Technische Universität München

Modulhandbuch

M.Sc. Nutrition and Biomedicine

Studienfakultät für Ernährungswissenschaft

Technische Universität München

www.tum.de
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Technische Universität München

Allgemeine Informationen und Lesehinweise zum Modulhandbuch

Zu diesem Modulhandbuch:

Ein zentraler Baustein des Bologna-Prozesses ist die Modularisierung der Studiengänge, das heißt die Umstellung des vormaligen Lehrveranstaltungssystems auf ein Modulsystem, in dem die Lehrveranstaltungen zu thematisch zusammenhängenden Veranstaltungsblöcken - also Modulen - gebündelt sind. Dieses Modulhandbuch enthält die Beschreibungen aller Module, die im Studiengang angeboten werden. Das Modulhandbuch dient der Transparenz und versorgt Studierende, Studieninteressierte und andere interne und externe Adressaten mit Informationen über die Inhalte der einzelnen Module, ihre Qualifikationsziele sowie qualitative und quantitative Anforderungen.

Wichtige Lesehinweise:

Aktualität

Jedes Semester wird der aktuelle Stand des Modulhandbuchs veröffentlicht. Das Generierungsdatum (siehe Fußzeile) gibt Auskunft, an welchem Tag das vorliegende Modulhandbuch aus TUMonline generiert wurde.

Rechtsverbindlichkeit

Modulbeschreibungen dienen der Erhöhung der Transparenz und der besseren Orientierung über das Studienangebot, sind aber nicht rechtsverbindlich. Einzelne Abweichungen zur Umsetzung der Module im realen Lehrbetrieb sind möglich. Eine rechtsverbindliche Auskunft über alle studien- und prüfungsrelevanten Fragen sind den Fachprüfungs- und Studienordnungen (FPSOen) der Studiengänge sowie der allgemeinen Prüfungs- und Studienordnung der TUM (APSO) zu entnehmen.

Wahlmodule

Wenn im Rahmen des Studiengangs Wahlmodule aus einem offenen Katalog gewählt werden können, sind diese Wahlmodule in der Regel nicht oder nicht vollständig im Modulhandbuch gelistet.

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Verzeichnis Modulbeschreibungen

Pflichtmodule (Required Courses)

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Modulbeschreibung

WZ3235: Advanced Metabolism (Advanced Metabolism)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Sommersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	105	45

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
Written exam (120 min). In the exam the students have to demonstrate that they have achieved a general understanding of various anabolic and catabolic processes as well as their regulation. The students should be able to outline complex metabolic pathways and logically connect them to the central pathways presented in the module Basics Nutrition and Food. The students will be able to elaborate on various mechanisms that control physiological processes and analyse pathophysiological situations.

Wiederholungsmöglichkeit:
Folgesemester

(Empfohlene) Voraussetzungen:
It is essential that the students have previously visited the module Basics Nutrition and Food. Many of the materials presented in Advanced Metabolismbuild upon and logically connect to the contents of the module Basics Nutrition and Food.

Inhalt:
The aspects covered in this lecture will include
biosynthesis and degradation of fatty acids, phospholipids, phospholipid-derived hormones
biosynthesis of sphingolipids and sterols
degradation of ethanol, sugar alcohols and the carbohydrates fructose, galactose and lactose
generation of lactose, glycolipids, proteoglycans and glycoproteins
protein synthesis and degradation, oxidation of amino acids, amino acids as metabolic precursors
hormones and the regulation of physiological processes
classical hormones originating from the hypothalamus, pituitary gland, thyroid gland, adrenal gland
hormones originating from the gastro-intestinal tract, adipose tissue and the musculature
physiology and nutritional relevance of growth hormones

Lernergebnisse:
In the lecture Advanced Metabolism,the students will understandthe various levels of metabolic regulation processes and of inter-organ metabolism. This includes an in-depth understanding of biological signal transduction processes that are triggered by hormones that are produced in many different tissues and have a plethora of diverse consequences on human physiology. After successful participation the students will also appreciate the complexity of chemical reactions that constitute human metabolism, such as the biosynthesis of cholesterol, triglycerides and membrane lipids. They will understand in detail how dietary carbohydrates other than glucose are metabolized and how their carbon skeletons are introduced into central biochemical pathways. The students will understand that carbohydrates have additional functions such as building materials in the extracellular matrix or in the synthesis of glycoproteins and glycolipids. Altogether, the lecture has many links to Basics Nutrition and Foodbut brings the participants to a higher level of complexity and understanding.

Lehr- und Lernmethoden:
The main body of the module consists of PowerPoint presentations. The lectures will include time for questions to clarify or deepen individual aspects.

Medienform:
PowerPoint presentations.

Literatur:
Jeremy M. Berg, Lubert Stryer, John L. Tymoczko and Gregory J. Gatto: Biochemistry (8thedition, 2015)Stipanuk, MH and Caudill, MA: Biochemical, Physiological, and Molecular Aspects of Human Nutrition. Elsevier/Saunders, 2013.Bender, David A: Introduction to Nutrition and Metabolism, Boca Raton: CRC Press, 2014.

Modulverantwortliche(r):
Jürgen Stolz
nutrition@tum.de

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Advanced Metabolism (Vorlesung, 3 SWS)
Stolz J [L], Daniel H, Spanier B, Stolz J

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

Technische Universität München

Modulbeschreibung

WZ3201: Basics Nutrition and Food (Basics Nutrition and Food)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Wintersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
3	90	30	60

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The progress of the students will be tested in a written exam (two hours) roughly six weeks after the end of the lecture. Because of the ¿crash course¿ character of the lecture no grade will be given for the exam. Passing of the exam will require a broad overview over the subjects presented in the lectures, rather than remembering all the details. Students need to demonstrate that they have acquired all the skills that are necessary for a successful continuation in the master program. These skills include, for example, the correct use of the scientific vocabulary, the recognition of the chemical structures of molecules that line the main metabolic pathways and the foundations of how energy is generated and used in biological systems and the classes and chemical structures of nutrients and other biomolecules. In the exam, students are allowed to bring a calculator (for simple calculations) and a dictionary (English into their mother tongue).

Wiederholungsmöglichkeit:
Folgesemester

(Empfohlene) Voraussetzungen:
Formally, this course is at the very entry level for the MSc program Nutrition and Biomedicine. Students are strongly advised to refresh their knowledge from relevant subjects (cell biology, physiology, biochemistry, human anatomy) from their BSc studies.

Inhalt:
The individual aspects covered include:
anatomy and function of the nervous system, the gastrointestinal tract, the adipose tissue, muscles, the liver and the kidneys
basic function of the immune system
use of macronutrients as energy source, energy metabolism
inter-conversion between macronutrient classes
regulation of metabolism after a meal / in hunger / during exercise
vitamins and their relevance for enzymatic processes as precursors of cofactors
classes, production and biological function of hormones
basic molecular biology (DNA, transcription and translation).

Lernergebnisse:
Learning outcomes will be a deeper understanding of metabolic pathways related to nutritional sciences, their regulation and also a comprehensive understanding of the function and interplay of individual organs. The students will achieve a basic understanding of metabolic and physiological processes that are relevant to the area of nutrition. They will also be able to define and correctly apply technical terms as applicable to the area of nutrition and will be able to critically reflect information on diverse aspects of nutrition that comes from a diversity of

scientific and non-scientific sources. The intention of this module is to bring all students to a similar level of understanding, which is considered the prerequisite for all modules that will follow.

Lehr- und Lernmethoden:
This module is designed to level the students, who come from various scientific and cultural backgrounds and to provide a first glance into the broad field of nutrition and biomedicine. It consists of a lecture that covers the first two weeks of the winter term. No other lectures will be held in this time so that the students can entirely focus on this lecture. The lecture covers basic knowledge from biological and nutritional sciences in a compressed form. It is a primer that is intended to bring all students to a similar entry level for the other lectures to come. The main body of the module is a lecture in PowerPoint format given by several lecturers. The exercise units will take place in the time between the lecture and the exam. These will allow students to ask questions that may have appeared during the self-study time. The exercise provides more space for the interaction with other students as well as with the lecturers and helps to identify areas that need more attention.

Medienform:
The lecture will mainly be based on PowerPoint presentations. There is time for questions and discussions during the lectures. A blackboard or whiteboard may be used in the exercises to explain individual aspects in greater depth

Literatur:
Stipanuk, MH and Caudill, MA: Biochemical, Physiological, and Molecular Aspects of Human Nutrition. Elsevier/Saunders, 2013.
Bender, David A: Introduction to Nutrition and Metabolism, Boca Raton: CRC Press, 2014.

Modulverantwortliche(r):
Stolz, Jürgen; PD Dr. rer. nat. habil.

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Basics Nutrition And Food (Vorlesung, 4 SWS)
Daniel H [L], Bader B, Daniel H, Fromme T, Haller D, Klingenspor M, Schemann M, Stolz J, Willershäuser M (Klingenspor M)

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

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Modulbeschreibung

WZ3226: Basics in Computational Biology (Basics in Computational Biology)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Sommersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	105	45

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The learning outcome will be verified in a written exam (90 min) where the student has to demonstrate that she/he knows the appropriate tools to address bioinformatics problems, can apply and combine these web-based analysis tools to solve the respective problems, and can also interpret the results delivered by these tools. Students may use their lab notebooks to solve the problems in the exam. For example, students may be asked to download specific gene sequences from online databases, generate alignments, identify identity and similarity, find cleavage sites for restriction enzymes, select primer pairs for PCR experiments, develop cloning strategies, or construct phylogenetic trees using a set of protein sequences and interpret the results obtained.

