

Lab & Data Sciences: Basic Principles

Fac. Health, Medicine and Life Sciences

MBS1001

Period 1:

1 Sep 2025

24 Oct 2025

Credits:

10.0

Coordinator:

L.C.C. de Nijs

Teaching methods:

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

Assessment methods:

Written exam, Final paper, Presentation, Attendance, Assignment

Keywords:

Biomedical Challenges, Disease Mechanisms, Biomedical Approaches, Problem-Solving Strategies, Data Science, Scientific Method, Critical Thinking and Analysis, Science Communication, Knowledge Integration.

Full course description

Biomedical Sciences help us better understand how the human body functions. The insights gained from this field are essential for understanding, diagnosing, treating, and preventing human diseases. Biomedical Sciences specifically translate knowledge from the natural sciences into medical applications.

However, the field also faces complex biomedical challenges—real-world problems related to human health, disease, and healthcare that require scientific investigation and innovative solutions.

Understanding these challenges is fundamental for students at the beginning of a master's in Biomedical Sciences. It helps them connect theory to real-life applications, recognize the societal impact of their work, and develop the problem-solving mindset essential for research and innovation. In this first course of the master's program, students will be introduced to the wide range of topics addressed within Biomedical Sciences. The course explores the pathophysiology, diagnostics, therapies, and current research on various diseases, with particular emphasis on identifying and critically evaluating the biomedical challenges they present, as well as exploring current approaches used to address them.

To address these challenges effectively, modern biomedical scientists also need strong data science skills. Therefore, this course introduces the basic principles of data science essential to biomedical research, including core concepts in statistical analysis, regression analysis, (multivariate) data processing and visualization, algorithmic thinking and computer scripting.

Course objectives

- ILO1. Analyze and describe the mechanisms of molecular dysfunction, etiological factors, clinical manifestations, diagnostic strategies, and treatment approaches related to diseases within the biomedical field.
- ILO2. Identify and critically evaluate biomedical challenges and explore current approaches to address them within the biomedical field.
- ILO3. Apply basic principles of data science in biomedical research, including statistical analysis, regression analysis, (multivariate) data processing and visualization, algorithmic thinking and computer scripting.
- ILO4. Apply the principles of the scientific method by identifying research questions, methodologies, and reasoning processes in scientific literature, and critically using these insights to explore biomedical challenges.
- ILO5. Synthesize and present complex scientific information on state-of-the-art knowledge and challenges in biomedical field.

Recommended reading

[This is the link to Keylinks, our online reference list.](#)

Lab & Data Sciences: advanced approaches

Fac. Health, Medicine and Life Sciences

MBS1002

Period 2:

27 Oct 2025

19 Dec 2025

Credits:

10.0

Coordinator:

B. Cillero Pastor

Teaching methods:

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

Assessment methods:

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

Keywords:

Practical skills

Full course description

The course teaches core biomedical skills, methods and techniques focused on:

1. Cell culture
2. Animal models
3. Mass spectrometry
4. Microscopy
5. Genomics and transcriptomics
6. Flow cytometry

Course objectives

After the course, for each biomedical technique students can:

- ILO1 Describe the goal and application of the technique
- ILO2 Discuss the biomolecular principle how the technique works
- ILO3 Interpret read-outs including measurements, scans, bands, plots etc. Explain and interpret a figure with results of the experiments, including axis and controls.
- ILO4 Justify the recommendation for alternative techniques by describing their pros and cons, especially in relation to feasibility in terms of materials available, costs, equipment and time investment.

Recommended reading

[This is the link to Keylinks, our online reference list.](#)

Biosafety

Fac. Health, Medicine and Life Sciences

MBS1103

Period 2:

27 Oct 2025

19 Dec 2025

Credits:

1.0

Coordinator:

B. Cillero Pastor

Teaching methods:

Lecture(s), Assignment(s)

Assessment methods:

Written exam

Full course description

This course is an introduction to the principles of biosafety, how to work safely with biological agents, microorganisms and genetic modified organisms in laboratory.

In Hospitals and (Biomedical) Science biological materials (micro-organisms, eukaryotic cells, tissues, body fluids, faeces...) are intensively used in both basic research and diagnostics. In many situations these biological materials are genetically modified or originated from genetic modified organisms.

The biological materials can be pathogenic and therefore one should know the rules how to handle these material in a safe way to avoid any harm to yourself or the environment. For working with genetic modified organisms additional legislation applies. In this course the importance of working safely and responsibly with biological materials and genetically modified materials are stressed.

Guidelines and regulation, decontamination and disinfection, disposal and sterilization, facility and equipment design will be discussed.

During the online training in LabBuddy, in which experiments with biological agents (wild-type and genetically modified) are described, all kinds of aspects of working safely with biological agents will be adressed.

If you have passed the course successfully you can perform microbiological work at Biosafety/Microbiological laboratory Level I (BSL-I/ML-I)

Course objectives

- know the principles of biosafety

- know the general biosafety rules and be able to work according to them
- know the legislation related to (genetic modified)microorganism
- know how to handle when spills/incidents occur

Advanced Principles of Genetics and Genomics

Fac. Health, Medicine and Life Sciences

MBS1101

Period 3:

5 Jan 2026

6 Mar 2026

Credits:

10.0

Coordinator:

L.M.T. Eijssen

Teaching methods:

PBL, Lecture(s), Skills, Paper(s), Assignment(s), Working visit(s)

Assessment methods:

Written exam, Final paper, Participation, Assignment

Keywords:

**advanced genetics genomics bioinformatics epigenetics gene-environment interaction
gene expression analytical techniques data handling/analysis ethical/societal issues**

Full course description

The genome is the fundament of life. In this course, various aspects of the composition of the genome will be addressed, such as unique vs repetitive DNA and transcribed vs non-transcribed segments. Another important aspect is the dynamic nature of the genome, especially in regard to epigenetic modification and of the various types of genetic variation. Epigenetic responses and genetic variation partly underlie complex traits and explain the individual susceptibility to influences from the environment.

