

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

Recommended reading

iGenetics: a Molecular Approach - Peter J Russell
Molecular biology of the cell - Bruce Alberts
Introduction to general, organic, and biochemistry - Bettelheim

BBS1001

Period 1

5 Sep 2022

28 Oct 2022

[Print course description](#)

Bachelor Biomedical Sciences

ECTS credits:

7.0

Instruction language:

English

Coordinator:

- [S.G.J. van Breda](#)

Teaching methods:

Assignment(s), Work in subgroups, Lecture(s), Paper(s), PBL, Research, Skills, Presentation(s), Training(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

Homeostasis and Organ Systems

Full course description

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 heart and lungs, and the gastro-intestinal and renal systems. The interaction and communication between these organ systems will also be studied. The central theme is how important nutrients of life, for example oxygen and water, are distributed throughout the body and how regulatory systems such as the autonomic nervous system and hormones maintain steady oxygen and fluid levels and regulate movement of gases, water and wastes between compartments. Main physiological processes, such as digestion, uptake, filtration, reabsorption, secretion and excretion, as well as maintenance of the acid-base balance, will be discussed. 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. 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, where knowledge and understanding of normal physiology of the organ systems and regulatory mechanisms will be used to go into more depth by studying disturbances of homeostasis. The groups will propose a research question on a (selected) disturbance of homeostasis and design a computer-simulated experiment to test this hypothesis. Findings will be presented within a small group setting.

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 mechanismB-ILO2:
- 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

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through the body and to its accessory organs

- 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

31 Oct 2022

23 Dec 2022

[Print course description](#)

ECTS credits:

7.0

Instruction language:

English

Coordinator:

- [D. Neumann](#)

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

31 Oct 2022

Bachelor Biomedical Sciences

23 Dec 2022

[Print course description](#)

ECTS credits:

0.0

Instruction language:

English

Coordinator:

- [F.R.M. Stassen](#)

Fac. Health, Medicine and Life Sciences

Brain, Behavior and Movement

Full course description

This unit is dedicated to the human capacity to perceive, act and move within a constantly changing environment. Being able to integrate incoming information and to react to it properly, e.g. by changing position or by executing an action, is an essential and distinctive feature of all human and animal life. Adequate, adaptive movement requires sensing, coordination, action generation and monitoring the result of the action. This course addresses all of these features by looking into the organization of and communication within the brain, sensory perception, decision making, how we make movements, feel pain, learn and memorize, and experience stress.

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

- Neuroscience: exploring the brain (3rd ed.). Bear et al.. Publisher: Lippincott Williams & Wilkins, 2007 - Principles of neural science (5th ed.). Kandel et al. Publisher: McGraw-Hill Medical, 2013 - Fundamental neuroscience (2nd ed.). Squire et al. Publisher: Academic Press, 2003 - Behavioral Neuroscience. Breedlove and Watson. Publisher: Sinauer Associates : Oxford University Press, 2018 - Motor control and learning: a behavioral emphasis (5th ed.). Schmidt and Lee. Publisher: Human Kinetics, 2012 - Fundamental biomechanics of sport and exercise. Watkins. Publisher: Taylor and Francis, 2014 - Nerve and muscle (4th ed.). Keynes et al. Publisher: Cambridge University Press,

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2011 - Skeletal muscle structure, function & plasticity : the physiological basis of rehabilitation. Lieber et al. Publisher: Wolters Kluwer Health 2010 - Surface electromyography: physiology, engineering and applications. Merletti and Farina. Publisher: IEEE Press, Wiley, 2016

BBS1004

Period 4

6 Feb 2023

7 Apr 2023

[Print course description](#)

ECTS credits:

7.0

Instruction language:

English

Coordinator:

- [N.K. Leibold](#)

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

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Human Genetics, Reproduction and Prenatal Development

Full course description

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

1. Basic mechanisms of cellular life cycle, cellular interaction and human genetics.
2. Mechanisms of the human reproduction and embryonic development.
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

S.F. Gilbert: Developmental Biology (8th & 9th & 10th ed.). Sinauer Ass., Sunderland, 2006/2011. W. J. Larsen: Human Embryology, 3rd/4th edition (2001/2008) Moore and Persaud "The developing human" 8th edition 2008, 9th edition 2012 Langmans medical embryology 11th / 12th edition 2008/2011 Carlson "Human embryology and developmental biology" 5th edition Elsevier Saunders Silverthorn DU: Human Physiology, 5th ed., 2009, Prentice Hall, Pearson, San Francisco, USA ; ISBN-13 9780321559395 / 6th edition 2012 / ISBN 9780321798619 Alberts et al.: Molecular Biology of the Cell. 5th ed. 2007) Garland Science A.L. Kierszenbaum: Histology and Cell Biology, an Introduction to Pathology. Mosby, St. Louis, 2002; 3e editie 2011 / ISBN 9780323078429 Ross, Pawlina: Histology a text and atlas (6th) Lippincott Williams and Wilkins Alberts, 6th edition, Molecular Biology of the Cell Lodish, 7th edition, Molecular Cell Biology: Lewine: 3rd edition Cells In addition research and review articles will be used.

BBS1005

Period 5

10 Apr 2023

9 Jun 2023

[Print course description](#)

ECTS credits:

7.0

Instruction language:

English

Coordinator:

- [S.L.M. Steinbusch - Coort](#)

Teaching methods:

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

Assessment methods:

Assignment, Attendance, Participation, Presentation, Written exam

Keywords:

Gametogenesis - Blastocyst - Implantation

Fac. Health, Medicine and Life Sciences

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 foetal 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

Students will study the topography of the sexual organs in focusing on developmental aspects.

Practical 5: Development of the heart

Students will study the the heart in focusing on developmental aspects.

Lab practical 1: DNA isolation quality and PCF

Student will isolation of genomic DNA from buccal cells. Student will analyse the concentration of their DNA and perform a Polymerase Reaction (PCR) for Clade Marker M270.

Computer practical: Online Mendelian Inheritance in Man (OMIM) and NEBcutter

Student will learn how to browse and interpret OMIM entries and they will learn how to use NEBcutter for restriction enzyme analysis.

Lab practical 2: DNA visualization

Student will perform restriction enzyme digestion and will visualize the experimental products with gel electrophoresis

Recommended reading

Embryology S.F. Gilbert: Developmental Biology (10th & 11th ed.). Sinauer Ass., Sunderland, 2006/2011. W. J. Larsen: Human Embryology, 3rd/4th edition (2001/2008) Moore and Persaud "The developing human" 8th edition 2008, 9th edition 2012 Langmans medical embryology 11th / 12th edition 2008/2011 Carlson "Human embryology and developmental biology" 5th edition Elsevier Saunders Films embryonic development (available via ELEUM anatomical site under "Course Materials") Physiology Silverthorn DU: Human Physiology, 5th ed., 2009, Prentice Hall, Pearson, San Francisco, USA ; ISBN-13 9780321559395 / 6th edition 2012 / ISBN 9780321798619 Alberts et al.: Molecular Biology of the Cell. 5th ed. 2007) Garland Science Macroscopic anatomy - atlases Prometheus: Atlas of human anatomy Sobotta: Atlas of human anatomy Virtual microscopy A.L.

Kierszenbaum: Histology and Cell Biology, an Introduction to Pathology. Mosby, St. Louis, 2002; 3e editie 2011 / ISBN 9780323078429
Ross, Pawlina: Histology a text and atlas (6th) Lippincott
Williams and Wilkins Molecular biology Lewine 3rd edition: Cells Alberts, 6th edition, Molecular Biology of the Cell Lodish, 7th edition, Molecular Cell Biology:

BBS1105

Period 5

10 Apr 2023

9 Jun 2023

[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), PBL

Assessment methods:

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

Full course description

In this course, different types of threats coming from outside the body, including injury, infections (bacterial, viral, parasitic) and toxins, are analyzed and integrated with the appropriate defence mechanisms. The most relevant entry sites with regard to these threats are the skin, the airways and the gastrointestinal tract. Different threats and different sites of entry (skin, lung, gut) require a diversity of defence mechanisms.

Hemostasis, inflammation and wound healing are the defence mechanisms against injury and bleeding. Physical, chemical and biological barriers, complement activation, inflammation, and phagocytosis form the first defence mechanisms against invading micro-organisms. Reactive oxygen species are formed by phagocytes to deal with micro-organisms. Also in response to air pollution and nanoparticles, reactive oxygen species are an important defence mechanism. A second line of defence, as well as memory for future threats, is provided by different T- or B-lymphocyte subsets and antibodies. Each of these responses need to be well controlled by homeostatic processes to downregulate the reaction once the threat is conquered. Furthermore, orchestration of all defence mechanisms in order to obtain the most effective response against each type of invading micro-organisms requires optimal communication between immune cells. Consequently, central themes in all defence mechanisms are intra- and intercellular communication and homeostatic responses.

