Bachelor Biomedical Sciences
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Major

**Competence Biomedical Expert**

Fac. Health, Medicine and Life Sciences

**The LEGO Bricks of Life**

**Full course description**

This course focuses on the question how biomolecules impact biology as a whole, up to the level of populations and processes as complex as evolution. The course starts with the study of the structures and functions of major biomolecules (nucleic acids, proteins, fats and sugars), and how these form the building bricks for organelles, cells, organs, and organisms. Special emphasis is placed on natural changes in DNA sequences that subsequently alter protein structure and function, and thereby affect the proper function of cells, organs, organisms and populations.

**Course objectives**

**Intended Learning Outcomes (ILOs)**

- ILO1 Define different forms of life
- ILO2 Explain evolutionary mechanisms of random events and selection pressure and their effects on protein evolution
- ILO3 Describe the macromolecules of life (nucleic acid, proteins, fats and sugars) and explain how their structure relates to their function
- ILO4 Explain how organelles (Golgi apparatus, mitochondria) contribute to cell homeostasis (structure-function relationships)
- ILO5 Demonstrate why the effects of random events may have a bigger impact in a bacterium than in a eukaryotic cell
- ILO6 Explain cellular communication and its role in the specialization of cells – a prerequisite for tissue formation
- ILO7 Explain how tissues form organs with specific function

BBS1001
Period 1
4 Sep 2017
27 Oct 2017
Print course description
ECTS credits:
7.0
Instruction language:
English
Coordinator:
Bachelor Biomedical Sciences
  • R.W.L. Godschalk

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), Paper(s), PBL, Research, Skills, Presentation(s)

Assessment methods:
Assignment, Attendance, Final paper, Participation, Portfolio, Written exam

Keywords:
macromolecules cell structure and function basic genetics basic molecular biology evolution inheritance

Fac. Health, Medicine and Life Sciences

Practicals The LEGO Bricks of Life

Full course description

This course will have 4 practical trainings:

1. Good laboratory practice (GLP)
   Part 1: Safety regulations, environmental safety and standard materials in a lab (glassware, balance, pipets etc.). This part will include instructions about how to use standard lab materials.
   Part 2: Students learn how to use various lab materials in more detail. This part will contain an interim test: Making your own calibration curve by spectrophotometry and Excel. Students have to show their ability to make a calibration curve. The slope of regression line and variation between duplicates will be checked. If students have values that are >10% deviant from the expected value, they will have to make a new calibration curve (immediate feedback). In this practical, simple bioinformatics will be included by the use of Excel. How to prepare a calibration curve in Excel will be introduced during this practical training.

2. Effect of pH on enzyme activity.
   Different buffers will be used to perform the test at various pH-conditions. The pH and preparation of these buffers will also be discussed and calculated as additional task in case 4 of course bbs1001. The calibration curve was already produced in practical 1, part 2.

3. Virtual microscopy
   An introduction is provided how to fulfil the tasks in virtual microscopy training. This training deals with general histology, which shows how various cell types build organs.

4. Introduction to the dissection Hall
   In the coming courses, human anatomy will be studied on real human bodies/ preparations. Students need to be introduced properly before they are allowed to join practical trainings in the dissection hall of Maastricht University.

Course objectives

You will have to prepare for all practicals. Your preparation will be checked, and you are only allowed to start the practical if your preparation is considered sufficient. All practical trainings will be evaluated by inspection of the lab-journal and specific questions in the final exam.

BBS1101
Period 1
4 Sep 2017
Bachelor Biomedical Sciences

27 Oct 2017

Print course description

ECTS credits:
0.0

Instruction language:
English

Coordinator:
- R.W.L. Godschalk

Teaching methods:
Assignment(s), Lecture(s), Skills

Assessment methods:
Assignment, Attendance, Participation

Keywords:
Basic laboratory skills Good laboratory Practice Laboratory Safety guidelines spectrophotometry

Fac. Health, Medicine and Life Sciences

Homeostasis and Organ Systems

Full course description

knowledge and understanding of normal physiology of the organ systems and regulatory mechanisms will be used to go into more depth with disturbances of homeostasis. The groups will propose a RQ on a (selected) disturbance of homeostasis and design a computer-simulated experiment to test this hypothesis. Findings will be presented within the tutorial group setting. In this course, the role of several major organ systems in the maintenance of homeostasis will be studied. The focus will be on the blood circulation, the gastro-intestinal system, the pulmonary and cardiovascular system and the urinary and renal system in the filtration, reabsorption, secretion and excretion of electrolytes and water and maintenance of the acid-base balance. The interaction and communication between these organs systems will also be studied. The practical trainings will further guide understanding of normal structure and function of the organ systems, and are tailored to the learning objectives discussed in the tutorial groups. There are two practical trainings: spirometry and blood pressure measurements, and creatinine clearance measurement. In addition there will be anatomy and virtual microscopy sessions for the main organ systems, insights from these sessions will be used in the tutorials. Students will further work on academic writing skills, where the main aim of the assignment is: To write an introduction that leads to a research question (RQ) and define the required experimental aims to address this RQ. The tutorial groups will be planned in the first six weeks of the course. In the last two weeks of the course, students will work in small groups on the Academic project, in which the

Course objectives

- B-ILO1: Describes the nutrients of life and how they enter the system
- B-ILO2: Describes the role of the circulation in transporting nutrients to the various organs and explain the various transport mechanism
- B-ILO3: Explains how the structure of the cardiovascular and pulmonary systems enable and regulate gas exchange
- B-ILO4: Explains how the Bauplan of the gastro-intestinal tract facilitates passing of food through the body and to its accessory organs
Bachelor Biomedical Sciences

- B-ILO5: Explains the role of the urinary and renal system in excretion and reabsorption of water and in maintaining the acid base balance and regulating blood pressure
- B-ILO6: Describes how communication between organ systems ensures homeostasis of the organisms

- C-ILO1: Adjusts communication written or oral, to specific global audience/readership and international setting
- C-ILO2: Communicates professionally with peers and staff originating from diverse cultural and disciplinary backgrounds
- C-ILO3: Shows awareness of team roles and takes responsibly her/his position in a diversely composed international team
- C-ILO4: Works effectively in an international and intercultural team

- I-ILO1: Summarizes and reflects on social, political, international and normative issues in the biomedical science
- I-ILO2: Understands the values of and is able to apply scientific method to obtain academic knowledge, understanding and insight
- I-ILO3: Has developed a critical approach to scientific knowledge
- I-ILO4: Designs and rationalizes an biomedical experiment

- P-ILO1: Summarizes and reflects on social, political, international and normative issues in the biomedical science
- P-ILO2: Understands the values of and is able to apply scientific method to obtain academic knowledge, understanding and insight
- P-ILO3: Has developed a critical approach to scientific knowledge
- P-ILO4: Designs and rationalizes an biomedical experiment

BBS1002
Period 2
30 Oct 2017
22 Dec 2017
Print course description
ECTS credits: 7.0
Instruction language: English
Coordinator: F.R.M. Stassen

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentation(s), Skills, Training(s)

Assessment methods:
Attendance, Computer test, Portfolio, Presentation, Written exam
Fac. Health, Medicine and Life Sciences

Practicals Homeostasis and Organ Systems

BBS1102
Period 2
30 Oct 2017
22 Dec 2017
Brain, Behavior and Movement

Full course description

This unit will be dedicated to the capacity of animals to interpret, act and move within the environment they live in. Being able to integrate incoming information and to react to it properly, e.g. by changing its position, is an essential and distinctive feature of animal life. For humans, the capacity to filter incoming information, reasoning and responding adequately to environmental variation, and having the ability to move are all major aspects of being, whereas a disturbance at any of these levels is an important reason for psychological and/or medical intervention. As such, adequate movement requires sensing, coordination, action generation and monitoring of the result of the action. This course will address all these features in order to understand and to be able to intervene in human cognitive and affective functioning as well as in movement capacity.

Course objectives

- B-ILO1004.1. Relate body functions to the outline of the nervous system
- B-ILO1004.2. Describe how humans sense and control their position and movement in the environment
- B-ILO1004.3. Describe the control of goal-directed behavior
- B-ILO1004.4. Explain how neurotransmitters and hormones facilitate neuronal and neuromuscular communication
- B-ILO1004.5. Explain how variation in neural activation affects muscle forces
- B-ILO1004.6. Compute the force generated by a muscle-tendon complex given its morphology and its actual state
- B-ILO1004.7. Relate the function of a muscle to its position in a musculoskeletal system
- B-ILO1004.8. Explain the molecular, cellular and structural mechanisms underlying learning and memory formation
- B-ILO1004.9. Explain how the brain and body deals with exposure to acute and chronic stress and how this relates to fear and anxiety.

Recommended reading

Bachelor Biomedical Sciences


BBS1004
Period 4
5 Feb 2018
6 Apr 2018
Print course description
ECTS credits:
7.0
Instruction language:
English
Coordinator:

- **D.L.A. van den Hove**

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations, Skills
Assessment methods:
Attendance, Final paper, Participation, Portfolio, Presentation, Written exam
Keywords:
Neuroanatomy, Sensory systems, Movement, Muscles, Postural control, Neuromechanics, Behavior, cognition, affect
Fac. Health, Medicine and Life Sciences

**Practicals Brain, Behavior and Movement**

BBS1104
Period 4
5 Feb 2018
6 Apr 2018
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinator:

- **D.L.A. van den Hove**

Fac. Health, Medicine and Life Sciences

**Human Genetics, Reproduction and Prenatal Development**

Full course description

We will follow three lines which will be linked to each other:
Bachelor Biomedical Sciences

3. Ethical questions/problems around human reproduction and genetics.

We will start studying the first differentiation steps from gametogenesis via fertilization to the very early embryonic development. This will be linked to the general concept of cell cycle regulation, cellular differentiation and types of mutations which may accompany these processes. The students will learn about the general body plan (segmentation, symmetry, body axes, development of the extremities) and the development of different organ systems (e.g. digestive system, genital system, heart, nervous system). Thereby concepts of cell-cell signalling, receptor ligand interaction, influence of hormones as mechanisms included in development will be discussed. In addition apoptosis as a mechanism included in forming of the body will be shown.

Students will be able to explain several disruptions during development and morphogenesis leading to congenital pathologies and disturbances in function. In practical trainings students will compare the “normal” human anatomy to (pathological) variations originating from aberrant human development.

In addition basic epigenetic mechanism will be shown and their implication in human development will be analysed. Existing parallels between embryonic development and cancer development during adult life will be shown exemplarily.

Chances, risks and ethical questions around human reproduction and development as in-vitro-fertilization, embryo selection, prenatal screening and increasing availability of genetic data will be discussed. In this context students will learn about the possibilities to detect and treat a monogenic disease and will be able to train the lab techniques necessary. Actual knowledge on epigenetic mechanisms leads to a broader idea of heredity transmission. Students will be made aware of the resulting inter-generational responsibility in the course of the SoPhia academic project.

Course objectives

- Describe how human reproduction works at the level of organ structure, function and regulation
- Describe prenatal human development from fertilisation to organogenesis
- Describe molecular mechanisms that govern proliferation and differentiation
- Explain the levels at which expression of genetic information works
- Produce a functioning expression construct by applying bioinformatics, recombinant DNA and biochemical technology

Recommended reading

Practicals Human Genetics, Reproduction

Full course description

Practical 1: Anatomy - Blastocyst development/Implantation/Early development
Students will learn about the development during week 1-4 of embryonic development. They will study how to judge the adequate development during fetal and embryonic period.

Practical 2: Anatomy - Body Plan + Gut
Students will study general aspects of the body plan and will have a special look on the macroscopy of the gut system.

Practical 3: Anatomy - Sexual differentiation - virtual microscopy
Development of the gonads and differentiation of germ cells will be studied.

Practical 4: Anatomy sexual organs + Heart development
Students will study the topography of the sexual organs and the heart in focusing on developmental aspects.