In this course the molecular mechanisms of genetic and environmental influences on gene expression and protein function are addressed with special attention for deviation from Mendelian inheritance as well as complex regulatory mechanisms in case of both single-gene and multifactorial traits and disorders.

Considerable attention in this course goes to analytical methods for genomics and genetics. A technological revolution has taken place since the start of the unravelling of the human genome, leading to the development of techniques to rapidly sequence a complete genome, but also to perform functional analysis of gene expression and protein function and to incorporate the influence of genetic variation and epigenetic modification into these expression data.

These technological applications lead to huge amounts of data demanding specific algorithms for data analysis to be developed by researchers working in bioinformatics. Throughout the course students will obtain experience with several such algorithms, databases and analytical programs available in the public domain.

Finally, the large increase in knowledge on genomics and genetics together with the still growing potential of analytical possibilities impact research, society and the individual's way of life. A time slot in the course will be reserved to discuss these developments.

Course objectives

In this course we address advanced principles of Genetics and Genomics according to specific Themes, which correspond with the Intended Learning Outcomes (ILOs). For each Theme there will be tutorial sessions, a journal club, an expert lecture and career-related sessions, in which researchers will explain the research that they are performing. During site visits students will go to some of the laboratories for genetics and genomics to get insight into the technological requirements for genetic and genomics in daily practice. In addition, several computer sessions are scheduled to introduce and train students in data handling and analysis. Finally, students are requested to write an essay on a specific topic of genetics or genomics. The ILOs of this course are:

- Describe human genetic diversity and its dynamics based on the principles of population genetics.- ILO1
- Integrate the influence of epigenetics with the fundamental regulation of gene expression. ILO2
- Explain the impact of genetic variation on gene expression and protein function.- ILO3
- Explain deviations from fundamental genetics in eukaryotes.- ILO4
- Apply advanced analytical methods of genetics and genomics. - ILO5
- Analyze data handling in genetics and genomics. - ILO6
- Define ethical and societal issues concerning genetics and genomics.- ILO7

Recommended reading

[This is the link to Keylinks, our online reference list.](#)

Pathophysiology of Disease

Fac. Health, Medicine and Life Sciences

MBS1201

Period 3:

5 Jan 2026

6 Mar 2026

Credits:

10.0

Coordinator:

K.A.M. Wouters

Teaching methods:

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

Assessment methods:

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

Keywords:

Pathophysiology Infections: virus, bacteria, fungi Sterile inflammation Microbiota Metastasis, tumor evasion Innate/Adaptive immune responses Auto-antibodies/Autoimmunity Allergy

Full course description

As our society ages, we face increasing health challenges—ranging from infections to cancer, neurodegeneration, and cardiometabolic diseases—all deeply linked to inflammation. This course provides a cutting-edge understanding of how immune system dysfunction contributes to disease, covering topics such as sterile and infectious inflammation, autoimmunity, and tumor development. Students will first receive an overview of immune system physiology through lectures and concept maps, ensuring a solid foundation. From weeks 2 to 7, the focus shifts to immune dysregulation in various diseases. Each week introduces a new theme, with case studies, expert-led lectures, workshops, technical training, and journal club discussions. Weekly assignments will guide students through key learning objectives, with ample time for self-study and collaborative work. A major component of the course is a research project, where students will analyze a pathophysiological threat and present their findings as a scientific poster.

Course Themes:

- Week 1: Immune system fundamentals
- Week 2: Innate immunity to bacteria & fungi
- Week 3: Immunity to viruses

- Week 4: Sterile inflammation & pathological threats
- Week 5: Tumor immunity
- Week 6: Hypersensitivity & autoimmunity
- Week 7: Microbe-host interactions in immune homeostasis
- Week 8: Reflection, poster presentations & final exam

By the end of the course, students will be well-equipped to contribute to research on inflammation-driven diseases and their clinical implications.

Course objectives

B-ILO1202.1 Explain immunity to microbes and viruses

1. Recognize and compare innate and adaptive immunity to extracellular and intracellular bacteria and viruses.
2. Explain immune evasion by extracellular and intracellular bacteria and viruses.
3. Explain the immunological principles of vaccinations
4. Discuss injurious effects of immune responses to extracellular bacteria: inflammation, septic shock.
5. Explain the plasticity of innate immune cells in different tissues and during infections
6. Explain the concept of trained immunity during infection and understand the underlying epigenetic and metabolic mechanisms.
7. Describe the ontogeny of tissue macrophages

B-ILO1202.2 Explain sterile inflammation and other pathological threats

1. Analyze the role of sterile inflammation in trauma and ischemia-reperfusion.
2. Discuss pathological threats such as neurodegeneration, atherosclerosis, and myocardial infarction.

B-ILO1202.3 Explain immunity to tumors

1. Differentiate tumor immunity, tumor antigens and immune response to tumors.
2. Explain evasion of the immune response by tumors.
3. Effect of the tumor microenvironment on anti-tumor immune responses.
4. The role of the immune system in promoting tumor growth/tumor progression.

B-ILO1202.4 Explain hypersensitivity disorders and autoimmunity

1. Recognize diseases caused by hypersensitivity
2. Discuss immunological diseases, their pathogenesis and current therapy.
3. Explain IgE and mast cell-dependent reactions and allergic reactions in humans.

