UNIVERSITÄT HOHENHEIM

Modulhandbuch

für den Studiengang

Master of Science

Food Biotechnology

Stand Oktober 2018

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Modul: Advanced Flavor Chemistry (1508-410)

Modulverantwortung	Yanyan Zhang
Teilnahmevoraussetzungen	Scientific background in chemistry
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Studienleistung	Lecture with lab exercise + Seminar
Modulprüfung	written exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56h attendance + 140h independent studies = 196h workload
Fachkompetenzen / 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. \r\n\r\nThey become familiar with presenting their work through written reports and oral presentations.
Schlüsselkompetenzen	The students: • learn the various analytical measurements of flavour compounds, correlated in-strument and data analysis • gain an awareness of relationship among main flavour & off-flavor reactions in food and their impact on quality & shelf life • are able to independently analyse aroma compounds of food and drink using the proper methods, equipment and data analysis
Anmerkungen	Anzahl Teilnehmerplätze: 12 Anmeldung zum Modul: ILIAS Anmeldezeitraum: 1st, April 2018

Advanced Flavor Chemistry (1508-411)

Person(en) verantwortlich	Yanyan Zhang
Person(en) begleitend	Dr. Martin Spraul
Lehrform	Vorlesung mit Übung
SWS	3
Inhalt	Lecture: Basic information on flavor property, individual aroma compounds and corresponding non-enzymatic or enzymatic pathways, flavor biotechnology, prin-ciples 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 frag-mentation

Literatur	Belitz, H.D., Grosch, W. Schieberle, P.: Food Chemistry. Springer, 2009 Berger, R.G.: Flavours and Fragrances. Springer, 2007
Advanced Flavor Chemistry (1508-411)	
Person(en) verantwortlich	Yanyan Zhang
Person(en) begleitend	Dr. Martin Spraul
Lehrform	Vorlesung mit Übung
SWS	3
Inhalt	Lecture: Basic information on flavor property, individual aroma compounds and corresponding non-enzymatic or enzymatic pathways, flavor biotechnology, prin-ciples 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 frag-mentation
Literatur	Belitz, H.D., Grosch, W. Schieberle, P.: Food Chemistry. Springer, 2009 Berger, R.G.: Flavours and Fragrances. Springer, 2007
Advanced Flavor Chemistry (1508-412)	
Lehrform	Seminar
SWS	1
Inhalt	Evaluation of publications and research contributions Conclusion of scientific literature, presenting and discussing on topic on flavour chem-istry and biotechnology.

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

Modulverantwortung	Prof. Dr. Jochen Weiss
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 1)
Verbindlichkeit	Wahl

Modulprüfung	Written exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h attendance + 154 h independent study = 210 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	After completion of the course, students are expected to have gained a knowledge of fundamental biochemical properties of animal based raw materials (meat, fat, collagen, etc.). They have understood various industrial processes used to convert these specific raw materials into various meat products such as boiled, cooked or raw (fermented) sausages, or cooked or raw ham. They can perform the required process operations on a pilot plant laboratory scale to generate those products. They understand scale up issues due to them having gotten insights into plant design and mode of operation of various companies that have been have visited during the course. They understand the function and role of various additives and ingredients used to industrially manufacture meat products. They understand issues surrounding hygiene and safety of meat-based products.
Schlüsselkompetenzen	This module provides students with an advanced knowledge of meat science and technology thereby introducing them to one of the key in-dustrial sectors in the food industry. Students will learn about the prop-erties of raw materials used and issues surrounding their provisioning (e.g. slaughtering, dressing and cutting, conditioning or confectioning). A focus of the course is to introduce students to modern industrial pro-cesses used to generate the most popular and commonly manufactured meat products, i.e. boiled, cooked or raw, fermented sausages as well as cooked or raw hams. Students will participate in daily pilot plant ex-ercises (pilot plant laboratories) where they will have the opportunity to manufacture these products themselves to put theory into practice. 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 also allow students to gain an insight into key analytical methods that are required to comply with regulatory aspects of the meat or meat product manufacturing sector, such as method to analyze meat product quality and safety. Finally, participants will have the opportunity to visit one or more industrial meat product manufacturing facilities.
Anmerkungen	Maximum number of participants: 24 Registration opens 4 weeks prior to the start of the semester and closes at the beginning of the semester. Registration is mandatory since space is limited. First preference will be given to students enrolled in the M.Sc. Food Science and Engineering. Remaining free slots will then be given to students enrolled in the M.Sc. in Food Microbiology and Biotechnology. Further free slots may be given to students enrolled in other Master degree programs at the University of Hohenheim.

Advanced Meat Science and Technology (1507-501)

Person(en) verantwortlich	Prof. Dr. Jochen Weiss
Lehrform	Vorlesung mit Übung, Praktikum und Exkursion

SWS	4
Inhalt	This module provides students with an advanced knowledge of meat science and technology thereby introducing them to one of the key in-dustrial sectors in the food industry. Students will learn about the prop-erties of raw materials used and issues surrounding their provisioning (e.g. slaughtering, dressing and cutting, conditioning or confectioning). A focus of the course is to introduce students to modern industrial pro-cesses used to generate the most popular and commonly manufactured meat products, i.e. boiled, cooked or raw, fermented sausages as well as cooked or raw hams. Students will participate in daily pilot plant ex-ercises (pilot plant laboratories) where they will have the opportunity to manufacture these products themselves to put theory into practice. 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 also allow students to gain an insight into key analytical methods that are required to comply with regulatory aspects of the meat or meat product manufacturing sector, such as method to analyze meat product quality and safety. Finally, participants will have the opportunity to visit one or more industrial meat product manufacturing facilities.
Literatur	A script will be provided.

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

Modulverantwortung	Prof. Dr. Bernd Hitzmann
Teilnahmevoraussetzungen	English language skills
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Studienleistung	Passing the practical course
Modulprüfung	Depending on the number of participants either a written (60 minutes) or an oral exam (30 minutes).
Arbeitsaufwand	56 h attendance + 132 h independent study = 188 h workload
Fachkompetenzen / 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.
Anmerkungen	Maximum number of participants: 20
Advanced Process Engineering Techniques for Cereal Processing (1509-501)	
Person(en) verantwortlich	Prof. Dr. Bernd Hitzmann
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

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

Modulverantwortung	Prof. Dr. Philipp Kügler
Teilnahmevoraussetzungen	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.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester

Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Studienleistung	Regular attendance and active software programming
Modulprüfung	written exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	84 h attendance + 106 independent study = 190 h workload
Fachkompetenzen / 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 engineering and earth system sciences and use the software packages MATLAB and COMSOL to implement and numerically ana-lyze them. Furthermore, students will know central concepts of model parameter identification from experimental data.
Anmerkungen	Maximum number of participants: 50
Applied Mathematics for the Life Sciences, Lecture and Exercise (1101-401)	
Person(en) verantwortlich	Prof. Dr. Philipp Kügler
Person(en) begleitend	Heiko Schulz, Dr. André Erhardt
Lehrform	Vorlesung mit Übung
SWS	6
Inhalt	Linear and nonlinear ordinary differential equations Systems of ordinary differential equations Initial and boundary value problems Numerical Integration Finite difference method Finite element method Partial differential equations Parameter identification problems Control of differential equations
Literatur	

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

Modulverantwortung	Prof. Dr. Philipp Kügler
Bezug zu anderen Modulen	Builds on the module "Applied Mathematics for the Life Sciences (1101-400)"
Teilnahmevoraussetzungen	Successful completion of the module "Applied Mathematics for the Life Sciences (1101-400)" and knowledge in Matlab
Sprache	englisch
ECTS	7,5

Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Studienleistung	Active participation in the lecture and exercise
Modulprüfung	Written exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	84 h attendance + 106 h independent study = 190 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Upon completion of the module students are able to:\r\n- classify and numerically solve common partial differential equations,\r\n- formulate optimization tasks and solve them numerically,\r\n- use simulation software.
Schlüsselkompetenzen	Upon completion of the module students are able to:\r\n- independently solve simple simulation taks in research and development,\r\n- enter a dialogue with simulation experts in the context of interdisciplinary cooperation,\r\n- analyze scientific problems in a structured manner.
Applied Mathematics for the Life Sciences II (1101-411)	
Person(en) verantwortlich	Prof. Dr. 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

Modul: Bioanalysis (1502-460)

Modulverantwortung	Prof. Dr. rer. nat. Lutz Fischer
Teilnahmevoraussetzungen	-
Sprache	englisch

ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 1)
Verbindlichkeit	Wahl
Studienleistung	Regular attendance and active participation
Modulprüfung	Written exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h attendance + 132 h independent study = 188 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The students will understand the theoretical background and gain practical experiences in bioanalytical methods for protein and small molecule analysis. In particular, the students will learn to identify proteins by 2D-electrophoresis, MALDI-ToF and Electrospray mass spectrometry. Furthermore, the students will learn how to perform absolute quantification of proteins and small molecules using mass spectrometry.
Schlüsselkompetenzen	The students learn to act in a team and get practice in organizing the workflow of scientific experiments. The students also learn to analyze and evaluate their data and to communicate about scientific issues in English.
Anmerkungen	Maximum number of participants: 10 Registration via ILIAS till 15th September The mandatory meeting for the introduction to the course "Bioanalysis" is on 1st October at 11 a.m. in seminar room -1.22 Garbenstr. 25.
Bioanalysis, Lecture (2303-461)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Lutz Fischer
Person(en) begleitend	Dr. rer. nat. Sabine Lutz-Wahl, Dr. rer. nat. Jens Pfannstiel, Dr. rer. nat. Ines Seitl
Lehrform	Vorlesung
SWS	1
Inhalt	The lecture comprises the theoretical background of the experiments carried out in the practical course. Principles and applications of 2D-electrophoresis, MALDI-ToF and Electrospray mass spectrometry in the qualitative and quantitative analysis of proteins and small molecules will be explained.
Literatur	Lottspeich, F., Zorbas, H.: Bioanalytik,: 3. Auflage (2012), Springer/Spektrum, München, ISBN-13: 978-3827429421
Bioanalysis, Practical (2303-462)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Lutz Fischer
Person(en) begleitend	Dr. rer. nat. Sabine Lutz-Wahl, Dr. rer. nat. Jens Pfannstiel, Dr. rer.

	nat. Ines Seitl
Lehrform	Übung
SWS	3
Inhalt	The practical comprises the following bioanalytical experiments which are carried out, analysed, and documented independently by the students: - Cultivation of Yarrowia lipolytica and sample preparation - 2D gel electrophoresis for separation of proteins and protein isoforms. - Tryptic digestion of proteins in gel slices Separation of peptides by HPLC - Maldi-ToF and ESI mass spectrometry combined with data bank analysis (e.g. MASCOT) for identification of proteins The students understand the theoretical background and gain practical experiences in carrying out bioanalytical methods. This includes: - Using 1D- and 2D-electrophoretical methods for protein separation. - Learning the principals and gaining practical experiences in immunological protein detection methods. - Learning the principals and gaining practical experiences in MALDI-ToF mass spectrometry. - Using MALDI-ToF mass spectrometry for protein identification and characterization of protein modifications. - Learning the principals and gaining practical experiences in nano-HPLC coupled electrospray mass spectrometry. - Learning how to perform database searching for mass spectrometry based protein identification. - Using electrospray mass spectrometry for the absolute quantification of small molecules in extracts of biological fluids.
Literatur	Lottspeich, F., Zorbas, H.: Bioanalytik,: 3. Auflage (2012), Springer/Spektrum, München, ISBN-13: 978-3827429421

Modul: Bioethanol and Distilled Spirits (1506-500)

Modulverantwortung	Prof. Dr. Ralf Kölling-Paternoga
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 4)
Verbindlichkeit	Wahl

Studienleistung	Regular attendance and active participation. Practical report.
Modulprüfung	Written exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	70 h attendance + 118 h independent study = 188 h workload
Fachkompetenzen / 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.
Anmerkungen	Maximum number of participants: 20
Bioethanol and Distilled Spirits, Lecture (1506-501)	
Person(en) verantwortlich	Prof. Dr. Ralf Kölling-Paternoga
Person(en) begleitend	Dr. Daniel Einfalt
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.
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	Prof. Dr. Ralf Kölling-Paternoga
Person(en) begleitend	Dr. 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.
Bioethanol and Distilled Spirits, Practical (1506-503)	
Person(en) verantwortlich	Prof. Dr. Ralf Kölling-Paternoga
Person(en) begleitend	Dr. 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.

Modul: Biologie des Alterns und die Rolle der Ernährung (1403-430)

Modulverantwortung	Prof. Dr. Jan Frank
Teilnahmevoraussetzungen	B. Sc. Ausbildung mit Toxikologie, Biofunktionalität, Biochemie o.ä.
Sprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Modulprüfung	Klausur
Prüfungsdauer	60 Minuten
Arbeitsaufwand	56 h Präsenz + 154 h Eigenanteil = 210 workload
Fachkompetenzen / Lern- und Qualifikationsziele	Die Studierenden\r\n- verstehen die Grundlagen des Alterungsprozesses.\r\n- verstehen den Pathomechanismus altersbedingter Erkrankungen.\r\n- verstehen die Potentiale und Grenzen von Ernährungsinterventionen in den Alterungsprozess und die Pathophysiologie altersbedingter Erkrankungen.
Anmerkungen	Anmeldung zur Teilnahme am Modul: Persönlich bis spätestens vier Wochen vor Modulbeginn

Modul: Cellular Microbiology (2502-430)

Modulverantwortung	Prof. Dr. Julia Fritz-Steuber
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Studienleistung	Regular and active participation
Modulprüfung	Oral presentation and protocol
Arbeitsaufwand	56 h presence + 169 h personal contribution = 225 h workload
Fachkompetenzen / 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
Schlüsselkompetenzen	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.
Anmerkungen	Maximum number of participants: 6 Registration for participation: from March 18 to April 5 via ILIAS
Cellular Microbiology, Lecture (2502-431)	
Person(en) verantwortlich	Prof. Dr. 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” (2502-432)

Cellular Microbiology, Research Internship (2502-432)	
Person(en) verantwortlich	Prof. Dr. 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” (2502-431)

Modul: Cellular Signalling (1402-450)

Modulverantwortung	Prof. Dr. Lutz Graeve
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Studienleistung	Inquest and compiling cytokine profiles for a database
Modulprüfung	Written exam
Prüfungsdauer	90 Minuten
Arbeitsaufwand	56 h presence + 132 h personal contribution = 188 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	After this module the students are able to - describe the mechanisms of proliferation, differentiation and apoptosis. - understand the significance of different cellular signalling cascades for these processes. - have extensive knowledge about the different components of signalling cascades. - analyse pathophysiological consequences of malfunctioning signalling pathways. - understand in which ways nutrition is able to interfere with these complex processes.