Course objectives

1. Describe the mechanisms of haemostasis and thrombosis in injury and wound healing
2. Explain the pathogenesis of bacterial, viral and parasitic infections
3. Explain the innate immune responses, including recognition of damage and micro-organisms, the inflammatory process and the role of complement, neutrophils, macrophages and NK cells
4. Explain the adaptive immune responses, including recognition of antigens by B and T cells, T and B cell activation, T helper subset differentiation, isotype switching and the effector function of T helper cells, antibodies and cytotoxic T cells
5. Explain defence against xenobiotics, including particulate matter and reactive oxygen species and antioxidants in toxicological defences
6. Explain the mechanisms underlying antibiotics and the threat of antibiotics resistance

Recommended reading

Medical microbiology / Murray 8th edition, 2016 (isbn 9780323299565) Basic immunology / Abbas 5th edition, 2016 (ISBN 9780323390828)

BBS2001

Period 1

5 Sep 2022

28 Oct 2022

[Print course description](#)

ECTS credits:

6.0

Instruction language:

English

Coordinator:

- [M.M.P.C. Donners](#)

Teaching methods:

Assignment(s), Lecture(s), Work in subgroups, PBL, Presentations, Skills, Training(s)

Assessment methods:

Attendance, Participation, Written exam

Keywords:

Hemostasis Thrombosis Innate immune system Adaptive immune system Microbiology Bacteria

Viruses Toxicology Antibiotics

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 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. In parallel the SoPhiA longitudinal track will be taught during this period

(BBS2008-part I). Sophia focuses on normative aspects of prevention of (later onset)) disease, which are linked to the content of the course BBS2002

Course objectives

B-ILO2002.1 Describe post-natal development

1. Describe physical growth (muscle and bone) and sexual maturation
2. Describe the effect of hormones on physical growth and sexual maturation
3. Describe the post-natal development of the organ systems such as lung and brain on cellular, structural and functional level

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

1. Describe the evolutionary theories of ageing and use them to explain the ageing process
2. Describe maintenance and repair mechanisms and explain how homeostasis changes with ageing
3. Describe the hallmarks of ageing (molecular and cellular) and use them to explain the ageing process
4. 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

1. Explain the interplay between stem cells, stress, ageing and disease such as cancer.
2. Describe age related diseases (such as neurodegenerative disease, lung disease, musculoskeletal decline) and explain the relationship with the hallmarks of ageing.
3. Explain risk factors of specific age related diseases
4. 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

31 Oct 2022

23 Dec 2022

[Print course description](#)

ECTS credits:

6.0

Instruction language:

English

Coordinators:

- [M.A. Dentener](#)

- [G.G.H. van den Akker](#)

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, Computer test

Fac. Health, Medicine and Life Sciences

Human Intermediary Metabolism

Full course description

Fat, carbohydrates and proteins are major constituents of the human diet. These three macronutrients are ultimately converted or stored as energy by a wide variety of different metabolic pathways. First, the digestion, uptake, and transport of macronutrients from the intestinal tract to various organs and tissues will be addressed. This will include the enzymatic breakdown of macromolecules in the gastro-intestinal tract, and the transport and uptake of nutrients by various target organs. The nutrients also induce the secretion of signaling molecules: molecules secreted by one organ can modulate metabolism in another organ. Examples of such cross-talk between organs will be discussed. The nutrients will ultimately be used as a source of energy and key concepts of energy production in different tissues will be examined. In addition, methods and principles used to measure energy metabolism during rest and exercise will be discussed. Substrate metabolism also depends on factors like vitamins and minerals. The importance of these (co)-factors will be discussed especially by referring to the role of B-vitamins in amino acid and iron metabolism. Finally, it is clear that inter-individual variation in substrate metabolism exists. It will be highlighted how this variability is related to differences in body composition, sex, and genetic background. Ultimately, this knowledge is translated into dietary recommendations. Insight will be provided on how these recommendations are derived for different groups of people and if it is already possible to recommend personalized nutrition.

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

6 Feb 2023

7 Apr 2023

Bachelor Biomedical Sciences

[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, Paper(s)

Assessment methods:

Attendance, Participation, Presentation, Written exam, Final paper

Keywords:

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

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

6 Feb 2023

7 Apr 2023

[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

Biorhythms in Homeostasis

Full course description

The ability to maintain homeostasis is a prerequisite for life in general. Embedded in homeostatic control lays rhythmic control which help to maintain body and cellular function, but are also important to adjust the human body to rhythms that are enforced on us by nature, of which day and night is the best-known example. Next to these environmental factors, also other external stimuli threaten homeostasis of the human body.

During this course, the knowledge gained from the first-year course "Homeostasis and organ systems" (BBS1002) will be refreshed and extended. The basic principles of hormonal, neural and other regulation systems will be studied around the overarching theme of body weight regulation. The regulation of body weight starts at the level of the nucleus and cell, where gene transcription is regulated by the molecular clock, leading to rhythmicity in gene expression patterns. At the organ level, hormones, including adipokines are secreted to regulate metabolic processes that are involved in the maintenance of body weight. At a macro level, body weight is also regulated by patterns of physical activity, food intake and energy homeostasis (supply and demand). A complicating factor in body weight regulation in humans are societal, cultural and environmental factors that also affect body weight, and these environmental factors may be exposed on us in a rhythmic manner too. Students will learn the basics of the regulation factors in the form of six cases, supported by one lecture per theme. An important part of the course consists of applying knowledge in projects, around five different themes. In every theme, approximately 5 students will work together. The product of the project teams is two-fold: a symposium (oral and poster presentation) for peers and stakeholders (patients, industrial partners, lay people, health professionals etc.).

Course objectives

- B-ILO1 Understands the concept of regulatory systems and how positive and negative feedback systems function in maintaining homeostasis
- B-ILO2 Understands the concept of rhythmicity at different levels (molecular, circadian, seasonal) and how this affects regulatory systems
- B-ILO3 Integrates short- and long-term regulatory systems and rhythmicity into body weight regulation
- B-ILO4 Argues how challenges to the control system result in dysregulation and adaptation to a new set-point which can be modulated by interventions (pharmaca, lifestyle)
- B-ILO5 Discusses how external cues challenge the regulatory system
- B-ILO6 Applies acquired knowledge of control systems in a predefined scenario and translates this into advice to stakeholder
- B-ILO7 Applies appropriate statistics (logistic regression) to a dataset derived from practical during course

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BBS2051

Period 5

10 Apr 2023

9 Jun 2023

[Print course description](#)

ECTS credits:

6.0

Instruction language:

English

Coordinator:

- [M. Buitinga](#)

Teaching methods:

Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations, Training(s)

Assessment methods:

Assignment, Attendance, Participation, Presentation, Written exam

Fac. Health, Medicine and Life Sciences

Neuromuscular Control of Movement

Full course description

The course neuromuscular control of human movement seeks to understand how muscles, sense organs, motor pattern generators, and brain interact to produce coordinated movement. Applications of this field include ameliorating human health problems, e.g., restoration of movement following brain or spinal cord injury and prosthetic design. Additionally, understanding the remarkable performance that humans can achieve in sports. Conceptually, the key element of neuromuscular control is the emergent cooperation of the neural system (sensors and CNS) and the biomechanical system (muscles and bones). A key goal is dynamic tuning of all systems to create stable and effective locomotor behavior in a continuous interaction with the environment.

In this course specific aspects of human movement (e.g. walking, running, jumping) are addressed to elucidate the basic principles underlying neuromuscular control. Proper execution of an intended task requires a complex intermuscular coordination, involving both neuronal sensing of movement and neuronal control of the muscular motors. Topics that will be addressed in the course are: neural pathways involved in human movement, structure and function of the musculoskeletal system, control schemes for upright stance, but also stable and efficient walking and running. Furthermore, the course will address how knowledge on neuromuscular control can help to understand the limitations that certain patient groups experience and to improve performance via motor learning strategies and external aids. Such knowledge is of vital importance for biomedical scientists that want to contribute to (para) medical disciplines like neurology, orthopedics, physical therapy, sports medicine or rehabilitation medicine.

The course is an introduction into the neuromuscular control of human posture and movement. It requires a basic understanding of the anatomical structures and functional units of the neuromuscular skeletal system, which has been addressed in BBS1004 Brain and Movement. The course also includes statistics, which is an extension to the statistical skills developed in courses BBS1003 and BBS2001.

Course objectives

- To describe the neural structures and pathways involved in human posture and movement B-ILO1
- To describe the functional units of the musculoskeletal system B-ILO2
- To apply mechanical principles to solve human movement problems B-ILO3
- To explain how central nervous system, sense organs and musculoskeletal systems work together to produce coordinated movement B-ILO4
- To interpret human movement in terms of: B-ILO5
Effects of pathology on locomotion, e.g. stroke and prostheses
Economy and stability
- To apply the principles of neural control and mechanics in a selected field (project) B-ILO6

Recommended reading

Tresilian, J. (2012). Sensorimotor control and learning : An introduction to the behavioral neuroscience of action. Basingstoke etc.: Palgrave Macmillan. Rose. J. and Gamble J.G (2006) Human Walking; Lippincott Williams & Wilkins

BBS2052

Period 5

10 Apr 2023

9 Jun 2023

[Print course description](#)

ECTS credits:

6.0

Instruction language:

English

Coordinators:

- [M.R. Drost](#)
- [K. Meijer](#)

Teaching methods:

Assignment(s), Work in subgroups, Lecture(s), PBL, Presentations

Assessment methods:

Assignment, Written exam

Fac. Health, Medicine and Life Sciences

Systems Biology

Full course description

With the progress of genome sequencing and other -omics technologies, a wealth of multi-level data on the molecular nature of biological systems is being generated. Systems biology is a new approach to biological and biomedical research based on a more holistic perspective and relying on the use of mathematical and computational tools, complementing experiments in the lab. In biomedical science, '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.

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In this course, some basic knowledge and tools used in 'systems biology' will be taught including pathway and network analysis, metabolic modeling, and patient subtyping. The approaches will be applied to study the detailed molecular mechanisms affected in breast cancer patients.