Lab practical 1: DNA isolation from buccal cells - Preparation buffers lab training 2 + 3.
DNA Isolation from their own buccal cells. DNA Concentration analysis (data used for a short Excel/SPSS task, buffer preparation

Lab practical 2: Analyzing the DNA concentration + PCR
Students will measure the DNA concentration of a given DNA and perform a PCR to amplify a sequence which may include a genetic variance

Lab practical 3: Restriction enzyme digestion, Gel electrophoresis (visualization of products)
Students will make a restriction analysis to find out if their DNA is mutated

Practical 5  Computer - How to find and interpret online Epigenetics information
Students will be guided in finding epigenetic information and will have the time to try for themselves to do so.

**Recommended reading**


BBS1105
Period 5
9 Apr 2018
8 Jun 2018
[Print course description](#)
ECTS credits:
0.0
Instruction language:
English
Coordinator:
- **U. von Rango - Hilmes**

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Skills, Training(s)
Assessment methods:
Final paper, Written exam
Keywords:
early human development organogenesis virtual microscopy gross anatomy lab techniques - analysis of the genetic code find online information on the genetic code
Fac. Health, Medicine and Life Sciences

**Threats and Defence Mechanisms**

BBS2001
Period 1
4 Sep 2017
27 Oct 2017
[Print course description](#)
ECTS credits:
6.0
Instruction language:
Bachelor Biomedical Sciences

English

Coordinators:

- A.T. den Boer
- M.M.P.C. Donners

Fac. Health, Medicine and Life Sciences

**Practicals Threats and Defence Mechanisms**

BBS2101
Period 1
4 Sep 2017
27 Oct 2017

Print course description

ECTS credits:
0.0

Instruction language:
English

Coordinator:

- A.T. den Boer

Fac. Health, Medicine and Life Sciences

**From Cradle to Grave: Development, Ageing and Disease**

Full course description

This course is dedicated to post-natal development, ageing and development of (age related) disease. Aspects of the respiratory/circulatory, urogenital and musculoskeletal systems, as well as sexual development, motor development and brain maturation and cognitive development will be explained at the molecular, cellular and functional level. At the other side of the spectrum of 'living', human ageing and the associated functional decline of various systems will be illustrated. In addition, during the course risk factors (genetic, lifestyle, environment) that affect development, ageing and (ageing related) disease will be discussed. The SoPhiA longitudinal track focuses on normative aspects of prevention of (later onset) disease, which are linked to the content of the course.

Course objectives

Describe post-natal developmentB-ILO2002.1

- Describe physical growth (including sexual maturation, muscle and bone)
- Describe brain development (cellular/structural and functional)
- Describe the post-natal development of the organ systems (i.e., heart/circulatory system, lungs, kidneys, liver, GI tract)
- Describe the development of the Immune system (i.e., bone marrow, thymus, lymphatic, gut)

B-ILO2002.2 Describe the ageing process, explain its underlying biological mechanisms and functional consequences
Bachelor Biomedical Sciences

- Describe the evolutionary theories of ageing and use them to explain the ageing process
- Describe maintenance and repair mechanisms and explain how homeostasis changes with ageing
- Describe the hallmarks of ageing (molecular and cellular) and use them to explain the ageing process
- Explain the functional consequences of ageing with respect to muscle and bone, brain, organ systems and immune system

B-ILO2002.3 Describe the pathogenesis and explain risk factors of specific age related diseases

- Explain the interplay between stem cells, stress, ageing and disease such as cancer.
- Describe age related diseases (such as neurodegenerative disease, cardiovascular disease, musculoskeletal decline) and explain the relationship with the hallmarks of ageing.
- Explain risk factors of specific age related diseases
- Explain potential interventions to support healthy ageing

B-ILO2002.4 Explain the effect of genetics, lifestyle and environmental factors in post-natal development, the ageing process and the pathogenesis of age related diseases

Recommended reading

Books; EleUM; papers; other resources

BBS2002
Period 2
30 Oct 2017
22 Dec 2017
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinators:
  - M.A. Dentener
  - A.H.N. Hopman

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations, Skills, Training(s)
Assessment methods:
Assignment, Attendance, Final paper, Participation, Presentation, Written exam
Fac. Health, Medicine and Life Sciences

Practicals From Cradle to Grave: Development, Ageing and Disease

Full course description

This course is dedicated to post-natal development, ageing and development of (age related) disease.
Aspects of the respiratory/circulatory, urogenital and musculoskeletal systems, as well as sexual development, motor development and brain maturation and cognitive development will be explained at the molecular, cellular and functional level. At the other side of the spectrum of ‘living’, human ageing and the associated functional decline of various systems will be illustrated. In addition, during the course risk factors (genetic, lifestyle, environment) that affect development, ageing and (ageing related) disease will be discussed.

During the course 5 practical trainings will be provided which support the subjects discussed in the tutorial meetings. As a part of those practical trainings bioinformatics is given.

1. **Functional test**: comparison of young, adult and elderly people, correlate physical activity with score form (PASE). Perform ANOVA (~statistics)
2. **Virtual microscopy brain development**
3. **Use of data resources** (bio-informatics) Bio-informatics will be applied to learn more about online resources to find out more about genes, proteins, metabolites, and their functions and regulation.
4. **TBARS**: Test effect of dietary antioxidants on lipid peroxidation in liver or brain homogenate in vitro
   1) Design practical protocol
   2) Write a report
   3) Perform ANOVA (~statistics)
   4) Feedback on lab notebook
5. **Visualization of the hallmarks of cancer (e.g. virtual microscopy)**: hyperplasia, dysplasia and stem cells

**Course objectives**

I-ILO4: Designs and rationalizes an biomedical experiment

- Bio-informatics will be applied to learn more about online resources to find out more about genes, proteins, metabolites, and their functions and regulation.
- Results of practical training 1 and practical training 4 will be analyzed using ANOVA
- Protocols, experiment and results concerning Practical trainings 4 will be recorded in the Lab Journal.
Human Intermediary Metabolism

Full course description

The course is organised around four partly overlapping themes.

The digestion, uptake and transport of macronutrients (fats, carbohydrates, and proteins) and dietary fibres from the intestinal tract into the various organs and tissues will be addressed in Theme 1. This includes the enzymatic breakdown of macromolecules in the gastro-intestinal tract and the conversion of dietary fibres into short-chain fatty acids by microbiota in the colon. After uptake, nutrients are transported and taken up by various target organs. The (macro)nutrients also induce the secretion of signalling molecules, which modulate metabolism in another organ. Examples of such crosstalk between organs (e.g. gut-brain, adipose tissue-muscle tissue) will be discussed.

The nutrients serve as a source of energy (Theme 2). Key concepts of energy production in different tissues will, therefore, be addressed. In addition, methods and principles to measure energy metabolism during rest and exercise will be discussed. An important determinant of energy metabolism is body composition. Therefore, attention will be paid to the relationship between fat-free mass and energy expenditure.

Substrate, and intermediary metabolism in general, also depends on other factors like minerals and vitamins (Theme 3). Importance of these (co)-factors will be discussed focussing on the role of B-vitamins in amino acid metabolism.

Finally, inter-individual variation in substrate metabolism exists (Theme 4). It will be highlighted how this variability is related to body composition, sex, race and age. Also, the importance of single-nucleotide polymorphisms will be discussed. In the end, insight will be provided how dietary recommendations are derived for different populations.

Course objectives

- To describe the digestion, uptake and transport of macronutrients and dietary fibres from the intestinal tract into the various organs and tissues
- To explain the cross-talk between the various organs and tissues in human substrate metabolism during the fasted and postprandial phase
- To apply principles of human energy and substrate metabolism during rest and exercise
- To integrate the role vitamins and micronutrients in human substrate metabolism
- To identify causes of inter-individual variation in human substrate metabolism
- To explain the basis for dietary recommendation

Recommended reading

No specific literature will be provided to stimulate students to search their information needed for the tutorials. Students will be encouraged to use basic books.

BBS2041
Period 4
Bachelor Biomedical Sciences

5 Feb 2018
6 Apr 2018

Print course description

ECTS credits:
6.0

Instruction language:
English

Coordinators:
- R.P. Mensink
- Y. Oligschläger

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, PBL, Presentation(s), Research

Assessment methods:
Attendance, Participation, Presentation, Written exam

Keywords:
nutrition, physical activity, metabolism, energy expenditure, inter-individual variation, dietary recommendations

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Practicals Human Intermediary Metabolism

Full course description

Anatomy: Liver and pancreas

For this training, sections from parts of the liver and pancreas will be given. Structure and structure-function relationships are studied on a histological level.

Anatomy: Muscle

For this training, sections from parts of different types of muscles will be given. Structure and structure-function relationships are studied on a histological level.

Body composition

Various methods (measurement of body volume by underwater weighing, skin fold measurements, measurement of bio-impedance, and measurement of body height) will be applied and the theory behind these measurements will be discussed.

Food intake

Students will record on one working day and one weekend day. Food intake will be converted into energy and macronutrient intake. Results of all students will be collected and differences in intake between the working day and weekend day will be statistically examined. Intakes will be compared with official dietary recommendations.

Course objectives

- To describe the digestion, uptake and transport of macronutrients and dietary fibres from the
Bachelor Biomedical Sciences

intestinal tract into the various organs and tissues To explain the cross-talk between the various organs and tissues in human substrate metabolism during the fasted and postprandial phase
- To apply principles of human energy and substrate metabolism during rest and exercise
- To integrate the role vitamins and micronutrients in human substrate metabolism
- To identify causes of inter-individual variation in human substrate metabolism
- To explain the basis for dietary recommendation

BBS2141
Period 4
5 Feb 2018
6 Apr 2018
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinators:
- R.P. Mensink
- Y. Oligschläger

Teaching methods:
Assignment(s), Presentations, Skills
Assessment methods:
Assignment, Attendance, Participation, Presentation
Fac. Health, Medicine and Life Sciences

Cell Signaling

Full course description

B-ILO1 Define different cell-cell communication routes
B-ILO2 Describe the functions of cell-derived signalling molecules
B-ILO3 Explain the three major cellular signalling transduction mediators
B-ILO4 Understand the consequences of alterations in external signalling molecules (nutrients, hormones, xenobiotics)
B-ILO5 Define the integration and dynamics of different cell signalling pathways
B-ILO6 Understand the application of recent biotechnology techniques in cell signalling research
B-ILO7 Relate altered cell signalling to pathological development

Recommended reading

There is no specific literature. Instead, information from text books (recommended: Alberts et al. Molecular Biology of the Cell), PubMed, provided papers via Eleum and reliable internet sources can be used.

BBS2042
Period 4
5 Feb 2018
6 Apr 2018
Bachelor Biomedical Sciences

Print course description

ECTS credits:
6.0

Instruction language:
English

Coordinators:
- J.J. Briedé
- J.W. Renes

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations, Training(s), Working visit(s)

Assessment methods:
Assignment, Attendance, Final paper, Participation, Written exam

Keywords:
Cellular communication routes, Signal transduction, Pathological development, Recent biotechnology techniques

Fac. Health, Medicine and Life Sciences

Practicals Cell Singnaling

Full course description

This course will have 3 practical trainings:

Practical 1: Ah-receptor (connection to B-ILO3)

Students will use in vitro cultured cells and incubate these with an Ah-receptor ligand. Activation of the Ah-receptor will be monitored by a fluorescent read-out of the CYP1A activity. Students are expected to elucidate the signalling pathway between the ligand > Ah-receptor > CYP1A activity. This practical training involves a large data set that should be analysed with proper statistical methods. Students will write a report about this practical training which will be assessed with formative feedback.

Practical 2: Muscle contraction by Ca2+ (connection to B-ILO4)

In this practical training muscle contraction will be studied by exposing isolated muscles to Ca2+. Ca2+ works via membrane-bound receptors. Students are expected to elucidate the Ca2+-induced signalling pathway that leads to muscle contraction.