Schlüsselkompetenzen	After this module the students are able to - discuss the regulation of the homeostasis of the human body by hormones, cytokines and growth factors in health and disease and to grasp the complexity of this regulatory network. - evaluate the possible input of "omics" technologies and bioinformatics in these scenarios. - apply this knowledge in the appraisal of problems of human nutrition and health.
Anmerkungen	Maximum number of participants: 30 Registration for participation: via ILIAS
Biochemistry of Signal Transduction (1402-451)	
Person(en) verantwortlich	Prof. Dr. Lutz Graeve
Lehrform	Vorlesung
SWS	2
Inhalt	- Proliferation, differentiation and apoptosis - Ligands, receptors, G-Proteins, second messenger - Kinases - Cellular signal cascades - Adipokines - Nutrient signalling
Literatur	Heinrich, Müller, Graeve Hrsg.: Löffler/Petrides Biochemie und Pathobiochemie Gomperts: Signal transduction Krauss: Biochemistry of Signal Transduction and Regulation
Mediators of Regulation in Health, Disease and Nutrition (1402-452)	
Person(en) verantwortlich	Prof. Dr. Lutz Graeve
Lehrform	Seminar
SWS	2
Inhalt	Updating and extension of a cytokine database, short presentations
Literatur	Recent reviews on the topic
Anmerkungen	This course is suitable for international students with competencies in human biology and nutrition

Modul: Chemical Analytical Methods (1302-440)

Modulverantwortung	Prof. Dr. rer. nat. Uwe Beifuß
Teilnahmevoraussetzungen	Scientific basics in inorganic, organic and analytical chemistry
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Semesterlage	1. Semester

Dauer des Moduls	4 Wochen (Block 4)
Verbindlichkeit	Pflicht
Studienleistung	Regular attendance, lab reports
Modulprüfung	oral examination
Prüfungsdauer	30 Minuten
Arbeitsaufwand	96 h attendance + 114 h independent study = 210 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The students understand principles and concepts related to the description and analysis of chemical reactions, the separation of reaction mixtures, the purification and characterization of organic compounds, stereochemistry and the analysis and separation of diastereomeric and enantiomeric mixtures. The students acquire practical skills in a) performing laboratory procedures for synthetic and analytical chemistry b) safe handling of chemi-cals and instruments.
Anmerkungen	For participation in this module please register via ILIAS. Registration is possible until the module commences.
Chemical Analytical Methods, Lecture (1302-441)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Uwe Beifuß
Lehrform	Vorlesung
SWS	1
Inhalt	Description and analysis of chemical reactions; methods for the separa-tion of reaction mixtures; methods for the purification of organic com-pounds; principles of stereochemistry; methods for the analysis and separation of diastereomeric and enantiomeric mixtures.
Literatur	J. E. McMurry, Organic Chemistry, Brooks/Cole, 2012 or any other text-book of organic chemistry D. A. Skoog, D. M. West, F. J. Holler, S. R. Crouch, Fundamentals of Analytical Chemistry, Brooks/Cole, 2004
Anmerkungen	Maximum number of participants: 20
Chemical Analytical Methods, Exercise (1302-442)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Uwe Beifuß
Lehrform	Übung
SWS	1
Inhalt	Exercises related to the topics of the lecture and the laboratory course
Anmerkungen	Maximum number of participants: 20
Chemical Analytical Methods, Practical (1302-443)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Uwe Beifuß

Person(en) begleitend	Dr. rer. nat. Alevtina Baskakova, Heike Weischedel
Lehrform	Praktikum
SWS	4
Inhalt	Practical skills in a) performing laboratory procedures for synthetic and analytical chemistry; b) safe handling of chemicals and instruments. Enzyme-catalyzed reactions; methods in reaction control; separation of reaction mixtures; preparation and characterization of pure organic compounds; analysis and separation of diastereomeric and and enantiomeric mixtures.
Literatur	D. R. Palleros, Experimental Organic Chemistry, J. Wiley, New York, 2000
Anmerkungen	Maximum number of participants: 20

Modul: Chemistry of Catalytic Redox Systems (1302-450)

Modulverantwortung	Prof. Dr. rer. nat. Uwe Beifuß
Bezug zu anderen Modulen	Successfull completion of 1302-440 (Chemical Analytical Methods) is a prerequisite for taking part in this module.
Teilnahmevoraussetzungen	Scientific basics in inorganic, organic and analytical chemistryrnrnSuccessful completion of the module Chemical Analytical Methods (1302-440).
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Studienleistung	Regular attendance, lab reports
Modulprüfung	Oral examination
Prüfungsdauer	30 Minuten
Arbeitsaufwand	56 h attendance + 154 h independent study = 210 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The students understand principles and concepts related torna) the structure and function of dehydrogenases, oxidases, monooxygenases, dioxygenases and peroxidasesrnb) selective reductions and oxidations using dehydrogenases, oxidases, oxygenases and peroxidasesrnc) the separation of reaction mixtures, the purification and characterization of organic compounds, the analysis and separation of diastereomeric and enantiomeric mixtures. The students acquire practical skills in a) performing laboratory

	procedures for synthetic and analytical chemistry, b) safe handling of enzymes, chemicals and instruments.
Schlüsselkompetenzen	- Development of organizational skills - Ability to work safely - Ability to work independently
Anmerkungen	Maximum number of participants: 8 Please register for this module.
Chemistry of Catalytic Redox Systems, Lecture (1302-451)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Uwe Beifuß
Lehrform	Vorlesung
SWS	1
Inhalt	Structure and function of dehydrogenases, oxidases, monooxygenases, dioxygenases and peroxidases Cofactors Selective reductions and oxidations using dehydrogenases, oxidases, oxygenases and peroxidases Significance to nature and technology
Literatur	Grunwald, P.: Biocatalysis, Imperial College Press, London, 2009 Faber, K.: Biotransformations in Organic Chemistry, Springer, Heidelberg, 2004
Chemistry of Catalytic Redox Systems, Exercise (1302-452)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Uwe Beifuß
Lehrform	Übung
SWS	1
Inhalt	Detailed discussion of the topics of the lecture and the practical
Literatur	Grunwald, P.: Biocatalysis, Imperial College Press, London, 2009 Faber, K.: Biotransformations in Organic Chemistry, Springer, Heidelberg, 2004
Chemistry of Catalytic Redox Systems, Practical (1302-453)	
Person(en) verantwortlich	Dr. rer. nat. Alevtina Baskakova
Lehrform	Praktikum
SWS	4
Inhalt	Enzyme-catalyzed reactions using dehydrogenases, oxidases, monooxygenases, dioxygenases und peroxidases Analytical methods in reaction control Methods for the separation of reaction mixtures Methods for the preparation of pure organic compounds Methods and procedures for the structure analysis of organic compounds Methods and procedures for the analysis and separation of diastereo-meric and enantiomeric mixtures

	Safe handling of enzymes, chemicals and instruments
Literatur	Experimental procedures

Modul: Dairy Science and Technology (1505-440)

Modulverantwortung	Prof. Dr.-Ing. habil. Jörg Hinrichs
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Prüfungsleistung	Exam (70 % of total), practical seminar (30% of total)
Modulprüfung	Written (120 minutes) and/or oral (20 minutes) exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	70 h attendance + 108 h independent study = 188 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The aim of the course is to learn about the physical and chemical properties of milk ingredients and their processing characteristics. The relationships between raw material processing technology and product characteristics are introduced. It also teaches the concept of mass and energy balances, the estimation of the microbial risk of dairy products and the hazards associated with the various processing steps. The students develop their ability to work independently through practical work. At the same time, they are expected to work in teams for some exercises. They also gain problem solving skills in these tasks.
Anmerkungen	Maximum number of participants: 25

Dairy Science and Technology (1505-441)

Person(en) verantwortlich	Prof. Dr.-Ing. habil. Jörg Hinrichs
Lehrform	Vorlesung mit Übung, Praktikum und Exkursion
SWS	5
Inhalt	- Physics and chemistry of milk components - Analytical tools - Hygiene and aseptic - Evaporation to milk concentrate - Membrane filtration to fractionate milk - Milk powder production tehnology & application aspects

	- Milk desserts and foams
Literatur	Kessler, H.G., Food & Bio Process Engineering – Dairy Technology, A. Kessler, München, 2011. Hinrichs, J., Lecture notes Palzer, S., Lecture notes
Anmerkungen	A one-day excursion is part of this module.

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

Modulverantwortung	Prof. Dr.-Ing. Reinhard Kohlus
Teilnahmevoraussetzungen	Knowledge of equivalent to Food Process Design I, e.g. Basics of fluid mechanics, mass and heat transfer, unit operations in food processing.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 4)
Verbindlichkeit	Wahl
Modulprüfung	Written exam (60 minutes), oral exam (30 minutes).
Arbeitsaufwand	56 h attendance + 154 h independent study = 210 h workload
Fachkompetenzen / 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.
Schlüsselkompetenzen	Key competencies addressed in this module are critical problem assessment and analytical thinking.
Anmerkungen	Maximum number of participants: 20 Registration via ILIAS until 2 weeks before the course starts.
Drying, Granulation and Instantisation, Lecture (1503-541)	
Person(en) verantwortlich	Prof. Dr.-Ing. Reinhard Kohlus
Person(en) begleitend	Dr. Martin Spraul
Lehrform	Vorlesung

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: Einführung in Matlab (1101-060)

Bezug zu anderen Modulen	Algorithmen aus Mathematik für Biowissenschaften werden aufgegriffen
Teilnahmevoraussetzungen	Mathematik für Biowissenschaften (oder vergleichbare LVen)
Sprache	deutsch
ECTS	3
Angebotshäufigkeit	jedes SS
Semesterlage	4. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	Lösung von Übungsprogrammieraufgaben
Prüfungsleistung	Computerklausur mit Programmieraufgaben
Modulprüfung	Computerklausur mit Programmieraufgaben
Prüfungsdauer	120 Minuten
Arbeitsaufwand	Präsenzzeit 28 SWSrnEigenanteil 62 SWSrnArbeitsaufwand 90 SWSrn
Fachkompetenzen / Lern- und	Ziel des Moduls ist, dass die Studierenden nach dessen Abschluss in der Lage sind, …\r\n\r\nto implement in Matlab solution algorithms

Qualifikationsziele	presented in the introductory mathematics\r\nlectures \r\nto use Matlab as a programming tool for data analysis\r\n
Schlüsselkompetenzen	Ziel des Moduls ist, dass die Studierenden nach dessen Abschluss in der Lage sind, …\r\n\r\nto use modern computing software to solve problems in life sciences.\r\nto understand and apply basic control and data structures to construct sim-\r\nple programs.\r\nto apply testing and debugging techniques to identify and correct errors in\r\nprograms.\r\nto understand and implement some basic algorithms, including numerical\r\nmethods.\r\n
Anmerkungen	Anzahl Teilnehmerplätze: 20rnAnmeldung zum Modul: per ILIASrnAnmeldezeitraum: bis zum Beginn des SommersemestersrnKriterien, nach denen Studienplätze vergeben werden: Reihenfolge der Anmeldungrn
Introduction to Matlab (1101-061)	
Lehrform	Vorlesung
SWS	2
Inhalt	The course gives an introduction to MATLAB, a powerful programming language and development environment for engineers and life scientists. The course contents is Basics of Matlab Plotting and Matrics Array Operations and Linear Equations Programming in Matlab Control Flow and Operator
Literatur	D. C. Hanselman and B. L. Little_eld. Mastering MATLAB. Prentice Hall Press, Upper Saddle River, NJ, USA, 1st edition, 2011. A. Quarteroni and F. Saleri. Scientific Computing with MATLAB and Oc- tave (Texts in Computational Science and Engineering). Springer-Verlag New York, Inc., Secaucus, NJ, USA, 2006.