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 personalized treatment)
- Use and process the relevant experimental datasets and information sources to solve problems/answer research questions with systems biology approaches
- Select the correct computational methods and tools to answer biomedical research questions using systems biology approaches

Recommended reading

Amjad E, Asnaashari S, Sokouti B, Dastmalchi S. Systems biology comprehensive analysis on breast cancer for identification of key gene modules and genes associated with TNM-based clinical stages. *Scientific reports*. 2020 Jul 2;10(1):1-4. <https://doi.org/10.1038/s41598-020-67643-w> Rocca A, Kholodenko BN. Can Systems Biology Advance Clinical Precision Oncology?. *Cancers*. 2021 Jan;13(24):6312. <https://doi.org/10.3390/cancers13246312> Joshi A, Rienks M, Theofilatos K, Mayr M. Systems biology in cardiovascular disease: a multiomics approach. *Nature Reviews Cardiology*. 2021 May;18(5):313-30. <https://doi.org/10.1038/s41569-020-00477-1>

BBS2061

Period 6

12 Jun 2023

7 Jul 2023

[Print course description](#)

ECTS credits:

5.0

Instruction language:

English

Coordinator:

- [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:

SYSTEM BIOLOGY BREAST CANCER BIOLOGICAL PATHWAYS METABOLIC PATHWAYS
MOLECULAR NETWORKS CLASSIFICATION PROGNOSIS DRUG RESPONSE DATA ANALYSIS

Fac. Health, Medicine and Life Sciences

Allometry

Full course description

In a strict sense, the term 'allometry' originally referred to the scaling relationship between the size of a body part and the size of the body as a whole. More broadly, allometry is concerned with biological scaling relationships in general, including morphological traits (e.g. the relationship between brain size and body size), physiological traits (e.g. the relationship between metabolic rate and body size) or even ecological traits (e.g. the relationship between body size and territory size). Indeed, allometric relationships can be described for almost any pair of co-varying biological measurements. For biomedical sciences, such allometric relations (or the deviation thereof) have huge implications for the extrapolation of study data from cells to animals to humans, for example in the field of drug development. In addition, allometry is used to assess or correct for the influence of the variable body size within human study populations.

The course will begin with a general introduction on the influence of body size. Next, specific examples will be studied to gain a broader understanding of the topic. Examples of allometric relations in biomedical sciences we will study during the PBLs and lectures are skeletal dimensions, cardiac function, energy metabolism, thermoregulation, movement efficiency and pharmacokinetics. Allometric relations within the student population will be determined during the practicals body composition, electrocardiography, gait transition and pharmacokinetics/ pharmacodynamics. In addition, students will collaborate in a project where they explore a variety of topics related to the influence of animal/ body size.

Course objectives

B-ILO1001.1

To understand the nature of allometric scaling laws

B-ILO1001.2

Explain how body size affects body structure

B-ILO1001.3

Explain how body size affects (energy) metabolism

B-ILO1001.4

Know the implications of allometric scaling for biomedical research: how to extrapolate from mouse to man

B-ILO1001.5

Demonstrate taking allometric scaling into account in human studies: how to correct for body size

Recommended reading

- Schmidt-Nielsen, K. (1984) 'Scaling. Why is animal size so important', Cambridge University Press, Cambridge, UK
- Boner JT. (2011) Why Size Matters: From Bacteria to Blue Whales, Princeton University Press
- Brown JH & West GB (2000) 'Scaling in Biology', Oxford University Press.

BBS2062

Period 6

12 Jun 2023

7 Jul 2023

Bachelor Biomedical Sciences

[Print course description](#)

ECTS credits:

5.0

Instruction language:

English

Coordinators:

- [S. Verheule](#)
- [M.M.J. Caron](#)

Teaching methods:

Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Skills

Assessment methods:

Assignment, Attendance, Presentation, Written exam

Keywords:

Body size Anatomical structure Organ function Metabolism Pharmacokinetics Animal research

Clinical studies

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 movements 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
- 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

Elliott, D., Lyons, J., Hayes, S. J., Burkitt, J. J., Roberts, J. W., Grierson, L. E., . . . Bennett, S. J. (2017). The multiple process model of goal-directed reaching revisited. *Neurosci Biobehav Rev*, 72, 95-110. doi: 10.1016/j.neubiorev.2016.11.016 Xu, T., Yu, X., Perlik, A. J., Tobin, W. F., Zweig, J. A., Tennant, K., . . . Zuo, Y. (2009). Rapid formation and selective stabilization of synapses for enduring motor memories. *Nature*, 462(7275), 915-919. doi: 10.1038/nature08389 Peters, A. J., Chen, S. X., &

Bachelor Biomedical Sciences

Komiyama, T. (2014). Emergence of reproducible spatiotemporal activity during motor learning. *Nature*, 510(7504), 263-267. doi: 10.1038/nature13235 Green, A. M., & Kalaska, J. F. (2011). Learning to move machines with the mind. *Trends Neurosci*, 34(2), 61-75. doi: 10.1016/j.tins.2010.11.003

BBS2063

Period 6

12 Jun 2023

7 Jul 2023

[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 that can be used in all kinds of research problems encountered in Biomedical science are introduced.

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.

Recommended reading

Course notes are provided on the Student Portal Additionally, reading one of the two following books o Utts and Heckard (2015) Mind on statistics, Cengage Learning, (5th edition) o Field, A. (2013). Discovering statistics using SPSS, 4th edition. Sage: London. is recommended but not mandatory. Pieces of the lecture material are based on the first reference. An alternative reference is the following book: o Moore/ Mc Cabe/Craig (2012). Introduction to the practice of Statistics Freeman and Company, New York (seventh edition or later)

BBS1003

Period 3

9 Jan 2023

3 Feb 2023

[Print course description](#)

ECTS credits:

5.0

Instruction language:

English

Coordinator:

- [S. Vanbelle](#)

Teaching methods:

Assignment(s), Lecture(s), Work in subgroups, PBL, Presentation(s), Skills

Assessment methods:

Assignment, Written exam

Keywords:

descriptive, Inferential statistics, t-test, chi-square test, simple linear regression, SPSS

Fac. Health, Medicine and Life Sciences

Philosophy in Action I

Full course description

Students will be made aware of the ethical aspects of the possibility to manage reproduction. In addition they will discuss the need to reliably handle the increasing availability of genetic data and the knowledge of genetic and epigenetic mechanisms.

Bachelor Biomedical Sciences

In week 1 students will be introduced to ethics, its role in science and its role in the context of reproductive genetics. In addition, the planning of the symposium and the work on assignment A will be introduced.

During week 1-3 students read scientific and ethical literature on one key, preselected topic, and create a rough draft of the ethical analysis. They can use the Q&A session in week 3 to overcome problems. During week 4 students finalise the analysis and present as a group in a symposium (=Assignment A see below).

In week 5 students will be introduced into the topics of science in society, the context of scientific inquiry regarding e.g. the increasing availability of genetic data. In addition, assignment B (writing assignment see below) will be explained. Students will write a brief reflection on their experiences in the symposium/debate.

During week 6-8 Students will collect questions for discussion meetings taking place in week 6 and work on assignment B. Students have to submit the assignment at the end of week 7.

Groups may rotate/switch/trade assigned topics.

Course objectives

We will work towards attaining the following competence; to be able to summarize and reflect on social, political, international and ethical issues in biomedical science.

Recommended reading

See online portal

BBS1008

Period 5

10 Apr 2023

9 Jun 2023

[Print course description](#)

ECTS credits:

2.0

Instruction language:

English

Coordinator:

- [G.M.W.R. de Wert](#)

Teaching methods:

Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentation(s)

Assessment methods:

Assignment, Attendance, Participation

Fac. Health, Medicine and Life Sciences

Critical Appraisal of Biomedical Publication

Full course description

Biomedical Sciences covers a broad range of different research approaches and study designs. Results from these studies are reported in articles published in a wide range of journals. Information from these articles is vital for the progression of science. However, a critical view on biomedical publications is necessary to maintain the required level of scientific quality. The design of a study by using the empirical cycle, and the way the study design and results are reported are the main items of the course Critical Appraisal of Biomedical Publications (BBS1006). This course will teach students to recognise and value the diversity of study designs and to critically appraise how results of these studies are reported. 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. This is done by means of lectures, team-based learning sessions and journal clubs. During this 4-week course students are trained to make so-called critical appraisals of biomedical publications (CABPs) reports. One CABP report will serve as a practice run and will be discussed according to provided feedback. The second CABP report is assessed. Since research not only involves correct reporting but also hands-on skills, a lab-skill test and a calculation test will be conducted during the BBS1006 course period. These tests will be assessed but do not count for the BBS1006 course itself. Success in BBS1006 requires a strong collaborative approach to critically assess biomedical publications and research methodology. BBS1006 is assessed with an exam at the end of the course using multiple choice questions that measure both critical thinking about a provided article and application of the learned CABP process.

Course objectives

- Recognise and describe the empirical cycle in published biomedical articles
- Gain knowledge on the technical aspects of a biomedical publication
- Argue/ value the quality aspects of a biomedical publication with respect to hypothesis, introduction, study design, research methodology, results reporting, results discussion and conclusions.
- Suggest alternatives and solutions related to flaws in publications
- 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
- Several quality checklists
- Literature around quality checklists
- Various books on research methodology

Bachelor Biomedical Sciences

BBS1006

Period 6

12 Jun 2023

7 Jul 2023

[Print course description](#)

ECTS credits:

5.0

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

Non-invasive Techniques in Biomedical Research

Full course description

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 invasive and non-invasive imaging techniques, frequently used in both research and clinic, will be introduced and discussed. These techniques are advanced optical microscopy, MS Imaging, MRI/MRS, PET/CT, and Breath/faeces analysis.

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 1 to 4 the students will work on writing an Imfolio individually, containing up-to-date information on the practicals of each week.

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 (e.g., half the tutor groups) will work on the assignment from the start of the block. They will defend their (group) assignment at the end of the block in to other sub groups. Both defense and asking questions to other sub groups will be graded, including self-assessment.

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:

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

Recommended reading

Will be discussed during the block

BBS2003

Period 3

9 Jan 2023

3 Feb 2023

[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, Participation

Keywords:

Non-invasive and invasive imaging Biomedical research Medical research

Fac. Health, Medicine and Life Sciences

Statistics: Linear and Logistic Regression and Repeated Measures Analysis

Full course description

In this course the statistical techniques linear regression, 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

Goals: Linear regression analysis, 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 biomedical data and can interpret the obtained results.

