

Major

## Competence Biomedical Expert

Fac. Health, Medicine and Life Sciences

### The LEGO Bricks of Life

#### Full course description

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

#### Course objectives

##### Intended Learning Outcomes (ILOs)

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

BBS1001

Period 1

1 Sep 2021

22 Oct 2021

[Print course description](#)

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)

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 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

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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

25 Oct 2021

17 Dec 2021

[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

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## Practicals Homeostasis and Organ Systems

BBS1102

Period 2

25 Oct 2021

17 Dec 2021

[Print course description](#)

ECTS credits:

0.0

Instruction language:

English

Coordinator:

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

# 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, 2011 - Surface electromyography: physiology, engineering and applications. Merletti and Farina. Publisher: IEEE Press, Wiley, 2016

BBS1004

Period 4

1 Feb 2022

1 Apr 2022

[Print course description](#)

Bachelor Biomedical Sciences

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

4 Apr 2022

3 Jun 2022

[Print course description](#)

ECTS credits:

7.0

Instruction language:

English

Coordinator:

- [U. von Rango - Hilmes](#)

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

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## 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

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study how to judge the adequate development during fetal and embryonic period.

**Practical 2: Anatomy - Body Plan + Gut**

Students will study general aspects of the body plan and will have a special look on the macroscopy of the gut system.

**Practical 3: Anatomy - Sexual differentiation - virtual microscopy**

Development of the gonads and differentiation of germ cells will be studied.

**Practical 4: Anatomy sexual organs**

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**

Student will isolation of genomic DNA from buccal cells and prepare lab buffers for practical days 2 and 3.

**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 concentration analysis and PCR**

Student will analyze the concentration of their DNA and perform a Polymerase Reaction (PCR) for Clade Marker M270.

**Lab practical 3: 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

4 Apr 2022

3 Jun 2022

[Print course description](#)

Bachelor Biomedical Sciences

ECTS credits:

0.0

Instruction language:

English

Coordinator:

- [U. von Rango - Hilmes](#)

Teaching methods:

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

Assessment methods:

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

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## 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

1 Sep 2021

22 Oct 2021

[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

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## 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,

**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

25 Oct 2021

17 Dec 2021

[Print course description](#)

ECTS credits:

6.0

Instruction language:

English

Coordinators:

- [M.A. Dentener](#)
- [A.H.N. Hopman](#)

Teaching methods:

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

Assessment methods:

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

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# 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

1 Feb 2022

1 Apr 2022

[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

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## 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

1 Feb 2022

1 Apr 2022

[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

## **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

BBS2051

Period 5

4 Apr 2022

3 Jun 2022

[Print course description](#)

ECTS credits:

- [S. Baumgartner](#)

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

4 Apr 2022

3 Jun 2022

[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

Recent advances in technology and in the analyses of biomolecules (DNA, RNA, proteins and metabolites) allow determining the levels of millions of hits at the same time in specimens. It is now possible to identify in one shot all mutations and chromosomal rearrangements present in one subject or in a patient; to determine the level of expression of the  $\pm 20.000$  human genes, the hundreds of thousands of proteins and of several biological metabolites including sugars, lipids, hormones, etc. This is the 'omics' revolution.

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

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

## Course objectives

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

## Recommended reading

1. Similarity network fusion for aggregating data types on a genomic scale. Bo Wang et al. Nature Methods 2014, 11, 233
2. Comprehensive Molecular Portraits of Invasive Lobular Breast Cancer Giovanni Ciriello et al. Cell 2015, 163, 506-19
3. <https://wiki.cancerimagingarchive.net/display/Public/TCGA+Breast+Phenotype+Research+Group>

BBS2061

Period 6

6 Jun 2022

1 Jul 2022

[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:

BREAST CANCER SYSTEM BIOLOGY CLASSIFICATION PROGNOSIS DRUG RESPONSE

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

6 Jun 2022

1 Jul 2022

[Print course description](#)

ECTS credits:

5.0

Instruction language:

English

Coordinators:

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

Bachelor Biomedical Sciences

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., & 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

6 Jun 2022

1 Jul 2022

Bachelor Biomedical Sciences

[Print course description](#)

ECTS credits:

5.0

Instruction language:

English

Coordinator:

- [J.J.M.E. Adam](#)

Teaching methods:

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

Assessment methods:

Assignment, Attendance, Final paper

Keywords:

hand-arm function - sensorimotor control - perception-action coupling - neuroplasticity - brain-computer interfaces

## Competence Investigator and Scholar

Fac. Health, Medicine and Life Sciences

## Introduction to Statistical Methods for Data Analysis

### Full course description

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

The focus is on statistical concepts and techniques that play a role in summarizing and describing observed variables and relationships between variables, as well as generalizing the results for a larger group than the observed group. The first theme of this course is to summarize the observed data. The second theme is the testing concept. The third theme pertains to various basic statistical techniques that are used to analyse observed data.