Modul: Einführung in wissenschaftliches Programmieren (1509-900)

Modulverantwortung	Prof. Dr. Bernd Hitzmann
Sprache	deutsch/englisch
ECTS	2
Angebotshäufigkeit	jedes SS

Semesterlage	2. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	Erstellen eines Programms
Modulprüfung	Programmieraufgabe lösen
Prüfungsdauer	60 Minuten
Arbeitsaufwand	28 h Präsenzzeit + 28 h Eigenanteil = 56 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Ziel des Moduls ist, dass die Studierenden nach dessen Abschluss in der Lage sind, eine Programmierumgebung, typische Datentypen, Operatoren und Ausdrücke sowie Kontrollstrukturen zu handhaben. Die strukturierte Vorgehensweise beim Erstellen von Programmen kennen und praktische wissenschaftliche Problemstellungen durch selbst geschriebene Programme lösen können (Algorithmen aus der Mathematik, z.B. für Approximationen, Optimierung oder Analyse von Daten in Dateien, ...).
Schlüsselkompetenzen	- Selbstständiges Arbeiten und Programmieren\r\n- Kritisches, analytisches Denken
Anmerkungen	Teilnehmerplätze: 10rnAnmeldung: ILIASrnAnmeldezeitraum: 01.02.-31.03.2017
Einführung in wissenschaftliches Programmieren (1509-901)	
Person(en) verantwortlich	Prof. Dr. Bernd Hitzmann
Person(en) begleitend	Dipl.-Chem. Olivier Paquet-Durand, Bernhard Hermannseder
Lehrform	Vorlesung mit Übung
SWS	2
Inhalt	- Funktionsweise eines Compilers, Linkers - Aufbau eines Programms - Datenstrukturen, Kontrollstrukturen und Schleifen - Programmierfähigkeit
Literatur	Thomas Theis, Einstieg in Python: Ideal für Programmieranfänger geeignet, Galileo Computing, 2014 Johannes Ernesti, Peter Kaiser, Python 3: Das umfassende Handbuch: Sprachgrundlagen, Onjektorientierung, Modularisierung, Rheinwerk Computing, 2015 Michael Weigend, Raspverry Pi programmieren mit Python, mitp, 2013

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

Modulverantwortung	Prof. Dr. Jochen Weiss

Teilnahmevoraussetzungen	Admission to a Master's program or the doctoral degree program at the Faculty of Natural Sciences
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 3)
Verbindlichkeit	Wahl
Studienleistung	regular and active participation, presentation
Modulprüfung	oral examination
Prüfungsdauer	20 Minuten
Arbeitsaufwand	68 h attendance + 127 h independent study = 195 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	After completion of the course, students are expected to have gained an overview of the importance of encapsulation systems and encapsulants for applications in food and pharmaceutical systems. The students will get to know a variety of functional compo-nents that are used in food and related industries. They will gain an overview of the physicochemical properties of functional food components. In addition, they will learn the fundamental physical and chemical processes that govern the behavior and stability of delivery systems. Moreover, the students will gain knowledge of encapsulation processes and industrial applications (food, feed, pharma, personal care). Furthermore, students will gain practical experience in formulating an encapsulation system for sample application in a beverage and in ice cream.
Schlüsselkompetenzen	The goal of this module is to promote the following key competences: The students are able to work independently and as a part of a group. The students are supposed to be able to use critical and analytical thinking to solve a problem when presented with a task of encapsulating functional components in a delivery system. Furthermore, they will learn how to prepare an oral presentation, and are encouraged to ask critical questions during presentations and excursion. The students are required to use English during the module which will promotes both written and spoken foreign language skills.
Anmerkungen	Available places: 15rnRegistration: at the beginning of the semester, but 4 weeks before the module begins at the latest (first come, first serve)
Encapsulation of Functional Food Components (1507-411)	
Person(en) verantwortlich	Prof. Dr. Jochen Weiss
Person(en) begleitend	Dr. Benjamin Zeeb, Dr. rer. nat. Hanna Salminen, Dr. Thrandur Helgason
Lehrform	Seminar mit Übung

SWS	4
Inhalt	The students learn the principles of encapsulation and a variety of functional food components. The main focus is on gaining knowledge of numerous en-capsulation systems (e.g., emulsions, nanoparticles, biopolymer complexes, micelles, liposomes, fibers etc.) and encapsulation processes (e.g., homoge-nization, microfluidics, vibrating nozzle, spray-drying, spray-chilling, extrusion, electrospinning etc.). They will learn about encapsulation from an industrial point-of-view in the field of food, feed, pharma and personal care, and gain more insights upon excursion to a company. Students will be given tasks to encapsulate functional food components into real food products. This will involve both a literature-based development project, which will be orally presented during the module, and a short laboratory study.
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

Modul: Fermentation Technology (1501-400)

Modulverantwortung	Prof. Dr. rer. nat. Lutz Fischer
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	1. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Pflicht
Studienleistung	Keep a lab book - Attendance on the daily lab meeting - Attendence at the final discussion of the obtained results - Protocol of the lab experiments
Modulprüfung	Written exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	64 h attendance + 146 h independent study = 170 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	After this modul, the students have knowledge about the fundamtel requirments for a cultivation of microorganims. This includes the composition of complex and defined media as well as of submers and solid state fermenters. Additionally, the students know about the measuring principle of pH-electrodes, oxygen and exhaust gas measurment devices. Upon completion of this modul, the students

	are able to plan and conduct suberms cultivations of microorganisms in shaking flasks and a bioreactor. Also the students are able to conduct a solid-state fermentation. After this modul the students can evaluate cultivations of microorganims in view of fundamental requirements like yield, biomass, growth rate etc.. They have knowledge about microorganisms and processing of diverse fermented foods.
Schlüsselkompetenzen	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.
Anmerkungen	Maximum number of participants: 24
Fermentation Technology, Lecture with Exercise (1501-401)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Lutz Fischer
Person(en) begleitend	Dipl.-Ing. (FH) Wolfgang Claaßen, Priv. Doz. Dr. rer. nat. Timo Stressler
Lehrform	Vorlesung mit Praktikum
SWS	4
Inhalt	In interactive lessons the students will learn the preparation and composition of differnet culture media, the assembly of the bioreactor and sterile sampling during cultivation. Also the analysing of samples will be understood, planned, performed and evaluated. The theoretical background for planning, performing and analysing batch-cultivations will be discussed and exercised in the practical course. The students will be able to cultivate bacteria and yeasts in shaking flask and bioreactor (1 L; 30 L scale). Important biotechnological parameters such as oxygen transfer (Kla), biomass yields, product yields, enzyme activites and C-source consumption will be discussed and evaluated. Also, the students will be able to cultivate microorganisms using the solid-state principle.
Literatur	Principles of Fermentation Technology (2nd edition), Edts. Stanbury, Whitaker and Hall, 1999, Reed Educational and Professional Publishing Ltd. Manual of Industrial Microbiology and Biotechnology, Edts. Demain and Davies, 1999, ASM Press

Modul: Food and Nutrition Security (4902-430)

Modulverantwortung	Dr. Kirsten Boysen-Urban
Bezug zu anderen Modulen	This module will be of particular interest for students with a specialization in development economics and policy.
Teilnahmevoraussetzungen	Students should be familiar with the basics in microeconomics and macroeconomics. Furthermore, some previous exposure to aspects

	related to poverty and economic development is assumed.
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	2. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Modulprüfung	written test
Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload
Fachkompetenzen / Lern- und Qualifikationsziele	Students will become familiar with the multidimensional problems of hunger and malnutrition, including global trends, measurement concepts, causes, and economic implications. Furthermore, policies to improve food and nutrition security will be analyzed and discussed.
Schlüsselkompetenzen	Students will acquire communication and cooperation skills within a multicultural framework. They will be instructed to think critically and analytically about the multidimensionality of hunger and malnutrition. Students will be able to effectively evaluate and communicate the problems and challenges of food security.
Food and Nutrition Security (4902-431)	
Person(en) verantwortlich	Prof. Dr. Manfred Zeller, Dr. Kirsten Boysen-Urban
Lehrform	Vorlesung
SWS	4
Inhalt	This module mostly focuses on socioeconomic aspects of hunger and malnutrition, including causes, consequences, and remedial policies. Furthermore, some basic aspects of nutritional sciences are discussed. For this you should be familiar with the basics in microeconomics and macroeconomics. Furthermore, some previous exposure to aspects related to poverty and economic development is assumed. Overview of main topics covered: - Global Perspective on Hunger and Food Insecurity - Concepts of Hunger and Malnutrition: Measurement Approaches and Nutrition-Health Linkages - The Economic Cost of Malnutrition - The World Food Equation: Factors of Global Food Supply and Demand - Multidimensionality of Hunger and Poverty: Food Security-Poverty Linkages - Access to Rural Finance: Empowerment, Participation and Gender - Targeting of Rural Development Policies

	- Food Demand Analysis: Empirical Approaches and Data Collection - Food and Nutrition Policies - Multidimensionality of Hunger and Poverty: Risk and Vulnerability - Institutional Change: Access to Land and Water Resources - Trade Policies in Developing Countries; Poverty and Trade - The Challenge of Food Security Through the lectures and discussion of case studies you will become familiar with the multidimensional problems of hunger and malnutrition, including global trends, measurement concepts, causes, and economic implications.
Literatur	Leathers, H.D., and P. Foster (2009): The World Food Problem: Towards Ending Undernutrition in the Third World. 4th edition. Lymne Rienner Publishers, Boulder. Leathers, H.D., and P. Foster (2004): The World Food Problem: Tackling the Causes of Undernutrition in the Third World, 3rd edition, Lymne Rienner Publishers, Boulder. Southgate, D., D.H. Graham and L. Tweeten (2010): The World Food Economy. Oxford, Blackwell Publishing. Thirlwall, A.P. (2006): Growth and Development. With Special References to Developing Economies. 8th edition. Palgrave Macmillian, New York. Todaro, M. P. and S. C. Smith (2009): Economic Development. 10th edition. Pearson, London.

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

Modulverantwortung	Prof. Dr.-Ing. Reinhard Kohlus
Teilnahmevoraussetzungen	Technical basics, process engineering, physical chemistry or thermody-namics of multiphase systems
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 3)
Verbindlichkeit	Wahl
Arbeitsaufwand	80 h attendance + 130 h independent study = 210 h workload
Fachkompetenzen / Lern- und	The students know the fundamentals of thermal separation pro-cesses. They are capable of applying physical-chemistry funda-

Qualifikationsziele	mentals, 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.
Anmerkungen	Maximum number of participants: 50
Food Process Design I - Efficient Processing and Transport Phenomena, Lecture (1503-521)	
Person(en) verantwortlich	Prof. Dr.-Ing. Reinhard Kohlus
Lehrform	Vorlesung
SWS	3
Inhalt	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.
Literatur	Sattler; Thermische Trennverfahren; VCH Verlag Kraume, M: Transportvorgänge in der Verfahrenstechnik, Grund-lagen und Apparative Umsetzung , Springer Verlag 2004
Food Process Design I - Efficient Processing and Transport Phenomena, Exercise (1503-522)	
Person(en) verantwortlich	Prof. Dr.-Ing. Reinhard Kohlus
Person(en) begleitend	Dr.-Ing. Peter Gschwind
Lehrform	Übung
SWS	2
Inhalt	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, M: Transportvorgänge in der Verfahrenstechnik, Grund-lagen und Apparative Umsetzung , Springer Verlag 2004

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

Modulverantwortung	Prof. Dr.-Ing. Reinhard Kohlus
Teilnahmevoraussetzungen	Knowledge of equivalent to Food Process Design I, e.g. Basics of fluid mechanics, mass and heat transfer, unit operations in food processing.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 3)
Verbindlichkeit	Wahl
Modulprüfung	Written or oral exam depending on the number of participants.
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h attendance + 154 h independent study = 210 h workload
Fachkompetenzen / 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.
Schlüsselkompetenzen	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.
Anmerkungen	Maximum number of participants: 24 Registration via ILIAS
Food Process Design II – Process Integration and Scale up, Lecture and Exercise (1503-501)	
Person(en) verantwortlich	Prof. Dr.-Ing. Reinhard Kohlus
Lehrform	Vorlesung mit Übung
SWS	4
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: Free Project Work (1500-020)

Teilnahmevoraussetzungen	M.Sc. Food Science and Engineering, M.Sc. Food Microbiology and Biotechnology
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Semesterlage	2. Semester

Dauer des Moduls	n. V.
Verbindlichkeit	Wahl
Modulprüfung	Report, presentation if demanded
Arbeitsaufwand	210 h
Fachkompetenzen / Lern- und Qualifikationsziele	Upon completion of this module students - have gained insight into a current research project - understand the theoretical foundation and methodology of the research project - acquire practical experience by employing the methodology - learn how to properly document research findings - acquire experience in presenting research findings orally
Anmerkungen	Maximum number of participants: 3 This module does not count towards the final grade. Registration on an individual basis in consultation with the supervisor. Students have to find a professor to supervise the project.