B-ILO1202.5 Explain microbe-host interactions in (immune) homeostasis

1. Discuss interplay between microbial colonization and the development of the immune system
2. Understand the induction of immune responses by microbes at mucosal interfaces

3. Know how the functional output of the microbiota affects homeostasis
4. Recognize microbial dysbiosis and its role in immune-mediated disease

Recommended reading

[This is the link to Keylinks, our online reference list.](#)

Nutrition, Physical Activity and Metabolism; Fundamental Aspects

Fac. Health, Medicine and Life Sciences

MBS1301

Period 3:

5 Jan 2026

6 Mar 2026

Credits:

10.0

Coordinator:

M.K.C. Hesselink

Teaching methods:

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

Assessment methods:

Written exam, Final paper, Presentation, Attendance, Assignment

Full course description

This course aims to provide a solid fundament to understand the mechanisms underlying the metabolic aberrations that are commonly observed in many of the current no-communicable disorders. A proper understanding of these mechanisms is essential to design, optimize, apply and examine interventions that aim to alleviate the metabolic aberrations and to slow down disease progression. To this end this course will encompass studying the major systems involved in human (nutritional) physiology and metabolism. This ranges from the process of nutrient uptake across the gastrointestinal tract to cell and organ specific routes for conversion of macromolecules into their oxidizable derivatives.

The pivotal role of intermediary metabolism and (subcellular) energy sensing and of metabolites and small circulatory hormone like peptides (e.g., adipocytokines) will be studied. This course will, therefore, further deal with the important notion of inter-organ cross-talk and designates how to convey this knowledge to the development of whole body metabolic control. It will provide a basis for targeted treatment of aberrations in (energy) homeostasis, substrate metabolism, inter-organ cross talk as related to macronutrients (fat, carbohydrates, and protein) and specific nutritional components. Special attention will be given to the metabolic routes that are altered in acute and chronic metabolic disorders and the putative role of the biological clock herein. More specifically,

these disorders are discussed in relation to the role of nutrition in preventing and treating these disorders.

Nutrients play a role in the regulation of gene transcription, translation, and signal transduction. This, of course, affects cellular pathways. If these pathways become disturbed, it may ultimately result in disease, which may require special dietary interventions. In this course, the molecular basis and cellular mechanisms by which nutrients affect metabolic control is studied at the cellular level.

Course objectives

1. Describe the function and interaction of the listed organs in nutritional physiology and physical activity: Liver, stomach and gut, adipose tissue, brain and muscle.
2. Explain and predict the uptake, storage, degradation, and the intermediary metabolism of nutrients and substrates on organ, cellular and subcellular level.
3. Characterize the transport, uptake and metabolism of macro- and micronutrients.
4. Explain competition and selection of nutrients and substrate flux in pre- and post -prandial states.
5. Explain competition and selection of nutrients, and substrate flux during rest and exhaustive exercise in a trained and untrained state.
6. Apply the concepts above to healthy and chronic disease scenarios.
7. Characterize metabolic aberrations in chronic disease and come-up personalized interventions for intervention.
8. Argue the translational aspects of nutritional and physical activity related model systems.
9. Argue the scientific basis for policy making on human nutrition, physical activity, and dietary guidelines.
10. Critically evaluate recent manuscripts discussing aspects of health related to nutritional status and physical activity.

Recommended reading

[This is the link to Keylinks, our online reference list.](#)

Science and Technology of Regenerative Therapeutics

Fac. Health, Medicine and Life Sciences

MBS1401

Period 3:

5 Jan 2026

6 Mar 2026

Credits:

10.0

Coordinator:

F.H.J. van Tienen

Teaching methods:

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

Assessment methods:

Written exam, Final paper, Participation, Presentation

Keywords:

Organ and tissue regeneration Biomaterials Tissue engineering Stem cell therapy Interdisciplinary Regenerative medicine

Full course description

This is the first course for the Regenerative Medicine (RM) specialization within the Biomedical Sciences (BMS) Master's program. This first block will provide the student with a solid foundation of knowledge in the interdisciplinary field of RM. At its core, RM aims to replace, engineer, or regenerate tissues and organs in order to establish normal function in the human body. Not falling completely within a traditional discipline, researchers and teams within RM combine fundamental physical and biomedical sciences with technology and engineering in order to discover novel methods of regenerating the body. With successes, scientists within RM must also be able to effectively translate this scientific knowledge into a useful clinical therapy. In this first course, students will learn the basics in not only the biological science of regeneration, including stem cell biology and pathophysiology, but also the technology behind RM, including materials science, chemistry, biofabrication, and computational modeling. This intensive course employs a variety of educational forms in order to both give an overview of the field and allow students to dig into topics of interest. Students will learn to work in teams, to think critically utilizing the scientific method, and to communicate across the borders of traditional disciplines. Already in this first block, the acquired knowledge will directly be applied to propose new solutions for state-of-the-art RM case studies.

Course objectives

Understand the molecular processes of wound healing and modulation of tissue homeostasis, and how these mechanisms can be leveraged in the development of regenerative therapies.

Obtain working knowledge of both a cell's (or tissue's) immediate natural environment, and the current uses of biomaterials to provide artificial environments for tissue growth.

Understand the successes and failures of current (stem) cell regenerative approaches.

- Understand the different applications of organoid technology for studying development, homeostasis, tissue repair, and diseases.
- Be able to describe the composition and organization of ECM (the original biomaterial) and understand the synthesis, structure, and degradation of therapeutic biomaterials.
- Be able to describe processing technologies used to fabricate biomaterials into 3D scaffolds for tissue engineering, and be able to identify what the important factors of scaffold design are.
- Understand the basics of microfabrication techniques and the working concepts of bioreactors and organ-on-a-chip.
- Understand the importance of the cell-material interface for tissue engineering, and be able to explain how Materiomics approaches can aid in the designing of this interface.
- Identify differentially expressed genes from processed microarray data, construct a protein interaction network and perform a GO-analysis.
- Conduct a literature review on relevant signaling pathways, integrate findings into a testable hypothesis and follow-up experiment
- Be able to critically assess the quality aspects of a research question, methodology, and results.
- Be able to make supported decisions when designing a regenerative medicine experiment.
- Be able to clearly present and discuss scientific research in the field of regenerative medicine to those within and outside of the field.