This course will have 3 practical trainings:

Practical 1: Ah-receptor (connection to B-ILO3)

Students will use in vitro cultured cells and incubate these with an Ah-receptor ligand. Activation of the Ah-receptor will be monitored by a fluorescent read-out of the CYP1A activity. Students are expected to elucidate the signalling pathway between the ligand > Ah-receptor > CYP1A activity. This practical training involves a large data set that should be analysed with proper statistical methods. Students will write a report about this practical training which will be assessed with formative feedback.
Practical 2: Muscle contraction by Ca2+(connection to B-ILO4)

In this practical training muscle contraction will be studied by exposing isolated muscles to Ca2+. Ca2+ works via membrane-bound receptors. Students are expected to elucidate the Ca2+-induced signalling pathway that leads to muscle contraction.

Practical 3: Visualisation and modulation of cell signalling pathways in (patho)physiological conditions (connection to B-ILO 3,4,5)

In this practical training bioinformatics, particularly pathway visualisation, will be applied to monitor cellular signalling pathways. The modulation of single signal transduction routes by different compounds (nutrients, hormones) will be visualized. In addition, integration of different cell signalling pathways will be visualized to gain a better understanding of the complexity of the cell signalling network.

In this practical training bioinformatics, particularly pathway visualisation, will be applied to monitor cellular signalling pathways. The modulation of single signal transduction routes by different compounds (nutrients, hormones) will be visualized. In addition, integration of different cell signalling pathways will be visualized to gain a better understanding of the complexity of the cell signalling network.

Course objectives

B-ILO3 Explain the three major cellular signalling transduction mediators
B-ILO4 Understand the consequences of alterations in external signalling molecules (nutrients, hormones, xenobiotics)
B-ILO5 Define the integration and dynamics of different cell signalling pathways

Recommended reading

There is no specific literature. Instead, information from text books (recommended: Alberts et al. Molecular Biology of the Cell), PubMed, provided papers via Eleum and reliable internet sources can be used.

BBS2142
Period 4
5 Feb 2018
6 Apr 2018
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinators:
- J.J. Briedé
- J.W. Renes

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), Research, Skills
Assessment methods:
Bachelor Biomedical Sciences
Assignment, Attendance, Final paper, Participation, Written exam
Keywords:
Cell culture General lab work Muscle preparation Lab journal Statistical analysis Bioinformatics
Fac. Health, Medicine and Life Sciences

**Biorhythms in Homeostasis**

BBS2051
Period 5
9 Apr 2018
8 Jun 2018
*Print course description*
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- P.A.J. Schrauwen

Fac. Health, Medicine and Life Sciences

**Practical Biorhythms in Homeostasis**

BBS2151
Period 5
9 Apr 2018
8 Jun 2018
*Print course description*
ECTS credits:
0.0
Instruction language:
English
Coordinator:

- P.A.J. Schrauwen

Fac. Health, Medicine and Life Sciences

**Neuromuscular Control of Movement**

BBS2052
Period 5
9 Apr 2018
8 Jun 2018
*Print course description*
ECTS credits:
6.0
Instruction language:
English
Coordinators:
Recent advances in technology and in the analyses of biomolecules (DNA, RNA, proteins and metabolites) allow determining the levels of millions of hits at the same time in specimens. It is now possible to identify in one shot all mutations and chromosomal rearrangements present in one subject or in a patient; to determine the level of expression of the ±20,000 human genes, the hundreds of thousands of proteins and of several biological metabolites including sugars, lipids, hormones, etc. This is the ‘omics’ revolution.

In biomedical science, such ‘omics’ approaches have changed several paradigms, in particular the use of single biomarkers in diagnostics and prognostics is shifting to the use of biomarker signatures, and the integration of different ‘omics’ data. Performing such analyses is only possible today through the aid of bioinformatics and system biology.

In this course, some basic knowledge and tools used in ‘systems biology’ will be taught. Breast cancer will be used as an example throughout the course.

Course objectives

- Understand the added value of systems biology in biomedical research
- Describe how systems biology can help improve healthcare (in terms of better diagnosis, improved prognosis and personalised treatment)
- Use and process the relevant datasets and information sources to solve problems/answer research questions with systems biology approaches
- Select the correct computational methods and tools to answer research questions (of clinical relevance) using systems biology approaches

Recommended reading

3. https://wiki.cancerimagingarchive.net/display/Public/TCGA+Breast+Phenotype+Research+Group
Bachelor Biomedical Sciences
Instruction language:
English
Coordinators:

- A. Romano
- M. Summer - Kutmon

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, PBL, Presentations, Research, Skills, Training(s)
Assessment methods:
Assignment, Attendance, Final paper, Participation, Presentation
Keywords:
BREAST CANCER SYSTEM BIOLOGY CLASSIFICATION PROGNOSIS DRUG RESPONSE
Fac. Health, Medicine and Life Sciences

Allometry

BBS2062
Period 6
11 Jun 2018
6 Jul 2018
Print course description
ECTS credits:
5.0
Instruction language:
English
Coordinators:

- S. Verheule
- M.M.J. Caron

Fac. Health, Medicine and Life Sciences

Sensorimotor Behaviour and Neuroplasticity

Full course description

Given the importance of human movement in many aspects of daily life, and arm-hand movement in particular, it is crucial to understand how the brain converts sensory information into goal-directed motor actions. This course provides an in-depth treatment of brain-movement relationships, focusing on sensorimotor transformations that underlie arm reaching and how it can adapt to changing circumstances. Adaptations in movements under changing circumstances are covered with the concept of neuroplasticity, the notion that the brain is dynamic by rewiring itself contingent on task demands and new experiences. Finally, this course invites the students to link the acquired knowledge on sensorimotor transformations with the exciting, surging field of brain-computer interfaces (BCI), which allow compensation for lost motor function, for instance, in people suffering from spinal cord injury or stroke.

Course objectives

- Explain sensorimotor transformations underlying arm reaching
Bachelor Biomedical Sciences

- Design, assess, and interpret experimental manipulations disturbing arm reaching at the level of perception, planning and execution
- Explain determinants and mechanisms of neuroplasticity at the molecular, cellular, and organization level
- Describe basic principles and applications of Brain-Computer Interfaces (BCI)

**Recommended reading**


BBS2063
Period 6
11 Jun 2018
6 Jul 2018
Print course description
ECTS credits:
5.0
Instruction language:
English
Coordinator:
- J.J.M.E. Adam

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations, Research
Assessment methods:
Assignment, Attendance, Final paper
Keywords:
hand-arm function - sensorimotor control - perception-action coupling - neuroplasticity - brain-computer interfaces

**Competence Investigator and Scholar**

Fac. Health, Medicine and Life Sciences

**Introduction to Statistical Methods for Data Analysis**

**Full course description**

In this course, statistical methods are introduced that can be used in all kinds of research problems encountered in Biomedical science

The focus is on statistical concepts and techniques that play a role in summarizing and describing observed variables and relationships between variables, as well as generalizing the results for a larger group than the observed group. The first theme of this course is to summarize the observed data. The second theme is the testing concept. The third theme pertains to various basic statistical techniques that are used to analyse observed data.
Some best practice statistical methods will be introduced and are considered as standard methods to deal with the above stated questions.

Course objectives

Important learning goals in this course are:

- Knowledge of descriptive statistics (including frequency, average, median, standard deviation, cross-classified table among others).
- Knowledge of the principles of inferential statistics, such as population distribution, sample distribution, sampling distribution, central limit theorem, hypothesis testing, p-value, and confidence interval.
- Knowledge of the basic principles and concepts of elementary statistical techniques (including t-test, chi-square test, and simple linear regression).
- Knowledge of the differences and similarities between the various basic techniques (such as a t-test and simple linear regression).
- Ability to perform a simple test (t-test, chi-square test) with SPSS.
- Ability to perform a simple linear regression analysis with SPSS.
- Ability to interpret adequately the results of the learned statistical analysis in view of the research question and, in doing so, to provide critical comments.

BBS1003
Period 3
8 Jan 2018
2 Feb 2018
Print course description
ECTS credits:
5.0
Instruction language:
English
Coordinator:
- E.S. Tan

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, PBL, Presentation(s), Skills
Assessment methods:
Assignment, Written exam
Fac. Health, Medicine and Life Sciences

Critical Appraisal of Biomedical Publication

Full course description

Biomedical Sciences covers a broad range of different research approaches. This course on the critical appraisal of biomedical publications will teach students to recognise and value the diversity of study designs used in the field of biomedical research. The course uses a competency-based approach and will enable students to critically review research quality and methodology as they are used in daily practice. During this 4-week course four critical appraisals of biomedical publications (CABPs) are performed. Three are practice runs and the fourth is assessed (BBS1007). Journal club sessions and team-based learning sessions guide the students through the CABP process. A strong
Bachelor Biomedical Sciences

A collaborative approach is necessary to be able to argue and discuss research methodology. The course will specifically address three different types of studies; (i) observational research, (ii) randomised controlled trials (RCT) and (iii) experimental laboratory-based studies (i.e. cell and genetic studies). BBS1006 is assessed with an exam at the end of the course using multiple choice questions that measure critical thinking.

Course objectives

- Introduction in cholesterol research
- Recognise and describe the empirical cycle in published biomedical articles
- Describe (and compute) frequency measures and risk indices often used in biomedical sciences
- Differentiate between regularly used research designs in biomedical sciences
- Argue/ value the quality aspects of research methodology and suggest alternatives and solutions to problems
- Review methodological aspects of scientific publications in relation to the topical results, the research question and statistics used
- Make supported decisions/ balanced choices when designing a biomedical study
- The students develop a critical attitude towards research methodology

Recommended reading

- A number of biomedical publications related to cholesterol
- Multiple quality checklists (STARD, CONSORT, RIPOSTE)
- Literature around quality checklists
- Various books on research methodology Ranjit Kumar.
- Nursing research: generating and assessing evidence for nursing practice. 9th edition

BBS1006
Period 6
11 Jun 2018
6 Jul 2018
Print course description
ECTS credits:
3.0
Instruction language:
English
Coordinator:
- J.W. Renes

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), Presentations, Research, Skills, Training(s)
Assessment methods:
Assignment, Attendance, Final paper, Participation, Portfolio, Written exam
Keywords:
Critical appraisal, Study design, research methodology, (non)experimental studies
Fac. Health, Medicine and Life Sciences
CABP Assignment

Full course description

Course BBS1006 is a 4-week course during which critical appraisals of biomedical publications (CABP – BBS1007) are the central theme. These CABPs are structured appraisals of methodological aspects of biomedical publications around the topic of cholesterol. Each publication is discussed and appraised in journal clubs and written assignments. The students are guided in increasing their level of understanding of each biomedical publication with the ultimate goal to value and argue the methodological quality aspects of these publications. Three CABPs are guided by tutors and performed in teams while the fourth CABP is performed individually and is part of the student’s final mark. The CABPs are assessed for BBS1007, whereas course BBS1006 is assessed using multiple choice questions that measure critical thinking.

Course objectives

- Recognise and describe the empirical cycle in published biomedical articles
- Describe (and compute) frequency measures and risk indices often used in biomedical sciences
- Differentiate between regularly used research designs in biomedical sciences
- Argue/value the quality aspects of research methodology and suggest alternatives and solutions to problems
- Review methodological aspects of scientific publications in relation to the topical results, the research question and statistics used
- Make supported decisions/balanced choices when designing a biomedical study
- The students develop a critical attitude towards research methodology

Recommended reading

- A number of biomedical publications related to cholesterol
- Multiple quality checklists (STARD, CONSORT, RIPOSTE)
- Literature around quality checklists
- Various books on research methodology Ranjit Kumar.
- Nursing research: generating and assessing evidence for nursing practice. 9th edition
Imaging is a crucial step to visualize and conceptualize important processes in health and disease on various scales, ranging from molecular detail, via cellular and tissue level, towards animal and patient. In this 4-weeks course various non-invasive imaging techniques, frequently used in both research and clinic, will be introduced and discussed. These techniques are MRI/MRS, PET/CT, MS Imaging, and Breath/faeces analysis. Furthermore, advanced optical microscopy will be introduced, since this is an important, albeit invasive, supportive technique.