Wiederholungsmöglichkeit:
Folgesemester

(Empfohlene) Voraussetzungen:
none

Inhalt:
Public databases, open source and commercial software for the analysis of sequences related to nutritional biomedicine and biological sciences. Topics: Genomes, sequence archives, alignments, polymerase chain reaction, cloning, molecular phylogeny, primary structures of proteins, functional domains und 3D-structures, promoter analysis, polymorphisms.

Lernergebnisse:
Students have acquired basic skills in biological computing. At the end of the module they can apply basic knowledge in bioinformatics to solve new problems related to nutrition science and biomedical research. They are able to use their knowledge to solve practical problems occurring in everyday life of a molecular biologist in the laboratory. Students will be able to run the required software on their own computer, and can apply the software in their research internship and master thesis.

Lehr- und Lernmethoden:
The lecture provides the theoretical basics and hands-on instructions to apply selected methods in computational biology. Students write lab notebooks to protocol step-by-step procedures in computational biology. To recapitulate the practical parts, exercise sheets are distributed regularly. The correct answers will be released on the learning platform and discussed in the course. Exercises in Computational Biology are offered to solve the exercise sheets with support of student tutors. For the successful completion of exercises, self-study hours are required to get familiar with web-based bioinformatics tools and to explore different analytical options without social pressure.

Medienform:
Presentations with PowerPoint, exercise sheets, web links available on Moodle platform.

Literatur:
The lecturer recommends textbooks covering molecular genetics, biochemistry and evolutionary biology at start of term. Initial sequencing and analysis of the human genome (409;860-921; Nature 2001) Initial sequencing and comparative analysis of the mouse genome (420;520-562; Nature 2002)

Modulverantwortliche(r):
Klingenspor, Martin; Prof. Dr. rer. nat.

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

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Modulbeschreibung

WZ3210: Disease Pathologies and Nutrition (Disease Pathologies and Nutrition)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Wintersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
8	240	150	90

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The students have to present their group work (2 to 3 students per group, 60 min) comprising the analysis of specific published disease/nutrition-related human studies and/or animal models by the group members followed by the discussion (20 min) with the seminar audience.

The students overall achievements in the module are assessed by a graded written exam (120 min). The exam tests the students understanding of the basics in pathophysiologies and their underlying molecular and metabolic mechanisms. The grade of the test equals the final grade for the module.

Wiederholungsmöglichkeit:

(Empfohlene) Voraussetzungen:
Basics in nutrition, metabolism, physiology and nutritional medicine.

Inhalt:
The module deals with the pathophysiology of selected common nutrition-related chronic diseases such as obesity, diabetes type 2, cardiovascular diseases, allergy, inflammatory bowel disease, cancer (colorectal cancer, breast cancer, alcohol-associated cancer) and neurodegenerative diseases among others.
In the lectures, presented by different lecturers (see above), the understanding of specific pathologies, their causes and the underlying molecular and metabolic mechanisms of the disease processes are taught, and nutritional influences (e.g. diets, nutrients, nutritional components, active ingredients) are particularly addressed.
For the seminar students have to analyze (self-study hours) published data from original scientific publications. Specific topics on chronic diseases are chosen that build on the theoretical knowledge of the students. For example, how nutrition relates to the potential cause of, or contribution to, the disease and the efficacy of specific diets or nutrients for the prevention or treatment of a disease. In the seminar the groups present their work as oral presentation and discuss the results of their analysis with the students in the audience.

Lernergebnisse:
Upon successful completion of the module students are able to understand the basic pathophysiology of nutrition-related chronic diseases, their underlying molecular and metabolic mechanisms and the correlations between nutrition and pathological processes. The students can apply their theoretical knowledge to analyze published studies and concepts on the prevention and treatment of nutrition-related chronic diseases using evidence-based medical standards. Furthermore, the students are able to present complex scientific studies in a concise way. They can lead a scientific debate and defend their standpoint in a scientific discussion.

Lehr- und Lernmethoden:
Lecture:
lecturers will give their oral presentations on their topics by means of PowerPoint presentations
Seminar:
individual students receive specific original publications (e.g. research articles, observational and prospective studies, systematic reviews or meta-analyses) to be analyzed and presented in the seminar
the students transfer their theoretical knowledge to actual medical cases and practical scientific research
students search for additional literature where it is necessary for their analysis and presentation
the groups present their work as oral presentation (approx. 60 min) using PowerPoint followed by the discussion (approx. 20 min) with the students in the audience

Medienform:
PDFs from the PowerPoint presentations of the lecture and seminar, as well as other study materials (PDFs from publications) and informations are distributed via TUM-Moodle.

Literatur:
Specific original literature and publications will be appointed to each student individually by the lectures.

Modulverantwortliche(r):
Hauner, Johann; Univ.-Prof. Dr.

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Disease Pathologies and Nutrition (Vorlesung, 4 SWS)
Hauner J [L], Bader B, Fromme T, Haller D, Hauner J, Maurer S, Schemann M, Skurk T, Traidl-Hoffmann C, Witt H

Seminar Disease Pathologies and Nutrition (Seminar, 2 SWS)
Hauner J [L], Bader B, Hauner J

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

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Modulbeschreibung

WZ3205: Integrated Lab-Course (Integrated Lab-Course)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Zweisemestrig	Wintersemester/Sommersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
10	300	180	120

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
In total, the students participate in 13 practical courses. Each practical course starts with a colloquium in which the lecturer confirms that students have acquired the theoretical background to conduct the lab work in a safe manner. Students that do not fulfill this safety requirement cannot not participate in the course and can repeat the course on another day. Students are required to protocol the experimental steps during the course. For this purpose, each student will have a personal lab notebook. Based on their notes and the data collected, students generate a protocol of each lab course. At the start of the lab course, all students receive instructions in the writing of experimental lab protocols and receive a written guideline. Lecturers evaluate and grade the protocols in due time, and provide criticism and recommendations to the students. The grading of the protocol is based on the knowledge in the colloquium and hands-on performance of students during the lab course (20%) and the quality of the lab protocol (80%).

Wiederholungsmöglichkeit:
Folgesemester

(Empfohlene) Voraussetzungen:
Principles of laboratory safety and good laboratory practice; basics in physics and biochemistry; basics innutrition and food science, basic scientific writing skills.

Inhalt:
Students acquire practical knowledge in a broad spectrum of experimental methods applied in research laboratories for nutrition and food science and in biomedical research:
A. Western blot analysis (LS Ernährungsmedizin, Hauner)
B. Mycotoxins in the food chain (LS Tierhygiene, komm. Langosch)
C. Neurogastroenterology (LS Humanbiologie, Schemann)
D. Flow cytometry for cell cycle studies (LS Ernährung und Immunologie, Haller)
E. Electrophoretic mobility shif assay (EMSA) (Professur Pädiatrische Ernährungsmedizin, Witt)
F. Isolation, identification and sensory evaluation of volatiles (LS Allgemeine Lebensmitteltechnologie, Engel)
G. Functional genomics in animals (LS Tierzucht, Fries)
H. Analysis of substances in beer and hop (LS Analytische Lebensmittelchemie, Rychlik)
I. Behavioral analysis and anatomy of brain and gut in the Drosophila model (Professur für Neuronale Kontrolle des Metabolismus, Grunwald Kadow)
J. LC-MS-Analysis of plant extracts (LS Biotechnologie der Naturstoffe, Schwab)
K. Investigation of peptide transporters (LS Ernährungsphysiologie, Daniel)
L. Tumormetastasis in mouse models (Experimentelle Onkologie und Therapieforschung, Krüger)
M. Mitochondrial respiration (LS Molekulare Ernährungsmedizin, Klingenspor)

Lernergebnisse:
After successful completion students know a broad spectrum of experimental methods applied in experimental nutrition and food sciences and biomedical research. They are familiar with the theoretical background, technical details and potential pitfalls of these methods, and have first hands-on experience in their application. Students are able to generate laboratory protocols of their experimental work, documenting data acquisition, processing and analysis. They can evaluate results obtained in a self-contained manner. Students understandthe principles of experimental design and apply suitable methods in the framework of a research project.

Lehr- und Lernmethoden:
For each individual lab course, students mustdownload and study the specificlab instructions from Moodle in advance. Students must read and understand these lab instructions before they attend the practical course. In particular, they need to attend the safety instructions. Practical training in laboratory skills and techniques takes place in small groupsduring the course

Medienform:
Experimental instructions will be made available onMoodle.

Literatur:
In their lab instructions, lecturers specify text books and other literature sources required to prepare for the course.

Modulverantwortliche(r):
Klingenspor, Martin; Prof. Dr. rer. nat.