Some best practice statistical methods will be introduced and are considered as standard methods to deal with the above stated questions.

### Course objectives

Important learning goals in this course are:

- Knowledge of descriptive statistics (including frequency, average, median, standard deviation, cross-classified table among others).
- Knowledge of the principles of inferential statistics, such as population distribution, sample distribution, sampling distribution, central limit theorem, hypothesis testing, p-value, and confidence interval.
- Knowledge of the basic principles and concepts of elementary statistical techniques (including t-test, chi-square test, and simple linear regression).
- Knowledge of the differences and similarities between the various basic techniques (such as a t-test and simple linear regression).

## Bachelor Biomedical Sciences

- 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

3 Jan 2022

28 Jan 2022

[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 reliable handle the increasing availability of genetic data and the knowledge of genetic and epigenetic mechanisms.

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 one 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).

## Bachelor Biomedical Sciences

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

4 Apr 2022

3 Jun 2022

[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

## Bachelor Biomedical Sciences

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 in parallel to the theoretical approach. These tests will be assessed. Success in BBS1006 requires a strong collaborative approach to critically assess biomedical publications and research methodology. Furthermore, a critical attitude towards own hand-on skills is required. BBS1006 is assessed with an exam at the end of the course using multiple choice questions that measure critical thinking about a provided article.

### 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

BBS1006

Period 6

6 Jun 2022

1 Jul 2022

[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 non-invasive imaging techniques, frequently used in both research and clinic, will be introduced and discussed. These techniques are MRI/MRS, PET/CT, MS Imaging, and Breath/faeces analysis. Furthermore, advanced optical microscopy will be introduced, since this is an important, albeit invasive, supportive technique.

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

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

### **Course objectives**

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

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

### **Recommended reading**

Will be discussed during the block

Bachelor Biomedical Sciences

BBS2003

Period 3

3 Jan 2022

28 Jan 2022

[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, 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. The student is able to interpret the obtained results.

Concepts: dependent variable, independent variable, intercept, slope, standard error, t-test for coefficient, t-value, p-value, confidence interval for coefficient, continuous and categorical independent variables, dummy variables, F-test for set of independent variables, 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 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

30 Aug 2021

3 Jun 2022

[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 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

## Bachelor Biomedical Sciences

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

25 Oct 2021

1 Apr 2022

[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).

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

1 Feb 2022

1 Apr 2022

[Print course description](#)

ECTS credits:

6.0

Instruction language:

English

Coordinators:

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

Teaching methods:

Assignment(s), Work in subgroups, Research

Assessment methods:

Bachelor Biomedical Sciences

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

1 Feb 2022

1 Apr 2022

[Print course description](#)

ECTS credits:

2.0

Instruction language:

Bachelor Biomedical Sciences

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

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

#### 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

## Bachelor Biomedical Sciences

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

1 Sep 2021

31 Aug 2022

[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

## 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 lecture and participate in a workshop on cultural diversity. Herein, among others, it is addressed how to give feedback.

### Course objectives

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

a. Prepares and delivers presentation(s) about biomedical topics in tutorials, practicals, etc.

Bachelor Biomedical Sciences

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

a. Interacts effectively in all educational settings

BBS1022

Year

1 Sep 2021

31 Aug 2022

[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

Assessment methods:

Presentation, Attendance

Keywords:

Oral presentation, cultural diversity

Fac. Health, Medicine and Life Sciences

## Cooperation and Communication (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

Bachelor Biomedical Sciences

Year

1 Sep 2021

31 Aug 2022

[Print course description](#)

ECTS credits:

4.0

Instruction language:

English

Coordinator:

- [J.M.E.M. Cosemans](#)

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 BBS2003, students write an individual abstract/summary as well as papers as group assignments. 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. 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,

## Bachelor Biomedical Sciences

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

1 Sep 2021

31 Aug 2022

[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 lecture and participate in a workshop on cultural diversity.