Combining lectures, practicals, and dedicated tutorials, in the first two weeks all the mentioned imaging methods will be introduced in general terms. After these two weeks, the group will be divided over five topics (MRI/MRS; PET/CT; MSI; B/F analysis; and Optical Microscopy). The topic will, within this group, be discussed in more detail. During weeks 2 to 4 the students will work on writing an Imfolio in small subgroups, containing up-to-date information on the topics of each week (practicals, lectures).

While each group during the last 2 weeks will go into details on one topic only, the general line of imaging methods will come back in the final assignment. Subgroups will work on the assignment from the start of the block. They will of the (other) subgroups. Both defense and asking questions to other groups will be graded, including self-assessment. presentedefend their assignment at the end of the block in the
Bachelor Biomedical Sciences

**Course objectives**

B-ILO-1: Students learn the difference between various non-invasive imaging techniques. B-ILO-2: Students can select and apply the best (combination of) methods to a specific question in either clinical or research setting. B-ILO-3: Students can deal with complex data in a practical setting. B-ILO-4: Students have in-depth knowledge on one of the following techniques:

- MRI/MRS
- PET/CT
- Mass Spectroscopic Imaging
- Optical Microscopy
- Breath and Faeces analysis

**Recommended reading**

Will be discussed during the block

BBS2003
Period 3
8 Jan 2018
2 Feb 2018

[Print course description](#)

ECTS credits:
5.0

Instruction language:
English

Coordinators:
- [M.A.M.J. van Zandvoort](#)
- [A.M. Blanchet - Smolinska](#)

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), Paper(s), PBL, Presentations, Skills

Assessment methods:
Assignment, Attendance, Portfolio, Presentation

Keywords:
Non-invasive imaging Biomedical research Medical research
Fac. Health, Medicine and Life Sciences

**Statistics: Regression Analysis, ANOVA, Logistic Regression, Repeated Measurements**

**Full course description**

In this course the statistical techniques simple and multiple linear regression, analysis of variance, logistic regression, and analysis of repeated measurements are introduced. With these techniques a broad range of statistical analyses of biomedical data can be conducted.
Course objectives

Simple linear regression, multiple linear regression, analysis of variance, logistic regression analysis, analysis of repeated measurements.

- The student learns the most important concepts associated with these techniques.
- The student is able to apply these techniques with the statistical package SPSS on real data.
- The student is able to interpret the obtained results.

Concepts:

- dependent variable
- independent variable
- intercept, slope, standard error
- t-test for coefficient
- t-value, p-value
- confidence interval for coefficient
- continuous and categorical independent variables
- dummy variables
- F-test for set of independent variables
- residual plot
- histogram of residuals
- normal probability plot
- interaction
- R-square
- sum of squares
- multiple comparisons
- Bonferroni adjustment
- relation between regression analysis and analysis of variance
- general linear model
- transformation of dependent variable
- prediction of conditional means
- multicollinearity
- variance inflation factor
- vif. Dichotomous dependent variable
- relative risk
- odds
- odds ratio
- Hosmer and Lemeshow goodness of fit test.

Set of dependent variables, fixed variables, random factors, mixed model.

Recommended reading

Bachelor Biomedical Sciences

Year
1 Sep 2017
6 Jul 2018

Print course description
ECTS credits:
3.0
Instruction language:
English
Coordinator:

• A.W. Ambergen

Teaching methods:
Lecture(s), Training(s)
Assessment methods:
Attendance, Written exam
Keywords:
Linear regression, analysis of variance, logistic regression, analysis of repeated measures.
Fac. Health, Medicine and Life Sciences

Philosophy in Action II

BBS2008
Period 2
30 Oct 2017
22 Dec 2017

Print course description
ECTS credits:
3.0
Instruction language:
English
Coordinators:

• G.M.W.R. de Wert
• B. Penders

Competence Communicator and Collaborator

Fac. Health, Medicine and Life Sciences

Competency Communicator and Collaborator

Full course description

The bachelor biomedical sciences program is structured around four competences:

1. Biomedical expert
2. Communicator and Collaborator
3. Investigator and Scholar
4. Professional and Organiser
 Bachelor Biomedical Sciences

These competences will be monitored in part via a mentor system. Students create a portfolio in EPASS that contains the documentation required to demonstrate progress in all competencies. Typically, the portfolio contains tutor and peer feedback on performance and professional behaviour during tutorial groups, peer feedback on lab work, feedback on scientific writing assignments, grades for end-of-course tests, feedback on presentations and self evaluations.

The intended learning outcomes related to the competence Biomedical Expert are organised within the content of courses. The intended learning outcomes for the competences Communicator and Collaborator, Investigator and Scholar, and Professional and Organiser will be addressed in course-overarching education.

Course objectives

For the competence Communicator and Collaborator (C) the following four intended learning outcomes (ILO) for a B-BMS graduate have been defined:

C-ILO1. Adjusts communication written or oral, to specific global audience/readership and international setting
For year 1, the ILOs for this sub-competence are:

- Reports on methods, results and discussion sections according to current conventions.
- Prepares and delivers presentation(s) about biomedical topics in tutorials, practicals, etc.

C-ILO2. Communicates professionally with peers and staff originating from diverse cultural and disciplinary backgrounds
For year 1, the ILO for this sub-competence is:

- Interacts effectively in all educational settings

C-ILO3. Shows awareness of team roles and takes responsibly her/his position in a diversely composed international team
For year 1, the ILOs for this sub-competence are:

- Takes responsibility for team processes and team performance
- Demonstrates an open mind to input of others
- Accepts feedback, and is able to provide constructive feedback to others

C-ILO4. Works effectively in an international and intercultural team
For year 1, the ILO for this sub-competence is:

- Is aware of cultural diversity and its impact on group dynamics and team processes

BBS1020
Year
1 Sep 2017
6 Jul 2018
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:
Bachelor Biomedical Sciences

• J.M.E.M. Cosemans

Teaching methods:
Assignment(s), Work in subgroups, Paper(s), PBL, Presentation(s), Training(s)
Assessment methods:
Assignment, Attendance, Final paper, Participation, Portfolio, Presentation

Keywords:
collaborator, communicator, cultural diversity, longitudinal tracks, multisource feedback,
presentation, Scientific writing

Fac. Health, Medicine and Life Sciences

Competence Domain Communicator and Collaborator Year 2

Full course description

The bachelor biomedical sciences program is structured around four competences: 1. Biomedical expert 2. Communicator and Collaborator 3. Investigator and Scholar 4. Professional and Organiser. These competences will be monitored in part via a mentor system. Students create a portfolio in EPASS that contains the documentation required to demonstrate progress in all competencies. Typically, the portfolio contains tutor and peer feedback on performance and professional behaviour during tutorial groups, peer feedback on lab work, feedback on scientific writing assignments, grades for end-of-course tests, feedback on presentations and self evaluations. The intended learning outcomes related to the competence Biomedical Expert are organised within the content of courses. The intended learning outcomes for the competences Communicator and Collaborator, Investigator and Scholar, and Professional and Organiser will be addressed in course-overarching education.

Course objectives

For the competence Communicator and Collaborator (C) the following four intended learning outcomes (ILO) for a B-BMS graduate have been defined: C-ILO1. Adjusts communication written or oral, to specific global audience/readership and international setting. For year 2, the ILOs for this sub-competence are: a. Orally presents lab work to a group of peers b. Writes a lab report in the style of a research paper in accordance with current conventions c. Designs and presents a poster of lab work d. Gives effective feedback to peers about written lab reports

C-ILO2. Communicates professionally with peers and staff originating from diverse cultural and disciplinary backgrounds. For year 2, the ILO for this sub-competence are: a. Participates in and initiates discussion during peer presentations b. Communicates respectfully c. Shows awareness of team roles and takes responsibly her/his position in a diversely composed international team. For year 2, the ILOs for this sub-competence are: a. Takes responsibility for team processes and team performance b. Demonstrates an open mind to input of others c. Accepts feedback, and is able to provide constructive feedback to others d. Works effectively in an international and intercultural team. For year 2, the ILO for this sub-competence is: Demonstrates cultural sensitivity when interacting with co-workers from diverse backgrounds and abilities

BBS1026
Year
1 Sep 2017
Bachelor Biomedical Sciences
6 Jul 2018

Print course description

ECTS credits:
10.0

Instruction language:
English

Coordinator:

- J.M.E.M. Cosemans

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentation(s), Training(s)

Assessment methods:
Assignment, Attendance, Final paper, Participation, Portfolio, Presentation

Keywords:
collaborator, communicator, cultural diversity, longitudinal tracks, multisource feedback, presentation, Scientific writing

Competence Professional and Organisor

Fac. Health, Medicine and Life Sciences

Competency Professional and Organizer

Full course description

The bachelor biomedical sciences program is structured around four competences:

1. Biomedical expert
2. Communicator and Collaborator
3. Investigator and Scholar
4. Professional and Organiser

These competences will be monitored in part via a mentor system. Students create a portfolio in EPASS that contains the documentation required to demonstrate progress in all competencies. Typically, the portfolio contains tutor and peer feedback on performance and professional behaviour during tutorial groups, peer feedback on lab work, feedback on scientific writing assignments, grades for end-of-course tests, feedback on presentations and self evaluations.

The intended learning outcomes related to the competence Biomedical Expert are organised within the content of courses. The intended learning outcomes for the competences Communicator and Collaborator, Investigator and Scholar, and Professional and Organiser will be addressed in course-overarching education.

Course objectives

For the competence Professional and Organiser (P) the following four intended learning outcomes (ILO) for a B-BMS graduate have been defined:

P-ILO1. Demonstrates appropriate interpersonal behaviour

For year 1, the ILO for this sub-competence is:
Behaves in a respectful, professional and reliable manner in PBL groups, practical trainings and group work

P-ILO2. Appreciates the conventions of scientific integrity and legal and ethical standards and operates accordingly
For year 1, the ILOs for this sub-competence are:

- Meets obligations in writing academic reports free of fraud and plagiarism
- Identifies personal biases and prejudices related to professional responsibilities

P-ILO3. Takes responsibility for her/his personal and academic development
For year 1, the ILOs for this sub-competence are:

- Accepts feedback; Critically reflects on his/her learning and academic development
- Formulates SMART learning goals -with help of mentor - in order to take adequate action with a view to raising her/his competencies up to the desired level

P-ILO4. Organizes his/her work and study well
For year 1, the ILOs for this sub-competence are:

- Lists the principles of keeping a lab notebook
- Works according to principles of GLP
- Appreciates and applies relevant ICT to prepare documents and presentation. Appreciates the value of ICT in data processing and management
- Distributes workload throughout a course or project

BBS1030
Year
1 Sep 2017
6 Jul 2018
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:

- J.M.E.M. Cosemans

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, PBL, Skills, Training(s)
Assessment methods:
Assignment, Attendance, Participation, Portfolio
Keywords:
lab skills, longitudinal tracks, multisource feedback, organiser, Portfolio, professional development
Fac. Health, Medicine and Life Sciences

Competence Domain Professional and Organizer Year 2

Full course description

The bachelor biomedical sciences program is structured around four competences: 1. Biomedical
Bachelor Biomedical Sciences

expert 2. Communicator and Collaborator 3. Investigator and Scholar 4. Professional and Organiser

These competences will be monitored in part via a mentor system. Students create a portfolio in EPASS that contains the documentation required to demonstrate progress in all competencies. Typically, the portfolio contains tutor and peer feedback on performance and professional behaviour during tutorial groups, peer feedback on lab work, feedback on scientific writing assignments, grades for end-of-course tests, feedback on presentations and self evaluations.

The intended learning outcomes related to the competence Biomedical Expert are organised within the content of courses. The intended learning outcomes for the competences Communicator and Collaborator, Investigator and Scholar, and Professional and Organiser will be addressed in course-overarching education.