Modul: Innovative Milchtechnologie (1505-420)

Modulverantwortung	Prof. Dr.-Ing. habil. Jörg Hinrichs
Bezug zu anderen Modulen	Milchwissenschaft und -technologie, Rheologie und Struktur von Lebensmitteln, Projektarbeit
Teilnahmevoraussetzungen	Technische, physikalische, chemische und mikrobiologische Grundlagen der Lebensmittel- und Biotechnologie; Besuch der Vorlesung "Milchwissenschaft und Technologie"
Sprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	geblockt
Verbindlichkeit	Wahl
Studienleistung	Regelmäßige und aktive Teilnahme, Bearbeitung eines Themas
Modulprüfung	Ausarbeitung zum vergebenen Thema - nicht benotet
Arbeitsaufwand	80 h Präsenz + 130 h Eigenanteil = 210 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Die Studierenden - sind in der Lage die chemisch-physikalischen Eigenschaften der Milchinhaltsstoffe sowie die mikrobiologischen Rahmenbedingungen im Hinblick auf Neues einzuordnen und zu bewerten - überblicken mikrobiologische Risiken für Produkte und können daraufhin Forschungs- und Entwicklungsprojekte evaluieren - besitzen Kompetenz zum Einsatz von Unit-Operations für innovative Milch und Milchprodukte

	- haben Kompetenz in der Auswahl physikalischer, chemischer und mikrobiologischer Methoden zur quantitativen oder qualitativen Beurteilung von Zielgrößen in Milchmatrices oder in Bezug auf einzelne Inhaltsstoffe - sind in der Lage in einem Team Potenziale für neue Prozesse oder Produkte im Bereich Milch nach wissenschaftlichen Gesichtspunkten zu eruieren, dafür Hypothesen zu formulieren und Bearbeitungswege auszuarbeiten - sind in der Lage kurz und prägnant daraus abgeleitete Forschungs- und Entwicklungsideen im Team schriftlich zusammen zu stellen, zu diskutieren und zu präsentieren.
Anmerkungen	Das Modul findet ab einer Teilnehmerzahl von 10 Studierenden und mit maximal 20 Studierenden statt. Anmeldung zur Teilnahme am Modul: ILIAS und Aushang bis eine Woche vor Modulbeginn
Innovative Milchtechnologie (1505-421)	
Person(en) verantwortlich	Prof. Dr.-Ing. habil. Jörg Hinrichs
Lehrform	Vorlesung
SWS	2
Inhalt	- Analyse der Abfolge von Unit-Operations im Hinblick auf die Prozess-Struktur-Funktions Beziehungen für Milchprodukte - Neue bzw. alternative Prozesse in Forschung und Entwicklung - Innovative Unit operations zum Einsatz für Milch- und Milchprodukte, wie z.B. Membrantrenntechniken; Fraktionieren von Milchinhaltsstoffen; alternativen zur thermischen Behandlung - Ausgewählte ständig aktualisierte Kapitel aus dem wissenschaftlichen Bereich und wirtschaftlichen Umfeld der Milchtechnologie
Literatur	Wissenschaftliche Literatur, Dissertationen, Unterlagen des Lehrstuhls
Anmerkungen	Voraussetzung Besuch der Vorlesung "Milchwissenschaft und Technologie" Teilnehmerzahl begrenzt auf maximal 12 Studierende
Projektplanung und experimentelles Arbeiten (1505-422)	
Person(en) verantwortlich	Prof. Dr.-Ing. habil. Jörg Hinrichs
Lehrform	Seminar
SWS	1
Inhalt	- Sammeln, Evaluieren und strukturiertes Auswerten wissenschaftlicher Literatur. - Nutzung von Datenbanken mit Schwerpunkt Milchwissenschaft und -technologie - Einführen in das wissenschaftliche Schreiben - Teambildung und Organisation der Arbeitsschwerpunkte - Planung von Experimenten und statistische Auswertung

	- Erstellen eines Entwurfs für ein Projekt mir Arbeitsplan
Literatur	Fachliteratur / Bibliothek - ergänzende Unterlagen
Anmerkungen	Voraussetzung Besuch der Vorlesung "Milchwissenschaft und Technologie" Teilnehmerzahl begrenzt auf maximal 16 Studierende
Technologie und Analyse von Milchprodukten, Praktische Übung (1505-423)	
Person(en) verantwortlich	Prof. Dr.-Ing. habil. Jörg Hinrichs
Lehrform	Übung mit Praktikum
SWS	2
Inhalt	Theoretische Übungen und experimentelle Arbeiten im Rahmen von Projekten unter Nutzung von Pilotanlagen und spezifischen Analysen
Literatur	Wissenschaftliche Literatur; Methodensammlung, Unterlagen des Lehrstuhls
Anmerkungen	Voraussetzung Besuch der Vorlesung "Milchwissenschaft und Technologie" Teilnehmerzahl begrenzt auf maximal 16 Studierende

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

Modulverantwortung	Prof. Dr.-Ing. Rudolf Hausmann
Bezug zu anderen Modulen	Is part of the module series Integrated Bioprocess Engineering
Teilnahmevoraussetzungen	First practical experiences in microbiology are required
Sprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	geblockt
Verbindlichkeit	Wahl
Studienleistung	Regular and active participation in the laboratory course (laboratory notebook and scientific report), the lecture, the exercises and the holding of a seminar talk.
Modulprüfung	Laboratory performance, lab book and colloquium (20%), seminar presentation (20%), oral exam (60%)
Prüfungsdauer	20 Minuten
Arbeitsaufwand	90 h attendance + 135 h independent study = 225 h workload

Fachkompetenzen / Lern- und Qualifikationsziele	After the completion of the module participants, 1. are able to design of media and lay-out feed compositions and strategies 2. are able to explain all functions of bioreactors and safely operate bioreactors. 3. Explain kinetics of bioprocesses and modelling thereof 4. Are able to express expectations on the scale-up of bioprocesses.
Schlüsselkompetenzen	After the completion of the module the participants - have demonstrated working in a self-organized team - have analyzed and interpreted experimental data and discussed them theoretically - have experienced and adapted to an interdisciplinary field. - have enhanced their scientific written and verbal skills.
Anmerkungen	places: 9rnRegistration for module: by email to: bvt@uni-hohenheim.de Registration period: until the last working day before the module start. Criteria for admission is granted: Mostly after first-served basis.
Bioproduction, lecture (1510-421)	
Person(en) verantwortlich	Prof. Dr.-Ing. Rudolf Hausmann
Person(en) begleitend	Dr. rer. nat. Karin Moß, Dr.-Ing. Marius Henkel
Lehrform	Vorlesung mit Seminar und Übung
SWS	2
Inhalt	Design of media and laying-out of feed strategies and compositions Functions of bioreactors Kinetics of bioprocesses and modelling thereof Scale-up of bioprocesses
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
Bioproduction, internship (1510-422)	
Person(en) verantwortlich	Prof. Dr.-Ing. Rudolf Hausmann
Person(en) begleitend	Dr. rer. nat. Karin Moß, Dr.-Ing. Marius Henkel
Lehrform	Praktikum
SWS	4

Inhalt	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	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 - Upstream Processing (1510-440)

Modulverantwortung	Prof. Dr.-Ing. Rudolf Hausmann
Bezug zu anderen Modulen	Completion of the module "Recombinant Proteins (1506-430)" is recommended.
Teilnahmevoraussetzungen	Basic knowledge in microbiology, bioechmistry and genetics
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Studienleistung	Regular and active participation in the internship (laboratory notebook and scientific report), the lecture, the exercises and the holding of a seminar talk.
Modulprüfung	Laboratory performance, lab book and colloquium (20%), seminar presentation (20%), oral exam (60%)
Prüfungsdauer	20 Minuten

Arbeitsaufwand	90 h attendance + 135 h independent study = 225 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	After the completion of the module participants, ...\r\n1. …are able to theoretically report on products of industrial biotechnology. \r\n2. …are able to evaluate advantages and disadvantages of different biological sys-tems. \r\n3. …are able to give an overview in current methods of upstream processing using bio-molecular methods.\r\n4. …have practically developed skills of the strain construction with a simple example.\r\n5. … have submitted a scientific documentation and report.\r\n6. … are able to analyze biosynthetic pathways in respect to the involved enzymes and corresponding genes with the help of internet-based databases.
Schlüsselkompetenzen	After the completion of the module participants, ...\r\n1. … have demonstrated organizational skills in the planning of the practical experi-ments.\r\n2. … have shown independent working in the lab.\r\n3 … have trained analytical thinking in the preparing of the scientific reports.\r\n4. …have practiced written and oral expression in scientific English.\r\n5. … have practiced communication and cooperation skills in planning the lab experi-ments.
Anmerkungen	Available places: 9rnRegistration for module: by email to: bvt@uni-hohenheim.dernRegistration period: until the last working day before the module start.rnCriteria for admission is granted: Mostly after first-served basis.
Industrial Biotechnology (1510-441)	
Person(en) verantwortlich	Prof. Dr.-Ing. Rudolf Hausmann
Person(en) begleitend	Dr. rer. nat. Karin Moß, Dr.-Ing. Marius Henkel
Lehrform	Vorlesung mit Übung und Seminar
SWS	2
Inhalt	- Overview of the products of industrial biotechnology with a focus on food addi-tives 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 Re-actor 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	Compulsive attendance of the lectures and exercises.
Genetic Strain Construction (1510-442)	
Person(en) verantwortlich	Prof. Dr.-Ing. Rudolf Hausmann
Person(en) begleitend	Dr. rer. nat. Karin Moß, Dr.-Ing. Marius Henkel
Lehrform	Praktikum
SWS	4
Inhalt	A prokaryotic expression system (E. coli) with a plasmid cloning vector has been suc-cessfully constructed for the heterologous protein production. Options for different strategies have been investigated and discussed. These include: - expression systems, promotor and induction systems, restriction endonucleas-es and respective recognition sites, genetic markers, preparation of vector, DNA-preparation, ligation, transformation, screening, molecular tags. A laboratory work and evaluation of results have been documented in a lab journal and scientific report.
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	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	Prof. Dr.-Ing. Rudolf Hausmann
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 3)
Verbindlichkeit	Wahl
Studienleistung	Regular and active participation in the laboratory course (laboratory notebook and scientific report), the lecture, the exercises and the holding of a seminar talk.
Modulprüfung	Laboratory performance, lab book and colloquium (20%), seminar

	presentation (20%), oral exam (60%)
Prüfungsdauer	20 Minuten
Arbeitsaufwand	90 h attendance + 135 h independent study = 225 h workload
Fachkompetenzen / 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 meth-ods.
Schlüsselkompetenzen	After the completion of the module the participants \r\n- have demonstrated working in a self-organized team\r\n- have analyzed and interpreted experimental data and discussed them theoreti-cally\r\n- have experienced and adapted to an interdisciplinary field.\r\n- have enhanced their scientific written and verbal skills.
Anmerkungen	Available places: 9rnRegistration for module: by email to: bvt@uni-hohenheim.dernRegistration period: until the last working day before the module start.rnCriteria for admission is granted: Mostly after first-served basis.
Downstream Processing (1510-431)	
Person(en) verantwortlich	Prof. Dr.-Ing. Rudolf Hausmann
Person(en) begleitend	Dr. rer. nat. Karin Moß, Dr.-Ing. Marius Henkel
Lehrform	Vorlesung mit Seminar und Praktikum
SWS	6
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) Summary
Literatur	R. G. Harrison, P. Todd, S. R. Rudge, D. P. Petrides (2003): Bioseparations Science and Engineering, Oxford University Press
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: Internship FB (Industrial placement) (12 weeks, 15 ECTS) (1500-610)

Modulverantwortung	N.N.
Teilnahmevoraussetzungen	Admission to the Master's programme has to be present when beginning the internship. The 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.
Sprache	englisch
ECTS	15
Angebotshäufigkeit	jedes Semester
Semesterlage	3. Semester
Dauer des Moduls	n. V.
Verbindlichkeit	Wahl
Modulprüfung	Internship report, presentation of the research done during the internship (the presentation is done in consultation with the supervising professor)
Arbeitsaufwand	450
Fachkompetenzen / Lern- und Qualifikationsziele	Upon completion of this module students - have gained insight into research and development in the area of food microbiology and biotechnology - expand their methodological repertoire
Schlüsselkompetenzen	Upon completion of this module students - have gained relevant professional experience, including its social and economic/managerial aspects - have gained insight into organizing research projects - have established first contacts with potential employers - have sharpened their critical thinking skills when developing practical solutions - have learned to work in a goal-oriented manner and within a team - improve their team and communication skills in a professional workplace
Anmerkungen	Students choose a supervisor related to the subject-area prior to beginning their internship (Prof. Dr. Lutz Fischer, Prof. Dr. Herbert Schmidt, Prof. Dr. Ralf Kölling, Prof. Dr. Uwe Beifuß, Prof. Dr. Andreas Kuhn, Prof. Dr. Armin Huber). 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 15 ECTS can be awarded, the duration of the in-ternship is not limited to 12 weeks.

Modul: Internship FB (Industrial placement) (6 weeks, 7,5 ECTS) (1500-600)

Teilnahmevoraussetzungen	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.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Semesterlage	3. Semester
Dauer des Moduls	n. V.
Verbindlichkeit	Wahl
Modulprüfung	Internship report, presentation of the research done during the internship (the presentation is done in consultation with the supervising professor)
Arbeitsaufwand	225
Fachkompetenzen / Lern- und Qualifikationsziele	Upon completion of this module students - have gained insight into research and development in the area of food microbiology and biotechnology - expand their methodological repertoire
Schlüsselkompetenzen	Upon completion of this module students - have gained relevant professional experience, including its social and economic/managerial aspects - have gained insight into organizing research projects - have established first contacts with potential employers - have sharpened their critical thinking skills when developing practical solutions - have learned to work in a goal-oriented manner and within a team - improve their team and communication skills in a professional workplace
Anmerkungen	Students choose a supervisor related to the subject-area prior to begin-ning their internship (Prof. Dr. Lutz Fischer, Prof. Dr. Herbert Schmidt, Prof. Dr. Ralf Kölling, Prof. Dr. Uwe Beifuß, Prof. Dr. Andreas Kuhn, Prof. Dr. Armin Huber). 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 7,5 ECTS can be awarded, the duration of the in-ternship is not limited to 6 weeks.