Bachelor Biomedical Sciences

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, residuals, residual plot, histogram of residuals, normal probability plot, interaction, R-square, sum of squares, multiple comparisons, Bonferroni adjustment, relation between regression analysis and independent-samples t-test or Pearson correlation coefficient, dichotomous dependent variable, risk, relative risk, odds, odds ratio, confidence interval for odds ratio, relation between relative risk and odds ratio, different sources for correlated data, linear mixed model analysis, fixed effect variable, random effect variable, random intercept model, interpretation of fixed effects parameters, variance of random intercepts, variance of residuals, intra-class correlation (ICC).

Recommended reading

Rosner, B. Fundamentals of Biostatistics, 8th edition, Brooks/Cole Cengage Learning, 2016. Field, A. Discovering statistics using IBM SPSS statistics, 5th edition, Sage, 2017. (David S. Moore, George P. McCabe, Bruce A. Craig. Introduction to the Practice of Statistics, 9th edition, MacMillan Learning, 2017.)

BBS2007

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

3.0

Instruction language:

English

Coordinator:

- [B. Winkens](#)

Teaching methods:

Lecture(s), Training(s)

Assessment methods:

Attendance, Written exam

Keywords:

Linear regression, logistic regression, analysis of repeated measurements.

Fac. Health, Medicine and Life Sciences

Philosophy in Action II

Full course description

Sophia II is taught in two separate trajectories, one in autumn and one in spring.

In the first part of the Sophia II trajectory, students will be made aware of and analyze the ethical aspects of both predictive genetic testing for (future) diseases and the trend to emphasize 'personal and parental responsibility for health'.

In the second part of the Sophia II trajectory, students will venture into the philosophy and the sociology of science. Both of these disciplines study science, its processes, its object, its culture and

Bachelor Biomedical Sciences

its inhabitants not unlike science itself studies a multitude of natural or social objects. Over the course of the Sophia trajectory 'Credibility in and of science', students will encounter a number of (probably) familiar and (possibly) less familiar ways to think about what science is and does, and how it is related to society at large.

Combined, the two parts of Sophia II will offer students the capacity to critically reflect on social, political, international and normative issues in biomedical science and critically reflect on the nature of science itself.

The mark is calculated as the average of the mark for the course part I and course part II [50% each], in which part I requires attendance at the symposium, a passing grade for the presentation and reflection and a sufficient score for the group paper. Part II requires attendance in group discussion meetings and its grade is derived from the pod-cast mark (85%) and the group reflection (15%).

Course objectives

I-ILO1: Summarize and reflect on social, political, international and normative issues in biomedical science

BBS2008

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

3.0

Instruction language:

English

Coordinator:

- [G.M.W.R. de Wert](#)

Teaching methods:

Assignment(s), Lecture(s), Work in subgroups, Paper(s), Research

Assessment methods:

Assignment, Final paper

Fac. Health, Medicine and Life Sciences

The Core of Biomedical Sciences

Full course description

During this course, students get the opportunity to work in one of a research lab of the Maastricht University and MUMC+. This part of the course is dedicated to learning basic principles, opportunities and challenges of techniques/methods/skills that will contribute to the development towards an investigator. For 6 weeks, the students will be immersed in a research environment where they will have the opportunity to interact with research teams and learn from expert in various fields of the biomedical area (e.g. oncology, cardiovascular, neurosciences, metabolism, bioinformatics, genetics, imaging).

Bachelor Biomedical Sciences

Students will work in groups of 5 students, and will learn step-by-step to work with these techniques/methods/skills; and how to explain to their peers the best standard operating procedures. Students will also attend workshops on video editing and at the end of the course a skills clip demonstrating the technique practiced will be presented. The course offers a wide variety of research topics and techniques that the students can select, including (list non-exhaustive): mass spectrometry imaging (MSI); Light microscopy; Magnetic resonance imaging (MRI); electromyography; glucose analysis; blood pressure measurement; western blots; PCR; FISH combined to confocal imaging. Some projects are also dedicated to Data analysis.

Course objectives

Competence Investigator

- I-ILO1. Write a critical reflection on a scientific theme from an ethical and societal perspectives
- I-ILO2. Writes a clear standard operating procedure with explicitly deduced hypotheses, an appropriate study design
- I-ILO3. Explain the basic principles of the techniques learnt
- I-ILO4. Review the current opportunities and limitations of the technique(s)
- Describe the opportunities of the technique(s)
- Describe the technological limitations to the technique(s)
- Describe the main challenges for translation towards clinical practice (if applicable)

Competence Biomedical Expert

Students determine their own ILOs related to the competence Biomedical Expert at the beginning of the course and in discussion with the Practical project supervisor.

Competence Communicator

- C-ILO1. Designs and produces a skills clip for peers (writes scenario and script, records, edits and publishes a skills clip collaboratively) - about her/his work with persons with different backgrounds.
- C-ILO2. Provides effective feedback to peers on their contribution to the group activity (during the lab work), and the quality of the skills clips (on design, structure and content)
- C-ILO3. Cooperates with peers to design a protocol and answer a specific research question

Competence Professional

- P-ILO1. Behaves in a respectful, professional and reliable manner in practical trainings, internships and group work
- P-ILO2. Accepts responsibility for his/her own professional performance and is prepared to accept standards of accountability
- P-ILO3. Organises his/her work and study well

BBS3004

Period 4

6 Feb 2023

7 Apr 2023

[Print course description](#)

ECTS credits:

6.0

Bachelor Biomedical Sciences

Instruction language:

English

Coordinators:

- [E. Cuypers](#)
- [D. Kapsokalyvas](#)

Teaching methods:

Assignment(s), Work in subgroups, Research, Skills

Assessment methods:

Assignment, Attendance, Participation, Presentation, Final paper

Keywords:

research project, group

Fac. Health, Medicine and Life Sciences

Philosophy in Action III

Full course description

The course 'Sociology and Philosophy in Action III, Books and Letters' challenges students to understand science philosophical and sociologic positions, as well as multiple views of science and the relationship between science and society, to apply this knowledge to explain or contrast these different views through a twofold process of first familiarising oneself with a subset of them and subsequently use these positions to participate in ongoing scientific debates.

To this end, students will read, in full, an approved book drawn from the philosophy, sociology or history of science and translate its conceptual apparatus to a scientific debate of their own selection. This will allow them to synthesize conceptual understanding of biomedical science with actual scientific problems or public dilemmas and constructively participate in scientific exchanges.

As part of the course, students will receive instructions in the form of lectures and meetings to help them review the relevant literature, draft their own contributions, review peer contributions, work with reviews of their own work and compile all elements in a portfolio. The course will be assessed through two written assignments. The book review counts towards 40% and the portfolio of letters and reviews counts towards 60% of the grade.

Course objectives

Detailed learning objectives are listed in the coursebook:

1. You will have knowledge and understanding of science philosophical positions, as well as of multiple conceptualisations of science and the relationship between science and society;
2. You can apply this knowledge to explain or contrast or confront one view of science and scientific practice with others, as they populate science and society;
3. You can assess science philosophical problems critically and provide arguments for said assessment;
4. You can position science theoretical and science political issues (within the broader realm of the biomedical sciences) in a wider societal perspective.
5. You can synthesize conceptual understanding of biomedical science with actual scientific problems or public dilemma's.
6. You can translate conceptual understanding from its source [book project] to real-world problems [the letter project].

7. You can actively and constructively participate in scientific exchanges.

BBS3007

Period 4

6 Feb 2023

7 Apr 2023

[Print course description](#)

ECTS credits:

2.0

Instruction language:

English

Coordinator:

- [G.M.W.R. de Wert](#)

Teaching methods:

Assignment(s), Lecture(s), Work in subgroups, Paper(s)

Assessment methods:

Assignment, Portfolio

Competence Communicator and Collaborator

Fac. Health, Medicine and Life Sciences

Scientific Writing I

Full course description

This course is part of the Communicator and Collaborator competence, which is a longitudinal trajectory during the entire study year. Students learn to write reports using the format of scientific articles consisting of an Introduction, a Materials and Methods section, a Results section, a Discussion and a Reference list. In each of the 8-week courses of the first year (BBS1001, BBS1002, BBS1004, BBS1005), students have to write an individual report based on a lab practical. Students are assigned to one assessor for the entire first bachelor year. This assessor will introduce the students to scientific writing during assessor meetings in the first 2 courses and will provide feedback on the first versions of all 4 individual reports. Based on this feedback, students hand in a second, improved version, which will then be graded (No Grade/Fail/Pass/Good). Students have to hand in 4 papers in the first year, of which at least 3 should be a Pass or Good in order to receive the corresponding ECTS for this trajectory in year 1. Plagiarism, fraud, incomplete reports and reports handed in after the communicated deadline will result in a No Grade for that paper and an overall No Grade (and thus no ECTS) for Scientific Writing for the whole year.

Course objectives

C-ILO1. Adjusts communication written or oral, to specific global audience/readership and international setting

- Reports on methods, results and discussion sections according to current conventions.
- Meets obligations in writing academic reports free of fraud and plagiarism

Recommended reading

1. Kotz D, Cals JW. Effective writing and publishing scientific papers--part I: how to get started. J Clin Epidemiol. 2013;66(4):397. 2. Cals JW, Kotz D. Effective writing and publishing scientific papers, part II: title and abstract. J Clin Epidemiol. 2013;66(6):585. 3. Cals JW, Kotz D. Effective writing and publishing scientific papers, part III: introduction. J Clin Epidemiol. 2013;66(7):702. 4. Kotz D, Cals JW. Effective writing and publishing scientific papers, part IV: methods. J Clin Epidemiol. 2013;66(8):817. 5. Kotz D, Cals JW. Effective writing and publishing scientific papers, part V: results. J Clin Epidemiol. 2013;66(9):945. 6. Cals JW, Kotz D. Effective writing and publishing scientific papers, part VI: discussion. J Clin Epidemiol. 2013;66(10):1064. 7. Kotz D, Cals JW. Effective writing and publishing scientific papers, part VII: tables and figures. J Clin Epidemiol. 2013;66(11):1197. 8. Cals JW, Kotz D. Effective writing and publishing scientific papers, part VIII: references. J Clin Epidemiol. 2013;66(11):1198.