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Integrated lab-course I (Übung, 8 SWS)
Annahazi A, Bader B, Ewers M, Fromme T, Grunwald I, Hoffmann T, Kiske C (Riegel A), Krüger A, Laumen H, Meyer K, Reil G, Riegel A, Schmöller I, Spanier B, Willershäuser M, Wurmser C

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

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Modulbeschreibung

WZ3208: Energy Balance and Regulation (Energy Balance and Regulation)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Sommersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	90	60

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
Students give short oral presentations (10 min) reporting the results of their group work and discuss these results in the plenum. These presentations train the students¿ capability to apply the theoretical knowledge addressed in the lecture on actual scientific research results. In the presentation and discussion, the students acquire skills to present complex scientific data in a concise way and to explain it to their peers. Furthermore, the oral presentation addresses relevant issues related to experimental design of research, methodology, graphical display and statistical analyses of data, interpretation of results and identification of strengths and weaknesses of the study. The students develop their ability to answer questions from their peers and defend their standpoint in a rigorous scientific debate.
A written exam (120 min) will assess whether the student has attained an advanced level of knowledge and understanding of the theoretical background in energy balance regulation. In preparation for the exam students will be provided with an original research article dealing with a specific aspect of energy balance regulation that was discussed in the lecture. The exam will test whether they have understood the science behind the paper, can recapitulate the applied methods, identify the main outcomes, are able to evaluate the impact of the study and identify findings contrasting to state-of-the-art knowledge presented in the lecture. In particular, the questions will test whether the student can
- repeat and classify elements of energy balance physiology in the correct context.
- apply this knowledge to a new problem in this field of research.
- evaluate the influence of genetic and environmental factors on energy balance.
- predict the outcome of defined experimental interventions altering energy intake, energy storage or energy expenditure.
They may use an English-German Dictionary or Thesaurus and they must bring a hardcopy of the original research paper which is subject of the examination. The final grade for the module depends exclusively on the written exam.

Wiederholungsmöglichkeit:
Semesterende

(Empfohlene) Voraussetzungen:
Basic knowledge in mammalian physiology, cell biology, biochemistry, genetics and molecular biology.

Inhalt:
In the context of energy balance, the module conveys advanced knowledge in metabolic physiology, endocrinology, neurobiology and molecular genetics. In particular the following topics are covered:
1. Components of energy homeostasis
2. Exogenous factors (diet, exercise, ambient temperature, photoperiod)
3. Endogenous factors (allelic variation, neuronal and endocrine communication, metabolites)
4. Body composition and impact on energy storage and energy expenditure.

5. Biochemical mechanisms of thermogenesis
6. Gastrointestinal nutrient sensing in the control of food intake
7. Neuroanatomy and neuroendocrine regulation of food intake and energy expenditure
8. Orexigenic and anorexigenic signaling in the brain
9. Neuropeptides and transmitters
10. Nutrient sensing in the brain
11. Chronobiology of energy balance

Lernergebnisse:
After successful completion of the module, students have acquired an advanced level of understanding of established and novel concepts in integrative energy balance physiology. They gained a solid foundation of exo- and endogenous factors that influence energy balance regulation in a physiological context. They know the biochemical basis for sensing and signaling of food intake and energy consumption as well as energy storage. Students are able to elaborate open questions and unsolved problems in this discipline of life sciences. They know how to address these questions according to experimental design and applied methodology. They are able determine the essential biological parameters required for these experiments and select adequate methods for valid measurement and statistical assessment of these parameters.
The students are able to critically assess state of the art research on energy balance regulation in animal models and humans and to present these results in a concise way. They can weigh the positives and negatives of experimental design, address limitations in study designs, data presentation as well as data interpretation. Most importantly, the students can debate in depth with their peers about scientific approaches and defend their own stand point against criticism of a peer group.

Lehr- und Lernmethoden:
The lecture part conveys the scientific foundation for the work on actual research during the seminar part. Using beamer presentations and white board illustrations landmark research findings and their impact on the incremental advance of understanding are presented. Review articles and textbook chapters on animal and human physiology round up the theoretical background of energy balance regulation.
The seminar translates the theoretical knowledge into actual state-of-the-art research. Students are independently analyzing and interpreting research findings reported in original research articles and discuss the assigned scientific publications in groups. These articles are preselected to match and expand on the topics of the lecture. Thereby, knowledge presented in the lecture is consolidated and extended. The students learn to dissect research articles in a stepwise manner, starting with understanding the methods applied for the research, identifying the most relevant research results, and understanding and evaluating the interpretation of results as presented by the authors in the discussion section of their article. Students are encouraged to search for other original research articles with confirmatory or conflicting results. Furthermore, they will present the results of their group work to the plenum. Dissemination of their results to the plenum triggers discussions of the topic within the groups as well as in the plenum. These discussions serve to deepen the knowledge of students in energy balance regulation, identify the strengths and weaknesses of scientific research. Most importantly, the students practice scientific debate in front of a peer group audience.

Medienform:
PowerPoint presentations; additional reading of original research papers and reviews; case studies; all materials are made available on Moodle; occasional white board illustrations;

Literatur:
Original Research and Review Articles are made available on the Moodle platform.
Textbooks for background in Energy Balance Physiology
Biochemical, Physiological, and Molecular Aspects of Human Nutrition. Martha H. Stipanuk and Marie A. Caudill, Elsevier
Introduction to Nutrition and Metabolism. David A. Bender, CRC Press
Metabolic Regulation ¿ A Human Perspective. Keith N. Frayn, Blackwell Publishing

Modulverantwortliche(r):
Klingenspor, Martin; Prof. Dr. rer. nat.

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Energy Balance and Regulation (Vorlesung, 2 SWS)
Klingenspor M

Energy Balance and Regulation (Seminar, 2 SWS)
Klingenspor M

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Modulbeschreibung

WZ3233: Food and Health (Food and Health)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Sommersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
8	240	150	90

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
A written exam (120 min, open questions and multiple choice) will assess all the skills that the students have obtained in the module. The students have to show detailed knowledge about the functionality of food, food components and different forms of nutrition on the human health and nutrition-related diseases. For the exam, no supporting material is allowed.
Additionally, the students have to give an ungraded oral presentation (PowerPoint) during the seminar, reporting the results of the group work. In the presentation and the following debate, the students must demonstrate that they are able to investigate independently the legal and scientific substantiation of a new functional or medical food by literature research. They have to show, that they are able to defend their results in a subsequent discussion.

Wiederholungsmöglichkeit:
Folgesemester

(Empfohlene) Voraussetzungen:
Basic knowledge of the biofunctionality of food and food components as well as nutritional science.

Inhalt:
The lecture series ¿Food and Health¿ gives an overview about functional-, medical- and novel food. It deals with the interplay of food and food components like polyphenols, antioxidants, folates and different types of diets (e.g. ketogenic diet, vegan lifestyle) with health benefits and nutrition-related diseases. Additionally, biomedical background knowledge will be taught. The main focus is on how functionality can be proven by clinical studies. The seminar, which consists of a practical exercise (teamwork), deepens the knowledge communicated in the lecture series. Here, the students have to hypothetically develop a new functional- or medical food and have to go through the regulations on the scientific requirements for health claims related to e.g. oxidative damage, cardiovascular health, immune system or the areas of the gastrointestinal tract.

Lernergebnisse:
After successful completion of the module, students will comprehend the effects of food, bioactive food components and different forms of nutrition on the human health and the development, prevention or treatment of nutrition-related diseases. At the end of the module students are able to evaluate clinical studies and put them into a scientific context. Additionally, students are able to independently acquire information needed to apply for health claims. They can present the results of their investigation in a concise way to their peers and defend their point of view in a rigorous scientific debate.

Lehr- und Lernmethoden:
The theoretical part of the course will be taught in the lecture series. In the seminar, students will work in teams (4-5 students) to deepen their knowledge by developing a new functional or medical food on their own. By

independent literature research students have to show the scientific substantiation necessary to obtain a health claim or get approval for the European market.

Medienform:
PowerPoint presentations; original research papers and reviews

Literatur:
Register of nutrition and health claims made on foods (European Commission).
Various scientific Opinions on the substantiation of health claims related to various food(s)/food constituents(s) (published by EFSA).

Modulverantwortliche(r):
Haller, Dirk; Prof. Dr. rer. nat.

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Food and Health (Lecture) (Vorlesung, 4 SWS)
Haller D [L], Haller D, Klingenspor M, Stolz J, Bader B, Blum-Sperisen S, Daniel H, Hauner J, Schmöller I, Skurk T, Engel K, Maurer S

Food and Health (Seminar) (Seminar, 2 SWS)
Haller D [L], Haller D, Schmöller I, Blum-Sperisen S

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Technische Universität München

Modulbeschreibung

WZ3211: Research Internship (Research Internship)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Wintersemester/Sommersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
10	300	75	225

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The student¿s performance is evaluated, as documented in the lab notebook and the internship report (max. 20 pages), by the following criteria:
-understanding of the research question and ability to develop the project
-ability to learn and apply new methods
-skills in self-directed experimental design
-precision and accuracy in data acquisition and data management
-ability to study and work autonomously
-data analyses and evaluation

Wiederholungsmöglichkeit:

(Empfohlene) Voraussetzungen:
Module Research MethodsModule Basics in Computational BiologyModule Integrated Lab Course

Inhalt:
The scientific questions addressed by laboratories on the TUM campus or at external research facilities hosting our master students for the research internship deal with nutrition-related research, either on the fundamental or applied level, using biochemistry, molecular biology, nutrition physiology, metabolism, microbiology, food chemistry, nutrition medicine, genetics, clinical studies, epidemiology and public health. The internship is the first opportunity for our students to apply their theoretical and practical knowledge acquired during the first two semesters to a specific research question in the framework of a project in the host laboratory.

