical terms correctly - use scientific terminology - plan, carry out and evaluate laboratory experiments independently - evaluate own results against the background of the scientific literature. - apply the acquired knowledge in an interdisciplinary manner - apply communication and cooperation skills
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 24 Registration: via ILIAS Criteria according to which places are allocated: Registration within the registration period, study course
Modulprüfung und Gewichtung	Protocol / seminar presentation / poster (All three performances must be completed. The module is ungraded)
Studienleistung und Gewichtung	-
Food Microbiology - Laboratory Course and Documentation (1501-441)	
Person(en) verantwortlich	Herbert Schmidt
Lehrform	Vorlesung mit Seminar und Laborübungen
SWS	6
Inhalt	- Microbial starter cultures: taxonomy, fermentation, metabolism and genetics - Literature databases - Documentation and presentation tools - Preparation of culture media, solutions and buffer - Isolation and characterization of lactic acid bacteria from fermented dairy products

	- Identification by 16S rRNA PCR and DNA sequencing - Bioinformatic analysis of DNA sequences
Literatur	Hutkins, Robert W., 2006. Microbiology and Technology of Fermented Foods. IFT Press, Blackwell Publishing, 2121 State Avenue, Ames, Iowa 50014, USA, 1st Edition.
Anmerkungen	-

Modul: Food Process Design I - Efficient Processing and Transport Phenomena (1503-520)

Modulverantwortung	Reinhard Kohlus
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Technical basics, process engineering, physical chemistry or thermody-namics of multiphase systems
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 3)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 1. Semester, Pflicht Bioeconomy (Master, PO vom 01.10.2014) 3. Semester, Wahl (Profil: Transforming Food Systems) Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl Bioeconomy (ab WS 16/17) (Master, PO vom 01.04.2017) 3. Semester, Wahl Food Systems (Master, PO 01.10.2019) 1. Sem., Wahl
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	80
Selbststudium (in Stunden)	145
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The students know the fundamentals of thermal separation processes. They are capable of applying physical-chemistry fundamentals, to design the processes. The laws of energy and mass and momentum transfer are known and can be applied to standard problems. The fundamental calculation methods are mastered.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 50

Modulprüfung und Gewichtung	oral exam (20 minutes), optional written exam (120 minutes)
Studienleistung und Gewichtung	-
Food Process Design I - Efficient Processing and Transport Phenomena (1503-521)	
Person(en) verantwortlich	Reinhard Kohlus
Lehrform	Vorlesung mit Übung
SWS	6
Inhalt	Lecture: Application of the fundamentals of thermal separation processes, multiphase flow and food process design. Specifically covered topics are drying technology, distillation and rectification, extraction, crystallization, heat transfer processes. Fundamentals: Equilibria equations, Phase and state diagrams, mass transfer equations, Multiphase flows: especially gas –liquid flows, Mass transfer in multiphase systems, two film theory, surface renewance theory Design of rectification system: McCabe Thiele Diagram, hydrodynamic design of rectification columns. Description of residence time distributions, prediction of RTD's Drying, coupling of heat and mass transfer, Glass transition temperature, sorp-tion isotherms. Optimisation of energy requirements, coupling of heat flows- Design and decision taking of heat transfer systems. Exercises and problems in the above given areas will be covered using calcu-lation and engineering software.
Literatur	Sattler; Thermische Trennverfahren; VCH Verlag Kraume, Kraume, M: Transportvorgänge in der Verfahrenstechnik, Grundlagen und Apparative Umsetzung , Springer Verlag 2004
Anmerkungen	-

Modul: Food Process Design II - Process Integration and Scale up (1503-500)

Modulverantwortung	Reinhard Kohlus
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Knowledge of equivalent to Food Process Design I, e.g. Basics of fluid mechanics, mass and heat transfer, unit operations in food processing.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 3)
Studiengänge	Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Food Systems (Master, PO vom 01.10.2019) 2. Semester, Wahl Bioeconomy (Master), 2. Semester, Wahl (Profil: Transforming Food Systems within the Bioeconomy)
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The students will learn to structure a line design problem and place it in the economical context. They will be able to make a systematic construction based on the main process-product interactions. They know the principles of the design of experiment approach and can apply these to a process design question. The students are able to solve scale up problems by principles of similitude. The learned skills focus on applicable knowledge which is based on strong basic / theoretical foundations allowing to apply it in a wide context.

	A key skill needed in this context is the ability to combine the set of tools to appropriately tackle a complex process design problem. Key competencies addressed in this module are threefold: decision making and dealing with complexity, understanding different roles in project management and team work and lastly professional communication with business partner.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 24 Registration via ILIAS
Modulprüfung und Gewichtung	oral exam (20 minutes), optional written exam (120 minutes)
Studienleistung und Gewichtung	-
Food Process Design II - Process Integration and Scale up (1503-501)	
Person(en) verantwortlich	Reinhard Kohlus
Lehrform	Vorlesung mit Übung
SWS	5
Inhalt	Set-up of requirement lists, systematic construction processes (i.e. conceptual process design), apparatus and plant engineering and construction, Process-product interactions, Robust plant design, Process scale up, Design of experi-ments for process modelling. Hygienic design rules and cleaning considera-tions (cip, wip, sip), process control strategies and process optimization.
Literatur	Blass, E.; Entwicklung Verfahrenstechnischer Prozesse; Springer, Berlin (1997) Zlokarnik, M.; Scale up ; WILEY-VCH Verlag GmbH (2005) Kleppmann, W.; Taschenbuch Versuchsplanung; Hanser Verlag 2008 Douglas, J.,M. ; Conceptual Design of Chemical Prozesses; Mac GrawHill, Boston 1976 Hauser, G.; Hygienische Produktgestaltung; WILEY-VCH Verlag GmbH (2007)
Anmerkungen	List of English literature will be provided at start of course

Modul: Food Product Development: From Concept Ideation to Product Launch (1507-520)

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Student of one of the above mentioned Master programes with good command in English language
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 4)
Studiengänge	M.Sc. Food Systems, 1./3. Semester, Wahl M.Sc. Bioeconomy, 3. Semester, Wahl Profil: Transforming Food Systems M.Sc. Food Biotechnology, 3. Semester, Wahl M.Sc. Food Science & Engineering, 3. Semester, Wahl M.Sc. Lebensmittelchemie, 3. Semester, Wahl M.Sc. Molekulare Ernährungswissenschaft, 3. Semester, Wahl M.Sc. Molekulare Ernährungswissenschaft (ab Studienbeginn WS 23/24), 3. Semester, Wahl M.Sc. Ernährungsmedizin, 3. Semester, Wahl M.Sc. Medizinische Ernährungswissenschaft, 3. Semester, Wahl
Prüfungsdauer (in Minuten)	60
Präsenzstudium (in Stunden)	70
Selbststudium (in Stunden)	155
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Students will also be able to identify and respond to market needs based on a basic understanding on. Holistic insights food product development and business creation into this topic will give them the tools to critically assess tasks in the field of product development and improvement, as well as entrepreneurial challenges to bring products to the market. This will allow them to develop leadership qualities and to work together as a team. Furthermore they will know technical terms and prerequisites related to these fields.
empfohlene Vorkenntnisse	-
Anmerkungen	Number of participants: 20

	Registration via ILIAS (4 weeks before module start) Place allocation: Eligibility and registration order in ILIAS Please note: In winter semester, this module is offered as a block (1507-521). In summer semester, this module is offered during the whole semester (1507-522).
Modulprüfung und Gewichtung	written business case (60%) and oral presentation (40%)
Studienleistung und Gewichtung	-
Food Product Development: From Concept Ideation to Product Launch (1507-521)	
Person(en) verantwortlich	Lisa Berger Jochen Weiss
Lehrform	Vorlesung
SWS	4
Inhalt	The module will cover different topic areas, such as: - Ideation in Start-Ups (conceptualization; start-up hub & entrepreneurial spirit) - Current Trends (market analysis, market trends, consumer trends) - Applied Product Development (emerging materials, emerging technologies, labelling & claims, sensory analysis, case studies, food safety, legal assessments and IP, challenges) - Corporate Identity (brand development, PR & marketing) - Innovations in Packaging (packaging materials science, packaging trends) - External Demands on Start-Ups (investment, targeting the retail) - Start-Up Case Studies (pre-seed, seed invest, invested & scaled, established businesses)
Literatur	Will be provided during the module

Anmerkungen	In winter semester, this module is offered as a block. In summer semester, this module is offered during the whole semester.