BBS1021

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

4.0

Instruction language:

English

Coordinator:

- [A.W. Boots](#)

Teaching methods:

Assignment(s), Paper(s)

Assessment methods:

Assignment, Final paper

Keywords:

Scientific writing, hypothesis-driven research, empirical cycle, referencing, plagiarism

Fac. Health, Medicine and Life Sciences

End Note

BBS1121

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

0.0

Instruction language:

English

Coordinator:

- [S.E. Köhler](#)

Presenting, Intercultural Awareness I

Full course description

This course is part of the Communicator and Collaborator competence and consist of two elements: a) presenting and b) intercultural awareness.

1. Students learn to give oral presentations, individually and/or in small groups. In BBS1002 they receive an interactive lecture on presentation skills. During the study year they present learning goals in tutorial groups on a regular basis. Regarding the presenting part of BBS1022, students have to collect feedback on 1 individual oral presentation using an electronic form.
2. Students attend a workshop on cultural diversity.

Course objectives

C-ILO1. Adjusts communication written or oral, to specific global audience/readership and international setting

1. 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

1. Interacts effectively in all educational settings

C-ILO3.

1. Reflect on your own multicultural personality and cultural intelligence.
2. Raise awareness on the importance of intercultural competence for functioning within diverse groups.

BBS1022

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

2.0

Instruction language:

English

Coordinators:

- [S.H. van Rijt](#)
- [J.M.E.M. Cosemans](#)

Teaching methods:

Assignment(s), Presentations

Bachelor Biomedical Sciences

Assessment methods:

Presentation, Attendance

Keywords:

Oral presentation, cultural diversity

Fac. Health, Medicine and Life Sciences

Communication and Cooperation (MSF) I

Full course description

This course is part of the Communicator and Collaborator competence, which is a longitudinal trajectory that spans over the study year. In all eight-week courses and in a selection of the four-week courses, students are being assessed and receive feedback from their tutor and peers on their communicative and collaborative skills in the tutorial groups or the academic project groups. An electronic multisource feedback form is used for this purpose. Among others, quality of expression, contribution to the group process, collegiality and attitude as a team member is assessed. Obtained scores are combined at the end of the of year (see assessment plan of the C-competence for details). Next to receiving feedback, students provide feedback to fellow students and perform self-assessments.

Course objectives

C-ILO3. Shows awareness of team roles and takes responsibly her/his position in a diversely composed international team

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

BBS1023

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

4.0

Instruction language:

English

Teaching methods:

PBL, Work in subgroups

Assessment methods:

Observation

Keywords:

multisource feedback

Fac. Health, Medicine and Life Sciences

Scientific Writing II

Full course description

In this longitudinal trajectory, which is part of the Communicator and Collaborator competence, students continue to write scientific reports. Assessors differ for each report. In addition to the requirements of the first year, students learn how to write an abstract/summary. During BBS2001, students write an individual full paper based on a lab class. In BBS2002 and in BBS2041/BBS2042 students are asked to write a group paper based on a lab class or an assignment. In BBS2003, students write an individual abstract/summary. Similar to year 1, students receive feedback on the first version of the paper and a grade (No Grade/Fail/Pass/Good) on the improved version. All papers in year 2 need to be assessed with a Pass or a Good in order to complete this trajectory and receive all ECTS corresponding to it. Fraud, plagiarism, incomplete papers or papers handed in after the set deadline will result in a No Grade.

Course objectives

C-ILO1. Adjusts communication written or oral, to specific global audience/readership and international setting

1. Writes a lab report in the style of a research paper in accordance with current conventions
2. Gives effective feedback to peers about written lab reports

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

1. Meets obligations in scientific writing reports free of fraud and plagiarism

Recommended reading

1. Kotz D, Cals JW. Effective writing and publishing scientific papers--part I: how to get started. *J Clin Epidemiol.* 2013;66(4):397. 2. Cals JW, Kotz D. Effective writing and publishing scientific papers, part II: title and abstract. *J Clin Epidemiol.* 2013;66(6):585. 3. Cals JW, Kotz D. Effective writing and publishing scientific papers, part III: introduction. *J Clin Epidemiol.* 2013;66(7):702. 4. Kotz D, Cals JW. Effective writing and publishing scientific papers, part IV: methods. *J Clin Epidemiol.* 2013;66(8):817. 5. Kotz D, Cals JW. Effective writing and publishing scientific papers, part V: results. *J Clin Epidemiol.* 2013;66(9):945. 6. Cals JW, Kotz D. Effective writing and publishing scientific papers, part VI: discussion. *J Clin Epidemiol.* 2013;66(10):1064. 7. Kotz D, Cals JW. Effective writing and publishing scientific papers, part VII: tables and figures. *J Clin Epidemiol.* 2013;66(11):1197. 8. Cals JW, Kotz D. Effective writing and publishing scientific papers, part VIII: references. *J Clin Epidemiol.* 2013;66(11):1198.

BBS2010

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

4.0

Instruction language:

English

Coordinator:

- [A.W. Boots](#)

Teaching methods:

Assignment(s)

Assessment methods:

Assignment

Keywords:

Scientific writing, hypothesis-driven research, empirical cycle, referencing, plagiarism

Fac. Health, Medicine and Life Sciences

Presenting, Intercultural Awareness II

Full course description

This course is part of the Communicator and Collaborator competence and consist of two elements: a) presenting and b) intercultural awareness.

1. Students learn to give oral and poster presentations, individually and/or in small groups. In BBS2001 they receive a presentation training. During the study year they regularly present during tutorial groups and/or academic projects. Regarding the presenting part of BBS2011, students have to collect feedback on 3 presentations (see assessment plan of the C-competence for details).
2. Students attend a workshop about communication in an intercultural setting.

Course objectives

C-ILO1. Adjusts communication written or oral, to specific global audience/readership and international setting

1. Orally presents lab work to a group of peers
2. Designs and presents a poster of lab work

C-ILO2. Communicates professionally with peers and staff originating from diverse cultural and disciplinary backgrounds

1. Participates in and initiates discussion during peer presentations
2. Communicates respectfully

C-ILO3

1. Collaborate with others in multi- and interdisciplinary teams
2. Demonstrate (verbal and non-verbal) communicator skills across cultural and disciplinary boundaries

Recommended reading

BBS2011

Year

Bachelor Biomedical Sciences

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

2.0

Instruction language:

English

Coordinators:

- [S.H. van Rijt](#)
- [J.M.E.M. Cosemans](#)

Teaching methods:

Presentation(s), Assignment(s)

Assessment methods:

Presentation, Attendance

Keywords:

Poster presentation, Oral presentation, cultural diversity

Fac. Health, Medicine and Life Sciences

Communication and Cooperation (MSF) II

Full course description

This course is part of the Communicator and Collaborator competence, which is a longitudinal trajectory that spans over the study year. In all eight-week courses and in a selection of the four-week courses, students are being assessed and receive feedback from their tutor and peers on their communicative and collaborative skills in the tutorial groups or the academic project groups. An electronic multisource feedback form is used for this purpose. Among others, quality of expression, contribution to the group process, collegiality and attitude as a team member is assessed. Obtained scores are combined at the end of the of year (see assessment plan of the C-competence for details). Next to receiving feedback, students provide feedback to fellow students and perform self-assessments.

Course objectives

C-ILO3. Shows awareness of team roles and takes responsibly her/his position in a diversely composed international team

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

BBS2012

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

4.0

Instruction language:

Bachelor Biomedical Sciences

English

Teaching methods:

Work in subgroups, PBL

Assessment methods:

Observation

Keywords:

multisource feedback

Competence Professional and Organisator

Fac. Health, Medicine and Life Sciences

Professional Behaviour (MSF) I

Full course description

This course is part of the Professional and Organizer competence, which is a longitudinal trajectory that spans over the study year. In all eight-week courses and in a selection of the four-week courses, students are being assessed and receive feedback from their tutor and peers on their professional behavior and organization skills in the tutorial groups or the academic project groups. An electronic multisource feedback form is used for this purpose. Among others, attendance, being on time, (professional) behavior in group processes and openness to feedback from others is assessed. Obtained scores are combined at the end of the of year (see assessment plan of the P-competence for details). Next to receiving feedback, students provide feedback to fellow students and perform self-assessments.

Course objectives

P-ILO1. Demonstrates appropriate interpersonal behaviour

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

P-ILO-4. Organizes his/her work and study well

- Distributes workload throughout a course or project

BBS1035

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

3.0

Instruction language:

English

Teaching methods:

Work in subgroups, PBL

Assessment methods:

Attendance, Observation

Laboratory Practice

Full course description

The aim of this course is to provide students with the skills necessary for a “driver’s license” for the laboratory. This includes the knowledge about Good Laboratory Practice (GLP) standards and the acquisition of basic lab skills: working according to safety rules, handling of toxic solutions, proper removal of waste, pipetting, weighing, pH adjustments, making buffers and other solutions, preparing calibration curves, spectrophotometric measurements, centrifugation, gel electrophoresis, usage of basic lab equipment (pipettes, scales, pH-meters, spectrophotometer, water baths, centrifuges, glassware, cold rooms, incubators).

Students participate in several lab classes throughout year 1, which are linked to specific courses (e.g. creatinine clearance, DNA isolation, restriction analysis, agarose gel electrophoresis, PCR), but in addition to that, course-overarching lab classes and exams have to be followed by all students to pass the requirements for BBS1038.