### 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

Bachelor Biomedical Sciences

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

## Recommended reading

BBS2011

Year

1 Sep 2021

31 Aug 2022

[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

## Cooperation and Communication (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

1 Sep 2021

31 Aug 2022

[Print course description](#)

ECTS credits:

4.0

Instruction language:

English

Coordinator:

- [J.M.E.M. Cosemans](#)

Teaching methods:

Work in subgroups, PBL

Assessment methods:

Observation

Keywords:

multisource feedback

Fac. Health, Medicine and Life Sciences

## End Note

BBS1121

Year

1 Sep 2021

31 Aug 2022

[Print course description](#)

ECTS credits:

0.0

Instruction language:

English

Coordinator:

- [A.W. Boots](#)

## 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

1 Sep 2021

31 Aug 2022

[Print course description](#)

ECTS credits:

3.0

Instruction language:

English

Coordinator:

- [J.M.E.M. Cosemans](#)

Teaching methods:

Work in subgroups, PBL

Assessment methods:

Attendance, Observation

Keywords:

multisource feedback

Fac. Health, Medicine and Life Sciences

## 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

1 Sep 2021

31 Aug 2022

[Print course description](#)

ECTS credits:

4.0

Instruction language:

English

Coordinator:

- [H.E. Popeijus](#)

Teaching methods:

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

1 Sep 2021

31 Aug 2022

[Print course description](#)

ECTS credits:

3.0

Instruction language:

English

Coordinator:

- [J.M.E.M. Cosemans](#)

Teaching methods:

Work in subgroups, Assignment(s)

Assessment methods:

Portfolio

Keywords:

Portfolio, professional development

Fac. Health, Medicine and Life Sciences

## Lab Skills

BBS1040

Year

1 Sep 2021

31 Aug 2022

[Print course description](#)

ECTS credits:

0.0

Bachelor Biomedical Sciences

Instruction language:

English

Coordinator:

- [H.E. Popeijus](#)

Fac. Health, Medicine and Life Sciences

## Calculation Test

BBS1041

Year

1 Sep 2021

31 Aug 2022

[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

1 Sep 2021

31 Aug 2022

[Print course description](#)

ECTS credits:

2.0

Instruction language:

English

Coordinator:

- [H.E. Popeijus](#)

Teaching methods:

Skills

Assessment methods:

Attendance, Observation

Keywords:

GLP, labbuddy

Fac. Health, Medicine and Life Sciences

## 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

1 Sep 2021

31 Aug 2022

[Print course description](#)

ECTS credits:

4.0

Instruction language:

English

Coordinator:

- [J.M.E.M. Cosemans](#)

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

1 Sep 2021

31 Aug 2022

[Print course description](#)

ECTS credits:

4.0

Instruction language:

English

Coordinator:

- [J.M.E.M. Cosemans](#)

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

## 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

1 Sep 2021

31 Aug 2022

[Print course description](#)

ECTS credits:

2.0

Instruction language:

English

Coordinator:

- [J.M.E.M. Cosemans](#)

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

## 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 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

## Bachelor Biomedical Sciences

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

4 Apr 2022

1 Jul 2022

[Print course description](#)

ECTS credits:

20.0

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

4 Apr 2022

3 Jun 2022

[Print course description](#)

ECTS credits:

0.0

Instruction language:

English

Coordinator:

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

Fac. Health, Medicine and Life Sciences

## Presentation

### Full course description

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

BBS3008

Period 5

4 Apr 2022

3 Jun 2022

[Print course description](#)

ECTS credits:

0.0

Instruction language:

English

Coordinator:

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

Minor

## Minor

Fac. Health, Medicine and Life Sciences

## Global Differences in Disease and Treatment

### Full course description

The course will introduce how the global burden of disease (theme 1), or perception thereof, may

differ around the globe. The possible reasons for such difference, and the multiple factors (e.g. genetic, environmental, social, regulatory, cultural) implicated in it, will be introduced and discussed.

Next, treatment options available at the population level (theme 2) to tackle the several diseases will be introduced. An historical perspective on how drug classes and specific example compounds are, or have been, developed will be presented.

Having introduced main drug classes, the course will continue by discussing how those treatment options are produced, and will explain the drug development process (theme 3). Differences in the development of blockbusters and orphan drugs will be discussed.

The course will finish by debating the current challenges in drug development (theme 4) for populations, and will bridge to the content to the next course (BBS3012) focusing on the tailor-made approach in drug therapy.