Lernergebnisse:
After successful finalization of the module, our students have acquired theoretical and practical skills to tackle scientific questions and conduct research tasks under guidance by a supervisor. They have gained hands-on experience in the design of experiments in life science laboratories, or the development of study protocols in clinical study units. They are experienced in sensible and reproducible application of known and new methods, understand the technical background of the applied technologies and gained insights into quality control procedures in scientific research. They have learned to document the day-by-day progress of their work in a comprehensible manner that allows independent recapitulation of the applied methods, the acquired data and the results obtained. In a written report, outlined as a scientific manuscript, they can explain the scientific context of their research project, explain the detailed application of methods, document and analyze the acquired data, judge upon the reliability and reproducibility of the results, and evaluate and interpret these results in relation to published work. They are able to explain the goals, experimental design and essential outcome of their research internship to

their peers and supervisor in short and concise oral presentations, and in written reports.

Lehr- und Lernmethoden:
The internship is composed of three elements with theoretical and practical aspects: Phase 1-Developing and planning of a scientific project, Phase 2- Implementation of a research plan devised in Phase 1, and Phase 3¿ writing a scientific report about the research project. In the practical course, students are trained to identify and specify a selected basic or applied research problem related to nutrition science and biomedicine. The research internship embeds in a defined research context at the respective chair hosting the student. High intensity supervision of students by experienced scientific personnel supports the training success. Students document their research work in a dedicated lab notebook, with a focus on detailed description of applied methodologies, data acquisition and data analyses. They report to their supervisor on the progress of their work in regular meetings (examination colloquium) and summarize the goals of their research project and the main findings in short oral presentations, using PowerPoint or equivalent presentation tools. Within this setting, the project progress is discussed and plans to further develop the project in the given time frame are developed.

Medienform:

Literatur:
Review articles and original research articles related to the topic of the research internship. The supervisor assists the student to find the relevant papers and recommends specialized textbooks.

Modulverantwortliche(r):
Klingenspor, Martin; Prof. Dr. rer. nat.

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Research Internship Nutrition and Immunology (Praktikum, 15 SWS)
Haller D [L], Waldschmitt N

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Technische Universität München

Modulbeschreibung

WZ3207: Nutrition and Microbe-Host Interactions (Nutrition and Microbe-Host Interactions)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Sommersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	90	60

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The examination requirements of the module "Nutrition and Mirobe-host Interactions" consist of a written examination (90 min, open questions and multiple choice). The examination can be based on any subject of the lectures and the corresponding seminar. The written exam will assess whether the student has attained an advanced level of knowledge about the diversity and functions of the mammalian gut microbial ecosystem and the role of dietary and microbial triggers in regulation of host health. No supporting material is allowed. The seminar (course work), consisting of theoretical input and practical exercises (teamwork), pertains to the sequence-based analysis of microbial communities.

Wiederholungsmöglichkeit:
Semesterende

(Empfohlene) Voraussetzungen:
Basic knowledge in physiology, microbiology, bio functionality and immunology.

Inhalt:
This lecture and seminar series teaches deep insight into the diversity and functions of the mammalian gut microbial ecosystem (intestinal microbiota) in close interaction with the host and with dietary factors. Particular attention will be drawn to the development of the microbiota throughout life as well as underlying cross-talk mechanisms with the mucosal immune system with a particular focus on chronic inflammatory disorders, enteric infections and metabolic disorders.

Lernergebnisse:
After successful participation in the lecture and the seminar, students comprehend the diversity and functions of the mammalian gut microbial ecosystem and are able to estimate the role of dietary and microbial triggers in regulation of host health. They are able to use this knowledge to critically assess recent findings.

Lehr- und Lernmethoden:
Lecture (reiteration and extension of topics of the lecture by studying independently), seminar (teamwork, practical implementation of theoretical knowledge)

Medienform:

Literatur:
Microbial Inhabitants of Humans: Their Ecology and Role in Health and Disease. Cambridge University Press, 2005, ISBN: 0 521 84158 5

Modulverantwortliche(r):
Haller, Dirk; Prof. Dr. rer. nat.

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Microbe-host interaction and nutrition in health and disease (seminar) (Seminar, 2 SWS)
Haller D [L], Coleman O, Haller D, Metwaly A, Schmöller I

Microbe-host interaction and nutrition in health and disease (lecture) (Vorlesung, 2 SWS)
Haller D [L], Haller D, Schmöller I

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

Technische Universität München

Modulbeschreibung

WZ3204: Recent Topics (Recent Topics)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Zweisemestrig	Wintersemester/Sommersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	180	120	60

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The students will write scientific abstracts on one of the topics presented in the module(written and graphical abstracts, one page each). The topics will be randomly assigned to the students at the end of the summer term. Their task is to search and select recently published work from peer-reviewed journals for their abstracts. Ideally, they identify papers with opposing opinions or conflicting results / conclusions. In their abstract they provide a short introduction to the topic highlighting the research goal, describe the applied experimental approaches and methods, present the main results of the selected publications with a focus on novelty aspects, and discuss and interpret the relevance of these findings in the context of state-of-the-art in nutrition and biomedicine. Distinct guidelines for the abstracts are provided determining format, length, number of characters, requirements for figures and tables and references. Moreover, the catalogue of criteria for the assessment of the abstracts by the examiner are delivered to the students prior to assignment of the essay. The abstracts must be submitted within 4 months after assignment of the topic. The abstracts must be delivered in electronic format (PDF) and as a hardcopy. A new topic will be assigned if the student fails to meet this deadline.

Wiederholungsmöglichkeit:
Folgesemester

(Empfohlene) Voraussetzungen:
No prerequisites. Participation in the examination requires that students have passed the module Basics in Nutrition and Food

Inhalt:
The lecture communicates the relevance of interdisciplinary knowledge in the area of nutrition and biomedical research. Students are exposed to a selection of current research topics. In preparation of each lecture they are provided with original research articles and reviews dealing with the topic of the day. The students gain practical experience in the evaluation and discussion of scientific matters with experts in nutrition and biomedicine. Original papers addressing most recent developments in nutritional biomedicine research are discussed and evaluated.

Lernergebnisse:
Students have gained insight into current research topics in nutrition science and biomedical research at the TUM campus and beyond (external guest lecturers). They can apply their abilities in reading and understanding of original research papers as well as in the critical assessment of data. They can discuss and evaluate research results together with their peers. In a self-contained manner, they identify unsolved scientific questions and can outline new research ideas. They are able to apply this knowledge in short scientific abstracts. In an abstract writing exercise the students have improved their proficiency to solve a scholarly complex task by applying scientific methods independently based on the knowledge and skills acquired in the course of their master study

course Nutrition and Biomedicine.

Lehr- und Lernmethoden:
Lectures with subsequent discussions

Medienform:
- PowerPoint presentations
- Review articles and original research papers provided beforehand on Moodle

Literatur:
Topics of this module change annually, scientific literature is individually appointed to each student.

Modulverantwortliche(r):
Klingenspor, Martin; Prof. Dr. rer. nat.

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Recent Topics I (Vorlesung, 2 SWS)
Grunwald I, Haller D, Hauner J, Klingenspor M, Krautwurst D, Rychlik M, Traidl-Hoffmann C, Witt H

Recent Topics II (Vorlesung, 2 SWS)
Klingenspor M [L], Daniel H, Annahazi A, Ecker J, Engel K, Grunwald I, Haller D, Hauner J, Klingenspor M, Laumen H, Rychlik M

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Technische Universität München

Modulbeschreibung

WZ3225: Research Methods (Research Methods)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Wintersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	105	45

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The participants will be able to understand and evaluate modern analytical techniques that are designed for parallel analyses of biological samples. They will be able to judge the advantages and disadvantages of these techniques and have an advanced understanding of the opportunities and challenges, possibilities, drawbacks and limitations of existing techniques and experimental systems. This will include some basic knowledge of biological model organisms that are employed in nutrition research as well as a first idea of what it takes to perform a study on human subjects. They will be capable to distinguish between the various study designs as well as to evaluate the degree of scientific evidence that can be derived.
The students will be aware of legal implications of the work on animals and humans. They will be able to compile all necessary documents for initiating a clinical study as well as to write publications based on currently accepted standards. Concomitantly, the students will also learn the meaning and correct use of technical terms that are inherent to the various scientific areas.

Wiederholungsmöglichkeit:
Folgesemester

(Empfohlene) Voraussetzungen:
For the lecture Research Tools some basic knowledge in the core biological areas cell biology, classical genetics, molecular biology and biochemistry and in some classical analytical methods (such as SDS-PAGE, Western Blot, Northern Blot), is necessary. This is partially covered in the module Basics Nutrition and Food.
For the lecture Clinical Studies the pathophysiology of important metabolic disorders (e.g. diabetes mellitus type 2, dyslipidemia) is necessary. Also, basic statistical knowledge is necessary for calculating effect size and power of the study, etc. Basic principles of ¿Good Clinical Practice¿ (GCP) should be known.