These consists of: 3 obligatory lab classes on GLP (during BBS1001), an introduction to the dissection hall (human anatomy, during BBS1001), 2 teacher-independent lab classes ILT1 and ILT2 (vitamin C determination, toluidine blue determination), several calculation exams on typical laboratory calculations (2 obligatory tests with normative feedback, one obligatory summative test) and a final lab skills test. All lab classes require preparation and upload of results using the online platform LabBuddy. Adequate preparation and uploading of results for ILT1 and ILT2 is required to receive a pass. More details regarding the assessment are stated in the Assessment plan of the P-competence year 1, which is available on the intranet.

Course objectives

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

1. Lists the principles of keeping a lab notebook
2. Works according to principles of GLP

BBS1038

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

4.0

Instruction language:

English

Coordinator:

- [H.E. Popeijus](#)

Teaching methods:

Bachelor Biomedical Sciences

Skills

Assessment methods:

Assignment, Attendance

Keywords:

Good Laboratory Practice (GLP), labbuddy

Fac. Health, Medicine and Life Sciences

Professional Development I

Full course description

Students compile an electronic portfolio, which among others contains 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, career reports, self evaluations, reflections and learning goals.

Students use the portfolio to monitor and steer their professional development. Throughout the year guidance is provided to the student by a mentor. At the end of the academic year the portfolio is assessed by the portfolio assessment committee.

Course objectives

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

1. Accepts feedback; Critically reflects on his/her learning and academic development
2. 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

BBS1039

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

3.0

Instruction language:

English

Teaching methods:

Work in subgroups, Assignment(s)

Assessment methods:

Portfolio

Keywords:

Portfolio, professional development

Fac. Health, Medicine and Life Sciences

Lab Skills

BBS1040

Year

5 Sep 2022

31 Aug 2023

Bachelor Biomedical Sciences

[Print course description](#)

ECTS credits:

0.0

Instruction language:

English

Coordinator:

- [H.E. Popeijus](#)

Fac. Health, Medicine and Life Sciences

Calculation Test

BBS1041

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

0.0

Instruction language:

English

Coordinator:

- [H.E. Popeijus](#)

Fac. Health, Medicine and Life Sciences

Lab Notebook II

Course objectives

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

1. Keeps a well-structured lab notebook

BBS2030

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

2.0

Instruction language:

English

Coordinator:

- [H.E. Popeijus](#)

Teaching methods:

Skills

Assessment methods:

Attendance, Observation

Professional Behaviour (MSF) II

Full course description

This course is part of the Professional and Organizer competence, which is a longitudinal trajectory that spans over the study year. In all eight-week courses and in a selection of the four-week courses, students are being assessed and receive feedback from their tutor and peers on their professional behavior and organization skills in the tutorial groups or the academic project groups. An electronic multisource feedback form is used for this purpose. Among others, attendance, being on time, (professional) behavior in group processes and openness to feedback from others is assessed. Obtained scores are combined at the end of the of year (see assessment plan of the P-competence for details). Next to receiving feedback, students provide feedback to fellow students and perform self-assessments.

Course objectives

P-ILO1. Demonstrates appropriate interpersonal behaviour

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

P-ILO-4. Organizes his/her work and study well

- Distributes workload throughout a course or project

BBS2031

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

4.0

Instruction language:

English

Teaching methods:

Work in subgroups, PBL

Assessment methods:

Observation, Attendance

Keywords:

multisource feedback

Fac. Health, Medicine and Life Sciences

Professional Development II

Full course description

Students compile an electronic portfolio, which among others contains 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, career reports, self evaluations, reflections and learning goals.

Students use the portfolio to monitor and steer their professional development. Throughout the year guidance is provided to the student by a mentor. At the end of the academic year the portfolio is assessed by the portfolio assessment committee.

Course objectives

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

1. Accepts feedback; Critically reflects on personal values and priorities with minor help of mentor and develops strategies to promote personal growth
2. 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
3. Chooses electives, minor courses and bachelor thesis subject based on future career plans

BBS2032

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

4.0

Instruction language:

English

Teaching methods:

Work in subgroups, Assignment(s)

Assessment methods:

Portfolio

Keywords:

Portfolio, professional development

Fac. Health, Medicine and Life Sciences

Professional Development III

Full course description

Students compile an electronic portfolio, which among others contains 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, career reports, self evaluations, reflections and learning goals.

Students use the portfolio to monitor and steer their professional development. Throughout the year guidance is provided to the student by a mentor. At the end of the academic year the portfolio is assessed by the portfolio assessment committee.

Course objectives

P-ILO-3: Takes responsibility for her/his personal and academic development

1. Reflects on strengths and weaknesses in his/her own professional performance and, in that way, can guide his/her own learning process and accepts responsibility for his/her own professional growth, aiming to engage in lifelong development (as a biomedical scientist).
2. Formulates SMART learning goals – independently - in order to take adequate action with a view to raising her/his competencies up to the desired level
3. Makes a well-considered career choice that matches her/his own capabilities

BBS3051

Year

5 Sep 2022

31 Aug 2023

[Print course description](#)

ECTS credits:

2.0

Instruction language:

English

Teaching methods:

Work in subgroups, Assignment(s)

Assessment methods:

Observation, Portfolio

Keywords:

Portfolio, professional development

Integrated Competencies Biomedical Sciences

Fac. Health, Medicine and Life Sciences

Presentation

Full course description

For more info see BBS3005 (internship) and BBS3006 (thesis)

BBS3008

Period 5

10 Apr 2023

9 Jun 2023

[Print course description](#)

ECTS credits:

0.0

Instruction language:

English

Coordinator:

- [J.W.E. Jocken](#)

Fac. Health, Medicine and Life Sciences

Internship

Full course description

Twelve weeks are dedicated to the internship and to writing the bachelor's thesis in the bachelor's phase of the Biomedical Sciences programme. The internship focuses on becoming acquainted with research, meaning that the student will need to gain experience in performing biomedical scientific research, preferably within an existing study. This (sub) study is the basis for the bachelor's thesis. An internship within FHML (Faculty of Health, Medicine and Life Sciences) or MUMC+ (Maastricht University Medical Centre Plus) is considered an internal internship; any other internship is considered an external internship. The term 'FHML' is used in the rest of this document to indicate both FHML and MUMC+ for the sake of brevity. An internship within FHML is supervised by the 'faculty supervisor' i.e. the 'first assessor' (examiner). This supervisor must meet the requirements as stated in the exam regulations. Besides the faculty supervisor, there can be one or more daily supervisors. For internships outside FHML, a student has one or more external supervisors besides the faculty supervisor. The thesis will be assessed by the faculty supervisor and by an independent second assessor. The internship coordinator for the Bachelor Biomedical Sciences is the first contact person for the student for questions concerning the preparation and content of an internal or external internship. The coordinator will provide information on the internship by means of a lecture: the possibilities and impossibilities, the procedure, the conditions, etc.

Course objectives

The internship focuses on becoming acquainted with research, meaning that the student will need to gain experience in performing biomedical scientific research, preferably within an existing study. This (sub) study is the basis for the bachelor's thesis.

BBS3005

Period 5

10 Apr 2023

9 Jun 2023

[Print course description](#)

ECTS credits:

0.0

Instruction language:

English

Coordinator:

- [J.W.E. Jocken](#)

Fac. Health, Medicine and Life Sciences

Thesis

Full course description

Twelve weeks are dedicated to the internship and to writing the bachelor's thesis in the bachelor's phase of the Biomedical Sciences programme. The internship focuses on becoming acquainted with research, meaning that the student will need to gain experience in performing biomedical scientific

Bachelor Biomedical Sciences

research, preferably within an existing study. This (sub) study is the basis for the bachelor's thesis. An internship within FHML (Faculty of Health, Medicine and Life Sciences) or MUMC+ (Maastricht University Medical Centre Plus) is considered an internal internship; any other internship is considered an external internship. The term 'FHML' is used in the rest of this document to indicate both FHML and MUMC+ for the sake of brevity. An internship within FHML is supervised by the 'faculty supervisor' i.e. the 'first assessor' (examiner). This supervisor must meet the requirements as stated in the exam regulations. Besides the faculty supervisor, there can be one or more daily supervisors. For internships outside FHML, a student has one or more external supervisors besides the faculty supervisor. The thesis will be assessed by the faculty supervisor and by an independent second assessor. The internship coordinator for the Bachelor Biomedical Sciences is the first contact person for the student for questions concerning the preparation and content of an internal or external internship. The coordinator will provide information on the internship by means of a lecture: the possibilities and impossibilities, the procedure, the conditions, etc.

Course objectives

The internship focuses on becoming acquainted with research, meaning that the student will need to gain experience in performing biomedical scientific research, preferably within an existing study.

BBS3006

Period 5

10 Apr 2023

9 Jun 2023

[Print course description](#)

ECTS credits:

20.0

Instruction language:

English

Coordinator:

- [J.W.E. Jocken](#)

Minor

Minor

Fac. Health, Medicine and Life Sciences

Diet, Nutrition and Health

Full course description

General information

It is generally acknowledged that nutrition plays an important role in an optimal development and maintaining health throughout the life course. As such, optimal nutrition not only plays an important role in disease prevention but also in disease management. Current nutritional guidelines mainly focus on obesity, cardiovascular disease and type 2 diabetes. However, increasing experimental and clinical evidence suggests that nutrition can also be considered a modifiable factor to prevent the onset and progression of other chronic diseases, such as Alzheimers, COPD, macular degeneration,

non-alcoholic fatty liver disease, Irritable Bowel Syndrome and intestinal bowel diseases. Therefore, the main aim of the minor Nutrition is to study the role of (personalized) nutrition in the prevention and treatment of chronic diseases.