Modul: Global Nutrition and Food Security (1403-400)

Modulverantwortung	Jan Frank
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Basic knowledge of nutrition physiology (macro- and micronutrients: biochemical function and requirements) is assumed.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester (Block 4)
Studiengänge	M.Sc. Molekulare Ernährungswissenschaft, 3. Semester (Wahl) M.Sc. Molekulare Ernährungswissenschaft (ab Studienbeginn WS 23/24), 3. Semester, Wahl M.Sc. Ernährungsmedizin, 3. Semester, Wahl M.Sc. Medizinische Ernährungswissenschaft, 3. Semester, Wahl M.Sc. Food Science and Engineering, 3. Semester, Wahl M.Sc. Food Biotechnology, 3. Semester, Wahl M.Sc. Lebensmittelchemie, 3. Semester, Wahl M.Sc. Food Systems, 3. Semester, Wahl
Prüfungsdauer (in Minuten)	60
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Students can explain the framework of Food and Nutrition Security and the drivers of food insecurity. They are familiar with the nutrition situation of developing and industrialized countries and with the problems of nutrition transition. They can analyze the complexity of the interrelationship between nutrition and health in particular in the case of vulnerable groups such as pregnant women, breastfeeding mothers, children and elderly. They will be able to assess food intake and measure nutritional status, taking into account the role of food analyses. Strategies to improve nutrient intake by both food-based and non-food based approached, their limitations and how these differ between developing

	and industrialized countries are finally known by the students.
empfohlene Vorkenntnisse	-
Anmerkungen	Number of participants: 50 Registration for the module: ILIAS Registration period: 1.4. to 1 week before the start of the module Criteria according to which places are allocated: Order of registration.
Modulprüfung und Gewichtung	Written Exam (70%) and Presentation (30%)
Studienleistung und Gewichtung	Regular and active participation
Global Nutrition and Food Security (1403-401)	
Person(en) verantwortlich	Jan Frank
Lehrform	Vorlesung
SWS	4
Inhalt	This module will provide a basic oversight as to the state of global nutrition and food security and how it is assessed: dietary and anthropometric assessment, biomarkers of nutritional status and food security. The direct and indirect causes of malnutrition and food insecurity will be evaluated as well as the food based and non-food based strategies available to address these. The emerging health crisis of the double burden of malnutrition, together with nutritional transitions will be evaluated. The risks with regard to malnutrition and food insecurity for vulnerable groups such as pregnant and lactating women and refugees will be evaluated. The important roles of agricultural development, climate change and gender equality in global nutrition and food security will be discussed. Special attention will also be paid to the differences between developed and developing countries in the risks factors, vulnerable populations and appropriate strategies to address malnutrition and food insecurity.
Literatur	Development Initiatives, 2020. Global Nutrition Report 2020: Action on equity to end malnutrition, Bristol, UK: Development Initiative. Development Initiatives, 2018. Global Nutrition Report 2018: Shining a light to spur action on nutrition, Bristol, UK: Development Initiative.

	GBD 2017 Diet Collaborators. “Health effects of dietary risks in 195 countries, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017.” Lancet (London, England) vol. 393,10184 (2019): 1958-1972. https://www.thelancet.com/article/S0140-6736(19)30041-8/fulltext FAO, IFAD, UNICEF, WFP and WHO. 2020. The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets. Rome, FAO. https://doi.org/10.4060/ca9692en FAO, IFAD, UNICEF, WFP and WHO. 2019. The State of Food Security and Nutrition in the World 2019. Safeguarding against economic slowdowns and downturns. Rome, FAO. https://www.wfp.org/publications/2019-state-food-security-and-nutrition-world-sofi-safeguarding-against-economic
Anmerkungen	Ansprechpartner für diese Veranstaltung ist Herr Stütz (wolfgang.stuetz@uni-hohenheim.de)

Modul: Innovative Technologien für Milchprodukte und pflanzliche Alternativen (1505-520)

Modulverantwortung	Jörg Hinrichs
Bezug zu anderen Modulen	Das Modul ergänzt analytisch und verfahrenstechnisch orientierte Module und setzt sich insbesondere mit der Erforschung und Entwicklung neuer Ideen und Strategie zur Nachhaltigkeit, Ernährung, neuen Rohstoffen und Umweltfragen auseinander.
Teilnahmevoraussetzung	Grundlagen in Mikrobiologie, Chemie, Physik
Lehrsprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	1 Semester (1. Block)
Studiengänge	M.Sc. Food Biotechnology, 3. Semester, Wahl M.Sc. Food Science and Engineering, 3. Semester, Wahl M.Sc. Food Systems, 3. Semester, Wahl M.Sc. Lebensmittelchemie, 3. Semester, Wahl
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	70
Selbststudium (in Stunden)	155
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Ziel des Moduls ist, dass die Studierenden nach dessen Abschluss in der Lage sind, wissenschaftliche Publikationen zu neuen Themen zu suchen, einzuordnen und zu bewerten. Sie sind in der Lage, neue Fragestellungen z. B. hinsichtlich Nachhaltigkeit, neuer Rohstoffe in Verbindung z. B. mit adressierter Produktfunktionalität zu strukturieren. Sie gewinnen Kompetenz in der Anwendung von Unit Operations zur Verarbeitung innovativer Lebensmittelprodukte und der Auswahl von physikalischen, chemischen und mikrobiologischen Methoden zur quantitativen oder qualitativen Bewertung von Zielparametern. Sie sind in der Lage, im Team Potenziale für neue Verfahren oder Produkte aus wissenschaftlicher Sicht zu identifizieren, Hypothesen zu formulieren und Verarbeitungswege zu postulieren. Daraus abgeleitet sind Forschungs- und daraus abgeleitete Entwicklungsideen im Team kurz und prägnant schriftlich zusammenzustellen, zu diskutieren und zu präsentieren.

	Dieses Modul dient zudem der Einführung in die selbstständige Durchführung eines Forschungsprojektes und bereitet auf die Bearbeitung der Masterarbeit vor. Verfassen eines Manuskripts unter Verwendung der einschlägigen wissenschaftlichen Literatur zum Thema (10-15 Seiten). Diese Arbeit wird eingereicht und mit dem Betreuer besprochen und ggf. zur Publikation in einem Journal vorbereitet.
empfohlene Vorkenntnisse	-
Anmerkungen	Anzahl Teilnehmerplätze: 10 Anmeldung zum Modul: Beginn WS über ILIAS Kriterien, nach denen Studienplätze vergeben werden: First in Studierende, die eine ansteckende Krankheit nach Bundesseuchengesetz haben, dürfen nicht teilnehmen! Die Teilnahme an den Experimenten im Technikum der For-schungs- und Lehrmolkerei Hohenheim ist nur zulässig mit entsprechender Schutzkleidung.
Modulprüfung und Gewichtung	Mitarbeit im Seminar und in den praktischen Übungen; ausgearbeitetes Manuskript
Studienleistung und Gewichtung	schriftlicher Bericht
Innovative Technologien (1505-521)	
Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Vorlesung
SWS	-
Inhalt	In diesem Modul werden Fähigkeiten und Fähigkeiten vermittelt, um die Abfolge von Unit-Operations im Hinblick auf die Prozess-Struktur-Funktions Beziehungen für Milchprodukte und pflanzliche Alternativen zu analysieren. Sie lernen neue und alternative Prozesse in Forschung und Entwicklung kennen anhand von Beispielen aus der aktuellen Forschung. Präsentiert werden ausgewählte, ständig aktualisierte Topics aus dem wissenschaftlichen Bereich und wirtschaftlichen Umfeld der Verarbeitung von

	Milch und deren Alternativen. Gewährt werden Einblicke in die Beantragung und Durchführung von Forschungsprojekten.
Literatur	Wissenschaftliche Literatur, Dissertationen, Veröffentlichungen des Fachgebiets, Lehrbücher in der Fachbereichsbibliothek.
Anmerkungen	-
Projektplanung und experimentelles Arbeiten (1505-522)	
Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Seminar
SWS	1
Inhalt	Die Studierenden analysieren aktuelle Themen aus dem Bereich der nachhaltigen Lebensmittelverarbeitung auf der Basis von Natur- und Ingenieurwissenschaften. Die Auswahl des Themas erfolgt in Absprache mit dem Betreuer. Mit Unterstützung des Betreuers beschreiben, analysieren und identifizieren die Studierenden Lücken auf der Grundlage einer Literaturrecherche. Abschließend werden Forschungs- und Entwicklungsfragen diskutiert und in Manuskriptform formuliert. Folgende Methoden und Instrumente werden für die Analyse verwendet: - Literaturrecherche - Zusammenstellung und Einordnung von Daten und Erkenntnissen aus der Literatur. - Verfassen von wissenschaftlichen Texten und Erstellen von aussagekräftigen Bildern und Tabellen.
Literatur	Wissenschaftliche Literatur, Dissertationen, Veröffentlichungen des Fachgebiets, Lehrbücher in der Fachbereichsbibliothek.
Anmerkungen	-
Innovative Technologien und Analysen – Praktische Übungen (1505-523)	
Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Praktische Übung

SWS	2
Inhalt	In diesem Modul werden Fähigkeiten und Fähigkeiten vermittelt, um die Abfolge von Unit-Operations im Hinblick auf die Prozess-Struktur-Funktions Beziehungen zu analysieren. Sie lernen neue und alternative Prozesse in Forschung und Entwicklung kennen anhand von Beispielen aus der aktuellen Forschung. Theoretische Übungen und experimentelle Arbeiten im Rahmen von Projekten unter Nutzung von Pilotanlagen und spezifischen Analysen.
Literatur	Dissertationen, Aktuelle Veröffentlichungen des Fachgebiets
Anmerkungen	-

Modul: Instrumentelle Analytik und Bioassays (1701-410)