Course objectives

For the competence Professional and Organiser (P) the following four intended learning outcomes (ILO) for a B-BMS graduate have been defined:

P-ILO1. Demonstrates appropriate interpersonal behaviour

For year 2, the ILO for this sub-competence is:

Behaves in a respectful, professional and reliable manner in PBL groups, practical trainings and group work

P-ILO2. Appreciates the conventions of scientific integrity and legal and ethical standards and operates accordingly

For year 2, the ILOs for this sub-competence are:

a. Meets obligations in scientific writing reports free of fraud and plagiarism
b. Identifies personal biases and prejudices related to professional responsibilities and acts responsibly to address them

P-ILO3. Takes responsibility for her/his personal and academic development

For year 2, the ILOs for this sub-competence are:

a. Accepts feedback; Critically reflects on personal values and priorities with minor help of mentor and develops strategies to promote personal growth
b. Formulates SMART learning goals – with minor help of mentor - in order to take adequate action with a view to raising her/his competencies up to the desired level

P-ILO4. Organizes his/her work and study well

For year 2, the ILOs for this sub-competence are:

a. Keeps a well-structured lab notebook
b. Sets up and carries out a simple protocol
c. Masters and applies relevant ICT applications to prepare documents and presentations and to process and archive data
d. Distributes workload throughout a course or project
Bachelor Biomedical Sciences

Major Molecular Life Sciences

Fac. Health, Medicine and Life Sciences

The Diseased Organism: Diagnosis and Therapy

Full course description

In this block, knowledge obtained during year 1 and year 2 and block 3.1 is integrated and translated into approaches to treat patients. This involves classical (symptom rather than mechanism based) approaches in which deregulated physiological processes are interfered with and more modern approaches in which the (drug) treatment is directed to selected molecular targets and individuals. In addition some diagnostic methods and imaging techniques are included in the program as a means to detect diseases and to choose and monitor treatments. Due to the limited time, the focus will mainly be on cardiovascular diseases and cancer. As a red line theory will be coupled to practical (clinical) applications. The block involves PBL cases, lectures, (computer and demo) practicals and interactive group assignments/presentations. The block consists of three themes. The first theme (pharmacotherapy of cardiovascular diseases) deals with how drugs can be used to interfere with the cardiovascular system and what one would like to and can achieve with this, the mechanisms of action of major drug classes are and how drugs can be developed for a defined target. The second theme involves imaging techniques as MRI en fluorescence based (particularly confocal and two/multiphoton) microscopy. Next to theoretical principles, practical aspects and (diagnostic and research) applications are discussed. The third theme involves target directed therapies and molecular diagnostics in cancer therapy. This includes the principle behind and the mechanisms of drugs that are directed to specific targets in tumors as well as mechanisms by which tumors can obtain resistance to such drugs. In addition, the use of molecular diagnostics to select the treatment or molecular target is addressed as well as the fact that inter-individual (genetic) differences are important. Finally, a company visit allows introduction into the vision and strategies of companies to amongst others develop, test and market drugs.

Course objectives

Integration and translation of knowledge from previous years and blocks into diagnostic and therapeutic approaches. Specific aims The student acquires knowledge of mechanisms of actions of drugs The student acquires knowledge in approaches to develop drugs based on defined drug targets. The student understands the rationale of the pharmacotherapy of cardiovascular diseases and knows the mechanism of action of the major drug classes for these diseases. The student acquires knowledge regarding the rationale and mechanisms involved in target directed anti-tumor therapy. The student acquires knowledge regarding the influence of (DNA) variations between individuals on the effectiveness of drugs. The student understands at which intrinsic and extrinsic cellular levels tumors can become resistant to targeted therapies. The student acquires knowledge in the (molecular) technology in diagnostics and how molecular diagnostics can help to a better and more patient oriented and effective treatment. The student knows the difference between susceptibility genes and disease causing genes. The student understands how MRI images are made and what the basis of this technique is. The student understands the difference between T1, T2 and density weighed MRI images. The student acquires knowledge in the application of MRI in the detection and investigation of diseases. The student knows the technology that forms the basis of fluorescence confocal and two/multiphoton microscopy. The student learns how confocal and multiphoton microscopy can be used to study cellular processes and molecular diagnostics. Skills By
Bachelor Biomedical Sciences

giving presentations and writing a report the students will develop and sharpen their skills to work in a cooperative setting, develop a critical attitude to and interpret data and findings, reason and write scientifically.

**Recommended reading**

- Basic and Clinical Pharmacology, Betram Katzung, Susan Masters and Anthony Trevor, McGraw-Hill Medical; 12 edition (December 13, 2011) | ISBN: 0071764011 (available online via e-books, UM library). During the block, various references to journal articles will be given.

MLW3003
Period 3
8 Jan 2018
2 Feb 2018

**Practicals The Diseased Organism: Diagnosis and Therapy**

**Full course description**

In this block, knowledge that is obtained during your study in year 1 and year 2 and block 3.1 will be integrated and translated into approaches to treat diseases/patients, particularly with drugs. This involves classical (often symptom rather than mechanism based) approaches in which deregulated physiological processes are interfered with (particularly in cardiovascular diseases) as well as more modern approaches in which the (drug) treatment is more directed to selected molecular targets and individuals (modern anti-tumor therapy). In addition a number of diagnostic methods and imaging techniques will be included in the program as a means to detect diseases and to choose and monitor a treatment method. Due to the limited time, the focus will mainly be on cardiovascular diseases and cancer.

**Course objectives**

- The student acquires knowledge of mechanisms of actions of drugs
- The student acquires knowledge in approaches to develop drugs based on defined drug targets
- The student understands the rationale of the pharmacotherapy of cardiovascular diseases and knows the mechanism of action of the major drug classes for these diseases
- The student acquires knowledge regarding the rationale and mechanisms involved in target directed anti-tumor therapy
- The student acquires knowledge regarding the influence of (DNA) variations between individuals on the effectiveness of
Bachelor Biomedical Sciences
drugs. - The student understands at which intrinsic and extrinsic cellular levels tumors can become resistant to targeted therapies. - The student acquires knowledge in the (molecular) technology in diagnostics and how molecular diagnostics can help to a better and more patient oriented and effective treatment. - The student knows the difference between susceptibility genes and disease causing genes. - The student understands how MRI images are made and what the basis of this technique is. - The student understands the difference between T1, T2 and density weighed MRI images. - The student acquires knowledge in the application of MRI in the detection and investigation of diseases. - The student knows the technology that forms the basis of fluorescence confocal and two/multiphoton microscopy. - The student learns how confocal and multiphoton microscopy can be used to study cellular processes and molecular diagnostics.

Recommended reading


MLW3103
Period 3
8 Jan 2018
2 Feb 2018
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinator:
- W.M. Blankesteijn

Teaching methods:
Work in subgroups, Lecture(s), Skills
Assessment methods:
Written exam
Keywords:
diagnosis, therapy, drug, therapeutic target, cardiovascular disease, cancer, resistance, molecular diagnostics, MRI, multuphoton microscopy, fluorescence
Fac. Health, Medicine and Life Sciences
Multimorbiditeit in Obesitas

Full course description

The course ‘Obesity and its comorbidities’ is the final course in the bachelor Biomedical Sciences. In the past 2 years you have obtained in-depth knowledge on your own specialty of choice. This course is a joint course for all three specializations, being Movement Sciences, Biological Health Sciences and Molecular Life Sciences. In short, this course covers several major (patho)physiological disturbances in - and consequences of - obesity, from molecule to man. Emphasis will be on (disturbances in) inter-organ cross-talk in obesity, its detrimental health consequences, and potential intervention strategies.

Course objectives

Overall aim:
Integration and application of previously obtained knowledge on (1) metabolic homeostasis and the inter-organ relations required to maintain metabolic health and (2) to study metabolic dysregulation associated with obesity. By merging the 3 specializations – Molecular Life Sciences, Biological Health Sciences and Movement Sciences - this course also aims to (1) expand or apply previously obtained knowledge in neighboring disciplines and (2) stimulate interdisciplinary collaboration and communication.

Specific aims:

- Obtain knowledge on obesity and its comorbidities with emphasis on the metabolic consequences of obesity in middle-aged to elderly populations.
- Become familiar with the different definitions of the Metabolic Syndrome
- Become familiar with key signaling routes, cells, tissues and organs (adipose tissue, muscle, liver, the gastrointestinal system, the (cardio)vascular system and brain) that are involved in development and consequences of obesity and the metabolic syndrome
- Obtain insight in the mechanisms underlying disturbances in these processes
- Be able to understand how these aberrations at the cell and interorgan level translate into whole body complications.
- Obtain knowledge on the (clinical) consequences of the metabolic disturbances that underlie the metabolic syndrome
- Understand the mechanisms underlying the adaptive responses to interventions that focus on nutrition, physical activity, pharmacology or surgery
- Deepen, expand and communicate to peers, the knowledge that has been obtained in previous years and apply that in the context of obesity and the metabolic syndrome

Recommended reading


BMW3010
Period 4
5 Feb 2018
6 Apr 2018
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinators:
- M.M.J. van Greevenbroek
- G.H. Goossens

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), PBL, Presentation(s), Training(s)
Assessment methods:
Assignment, Attendance, Presentation, Written exam
Keywords:
Obesity Organ crosstalk Exchange and integration of knowledge Insulin Adipokines Adipose tissue Muscle Liver Gut Musculoskeletal disease Macro- and Microvascular circulation

Major Biological Health Sciences
Fac. Health, Medicine and Life Sciences

Non-invasive Metabolic Diagnostics

Full course description
Data from 31P-MRS measurements, from a PET-FDG measurement and breath samples will be analysed. The students will also perform (and undergo) a measurement of endothelial function where the influence of caffeine on endothelial function will be studied.

Course objectives
Students will learn what the outcome parameters of 31P-MRS-, and FDG-PET measurements are and how they are calculated. They will also get acquainted with the performance of breath analysis and
will get insight in the possibilities to investigate endothelial function.

**Recommended reading**

- Blokbook ‘non-invasieve Metabolic Diagnostics’.
- To search for review articles, students will use PubMed. Specific literature will be provided by E-readers.

**Practicals Non-invasive Metabolic Diagnostics**

**Full course description**

Data from 31P-MRS measurements, from a PET-FDG measurement and breath samples will be analysed. The students will also perform (and undergo) a measurement of endothelial function where the influence of caffeine on endothelial function will be studied.

**Course objectives**

Students will learn what the outcome parameters of 31P-MRS-, and FDG-PET measurements are and how they are calculated. They will also get acquainted with the performance of breath analysis and will get insight in the possibilities to investigate endothelial function.

**Recommended reading**

Practicuminstructions on ELEUM
Multimorbiditeit in Obesitas

Full course description

The course ‘Obesity and its comorbidities’ is the final course in the bachelor Biomedical Sciences. In the past 2 years you have obtained in-depth knowledge on your own specialty of choice. This course is a joint course for all three specializations, being Movement Sciences, Biological Health Sciences and Molecular Life Sciences. In short, this course covers several major (patho)physiological disturbances in - and consequences of - obesity, from molecule to man. Emphasis will be on (disturbances in) inter-organ cross-talk in obesity, its detrimental health consequences, and potential intervention strategies.

Course objectives

Overall aim:
Integration and application of previously obtained knowledge on (1) metabolic homeostasis and the inter-organ relations required to maintain metabolic health and (2) to study metabolic dysregulation associated with obesity. By merging the 3 specializations – Molecular Life Sciences, Biological Health Sciences and Movement Sciences - this course also aims to (1) expand or apply previously obtained knowledge in neighboring disciplines and (2) stimulate interdisciplinary collaboration and communication.