Recommended reading

[This is the link to Keylinks, our online reference list.](#)

Invasive Neuromodulation

Fac. Health, Medicine and Life Sciences

MBS1601

Period 3:

5 Jan 2026

6 Mar 2026

Credits:

10.0

Coordinator:

S.A. Hescham

Teaching methods:

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

Assessment methods:

Written exam, Final paper, Presentation, Assignment

Keywords:

Neuroscience; neuromodulation; neurophysiology; neuroanatomy; deep brain stimulation; transcranial magnetic stimulation

Full course description

At the end of this course, students will have a detailed understanding of neuromodulation approaches, and they will be aware of recent trends and developments in the field. Building on this foundation, various state-of-the-art neuromodulation approaches will be explored in detail, with a particular focus on deep brain stimulation, spinal and sacral neuromodulation, and transcranial magnetic stimulation. This course starts by providing essential knowledge about neuroanatomy and neurophysiology required to understand the basic principles of neuromodulation techniques. To ensure that the entry-level is comparable we give an introductory explanation in week 1 to reactivate the prior knowledge. The students are expected to have general knowledge about the normal functioning of the CNS. MBS1601 will build on the knowledge obtained during the first 8-weeks in the course, Biomedical Challenges. This prevents the current and following courses from being too abstract and allows episodic experiences to connect the discussions and scientific literature. The practicals add depth and practical experience to this overview of methods since students will actively use and see in use these various techniques. It is important to provide and develop this basis, to allow the following courses to build on a broad, but still the relatively superficial treatment of, or meta-perspective on, a young and burgeoning field. These approaches span invasive and non-invasive modulation, from animal to human brains. In the following weeks, we provide an overview of the

wide range of available neuromodulation approaches. Each week contains three different forms of teaching, to meet the range of ILOs that span theoretical, applied, and practical knowledge. A practical session in the middle of the week provides concrete knowledge, examples, and helps develop skills.

Course objectives

Intended Learning Outcomes (ILOs)

- ILO1601-1: To understand the basic anatomy of the central nervous system (CNS)
- ILO1601-2: To understand the basic physiology of the central nervous system (CNS)
- ILO1601-3: To understand the basics of micro-neuromodulation techniques (optogenetic and DREADD)
- ILO1601-4: To understand and explain the basic principles of invasive neuromodulation and discuss the application of deep brain stimulation (DBS) and spinal cord stimulation in preclinical settings
- ILO1601-5: To describe the current neuroimaging techniques available for neuromodulation.
- ILO1601-6: To understand the basic mechanisms of action of transcranial magnetic stimulation (TMS) and transcranial electrical stimulation (TES)
- ILO1601-7: To understand how TMS and TES can be applied in the experimental context
- ILO1601-8: To gain practical, hands-on knowledge, and experience with TMS and TES

Recommended reading

[This is the link to Keylinks, our online reference list.](#)

Clinical and Applied Genetics and Genomics

Fac. Health, Medicine and Life Sciences

MBS1102

Period 4:

9 Mar 2026

8 May 2026

Credits:

10.0

Coordinator:

M. Gerards

Teaching methods:

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

Assessment methods:

Written exam, Participation, Presentation, Attendance, Assignment

Keywords:

genetics, genomics, epigenetics, clinical diagnostics, forensics, pharmacogenomics, model systems

Full course description

This course will elaborate further on genetic fundamentals discussed in the previous courses (MBS1001 and MBS1101) and includes amongst others currently applied approaches in the clinic as well as examples of functional genomics approaches used in scientific research (week 1).

Week 2 focusses on the use of model systems to study, for example, the function of newly identified genes and unknown variants in known genes. These model systems can be experimental models (e.g. cell or animal models) as well as in silico models.

In week 3, we will explore pharmacogenomics, uncovering how this cutting-edge field is revolutionizing personalized medicine and delve into the relationship between our genetic makeup and the effectiveness of pharmaceutical therapies.

During the 4th week of the course, we will focus on (epi)genomics technologies and approaches used in forensics, which require a high standard of quality control, should be applicable to minute DNA traces and involve multiple societal dimensions for successful implementation.

Week 5-7 will focus on diagnostic tools and biomedical research performed for different disorders with a genetic etiology. For example, in week 5 the molecular mechanisms underlying cancer will be discussed as well as clinical applications that have been developed utilizing this knowledge, while the

genetic basis of heart disease will be the topic of week 6. Besides genetics, also epigenetic modifications play an important role in many diseases. In week 7, the main focus will be on epigenetic mechanisms involved in neurodegenerative disorders.

Course objectives

Overall Goal: At the end of this course, each student has gained a high level of knowledge on the use of genetic and genomic techniques in research and clinical diagnostics.

- **ILO1102.1** Explain genetic and genomic technology used in precision medicine and diagnostics of genetic disorders.
- **ILO1102.2** Apply data analysis approaches to analyze and interpret next generation sequencing data
- **ILO1102.3** Be familiar with the main genomic mechanisms and involved signaling pathways underlying cancer development, cardiovascular and neurological diseases.
- **ILO1102.4** Explain advantages/disadvantages when utilizing genetic testing in research and clinical applications.
- **ILO1102.5** Know which tools are available to model genetic disorders and apply them to study genetic disorders in research and clinical applications.
- **ILO1102.6** Apply the concepts of molecular genetics to design novel research projects in genetics and precision medicine.