Modulverantwortung	Claudia Oellig
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester
Studiengänge	Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	30
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Die Studierenden beherrschen grundlegende Kenntnisse und Fertigkeiten - im Einsatz von Enzymen und Antikörpern in der instrumentellen Analytik - im Einsatz flüssigchromatographischer Analysentechniken (HPLC, HPTLC) - in der Kopplung flüssigchromatographischer Analysentechniken mit Methoden der Biodetektion sowie mit der Massenspektrometrie siehe Fachkompetenzen
empfohlene Vorkenntnisse	-
Anmerkungen	Teilnehmerbegrenzung: 10 Plätze Der Eingang der Anmeldung ist entscheidend für die Platzvergabe. Anmeldung über ILIAS: https://ilias.uni-hohenheim.de/ilias.php?ref_id=758210&cmdClass=ilrepositorygui&cmdNode=tr&baseC
Modulprüfung und Gewichtung	Mündliche Prüfung

Studienleistung und Gewichtung	Auswertung von Versuchsergebnissen in Form eines Berichts
Instrumentelle Analytik und Bioassays, Vorlesung (1701-411)	
Person(en) verantwortlich	Wolfgang Armbruster Claudia Oellig
Lehrform	Vorlesung
SWS	2
Inhalt	Grundlagen und Methoden der instrumentellen Flüssigkeitschromatographie (HPLC, HPTLC) Enzymassays Immunoassays Rezeptorassays Zellassays Kopplung der Flüssigkeitschromatographie mit Bioassays (wirkungsbezogene Analytik) Kopplung der Flüssigkeitschromatographie mit der Massenspektrometrie
Literatur	Skript mit speziellen Literaturempfehlungen zu den einzelnen Themengebieten
Anmerkungen	-
Instrumentelle Analytik und Bioassays, Übung (1701-412)	
Person(en) verantwortlich	Wolfgang Armbruster Claudia Oellig
Lehrform	Übung mit Praktikum
SWS	3
Inhalt	Flüssigkeitschromatographie (HPLC, HPTLC, IC) Kopplung der Flüssigkeitschromatographie mit Massenspketrometrie Kopplung Flüssigkeitschromatographie mit Bioassays (wirkungsbezogene Analytik) Immunoassays
Literatur	Skript mit speziellen Literaturempfehlungen zu den einzelnen Themengebieten
Anmerkungen	-

Modul: Integrated Bioprocess Engineering - Bioproduction (1510-420)

Modulverantwortung	Rudolf Hausmann
Bezug zu anderen Modulen	Is part of the module series Integrated Bioprocess Engineering
Teilnahmevoraussetzung	First experiences in microbiology are required
Lehrsprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 2)
Studiengänge	Bioeconomy, 2. Semester, Wahl Biologie, 2. Semester, Wahl Food Biotechnology, 2. Semester, Wahl Food Science and Engineering, 2. Semester, Wahl Promotionsstudiengang Naturwissenschaften, 2. Semester, Wahl
Prüfungsdauer (in Minuten)	20
Präsenzstudium (in Stunden)	90
Selbststudium (in Stunden)	135
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	After the completion of the module participants - are able to design of media and lay-out feed compositions and strategies - are able to explain all functions of bioreactors - explain kinetics of bioprocesses and modelling thereof - are able to express expectations on the scale-up of bioprocesses - have experienced and adapted to an interdisciplinary field. - have enhanced their scientific written and verbal skills
empfohlene Vorkenntnisse	-
Anmerkungen	Places: 9 | Registration via ILIAS
Modulprüfung und Gewichtung	Seminartalk 25%, oral exam 75%
Studienleistung und Gewichtung	self-study of lecture material

Bioproduction (1510-421)	
Person(en) verantwortlich	Rudolf Hausmann
Lehrform	Vorlesung mit Seminar und Praktikum
SWS	5
Inhalt	Lecture: Design of media and laying-out of feed strategies and compositions Functions of bioreactors Kinetics of bioprocesses and modelling thereof Scale-up of bioprocesses Practical: Exemplary production of an heterologous protein in E.coli high cell density bioreactor cultivation Keeping of a labjournal / protocol Documentation and evaluation of bioreactor cultivation Working under sterile conditions On and off line analysis of key cultivation parameters (pO2, pH, xO2, xCO2, cell density, substrate and product concentration) Bioreactor set-up: functions and peripherals Independently plan and carry out operations on the bioreactor Application of feed and induction strategies
Literatur	- J. Villadsen, J Nielsen and G Lidén (2011): Bioreaction Engineering Principles, Springer - P. M. Doran (2013): Bioprocess Engineering Principles, Academic Press - S Liu (2013): Bioprocess Engineering: Kinetics, Biosystems, Sustainability, and Reactor Design, Elsevier

	- S. K. Niazi and J. L. Brown (2016): Fundamentals of Modern Bioprocessing, CRC Press - N. S. Mosier and M. R. Ladisch (2009): Modern Biotechnology: Connecting Innovations in Microbiology and Biochemistry to Engineering Fundamentals, Wiley/AICHE - Henkel et al. (2015): Teaching bioprocess engineering to undergraduates: Multidisciplinary hands-on training in a one-week practical course, in: Biochemistry and Molecular Biology Education, Vol. 43, Iss. 3, pp 189–202 (http://dx.doi.org/10.1002/bmb.20860)
Anmerkungen	Attendance and active participation in the laboratory course is mandatory. Due to the fact that every group has full responsibility for performing their own experiment, in-lab times will be flexible but require reasonable planning on the main experimental days.

Modul: Integrated Bioprocess Engineering - Bioseparation Process Science (Downstream Processing) (1510-430)

Modulverantwortung	Rudolf Hausmann
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 3)
Studiengänge	Biologie (Master, PO vom 01.10.2010) 3. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Wahl Bioeconomy (Master, PO vom 01.10.2014) 3. Semester, Wahl Promotionsstudiengang Naturwissenschaften (Promotionsstudiengänge, PO vom 14.02.2015) 1. Semester, Wahl Bioeconomy (ab WS 16/17) (Master, PO vom 01.04.2017) 3. Semester, Wahl
Prüfungsdauer (in Minuten)	20
Präsenzstudium (in Stunden)	90
Selbststudium (in Stunden)	135
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The participants should obtain a theoretic overview of all relevant process steps used in the purification of industrial bioproducts. At the end of the module they should be able to outline a product-specific scheme of purification. In a hands-on training the participants will have performed and analyzed some selected methods. After the completion of the module the participants - have experienced and adapted to an interdisciplinary field. - have enhanced their scientific written and verbal skills.
empfohlene Vorkenntnisse	-
Anmerkungen	Available places: 12

	Registration for module via ILIAS Criteria for admission is granted: Mostly after first-served basis.
Modulprüfung und Gewichtung	seminar presentation (25%), oral exam (75%)
Studienleistung und Gewichtung	Regular and active participation in the online lecture, the lecture, the exercises and the holding of a seminar talk
Integrated Bioprocess Engineering Bioseparation Process Science (Downstream Processing) (1510-431)	
Person(en) verantwortlich	Rudolf Hausmann
Lehrform	Vorlesung mit Seminar und Praktikum
SWS	4
Inhalt	The module comprises a lecture, a seminar and a lab hands-on training in which the purification of bioproducts from the original state as a component of a fermentation broth through progressive purification steps to a final product are the topic. Outline: 1) Introduction 2) Solid-Liquid Separation 3) Cell Disruption 4) Precipitation and Crystallization 5) Preparative Chromatography 6) Membrane Separation 7) Extraction 8) Refolding 9) Summery.
Literatur	R. G. Harrison, P. Todd, S. R. Rudge, D. P. Petrides (2003): Bioseparations Science and Engineering, Oxford University Press
Anmerkungen	-

Modul: Integrated Bioprocess Engineering - Genetic Engineering Methodology (1510-600)

Modulverantwortung	Rudolf Hausmann
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Basics in Microbiology, Bioechmistry and Genetics are mandatory.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester (Block 4)
Studiengänge	M.Sc. Food Biotechnology, 2. Semester, Wahl M.Sc. Food Science and Engineering, 2. Semester, Wahl M.Sc. Biologie, 2. Semester, Wahl M.Sc. Bioeconomy, 2. Semester, Wahl
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	112
Selbststudium (in Stunden)	113
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	After completing the module, students are able to explain and apply fundamental aspects of biotechnology and molecular biology, as well as applications of gene manipulation technology. The students are able to apply the knowledge gained in the lecture for planning and designing a working project before the laboratory work (in silico) using Softwares like Serial Cloner, Mega, Geneious and SnapGene. The project designed by the students in the lecture will be applied in the laboratory bench, using techniques of genetic cloning like Gibson Assembly and GoldenGate cloning (in vivo).
empfohlene Vorkenntnisse	It is recommended to accomplish Recombinant Proteins (1506-430) first.
Anmerkungen	Available places: 9 Registration: via ILIAS until the last working day before the start of the module. Place allocation: according to previous knowledge
Modulprüfung und Gewichtung	presentation (100%)
Studienleistung und Gewichtung	exercises, seminar and laboratory work
Integrated Bioprocess Engineering - Genetic Engineering Methodology (1510-601)	

Person(en) verantwortlich	Rudolf Hausmann
Lehrform	Vorlesung mit Seminar und Laborübungen
SWS	8
Inhalt	Lecture & seminar: - Overview of the genetic engineering concepts, nucleic acids, gene and genome organization, data banks. - Gene manipulation and cloning techniques - Use of molecular biology softwares (Serial Cloner, Mega, Geneious and SnapGene) Screening of mutants (Next generation sequencing, PCR, RT-qPCR, blotting techniques) Lab: Construct a plasmid as planned in the seminars using one of the techniques taught in the lectures (Enzyme restriction, Gibson Assembly or GoldenGate)
Literatur	-
Anmerkungen	-

Modul: Integrated Bioprocess Engineering - Upstream Processing (1510-440)

Modulverantwortung	Rudolf Hausmann
Bezug zu anderen Modulen	Completion of the module "Recombinant Proteins (1506-430)" is recommended.
Teilnahmevoraussetzung	Basic knowledge in microbiology, bioechmistry and genetics
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 2)
Studiengänge	Biologie (Master, PO vom 01.10.2010) 3. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Wahl Bioeconomy (Master, PO vom 01.10.2014) 3. Semester, Wahl Promotionsstudiengang Naturwissenschaften (Promotionsstudiengänge, PO vom 14.02.2015) 1. Semester, Wahl Bioeconomy (ab WS 16/17) (Master, PO vom 01.04.2017) 3. Semester, Wahl
Prüfungsdauer (in Minuten)	20
Präsenzstudium (in Stunden)	90
Selbststudium (in Stunden)	135
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	After the completion of the module participants, - are able to theoretically report on products of industrial biotechnology. - are able to evaluate advantages and disadvantages of different biological systems. - are able to give an overview in current methods of upstream processing using bio-molecular methods. - have practically developed skills of the strain construction with a simple example.