## Course objectives

1. To compare global differences in the geographical distribution of burdens of the most common diseases. (Analyse)
2. To describe global differences in definition and perceptions of health and diseases. (Understand)
3. To examine health determinants of global disease burdens. (Analyse) - 3.1 To compare genetic diversity between populations using results from genetic population studies in databanks. (Analyse) - 3.2 To compare the diversity in occurrence of disease-causing variants in populations and their consequences. (Analyse) - 3.3 To describe relevant social and environmental determinant of health that influence global differences in health and disease. (Understand)
4. To compare global differences in pharmacological treatment standards. (Analyse) - 4.1 To question the underlying ethical reasons for such differences. (Analyse) - 4.2 To discuss the underlying regulatory and legal reasons for such differences. (Understand) - 4.3 To discuss how different health systems may be responsible for such differences. (Understand) - 4.4 To discuss how availability of drugs may be responsible for such differences. (Understand)
5. To state the historical milestones in the drug development process. (Remember)
6. To list and compare main drug classes. (Remember)
7. To explain the drug development process, including the pharmaceutical industry. (Understand) - 7.1 To describe the transitional process of scientific evidence into clinical products. (Understand) - 7.2 To discuss the design and execution of clinical trials. (Understand)
8. To describe the drug development process of blockbuster and orphan drugs. (Understand)
9. To explain the biomedical challenges of the current drug treatment options and development process. (Understand) - 9.1 To discuss the challenges related to lack of efficacy of treatment standards for populations of patients. (Understand) - 9.2 To discuss the challenges related to toxicity of treatment standards for populations of patients. (Understand)
10. To debate ethical, regulatory and economical aspects of the drug development process. (Evaluate)

## Recommended reading

WHO commission on the social determinants of health. Closing the gap in a generation - Health equity through action on the social determinants of health. 2008

[http://apps.who.int/iris/bitstream/handle/10665/43943/9789241563703\\_eng.pdf;jsessionid=A6DE75BD9E23DD0BCE32AFE3B091B8A5?sequence=1](http://apps.who.int/iris/bitstream/handle/10665/43943/9789241563703_eng.pdf;jsessionid=A6DE75BD9E23DD0BCE32AFE3B091B8A5?sequence=1) WHO commission on the social determinants of health. Challenging inequity through health systems. 2007

[http://www.who.int/social\\_determinants/resources/csdh\\_media/hskn\\_final\\_2007\\_en.pdf?ua=1](http://www.who.int/social_determinants/resources/csdh_media/hskn_final_2007_en.pdf?ua=1) WHO. The economics of social determinants of health and health inequalities: a resource book. 2013  
[http://apps.who.int/iris/bitstream/handle/10665/84213/9789241548625\\_eng.pdf?sequence=1](http://apps.who.int/iris/bitstream/handle/10665/84213/9789241548625_eng.pdf?sequence=1) Any basic textbooks on molecular cell biology and biochemistry. H.P. Rang et al. Pharmacology, 8th edition. Amsterdam: Elsevier, 2015. Study Landscape and online accessible via [clinicalkey.com](http://clinicalkey.com)  
Katzung et al. Basic and clinical pharmacology. 13th edition. Mc Graw Hill, 2011. Accessible online via [accessmedicine.mhmedical.com](http://accessmedicine.mhmedical.com)  
Goodman & Gilman`s: The pharmacological basis of therapeutics. 13th edition. Mc Graw Hill 2017 Accessible online via [accessmedicine.mhmedical.com](http://accessmedicine.mhmedical.com)  
S. Waldman et al. Pharmacology and Therapeutics: Principles to practice. 1st edition. Elsevier, 2009

BBS3011

Period 1

1 Sep 2021

22 Oct 2021

[Print course description](#)

ECTS credits:

12.0

Instruction language:

English

Coordinators:

- [L.M.T. Eijssen](#)
- [E. Ambrosino](#)

Teaching methods:

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

Assessment methods:

Attendance, Final paper, Presentation, Written exam

Keywords:

global health health policy genetic variation protein structure drug -targets -classes -development (cycle) treatment ethics legal aspects of treatment