Recommended reading

[This is the link to Keylinks, our online reference list.](#)

Engineering the Immune System; Treatment of Disease

Fac. Health, Medicine and Life Sciences

MBS1202

Period 4:

9 Mar 2026

8 May 2026

Credits:

10.0

Coordinator:

K. Lenaerts

Teaching methods:

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

Assessment methods:

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

Keywords:

Immunology Therapy Immune response Immune disease Immune modulation Immune suppression Immune therapy Pharmacotherapy Antibody therapeutics Microbiota

Full course description

Building on the knowledge gained from the MBS1201 course, the MBS1202 course will follow the same roadmap through the various areas of research and clinical medicine, covering immunology, inflammation and the pathophysiology of infectious and non-infectious diseases with a focus on diagnosis and therapy. Attention will be given to experimental approaches and technologies in medicine, as well as to broader translational aspects related to the key topics in sterile and non-sterile (infectious) inflammation, neurodegeneration, atherosclerosis and vascular disease, autoimmunity and tumour development.

The objective of this course is to provide a deeper understanding of how the immune system can be modulated for therapeutic purposes, and to explore current and emerging strategies for the treatment and prevention of immune-related disease.

Course objectives

- Summarize, explain and design approaches to modulate the immune system in inflammatory or infectious disease
- Summarize and explain basic pathophysiology, diagnosis and current therapy of sepsis and design novel therapeutic strategies

- Summarize and explain basic pathogenesis and current treatment of viral disease and design novel prophylactic vaccine based strategies for viral disease
- Explain and compare current and experimental therapies to treat/prevent atherosclerosis
- Explain and compare established and experimental types of immunotherapy and design novel therapeutic strategies
- Summarize state of the art diagnosis and treatment of hypersensitivity disorders
- Explain the therapeutic potential of targeting the microbiome for modulation of immunity and health
- Apply both descriptive ethics and normative ethics to a case study relevant within the specialisation

Recommended reading

[This is the link to Keylinks, our online reference list.](#)

Lifestyle Interventions and Metabolism; a Translational Perspective

Fac. Health, Medicine and Life Sciences

MBS1302

Period 4:

9 Mar 2026

8 May 2026

Credits:

10.0

Coordinator:

P.J. Joris

Teaching methods:

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

Assessment methods:

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

Keywords:

Lifestyle intervention Metabolism Translation approach Personalized approach Diet Exercise

Full course description

In this course, the central theme is the role of lifestyle changes in both health and disease. Lifestyle factors modulating human metabolism on a micro(cellular) and macroscale (organ) will be studied via a translational approach. This course will focus primarily on the more conventional strategies to promote health by exploring the underlying mechanisms and how these interventions may prevent various non-communicable diseases, including cardiovascular diseases, cancer, chronic respiratory diseases and diabetes. For this, effects of diet and physical activity on gene expression/cellular pathways, organ function and interorgan crosstalk will be studied in depth. However, the impact of lifestyle interventions may differ between individuals (e.g. responders vs. non-responders) indicating that successful lifestyle interventions may require a more personalized approach. Besides the more conventional strategies, the relevance of weight loss, specific (nutritional) compounds, exercise, sedentary behavior, sleep and stress management in affecting metabolism will be topic of study. Furthermore, core principles of potential interactions between lifestyle factors and drugs will be applied and students will critically evaluate the dietary and physical activity guidelines as defined by the Dutch Health council. The lectures/group meetings and journal club will be planned in the first

seven weeks of the course. Throughout the course and in the last week, students will work in small groups on the Academic project. The setup for the academic project intends to promote a largely independent and self-directed form of education that ultimately results in a written report and an oral presentation. The objective of the academic project is that students select a preventable, age-related disease and study possible short term interventions to treat or prevent the disease in humans. Subsequently, students will need to formulate a focused research question to study (i) the most promising lifestyle intervention and (ii) relevant outcome parameters to assess potential treatment effects.

Course objectives

Course objectives 1. To explain the effects of diet and physical activity: - on cellular pathways involved in health and disease - on (mal)adaptive gene expression involved in health and disease - on (disturbed) organ function involved in health and disease - on (disturbed) interorgan crosstalk involved in health and disease 2. To appreciate the bi-directional routes of how nutritional support can amplify the health and performance benefits of exercise 3. To explain the role of genetics in personalized approaches to prevent disease (responders vs. non-responders) 4. To recall differential effects of different forms of lifestyle interventions on metabolism involved in health and disease 5. To apply the core principles of interactions between lifestyle factors (diet and physical activity) and drugs 6. To argue the dietary and physical activity guidelines as defined by the Dutch health council 7. Critically evaluate recent manuscripts discussing lifestyle interventions in health and disease, also focusing on ethics, integrity and statistics

Recommended reading

[This is the link to Keylinks, our online reference list.](#)

Translating Therapies into Clinic and onto the Market

Fac. Health, Medicine and Life Sciences

MBS1402

Period 4:

9 Mar 2026

8 May 2026

Credits:

10.0

Coordinator:

M.M.J. Caron

Teaching methods:

Lecture(s), Paper(s), Assignment(s), Research, Work in subgroups, Presentation(s), Working visit(s)

Assessment methods:

Participation, Presentation, Assignment

Keywords:

**Regenerative Medicine Biomaterials Medical practice Innovation Patent Valorization
Regulatory affaires Project proposal Biomedical study Clinical trial**

Full course description

In this course 'Translating therapies into the clinic and onto the market' we will make the scientific journey from science and technology to the clinic and products. Using actual clinical challenges, students have to work out a new solution to that clinical problem supported by experts in the field. Students will know where to put biomedical solutions in the Technology Readiness Level chain and learn how to take it a step further and learn to communicate specialized knowledge to a group of scientists from different disciplines.