Inhalt:
Research Methods is comprised of two parts, both held in winter term.
The lecture Research Tools (2 SWS) will cover
- the (molecular) biology of model organisms used in nutrition research
- the advantages and disadvantages of the individual model organisms for research
- gene expression analysis by DNA arrays and sequencing approaches
- basics in human genetics and association of genetic variation with phenotypic traits such as disease susceptibility
- detection and functional analysis of genetic variation (coding and non-coding variants)
- techniques for proteome analyses and their limitations when applied to biomedical problems
- techniques for metabolome analyses, limitations encountered in the analysis of body fluids
- approaches for the analysis and visualization of complex data.

The lecture Clinical Studies (1 SWS)
- exemplifies how a study protocol is developed

- provides definitions of study inherent activities
- explains the differences between the different study designs and their advantages and limitations
- covers legal and ethical aspects that need to be considered when human subjects are studied
- outlines dissemination strategies of scientific results and their use for guideline development
- covers standardization of literature search strategies, publications and authorship
- introduces basics in quality management and evidence based medicine

Lernergebnisse:
The exam at the end of the winter term is a written test (120 min). This exam will check if the students can use the correct technical terms and are familiar with the advantages and disadvantages of the various lab techniques, experimental strategies and model organisms that are commonly used. The students will have to demonstrate that they know the current standards of how to make a clinical investigation and how to categorize and critically evaluate results of observational and interventional studies based on their design.

Lehr- und Lernmethoden:
The module uses lectures to familiarize the students with the materials and concepts. The PowerPoint presentations include data from original publications for discussions as well as recaps.
Exercises will be used to strengthen the students use of the correct technical wording.
Templates will be used for discussion to provide knowledge on study protocol development and study application with relevant authorities and the ethical commission.

Medienform:
PowerPoint presentations, use of topical publications, white board. Contents of teaching will be exemplified with case studies; computer work supports their application.

Literatur:
Basis for the development of clinical studies are legal tests as the ¿Good Clinical Practice¿ ¿ guideline.
https://ec.europa.eu/health//sites/health/files/files/eudralex/vol-10/3cc1aen_en.pdf

Modulverantwortliche(r):
Stolz, Jürgen; PD Dr. rer. nat. habil.

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):

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Technische Universität München

Wahlmodule (Elective Courses)

Technische Universität München

Modulbeschreibung

WZ3061: Applied Food Law (Applied Food Law)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Zweisemestrig	Wintersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	90	60

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The oral examination takes 20 min for each student and will take place in groups of 2-3 students. The students apply their knowledge by evaluating product samples presented to them and discussing the related legal questions. The legal texts can be used.

Wiederholungsmöglichkeit:

(Empfohlene) Voraussetzungen:
Food law lecture in B.Sc. study recommended, but no prerequisite

Inhalt:
Law of the EU: Principles, general food law, jurisdiction, categories of products, use of substances, food safety, novel food, GMOs, labeling, consumer information, responsibility, advertising, health and nutrition claims. Independent working with law texts, understanding of the principles of food law.

Lernergebnisse:
At the end of the module,students are able to apply the principles of food law.Especially, they are able to evaluate the use of ingredients in food and the advertising for foodstuffs.The students examine the various legal prerequisites for the marketing of different categories of food, e.g. novel food, food supplements and eco food, including their specific labelling requirements.

Lehr- und Lernmethoden:
The module consists of a lecture, including expert input

Medienform:
Presentations with PowerPoint

Literatur:

Modulverantwortliche(r):
Meisterernst, Andreas

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Applied Food Law (Vorlesung, 2 SWS)
Meisterernst A

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Technische Universität München

Modulbeschreibung

WZ3097: Basics in Chronobiology (Basics in Chronobiology)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Zweisemestrig	Wintersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	90	60

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The examination consists of a written exam at the end of the summer semester (lecture) and a presentation during the winter semester (seminar).In the written exam, students demonstrate their ability to remember the molecular components, the structure and organization of the circadian system including its functions. Important steps, figures and key findings in circadian research should be ranked chronologically and according to relevance. Students show that they understand the functional interrelation of the components of the circadian system and that they are able to transfer their knowledge to exemplary situations / pathologies. The written examination comprises 90 minutes; the questions asked include open questions as well as multiple choice tests.

During the seminar, the knowledge acquired by the lecture is applied on a specific topic of Chronobiology and liked to a pathology / mutation with the use of a scientific study. The examination during the winter semester (seminar) consists of a group presentation (35 min), a subsequent discussion (10 min) and preparation of an abstract. Additionally, a qualified peer-feedback is mandatory as coursework. By the delivery of the presentation students show (I) that they are able to illustrate the interrelation between circadian functions and pathologies with the help of scientific studies and (II) that they are able to analyze and evaluate relevant scientific literature. Additionally, students demonstrate their ability to present a subject to an audience and to stand a discussion about the presented content. By the written abstract, the ability is tested to summarize the major facts and the conclusion of a presentation in clear and concise manner.The final grade is an average grade from the written exam (70%) and the seminar (30%).Further informationPrerequisites (recommended)MediaPower Point Presentation, MoodleReading ListCircadian Physiology; Roberto Refinetti, PhD.; CRC Press: ISBN 9780849322334
Module

Wiederholungsmöglichkeit:

(Empfohlene) Voraussetzungen:

Inhalt:
The module disseminates the basics in Chronobiology. The circadian system in organisms is presented with a focus on different circadian clocks in various tissues and organs. Students learn how these periferal systems orchestrate the central clock in the brain and how disruption of the system leads to various diseases and pathologies. Based on this knowledge, students develop an understanding of circadian-related pathologies. Using selected examples, the impact of circadian disturbances, e.g. during Jetlag or shift work, on distinct pathologies is exemplified. By applying and transferring the knowledge acquired to a circadian science-associated question, the relevance is illustrated and evaluated.
¿ History of the science of Chronobiology¿ Properties of biological oscillators
¿ Hierarchy of the circadian system: the central circadian clock, peripheral circadian clocks and their

synchronization
¿ Molecular mechanisms of the circadian clock
¿ Signals of the circadian system
¿ Disruption of the circadian system and associated diseases
¿ Analysis of scientific studies with regard to study design
¿ Presentation of scientific topics related to circadian science.

Lernergebnisse:
Upon completion of the module, students are able to:
¿ memorize important steps, figures and key findings in circadian research and rank them chronologically and according to relevance.
¿ describe the molecular components, the structure and organization of the circadian system as well as its functions.
¿ describe the functional interrelation of the components of the circadian system.
¿ recognize and characterize the basic principles of circadian response-regulation.
¿ recognize the circadian aspects of acute diseases.
¿ analyze and evaluate scientific studies with regard to study design.
¿ prepare and present the interrelation of circadian functions, given disease and selected pathologies or mouse phenotypes.
¿ evaluate peer presentations based on given criteria.

Lehr- und Lernmethoden:
The lecture disseminates basic knowledge on the circadian system and the interrelation of the different components, under normal and diseased conditions or in mutants. The lecture is given with a teacher-centered approach. During the seminar, the knowledge acquired by the lecture is applied on a specific topic and linked to a disease pathology with the use of a scientific study. The seminar consists of a few attendance periods which serve to introduce the task/topic and to organize the seminar and extensive self-studying phases, in which students gather the topic and prepare a presentation and an abstract. Finally, group presentations are held and mutual feedback is given to practice the analysis and evaluation of scientific topics.

Medienform:
Power Point Presentation, Moodle

Literatur:
Circadian Physiology; Roberto Refinetti, PhD.; CRC Press: ISBN 9780849322334

Modulverantwortliche(r):
Dirk Haller
dirk.haller@tum.de

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Basics in Chronobiology (Vorlesung, 2 SWS)
Haller D [L], Kießling S, Schmöller I

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Technische Universität München

Modulbeschreibung

WZ3098: Basics of Metabolomics (Basics of Metabolomics)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Sommersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	105	45

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The examination consists of an oral presentation of 3-5 minutes (elevator pitch) (60% of final mark) and submission
of an maximum 6 page long abstract (40% of final mark) on the group work focusing on a specific problem.

Wiederholungsmöglichkeit:
Semesterende

(Empfohlene) Voraussetzungen:
- basic knowledge of biochemistry
- basic statistical knowledge, e.g. t-test, etc.
- basic laboratory skills

Inhalt:
Biochemical, analytical and data analytical basics of metabolomics are illustrated using relevant examples.
The following individual topics are covered:

biochemical basics
- Definition of systems biology and its disciplines (omics)
- Definition and aims of metabolomics and its role in systems biology
- relation of metabolomics to other omics-technologies

analytical basics
- basics of mass spectrometry (MS) and coupling of chromatographic methods
- application of MS in metabolomics
- basics of nuclear magnetic resonance (NMR) and its application in metabolomics

Metabolomics experiments
- experimental design
- sample preparation
- implementation of measurements
- quality control
- metabolite identification

data analytical basics
- basic statistical evaluation, e.g. HCA, PCA, PLS
- bioinformatic approaches

relevant applications
- in medicine, nutrition, food chemistry
- to model organisms
- in plant research and biotechnology

Lernergebnisse:
The students are able to define the term of systems biology and to state its different disciplines.
Furthermore, they know different omics technologies and can separate them from each other.
The students are able to compare analytical methods used in metabolomics based on their advantages and disadvantages and select a fitting method to solve a specific question. Moreover, they are able to apply basic statistical data analysis methods on a given dataset and interpret the results in biochemical context. Additionally, students are competent to perform problem-based literature research in relevant media.
On the basis of selected problems, students are able to question the current status of metabolomic research and state possibilities for improvement.
They can draft plans and execution of metabolomics experiments and are able to comment on them.