Tutorials, lectures and journal clubs

Within the course, a variety of 5 different areas will be discussed for 1-2 weeks each. These areas include the brain, intestines, liver, lungs and eyes and will cover a variety of different diseases including amongst others Alzheimers, macular degeneration, non-alcoholic fatty liver disease, COPD, lung cancer, celiac disease, Irritable Bowel Syndrome and intestinal bowel disease. The different areas will be covered in multiple lectures and will be further discussed using typical problem-based learning cases. Additionally, for each area a scientific paper will be discussed during a journal club.

Academic project

During the course, students will work in groups on an academic project, which will be guided by an experienced researcher. In this project, students will be asked to develop and follow either a diet low in gluten or a diet high in fiber. Each group will prepare a “making of”-movie about their experiences preparing and following the diet. Before and after the diet, students will measure several parameters which are related to the topics discussed in the PBL cases; i.e. cognition, bowel complaints, blood pressure etc. Once the measurements have been completed, results for each diet group will be combined, and each group of students will write a scientific report and give a presentation during the mini-symposium.

Practical

Next to the academic project, students will also learn how the role of nutrition in chronic disease can be investigated in an experimental setting. Students will perform a cell-culture experiment in the lab. C2C12 myoblasts will be cultured and stimulated with a nutritional component. After three days, students come back to the lab and measure the activity of a specific reporter in the cells to assess the effect of the nutritional component.

Visiting a nutritional company

Translating the concepts of basic nutritional science is necessary for the production of advanced clinical nutrition products. The Nutricia Research Centre in Utrecht is a company that builds bridges between science and food. Students will visit the centre in Utrecht not only to get insight on how nutritional products are being developed, but also to see an example where they could work after finishing biomedical sciences.

Assessment

Students will pass the course in case of 100% attendance, a pass for the academic project and the practical report and a sufficient mark on the final written exam.

BBS3013

Period 1

5 Sep 2022

28 Oct 2022

[Print course description](#)

ECTS credits:

12.0

Instruction language:

Immune Responses in Health and Disease

Full course description

The immune system is a remarkable natural system that is proving to be of great inspiration to scientists, medical staff and students. It is ubiquitous in present life. This course provides a detailed study of the functioning of the immune system. Students acquire insights into the molecular and cellular interactions and functioning of the immune system in normal conditions. Topics include the development of immune cells, humoral and cell-mediated immunity, and tolerance. During the past decades, evidence has mounted that many (chronic) diseases are characterized by an imbalance of the immune system. Moreover, we are challenged by complex situations where it is demonstrated that the immune system plays a crucial role. Therefore, the role of the immune system in a variety of diseases and complex situations (e.g. cancer, autoimmunity, neurodegenerative diseases, microbial defense, pregnancy, transplantation and vaccination) will be studied in an integrated way during the project week and integration assignment.

Course objectives

ILO3014.1 Explain the structure and function of lymphoid organs and the development of leucocytes:

1. Describe and draw lymphoid organs and relate the structure of lymphoid organs to their function.
2. Explain the development of innate immune cells.
3. Explain the development and maturation of adaptive immune cells.
4. Explain the migration pathways of leucocytes in the body (during homeostasis and disease/infection).

ILO3014.2 Analyze the activation and downregulation of innate and adaptive immune responses:

1. Compare the innate and the adaptive immune system during sterile and non-sterile inflammation.
2. Explain the genetic base and diversity of MHC molecules and their role in disease.
3. Examine the immune regulation mechanisms of the immune system.

ILO 3014.3 Explain the roles of immune cells in the innate and adaptive immune systems in health:

1. Explain in time (4D), order, and function
2. Gender diversity and aging
3. Influence of nutrition/environment

ILO 3014.4 Understand and present the immune processes underlying immune related pathophysiology:

1. Hypersensitivity (incl allergy and autoimmunity)
2. Immunodeficiency
3. Cancer

ILO 3014.5 Understand and present strategies to modulate immune responses to improve human health:

1. Design a plan to translate an invention from research to clinical application.

ILO 3014.6 Explain techniques commonly used to investigate the phenotype and function of cells in immune responses:

1. Students know the basic principles and applications of serological and cellular immune tests and can correctly analyze and interpret the results.
2. Students understand the selection and application of practical immunological approaches to conduct an investigation.

Recommended reading

Books (recommendation): ● Abbas, A. K., Lichtman, A. H., Pillai, S., & Baker, D. L. (2022). Cellular and molecular immunology (Tenth). Elsevier. ● Abbas, A. K., Lichtman, A. H., Pillai, S., & Baker, D. L. (2020). Basic immunology: functions and disorders of the immune system (Sixth). Elsevier.

Articles (mandatory for journal club): ● Bijnen M et al. Adipose tissue macrophages induce hepatic neutrophil recruitment and macrophage accumulation in mice. Gut 2018 Jul;67(7):1317-1327.. ● Sarkar S et al. Hypoxia induced impairment of NK cell cytotoxicity against multiple myeloma can be overcome by IL-2 activation of the NK cells. Plos One 2013 May 28;8(5):e64835. ● Vanderlocht et al. Increased tumor-specific CD8+ T cell induction by dendritic cells matured with a clinical grade TLR-agonist in combination with IFN-gamma. Int J Immunopathol Pharmacol 2010;23(1):35-50. ● Cloosen S et al. Expression of tumor-associated differentiation antigens, MUC1 glycoforms and CEA, in human thymic epithelial cells: implications for self-tolerance and tumor therapy. Cancer Res 2007 Apr 15;67(8):3919-3926. ● Gomez A et al. Proteasome inhibition with Bortezomib depletes plasma cells and specific autoantibody production in primary thymic cell cultures from early-onset Myasthenia Gravis patients. J Immunol 2014;193:1055-1063.

BBS3014

Period 1

5 Sep 2022

28 Oct 2022

[Print course description](#)

ECTS credits:

12.0

Instruction language:

English

Teaching methods:

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

Assessment methods:

Assignment, Attendance, Final paper, Participation, Presentation, Written exam

Keywords:

Bachelor Biomedical Sciences

Development of immune system Humoral and cell-mediated immunity Tolerance Immune-related conditions Immunological therapies

Fac. Health, Medicine and Life Sciences

Neurosciences and Control

BBS3015

Period 1

5 Sep 2022

28 Oct 2022

[Print course description](#)

ECTS credits:

12.0

Instruction language:

English

Coordinator:

- [M. Mané Damas](#)

Fac. Health, Medicine and Life Sciences

Pharmacological Interventions

BBS3016

Period 1

5 Sep 2022

28 Oct 2022

[Print course description](#)

ECTS credits:

12.0

Instruction language:

English

Fac. Health, Medicine and Life Sciences

Physical Activity and Health

Full course description

Physical activity and health are linked inseparably. If you want to improve health, prevent disease, or reduce symptoms by changing behavior, physical activity is often the way to go. Different types of physical activity and physical exercise training each have their own impact on our physical fitness. So, each desired goal requires a specific training program.

In this minor you will apply knowledge about the impact of physical activity to design an intervention to improve the health of a specific target group. The challenge is to discover which physical activity and training leads to the desired effect in your chosen target group, as well as which characteristics you should take into account, like age, baseline physical fitness, nutritional status, personal characteristics, and context.

Throughout the minor, student groups will design an intervention plan based on the knowledge and experience they gain from lectures and tutorials. Experts in the field will illustrate the important

aspects in interactive lectures, which also includes time for Q&A about the project. Student groups shortly describe their intervention plans and can ask questions to the expert for the further development of their intervention. In addition to the lectures and tutorials, students will learn how to measure physical activity and cardiorespiratory fitness during practicals about cardiopulmonary exercise testing and activity monitoring.

Course objectives

In this minor you will have a close look into the relationship of physical activity and health, applied to feasible and effective interventions to promote health. To this end, you will learn primarily how physical activity affects your health, and which factors to consider when putting this into practice. Students will:

- Understand the physical activity dimensions: frequency, intensity, time, and type; ranging from inactivity to exercise
- Identify causes of inter-individual variation in human performance
- Design a physical activity/physical exercise training program adequate for the goal chosen in patients with a chronic disease
- Be able to select an adequate assessment method of physical fitness for a given population and research question
- Be able to select an adequate physical activity monitoring method using the strengths and weaknesses of the main types of physical activity monitoring
- Be able to account for dietary status while designing a PA program
- Understand the personal characteristics that should be taken into account when designing a PA program.

BBS3023

Period 2

31 Oct 2022

23 Dec 2022

[Print course description](#)

ECTS credits:

12.0

Instruction language:

English

Teaching methods:

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

Assessment methods:

Assignment, Final paper

Keywords:

physical activity, assessment methods, training modalities, Health, monitoring, adherence, Behavior
Fac. Health, Medicine and Life Sciences

Infection and Immunity

Full course description

While pathogenic microorganisms cause infections and evoke pro-inflammatory immune responses, billions of commensal microorganisms live in symbiosis with their host. This raises various intriguing questions on the delicate interactions between the immune system and the plethora of

microorganisms that we as a host encounter. How can our (mucosal) immune system maintain peace with trillions of commensal microbes, while keeping pathogens at bay? What is the role of the commensals in providing protection against pathogens and in training our immune system? What are the immunological health consequences of loss of microbial biodiversity? How do pathogens evolve to evade our immune system and cause disease? Which options do we currently have to treat or prevent infectious diseases and what are potential future personalized treatment strategies?

In this course these bi-directional host-microbe interactions during homeostasis and infection will be analysed and compared.