	- are able to analyze biosynthetic pathways in respect to the involved enzymes and corresponding genes with the help of internet-based databases. - have practiced written and oral expression in scientific English. - have practiced communication and cooperation skills in planning the lab experiments.
empfohlene Vorkenntnisse	-
Anmerkungen	Available places: 9 Registration for module via ILIAS: Criteria for admission is granted: Mostly after first-come, first-served basis.
Modulprüfung und Gewichtung	seminar presentation (25%), oral exam (75%)
Studienleistung und Gewichtung	Regular and active participation in the online lecture, the exercises and the holding of a seminar talk.
Industrial Biotechnology (1510-441)	
Person(en) verantwortlich	Rudolf Hausmann
Lehrform	Vorlesung mit Übung und Seminar
SWS	2
Inhalt	- Overview of the products of industrial biotechnology with a focus on food additives and ingredients (for example, citric acid, glutamate, vitamin B2, etc ...) - In-depth theoretical knowledge of the use of biological, in particular microbial systems for the production of economically valuable biochemical. - Biosynthetic understanding of the primary and the secondary metabolism and fermentation products. - Represent theoretically optimal biosynthetic pathways and to calculate and establish the corresponding maximum yield coefficients.
Literatur	- P. M. Doran (2013): Bioprocess Engineering Principles, Academic Press - Shijie Liu (2013): Bioprocess Engineering: Kinetics, Biosystems, Sustainability, and Reactor Design, Elsevier - S. K. Niazi and J. L. Brown (2016): Fundamentals of Modern Bioprocessing, CRC Press

	- N. S. Mosier and M. R. Ladisch (2009): Modern Biotechnology: Connecting Innovations in Microbiology and Biochemistry to Engineering Fundamentals, Wiley/AICHE
Anmerkungen	-
Genetics and strain construcion (1510-442)	
Person(en) verantwortlich	Rudolf Hausmann
Lehrform	Vorlesung mit Praktikum
SWS	4
Inhalt	Options for different prokaryotic expression system have been discussed. These include: expression systems, promotor and induction systems, restriction endonucleases and respective recognition sites, genetic markers, preparation of vector, DNA-preparation, ligation, transformation, screening, molecular tags. A focus is on Bacillus subtilis as a basic biotechnological production organism. Practical skills in specialized online-databases and programs were practiced.
Literatur	- M. Green and J. Sambrook (2012): Molecular Cloning: A Laboratory Manual (Fourth Edition), CSH Press - Cornel Mülhardt (2013) Der Experimentator Molekularbiologie / Genomics, Springer
Anmerkungen	-

Modul: Internship FSE (Industrial Placement) (12 weeks) (1500-510)

Modulverantwortung	Jörg Hinrichs
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Admission to the Master's programme has to be present when beginning the internship.rnThe internship can be completed at a national or international research center or at a research and development department of a company in Germany or abroad that is related to the Life Sciences: food, pharma-ceutical as well as their supplying industries, plant design and engineer-ing and process technology.
Lehrsprache	englisch
ECTS	15
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	n. V.
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Wahl
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	450
Arbeitsaufwand (in Stunden)	450
Lern- und Qualifikationsziele	Upon completion of this module students - have gained insight into research and development in the area of food science and engineering - expand their methodological repertoire - have gained insight into organizing research projects - have sharpened their critical thinking skills when developing practical solutions - have learned how to work by trial and error
empfohlene Vorkenntnisse	-
Anmerkungen	Students choose a supervisor related to the subject-area prior to beginning their internship. The supervisor decides whether the internship

	placement is appropriate and assesses the report.rnrnThis module does not count towards the final grade.rnrnPlease note: whereas only 15 ECTS can be awarded, the duration of the internship is not limited to 12 weeks.
Modulprüfung und Gewichtung	Internship report
Studienleistung und Gewichtung	-
Internship FSE (Industrial placement) (12 weeks, 15 ECTS) (1500-511)	
Person(en) verantwortlich	Mario Jekle Jochen Weiss Jörg Hinrichs Reinhard Kohlus Yanyan Zhang
Lehrform	Praktikum
SWS	-
Inhalt	-
Literatur	-
Anmerkungen	-

Modul: Internship FSE (Industrial Placement) (6 weeks, 7,5 ECTS) (1500-500)

Modulverantwortung	Jörg Hinrichs
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Admission to the Master’s programme has to be present when beginning the internship.rnThe internship can be completed at a national or international research center or at a research and development department of a company in Germany or abroad that is related to the Life Sciences: food, pharma-ceutical as well as their supplying industries, plant design and engineer-ing and process technology.
Lehrsprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	n. V.
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Wahl
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	225
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Upon completion of this module students - have gained insight into organizing research projects - have sharpened their critical thinking skills when developing practical solutions - have learned how to work by trial and error - improve their team and communication skills
empfohlene Vorkenntnisse	-
Anmerkungen	Students choose a supervisor related to the subject-area prior to beginning their internship. The supervisor decides whether the internship placement is appropriate and assesses the report. This module does not count towards the final grade. Please

	note: whereas only 7,5 ECTS can be awarded, the duration of the internship is not limited to 6 weeks.
Modulprüfung und Gewichtung	Internship report
Studienleistung und Gewichtung	-
Internship FSE (Industrial placement) (6 weeks, 7,5 ECTS) (1500-501)	
Person(en) verantwortlich	Mario Jekle Jochen Weiss Jörg Hinrichs Reinhard Kohlus Yanyan Zhang
Lehrform	Praktikum
SWS	-
Inhalt	-
Literatur	-
Anmerkungen	-

Modul: Introduction to Machine Learning in Python (4407-480)

Modulverantwortung	Christian Krupitzer Anthony Stein
Bezug zu anderen Modulen	The module provides basic knowledge on machine learning that well prepare the students for participation in subsequent AI modules, i.e., 4407-440 "Einführung in die Künstliche Intelligenz", 4407-470 "Artificial Intelligence for Agriculture", 4407-490 "Bildanalyse mit Deep Learning" or 4407-810 "Machine Learning Reading Club".
Teilnahmevoraussetzung	-
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester
Studiengänge	Agrarwissenschaften - Agrartechnik (Master), 2. Semester, semi-elective All Master's programs of the Faculty of Agricultural and Natural Sciences, 2. semester, elective Information Systems (Master), elective Bioeconomy (Master), 2. Semester, elective (Profil: Data Science and Artificial Intelligence)
Prüfungsdauer (in Minuten)	90
Präsenzstudium (in Stunden)	0
Selbststudium (in Stunden)	225
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	After completing this module, students are able to critically assess the performance of different machine learning approaches and to choose the best approach for a specific use case. Therefore, this module will provide essential theoretical knowledge of the foundations of programming in Python and machine learning algorithms and approaches.Further, students acquire practically-applicable knowledge how to apply machine learning to solve real world problems. The online format, regular assignments as well as the self-study character of the module supports the students' organizational skills and trains their ability to work independently. Further, the module supports analytical thinking, i.e., how to structure a problem and find appropriate solutions to it by means

	of machine learning. Since the course materials and the teaching language are completely in English, the students further train their foreign language skills.
empfohlene Vorkenntnisse	Module 4407-480 is a Master's program module, but can already be taken as an elective in Bachelor's degree programs in agricultural sciences. No prior programming skills are assumed. The necessary basic concepts of Python programming are taught in the first third of the course. In order to prepare for later AI modules in the Master's programs, it is recommended to take this course already during the specialization phase in the Bachelor's programs.
Anmerkungen	The maximum number of participants is limited to a semester-specific amount. In case the threshold is exceeded, a waiting list will be maintained.
Modulprüfung und Gewichtung	Computer-based online exam (50%)
Studienleistung und Gewichtung	Integrated online quizzes and programming assignments to be solved individually by the students (50%)
Introduction to Machine Learning in Python (4407-481)	
Person(en) verantwortlich	Anthony Stein Christian Krupitzer
Lehrform	E-Learning
SWS	5
Inhalt	-
Literatur	-
Anmerkungen	-

Modul: Master-Arbeit (1500-410)