Modul: Membranbiochemie (2501-450)

Modulverantwortung	Prof. Dr. rer. nat. Andreas Kuhn
Teilnahmevoraussetzungen	-
Sprache	deutsch/englisch
ECTS	7,5

Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 4)
Verbindlichkeit	Wahl
Studienleistung	Regelmäßige und aktive Teilnahme, Praktikumsprotokoll
Modulprüfung	Klausur über den Vorlesungsstoff
Arbeitsaufwand	56 h Präsenz + 169 h Eigenanteil = 225 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Die Studierenden - können ein Membranprotein chromatographisch reinigen - können ein Membranprotein in Liposomen rekonstituieren - wissen wie Proteine durch Membranen transportiert werden - können wissenschaftliche Daten erheben, dokumentieren und anhand wissenschaftlicher Literatur interpretieren
Anmerkungen	Anzahl Teilnehmerplätze: 8 Anmeldung zur Teilnahme am Modul: über ILIAS/Auswahlverfahren
Membranbiochemie, Vorlesung (2501-451)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Andreas Kuhn
Lehrform	Vorlesung
SWS	1
Inhalt	- Membranaufbau - Membraneinbau in das ER, Signalsequenzen, SRP - Glykosilierung im ER, retrograder Transport - Transport in den Golgi Apparat, Modifikationen im Golgi, TGN - Vesikeltransport - Membrantransport in Mitochondrien - Membrantransport in Chloroplasten - Proteintraffic im Nucleus - Membrantransport iin Peroxisomen - Bakterielle Transportsysteme
Anmerkungen	Sprache Deutsch Regelmäßige und aktive Teilnahme an dem parallelen Praktikum Membranbiochemie ist erforderlich.
Membranbiochemie, Praktikum (2501-452)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Andreas Kuhn
Person(en) begleitend	Dr. Dorothee Kiefer, Dr. rer. nat. Sebastian Leptihn
Lehrform	Praktikum
SWS	3

Inhalt	- Reinigung eines Membranproteins - Rekonstitution in Liposomen - Transportexperimente in Proteoliposomen - radioaktive Markierung eines Proteinvorläufers, Translokation
Literatur	Economou, A.: "Protein Secretion" Humana Press 2010 Dalbey, R., von Heijne, G.: "Protein targeting, transport, and translocation" Academic Press 2002
Anmerkungen	Maximal 16 Teilnehmer, Sprache: Deutsch Regelmäßige Teilnahme an der parallelen Vorlesung Membranbiochemie ist erforderlich.

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

Modulverantwortung	Prof. Dr. rer. nat. Henry Strasdeit
Teilnahmevoraussetzungen	English and German language skills.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 3)
Verbindlichkeit	Wahl
Studienleistung	Regular attendance and active participation.
Modulprüfung	Written exam
Prüfungsdauer	90 Minuten
Arbeitsaufwand	56 h attendance + 132 h independent study = 188 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The students - know the paramount importance of metal ions in biochemistry and examples of the various functions of metal ions in biochemical processes. - know the basics of complex formation involving metal cations. - understand the principles of studying metal complexes. - know how metal ions and biological ligands mutually affect their properties. - learn how cellular concentrations of essential and toxic metal ions are regulated. - know the role of essential metal ions in the generation and utilization of the electrochemical potential of the cell. - realize that the chemical and physical principles used to describe inanimate systems can be equally applied to organisms.
Anmerkungen	Maximum number of participants: 14

Bioinorganic Chemistry (1301-451)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Henry Strasdeit
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., and Klein, A.: Bioinorganic Chemistry - Inorganic Elements in the Chemistry of Life. Wiley, Chichester, 2013
Anmerkungen	The lecture is suited as additional course for students of scientific Bachelor's programmes (from the 4th semester on) and other scientific Master's programmes.
Ion Transporters (1301-452)	
Person(en) verantwortlich	Prof. Dr. 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+, 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 - Comparing transport rates and ion selectivities of different systems
Literatur	Ashcroft, F. M.: Ion Channels and Disease. Academic Press
Anmerkungen	The lecture is suited as additional course for students of other scientific Master's programmes.
Principles of Coordination Chemistry (1301-453)	
Person(en) verantwortlich	Priv. Doz. Dr. Wolfgang Einholz
Lehrform	Vorlesung

SWS	1
Inhalt	The lecture covers the main principles of the formation of metal complexes as well as physical methods for the investigation especially of biological important metal complexes. In detail the following subjects 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 of the investigation of metal complexes - introduction to new spectroscopic methods for the investigation of biological relevant metal complexes.
Literatur	Riedel, E.: Anorganische Chemie, de Gruyter, Berlin, 2007 Shriver, D.F., Atkins, P.W., Langford, C.H.: Anorganische Chemie, Wiley-VCH Weinheim, 1997 Huheey, J., Keiter, E., Keiter, R.: Anorganische Chemie - Prinzipien von Struktur und Reaktivität, de Gruyter, Berlin, 2003 Cotton, F.A., Wilkinson, G.: Anorganische Chemie, Verlag Chemie Weinheim, 1982 Atkins, P.W.: Quanten, VCH, Weinheim,1993

Modul: Modulation von Signalkaskaden (2303-420)

Modulverantwortung	Prof. Dr. Armin Huber
Teilnahmevoraussetzungen	B.Sc. Biologie, Biochemie oder vergleichbar, deutsche Sprachkenntnisse
Sprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Studienleistung	Regelmäßige und aktive Teilnahme
Modulprüfung	Seminarvortrag und Versuchsprotokolle
Arbeitsaufwand	210 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Die Studierenden - lernen an den Beispielen Proteinkinase, Arrestin, Rhodopsin, Ionenkanal und G-Protein wie Signalkaskaden moduliert werden können - erlernen die Präsentation und Diskussion aktueller wissenschaftlicher Literatur Methoden: - Aufnahme und Auswertung von Elektroretinogrammen von

	Drosophila melanogaster - Anfertigen von Kryoschnitten und Immuncytochemie von Fliegenaugen - Wasserimmersionsmikroskopie zur Verfolgung eines wandernden Proteins
Anmerkungen	Anzahl Teilnehmerzahl: 12 Anmeldung zur Teilnahme am Modul über ILIAS/Auswahlverfahren
Modulation von Signalkaskaden, Seminar (2303-421)	
Person(en) verantwortlich	Prof. Dr. Armin Huber
Person(en) begleitend	Dr. rer. nat. Olaf Voolstra, Dr. rer. nat. Thomas Smylla
Lehrform	Seminar
SWS	1
Inhalt	Es werden aktuelle Artikel (englische Originalarbeiten) zu Signalmolekülen (z.B. GPCRs, Arrestine, Ionenkanäle, G-Proteine) referiert und diskutiert.
Modulation von Signalkaskaden, Übung (2303-422)	
Person(en) verantwortlich	Prof. Dr. Armin Huber, Dr. rer. nat. Olaf Voolstra
Person(en) begleitend	Dr. rer. nat. Thomas Smylla
Lehrform	Übung
SWS	4
Inhalt	In den Übungen werden immuncytochemische und elektrophysiologische Experimente durchgeführt. - Subzelluläre Lokalisation den Kationenkanals TRPL: Immuncytochemie, Wasserimmersionsmikroskopie - Einfluss von Mutationen in Signalproteinen auf die Physiologie der Photorezeptoren: ERG-Messungen

Modul: Molekulare Schalter bei Signalproteinen (2303-430)

Modulverantwortung	Prof. Dr. Armin Huber
Teilnahmevoraussetzungen	B.Sc. Biologie, Biochemie oder vergleichbar deutsche Sprachkenntnisse
Sprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 1)
Verbindlichkeit	Wahl

Studienleistung	Regelmäßige und aktive Teilnahme
Modulprüfung	Seminarvortrag und Versuchsprotokolle
Arbeitsaufwand	56 h Präsenz + 154 h Eigenanteil = 210 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Die Studierenden - erhalten einen Überblick über Funktionen von posttranslationalen Proteinmodifikationen in sensorischen Systemen - führen biochemische Analysen zur Identifikation und Charakterisierung posttranslationaler Proteinmodifikationen durch - erlernen die Präsentation und Diskussion aktueller wissenschaftlicher Literatur Methoden: - 2D-Gelelektrophorese und Western Blot zum Nachweis von Phosphorylierungen - Nachweis einer Proteinphosphorylierung mit Hilfe eines phosphospezifischen Antikörpers - Aufreinigung von Rinderrhodopsin und Nachweis der Glycoslyierung - Nachweis der lichtabhängigen reversiblen Bindung von Arrestin 2 and Rhodopsin
Anmerkungen	Anzahl Teilnehmerplätze: 12 Anmeldung zur Teilnahme am Modul über ILIAS/Auswahlverfahren
Molekulare Schalter bei Signalproteinen, Seminar (2303-431)	
Person(en) verantwortlich	Prof. Dr. Armin Huber, Dr. rer. nat. Olaf Voolstra
Person(en) begleitend	Dr. rer. nat. Thomas Smylla
Lehrform	Seminar
SWS	1
Inhalt	Es werden Originalpublikationen zur Regulation von Signalmolekülen referiert und diskutiert.
Molekulare Schalter bei Signalproteinen, Übung (2303-432)	
Person(en) verantwortlich	Prof. Dr. Armin Huber, Dr. rer. nat. Olaf Voolstra
Person(en) begleitend	Dr. rer. nat. Thomas Smylla
Lehrform	Übung
SWS	4
Inhalt	- Untersuchung der Glykosylierung von Proteinen mittels PNGase-Verdau - Nachweis der Proteinphosphorylierung mit phosphospezifischen Antikörpern - Proteinreinigung durch Immunpräzipitation - Identifikation von Phosphorylierungsstellen durch Massenspektrometrie

Modul: Molekulare Sinnesphysiologie (2301-430)

Modulverantwortung	Prof. Dr. rer. nat. Heinz Breer
Teilnahmevoraussetzungen	Bachelorabschluss mit biologischem Profil
Sprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Studienleistung	Regelmäßige Teilnahme, Vortrag im Grundlagenseminar und Vorstellung einer wissenschaftlichen Publikation
Modulprüfung	Klausur
Arbeitsaufwand	56 h Präsenz + 154 h Eigenanteil = 210 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Die Studierenden - erwerben vertieftes Wissen in Bereichen der Sinnesphysiologie - stellen in einer Präsentation aktuelle Forschungsergebnisse vor und diskutieren diese im Kreise der Mitstudierenden - erhalten Methodenkenntnis und erwerben Praxis bei ihrer Anwendung im Labor
Anmerkungen	Anzahl Teilnehmerplätze: 8 Anmeldung zur Teilnahme am Modul über ILIAS/Auswahlverfahren
Molekulare Sinnesphysiologie (2301-431)	
Person(en) verantwortlich	apl. Prof. Dr. rer. nat. Jörg Strotmann, Priv. Doz. Dr. rer. nat. Jürgen Krieger, Priv. Doz. Dr. rer. nat. Jörg Fleischer, Prof. Dr. rer. nat. Heinz Breer
Lehrform	Seminar mit Übung
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

Modul: Mutagenesis and Overexpression of Enzymes (1502-480)

Modulverantwortung	Prof. Dr. rer. nat. Lutz Fischer
Teilnahmevoraussetzungen	Knowledge of the scientific basics of molecular biology.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 4)
Verbindlichkeit	Wahl
Modulprüfung	Written exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	84 h attendance + 104 h independent study = 188 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	After this module the students know the theoretical and practical basics of Applied Molecular Biology for the recombinant overexpression of enzymes and for the customised modification of enzymes in microorganisms.The students are able to develop strategies for the industrial-orientated recombinant enzyme production (vector/host-system) on their own.
Schlüsselkompetenzen	The aim of this module is that the students are able to independently plan and work in a laboratory. They will be able to interpret their results and to compare them with known data from literature.
Anmerkungen	Maximum number of participants: 8 Registration via ILIAS by September 30 / Selection interview
Mutagenesis and Overexpression, Lecture (1502-481)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Lutz Fischer
Person(en) begleitend	Dr. rer. nat. Sabine Lutz-Wahl
Lehrform	Vorlesung
SWS	1
Inhalt	- Deepening of molecular biological methods for cloning of genes: DNA isolation methods, PCR, transformation methods, DNA se-quencing - Introduction in sequence data libraries and software-tools for applied molecular biology - Overexpression of enzymes: discussion of different expression systems (e.g. induction, stability of expression systems): E. coli, Lactobacillus, yeasts and their influences on enzyme

	production (yield), concepts of “food-grade”-systems, legal requirements in enzyme production for the food industry - Methods for side-directed and error-prone mutagenesis - Application examples for Directed Evolution and rational protein design
Literatur	Brown, T.A.: Gene cloning and DNA analysis, 6. Auflage, John Wiley and Sons, 2010 Glick, B. R., Pasternak, J.J.: Molecular Biotechnology - Principles and application of recombinant DNA, 3. Auflage, ASM, Washington, 2003. Gellissen, G.: Production of recombinant proteins, Wiley-VCH, Weinheim, 2005. current scientific publications (will be provided)
Mutagenesis and Overexpression, Practical (1502-482)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Lutz Fischer
Person(en) begleitend	Dr. rer. nat. Sabine Lutz-Wahl
Lehrform	Praktikum
SWS	5
Inhalt	The students - will learn strategies of cloning genes from target enzymes in suitable expression systems - will learn methods for mutagenesis of genes They will learn following methods: extraction and purification of genomic DNA and Plasmid-DNA, amplification of DNA by PCR, performance of site-specific mutagenesis by QuikChange PCR, error prone PCR, analytical and preparative agarose gel electrophoresis, restriction and ligation of DNA, transformation, DNA sequencing, cultivation of recombinant strains in shaking flasks, determination of enzyme activity and protein concentration, SDS polyacrylamide gel electrophoresis
Literatur	Brown, T.A.: Gene cloning and DNA analysis, 6. Auflage, John Wiley and Sons, 2010 Glick, B. R., Pasternak, J.J.: Molecular Biotechnology - Principles and application of recombinant DNA, 3. Auflage, ASM, Washington, 2003 Sambrook, J., Fritsch, E. F., Maniatis, T.: Molecular Cloning, 3. Auflage, Cold Spring Harbor, New York, 2001 current scientific publications (will be provided)

Modul: Nutrigenomik (1405-400)

Modulverantwortung	Prof. Dr. W. Florian Fricke
Teilnahmevoraussetzungen	/
Sprache	deutsch/englisch
ECTS	7,5

Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 4)
Verbindlichkeit	Wahl
Studienleistung	Regelmäßige und aktive Teilnahme
Modulprüfung	Klausur
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h Präsenz + 154 h Eigenanteil = 210 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Ziel des Moduls ist, dass die Studierenden nach dessen Abschluss in der Lage sind, - die Kernthemen der Nutrigenomik zu benennen und in ihrer Bedeutung für die Ernährungswissenschaften zu diskutieren. - die medizinische und ernährungswissenschaftliche Bedeutung des menschlichen Mikrobioms und der personalisierten Medizin darzulegen. - Mechanismen der Genomsequenzierung und bioinformatischen Sequenzanalyse zu beschreiben. - online Ressourcen der Bioinformatik zu kennen und einfache Sequenz-Analysen selbst durchführen zu können. - die besprochenen Themen im ethischen Kontext zu diskutieren.
Schlüsselkompetenzen	Ziel des Moduls ist, dass die Studierenden nach dessen Abschluss in der Lage sind, die wissenschaftliche, medizinische und ethische Relevanz der Nutrigenomik zu diskutieren.
Anmerkungen	Anzahl Teilnehmerplätze: 30 Anmeldung zur Teilnahme: ILIAS
Nutrigenomik (1405-401)	
Person(en) verantwortlich	Prof. Dr. W. Florian Fricke
Lehrform	Vorlesung mit Übung
SWS	4
Inhalt	- Omics-Technologien - Bioinformatik - Genom/Mikrobiom-Analyse - Epigenetik - Ethische Probleme

Modul: Portfolio Modul Sprachen (1502-420)

Modulverantwortung	Prof. Dr. rer. nat. Lutz Fischer
Sprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes Semester

Semesterlage	2. Semester
Dauer des Moduls	n. V.
Verbindlichkeit	Wahl
Modulprüfung	Erfolgreich abgeschlossene Sprachkurse am Sprachenzentrum der Universität Hohenheim
Arbeitsaufwand	225 h
Fachkompetenzen / Lern- und Qualifikationsziele	Ziel dieses Moduls ist der Erwerb von Kenntnissen in Fremdsprachen. Studierende können am Sprachenzentrum der Universität Hohenheim erlangte Scheine von erfolgreich abgeschlossenen Sprachkursen in diesem Modul zusammenfassen. Auf diesem Weg können Sprachkurse zur Erlangung des Abschlusses beitragen. Voraussetzung für die Anerkennung von Sprachscheinen (es darf sich nicht um die Muttersprache der bzw. des Studierenden handeln) im Rahmen des Portfolio Modul Sprachen ist, dass die Scheine in Summe mindestens 7,5 ECTS Credits ergeben. Die Anerkennung der Sprachscheine obliegt dem Modulverantwortlichen.
Anmerkungen	Die Anerkennung der Sprachscheine erfolgt in der Sprechstunde des Studiendekans, Prof. Dr. Lutz Fischer.

Modul: Prinzipien der technischen Milchverarbeitung und analytische Methoden (1505-400)

Modulverantwortung	Prof. Dr.-Ing. habil. Jörg Hinrichs
Teilnahmevoraussetzungen	-
Sprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 3)
Verbindlichkeit	Wahl
Studienleistung	Regelmäßige und aktive Teilnahme, Seminarausarbeitung (20% der Abschlussnote), Protokolle zum Praktikum und Exkursion
Modulprüfung	Klausur (90 Minuten) oder mündliche Prüfung (20 Minuten)
Arbeitsaufwand	78 h Präsenzzeit + 98 h Eigenanteil = 176 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Ziel des Moduls ist, dass die Studierenden nach dessen Abschluss in der Lage sind, technische Prozesse der Verarbeitung von Milch zu verschiedenen Produkten vertieft zu durchdringen. Im Speziellen soll die Auswirkung von Unit-Operations des Prozesses auf die Inhaltsstoffe diskutiert und analysiert werden. Zielgerichtet auf die

	Problemstellung sollen sie in der Lage sein, geeignete Methoden zur Kontrolle und solche zur Bewertung funktioneller Eigenschaften auszuwählen und anzuwenden.
Schlüsselkompetenzen	Ziel des Moduls ist, dass die Studierenden nach dessen Abschluss in der Lage sind, selbstständig technische Prozesse der Milchbe- und –verarbeitung unter Berücksichtigung der Anforderungen, z. B. Erhalt von wertgebenden Inhaltsstoffen, Sicherheit, Halt-barkeit außerhalb der Kühlkette kritisch zu analysieren. Darüber hinaus sollen die Studierenden die Fähigkeit besitzen, die Aufgaben und Auswirkungen einzelner Uni-Operation auf Milchinhaltsstoffe zu erkennen, um Variation in der Abfolge der Uni-Operation beurteilen zu können und ggf. eine Alternative theoretisch zu prüfen und zu bewerten.
Anmerkungen	Anzahl Teilnehmerplätze: 10 Anmeldung zum Modul: Im Fachgebiet Anmeldezeitraum: Februar-März Studierende, die eine ansteckende Krankheit nach Bundesseuchengesetz haben, dürfen am Praktikum nicht teilnehmen.
Prinzipien der Milchverarbeitung und analytische Methoden (1505-401)	
Person(en) verantwortlich	Prof. Dr.-Ing. habil. Jörg Hinrichs
Lehrform	Vorlesung
SWS	2
Inhalt	Prozess-Struktur-Funktions-Beziehungen im System Milch und Milchprodukte - unitoperations, wie z. B. Homogenisieren; Emulgieren, Aufschäumen, thermische Be-handlung. - Komponenten von Prozessanlage - Analysen zur Beurteilung von Qualitätsparametern, wie wertgebende Inhaltsstoffe, techno- und biofunktionellen Eigenschaften, Textur und Rheologie - Interaktion von Technologie und Milch(produkt)matrix in Bezug auf Komposition, funktionelle Eigenschaften und Sensorik - Mikrobiologische Aspekte & Analysen mit Auslegung der Prozessbedingungen - Produktbeispiele: Konsummilch-Produkte und Drinks sowie Eiskrem
Literatur	Töpel, A.: Chemie und Physik der Milch, Behr´s Verlag. Kessler H. G.: Food and Bio Process Engineering - Dairy Technology, Verlag A. Kessler, München. Belitz H.-D. Grosch W., Schieberle P. Food Chemistry Springer Verlag Ausgegebene Skripte.
Prozessanalyse der technischen Milchverarbeitung (1505-402)	
Person(en) verantwortlich	Prof. Dr.-Ing. habil. Jörg Hinrichs
Lehrform	Seminar
SWS	1

Inhalt	Die Studierenden sollen: 1. einen in der Vorlesung dargestellten technischen Prozess für Herstellung eines Milchprodukts hinsichtlich Ziel der Uni-Operation in Bezug chemischer, biochemischer, physikalischer und mikrobiologischer Aspekte analysieren und präsentieren. 2. die Uni-Operation für den technischen Prozess zur Herstellung eines innovativen Milchprodukts für spezielle Ernährungsanforderungen / technofunktionelle Anwendungen erarbeiten, analysieren, Analysenmethoden zur Prüfung und Überwachung geforderter Eigenschaften sowie Reinigungs- und Desinfektionsroutinen vorschlagen.
Literatur	Töpel, A.: Chemie und Physik der Milch, Behr´s Verlag. Kessler H. G.: Food and Bio Process Engineering - Dairy Technology, Verlag A. Kessler, München. Belitz H.-D. Grosch W., Schieberle P. Food Chemistry Springer Verlag aktuelle Fachliteratur
Milchtechnologisches Praktikum (1505-403)	
Person(en) verantwortlich	Prof. Dr.-Ing. habil. Jörg Hinrichs
Lehrform	Praktikum
SWS	2
Inhalt	Ausgehend vom Rohstoff Milch über verschiedene Uni-Operation durchgeführt mit Technikumsanlagen der Forschungs- und Lehrmolkerei Hohenheim werden Milchproduk-te, wie z. B. Joghurt, Käse, Eiskrem hergestellt und verschiedene chemisch-physikalische, rheologische und sensorische Analyse durchgeführt.
Literatur	Töpel, A.: Chemie und Physik der Milch, Behr´s Verlag. Kessler H. G.: Food and Bio Process Engineering - Dairy Technology, Verlag A. Kessler, München. Ausgegebene Skripte.

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

Modulverantwortung	Prof. Dr.-Ing. Reinhard Kohlus
Teilnahmevoraussetzungen	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.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl

Modulprüfung	Oral examination
Arbeitsaufwand	56 h attendance + 132 independent study = 188 h workload
Fachkompetenzen / 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.
Schlüsselkompetenzen	Key competencies addressed in this module are critical problem assessment and analytical thinking. Systematic problem solving.
Anmerkungen	Maximum number of participants: 24 Registration via ILIAS is open until October 11th
Process Driven Product Design: Cereals and Sweets, Lecture (1503-511)	
Person(en) verantwortlich	Prof. Dr.-Ing. Reinhard Kohlus
Person(en) begleitend	Hartmut Dr. Rohse, Hiltrud Rohenkohl, Dr. Wolfgang Bindzus
Lehrform	Vorlesung
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.
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	Prof. Dr. rer. nat. Lutz Fischer
Teilnahmevoraussetzungen	M.Sc. Food Science and Engineering, M.Sc. Food Microbiology and Biotechnology

Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (n. V.)
Verbindlichkeit	Pflicht
Studienleistung	Synopsis, report, presentation
Modulprüfung	Project work
Arbeitsaufwand	210 h
Fachkompetenzen / 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 about the chosen topic - experimental work in the laboratory repeating selected experi-ments of the literature (3-5 working days) - oral presentation of the topic (15-25 minutes) The topic of the project work is discused and given by the head of a department (member of the compulsary modules). The supervision will be conducted by a postgraduate of the department. The module is successfully performed, when all three parts were pas-sed. Grades will be informally given to the student in oral form. The mo-dule is scored passed/faiuled without an official grade.
Schlüsselkompetenzen	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 about the chosen topic - experimental work in the laboratory repeating selected experi-ments of the literature (3-5 working days) - oral presentation of the topic (15-25 minutes) The topic of the project work is discused and given by the head of a department (member of the compulsary modules). The supervision will be conducted by a postgraduate of the department. The module is successfully performed, when all three parts were pas-sed. Grades will be informally given to the student in oral form. The mo-dule is scored passed/faiuled without an official grade.
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.

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

Teilnahmevoraussetzungen	M.Sc. Food Science and Engineering, M.Sc. Food Microbiology and Biotechnology
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Semesterlage	2. Semester
Dauer des Moduls	n. V.
Verbindlichkeit	Wahl
Modulprüfung	Submission of a report and oral presentation of the results.
Arbeitsaufwand	210 h (attendance, including preparation of the synopsis, report and presentation)
Fachkompetenzen / 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 exper-iments (approximately 15 laboratory days). - Analysis of the data in writing.
Anmerkungen	Registration on an individual basis in consultation with the supervisor. Please refer to the professor in charge of the module most closely re-lated to your desired research topic.

Modul: Protein Expression in Bacteria (2501-440)

Modulverantwortung	Prof. Dr. rer. nat. Andreas Kuhn

Teilnahmevoraussetzungen	Basics of Protein Expression (B. Lewin: Gene Expression)
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Modulprüfung	Written exam
Prüfungsdauer	60 Minuten
Arbeitsaufwand	84 h attendance + 116 h independent study = 200 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The students will learn - to design oligonucleotide primers for amplifying/modifying a bacterial gene using bioinformatics tools. - how to modify a gene to enable its expression in E.coli using molecular biology methods. - which parameters can be optimised for protein over-expression in bacteria using biochemical methods. - to analyse, describe and present their data obtained and discussing them in the context of previous results from scientific publications.
Schlüsselkompetenzen	The students will gain - experience in planning and organising a scientific experiment. - more confidence in performing experiments independently. - more insights into a critical analysis of their data obtained. - more familiarity with presenting and discussing data in English.
Anmerkungen	Maximum number of participants: 10 Registration for participation: Letter of motivation and interview
Protein Expression in Bacteria (2501-441)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Andreas Kuhn
Person(en) begleitend	Dr. rer. nat. Domenico Lupo
Lehrform	Vorlesung mit Übung und Seminar
SWS	4
Inhalt	RNA polymerase and ribosome function, transcription and translation, mRNA and protein degradation, promoter and ribosome binding, chaperones Techniques: Site-directed mutagenesis, PCR, analytical restriction digest, DNA sequencing, SDS PAGE, Western blot
Literatur	B. Lewin: Genes, Oxford

Modul: Recombinant Proteins (1506-430)

Modulverantwortung	Prof. Dr. Ralf Kölling-Paternoga
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	1. Semester
Dauer des Moduls	4 Wochen (Block 3)
Verbindlichkeit	Pflicht
Studienleistung	Regular attendance and active participation, practical report
Modulprüfung	Written examination
Prüfungsdauer	120 Minuten
Arbeitsaufwand	80 h attendance + 130 h independent study = 210 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	On successful completion of the module, you are able to explain the steps leading to the expression of a functional protein. You know how to differentiate the mechanisms of gene expression in prokaryotic and eukaryotic microorganisms. You will appreciate how mechanistic concepts are derived from experimental data. You will be able to apply the knowledge gained in the lecture to understand original research articles and to critically evaluate the results presented in these articles. You learned to give a presentation and to participate actively in class discussions. You improved your skills in performing experiments at the lab bench.
Recombinant Proteins, Lecture (1506-431)	
Person(en) verantwortlich	Prof. Dr. Ralf Kölling-Paternoga
Lehrform	Vorlesung
SWS	2
Inhalt	In the lecture, the different steps leading to successful expression of a recombinant protein in microorganisms are presented. We closely examine the mechanisms and the control of gene transcription, mRNA translation and protein folding and other aspects connected to heterologous protein expression, like protein turnover and protein secretion. The prokaryotic model organism Escherichia coli will be contrasted with the eukaryotic model organism Saccharomyces cerevisiae. Similarities and differences in gene expression between the two will be explored. Special emphasis will be given to the practical aspects of gene expression, like gene cloning, choosing the right vector system and usage of protein tags.
Anmerkungen	Molecular Biology of the Cell, Alberts, Wiley-VCH (2007)
Recombinant Proteins, Seminar (1506-432)	
Person(en) verantwortlich	Prof. Dr. Ralf Kölling-Paternoga