Lehr- und Lernmethoden:
The module consists of a lecture, including expert input, single- and group work, case studies and student presentations.

Medienform:
Script; slides

Literatur:
Metabolomics in Practice - Successful Strategies to Generate and Analyze Metabolic Data, 2013, 1. Auflage, Wiley-VCH, ISBN: 9783527330898
- The Handbook of Metabonomics and Metabolomics, 2007, 1. Auflage, Elsevier, ISBN: 978-0-444-52841-4
- verschieden Original- und Übersichtsarbeiten

Modulverantwortliche(r):
Michael Witting
michael.witting@tum.de

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Basics of Metabolomics (Vorlesung, 3 SWS)
Witting M

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Technische Universität München

Modulbeschreibung

WZ3223: Design and Analysis of Experiments (Design and Analysis of Experiments)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Wintersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	90	60

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The learning outcome from this module is evaluated based on a 30 minute oral group examination with two examinees. Students demonstrate their abilities to discuss pros and cons of various experimental concepts in relation to predefined scientific problems; to understand general statistical concepts; to understand concrete statistical problems; to develop proper approaches for solving predefined statistical problems; to analyze given data
using the computer software R and suitable descriptive as well as inferential statistical approaches; to evaluate the obtained statistical output in a correct manner; to communicate statistical information in comprehensible fashion using proper terminology. Students may use a sheet of paper with personal notes as auxiliary means (1 sheet of paper, max. page size DIN A4, double sided).

Wiederholungsmöglichkeit:
Folgesemester

(Empfohlene) Voraussetzungen:
Basics in statistics

Inhalt:
Design of experiments: principles, randomization, statistical power and sample sizes, completely randomized designs, block designs, factorial designs; Analysis of variance: prerequisites, analysis of residuals, contrasts, posthoc-test,
nonparametric alternatives, bootstrapping; Correlations: Pearson, Spearman, Kendall, partial correlation; Linear Regression

Lernergebnisse:
Upon successful completion of the module, students are able to understand pros and cons of various experimental concepts, to apply suitable experimental designs in accordance to predefined scientific problems, to analyze respective experimental data using suitable statistical methods and the software R, and to evaluate the obtained statistical output in a correct manner.

Lehr- und Lernmethoden:
Lecture, group work, discussions, exercises, examples, demonstrations, computer hands-on training, student presentations, homework, students' self-dependent study of relevant literature

Medienform:
The following media will be used as and when required:
Reader, (white)board, exercise sheets, PowerPoint, moodle online course

Literatur:
Collins C & Seeney F (1999): Statistical Experiment Design and Interpretation. Chichester etc. : Wiley
Crawley MJ (2005): Statistics - An Introduction using R. West Sussex : Wiley
Crawley MJ (2007): The R Book. West Sussex : Wiley
Field A & Hole G (2003): How to Design and Report Experiments. Los Angeles etc. : Sage
Field A, Miles J & Field Z (2012): Discovering Statistics using R. Los Angeles etc. : Sage
Hatzinger R, Hornik K & Nagel H (2011): R - Einführung durch angewandte Statistik. München etc. : Pearson Studium
Hinkelmann K & Kempthorne O (2008): Design and Analysis of Experiments. Volume 1 - Introduction to Experimental Design.
2nd ed. New York etc. : Wiley
Kirk RE (2013): Experimental Design. 4th ed. Thousand Oaks etc. : Sage
Rasch D, Pilz J, Verdooren R, Gebhardt A (2011): Optimal Experimental Design with R. Boca Raton etc. : CRC Press
Ryan TP (2007): Modern Experimental Design. New Jersey : Wiley
Ugarte MD et al. (2009): Probability and Statistics with R. Boca Raton : CRC Press

Modulverantwortliche(r):
Kurt Gedrich
KGedrich@tum.de

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Design and Analysis of Experiments (Übung, 2 SWS)
Gedrich K [L], Gedrich K

Introduction to R (Übung, 1 SWS)
Gedrich K [L], Gedrich K

Design and Analysis of Experiments (Vorlesung, 2 SWS)
Gedrich K [L], Gedrich K

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

Technische Universität München

Modulbeschreibung

WZ3214: Experimental Immunology and Pathology (Experimental Immunology and Pathology)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Wintersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	75	75

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
Students have to hand in 6 lab reports (appx. 20 pages) covering the topics presented in the lab course including mouse dissection, histopathology, genotyping, immune phenotyping, gene expression analysis and microbiological analysis. The students demonstrate with the reports that they have gained deeper knowledge and understanding of the specific methodologies, lab equipment and measurement methodologies and can analyse data with the use of appropriate software tool as well as statistics. They show that they are able to complete extensive laboratory tasks, know how to evaluate and interpret data and results and identify possible sources of error.
In the written examination students demonstrate theoretical knowledge on the methodologies used in the lab and underlying medical, biochemical and analytical processes by answering questions without helping material.
The final grade is an averaged grade from the written examinations (8.34 % each/ overall 50%) and from the lab reports (8.34 % each/ overall 50%).

Wiederholungsmöglichkeit:
Folgesemester

(Empfohlene) Voraussetzungen:
Basic knowledge in immunology

Inhalt:
The practical lab course demonstrates the use of an animal model of intestinal inflammation in biomedical research.
Starting with mouse dissection, different techniques and methodologies to analyze disease-associated alterations at
the organ- and cellular level are applied including: histopathology, genotyping, immune phenotyping, gene expression analysis and microbiological analysis.

Lernergebnisse:
Students acquire detailed and differentiated knowledge on the laboratory work with animal models of diseases and are able to assess the possibilities and limits of these techniques. They apply relevant research methodologies and are able to link scientific questions on disease outcomes to research technologies and immunological/ physiological alterations.
Upon completion of the module, students have improved their practical laboratory working and scientific writing skills.

Lehr- und Lernmethoden:
Within the module, students attend short lectures on the background of the methods used in the lab course, prior to

their practical work in the lab. Within the practical lab course the students work in teams of two students. Each part of the internship is supervised individually.

Medienform:

Literatur:

Modulverantwortliche(r):
Dirk Haller
Dirk.haller@tum.de

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Experimental Immunology and Pathology (Übung, 5 SWS)
Bierwirth S, Coleman O, Kießling S, Kisling S, Rath E, Schmöller I, Waldschmitt N

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

Technische Universität München

Modulbeschreibung

WZ3231: Food Design and Food Industry (Food Design and Food Industry)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Wintersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	90	60

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
Student achievement will be tested in a written examination (120 min). The test will be comprised of 56-60 open and/or multiple choice questions. This is the easiest way to see whether students have an understanding/knowledge
of the presented material. Each question will have a pre-assigned number of points (3-6) which can be achieved with the correct answer. With half of the totally achievable points the student will have passed the test. Maximal points will get the grade 1. Scaling in grades of 0.3 from 1-4.3 will be done in steps of 3-4 points.

Wiederholungsmöglichkeit:
Semesterende

(Empfohlene) Voraussetzungen:
Students should have a basic understanding of food chemistry, food legislation and nutrition

Inhalt:
Driving forces for product development are described based on consumer expectations/trends and on essentials for the producer and trade ¿ convenience, cost, taste, appearance, health, ecological impact, etc. The role of the food industry in the society as employer and a factor to ensure food security is described as a link between the farm and the consumer. The impact of the food industry on the ecological food print and methods to reduce. Aspects of sustainability with regard to the food industry. Major players in the food industry (Agribusiness, Branded Product Producers, Trade and Restaurants) their size, structure and strategies.

Lernergebnisse:
At the end of this course the students are able to understand the role and structure of the food industry and working
methods to meet consumer demands for safe, convenient, healthy and affordable food. Students gain a good understanding of the structure of the food industry, specific strategies and the ecological impact of the food supply chain as well as aspects of sustainability in this respect.

Lehr- und Lernmethoden:
Lecturing with examples out of practical experience in food industry

Medienform:
After the lectures students will get all the charts (information) being presented during the course. Additional web links will be given.

Literatur:

Modulverantwortliche(r):
Gerd Harzer
gharzer@me.com

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Food Design (Vorlesung, 1,5 SWS)
Harzer G

Food Industry (Vorlesung, 1,5 SWS)
Harzer G

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

Technische Universität München

Modulbeschreibung

WZ3224: Health Behaviour and Health Promotion (Health Behaviour and Health Promotion)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Wintersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	105	45

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The learning outcome from this module is evaluated based on a seminar paper (approx. 10 pages per student), a seminar presentation (approx. 10 minutes per student plus discussion) and a 30 minute oral group examination.
With the seminar paper and the respective presentation, the students demonstrate that they are able
to understand a given scientific problem related to health behaviour and health promotion;
to use respective scientific literature;
to make use of a variety of behavioural theories when evaluating given strategies in disease prevention and health promotion w.r.t. a specific type of health compromising behaviour (e.g. smoking, diet, sedentary lifestyle);
to develop promising health promotion concepts;
to report their insight in a concise and well-comprehensible manner.
In the oral examination students prove their abilities
to remember important theories of health behaviour;
to understand consumers¿ health behaviours;
to evaluate advantages and disadvantages of various health systems.
Overall, students show their ability to discuss scientific matters of health behaviour and health promotion using proper terminology in oral as well as in written form. The final grade is an averaged from the seminar contributions (paper and presentation, 20% each) and the oral examination (60 %).