Modulverantwortung	Jörg Hinrichs
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Successful completion of modules in the amount of 78 credits.
Lehrsprache	englisch
ECTS	30
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	1 Semester
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 4. Semester, Pflicht
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	900
Lern- und Qualifikationsziele	Upon successful completion of the module students - are able to conduct independent experimental research in the field of food microbioloy and biotechnology or an adjacent field according to given instructions on an assigned topic, record their findings and discuss them - have extensive knowledge and expertise in the topic of their Master's thesis - are able to employ scientific methods in the field of food micro-biology and biotechnology or adjoining disciplines and present their findings as a scientific work - are able to independently work with complicated laboratory equipment
empfohlene Vorkenntnisse	-
Anmerkungen	Registration for the module on an individual basis in consultation with the supervising professor. The Master's thesis is graded by two professors, one of which has to be in charge of at least one compulsory module of the programme in Food Science and Engineering
Modulprüfung und Gewichtung	Bound Master's thesis and, if applicable, oral presentation of the findings
Studienleistung und Gewichtung	-

Modul: Mathematics and Computational Sciences of the Earth System II (1102-410)

Modulverantwortung	Georg Zimmermann
Bezug zu anderen Modulen	Continuation of Module 1102-400.
Teilnahmevoraussetzung	Successful completion of module 1102-400.
Lehrsprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester
Studiengänge	Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Earth and Climate System Science (Master, PO vom 01.10.2017) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	124
Arbeitsaufwand (in Stunden)	180
Lern- und Qualifikationsziele	The aim of this module is that the students can recognise ordinary and partial differential equations as such. They shall also recognise some special types of differential equations. They know how to solve certain types of differential equations, some explicitly, others numerically. They can recognise autonomous systems, find stationary solutions and determine their stability properties. The aim of this module is for students to understand differential equations in the sense that they recognise which effects are modelled by each term. They know stability properties and how to determine them.
empfohlene Vorkenntnisse	Successful participation in module 1102-400
Anmerkungen	Maximum number of participants: - Registration: in consultation with the lecturer at the beginning of the semester
Modulprüfung und Gewichtung	Exam (100%)
Studienleistung und Gewichtung	Submission of exercises (at least 50% of the total score must be achieved)
Mathematics and Computational Sciences of the Earth System II (1102-411)	

Person(en) verantwortlich	Georg Zimmermann
Lehrform	Vorlesung mit Übung
SWS	4
Inhalt	Ordinary differential equations: difference versus differential equations, solution methods, autonomous systems and the stability of their stationary solutions, existence and uniqueness of solutions; numerical methods. Partial differential equations: quasilinear PDEs, wave equation, heat equation; numerical methods.
Literatur	Lecture notes provided by the lecturer. Additional, if so desired: Any standard book on mathematics for physicists or engineers. Examples: in English: basic (undergraduate level): M.L. Boas, Mathematical Methods in the Physical Sciences advanced (graduate level): G. B. Arfken, Mathematical Methods for Physicists in German: H. Fischer / H. Kaul, Mathematik für Physiker 1 & 2
Anmerkungen	-

Modul: Metal Coordination Chemistry in Biomolecules (1301-450)

Modulverantwortung	
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	English and German language skills.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 3)
Studiengänge	Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	90
Präsenzstudium (in Stunden)	70
Selbststudium (in Stunden)	155
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	After having completed the module, the students should be able to explain important concepts (e. g., metal complex formation) and cause-and-effect relations in metal coordination chemistry of biomolecules. They know metal ion-containing/ dependent and metal ion-transporting biomolecules and can recall the relevant facts (e. g., structural and functional details). The students can also explain experimental observations and associated physical methods and theoretical models. They can compare different models. The students should be able to exemplify classes of molecules important in bioinorganic chemistry and functions of specific metal ions in biochemical processes. They know (i) the role of essential metal ions in the generation and utilization of the electrochemical potential of the cell, (ii) key methods specific to the field (e. g., the „synthetic analogue“ approach),

	(iii) how metal ions and biological ligands mutually affect their properties, and (iv) how cellular concentrations of essential and toxic metal ions are regulated. Furthermore, students should be able to deal with interdisciplinary problems by combining the methods and ways of thinking of various scientific disciplines.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 14
Modulprüfung und Gewichtung	Written exam
Studienleistung und Gewichtung	Regular attendance and active participation.
Bioinorganic Chemistry (1301-451)	
Person(en) verantwortlich	Moritz Kühnel
Lehrform	Vorlesung
SWS	2
Inhalt	Molecular foundations of the biological functions of metals; overview of biologically important metal ions and ligands; some principles of metal coordination chemistry; the basis of metal ion homeostasis; toxic metal ions; biological electron transfer: cytochromes, iron-sulfur proteins, blue copper proteins; „synthetic analogues“ concept; biological Lewis acid catalysis: carboxypeptidase, carboanhydrase, aconitase; transport of molecular oxygen: hemoglobin, hemerythrin, hemocyanine; structural functions of metal ions: calmodulin, zinc finger proteins; transport and storage of metal ions; physical methods for the characterization of metal ion-containing biomolecules (e. g. protein crystallography).
Literatur	Kaim, W., Schwederski, B., Klein, A.: Bioinorganic Chemistry - Inorganic Elements in the Chemistry of Life, 2nd edition, Wiley, Chichester, 2013.
Anmerkungen	This lecture is suited as additional course for students of scientific Bachelor‘s programmes (from the 4th semester onwards) and other scientific Master‘s programmes.
Ion Transporters (1301-452)	
Person(en) verantwortlich	Julia Fritz-Steuber
Lehrform	Vorlesung
SWS	1
Inhalt	The molecular basis for the biological function of ion transporters will be discussed. A focus is on systems for active and passive transport of Na+, K + and Ca2+. Topics: the electrochemical membrane potential; physiological relevance of Na+, K+ and

	Ca2+; primary producers of the electrochemical potential (cation pumps); how channels work/ how to study channels; voltage- versus ligand-gated channels; structure#function analysis of ion transporters; comparison of transport rates and ion selectivities of different systems.
Literatur	Nicholls, D.G., Ferguson, S.J.: Bioenergetics, 4th edition, Academic Press, London, 2013.
Anmerkungen	This lecture is suited as additional course for students of other scientific Master‘s programmes.
Principles of Coordination Chemistry (1301-453)	
Person(en) verantwortlich	Wolfgang Einholz
Lehrform	Vorlesung
SWS	2
Inhalt	The lecture covers the main principles of the formation of metal complexes as well as physical methods for the study of, especially, biologically important metal complexes. The following topics will be treated: electronic structures of metal cations; electronic, magnetic and optical properties of metal complexes; theories of the formation of metal complexes; physical principles relevant to the investigation of metal complexes; introduction to state-of-the-art spectroscopic methods for the study of biologically relevant metal complexes.
Literatur	Riedel, E., Janiak, C.: Anorganische Chemie, 9. Auflage, de Gruyter, Berlin, 2015. Cotton, F.A., Wilkinson, G., Murillo, C.A., Bochmann, M.: Advanced Inorganic Chemistry, 6th edition, Wiley, New York, 1999. Huheey, J.E., Keiter, E.A., Keiter, R.L.: Inorganic Chemistry: Principles of Structure and Reactivity, 4th edition, Harper Collins, New York, 1993.
Anmerkungen	-

Modul: Methoden der Strukturbiologie und deren Anwendung in der Wirkstoffforschung (1909-440)

Modulverantwortung	Günter Fritz
Bezug zu anderen Modulen	Das Modul "Proteinstrukturanalyse" ist eine optimale Ergänzung. _____ The module "Proteinstrukturanalyse" is an optimal addition
Teilnahmevoraussetzung	Voraussetzung für die Teilnahme am Kurs sind gute Kenntnisse in Biochemie, grundlegende Kenntnisse in Physik, und Interesse an der vertieften computergestützten Analyse von Daten und Molekülstrukturen. _____ Prerequisite for participation in the course is a good knowledge of biochemistry, basic knowledge of physics, and interest in the in-depth computer-assisted analysis of data and molecular structures.
Lehrsprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 3)
Studiengänge	Biologie (Master, PO vom 01.10.2010) 2. Semester, Wahlpflicht
Prüfungsdauer (in Minuten)	20
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Die Studierenden

	- kennen die Methoden zur Bestimmung der dreidimensionalen Struktur von biologischen Makromolekülen - können dreidimensionale Strukturen analysieren und interpretieren - kennen die Methoden der Strukturbiologie, die in der Wirkstoffentwicklung zur Anwendung kommen - analysieren kristallografische Daten und erstellen dreidimensionale Modelle - präsentieren die Ergebnisse im Bezug zu publizierten Arbeiten Im Kurs wird selbstständiges Arbeiten, analytisches Denken und kritische Datenanalyse vermittelt. _____ The students - know the methods for determining the three-dimensional structure of biological macromolecules - can analyse and interpret three-dimensional structures - know the methods of structural biology used in drug development - analyse crystallographic data and create three-dimensional models - present the results in relation to published work The course teaches independent working, analytical thinking and critical data analysis.
empfohlene Vorkenntnisse	-
Anmerkungen	Anzahl Teilnehmerplätze: 4 Anmeldung zur Teilnahme am Modul über ILIAS