Specific aims:

- Obtain knowledge on obesity and its comorbidities with emphasis on the metabolic consequences of obesity in middle-aged to elderly populations.
- Become familiar with the different definitions of the Metabolic Syndrome
- Become familiar with key signaling routes, cells, tissues and organs (adipose tissue, muscle, liver, the gastrointestinal system, the (cardio)vascular system and brain) that are involved in development and consequences of obesity and the metabolic syndrome
- Obtain insight in the mechanisms underlying disturbances in these processes
- Be able to understand how these aberrations at the cell and interorgan level translate into whole body complications.
- Obtain knowledge on the (clinical) consequences of the metabolic disturbances that underlie the metabolic syndrome
- Understand the mechanisms underlying the adaptive responses to interventions that focus on nutrition, physical activity, pharmacology or surgery
• Deepen, expand and communicate to peers, the knowledge that has been obtained in previous years and apply that in the context of obesity and the metabolic syndrome

**Recommended reading**


BMW3010
Period 4
5 Feb 2018
6 Apr 2018
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinators:
• M.M.J. van Greevenbroek
• G.H. Goossens

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), PBL, Presentation(s), Training(s)
Assessment methods:
Assignment, Attendance, Presentation, Written exam
Keywords:
Obesity Organ crosstalk Exchange and integration of knowledge Insulin Adipokines Adipose tissue Muscle Liver Gut Musculoskeletal disease Macro- and Microvascular circulation

**Major Human Movement Sciences**

Fac. Health, Medicine and Life Sciences
Movement Disorders

Full course description

Movement disorders may be caused by disease, trauma and/or degeneration. However, their consequences are not limited to the sensorimotor system, nor does treatment lead to full recovery in all cases. Loss of function often has invisible consequences. The emphasis in unit BWE3003 (Movement Disorders) is less on what a specific impairment (e.g. stroke, spinal cord injury etc) IS, but more on the consequences impairments may have on the level of functioning and participation of a person. This implies a more generic approach of the topic of Movement Disorders. Students will become acquainted with the major aspects of the International Classification of Functioning, Disability and Health (ICF) model, the presence or absence of relations between function loss on the one hand and level of activity and participation on the other hand, and how insight in these relations may be elucidated using measures and measurements. Students will learn that, although full recovery of function may not be possible, a person’s level of activity and participation may still improve strongly. Topics like “Disease is not equal to health minus impairment”, compensation, reorganisation, and use of aids will be covered, next to, for example, “effects of speed of injury/lesion”, age and patients’ perspective on (treatment) outcome. Identification, critical (and logical) reasoning, and reflection by students are key elements within unit BWE3003 (Movement Disorders).

Course objectives

Knowledge and insight
The bachelor student

- has reached an adequate level regarding knowledge of and insight in the neuromuscular / sensorimotor system
- has acquired adequate knowledge of and insight in the ICF model
- has acquired knowledge of the presence or absence of relationships between the 3 main levels of the ICF
- has acquired knowledge about measuring instruments targeting the 3 main levels of the ICF
- has general insight in the societal relevance of movement disorders, at the 3 main levels of the ICF, in various subpopulations.

Application of knowledge and insight gained
The bachelor student

- is able to apply knowledge of and insight in the neuromuscular / sensorimotor system, acquired during prior teaching units, in the understanding of basic mechanisms underlying common movement disorders
- is able to identify relationships between common movement disorders on the one hand, and possible consequences of such disorders at the level of activity and participation on the other hand.

Judgement
The bachelor student

- is able to adequately choose measurement instruments, targeting one or more levels of the ICF, appropriate to the underlying movement disorder problem and question
Bachelor Biomedical Sciences

- is able to (generally) interpret data mentioned above.

**Communication**

The bachelor student

- is able to concisely convey to his/her fellow students the data/information gathered as well as the interpretation of these data, using a short presentation
- is able to (individually) write a short report covering the analysis (at the 3 levels of the ICF) of a specific movement disorder problem (case).

**Learning skills**

The bachelor student

has the ability to analyse novel movement disorder-related problems analogous to the ones presented in teaching unit BWE3003, and to make a well-founded suggestion for appropriate measurement instruments.

**Recommended reading**

Bachelor Biomedical Sciences

6.0
Instruction language: English
Coordinator:
  - H.A.M. Seelen

Teaching methods:
Lecture(s), PBL, Presentation(s), Skills
Assessment methods:
Assignment, Attendance, Final paper, Participation, Presentation
Keywords:
movement disorders; International Classification of Functioning
Fac. Health, Medicine and Life Sciences

Practicals Movement Disorders

Full course description

Practical session 1: "Painful / stiff joints"

The aim of this practical is to acquaint the student with systematic observation, hands-on measurement and analysis of movement deviating from normal movement. The observations and measurements will mainly focus on ICF function level. Possible implications of impairments on the quality of skill performance will be addressed. Logical reasoning is the central theme in this practical, i.e. combining (basic) knowledge acquired earlier (e.g. anatomy, kinesiology, (neuro-)physiology, biomechanics, etc) with the (simple and more complex) movement disorder problems presented during this practical session.

Practical session 2: "Activity and participation: A different perspective on the same reality"

will be at the centre of attention. Also, students will be asked to critically evaluate how (effects of) these problems at function level, activity level and/or participation level may be quantified viewed from the patient’s perspective. Hemiparesis is a phenomenon that frequently occurs in stroke. These conditions will be mimicked using constraints. The aim of this practical is to let the student experience, first-hand, what kind of problems patients with a physical impairment, i.e. stroke, may encounter during their daily activities and participation in society. Physical and non-physical problems,

Course objectives

Practical 1:

What do I see? And: Why?

- How do my observations relate to pathology? And: Why? Or: Why not?
- How can I measure movement phenomena that are invisible to the eye?
- How do my observations relate to results of objective measures? What are the differences? What are the common factors? What kind of information is still missing? And: Why?
- How does the environment influence movement performance?
Bachelor Biomedical Sciences

**Practical 2:**

Main levels of the ICF encountered during the assignment. All the students will
- identify and
- systematically document specific problems (at

See also the general aims of this course.

BWE3103
Period 3
8 Jan 2018
2 Feb 2018
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinator:
- H.A.M. Seelen

Teaching methods:
Skills
Assessment methods:
Presentation
Keywords:
Movement disorders, ICF, function, activity, participation, measuring, gait, wheelchair, prosthesis, activities of daily living
Fac. Health, Medicine and Life Sciences

**Multimorbiditeit in Obesitas**

**Full course description**

The course ‘Obesity and its comorbidities’ is the final course in the bachelor Biomedical Sciences. In the past 2 years you have obtained in-depth knowledge on your own specialty of choice. This course is a joint course for all three specializations, being Movement Sciences, Biological Health Sciences and Molecular Life Sciences. In short, this course covers several major (patho)physiological disturbances in - and consequences of - obesity, from molecule to man. Emphasis will be on (disturbances in) inter-organ cross-talk in obesity, its detrimental health consequences, and potential intervention strategies

**Course objectives**

**Overall aim:**
Integration and application of previously obtained knowledge on (1) metabolic homeostasis and the inter-organ relations required to maintain metabolic health and (2) to study metabolic dysregulation associated with obesity. By merging the 3 specializations - Molecular Life Sciences, Biological Health Sciences and Movement Sciences - this course also aims to (1) expand or apply previously obtained
knowledge in neighboring disciplines and (2) stimulate interdisciplinary collaboration and communication.

Specific aims:

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- Become familiar with the different definitions of the Metabolic Syndrome
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- Obtain insight in the mechanisms underlying disturbances in these processes
- Be able to understand how these aberrations at the cell and interorgan level translate into whole body complications.
- Obtain knowledge on the (clinical) consequences of the metabolic disturbances that underlie the metabolic syndrome
- Understand the mechanisms underlying the adaptive responses to interventions that focus on nutrition, physical activity, pharmacology or surgery
- Deepen, expand and communicate to peers, the knowledge that has been obtained in previous years and apply that in the context of obesity and the metabolic syndrome

Recommended reading

Coursebook ‘Obesity and its comorbidities’ with:
- Background information and introduction to the problem
- Overview of the course goals
- Description of assignments
- Cases
- Literature references
(to be accessed via EleUUM - Reference List)

Volume 2:
This e-book is also accessible via Reference list on EleUUM: Open e-book in reference list - click to request separate items (bottom of the page) - click on the Volume (1 or 2) you want to access - click on URL: Full text.

Other relevant Textbooks

Note: These “Other relevant textbooks” are just examples of recent textbooks, which partly cover the main issues studied in this course. You might as well like to work from other texts. For more recent and up-to-date information, you are supposed to study the papers referred to at the cases.

BMW3010
Period 4
5 Feb 2018
6 Apr 2018
Print course description

ECTS credits:
10.0

Instruction language:
Bachelor Biomedical Sciences

English

Coordinators:
- M.M.J. van Greevenbroek
- G.H. Goossens

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), PBL, Presentation(s), Training(s)

Assessment methods:
Assignment, Attendance, Presentation, Written exam

Keywords:
Obesity Organ crosstalk Exchange and integration of knowledge Insulin Adipokines Adipose tissue Muscle Liver Gut Musculoskeletal disease Macro- and Microvascular circulation

**Academic Skills**

Fac. Health, Medicine and Life Sciences

**Academic Thinking III**

**Full course description**

This study programma is taught in Dutch. Hence, the programme information is only available in Dutch. If you would like to read the Dutch programme information, please choose ‘NL’ at the top of the website

BMW3011
Period 4
5 Feb 2018
6 Apr 2018

Print course description

ECTS credits:
2.0

Instruction language:
English

Coordinator:
- G.M.W.R. de Wert

**Thesis**

Fac. Health, Medicine and Life Sciences

**Internship**

BMW3035
Period 5
9 Apr 2018
6 Jul 2018

Print course description
The block "diseased cells" (8 weeks) has as central theme cancer and the underlying complex molecular pathways. It aims to integrate morphology (histology), molecular pathophysiology and cell biology. Cancer is primarily an environmental disease with about 90% of cases attributed to environmental factors (not inherited genetically) and only about 10% due to genetics (inherited genetically). Common environmental factors that contribute to cancer death include tobacco, diet, infections, radiation and environmental pollutants. Cancer comprises biological capabilities of the cell acquired during the multistep development of human tumors. These so called "hallmarks" include sustaining proliferative signaling, evading growth suppressors, resisting cell death, enabling replicative immortality, inducing angiogenesis, and activating invasion and metastasis. Underlying these hallmarks are genome instability, which generates the genetic diversity that expedites their acquisition, and inflammation, which fosters multiple hallmark functions. In the block BMW3001 cases are presented that illustrate these "hallmarks of cancer", multistep development and impact of environmental factors. The practicals focus on the cell cycle, visualization of a virus causal related to cancer and genome instability. In a written report the student will design his own knock out mouse to study a monogenic disease.

Main objectives (insight in) - Cell types and their normal grow and adaption reactions - Normal cell
Bachelor Biomedical Sciences

cycle, cellular differentiation and disturb intercellular communication - Basic genetic concepts and progression models for cancer - Grading and staging of tumors - Processes of apoptosis and necrosis - Processes of invasion and metastasis - Angiogenesis and hypoxia - Immunology of tumors - Mechanisms of cell damage - Morphologic cellular reactions during persistent stress - Model systems (transgenic and knock-out Mouse models) - Viral carcinogenesis i.e. HPV - Genetic alterations during carcinogenesis - Genetic predisposition for cancer - Impact of nutrition on cancer - Mechanisms for acute and chronic inflammation - Composition of extracellular matrix during wound healing - Wound healing, stem cells, repair and regeneration (skin, liver) Practical - Tackling the kinetics of the cell cycle - Protocol development and "hands on experiment" for (F)ISH and immunocytochemistry for the visualization of HPV and chromosomal aneusomy - Imaging of FISH and image analysis (ImageJ basic) Written report - Design your own knock-out mouse model

BMW3001
Period 1
4 Sep 2017
27 Oct 2017
Print course description
ECTS credits:
12.0
Instruction language:
English
Coordinator:
  • A.H.N. Hopman

Teaching methods:
Assignment(s), Lecture(s), Paper(s), PBL, Skills
Assessment methods:
Assignment, Attendance, Final paper, Participation, Presentation, Written exam
Keywords:
Cancer, hall marks of cancer, cell cycle, apoptosis, oncogenes, tumorsuppressor genes, angiogenesis, histology, metatasis, HPV, inflammation, stem cells, immunology, inter- and intracellular communication
Fac. Health, Medicine and Life Sciences

Practicals Diseased Cells

BMW3101
Period 1
4 Sep 2017
27 Oct 2017
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinator:
  • A.H.N. Hopman

Fac. Health, Medicine and Life Sciences
Molecular Nutrition

Full course description

Molecular nutrition is one of the most rapidly developing fields in nutritional science. Nutrition provides the building blocks of cells, tissues and finally our complete body. In addition, it provides fuel to construct and sustain our body. In fact, nutrients actively regulate the molecular processes that enable us to be what we are. Our knowledge about the active role that nutrients play on the molecular level has increased tremendously in the past few years. In some cases, nutrients exert an indirect effect, such as the induction of insulin release by glucose. In many cases, nutrients also directly influence the levels of rate-limiting metabolites. They directly interact with transcription factors and thus regulate the activity of genes, in particular of genes involved in metabolic processes. Knowledge about molecular activities of nutrients enables us to deliberately influence the metabolism through nutrient intake and thus to prevent disease or to improve physical and mental performance. At the same time, the border between medical drugs, pharmaceuticals, and bioactive nutrients, i.e. nutraceuticals, begins to fade.