Fac. Health, Medicine and Life Sciences

## **The Role of Nutrition in the Life Cycle in Relation to Global Health**

### **Full course description**

theme 5, focusses on healthy diet recommendations in the clinical setting (enteral and parenteral nutrition regimens). Finally, in theme 4 we focus on the role of nutrition in health maintenance, optimized performance and disease prevention during later life (prevention of chronic disease development, healthy aging and maintaining cognitive health). In theme 3 focuses on the role of nutrition in health maintenance and disease prevention during early life (epigenetic processes and intra-uterine health as well the role of optimal nutrition for growth and development at a child age; food allergy, celiac disease). In second theme positions nutrition and health in a global context addressing problems of over- and under-nutrition of energy and macronutrients as well as prevalent vitamin and mineral deficiencies globally. Additionally, the topic of sustainability of our food system and the relation between sustainability and health. The first themeThe the knowledge collected so far will be integrated to define a potential role of nutrition in personalized intervention approaches.

## Course objectives

- To describe the importance of social context, economic and cultural differences regarding the position of nutrition in health and disease.
- To describe the role of nutrition during preconception and intrauterine stages in the context of optimal development and disease prevention.
- To explain the role of nutrition at child age to assure optimal growth and prevention of disease.
- To explain the role of nutrition from adulthood to middle aged towards seniority in health maintenance and the prevention of chronic diseases.
- To describe the role of nutrition in the context of healthy aging with a focus on maintaining cognitive health / prevention of neuro-degenerative diseases.
- To integrate the evidence for a potential role of nutrition in personalized intervention approaches.
- To apply the principles of healthy diet recommendations in population based prevention perspectives as-well-as in a clinical setting.

## Recommended reading

many suggested papers and websites at the cases Insel, Paul / Nutrition. 4th edition / Jones and Bartlett / 2011 Frayn, Keith N. Metabolic regulation: a human perspective, (3rd edition). Oxford: Blackwell Science Koletzko B, et al. (eds): Pediatric Nutrition in Practice. World Rev Nutr Diet. Basel, Karger, 2015, vol 113

BBS3021

Period 1

1 Sep 2021

22 Oct 2021

[Print course description](#)

ECTS credits:

12.0

Instruction language:

English

Coordinator:

- [E.E. Blaak](#)

Teaching methods:

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

Assessment methods:

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

Keywords:

Nutrition and metabolism in global perspective Early life nutrition Nutrition and chronic disease development Clinical nutrition Personalized nutrition

Fac. Health, Medicine and Life Sciences

## Global Differences and Scientific Evidence for Physical Activity as Treatment/Preventive Measure

## Full course description

During this course students learn to appreciate the worldwide and historical diversity of physical activity (PA) intervention as a means to enhance health. The way people appreciate PA varies over continents and through time. PA has been and is applied to prevent and cure health issues and is also used as a means in rehabilitation and PA to improve daily performance and function. Students will learn how to measure PA and daily performance and function, and their components (endurance, strength, flexibility, coordination). In addition, this course will address scientific evidence for claimed effects of PA-interventions and their components on various health (risk) outcomes. Apart from the diverse separate small skills trainings there will be one large 'experiment' in which students will experience and train a physical activity exercise program themselves (during 8 weeks - half in module 1 and half in module 2) and assess it's effect. This means developing and writing a research protocol, executing and evaluating it

## Course objectives

- B-ILO3031.1: To understand the Physical activity dimensions: mode, frequency, duration and intensity; both for inactivity and exercise
- B-ILO3031.2: To understand the strengths and weaknesses of the main types of physical activity monitoring
- B-ILO3031.3: To identify causes of inter-individual variation in human performance
- B-ILO3031.4: To select an adequate assessment method of functional performance capacity for a given population and research question
- B-ILO3031.5: To design an exercise-training program adequate for the goal chosen both in healthy subjects, and in patients suffering from chronic diseases

## Recommended reading

ill be provided during the course

BBS3031

Period 1

1 Sep 2021

22 Oct 2021

[Print course description](#)

ECTS credits:

12.0

Instruction language:

English

Coordinators:

- [R.A. de Bie](#)
- [M.R. Drost](#)

Teaching methods:

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

Assessment methods:

Assignment, Written exam

Keywords:

physical activity, assessment methods, exercise, global burden of disease, co-morbidities, mental effects of PA, PA skillstraining

# From Pharmacological Mechanisms to Precision Medicine

## Full course description

This course introduces the basic pharmacological and toxicological principles of drug therapy and deals with a broad range of aspects that needs to be taken into account for the evolution of population-based drug therapy (BBS 3011) to a tailor-made approach for an individual patient.