	Modulnummer bis Sommersemester 2022: 2502-440 _____ Maximum number of participants: 4 Registration: via ILIAS Module code until summer term 2022: 2502-440
Modulprüfung und Gewichtung	Vortrag (50%) und Protokoll (50%) ---------- Presentation (50%) and protocol (50%)
Studienleistung und Gewichtung	56 h presence + 169 h own contribution = 225 h workload
Methoden der Strukturbiologie und deren Anwendung in der Wirkstoffforschung (ehemals 2502-441) (1909-441)	
Person(en) verantwortlich	Julia Fritz-Steuber Günter Fritz
Lehrform	Vorlesung mit Übung und Seminar
SWS	4
Inhalt	Structural biology developed in the past 15 years into a technique available to a large community of users and is now broadly applicable to many aspects in molecular biology. Development of new drugs goes hand in hand with structural biology. In the course the techniques to obtain three-dimensional structures of biological macromolecules are introduced, advantages and disadvantages of the different methods are discussed. Protein structures are analysed with respect to function and binding of substrates or inhibitors. The methods to identify drug candidates are introduced and examples are studied. There will be a focus on the technique of X-ray crystallography with praxis in growth of protein crystals, analysis of the obtained protein crystals at a synchrotron source, data analysis and obtaining

	a three-dimensional structure with substrate or drug candidate bound.
Literatur	Bernd Rupp, Biomolecular Crystallography
Anmerkungen	-

Modul: Molekulare Sinnesphysiologie (1922-430)

Modulverantwortung	Michael Föller
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Bachelorabschluss mit biologischem Profil
Lehrsprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 2)
Studiengänge	Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl Biologie (Master, PO vom 01.10.2010) 1. Semester, Wahlpflicht
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	75
Selbststudium (in Stunden)	150
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Ziel des Moduls ist, dass die Studierenden nach dem Abschluss des Moduls in der Lage sind, durch vertieftes Wissen in Bereichen der Sinnesphysiologie eine Präsentation zu aktuellen Forschungsergebnissen vorzustellen und diese im Kreise der Mitstudierenden zu diskutieren. Nach Abschluss des Moduls sind die Studierenden in der Lage, die erhaltenen Methodenkenntnisse zu nutzen und die dabei erworbene Praxis bei der experimentellen For-schungsarbeit im Labor umzusetzen.
empfohlene Vorkenntnisse	-
Anmerkungen	Anzahl Teilnehmerplätze: 8 Anmeldung zur Teilnahme am Modul über ILIAS/ Auswahlverfahren Modulnummer bis Sommersemester 2022: 2301-430
Modulprüfung und Gewichtung	Klausur (100%) oder mündliche Pürfung, wird den Studierenden mitgeteilt

Studienleistung und Gewichtung	Regelmäßige Teilnahme, Vortrag im Grundlagenseminar und Vorstellung einer wissenschaftlichen Publikation
Molekulare Sinnesphysiologie (ehemals 2301-431) (1922-431)	
Person(en) verantwortlich	Jörg Strotmann Michael Föller
Lehrform	Seminar
SWS	4
Inhalt	- Sinnesorgane, Sinneszellen: strukturelle und molekulare Spezialisieungen - Perirezeptor.Prozesse - Transduktionsmechanismen, Cross-talk, Regelkreise - Desensitisierung, Adaption, Inaktivierung sensorischer Reize - Neuronale "Verdrahtung" sensorischer Systeme - Integration multimodaler Information - Grundlagen für die Erfassung verschiedener Sinnesmodalitäten - Vorträge der Studierenden und Diskussionsrunden zu gezielten Fragestellungen - Experimentelle Übungen zur molekularen Sinnesphysiologie
Literatur	-
Anmerkungen	-

Modul: Nutrigenomik (1405-400)

Modulverantwortung	Florian Fricke
Bezug zu anderen Modulen	Das Modul baut inhaltlich auf dem Modul "Einführung in die Nutrigenomik" der ernährungswissenschaftlichen Bachelor-Studiengänge auf, legt aber den Schwerpunkt auf laborexperimentelle und bioinformatische Übungen.
Teilnahmevoraussetzung	Eine Belegung des Moduls ist nach erfolgreichem Abschluss des Moduls "Molekularbiologische Grundlagen" und "Einführung in die Nutrigenomik" sinnvoll, bzw. setzt die darin vermittelten Grundlagen der Molekularbiologie und Personalisierten Medizin zugrunde
Lehrsprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 1)
Studiengänge	M.Sc. Molekulare Ernährungswissenschaft, 2. Semester, Pflicht M.Sc. Molekulare Ernährungswissenschaft (ab Studienbeginn WS23/24), 2. Semester, Pflicht M.Sc. Ernährungsmedizin, 2. Semester, Wahlpflicht
Prüfungsdauer (in Minuten)	90
Präsenzstudium (in Stunden)	60
Selbststudium (in Stunden)	165
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Ziel des Moduls ist, dass die Studierenden nach dessen Abschluss in der Lage sind, molekularbiologische, bioinformatische und statistische Grundlagen der Nutrigenomik, Sequenzanalyse, Mikrobiomforschung und angewandten Bioinformatik zu diskutieren, kritisch zu hinterfragen und für eigene Arbeiten anzuwenden. Ziel des Moduls ist, dass die Studierenden nach dessen Abschluss in der Lage sind, den technischen, wissenschaftlichen und gesellschaftlichen Diskurs zu relevanten Zukunftsthemen der personalisierter Medizin mitzugestalten.
empfohlene Vorkenntnisse	-
Anmerkungen	Anzahl Teilnehmerplätze: 40 Anmeldung zum Modul: über ILIAS

	Anmeldezeitraum: ab ca. 8 Wochen vor Beginn Kriterien, nach denen Studienplätze vergeben werden: Alle MolEW-Studierende werden aufgenommen (Pflichtmodul). Von den verbliebenen Plätzen werden ca. 75% EM-Studierenden zugesprochen (Wahlpflicht), in der Reihenfolge ihrer Anmeldung in ILIAS. Die restlichen Plätze werden je nach Nachfrage und Anmeldezeitpunkt in ILIAS Studierenden anderer Studiengänge und Erasmus-Studierenden zugeteilt.
Modulprüfung und Gewichtung	Klausur (100%)
Studienleistung und Gewichtung	Graphical Abstract
Nutrigenomik (1405-401)	
Person(en) verantwortlich	Florian Fricke
Lehrform	Vorlesung mit Übung
SWS	4
Inhalt	In diesem Modul werden praktische Einblicke in die molekularbiologischen, rechnergestützten, bioinformatischen und statistischen Grundlagen der Nutrigenomik, Sequenzanalyse, Mikrobiomforschung und angewandten Bioinformatik vermittelt. Das Modul ist inhaltlich in folgende Schwerpunktbereiche aufgeteilt: Theoretische Grundlagen der Laborarbeit - Arbeit im S2-Labor, DNA-Isolation aus Mikrobiomproben, PCR, quantitative Mikrobiom-Analysen; Bioinformatische Übungen - Vorstellung bioinformatischer Tools, Grundlagen von Linux und R mit praktischen Übungen; Vorlesungen und Seminararbeit- Personalisierte Medizin, Ethik und Erstellung von ‘graphical abstracts'
Literatur	[nicht vorgeschrieben für Teilnahme am Modul] Haller, Dirk (Ed.) The Gut Microbiome in Health and Disease. 2018. Springer Verlag
Anmerkungen	-

Modul: Online Dairy Science and Technology (1505-450)

Modulverantwortung	Jörg Hinrichs
Bezug zu anderen Modulen	The module complements analytically or process-engineering oriented modules with the background of processing of milk to sophisticated milk products, e.g. milk concentrates and their application up to powders
Teilnahmevoraussetzung	Scientific background and basics in food microbiology, chemistry, engineering, and soft matter science. Participation at Online Dairy Science and Technology is only possible if 1505-440 has not been accomplished.
Lehrsprache	englisch
ECTS	5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	1 Semester
Studiengänge	M.Sc. Food Science and Engineering, 2. Semester, Wahl M.Sc. Food Biotechnology, 2. Semester, Wahl M.Sc. Food Systems, 2. Semester, Wahl M.Sc. Lebensmittelchemie, 2. Semester, Wahl M.Sc. Bioeconomy, 2. Semester, Wahl (Profil: Transforming Food Systems) Promotionsstudiengang Naturwissenschaften; 1./2. Semester, Wahl
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	94
Arbeitsaufwand (in Stunden)	150
Lern- und Qualifikationsziele	The students learn to understand the sophisticated processing of milk in relation to the physical, chemical and microbiological properties of the raw material and the final product properties. Thereby analytical tools to characterize composition and structure of milk products are studied in order to understand material-process-function relationships. It also teaches the concept of mass and energy balance, the estimation of microbiological risk of milk products and the hazard associated with the various processing steps

	Theoretical knowledge is deepened in composition, analytics, hygiene and aseptic of membrane filtration/ fractionation, evaporation, powder processing. Finally, trouble shooting on practical issue will be done in groups and an outlook will be given to running research projects addressed on future developments and innovations
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 10 (first-in)
Modulprüfung und Gewichtung	Oral exam (20 minutes) or written exam
Studienleistung und Gewichtung	protocol
Online Science and Engineering of milk processing (1505-451)	
Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Vorlesung
SWS	2
Inhalt	The topics are: 1) Physcis, chemistry milk components 2) Chemical and physical analytics 3) Hygiene and Aseptic processing 4) Vacuum evaporation and milk concentrates 5) Membrane materials and processing 6) Drying basics 7) Milk drying 8) Trouble shooting methods 9) Research innovations and outlook
Literatur	Scientific literature, doctoral theses, publications from the department, textbooks in the departmental library. Kessler H.G.: Food & Bio-Process Engineering – Dairy Technology. Verlag A. Kessler, München 2011 Belitz H.D., Grosch W., Schieberle P. Food Chemistry. Springer Verlag