Lehrform	Seminar
SWS	1
Inhalt	You will present a research article about a topic related to recombinant protein expression in a 30-minute talk. Knowledge obtained from the lecture will be applied to analyze and understand the original research articles.
Literatur	Specific articles will be provided; in addition, it is advisable to perform an individual literature search.
Recombinant Proteins, Practical (1506-433)	
Person(en) verantwortlich	Prof. Dr. Ralf Kölling-Paternoga
Lehrform	Praktikum
SWS	2
Inhalt	The following experiments will be performed: - detection of a gene cassette insertion into the yeast genome by PCR - agarose gel electrophoresis - localization of cellulase activities in yeast by cell fractionation - SDS-PAGE - Western Blotting - affinity-purification of 6His-tagged proteins from E. coli
Anmerkungen	Molecular Biology of the Cell, Alberts, Wiley-VCH (2007)

Modul: Rekombinante Expression von Signalmolekülen (2303-410)

Modulverantwortung	Prof. Dr. Armin Huber
Teilnahmevoraussetzungen	B.Sc. Biologie, Biochemie oder vergleichbar deutsche Sprachkenntnisse
Sprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 3)
Verbindlichkeit	Wahl
Studienleistung	Regelmäßige und aktive Teilnahme, Versuchsprotokolle
Modulprüfung	Klausur oder Kolloquium, je nach Teilnehmerzahl
Arbeitsaufwand	168 h workload

Fachkompetenzen / Lern- und Qualifikationsziele	Die Studierenden - erhalten einen Überblick über verschiedene Expressionssysteme und transgene Organismen - untersuchen die rekombinante Expression von Signalproteinen des visuellen Systems - erlangen fundierte Kenntnisse über Fluoreszenzmarker und photoaktivierbare Fluoreszenzproteine Methoden: - Heterologe Expression eines Proteins in E. coli und Aufreinigung über His-Tag - Transiente Transfektion von S2-Zellen und Expression eines photoaktivierbaren fluoreszierenden Proteins - in vitro-Translation - Immunpräzipitation - Herstellung transgener Drosophila
Anmerkungen	Anzahl Teilnehmerplätze: 12 Anmeldung zur Teilnahme am Modul: 2 Wochen vor Semesterbeginn über ILIAS/Auswahlverfahren
Rekombinante Expression von Signalmolekülen, Vorlesung (2303-411)	
Person(en) verantwortlich	Prof. Dr. Armin Huber
Person(en) begleitend	Dr. rer. nat. Olaf Voolstra
Lehrform	Vorlesung
SWS	1
Inhalt	Die Vorlesung vermittelt die theoretischen Grundlagen für die in den Übungen durchgeführten Experimente
Rekombinante Expression von Signalmolekülen, Übung (2303-412)	
Person(en) verantwortlich	Prof. Dr. Armin Huber
Person(en) begleitend	Dr. rer. nat. Olaf Voolstra
Lehrform	Übung
SWS	4
Inhalt	- Herstellung von transgenen Tieren - recombinante Expression von Proteinen in Bakterien - Aufreinigung von rekombinant exprimierten Signalproteinen über Tags. - rekombinante Expression und Aktivierung von PA-GFP in S2-Zellen - Untersuchung dynamischer zellbiologischer Prozesse: Expression von Signalmolekülen, die an den Fluoreszenzmarker eGFP gekoppelt sind. - Immunpräzipitation von Signalproteinen

Modul: Research in Enzyme Biotechnology (1502-400)

Modulverantwortung	Prof. Dr. rer. nat. Lutz Fischer, Priv. Doz. Dr. rer. nat. Timo Stressler
Bezug zu anderen Modulen	This modul serves to prepare a master´s thesis in the department „Biotechnology and Enzyme Science“.
Teilnahmevoraussetzungen	The participation is only meaningfull after successful completion of the four compulsory modules of the first semester and the elective modul “Enzymatic Reactions (1502-410). A selection interview has to be passed (please contact Priv.-Doz. Dr. Timo Stressler)
Sprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (n. V.)
Verbindlichkeit	Wahl
Studienleistung	Keep a lab book
Modulprüfung	Writing a draft publication manuscript based on the obtained results and to pass an internal peer-review process (graded) The draft manuscript has to be prepared according to the "Instructions for authors" of the particular peer-review journal. The Journals will be discussed with the students at the beginning of the course. The dead-line of the written draft manuscript is 4 weeks after ending the practical part.
Arbeitsaufwand	Attendance: 140h + Independent study: 40h = Workload: 180h
Fachkompetenzen / Lern- und Qualifikationsziele	After this module the students are able to plan and perform experiments resulting in data which are suitable for publication. The students will be able to present their results in form of a draft publication manuscript
Schlüsselkompetenzen	The students are able to plan and work in a research laboratory independently. They will be able to interpret their research results and to compare them with data from literature.
Anmerkungen	The available places are limited and dependend on the lab space and personal capacity. By agreement, the modul can be conducted at any time.
Research in Enzyme Biotechnology (1502-401)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Lutz Fischer, Priv. Doz. Dr. rer. nat. Timo Stressler
Person(en) begleitend	Dr. rer. nat. Ines Seitl
Lehrform	Praktikum mit Übungen
SWS	4
Inhalt	Depending on the particular research project, the students will learn different practical methods important for research in biotechnology e.g. cultivation, enzyme assays, different kind of analytical methods.

Literatur	Individual

Modul: Scientific Writing and Reporting (1502-500)

Modulverantwortung	Prof. Dr. Herbert Schmidt
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	1. Semester
Dauer des Moduls	4 Wochen (Block 1)
Verbindlichkeit	Pflicht
Modulprüfung	Preparing and giving a ca. 30 minute presentation with ensuing discussion on a given natural scientific topic in English (internally graded, grade does not count towards the final grade)
Arbeitsaufwand	112 h attendance + 113 h independent study = 225 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Students know how to - look for literature independently - use statistical methods for analysing experimental data and molecular-biological databases - maintain a laboratory journal - discuss the basic of scientific practice - analyse and discuss micro-biological and biotechnological publications - draft, write and discuss biotechnological presentations and publications - are able to articulate themselves well in the context of natural scientific topics, both in written and spoken form - give scientific presentations - actively participate in scientific discussions - use new experimental and analytical methods in the areas of biotech-nology and microbiology
Literature Research (1502-501)	
Person(en) verantwortlich	Prof. Dr. Herbert Schmidt, Prof. Dr. rer. nat. Lutz Fischer
Lehrform	Übung
SWS	2
Inhalt	Introduction to literature research (internet, library, interlibrary loan) Introduction to the analysis of statistical experimental data Exemplary display of molecularbiological databases for finding new

	or improving known proteins
Anmerkungen	This course is compulsory for all students of this MSc, also for those who have successfully completed the module Einführung in wissenschaftliches Arbeiten (Bachelor's programme Lebensmittwelwissenschaft und Biotechnologie) (1502-020).
Scientific Publications (1502-502)	
Person(en) verantwortlich	Prof. Dr. Herbert Schmidt
Lehrform	Seminar mit Übung
SWS	4
Inhalt	Introduction, theory and practice of scientific publications and presentations Students are given a topic / review & publication Preparation and independent presentation of a ca. 30-minute scientific presentation on a publication in the area of food microbiology and biotechnology with ensuing discussion
Introduction in Microbiological and Enzymatic Methods (1502-503)	
Person(en) verantwortlich	Prof. Dr. Herbert Schmidt, Prof. Dr. rer. nat. Lutz Fischer
Person(en) begleitend	Dr. rer. nat. Sabine Lutz-Wahl, Dr. Agnes Weiß, Dr. rer. nat. Elisabeth Hauser
Lehrform	Praktikum
SWS	2
Inhalt	The students learn: - Sterile working techniques - Factorial growth kinetics - Determination of food ingredients (e.g. ethanol, glucose, fructose, sucrose, nitrate, citrate) by enzymatic methods - Determination of enzyme activities in food - To protocol experiments - Using statistical methods for analysing experimental data
Literatur	Henniger, G. (2003) Enzymatic techniques for authenticating food components in Lees, M. (ed.) Food Authenticity and Traceability, CRC Press, 239-274

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

Modulverantwortung	Prof. Dr.-Ing. habil. Jörg Hinrichs, Dr. Stefan Nöbel, Prof. Dr. Bernd Hitzmann
Bezug zu anderen Modulen	Requirement for participation in the elective module "Innovative Dairy Technology"

Teilnahmevoraussetzungen	Scientific background in mathematics, physics and chemistry
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 4)
Verbindlichkeit	Wahl
Studienleistung	attendance in practical course, laboratory reports, seminar presentation
Prüfungsleistung	Exam (80 % of total), seminar (20% of total) and practical seminar (to pass)
Modulprüfung	30 minute oral or 120 minute written exam on the contents of the lecture (80 % of total), seminar (20% of total) and practical seminar (to pass)
Prüfungsdauer	120 Minuten
Arbeitsaufwand	96 h attendance + 113 h independent study= 210 h workload
Fachkompetenzen / 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, in-cluding 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.
Anmerkungen	Maximum number of participants: 45
Food Systems: Looking Beyond Rheology and Structure (1505-501)	
Person(en) verantwortlich	Prof. Dr.-Ing. habil. Jörg Hinrichs, Prof. Dr. Bernd Hitzmann
Lehrform	Vorlesung
SWS	2
Inhalt	Principles of structural, mechanical, and dynamic characteristics of food systems. Basic information and fundamental terms in rheology, meas-urement technology for different food matrices, mechanical strain, dy-namic 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.
Literature Seminar: Structural Models for Food Systems (1505-502)	
Person(en) verantwortlich	Prof. Dr.-Ing. habil. Jörg Hinrichs, Prof. Dr. Bernd Hitzmann

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	Prof. Dr.-Ing. habil. Jörg Hinrichs, Prof. Dr. Bernd Hitzmann
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	Prof. Dr. Jochen Weiss
Bezug zu anderen Modulen	Second part to Soft Matter I - Food Rheology and Structure
Teilnahmevoraussetzungen	Basic knowledge in physical chemistry and mathematics.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 1)
Verbindlichkeit	Wahl
Prüfungsleistung	Klausur (schriftliche Prüfung), mündliche Prüfung optional
Modulprüfung	Written exam
Prüfungsdauer	90 Minuten
Arbeitsaufwand	64 h attendance + 146 h independent study = 210 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	After completion of the course, students are expected to have gained a knowledge of physical phenomena that play a role in food systems. The importance of a molecular material science approach to food systems has been comprehended. Students have developed a molecular under-standing of structure-function relationships in matrices composed of proteins, lipids and carbohydrates. Course

	participants are able to apply principles of molecular mass transport, solution thermodynamics, phase transitions, and molecular interactions to solve problem oriented case studies in foods. Attendees have understood operating principles of advanced physical analytical techniques such as NMR, UV, CD, Raman spectroscopy, fluorescence, ESR, electron microscopy and x-ray crys-tallography as well as their use in the analysis of complex food struc-tures.
Anmerkungen	Maximum number of participants: 50
Soft Matter Science II - Food Physics (1507-511)	
Person(en) verantwortlich	Prof. Dr. Jochen Weiss
Lehrform	Vorlesung mit Übung
SWS	4
Inhalt	The module introduces students to the fundamental concepts of a new discipline in Food Science, namely Food Physics – a subsection of Food Material Science or Soft Matter Science. The course is organized in three parts, a theoretical section in which solution thermodynamics, mass transport phenomena, networks, gels and rubber elasticity, self-organization and adsorption processes and molecular interactions are introduced. Later in this section, the physics of lipids, proteins and car-bohydrates will be discussed and modern physical analysis methods will be introduced. Finally, two case studies, the physics of digestion and the physics of antimicrobials will be discussed that highlight how theory and practical relevance are connected. In the second part of the course, students have the opportunity to conduct laboratory experiments that involve problems in food physics such as multilayering of emulsions, surfactant phase diagrams, organogelation, role of molecular interactions in antimicrobials etc. Each student will conduct two ex-periments over the course of four days. In the third week, students will present their laboratory results to course participants. This is followed by individual student presentations about a paper that describes a results of a recent study in the area of Food Physics.
Literatur	R. Glaser: Biophysik, Springer Verlag, Berlin, 2001
Anmerkungen	Scientific basics in physical chemistry are welcome.