Wiederholungsmöglichkeit:
Folgesemester

(Empfohlene) Voraussetzungen:
Students may benefit from basic insights into Economics and Public Health

Inhalt:
Health behaviour from the perspective of Health Psychology: Models of health, health behaviour and health education;
Health behaviour from the perspective of Behavioural Economics: Prospect Theory;
Economics of Health and Health Care: stakeholders in health care systems, measures of cost containment, quality of health services;
Health Promotion: exemplary evaluation of strategies in disease prevention and health promotion.

Lernergebnisse:
Upon successful completion of the module, students are able
to remember the most important theories of health behaviour;
to understand consumers¿ health behaviours;
to evaluate pros and cons of various health care systems;
to evaluate given strategies and programes of health promotion;

and to create promising health promotion concepts.

Lehr- und Lernmethoden:
Lecture, group work, discussions, examples, demonstrations, student presentations, homework, students' selfdependent
study of relevant literature

Medienform:
The following media will be used as and when required:
Reader, (white)board, PowerPoint, moodle online course, videos

Literatur:
Antonovsky A (1996): The salutogenic model as a theory to guide health promotion. Health Promotion International : 11(1), 11-18
Bartholomew LK et al. (2006): Planning Health Promotion Programs. 2nd ed. Jossey-Bass
Folland S, Goodman AC, Stano M (2001): Economics of Health and Health Care. 3rd ed. Prentice-Hall
Gedrich K (2003): Determinants of nutritional behaviour ¿ a multitudes of levers for successful intervention? Appetite 41, p. 231-8
Kahneman D & Tversky A (1979): Prospect theory: An analysis of decision under risk. Econometrica 47/2, 263-291
van Lange PAM, Kruglanski AW & Higgins ET (Eds.) (2012): Handbook of Theories of Social Psychology. Vol. 1. Sage
Naidoo J, Wills J (2009): Foundations Health Promotion : Foundations for Practice. 3rd ed. Baillière Tindall (Elsevier)
Taylor SE (2003): Health Psychology. 5th ed. McGraw-Hill
Tversky A & Kahneman D (1981): The framing of decisions and the psychology of choice. Science 211, 453-458
Tversky A & Kahneman D (1986): Rational choice and the framing of decisions. The Journal of Business 59, 251-278

Modulverantwortliche(r):
Kurt Gedrich
KGedrich@tum.de

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Health Behaviour (Vorlesung, 2 SWS)
Gedrich K [L], Gedrich K

Health Promotion (Seminar, 1 SWS)
Gedrich K [L], Gedrich K, Madenach M

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

Technische Universität München

Modulbeschreibung

WZ3230: Mitochondrial Biology (Mitochondrial Biology)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Sommersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	90	60

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The students will demonstrate their acquired knowledge on mitochondrial biology during a graded, oral examination of 20 minutes. The ability of the student will be examined (1) to describe the underlying concepts of mitochondrial functional units as covered by the course, (2) to apply this knowledge in a novel context, e.g. to explain a primary dataset or the consequences of a disease mutation and (3) to integrate knowledge into recent scientific advance as covered by the seminar.

Wiederholungsmöglichkeit:

(Empfohlene) Voraussetzungen:
Basics in Nutrition and Food, Energy Balance Regulation

Inhalt:
The course covers the entire spectrum of mitochondrial involvement in cellular homeostasis and metabolism. This includes oxidative phosphorylation, membrane potential, thermogenesis, anaplerotic reactions, apoptosis, calcium homeostasis, reactive oxygen species, mtDNA and mitochondrial
transcription/translation, mtDNA mutations in disease and the phylogeny of human origin, evolution and the endosymbiotic theory, fusion and fission, protein import, solute transport, mito-ER association and iron/heme metabolism.

Lernergebnisse:
The students will have broadened their understanding of mitochondria from mere ATP producers to their complex role as integrative hubs in multiple metabolic and signaling pathways. They will be familiar with the state of the art and thus be able to participate in ongoing research projects studying mitochondrial function with little further training
on scientific background or typically employed technology. Due to the integrative nature of mitochondrial function within a plethora of other pathways, students will have acquired the ability to place seemingly self-contained knowledge fields into a greater cellular context. Students will be able to understand and integrate recent and future literature into this complete framework of mitochondrial function.

Lehr- und Lernmethoden:
Basic knowledge will be provided in the form of lectures (2 SWS). The corresponding seminar (2 SWS) will allow students to both practice their presentation skills of original literature and convey highlights of current research in the above fields.

Medienform:
presentation slides, whiteboard

Literatur:
`Bioenergetics 4¿ by David Nicholls, ISBN: 9780123884251
`Mitochondria¿ by Immo Scheffler, ISBN: 0471194220

Modulverantwortliche(r):
Tobias Fromme
fromme@tum.de

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Mitochondrial Biology (Seminar, 2 SWS)
Fromme T

Mitochondrial Biology (Vorlesung, 2 SWS)
Klingenspor M [L], Fromme T

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

Technische Universität München

Modulbeschreibung

WZ3203: Nutrition in Life Stages (Nutrition in Life Stages)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Sommersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	105	45

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The learning assessment will be controlled by a written exam of 120 minutes duration. Use of a calculator is allowed. The answers have to be written in own phrases. To assess active knowledge, there will be no multiplechoice
questions. In the written exam, students demonstrate their ability to remember aspects of nutrition in different life stages and of diseases, which are nutrition related or in which nutrition plays an important therapeutic role. Students should show that they understand the functional interrelation of the components of nutrition and that they are able to transfer their knowledge to exemplary pathologies. The result of the written exam will be the final grade of the module.

Wiederholungsmöglichkeit:
Folgesemester

(Empfohlene) Voraussetzungen:
Basic knowledge of human physiology, macronutrients and micronutrients as well as of analyzing and evaluating the current literature.

Inhalt:
The lecture series Nutrition in Life Stages covers nutritional aspects specific for different life stages. Focal points are
prenatal nutrition during the embryonal and fetal stage as well as nutrition of babies and infants, of adolescents, of adults and of the elderly. It includes as topics prenatal programming, breastfeeding, formula feeding, introduction of complementary food, food allergies and intolerances, water balance in different life stages in health and disease, malnutrition, aging, and sarcopenia and obesity in the elderly.

Lernergebnisse:
The students understand the specific nutritional problems and requirements in different phases of life including specific pathophysiological knowledge of common disease entities of the different age stages. They are also able to
analyze and evaluate the relevant literature on these topics.
After completion of the module, the students know and understand the different nutritional deficiencies and environmental influences which lead to prenatal damage of the fetus. The students understand the consequences of
these prenatal influences on health later in life. The students will also be able to understand the major consequences of breastfeeding and formula feeding for the babies, the mothers and the health care system and to realize the limitations of knowledge on this topic. The students will know the major preferences of eating behavior in
childhood and how this behavior can be influenced in practice. They will also know the causes and mechanisms of

water imbalance and food intolerances and how these conditions can be diagnosed and treated.

Lehr- und Lernmethoden:
Lecture with transfer of knowledge and critical discussion of the presented topics with the students during the lesson. The lecture is given with a teacher-centered approach (PowerPoint presentation).

Medienform:
PowerPoint presentation and discussion of the content with the students during the lectures.

Literatur:
Research articles and reviews presented and discussed in the lectures.

Modulverantwortliche(r):
Heiko Witt
heiko.witt@tum.de

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Lecture
Nutrition in Life Stages
3 SWS
Heiko Witt
heiko.witt@tum.de

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

Technische Universität München

Modulbeschreibung

WZ3240: Research Internship (4 Weeks) (Research Internship (4 Weeks))

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5			

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:

Wiederholungsmöglichkeit:

(Empfohlene) Voraussetzungen:

Inhalt:

Lernergebnisse:

Lehr- und Lernmethoden:

Medienform:

Literatur:

Modulverantwortliche(r):

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

Technische Universität München

Modulbeschreibung

WZ1676: Sustainable Land Use and Nutrition (Sustainable Land Use and Nutrition)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Sommersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	90	60

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
During the participation in the mandatory workshop (usually Friday + Saturday), students give talks on given topics (10 min per student plus 5 min discussion und questions per student). Here the students demonstrate that they have gained deeper knowledge of a given topic by using literature and are able to present their knowledge and discuss it. In the written examination (90 min) at the end of the semester students demonstrate the theoretical knowledge of the various perspectives of sustainable land use and nutrition by answering questions under time pressure and without helping material.
The final grade is a combined grade from the written examination (50 %) and from the student's talk (50 %).