	Lecture handouts
Anmerkungen	-
Online Seminar in advanced milk processing (1505-452)	
Person(en) verantwortlich	Jörg Hinrichs
Lehrform	Seminar
SWS	2
Inhalt	Rework lecture and questions, evaluation, discussion and deepening knowledge of the lecture.
Literatur	Scientific literature, doctoral theses, publications from the department, textbooks in the departmental library. Lecture handout
Anmerkungen	-

Modul: Process Driven Product Design: Cereals and Sweets (1503-510)

Modulverantwortung	Reinhard Kohlus
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Completion of the modules “Food Process Design I (1503-520)” and “Food Process Design II (1503-500)” is beneficial to understand the topic but not required.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 2)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The students will learn to design a process based on product on product requirements in the field of sugar based, products. They know key product process interactions for the discussed product groups and how to uses these. The learned skills focus on applicable knowledge which is based on strong basic / theoretical foundations allowing to apply it in a wide context. Key competencies addressed in this module are critical problem as-sessment and analytical thinking. Systematic problem solving.
empfohlene Vorkenntnisse	-

Anmerkungen	Maximum number of participants: 24 Registration via ILIAS is open until October 11th
Modulprüfung und Gewichtung	Oral examination
Studienleistung und Gewichtung	-
Process Driven Product Design: Cereals and Sweets (1503-511)	
Person(en) verantwortlich	Reinhard Kohlus
Lehrform	Vorlesung mit Übung und Seminar
SWS	4
Inhalt	The interplay between product quality generation and process design is discussed on three examples in detail. These are sugar articles, breakfast cereals and ice cream. In all three raw material composition and targeted product attributes require specific pro-cess conditions. The approach for each product group will be worked out. Typical equipment is explained and process parame-ter are discussed. Product design aspects are including storage, packaging and quality parameter are covered as well. In detail twin screw extruder, sugar cooker and freezer technology will be introduced. This allows to discuss the examples of breakfast cereals ex cooking extrusion, hard and soft caramel, marshmallows and ice cream.
Literatur	-
Anmerkungen	Zucker und Zuckerwaren; H. Hoffmann, W. Mauch, W. Untze; Behrs Verlag 1985, Science of Ice cream; C. Clark, The Royal Society of Chemistry 2004 Snack Foods Processing, R. Lusas, L. Rooney, CRC Press, Boca Raton, 2001

Modul: Project Work (compulsory) (1500-530)

Modulverantwortung	Lutz Fischer
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	M.Sc. Food Science and Engineering, M.Sc. Food Biotechnology
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	4 Wochen (n. V.)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Pflicht Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Pflicht Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 3. Semester, Pflicht Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Pflicht Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Pflicht Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Pflicht
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The student will learn to elaborate a scientific assignment. The module is designed to introduce to the later work in frame of the master thesis. It is structured in three parts: - preparation of a literature based exposé or report about the chosen topic or the experimental results respectively - experimental work in the laboratory repeating selected experiments of the literature (ca. 10 -14 working days) - oral presentation of the topic (15-25 minutes)

	The topic of the project work is discussed and given by the head of a department (member of the compulsory modules). The supervision will be conducted by a postgraduate of the department. The module is successfully performed, when all three parts were passed. Grades will be informally given to the student in oral form. The module is scored passed/failed without an official grade.
empfohlene Vorkenntnisse	-
Anmerkungen	The project work may be integrated into the course of studies flexibly during the first three semesters. However, it has to be completed before beginning to work on the Master's thesis at the latest. This module does not count towards the final grade.
Modulprüfung und Gewichtung	Project work
Studienleistung und Gewichtung	Synopsis, report, presentation
Project Work (compulsory) (1500-531)	
Person(en) verantwortlich	Mario Jekle Herbert Schmidt Jochen Weiss Lutz Fischer Jörg Hinrichs Reinhard Kohlus Rudolf Hausmann Yanyan Zhang Monika Gibis Viktoria Zettel Christian Krupitzer Alexander Schaum
Lehrform	Projekt/Projektarbeit
SWS	4
Inhalt	-
Literatur	-
Anmerkungen	-

Modul: Project Work (Elective) (1500-520)

Modulverantwortung	Lutz Fischer
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	M.Sc. Food Science and Engineering, M.Sc. Food Biotechnology
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	n. V.
Studiengänge	Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Wahl Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Science and Engineering (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	This module serves to introduce students to doing a research project independently, which also prepares them for working on their Master's thesis. The topic is chosen with the supervisor on the basis of the contents of a compulsory or elective module of the programme. The supervisor (postgraduate) is assigned by the department and the execution of There are two options for completing this module. Option A: Literature-based project work

	- Writing a synopsis of the research topic using relevant scientific literature on the topic (10-15 pages). This paper is handed in and discussed with the supervisor. - Experimental reproduction of selected relevant data found in the literature (maximum of 3-5 laboratory days; in consultation with the supervisor). Writing a protocol (5-10 pages). The report is handed in and discussed with the supervisor. - Oral presentation of the topic (25-30 minutes on the synopsis and own data). Option B: Experimental project work - Writing a report (15-25 pages) outlining the experimental task, the materials used as well as methods and results of the experiments (approximately 15 laboratory days). - Analysis of the data in writing.
empfohlene Vorkenntnisse	-
Anmerkungen	Registration on an individual basis in consultation with the supervisor. Please refer to the professor in charge of the module most closely related to your desired research topic. This module does not count towards the final grade.
Modulprüfung und Gewichtung	Submission of a report and oral presentation of the results.
Studienleistung und Gewichtung	-
Project Work (elective) (1500-521)	
Person(en) verantwortlich	Mario Jekle Herbert Schmidt Jochen Weiss Lutz Fischer Jörg Hinrichs Reinhard Kohlus Rudolf Hausmann Yanyan Zhang Monika Gibis Viktoria Zettel Christian Krupitzer Alexander Schaum
Lehrform	Projekt/Projektarbeit
SWS	-

Inhalt	-
Literatur	-
Anmerkungen	-

Modul: Soft Matter Science I - Food Rheology and Structure (1505-500)

Modulverantwortung	Jörg Hinrichs
Bezug zu anderen Modulen	Requirement for participation in the elective module “Innovative Dairy Technology”
Teilnahmevoraussetzung	Scientific background in mathematics, physics and chemistry.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Dauer des Moduls	4 Wochen (Block 4)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 1. Semester, Pflicht Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 3. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 3. Semester, Wahl Food Systems (Master, PO vom 01.10.2016), 1. Wahl
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	96
Selbststudium (in Stunden)	129
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	The students learn the basic principles of food structure and rheology. They gain an awareness of the various measurement technologies used to define the structure of complex food matrices. They design and conduct experiments, including standard methods, and perform data analysis. They work in small groups to characterise food systems and also learn about process modelling. They become familiar with presenting their work through written laboratory reports and oral presentations.
empfohlene Vorkenntnisse	-
Anmerkungen	Maximum number of participants: 45
Modulprüfung und Gewichtung	Exam (80 % of total), seminar (20% of total) and practical seminar (to pass)
Studienleistung und Gewichtung	attendance in practical course, laboratory reports, seminar presentation
Food Systems: Looking Beyond Rheology and Structure (1505-501)	
Person(en) verantwortlich	Mario Jekle Jörg Hinrichs
Lehrform	Vorlesung

SWS	2
Inhalt	Principles of structural, mechanical, and dynamic characteristics of food systems. Basic information and fundamental terms in rheology, measurement technology for different food matrices, mechanical strain, dynamic rheology. Measuring systems and principles, methods in structure analysis, analysis of measurement data and modelling.
Literatur	Scientific literature, doctoral theses, publications from the department, textbooks in the departmental library.
Anmerkungen	-
Literature Seminar: Structural Models for Food Systems (1505-502)	
Person(en) verantwortlich	Mario Jekle Jörg Hinrichs
Lehrform	Seminar
SWS	2
Inhalt	Evaluation of publications and research contributions. Analysing scientific literature, presenting and discussing one topic.
Literatur	Scientific literature / library – additional literature, research journals
Anmerkungen	Lecture, including principles, methods, conclusion.
Practical Course on Rheology and Structure (1505-503)	
Person(en) verantwortlich	Mario Jekle Jörg Hinrichs
Lehrform	Übung
SWS	2
Inhalt	Practical course on food rheology and structure.
Literatur	Scientific literature, collection of methods, scientific publications and research articles
Anmerkungen	Student groups of 3 to 6 people

Modul: Soft Matter Science II - Food Physics (1507-510)