This course has actual clinical challenges from the field of Orthopedic Surgery, Craniomaxillofacial surgery, Experimental Surgery, Gastrointestinal surgery and Endocrinology. Challenged by an expert doctor, students will have to work in small teams to come up with a new strategy to repair damaged tissue or organs which the body can't heal itself using a regenerative medicine multidisciplinary combination of materials science, fundamental biology, smart fabrication technology and bioengineering based on knowledge gained in course MBS1401. Additionally, we will pay attention to valorization which is the process of creating value from knowledge, by making this knowledge available and suitable for economic and social exploitation and to translate this knowledge into products, services, processes and new business. This valorization process is of course bound by

European and International rules and regulations such as FDA and ISO standards and clinical trial directives.

Students have to write a project proposal with predefined sections and present this to their peers and expert in the field at a mini-symposium. This process is closely guided by an expert in the field and students can gain knowledge (additional to literature) in interactive lectures.

Course objectives

- Develop and describe a new research strategy together with team members, to solve a clinical problem based on state of the art technology, biomaterials, biology and medical practice
- Explain and discuss scientific background of (chosen/given) clinical problem, current medical practice and ongoing developments in this field.
- Explain when and how to protect a new innovation and what is required to create a patent
- Explain and discuss the regulatory affairs involved in product development for biomedical applications (animal, human, GLP/GMP)
- Design a translational biomedical study, and write a project proposal
- Present and defend a new project proposal
- Adjusts communication written or oral, to specific global audience/readership and international setting
- Communicates professionally with peers and staff originating from diverse cultural and disciplinary backgrounds
- Shows awareness of team roles and takes responsibly her/his position in a diversely composed international team

Recommended reading

[This is the link to Keylinks, our online reference list.](#)

Non-invasive Neuromodulation

Fac. Health, Medicine and Life Sciences

MBS1602

Period 4:

9 Mar 2026

8 May 2026

Credits:

10.0

Coordinator:

H.P. Leunissen

Teaching methods:

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

Assessment methods:

Written exam, Final paper, Presentation, Attendance, Assignment

Full course description

This course will explore various state-of-the-art non-invasive neuromodulation approaches in detail, with a particular focus on transcranial magnetic and electrical stimulation (TMS/TES). In addition, the course showcases how insights into the pathophysiology of the central nervous system can be translated into clinical applications of non-invasive neuromodulation in psychiatry, neurology, and neuro-rehabilitation. Prominent examples include the application of TMS in depression and stroke. These and many other examples will be discussed, revealing the potential of non-invasive neuromodulation in clinical practice. At the end of this course, students will have a proper understanding of current non-invasive neuromodulation techniques and they will be aware of recent trends and developments for both fundamental and clinical applications.

Course objectives

Intended Learning Outcomes (ILO) in this course:

ILO1601-1: To understand the basic mechanisms of action of transcranial magnetic stimulation (TMS) and transcranial electrical stimulation (TES)

1. To describe the physical foundation of TMS and TES
2. To describe the physiological consequences of TMS and TES protocols
3. To describe, explain, and compare commonly used TMS and TES protocols

ILO1601-2: To understand how TMS and TES can be applied in experimental context

1. To determine and discuss which TMS and TES protocols are suitable to addressing different research questions

2. To interpret outcomes of TMS and TES experiments
3. To gain practical, hands-on knowledge and experience with TMS and TES, including procedural and safety considerations

ILO1602-3: To know about cutting-edge developments and future perspectives of non-invasive neuromodulation

1. To know about advanced concepts of non-invasive neuromodulation
2. To discuss current limitations of the field and identify ways forward
3. To integrate acquired knowledge and skills to reflect on novel applications of non-invasive neuromodulation

ILO1601-4: To describe the current neuroimaging techniques available for neuromodulation.

1. To discuss how neuroimaging can be applied to improve targeting in neuromodulation
2. To gain practical experience in pre-processing fMRI and EEG data in the context of a multimodal NIBS experiment
3. To describe the state of the art in novel research and clinical applications of multimodal NIBS

ILO1602-5: To describe and discuss the applications of TMS in psychiatry

1. To know about the pathophysiology of depression
2. To explain current treatment approaches in psychiatry with TMS
3. To gain practical, hands-on knowledge and experience with the implementation of a TMS treatment session

ILO1602-6: To describe and discuss the applications of TMS in neurology and neurorehabilitation

1. To understand the use of TMS as a diagnostic and prognostic tool
2. To explain current treatment approaches in neuro-rehabilitation with TMS
3. To gain practical, hands-on knowledge and experience with the combination of TMS and electromyographic recordings

Recommended reading

This course almost exclusively relies on recent scientific articles published in international peer-reviewed journals. On rare occasions, a text book may be used to provide basic knowledge required for a topic.

Designing Scientific Research

Fac. Health, Medicine and Life Sciences

MBS1005

Period 5:

11 May 2026

3 Jul 2026

Credits:

10.0

Coordinator:

A. Romano

Teaching methods:

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

Assessment methods:

Final paper, Participation, Presentation

Keywords:

scientific method, Research proposal

Full course description

The overall goal of this block is to familiarize you with the design of a scientific research strategy and the writing of a research proposal and present their data to a scientific public. Central to the block is practicing the scientific thinking: knowledge/research question /hypothesis /objectives /experimental set up/results /interpretation /new knowledge

The general idea of the block is to design a study based on ongoing fundamental, applied, preclinical or clinical research and to learn how to stress the relevance of the study in a convincing manner. The training in block MBS1005 serves as preparation for the block BMS2104 and BMS2004: the practical training period (Master Internship) which will last the complete 2nd year of the master (BMS2104) and will be concluded with the master thesis (BMS2004).

A tutor will be running/coaching a student tutor group. You will work in small teams on developing your own scientific proposal and learn how to present and defend it in the most convincing way. You will provide and receive feedback from the whole group, followed by comments and feedback from the tutors. All the assignments and writing tasks are closely linked, to each other. Your creativity will further be stimulated during the "Design Sprint" workshops (part of "MBS1006 Managing a Biomedical Innovation").