Wiederholungsmöglichkeit:

(Empfohlene) Voraussetzungen:

Inhalt:
The module provides an overview on the various perspectives of sustainable land use and nutrition. An introduction establishes the structure of the module, which follows a supply chain: 1) The production of commodities addresses: Availability of soil resources; ecology and history of landscapes; terrestrial ecology; horticultural products for sustainable nutrition; integrative land-use concepts; production technology. 2) The distribution of commodities (transport, storage) is analyzed under the aspects of resource economics. 3) Sustainability of processing. 4) The distribution through trade and services is focused by sustainable marketing concepts. 5) Finally, consumer affairs are addressed by health aspects in the context of global nutrition; food safety; new designed food.

Lernergebnisse:
The students know about the great variety of sustainability aspects in land use and nutrition. They understand the preconditions to understand the complexity and interconnectedness of multiple sectors. Students are able to analyze sustainability concepts and to transfer them to new problems. During the learning process it will become clear that only a comprehensive perspective will lead to sustainable concepts for land use and nutrition.

Lehr- und Lernmethoden:
Lecture, discussion, students¿ talks

Medienform:
Media
PowerPoint, research literature on moodle, Handouts

Literatur:
Each lecturer provides a list of articles regarding his/her topic on moodle and also during the lecture itselfl

Modulverantwortliche(r):
Knoke, Thomas; Prof. Dr. rer. silv.

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Sustainable Land Use and Nutrition (Vorlesung, 4 SWS)
Luksch C [L], Abate Kassa G, Albrecht H, Eisner P, Gräff A, Hauner J, Jekle M, Knoke T, Langowski H, Roosen J, Schad P, Windisch W, Zytynska S

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

Technische Universität München

Modulbeschreibung

WZ3055: Transgenic and Stem Cell Biotechnology (Transgenic and Stem Cell Biotechnology)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Deutsch	Einsemestrig	Wintersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	150	0

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:

Wiederholungsmöglichkeit:

(Empfohlene) Voraussetzungen:

Inhalt:

Lernergebnisse:

Lehr- und Lernmethoden:

Medienform:

Literatur:

Modulverantwortliche(r):

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Transgenic and Stem Cell Biotechnology (Vorlesung, 2 SWS)
Schnieke A, Flisikowska T, Fischer K

Transgenic and Stem Cell Biotechnology (Seminar, 2 SWS)
Schnieke A, Flisikowska T, Rieblinger B

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

Technische Universität München

Modulbeschreibung

WZ3239: The Theoretical and Practical Basics of Systemic Energy Balance Regulation (The Theoretical and Practical Basics of Systemic Energy Balance Regulation)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Wintersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
5	150	90	60

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
Oral exam: 20 min.

Wiederholungsmöglichkeit:
Semesterende

(Empfohlene) Voraussetzungen:
participation in the lecture "Energy Balance Regulation" from the 1st term is recommended

Inhalt:
The course will deepen the theoretical and practical knowledge on how energy metabolism is regulated and measured on the organismal and cellular level. The course starts with a refreshment of the knowledge obtained in the lecture ¿Energy Balance Regulation¿ from the 2nd term. We then in depth discuss the most important theoretical
and practical basics of energy balance regulation. This includes in depth discussion on relevant central and peripheral pathways and signal mechanisms implicated in systemic energy balance regulation as well as the principles of measuring relevant endpoints in rodent studies, such as e.g. indirect and direct calorimetry, pairfeeding
studies and in vivo measurement of glucose metabolism and insulin sensitivity.

Lernergebnisse:
At the end of the course, the students can explain the most common signal mechanisms underlying the regulation of
energy metabolism and the respective hormones regulating food intake and energy expenditure. Furthermore, the students can explain the most common theoretical and practical basics of how systems metabolism is measured including what the pros and cons of the different techniques are.

Lehr- und Lernmethoden:
teaching methods: lecture (2 SWS), seminar (2 SWS):
The lecture (2SWS) is best described as interactive frontal treaching, meaning that state-of-the art scientific context
is presented by the lecturer and is then discussed in the audience. Each lecture starts with a summary of the last leture, giving students the possibility to ask questions and to discuss topics between lectures and topics. It is key that the students prepare the lectures independently to best inspire interactive communication.
The seminar (2SWS) is organized in that the students prepare and present a research manuscript on a topic choosen by the teacher. The content of the manuscript is then reviewed by the student presenting, followed by in

depth discussion in the group. It is key to understand and reflect not only the key scientific message of the manuscripts, but also to critically assess the pitfalls and limitations of the studies presented. The overall goal of the seminar is tio sharpen the view of the investigator to read and to understand top class scientific manuscripts and to present in front of a class.
learning methods: literature search, preparation and holding of presentations, open discussions in small groups

Medienform:
PowerPoint, Flipchart

Literatur:

Modulverantwortliche(r):
Timo Müller
timo.mueller@helmholtz-muenchen.de

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Lecture
The theoretical and practical basics of systemic energy balance regulation
2 SWS

Seminar
The theoretical and practical basics of systemic energy balance regulation
2 SWS
Timo Müller
timo.mueller@helmholtz-muenchen.de

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

Technische Universität München

Wahlmodule auf Antrag (Accredited Elective Modules)

Technische Universität München

Master's Thesis (Master's Thesis)

Technische Universität München

Modulbeschreibung
WZ3212: Master's Thesis

Studienfakultät für Ernährungswissenschaft

Modulniveau:	Sprache:	Semesterdauer:	Häufigkeit:
Master	Englisch	Einsemestrig	Wintersemester/Sommersemester
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**
30	900	750	150

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:
The student actively participates in the examination colloquium. She/he writes a master thesis (50-70 pages), which
must be submitted within 6 months after start of the THESIS module. The master thesis is graded by the supervisor,
taking into account in equal parts theoretical and hands-on practical skills as well as quality of the written thesis.

Wiederholungsmöglichkeit:

(Empfohlene) Voraussetzungen:
Work on the master¿s thesis should commence after successful completion of all module examinations.

Inhalt:
Research conducted by the institutions hosting our master students deal with nutrition-related science in different life science disciplines, including for example biochemistry, molecular biology, nutrition physiology, metabolism, microbiology, food chemistry, nutrition medicine, genetics, clinical studies and epidemiology. Within this framework, the supervisor assigns the student to a selected aspect of ongoing research in the host institution.

Lernergebnisse:
After successful completion, the theoretical and practical training received in the THESIS module enables our students to investigate defined scientific questions on their own, with support from an experienced supervisor. Exposed to a scientific question, they can analyze and evaluate state-of-the art knowledge, identify possible solutions and answers, and subsequently plan and conduct experiments / studies addressing the scientific question with appropriate research methods and techniques. The students know the most important facts and theories related to their research topic and can critically discuss and evaluate their own results in relation to the state-of-theart
knowledge. In conducting their art of science they follow the rules of good scientific practice.

Lehr- und Lernmethoden:
Theoretical and practical training by a scientific supervisor of the host institution. The master student is guided in comprehensive analyses and study of the available literature related to the research topic, establishment of a work plan, experimental design, acquirement of hands-on skills in specific methodology and techniques, documentation and evaluation of data, scientific writing, description and critical discussion of results in relation to work published in the field. At start, the student and the scientific supervisor jointly develop the work plan of the master thesis and define goals achievable within the given timeframe of six months. In the course of the master thesis, pending results, the student and the supervisor mutually agree to adjust this work plan, accordingly. Students actively

participate in the examination colloquium, which takes place in regular intervals and can be offered in different formats (seminar, lab meeting, individual discussions), following the conditions at different institutions. In the colloquium, students get together with scientists at different levels of qualification to present progress reports and discuss with their peers and supervisors. In this forum, students train to talk about their research project, explain the
question and goals, discuss experimental plans, present results and problems, and elaborate on the outline and writing of their thesis.

Medienform:

Literatur:

Modulverantwortliche(r):
Martin Klingenspor
mk@tum.de

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):
Practical Course
Master thesis
8 SWS

Seminar/Examination Colloquium
Progress reports
2 SWS
Lecturers approved by the examination committee of the Study Program Division Nutrition.

Für weitere Informationen zum Modul und seiner Zuordnung zum Curriculum klicken Sie bitte campus.tum.de oder hier.

Technische Universität München

Nachweis Deutschkenntnisse (Requirement Proof of Proficiency in German)

Technische Universität München

Modulbeschreibung

WZ8000: Anerkennung Nachweis Deutschkenntnisse (Accredited Requirement Proof of Proficiency in German)

Studienfakultät für Ernährungswissenschaft

Modulniveau:	**Sprache:**	**Semesterdauer:**	**Häufigkeit:**
Credits:*	**Gesamtstunden:**	**Eigenstudiumsstunden:**	**Präsenzstunden:**

* Die Zahl der Credits kann in Einzelfällen studiengangsspezifisch variieren. Es gilt der im Transcript of Records oder Leistungsnachweis ausgewiesene Wert.

Beschreibung der Studien-/ Prüfungsleistungen:

Wiederholungsmöglichkeit:

(Empfohlene) Voraussetzungen:

Inhalt:

Lernergebnisse:

Lehr- und Lernmethoden:

Medienform:

Literatur:

Modulverantwortliche(r):

Lehrveranstaltungen (Lehrform, SWS) Dozent(in):

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Technische Universität München

Verzeichnis Modulbeschreibungen