Pharmacology deals with the effects of biologically active compounds on (patho)physiological processes. The disciplines are subdivided into two general subjects: (1) pharmacodynamics, which assesses the effects of a compound in the human physiology, and (2) pharmacokinetics, which assesses the fate of a compound in the human body. Both subjects determine the therapeutic effectivity and toxicity of a drug in humans. In an individual patient, the effectivity and toxicity of drugs is determined by a broad range of factors including e.g. age, gender, genotype, ethnicity, microbiome, concomitant drug and nutrient intake.

The course's subjects will be offered in an integrative setting of PBL cases, lectures and practical trainings.

## Course objectives

- Describe the basic principles of pharmacodynamics and pharmacokinetics
- Calculate basic pharmacodynamic and pharmacokinetic parameters and use them for the prediction of drug action.
- Explains molecular mechanisms underlying drug effects
- Describe drug interactions on population and individual level
- Explain side-effects of selected drugs on population and individual level
- Evaluate clinical trial data and present them to qualified persons so that they can follow and understand the outcomes and conclusions.
- Explain the effects of individual factors including age, gender, ethnicity, genotype, concomitant drugs, nutrients, socio-economic and environmental factors on the action of drugs.
- Discuss the design and application of methodologies/technologies enabling to investigate the efficacy of drugs in individuals.

## Recommended reading

1) Course manual Drug therapy: from confection to tailor-made 2) H.P. Rang et al. Pharmacology, 8th and 9th edition. Amsterdam: Elsevier, 2015/2019. Several copies are available at the Study Landscape and online accessible via [clinicalkey.com](http://clinicalkey.com) 3) Katzung et al. Basic and clinical pharmacology. 13th edition. Mc Graw Hill, 2011. Accessible online via [accessmedicine.mhmedical.com](http://accessmedicine.mhmedical.com) 4) Goodman & Gilman`s: The pharmacological basis of therapeutics. 13th edition. Mc Graw Hill 2017 Accessible online via [accessmedicine.mhmedical.com](http://accessmedicine.mhmedical.com) 5) S. Waldman et al. Pharmacology and Therapeutics: Principles to practice. 1st edition. Elsevier, 2009 6) Relevant medical books on human anatomy, physiology and pathophysiology available at the Study Landscape and search engines such as PubMed to find up-to-date scientific (review) articles.

Bachelor Biomedical Sciences

Period 2

25 Oct 2021

17 Dec 2021

[Print course description](#)

ECTS credits:

12.0

Instruction language:

English

Coordinator:

- [G.J.M. den Hartog](#)

Teaching methods:

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

Assessment methods:

Assignment, Attendance, Participation, Presentation, Written exam

Keywords:

pharmacology, Pharmacodynamics, ADME, Pharmacokinetics, precision medicine, Genetics, systems approaches

Fac. Health, Medicine and Life Sciences

## Clinical and Personalized Nutrition

### Full course description

- To describe the importance of social context, economic and cultural differences regarding the position of nutrition in health and disease.
- To describe the role of nutrition during preconception and intrauterine stages in the context of optimal development and disease prevention.
- To explain the role of nutrition at child age to assure optimal growth and prevention of disease.
- To explain the role of nutrition from adulthood to middle aged towards seniority in health maintenance and the prevention of chronic diseases.
- To describe the role of nutrition in the context of healthy aging with a focus on maintaining cognitive health / prevention of neuro-degenerative diseases.
- To integrate the evidence for a potential role of nutrition in personalized intervention approaches.
- To apply the principles of healthy diet recommendations in population based prevention perspectives as-well-as in a clinical setting.

### Recommended reading

many suggested papers and websites at the cases Insel, Paul / Nutrition. 4th edition / Jones and Bartlett / 2011 Frayn, Keith N. Metabolic regulation: a human perspective, (3rd edition). Oxford: Blackwell Science Koletzko B, et al. (eds): Pediatric Nutrition in Practice. World Rev Nutr Diet. Basel, Karger, 2015, vol 113

BBS3022

Period 2

25 Oct 2021

Bachelor Biomedical Sciences

17 Dec 2021

[Print course description](#)

ECTS credits:

12.0

Instruction language:

English

Coordinator:

- [J. Plat](#)

Teaching methods:

Assignment(s), Lecture(s), Paper(s), PBL, Presentations, Research, Working visit(s)

Assessment methods:

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

Keywords:

Nutrition and metabolism in global perspective Early life nutrition Nutrition and chronic disease development Clinical nutrition Personalized nutrition

Fac. Health, Medicine and Life Sciences

## **Physical Activity Applications in Health and (Daily) Performance; From Man to Molecule**

### **Full course description**

In this course students will learn to appreciate how PA, be it intense PA (exercise (EX)), low intense PA or sedentary behavior (SB) affects health at a molecular level and how such molecular adaptation affects people and their health. This will be studied in the context of:

- a range of non-communicable, lifestyle-related diseases
- ageing
- cognitive performance over the range of a lifetime
- enhancing of regaining functional, daily or sports performance

### **Course objectives**

- B-ILO3032.1: To evaluate differential effects of training programs aimed at physical activity improvement
- B-ILO3032.2: To understand and argue the impact of various co-morbidities on physical activity possibilities and outcomes
- B-ILO3032.3: To apply principles of human energy metabolism during rest and exercise (see also B-ILO2041.3)
- B-ILO3032.4: To identify causes of change in performance as a function of age
- B-ILO3032.5: To understand the mental effects of physical activity interventions in healthy persons and subgroups of persons with a chronic disease
- B-ILO3032.6: To argue which elements of a physical activity training program are key to achieve optimal training effect in healthy persons and subgroups of persons with a chronic disease

## Recommended reading

Will be provided during the course

BBS3032

Period 2

25 Oct 2021

17 Dec 2021

[Print course description](#)

ECTS credits:

12.0

Instruction language:

English

Coordinators:

- [R.A. de Bie](#)
- [M.R. Drost](#)

Teaching methods:

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

Assessment methods:

Assignment, Presentation

Keywords:

physical activity, assessment methods, exercise, global burden of disease, co-morbidities, mental effects of PA

Fac. Health, Medicine and Life Sciences

## Critical Review of a Biomedical Intervention

### Full course description

The content of the course depends on the choice of the individual student. Students choose a topic related to one of three trajectories focussing on either drug, nutritional, or physical activity interventions. The emphasis is on critically reviewing the literature on a chosen topic and related research question. The necessary knowledge and skills for this academic project were already obtained in previous courses throughout the bachelor.

A critical narrative literature review will be written in multidisciplinary groups of 3-4 students supervised by an experienced researcher (supervisor). Besides the narrative literature review, an individual and personal reflection report on the process of this project will be written as well. Students meet with their supervisor 2-3 times during this course. The supervisor finally assesses the group report, as well as the individual reflection report.

3): 101-117. DOI: 10.1016/S0899-3467(07)60142-6. Journal of Chiropractic Medicine, 5( literature review. The guidelines for such a review are based on the article of Green, B.N., Johnson, C.D. and Adams, A. (2006). Writing narrative literature reviews for peer-reviewed journals: secrets of the trade. narrativeThe focus is on writing a

### Course objectives

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

## Recommended reading

- Dawidowicz, P. (2010). Literature Reviews Made Easy: A Quick Guide to Success. UB: eBook. Comment: A comprehensive and easy readable eBook on literature review. Advantage: availability as eBook. Background: General, academic writing.
- Green, B.N., Johnson, C.D, & Adams, A. (2006). Writing narrative literature reviews for peer-reviewed journals: secrets of the trade. Journal of Chiropractic Medicine, 5(3): 101-117. DOI: 10.1016/S0899-3467(07)60142-6 Comment: Very useful article on content, process and structure regarding writing a narrative literature review. Background: Clinical.
- Torraco, R.J. (2005) Writing Integrative Literature Reviews: Guidelines and Examples. Human Resource Development Review 4(3): 356-367. DOI: 10.1177/1534484305278283 Comment: Very useful article on content, process and structure regarding writing a narrative literature review. Background: Human Resource Development.

BBS3003

Period 3

3 Jan 2022

28 Jan 2022

[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

Bachelor Biomedical Sciences

30 Aug 2021

28 Jan 2022

[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

30 Aug 2021

28 Jan 2022

[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

30 Aug 2021

28 Jan 2022

[Print course description](#)

ECTS credits:

Bachelor Biomedical Sciences

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

EDM3022

Period 1

30 Aug 2021

28 Jan 2022

[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

31 Jan 2022

1 Jul 2022

[Print course description](#)

ECTS credits:

5.0

Instruction language:

Dutch

## Bachelor Biomedical Sciences

Coordinators:

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