Course objectives

- To evaluate future solutions to treat and prevent deleterious infections and microbiome-mediated diseases
- To compare current strategies for the therapeutic treatment of infections by targeting the microbe or supporting the immune system
- To analyze the processes by which the immune system in response to an infection leads to pathology, and the consequences of failing to control infection
- To distinguish how the host's immune system discriminates between various microbes, and commensal vs. pathogenic bacteria
- To examine what determines microbial virulence and how commensals can turn into pathogens
- To understand the various microbial ecosystems in the human body and explain their role in maintaining human health and to analyze the link between lost microbial exposure and the rise in non-communicable/communicable diseases.

Recommended reading

Microbiology / Prescott 12th edition, 2022 Cellular and Molecular Immunology / Abbas 10th edition, 2021 (ISBN 9780323757485)

BBS3024

Period 2

31 Oct 2022

23 Dec 2022

[Print course description](#)

ECTS credits:

12.0

Instruction language:

English

Coordinator:

- [J. Penders](#)

Teaching methods:

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

Keywords:

Mucosal Immunology, Microbiome, Host-Microbe interactions, Innate immune system, Adaptive immune system, Microbiology, Bacteria, Antimicrobial therapy, Fecal Microbiota Transplantation, Vaccination, Virulence

Fac. Health, Medicine and Life Sciences

Omics Technologies and Their Analysis

Full course description

This course takes you on a journey through the varied landscape of -omics technologies and their applications. We discuss genomics screening methods, both focusing on detection of genetic variants and their association to diseases or other phenotypes, as well as transcriptomics detection of gene expression levels and their changes. Then we turn our attention to proteomics screening technologies, to determine protein abundances. Thereafter, metabolomics is discussed, to detect metabolites and determine their abundances. Finally, we touch upon the integration of the various methods and approaches. For the genomics part of the course, we mainly focus on the application of next-generation sequencing (genome, exome, and RNA sequencing). For proteomics, we discuss separation methods (gel electrophoresis, chromatography) and the most used technology for detection, mass spectrometry. Quantitative proteomics, as well as the combination with imaging technologies, are discussed. For metabolomics, next to gas and liquid chromatography and MS techniques, we discuss nuclear magnetic resonance (NMR) as a frequently used method. For all omics applications included in the course, we discuss sample preparation, quality control, the technology and equipment used, the data generated, its analytical processing, analysis and the interpretation of results. Besides specific omics, the course pays some attention to experimental design of omics-driven research. Also, various biomedical applications are explored. Furthermore, a number of wet-lab and computer practicals illustrate how to prepare samples, analyse them in the lab, process the generated data, and use online resources to interpret the findings. Also, in this course critical evaluation of published findings is taken into account. In addition, a group project has the application of the various omics methods to a dedicated biomedical domain as its core focus. A regular week features two one-hour lectures, one PBL tutorial, either a journal club or an experimental design discussion, a (wet-lab or computer) practical, and a meeting of the project group. Assessment consists of (i) a group presentation of the project work; (ii) a final exam with a number of open questions on the omics discussed as well as their application.

BBS3025

Period 2

31 Oct 2022

23 Dec 2022

[Print course description](#)

ECTS credits:

12.0

Instruction language:

English

Teaching methods:

Work in subgroups, Lecture(s), PBL, Presentation(s), Skills

Assessment methods:

Attendance, Participation, Presentation, Written exam

Keywords:

genomics transcriptomics proteomics metabolomics next-generation sequencing (NGS)
chromatography (GC, LC) mass spectrometry (MS, MS-MS) nuclear magnetic resonance (NMR)
Fac. Health, Medicine and Life Sciences

Environmental Health and Analytical Chemistry

Full course description

Epidemiological studies have linked several environmental pollutants to increased risks of developing (chronic) diseases in humans. For instance, increased levels of particulate air pollution during lifetime are associated to higher risks of developing asthma, but also lung cancer. Moreover, higher levels of heavy metals such as lead or pesticides, ingested through e.g. contaminated food, can increase the risk of developing neurodegenerative disease like Parkinson's and Alzheimer's disease in later life. Identifying these toxicological risks and subsequently to manage these is crucial for human health. This minor course will focus on understanding the influences and impact of environmental factors on humans. The course core concept is based on the risk governance framework wherein the main focus will be on the research information and needs within this framework.

Course objectives

The course will cover 5 main topics that will support the understanding of this framework:

1. Basic understanding of the principles of toxicology: What is toxicity, how can we classify different compounds (e.g. PFAS, PCB's, PAH's) for e.g. carcinogenicity, how are we exposed (Environment-effect chain), what is the dose response relationship etc.
2. Understanding of different study designs to assess toxicity and the differences and (dis)advantages if comparing human epidemiology, animal and in vitro (cellular: 2D/3D models, non-cellular) studies.
3. (NMR, MS and ESR/EPR spectroscopy). For most techniques a side-visit to see the analytical techniques will be included. Theoretical and practical insight into different analytical tools used in toxicology research, namely electrophoresis (gel-, affinity-, capillary- and immuno-electrophoresis) and spectroscopy
4. Data-analysis and applications of (toxico)genomics and in-silico studies to assess toxicity, including a computer practical where students will be able to work on their own data-set for a specific compound
5. Understanding of the risk governance framework for risk assessment and management of (complex) risks, with air pollution as an example.

Practical skills:

Practical performing ESR/EPR spectroscopy and computer practical for analysis of toxicogenomics datasets, as well as site-visits for demonstration of the analytical techniques on-site. You will conduct your own Toxicogenomics project, thereby working on actual research data comprising human demographic and exposure data as well as high-dimensional transcriptomics data derived from human blood cells. The aim of the project is to decipher the molecular impact of environmental pollutants on human health. Therefore, you will apply fundamental bioinformatics and statistics approaches to identify genes and pathways which may contribute to the chain of events connecting environmental exposure to increased risk of chronic diseases. Moreover, the results will be interpreted with respect to improving our understanding of the pathogenesis of environmentally-induced diseases, identifying at-risk populations, and potentially discovering of pre-clinical markers of disease related to environmental exposures

Bachelor Biomedical Sciences

BBS3026

Period 2

31 Oct 2022

23 Dec 2022

[Print course description](#)

ECTS credits:

12.0

Instruction language:

English

Teaching methods:

Assignment(s), Work in subgroups, Lecture(s), Paper(s), PBL, Presentations, Research, Skills, Training(s), Working visit(s)

Assessment methods:

Assignment, Attendance, Final paper, Participation, Presentation

Keywords:

environmental, Health, risk governance framework, analytical techniques, bioinformatics, chromatography, mass spectrometry

Fac. Health, Medicine and Life Sciences

Critical Review of a Biomedical Intervention

Full course description

This 4-week course is part of the minor program and focusses on biomedical interventions. In the first 8-week course of the minor programme, the focus has been on global diversity in interventions as well as on epidemiological aspects from both individual and population point of view. The second 8-week course of the minor programme addressed the molecular depth of various interventions. During both 8-week courses, the focus of the three trajectories was either drugs, nutrition or physical activity.

In this final 4-week course of the minor program, students will write a systematic literature review of a biomedical intervention that is either pharmacological, nutritional or physical based on the knowledge obtained in the trajectory followed during the first two minor courses. Reviews will be written in small groups of 3 to 4 students from the same minor background to focus on one concisely formulated research question related to the biomedical intervention route of their interest.

Course objectives

Applying academic skills to write a systematic literature review on a self-chosen biomedical intervention

Recommended reading

- A 24-step guide on how to design, conduct, and successfully publish a systematic review and meta-analysis in medical research | SpringerLink
- PRISMA (prisma-statement.org)
- PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews | The BMJ 4. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews | The BMJ

Bachelor Biomedical Sciences

BBS3003

Period 3

9 Jan 2023

3 Feb 2023

[Print course description](#)

ECTS credits:

6.0

Instruction language:

English

Coordinators:

- [A.W. Boots](#)
- [E.M.J.M. Schillings](#)

Teaching methods:

Assignment(s), Lecture(s), Paper(s), Research

Assessment methods:

Assignment, Final paper

Keywords:

academic writing narrative review

Educatieve Minor

Fac. Health, Medicine and Life Sciences

Vakdidactiek

Full course description

This study programme 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.

EDM3005

Period 1

5 Sep 2022

10 Mar 2023

[Print course description](#)

ECTS credits:

5.0

Instruction language:

Dutch

Coordinator:

- [J.H.J. Vernooy](#)

Fac. Health, Medicine and Life Sciences

Plantfysiologie en Ecologie

Full course description

This study programme 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.

EDM3006

Period 1

5 Sep 2022

10 Mar 2023

[Print course description](#)

ECTS credits:

5.0

Instruction language:

Dutch

Coordinators:

- [J.H.J. Vernooy](#)
- [H.E. Popeijus](#)

Fac. Health, Medicine and Life Sciences

Introductie en Werkplekieren I

Full course description

This study programme 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.

EDM3011

Period 1

5 Sep 2022

10 Mar 2023

[Print course description](#)

ECTS credits:

9.0

Instruction language:

Dutch

Coordinators:

- [J.H.J. Vernooy](#)
- [H.E. Popeijus](#)

Fac. Health, Medicine and Life Sciences

Pedagogisch Didactisch Traject

Full course description

This study programme is taught in Dutch. Hence, the programme information is only available in

Bachelor Biomedical Sciences

Dutch. If you would like to read the Dutch programme information, please choose 'NL' at the top of the website.

EDM3022

Period 1

5 Sep 2022

10 Mar 2023

[Print course description](#)

ECTS credits:

16.0

Instruction language:

Dutch

Coordinators:

- [J.H.J. Vernooy](#)
- [H.E. Popeijus](#)

Fac. Health, Medicine and Life Sciences

Werkplekieren II

Full course description

This study programme 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.

EDM3001

Period 4

6 Feb 2023

7 Apr 2023

[Print course description](#)

ECTS credits:

5.0

Instruction language:

Dutch

Coordinators:

- [J.H.J. Vernooy](#)
- [H.E. Popeijus](#)