On regular time points you will have a task to write part of your research proposal. This means that throughout the course you can revise and improve what you have written and gradually extend the

text to the full proposal. The work is designed to dovetail neatly with the proposal requirements for the whole course. To boost your scientific skills and creativity, you will also receive workshops on scientific and business thinking and communication skills. You will participate in a network career event in which you will meet BMS alumni which hold various jobs.

Course objectives

1. Formulate a novel project based on ongoing research.
2. Interact at a scientific level with peers and coaches.
3. Suggest research strategies to address specific scientific questions.
4. Define feasible deliverables to provide structured research strategies.
5. Critically review other research proposals.
6. Present and defend a research proposal.
7. Help you eliminate characteristic language errors from your scientific writing.
8. Help you improve the style of your written scientific work.
9. Give you practice in presenting your research proposal.
10. Evaluate the business and valorization value of your proposal.

Ethics in Biomedical Sciences I

Fac. Health, Medicine and Life Sciences

MBS1004

Year:

5 Jan 2026

31 Aug 2026

Credits:

1.0

Coordinator:

H. Ismaili M'hamdi

Teaching methods:

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

Assessment methods:

Assignment

Keywords:

Research Ethics Research Integrity Normative Frameworks Contributory expertise

Full course description

The course 'Historical developments and ethics in biomedical science' invites students to reflect on the emergence of normative frameworks associated with science as they progress through their biomedical curriculum. As part of the course, they will prepare a discussion of the research ethics connected to research they propose and plan themselves. While engaged in research activities, they will discuss and study conventions, standards and guidelines of research integrity. At the end of the year, students will have an active understanding of the frameworks of research ethics and research integrity and how they came into being. Grades are awarded to two written assignments students complete throughout the year, each contributing 50% to a P/F grade.

Course objectives

1. You have knowledge and understanding of research ethics principles, as well as of practices of evaluating and assessing research ethics;
2. You can discuss and reflect of the research ethics of research you design and/or propose;
3. You have knowledge and understanding of research integrity in its conventions, guidelines, and origins;
4. You can critically reflect on research integrity practices and cultures;
5. You are able to synthesize knowledge on research ethics and integrity and reflection on positions associated with them into a coherent discussion of actual research practices.

6. You can actively and constructively participate in exchanges on the normative frameworks in biomedical science.

Advancing Biomedical Innovations I

Fac. Health, Medicine and Life Sciences

MBS1008

Year:

1 Sep 2025

31 Aug 2026

Credits:

3.0

Coordinator:

R. Altara

Mentoring / Portfolio I

Fac. Health, Medicine and Life Sciences

MBS1009

Year:

1 Sep 2025

31 Aug 2026

Credits:

3.0

Coordinator:

M. Gijs

Teaching methods:

Skills, Training(s)

Assessment methods:

Attendance, Assignment

Full course description

The mentoring track in BMS is meant to provide support to your learning. The learning includes BMS-related expertise like biomedical knowledge and research skills, as well as the development of competences like communication and collaboration skills. You will capture your learning in a portfolio, and support reflections on your competences and skills with evidence where possible. The mentor will support you while you explore your competences and skills, helps you set goals, provides feedback on your reflections and portfolio, and eventually assesses your growth.

Course objectives

The BMS Career skills are:

Professional/Collaborator

- The ability to take an active and reliable role in teamwork
- The ability to accept and incorporate feedback and to provide feedback
- The ability to manage time properly;
- Taking responsibility for own personal and academic development;
- The ability to act according ethical standards.

Biomedical expert /Investigator

- The ability to critically reflect on Biomedical Research;
- Understanding the values of the empirical cycle of research.

Communicator

- The ability to communicate scientific ideas effectively in writing and oral presentation;

- The ability to communicate properly with others in non-academic and academic settings.

Creator/Innovator/Forerunner/Groundbreaker

- The ability to generate novel and effective ideas/views/concepts, to stand up for opinions, to criticize cherished beliefs;
- The ability to develop innovative solutions;
- The ability to foresee future applications/directions to experimental work .

Career Skills I

Fac. Health, Medicine and Life Sciences

MBS1010

Year:

1 Sep 2025

31 Aug 2026

Credits:

2.0

Coordinator:

R. Shiri - Sverdlöv, Theys

Teaching methods:

Paper(s), Assignment(s), Work in subgroups, Working visit(s)

Assessment methods:

Participation, Assignment

Keywords:

Career orientation Professional networking Communication skills Teamwork and group dynamics Personal development

Full course description

This longitudinal course is designed to help you build essential skills for a successful career in biomedical sciences. Spread across the Master's programme, it focuses on communication, collaboration, leadership and career exploration through hands-on and interactive activities.

The course includes lectures by professionals working in various biomedical fields and a site visit to the Chemelot Campus. These sessions offer insight into real-world applications of biomedical research and provide inspiration for your own career path. You'll be encouraged to reflect on your goals and interests based on these experiences.

As the programme progresses, you'll explore the job market more actively. You'll learn to network professionally, both online (e.g. via LinkedIn) and offline, and connect with people working in your field of interest. Through dedicated workshops on group dynamics, you'll gain tools to collaborate more effectively and resolve conflicts. You'll learn how to speak with confidence, manage your audience and present yourself convincingly. The course concludes with a career event featuring alumni who share their experiences, daily work routines and practical advice for students entering the field.

MBS1010 is not a traditional course with lectures and exams, it's a skills track that prepares you to transition from student to professional. Through guided reflection, active participation and exposure

to real-world environments, you'll develop the competencies that employers value and gain clarity about your future direction in biomedical sciences.