Modulverantwortung	Jochen Weiss
Bezug zu anderen Modulen	Second part to Soft Matter I - Food Rheology and Structure
Teilnahmevoraussetzung	Admission to a Master's program. Basic knowledge in physical chemistry and mathematics.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 1)
Studiengänge	Food Science and Engineering (Master, PO vom 01.10.2013) 2. Semester, Pflicht Food Microbiology and Biotechnology (Master, PO vom 01.10.2013) 2. Semester, Wahl Bioeconomy (Master, PO vom 01.10.2014) 2. Semester, Wahl Food Biotechnology (Master, PO vom 01.10.2016) 2. Semester, Wahl Bioeconomy (ab WS 16/17) (Master, PO vom 01.04.2017) 2. Semester, Wahl (Profil: Transforming Food Systems) Food Systems (Master, PO vom 01.10.2019) 2. Semester, Wahl
Prüfungsdauer (in Minuten)	120
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Upon completion of this online module, students are expected to have gained knowledge of physical phenomena that play a role in food systems. The students are able to demonstrate an understanding of (i) molecular material science approach to food systems, and (ii) structure-function relationships in matrices composed of proteins, lipids, and carbohydrates, and (iii) the operating principles of advanced physical analytical techniques as well as their use in the analysis of complex food structures. The students are able to apply principles of molecular mass transport,

	solution thermodynamics, phase transitions, and molecular interactions to solve problem-oriented case studies in foods. Furthermore, the students are able to explain, evaluate, and communicate concepts and results. Furthermore, students are able to develop stronger communication skills and develop their skills of applying digital tools by completing assignments and designing clear and well-organized presentatations, posters and flash talks. The students are expected to apply critical and analytical thinking to solve food physics-related challenges. Students are able to improve their written and oral English skills.
empfohlene Vorkenntnisse	-
Anmerkungen	Sign-up for module: in ILIAS Maximum number of participants: 50 Some lectures of this course might be held online.
Modulprüfung und Gewichtung	Written exam (75%) Oral or online exam optional. Three-minute-talk (10%) Poster and its presentation (15%)
Studienleistung und Gewichtung	Laboratory work, Laboratory presentation, Peer review
Soft Matter Science II - Food Physics (1507-511)	
Person(en) verantwortlich	Jochen Weiss
Lehrform	Vorlesung mit Übung und Praktikum
SWS	4
Inhalt	This module reviews fundamental concepts of food physics, and aims to deliver knowledge of principles of physical phenomena (e.g., mass transport, solution thermodynamics, molecular and particle interactions, and phase transitions) in complex food matrices. Case studies highlight the connection between the theory and practical relevance. Student assignments aim to promote knowledge transfer and enable the students to apply the scientific concepts and scientific literature. These assignments involve calculation exercises, virtual lab projects, and generating individual flash talks and poster

	presentations based on current papers in the area of food physics.
Literatur	Principles of Colloid and Surface Chemistry, CRC Press,1997, ISBN: 978-0824793975 Polymer Chemistry, CRC Press, 2007, ISBN: 978-1574447798 Phase Transitions in Foods (1. Ed), Academic Press,1995, ISBN: 978-0125953405 Phase Transitions in Foods (2. Ed) Academic Press, 2016, ISBN: 978-0124080867 Biophysics: An introduction, Springer, 2012, ISBN: 978-3-642-25211-2 Biophysics, Springer, 2002, ISBN: 978-1-4020-0218-2
Anmerkungen	The module is taught online. Online live sessions are designed to answer student questions about the teaching material, and present student assignments in a mini-conference.

Modul: Technologie pflanzlicher Lebensmittel II (1504-430)

Modulverantwortung	Mario Jekle
Bezug zu anderen Modulen	Einführung in Modul "Technologie pflanzlicher Lebensmittel I"
Teilnahmevoraussetzung	-
Lehrsprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Dauer des Moduls	4 Wochen (Block 3)
Studiengänge	M.Sc. Food Science and Engineering, 2. Semester, Wahl M.Sc. Food Biotechnology, 2. Semester, Wahl M.Sc. Bioeconomy, 2. Semester, Wahl (Profil: Transforming Food Systems)
Prüfungsdauer (in Minuten)	-
Präsenzstudium (in Stunden)	56
Selbststudium (in Stunden)	169
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Die Studierenden - führen im Rahmen des Praktikums im Technikum des Lehrstuhls unter industrienahen Bedingungen Versuche zur Verarbeitung pflanzlicher Lebensmittel durch - lernen den Umgang mit den hierfür notwendigen Maschinen und Apparaten kennen - bearbeiten in Kleingruppen komplette Prozesse vom Einsatz der Rohware bis zum fertig verpackten Produkt einschließlich prozessbegleitender Analysen - erwerben in der Vorlesung vertiefte Kenntnisse über alkaloidhaltige Rohwaren (Kaffee, Tee, Kakao und andere), deren Aufbereitung in den Ursprungsländern und Weiterverarbeitung in den Verbraucherländern
empfohlene Vorkenntnisse	-
Anmerkungen	Anzahl Teilnehmerplätze: 30 Anmeldung zur Teilnahme am Modul: Ab Mitte des Wintersemesters bis zu Beginn der Vorlesungszeit

	im Sommersemester durch Aushang am Schwarzen Brett des Fachgebietes.
Modulprüfung und Gewichtung	2-stündige schriftliche Prüfung, Kolloquium (20 Minuten)
Studienleistung und Gewichtung	-
Technologie pflanzlicher Lebensmittel II: Alkaloidhaltige Lebensmittel (1504-431)	
Person(en) verantwortlich	Mario Jekle
Lehrform	Vorlesung mit Seminar
SWS	3
Inhalt	- Kaffee - Tee - Kakao - Weitere alkaloidhaltige Lebensmittel (Guaraná, Maté usw.)
Literatur	Skripte mit speziellen Literaturempfehlungen für die einzelnen Themengebiete
Anmerkungen	-
Technologie pflanzlicher Lebensmittel II: Technologisches Praktikum (1504-432)	
Person(en) verantwortlich	Mario Jekle
Lehrform	Praktikum
SWS	2
Inhalt	- Haltbarmachung durch Erhitzen (Pasteurisation, Sterilisation) und Gefrieren (Nasskonserven, Tiefkühlprodukte) - Alkoholfreie Getränke (Fruchtsaft, -nektar) - Speiseöl - Gelierprodukte (Konfitüre, Fruchtzubereitung) - Lebensmittel-3D-Druck
Literatur	Skripte mit speziellen Literaturempfehlungen für die einzelnen Themengebiete
Anmerkungen	-

Modul: UNIcert III English for Scientific Purposes (1000-040)

Modulverantwortung	Lutz Fischer
Bezug zu anderen Modulen	-
Teilnahmevoraussetzung	Scoring at least 85 points in the Language Center's entrance examination OR a UNIcert II certificate or equivalent proof of English language proficiency OR being enrolled in an English-language Master's program at the Faculty of Natural Sciences.
Lehrsprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Dauer des Moduls	2 Semester
Studiengänge	M.Sc. Biologie, 1.-4. Semester, Wahlpflicht B.Sc. Biologie 3.-6. Semester, Wahlpflicht M.Sc. Earth System Science, 1.-4. Semester, Wahl M.Sc. Earth & Climate System Science, 1.-4. Semester, Wahl B.Sc. Ernährungsmanagement und Diätetik, 3.-6. Semester, Wahl B.Sc. Ernährungswissenschaft, 3.-6. Semester, Wahl B.Sc. Lebensmittelwissenschaft und Biotechnologie, 3.-6.Semester, Wahl M.Sc. Ernährungsmedizin, 3. Semester, Wahl M.Sc. Medizinische Ernährungswissenschaft, 3. Semester, Wahl M.Sc. Molekulare Ernährungswissenschaft, 3. Semester, Wahl M.Sc. Molekulare Ernährungswissenschaft (ab Studienbeginn WS 23/24), 3. Semester, Wahl M.Sc. Food Microbiology and Biotechnology, 1.-4. Semester, Wahl M.Sc. Food Biotechnology 1.-4. Semester, Wahl M.Sc. Food Science and Engineering (Master, PO vom 01.10.2013) 1.-4. Semester, Wahl M.Sc. Lebensmittelchemie (Master, PO vom 01.10.2015) 3. Semester, Wahl Promotionsstudiengang Naturwissenschaften, 1./2. Semester, Wahl
Prüfungsdauer (in Minuten)	240
Präsenzstudium (in Stunden)	-
Selbststudium (in Stunden)	-
Arbeitsaufwand (in Stunden)	225
Lern- und Qualifikationsziele	Upon successful completion of this module, the English language proficiency of the students

	corresponds to the level C1 of the Common European Framework of Reference for Languages. For details on the competencies you acquire beyond language proficiency, please read the individual course descriptions at https://spraz.uni-hohenheim.de/kurse?&L=1.
empfohlene Vorkenntnisse	-
Anmerkungen	You need to register for the UNIcert III courses. Information on how to register is available at https://spraz.uni-hohenheim.de/anmeldung?&L=1
Modulprüfung und Gewichtung	UNIcert III examination (240 minutes total): 180 minutes written exam, 30 minutes listening comprehension, 30 minutes oral exam
Studienleistung und Gewichtung	Regular attendance, active participation, other (see individual course descriptions at https://spraz.uni-hohenheim.de/kurse)
UNIcert III English for Scientific Purposes (1000-041)	
Person(en) verantwortlich	Lutz Fischer
Lehrform	Vorlesung
SWS	-
Inhalt	For details on the competencies you acquire beyond language proficiency, please read the individual course descriptions at https://spraz.uni-hohenheim.de/kurse?&L=1.
Literatur	-
Anmerkungen	-