This course provides insight knowledge on various ways by which nutrients can influence molecular processes in the body. In addition, different molecular strategies are addressed, which are currently applied to improve or sustain human health by making use of nutrients. Finally, students will be trained to adopt a critical attitude towards health claims of nutrients and to make evidence-based judgements with respect to those claims.

Special themes:

1. Nutritional epigenetics
2. Transcription factors/Orphan nutrient receptors
3. Gut-brain axis in food intake regulation
4. Vitamins, more than antioxidants
5. Bioactive food components, functional foods
6. Personalized nutrition and nutraceuticals
7. Nutrigenetics, gene-diet interaction

Course objectives

In detail, each student will have:

- Knowledge on the molecular processes underlying epigenetic influences of nutrition
- Understanding of the activity of transcription factors and the way by which nutrients influence the activity of transcription factors
- Knowledge on the roles of vitamins as essential regulators of gene expression
- Insight into the importance of the gut and the gut flora for food intake regulation and on body weight
- Understanding of the strategies aimed at preserving or improving human health with specific nutrients
- Understanding of modern genetic methods applied to detect genetic variation associated with nutrition-related traits/disorders
- Knowledge on the societal developments regarding personalized nutrition
- Insight into health claim regulations.

Application of knowledge and understanding:
Each student will be able to:

- Define nutrients that can have a healthy effect or a rather unfavorable effect
- Make a prediction about the foreseen impact of molecular nutrition in the near future
- Design experiments to assess the influence of a nutrient or dietary component on health.

Interpretation:
Each student will be able to:

- Judge from available data (or the lack of relevant data) whether a health claim is justified
- Extract relevant information on molecular nutrition from the scientific literature.

Communication:
Each student will be able to:

- Give an oral presentation on an executed research project for fellow students
- Answer the questions asked during or after such an oral presentation
- Actively ask critical questions during the presentations of fellow students.

Learning abilities:
Each student will acquire skills in:

- Searching for and critical reading of scientific publications
- Providing feedback to the tutorial group and practicing scientific discussions with fellow students.

Recommended reading

Needed as basic knowledge: Molecular Biology of the Cell by Bruce Alberts.

BMW3002
Period 1
4 Sep 2017
27 Oct 2017
Print course description
ECTS credits:
12.0
Instruction language:
English
Coordinator:
- E.C.M. Mariman

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), PBL, Presentation(s), Skills
Assessment methods:
Assignment, Attendance, Participation, Presentation, Written exam
Keywords:
nutrition; gene expression; gene-nutrient interaction; personalized; nutrition; nutraceuticals;
functional foods;
Fac. Health, Medicine and Life Sciences
Practicals Molecular Nutrition

Full course description

This course has four practicals on different topics, in line with the themes of the course. Needed are basic skills for standard molecular biology experiments.

**Epigenetic influences.** Methylation is one of the biological ways in which the expression activity of genes can be regulated and modified. Methylation can be influenced by nutrition, for instance by the food component folic acid. During the practical you will perform a chemical method by which the level of methylation in DNA can be estimated. This practical is related to Theme 1. *Epigenetic influences* No practical guidelines are provided in advance, but a protocol has to be designed during the practical.

**Nutrition and PPAR stimulation in vitro.** In the practical *Nutrition and PPAR stimulation in vitro*, you will measure the induction of target genes by the PPARg transcription factor via nutrients acting as PPARg ligands. As an extra challenge, you will have to design your own research protocol. The practical is related to Themes 2 and 3.

**Fat accumulation in liver cells.** PPARs and other nuclear receptors are involved in the regulation of the metabolism. One of the effects is the storage of lipids in liver cells. The rate of storage depends on the PPAR ligand, meaning the nutrient entering a cell. Incubating liver cells with different ligands you will visualize those effects, and have to provide a biochemical explanation. This practical ‘Fat accumulation in liver cells’ relates to Themes 3 and 6.

**Genetic variation and predisposition to obesity.** Everybody is different due to the enormous variation in the human genome. Scientists try to find out which genes carry variations influencing nutrition-related traits and disorders. During the practical ‘Genetic variation and predisposition to obesity’ you will test whether genetic variations in two genes predispose to the development of obesity. It relates to Theme 7.

Course objectives

Practicals will give you background insight on how experiments can be used to investigate and solve key questions related to Molecular Nutrition.

BMW3102
Period 1
4 Sep 2017
27 Oct 2017
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinator:
- E.C.M. Mariman

Teaching methods:
Skills
Training

Full course description

The main aim of this course is to gain insight into the structural, metabolic, and functional adaptations to regular physical activity, or exercise training. Over the past decades, it has been well established that regular physical activity represents one of the key factors for leading a healthy life. Physical activity, or exercise training, results in a range of structural and metabolic adaptations, improving exercise capacity and leading to increased functional performance. In this course, the adaptive response of the human body to regular exercise training will be studied from the whole-body down to the molecular level, including the mechanisms underlying these adaptations and the different factors affecting the training response (i.e. type of training, nutrition, etc.). With exercise inducing important health benefits, students will become familiar with more general exercise effects (i.e. in healthy or trained subjects), as well as exercise as a therapeutic means for several pathologic conditions. While the focus will be on skeletal muscle, various other organ systems are also involved in the adaptation to exercise training and are, as such, topic of study. Finally, the effect of physical inactivity will also be studied, such as seen during bed rest or immobilization. Additional lectures on specific topics (e.g. rehabilitation in children, overtraining) will also be provided. Apart from cases and lectures, students will work in small student teams on a project in which they will implement a 5wk training program. In several practicals, the adaptations to the program will be determined.

Course objectives

Knowledge and comprehension
At the end of the course the student should posses:

1. Knowledge on principles and terminology of general exercise physiology
2. Knowledge on different training modalities
3. Knowledge on structural, metabolic, and functional adaptive responses to these different training modalities (from whole-body to cellular level)
4. Insight in the mechanisms underlying the adaptive response to regular exercise (including molecular pathways)
5. Knowledge on the role of nutrition in supporting and/or augmenting the training response
6. Insight in how to adjust different training modalities to balance exercise intensity and workload with exercise capacity such as in more compromised populations

Applying knowledge
At the end of the course, students should be capable of applying the above-mentioned knowledge:

1. To define a specific training program to induce a specific adaptive response.
2. To assess the structural, metabolic, and functional adaptations to exercise training.
3. To explain how the adaptive response to a certain exercise program is accomplished.
Bachelor Biomedical Sciences

**Interpretation**

**At the end of the course the student should be capable of:**

1. Interpreting results from the practicals: analyze and evaluate experimental data to determine the adaptive response to a specific exercise training program
2. Selecting the training program and the appropriate methodology to assess training effects based on the desired adaptive response

**Communication**

**At the end of the course the student should be able:**

1. Writing a well structured, concise and well argued report on the findings from the practicals.

**Overall**

**At the end of the course the student should be capable of:**

1. Independently measuring, interpreting, and reporting the effects of a training program
2. Performing/supervising a specific training program
3. Setting up a short study design to evaluate the adaptive response to an exercise training program

The following end terms apply: A4, A5, A6, B3, C1, D1, E2.

BMW3003
Period 1
4 Sep 2017
27 Oct 2017

[Print course description](#)

ECTS credits: 12.0
Instruction language: English
Coordinators:
- L.J.C. van Loon
- L.B. Verdijk

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), Paper(s), PBL, Skills
Assessment methods:
Assignment, Attendance, Participation, Written exam

Keywords:
Training; exercise; physical activity; adaptation; skeletal muscle; metabolism;
Fac. Health, Medicine and Life Sciences

**Clinical Nutrition**

**Full course description**

The module Clinical Nutrition aims to provide a thorough grounding in all aspects of clinical nutrition and focuses on nutrition and its application in prevention and disease management. Clinical nutrition not only assesses deficiency states, but can be used to improve health by optimizing food selection and nutrition supplementation needs. This course is designed to recall knowledge of the function of macronutrients in the body and to learn how the ingestion of combined...
Bachelor Biomedical Sciences

Macronutrients affects overall metabolism as well as disease risk and recovery. Food intake regulation by hormones and psychologic factors in health and disease will be highlighted. This course reviews the array of assessment tools used in clinical nutrition practice including methodology, application, implications, strengths and limitations. A clinical and laboratory assessment allows the opportunity to develop an individualized therapeutic program. Practical nutritional applications including both dietary therapies and supplements directed at optimizing nutritional status are reviewed in detail. Specific nutrition intervention including diet, vitamins, minerals, essential fatty acids, fibers and amino acids are explored for a variety of diseases commonly encountered in clinical practice. The biochemistry of each intervention is discussed for a full understanding of how to integrate nutrition therapy into patient care. During this course attention goes to various ways by which nutrition can be applied; oral nutrition and suppletions, tube feeding, parenteral nutrition. You will learn when to apply these different nutritional interventions and the pros and cons of the different feeding techniques. Further there will be extensive attention for the composition of nutrition and the altered needs caused by disease in different pathologic situations. Finally you will be trained in the possibilities to perform research in the field of clinical nutrition and the interpretation of the literature.