Modul: Technologie pflanzlicher Lebensmittel I (1504-420)

Modulverantwortung	Prof. Dr. rer. nat. Dr. h.c. Reinhold Carle
Bezug zu anderen Modulen	Voraussetzung zur Teilnahme am Technologischen Praktikum im Rahmen des Moduls "Lebensmittel pflanzlicher Herkunft II"
Teilnahmevoraussetzungen	-
Sprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes WS

Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 2)
Verbindlichkeit	Wahl
Modulprüfung	Mündliche Prüfung (30 Minuten)
Arbeitsaufwand	56 h Präsenz + 132 h Eigenanteil = 188 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Die Studierenden - gewinnen einen vertieften Einblick in Spezialgebiete der Verarbeitung pflanzlicher Lebensmittel - kennen die Anforderungen an die Rohwaren im Hinblick auf die anzuwendende Technologie - haben Kenntnisse über die Reaktionen der Lebensmittelinhaltsstoffe und deren Beeinflussung während der Verarbeitung - kennen die spezifischen rechtlichen Grundlagen - erlernen sensorische Methoden zur Prüfung pflanzlicher Lebensmittel - erwerben die theoretischen Vorkenntnisse für das technologische Praktikum im Modul "Technologie pflanzlicher Lebensmittel II"
Anmerkungen	Anzahl Teilnehmerplätze: 50 Anmeldung zur Teilnahme am Modul: Ab Mitte des Wintersemesters bis zu Beginn der Vorlesungszeit im Sommersemester durch Aushang am Schwarzen Brett des Fachgebietes.
Technologie pflanzlicher Lebensmittel I (1504-421)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Dr. h.c. Reinhold Carle
Lehrform	Vorlesung
SWS	4
Inhalt	- Früchtetechnologie (Citrussaft und weitere Citrusprodukte, Spezialprodukte wie Buntsäfte, Smoothies usw., Verarbeitung tropischer Früchte) - Gemüsetechnologie (Verarbeitung von Tomaten, Leguminosen, insbesondere Soja, glucosinolathaltige Lebensmittel, Spezialprodukte wie Oliven, Kartoffeln und weitere stärkeliefernde Pflanzen, neue Verfahren zur Verarbeitung von Kräutern und Gewürzen) - Pflanzliche Fette und Öle (Palmöl, Olivenöl, Raffination, Modifikation, Spezial-Margarinen) - Sensorische Übungen zur Verkostung pflanzlicher Lebensmittel (gemäß DLG-Schema usw.) - Praktische Aspekte der Verarbeitung pflanzlicher Lebensmittel - Exkursion
Literatur	Skripte mit speziellen Literaturempfehlungen für die einzelnen Themengebiete

Modul: Technologie pflanzlicher Lebensmittel II (1504-430)

Modulverantwortung	Prof. Dr. rer. nat. Dr. h.c. Reinhold Carle
Bezug zu anderen Modulen	Einführung in Modul "Technologie pflanzlicher Lebensmittel I"
Teilnahmevoraussetzungen	-
Sprache	deutsch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 3)
Verbindlichkeit	Wahl
Modulprüfung	2-stündige schriftliche Prüfung, Kolloquium (20 Minuten)
Arbeitsaufwand	56 h Präsenz + 132 h Eigenanteil = 188 h workload
Fachkompetenzen / 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
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.
Alkaloidhaltige Lebensmittel (1504-431)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Dr. h.c. Reinhold Carle
Lehrform	Vorlesung
SWS	1
Inhalt	- Kaffee - Tee - Kakao - Weitere alkaloidhaltige Lebensmittel (Guaraná, Maté usw.)
Literatur	Skripte mit speziellen Literaturempfehlungen für die einzelnen Themengebiete
Technologisches Praktikum (1504-432)	

Person(en) verantwortlich	Prof. Dr. rer. nat. Dr. h.c. Reinhold Carle
Lehrform	Praktikum
SWS	3
Inhalt	- Haltbarmachung durch Erhitzen (Pasteurisation, Sterilisation) und Gefrieren (Nasskonserven, Tiefkühlprodukte) - Alkoholfreie Getränke (Fruchtsaft, -nektar) - Speiseöl - Gelierprodukte (Konfitüre, Fruchtzubereitung)
Literatur	Skripte mit speziellen Literaturempfehlungen für die einzelnen Themengebiete

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

Modulverantwortung	Prof. Dr. rer. nat. Lutz Fischer
Teilnahmevoraussetzungen	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.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Semesterlage	1. Semester
Dauer des Moduls	2 Semester
Verbindlichkeit	Wahl
Studienleistung	Regular attendance, active participation, other (see individual course descriptions at https://spraz.uni-hohenheim.de/kurse)
Modulprüfung	UNIcert III examination (240 minutes total): 180 minutes written exam, 30 minutes listening comprehension, 30 minutes oral exam
Arbeitsaufwand	225 h
Fachkompetenzen / 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.
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.

UNIcert III English for Scientific Purposes (1000-041)	
Lehrform	Kurs
SWS	8
Inhalt	Scientific Writing (2 SWS) “This course focuses on written communication in the scientific world using English. The primary emphasis is on the structure and vocabulary of a scientific paper/article. Printed materials include articles and papers from each student's area of interest, as well as vocabulary, writing, and grammar exercises.” Critical Thinking (2 SWS) “This course is relevant for anyone who would like to improve the way they read and deal with academic and scientific texts. Research based reading will cover strategies for improving reading techniques and skills such as speed reading and scanning academic texts for pertinent information. It will give you the opportunity to identify text types, critically assess and analyze their content to identify their main points, and distinguish fact from opinion.” Intercultural Communication (2 SWS) “Communication between two members of the same cultural community takes place within the framework of a common language and against a common socio-cultural background. International communication may thus fail, or be less satisfactory than it could be, not only because of language problems but also because the participants have insufficient knowledge of each other's cultural background and an undeveloped awareness of what is unique to their own cultural background.” Scientific Reading and Discussion (2 SWS) “This course is particularly important for science students, as many leading textbooks and the majority of scientific research articles are written in English. Instructor feed-back will be given to each student's grammar, vocabulary, and fluency problems.”
Anmerkungen	Registration: https://spraz.uni-hohenheim.de/anmeldung

Major Enzyme Biotechnology

Modul: Enzymatic Reactions (1502-410)

Modulverantwortung	Prof. Dr. rer. nat. Lutz Fischer
Bezug zu anderen Modulen	The module is part of the major Enzyme Biotechnology and is mandatory for performing a Master's thesis at the Department of Biotechnology and Enzyme Science. In addition, this module is required to participate in the module "Enzyme Technology (1502-510).
Teilnahmevoraussetzungen	Four modules of the Master's program need to be passed (exceptions after consultation) before attendance of this module. The

	students have to consult Professor Fischer for preliminary discussion before the final application is excepted. The date for this discussion is on Thursday 3rd May 2018. Please contact Professor Fischer for time arrangement.
Sprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 3)
Verbindlichkeit	Wahl
Studienleistung	Attendance and active participation in seminars and practical course
Prüfungsleistung	written examination is about the theoretical and practical parts
Modulprüfung	written examination (80%), written protocol (20%)
Prüfungsdauer	90 Minuten
Arbeitsaufwand	90 h attendance + 90 h independent study = 180 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Upon completion students are able to determine the enzyme activity of different types of enzymes. In addition, students are able to characterize enzymes using different methods on their own. Students are able to determine kinetic values of enzymes and calculate them using conventional methods and nonlinear regression.
Schlüsselkompetenzen	The aim of this module if 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.
Anmerkungen	Places available: 12 Registration: ILIAS between 01.02.-31.03.2018 Criteria for awarding places: interview
Enzymatic Reactions | Lectures and Seminar (1502-411)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Lutz Fischer
Person(en) begleitend	Dr. rer. nat. Sabine Lutz-Wahl, Priv. Doz. Dr. rer. nat. Timo Stressler, Dr. rer. nat. Ines Seitl, Paul Swietalski, Katrin Reichenberger, Lucas Kettner
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
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)
Enzymatic Reactions | Practical course (1502-412)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Lutz Fischer
Person(en) begleitend	Paul Swietalski, Katrin Reichenberger, Lucas Kettner, Ina Schirin Bußler
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

Modul: Enzyme Technology (1502-510)

Modulverantwortung	Prof. Dr. rer. nat. Lutz Fischer, Priv. Doz. Dr. rer. nat. Timo Stressler
Bezug zu anderen Modulen	The module is part of the Major course "Enzyme Biotechnology" and is mandatory for performing a Master Thesis in the Department of "Biotechnology and Enzyme Science".
Teilnahmevoraussetzungen	The module is for advanced master students. The participation is only meaningfull after successful completion of the four compulsory modules of the first semester and the elective modul “Enzymatic Reactions (1502-410)". Interested students have to register in ILIAS until 31th of December. Before the final participation is promised a preliminary discussion is required. This discussion will take place in January. The registered students will be informed by email.

Sprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 4)
Verbindlichkeit	Wahl
Studienleistung	Keep a lab book - Attendance on the daily lab meeting - Design and evaluation of a continuous biotransformation to produce L-amino acids
Modulprüfung	Preparation a poster showing own results (15 %) - Oral presentation of own results using the prepared poster and a Power Point presentation (60 %) - Protocol of the lab experiments (25 %)
Prüfungsdauer	120 Minuten
Arbeitsaufwand	90 h attendance + 90 h independent study = 180 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Upon completion of this modul, the students are able to design strategies to purify enzymes by Fast Protein Liquid Chromatography. Further, the students can evaluate the purification based on yield, purification factor and electrophoretic methods. After this modul the students can determine the enzyme activity of different enzymes using different methods (e.g. spectrometric, HPLC). Students have knowledge about different immobilisation methods of enzymes after this modul and can performe and evaluate a covalent immobilisation method on macropourus particels. Upon this modul, the students can perfom and evaluate biotransformation processes.
Schlüsselkompetenzen	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. They will be able to design a scientific poster.
Anmerkungen	Maximum number of participants: 8
Enzyme Technology, Vorlesung und Seminar (1502-511)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Lutz Fischer, Priv. Doz. Dr. rer. nat. Timo Stressler
Lehrform	Vorlesung mit Seminar
SWS	1.5
Inhalt	In interactive lessons the students will learn the theoretical background for enzyme purification with different methods (e.g. IEX, HIC, SEC,…). Further they will learn the basics of enzyme characterization methods and different electrophoretic methods. Further, the students will lern the theroretical background of different immobilisation methods. Additionally, together with the students the realization of batch and continuous biotransformations will be discussed.

Literatur	Current original papers, text books for laboratory work. Genral literature: Illanes, A.: Enzyme Biocatalysis, 1. ed., Springer, New York, 2008 Polaina, J.; MacCabe, A. P.: Industrial Enzymes, 1. ed., Springer, New York, 2007 Scopes, R. K.: Protein Purification Principles and Practice, 3. ed., Springer, New York, 1994
Enzyme Technology, Practical Course (1502-512)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Lutz Fischer, Priv. Doz. Dr. rer. nat. Timo Stressler
Lehrform	Praktikum
SWS	4.5
Inhalt	The students will perform different enzyme purification methods by their own. This includes primary purification methods like ammounium sulfate precipitation and different column chromatographic principles like ion exchange or hydrophobic interaction. The purification procedure will be evaluated by the students using different electrophoretic methods like SDS- and native-PAGE and the preparation of a purification table. Further, the students will perform different methods for enzyme activity measurments and learn how to biochemically characterize enzymes (e.g. pH, temperature, substrat specificity). Additionally, the students perform a covalent enzyme immobilisation and use the free and immobilised enzyme for biotransformation experiments. Finally, the students will design and evaluate a continuous biotransformation by their own.
Literatur	Current literature about particular purification protocol, original articles and reviews (will be discussed with supervisor). Illanes, A.: Enzyme Biocatalysis, 1. ed., Springer, New York, 2008 Scopes, R. K.: Protein Purification Principles and Practice, 3. ed., Springer, New York, 1994

Major Food Microbiology

Modul: Identification and characterization of foodborne microorganisms (1501-410)

Modulverantwortung	Prof. Dr. Herbert Schmidt
Bezug zu anderen Modulen	Part of the major "Food Microbiology" of the program in Food Biotechnology
Teilnahmevoraussetzungen	Participants need to want to complete the major "Food Microbiology" of the program in Food Biotechnology and need to have successfully completed the modules "Scientific Writing and Reporting (1502-500)" and "Fermentation Technology (1501-400)"

Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	4 Wochen (Block 3)
Verbindlichkeit	Wahl
Studienleistung	Seminar and lab protocol
Modulprüfung	Successful seminar participation, protocol, and written examination (2h)
Prüfungsdauer	120 Minuten
Arbeitsaufwand	90 h attendance + 90 h independent study = 180 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Students gain theoretical knowledge in relevant molecular methods used in Microbiology and Biotechnology and apply them in a practical context in the laboratory. Students learn to plan their experiments, to perform them and to analyze the data.
Schlüsselkompetenzen	Students learn to - organize and carry out their practical work independently, and to analyze their results critically, - improve written and oral skills, as well as the practical skills in the laboratory and in a team.
Anmerkungen	Maximum number of participants: 8

Modul: Microbial Ecology and Diversity in the Food Environment (1501-420)

Modulverantwortung	Prof. Dr. Herbert Schmidt
Bezug zu anderen Modulen	Required for the major in Food Microbiology along with the module "Identification and characterization of foodborne microorganisms (1501-410)".
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	4 Wochen (Block 4)
Verbindlichkeit	Wahl
Studienleistung	Regular attendance in the seminar and oral presentation
Modulprüfung	exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	90 h attendance + 90 h independent study = 180 workload

Fachkompetenzen / Lern- und Qualifikationsziele	Students gain theoretical knowledge in relevant areas of Food Microbiology and learn to present, discuss and apply them in a practical context.
Schlüsselkompetenzen	Students are able to learn and work self-motivated, they have improved written and oral skills as well as their scientific communication capabilities.
Anmerkungen	Available places: 24rnRegistration requiredrnAll students taking the Major in Food Microbiology of the program in Food Biotechnology are allowed to participate.rnrnA limited number of other students of the Master's program in Food Biotechnology, the program in Food Science and Engineering as well as Bioeconomy may take this module after being selected for participation.