Course objectives

- Obtain tools to explore the labour market Learn how to research job opportunities, expand your professional network, and align your interests with labour market needs.
- Interact with professionals from different BMS-related fields Gain insight into real-world biomedical careers through site visits and expert sessions, and reflect on possible career paths.
- Gain and apply knowledge on effective group dynamics Understand key principles of teamwork, leadership, and communication, and apply these in academic and professional settings.

Ethics in Biomedical Sciences II

Fac. Health, Medicine and Life Sciences

MBS2001

Year:

1 Sep 2025

7 Nov 2025

Credits:

1.0

Coordinator:

B. Penders

Recommended reading

[This is the link to Keylinks, our online reference list.](#)

Advancing Biomedical Innovations II

Fac. Health, Medicine and Life Sciences

MBS2005

Year:

1 Sep 2025

31 Aug 2026

Credits:

3.0

Coordinator:

A.K. Roth

Mentoring / Portfolio II

Fac. Health, Medicine and Life Sciences

MBS2006

Year:

1 Sep 2025

31 Aug 2026

Credits:

4.0

Coordinator:

M. Gijs

Career Skills II

Fac. Health, Medicine and Life Sciences

MBS2007

Year:

1 Sep 2025

31 Aug 2026

Credits:

2.0

Coordinator:

M. Gijs

Thesis

Fac. Health, Medicine and Life Sciences

MBS2004

Year:

1 Sep 2025

31 Aug 2026

Credits:

50.0

Coordinator:

H.R. Gosker

Teaching methods:

Paper(s), Research

Assessment methods:

Final paper, Oral exam

Keywords:

Thesis, research, biomedical

Full course description

MBS2104 (Internship) and MBS2004 (Thesis) are intertwined. During the 1-year internship (MBS2104) spanning the entire second year of the master, students participate in ongoing scientific research at UM, at other knowledge centres in the Netherlands, or in other countries and will conclude the internship with the master Thesis (MBS2004). The internship project details will be worked out and a preparatory research proposal will be written during course MBS1005 at end of the first year of the master. As a practical, hands-on experience, it offers students a unique opportunity to gain experience in independently carrying out a research project, which they personally designed. The length of the training period ensures the acquisition of valuable, in-depth experience, necessary for students' development into independent researchers. Students work individually and take part in ongoing research projects, supervised by a senior researcher. In this framework, they also participate in the regular meetings of the relevant research team. The internship period concludes with a final presentation to the other students as well as tutors and other experts. The final internship research report is prepared in the form of an extensive scientific paper, which constitutes the master's thesis.

Course objectives

- Ability to carry out a research project independently in a research environment
- Experience in adhering to a research plan (in terms of content and time management)

- Experience in problem solving during research
- Ability to revise or set up follow-up research (adjusted to the results obtained)
- Ability to process, interpret and report results
- Active participation in regular discussions in the research environment
- Ability to present and discuss interim and final results to and with colleagues and supervisor

Internship

Fac. Health, Medicine and Life Sciences

MBS2104

Year:

1 Sep 2025

31 Aug 2026

Credits:

0.0

Coordinator:

H.R. Gosker

Teaching methods:

Skills, Paper(s), Research, Work in subgroups, Presentation(s), Training(s), Patient contact

Assessment methods:

Participation, Presentation, Attendance, Assignment, Observation

Keywords:

Research, Internship, placement, biomedical, undefined

Full course description

MBS2104 (Internship) and MBS2004 (Thesis) are intertwined. During the 1-year internship (MBS2104) spanning the entire second year of the master, students participate in ongoing scientific research at UM, at other knowledge centres in the Netherlands, or in other countries and will conclude the internship with the master Thesis (MBS2004). The internship project details will be worked out and a preparatory research proposal will be written during course MBS1005 at end of the first year of the master. As a practical, hands-on experience, it offers students a unique opportunity to gain experience in independently carrying out a research project, which they personally designed. The length of the training period ensures the acquisition of valuable, in-depth experience, necessary for students' development into independent researchers. Students work individually and take part in ongoing research projects, supervised by a senior researcher. In this framework, they also participate in the regular meetings of the relevant research team. The internship period concludes with a final presentation to the other students as well as tutors and other experts. The final internship research report is prepared in the form of an extensive scientific paper, which constitutes the master's thesis.

Course objectives

- Ability to carry out a research project independently in a research environment

- Experience in adhering to a research plan (in terms of content and time management)
- Experience in problem solving during research
- Ability to revise or set up follow-up research (adjusted to the results obtained)
- Ability to process, interpret and report results
- Active participation in regular discussions in the research environment
- Ability to present and discuss interim and final results to and with colleagues and supervisor

Poster

Fac. Health, Medicine and Life Sciences

MBS2204

Year:

1 Sep 2025

31 Aug 2026

Credits:

0.0

Coordinator:

A. Romano

Teaching methods:

Assignment(s), Presentation(s)

Assessment methods:

Presentation, Assignment, Oral exam

Full course description

During the internship (spanning the entire second year of the master, MBS2004), students participate in ongoing scientific research at UM, at other knowledge centres in the Netherlands, or in other countries. The internship project details will be worked out and a preparatory research proposal will be written during course MBS1005 at end of the first year of the master. As a practical, hands-on experience, it offers students a unique opportunity to gain experience in independently carrying out a research project, which they personally designed. The length of the training period ensures the acquisition of valuable, in-depth experience, necessary for students' development into independent researchers.

Students work individually and take part in ongoing research projects, supervised by a tutor or researcher. The internship period concludes with a final presentation (poster, MBS2204) to the other students as well as tutors and other experts. This presentation/defence will take place during the MOSA conference.

The posters are assessed by at least five independent researchers, and their averaged scores will be listed as a separate mark in addition to the thesis score. A pass on the poster is required for a pass on the internship.

Course objectives

- Process, interpret and report results
- Participate in discussions in the research environment

- Present, discuss and defend final results to and with colleagues and supervisors
- Prepare a poster with internship results/research outcomes