Course objectives

- At the end of this course, the student has an improved level of knowledge and understanding
- The student increases his/her understanding on homeostatic and non-homeostatic regulation of food intake
- The student increases his/her knowledge about food intake and macronutrient metabolism in health and disease
- The student increases his/her understanding on the role of nutrients in pathophysiologic processes in the human body
- The student increases his/her knowledge about normal digestion and absorption
- The student increases his/her understanding on the influence of several disturbing factors on digestion and metabolism of nutrition
- The student has insight in altered nutritional needs during disease (metabolic stress, cachexia, protein-energy malnutrition, trauma, burn wounds, systemic inflammation, intensive care patients, chronic disease (COPD, oncology, kidney disease) gastrointestinal disease
- The student has insight in consequences of malnutrition on the course of disease and recovery
- The student has knowledge about factors influencing food intake (satiety mechanisms, medication, cerebral infarct, dementia, dysphagia, depression)
- The student has knowledge about possibilities to fulfill the altered nutritional needs during disease using nutritional support therapy; suppletions, tube feeding (nasal, gastrostomia, jejunostomia), parenteral nutrition
- The student has insight in pros and cons of nothing by mouth
- The student has insight in therapeutic possibilities of nutrition (probiotics, fibers, immunomodulation) Application of knowledge and understanding
- The student is able to use the acquired knowledge to assess nutritional status
- The student is able to use the acquired knowledge to set up a plan for route and composition of nutrition for a (critically) ill patient. Interpretation
- The student is able to critically read and interpret scientific publications concerning studies on clinical nutrition. Communication
- The student has the capacity to give an oral presentation about a scientific publication for his/her fellow students
- The student can answer the questions that are asked during or after such an oral presentation
- The student is able to actively ask critical questions during the presentations of fellow
Bachelor Biomedical Sciences

students
• The student is able to participate in a fictive multidisciplinary discussion about nutritional status and nutritional interventions in a critically ill patient (the project)

BMW3004
Period 2
30 Oct 2017
22 Dec 2017
Print course description
ECTS credits:
12.0
Instruction language:
English
Coordinator:
• D.A. van Waardenburg

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), PBL, Presentation(s), Skills, Working visit(s), Paper(s)
Assessment methods:
Assignment, Attendance, Participation, Written exam, Final paper
Keywords:
Food intake and regulation; macronutrients and metabolism.; Normal and disturbed digestion; Nutritional status; Cachexia and malnutrition; Nutritional support strategies; oral suppletion; tube feeding; parenteral nutrition; functional food
Fac. Health, Medicine and Life Sciences

Practicals Clinical Nutrition

Full course description

This course contains 4 practical trainings intended to clarify aspects of clinical nutrition. • Assessment of nutritional status; to measure is to know The influence of nutritional status on the course of disease is essential. Accurate measurement of individual nutritional status is required in clinical practice. It is important to guarantee a good nutritional status in healthy and sick persons. Unfortunately there is no golden standard for measuring body composition or nutritional status. This practical training reviews the array of assessment tools used in clinical nutrition practice including methodology, application, implications, strengths and limitations. Nutritional status assessment allows the health care provider the opportunity to develop an individualized therapeutic program. In this training the students learn to understand the options of choices available to evaluate nutritional status. Students will measure their anthropometric parameters (weight, height, skinfold and circumference measurements), bioelectric impedance and handgrip strength. The data derived in this training will be used for evaluation of nutritional status and will also be used in the practical training energy balance part 1. • Energy balance part 1; the healthy situation In this practical training the interplay between food intake, physical activity, body weight and body composition is studied by means of computer simulation. During the days before the practicals you will have to collect some data at home. It is expected that you register your food intake and physical activity during 3 days (see for details the practical instruction). • Energy balance part 2; disease In this workshop you will learn to recognize disease related factors that influence energy balance and factors contributing to an inadequate energy supply in critically ill patients. You will learn how to calculate nutritional requirements in patients. Presence during the practical training is obligatory.
Bachelor Biomedical Sciences

Only under compelling circumstances it is allowed to exchange with somebody of the other group. In any case, consult the supervisor in advance. Presence is confirmed by signing the registration form. Make sure that you sign this form during the training! A report needs to be handed in for the practicals; Assessment of nutritional status and Energy balance part 1 and 2. Reports have to comply to the standard rules unless stated otherwise. Reports need to score a satisfactory grade. There is only one chance to correct an insufficient report. Questions regarding the practical trainings may be part of the exam. Journal Club Scientific articles will be discussed plenary. The articles will be available through ELEUM. Carefully read the article and prepare yourself by answering the following questions: * What was the research question? * How did the research group experimentally try to get an answer to that question? * Have the data been presented in a clear way using tables and figures? * What can be concluded from the figures and tables? * Were the conclusions in line with the experimental findings? In addition you are expected to ask two critical questions about the article to one of the other students during the meeting. Vise versa you will be asked two questions by one of your colleagues. Project - multidisciplinary meeting of clinical nutrition The integration of the different aspects of the achieved knowledge regarding metabolism and nutrition will be aimed for in a parallel project assignment. In this assignment the students will elaborate, in small groups of 2-3 persons, on the nutritional treatment of a critically ill patient on the intensive care unit. These small groups separately will use a web-based case-based discussion in which several key questions must be answered and discussed before the next step in the disease history can be continued. In the end the answers to the questions will form the report of the subgroup. At the end of the block the students will discuss the treatment decisions in a real-time multidisciplinary meeting using a role-model scenario (surgeon, intensivist, dietician). This project will be introduced at the beginning of the block with an introductory lecture.

BMW3104
Period 2
30 Oct 2017
22 Dec 2017
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinator:

- D.A. van Waardenburg

Motor Learning

Full course description

Motor learning focuses on the understanding of the acquisition and modification of movements that are relatively permanent improvements in performance as a result of practice. The purpose of this module on motor learning is to provide students the knowledge, skills and understanding of the concept of motor learning, both on a behavioural as well as on a neuroscientific level. During this module basic knowledge will be provided that can be applied to any field of interest, for example;
Bachelor Biomedical Sciences

motor learning in healthy subjects, athletes, disabled people or an ageing population. The basis of this module’s approach is that motor learning is the result of an interaction between the person, the skill and the environment. Variables from within these three factors influence motor learning and a solid understanding of these variables is necessary to optimise motor learning and interventions that aim to enhance performance, whether in sports, neurological rehabilitation or any other application of motor learning. Motor learning by definition is a process, not a state, and this process is accompanied by changes on a behavioural and neural level. Insight will be provided into these changes and into the techniques and methods to investigate this.

Course objectives

The student has knowledge and understanding of:

- relevant theories and perspectives of motor control and motor learning
- the influences of practice conditions on motor learning
- concepts and practices related to enhancing motor skills (motor learning)
- the neurophysiological basis of motor learning and recovery of function
- the role of personal factors that modulate motor learning
- the characteristics of the motor learning process
- the importance of cognitive factors on motor learning
- the mechanisms underlying motor learning
- the relation between behavioural and neurophysiological changes

The student can apply knowledge and understanding:

- of the influences of practice conditions to learning any motor skill
- of concepts and practices related to enhancing motor skills to learning any motor skill
- of the role of personal factors on learning any motor skill
- of the characteristics of the motor learning process on learning any motor skill
- and can devise his/her own motor learning paradigm and argue his/her choices for the practice protocol
- and can obtain a critical understanding and the ability to apply scientific knowledge from motor learning for personal fitness, healthy lifestyles, sport, teaching and/or therapeutic rehabilitation
- and can measure and analyse motor learning
- from previous modules (e.g. neural processing, human anatomy, coordination, performance etc) to motor learning

Making judgements

The student:

- Can gather and interpret relevant information to design an effective motor learning paradigm
- Can be critical to the research literature and fellow students and be able to argue their choice
- Can gather data and interpret and analyse data from measurements

Communication

The student:

- Can collaborate with fellow students to develop a motor learning paradigm, execute, analyse and report this
- Is able to report his/her knowledge and insights, conclusions, motives and arguments in a
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- Can produce a scientific document in collaboration with fellow students
- Can produce an individual scientific document in which the student presents ideas, problems and solutions

**Learning skills**

**The student:**

- Can apply his/her critical view to fellow students’ work
- Can apply his/her skills to study further with a high level of autonomy

**Recommended reading**

A variety of sources will be used in this module consisting of books, scientific publications, internet and video’s. Some basic books are:  
- Shumway-Cook A, Woollacott MH. Motor control: translating research into clinical practice. 3rd edition, Lippincott Williams & Wilkins. 2011  

BMW3005  
Period 2  
30 Oct 2017  
22 Dec 2017

[Print course description](#)  
ECTS credits:  
12.0  
Instruction language:  
English  
Coordinator:  
- T.J.H. Bovend’eerdt  
  
Teaching methods:  
Assignment(s), Work in subgroups, Lecture(s), Paper(s), PBL, Presentation(s), Research, Skills  
Assessment methods:  
Assignment, Attendance, Final paper, Portfolio, Presentation, Written exam  
Keywords:  
Motor learning, motor control, individual, environment, skill, perception-action, plasticity, long term-potentiation, practice  
Fac. Health, Medicine and Life Sciences

**Practicals Motor Learning**

**Full course description**

This is the practical of course BMW3005. During this course the students execute a learning experiment over a period of 5-6 weeks. The students perform this experiment in teams and are as a group responsible for the design, execution, analyses and presentations of the study.
Course objectives

This practical is the application of all the goals described in BMW3005.

Recommended reading


Chronic Inflammatory Diseases

Full course description

During this elective Minor course of 8 weeks, students will get acquainted with experimental research in the context of complex chronic inflammatory diseases, like Chronic Obstructive Pulmonary Disease (COPD) and the Metabolic Syndrome. Inter-organ crosstalk and pathophysiology of complex diseases as well as inter/intra-cellular communication are the main focus of the course. The course consists of 4 modules of 2 weeks: Module 1: Gut - Module 2: Lungs - Module 3: Adipose tissue - Module 4: Muscle Every module starts with an introduction lecture to give an overview of principles and theories related to the central theme of that specific module. In each module, the students will work in small groups on a specific assignment that are directly related to ongoing research projects, supported by the research groups of the Departments of Respiratory Medicine,
Bachelor Biomedical Sciences

General Surgery, and/or Human Biology. Special emphasizes will be on the practical education assignments in order to teach the students both general and specific laboratory skills and techniques. The results of these practical assignments will be analyzed by the students themselves and written down in a practical report. In addition, every module includes a research seminar by a senior researcher, presenting state-of-the-art research linked to the central theme. A Journal club will be organized to practice critical reading and evaluation of a recent research paper. A final concept mapping assignment will be used as a wrap-up. By combining the practical assignments with critical evaluating of the obtained experimental results, listening to lectures by experts, group discussions and self-study, the students will learn the basis of experimental research within the domain of Life Sciences.

Course objectives

1. Students get acquainted with scientific research within the domain of Molecular Life Sciences while operationalizing using the knowledge and skills obtained during the bachelor phase of their BMW training.
2. More specifically, students learn how to adequately select and use research methods and techniques within the domain of Molecular Life Sciences. At the same time, students will have to plan and execute their own learning and ensure quality control of their own experimental work.
3. Students learn how to report their own results coherently and scientifically, both in oral and written form. These reports will be framed presented in the context of within the current scientific literature that which will be critically evaluated by the students.

BMW3006
Period 2
30 Oct 2017
22 Dec 2017

Print course description

ECTS credits:
12.0
Instruction language:
English
Coordinators:
- J.H.J. Vernooy
- G.H. Goossens

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), Paper(s), PBL, Presentation(s), Skills

Assessment methods:
Attendance, Final paper, Participation, Presentation, Written exam

Keywords:
Lectures, Practical training, Group assignments, Journal club, Conceptmapping, Scientific research, Oral presentations, Written reports.

Fac. Health, Medicine and Life Sciences

Research Methods in Neuroscience and Toxicology
Bachelor Biomedical Sciences

**Full course description**

During this elective course of 8 weeks, students will get acquainted with experimental molecular biological, biochemical and immunological research. General concepts and strategies for the design of experiments are the main focus of the course. The students will work in small groups on several assignments that are directly related to ongoing translational research projects of the Departments of Neurosciences and Toxicology. Special emphasis will be on the practical education assignments in order to teach the students molecular laboratory skills and techniques. Results of these practical assignments will be analyzed by the students themselves and then presented to their peers in small workgroups.

By combining the practical assignments with studying independently, listening to lectures by experts and critical evaluating of the obtained experimental results, the students will learn the basis of experimental research within Life Sciences.

**Course objectives**

1. Students get acquainted with scientific research within the domain of Molecular Life Sciences while using the knowledge and skills obtained during the bachelor phase of their BMW training.

2. More specifically, students learn how to adequately select and use research methods and techniques within the domain of Molecular Life Sciences. At the same time, students will have to plan and execute their own learning and ensure quality control of their own experimental work.

3. Students learn how to report their results coherently and scientifically, both in oral and written form. These reports will be presented in the context of current scientific literature which will be critically evaluated by the students.

**BMW3007**  
Period 2  
30 Oct 2017  
22 Dec 2017  
**Print course description**  
ECTS credits:  
12.0  
Instruction language:  
English  
Coordinators:  
- M.R. Losen  
- A.W. Boots  
Teaching methods:  
Work in subgroups, Lecture(s), Paper(s), PBL, Presentation(s), Research, Skills  
Assessment methods:  
Assignment, Attendance, Written exam
Bachelor Biomedical Sciences

Keywords:
Neurosciences, Toxicology, immunology, designing your own experiments, small workgroups, presenting own results