Master Biomedical Sciences

After the first multidisciplinary block, students choose one of the following specialisations:

Genetics and Genomics
Imaging from Molecule to Man
Inflammation and Pathophysiology
Nutrition, Physical Activity and Metabolism
Regenerative Medicine

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Genetics and Genomics

Introduction
Genetics and genomics both play roles in health and disease. Genetics helps us understand how diseases are inherited, what screening and testing options or treatments are available. Genomics helps us to discover why some people get sick from certain infections, environmental factors, and behaviours, while others do not.

Is this the right specialisation for me?
This specialisation is developed in order to provide students with a strong foundation and expertise in the field of genetics. Main focus is on the application of genetics and genomics principles in scientific research and in the clinic with specific attention for cancer, cardiogenetics, neurogenetics, model systems, forensics and personalised medicine.

What will I learn?
You will:
obtain knowledge about technologies for high-throughput collection of 'omics' data and about models used for genetic manipulation or complex human disorders;
learn about the concepts and limitations of genetic testing, genetics diversity and the influence of epigenetics on the fundamental regulation of gene expression;
analyse data and define ethical and societal issues concerning genetics and genomics;
apply the concepts of molecular genetics in the context of research and treatment of diseases (cancer progression, cardiogenetics and neurogenetics);
identify genetic and biological pathways in complex diseases; and
apply genetics and genomics in personal medicine.

What are my career prospects?
This specialisation prepares you for a research-oriented future in the field of genetics and genomics

in academia, biomedical companies and in the clinic.

Programme
In the first course, the basic principles of genetics and genomics will be taught. This course serves as the basis for work in the second course, which focuses on translation and application of the knowledge obtained in the first course to solve challenging clinical problems.

Course 1: *Advanced Principles of Genetics and Genomics*
In this course, the molecular mechanisms of genetic and environmental influences on gene expression and protein function are being addressed. Additionally, the principles of several algorithms and the databases and analytical programmes available in the public domain are being addressed. Finally, the impact of genetics and genomics on research and society with respect to personalised medicine and ethical issues will be discussed.

Course 2: *Clinical and Applied Genetics and Genomics*
This course further elaborates on the application of genetics and genomics principles in scientific research and clinical applications with specific attention for cancer, cardiogenetics, neurogenetics, model systems, forensics and personalised medicine.

Contact
For more information on this specialisation, please contact prof Ronit Sverdlov (r.sverdlov[at]maastrichtuniversity[dot]nl).

This video gives you an impression of the specialisation *Genetics and Genomics*. It is a show and tell by three people who are in one way or another involved in this specialisation: prof.dr Ronit Shiri-Sverdlov, student Jasper Germeraad and laboratory specialist in clinical Genetics at MUMC+ dr Bianca van den Bosch.

Master BMS, specialisation Genetics and Genomics

Imaging from Molecule to Man

Introduction
Imaging is increasingly and widely applied in biomedical studies and clinical practice. Imaging is the application of advanced visualisation technologies to bridge the gap between the biomolecular pathways to human diseases and metabolomic disorders. It deals with visualisation of molecular processes happening in cells, organs, and the whole body.

With imaging, we are able to understand basic biological processes, support diagnosis in early stages of disease, accessing effectiveness of current treatments and help in the development of new treatments. We have the unique opportunity to study organ function, such as movement of the heart and blood flow. We are able to follow a disease process in time, also before clinical symptoms occur.

As a biomedical scientist, specialized in imaging, you are a key person in linking physiological questions to novel imaging methods. You communicate with both clinicians and engineers and you apply state-of-the art imaging methods to clinical demands. You make sure that novel imaging methods can be directly applied in a (pre)clinical (research) environment.

During internships, students can participate in projects related to: metabolomic pathways in cancer systems; neurodegenerative diseases; cardiovascular diseases; cell regeneration; and metabolic diseases (type 2 diabetes, non-alcoholic fatty liver disease). The excellence of imaging infrastructure and expertise at Maastricht University Medical Center is recognised worldwide.

Is this the right specialisation for me?
This specialisation is developed to provide students with a strong background and experise in the field of biomedical imaging. Together with experts in the fields, we will focus on the application of a broad range of imaging techniques in biomedical and (translational) clinical research and will use these techniques to answer specific questions related to oncology, neurology, cardiovascular disease, metabolomic disorder, just to name a few applications.

What will I learn?
The focus is really on the biomedical problem and not so much on the underlying physical methodology/technology. The main question is how we can use advanced imaging modalities to understand biomedical problems. Within this specialisation, you will learn how to apply novel technologies to biomedical sciences to solve a biomedical research question. You will learn the basic principles of the imaging modalities, so you can make correct choices of imaging methods for specific questions.

The courses within the specialisation offer interactive teaching, hands-on experiments through practicals, lab visits, workshops, projects, interaction with clinicians, and internships in our research laboratories.

In the region and the Netherlands, no other integrative courses on imaging for biomedical scientists exist. This is a unique course encompassing all type of advanced imaging techniques like Mass spectrometry imaging, Nanoscopy, Advanced Microscopy, PET and MRI imaging. All these technologies are used with the biggest emphasis on biomedical applications.

Students have the opportunities to learn from expert researchers from each discipline, interact with professionals and clinicians from the Maastricht University Medical Center +.

What are my career prospects?
Clinical symptoms often occur unannounced. However, with imaging techniques changes can usually already be detected a long time before clinical events occur. Also imaging can provide crucial information for a better understanding of disease processes, leading to clinical events. Therefore, we need highly skilled scientists to apply imaging to scientific research and within the clinic. The specialization prepares you for a career at a university, in different research institutes affiliated with academic organisations, companies (biomedical and pharmaceutical companies) or university hospitals.

Programme
Course 1: *Pre-clinical Imaging*
This first course is focused on pre-clinical imaging, which ranges from ex vivo imaging of a single molecule to in vivo imaging of animal models. The course aims to give you insight into the basic principles as well as the biomedical applications of ex vivo and noninvasive in vivo imaging techniques. Imaging techniques that will be discussed are mass spectrometry imaging (MSI), electron and light microscopy (EM and LM), ultrasonography, Magnetic Resonance Imaging (MRI), Computed Tomography (CT), and nuclear imaging (Single Photon Emission Computed Tomography (PECT) and Positron Emission Tomography (PET).

You will be taught to prepare, acquire, transform, analyse and utilize various imaging modalities to visualize sub-cellular structures up to whole animal imaging. Combined, these preclinical research methods pave the way for new diagnostic approaches required for personalised and systems medicine.

Within this course you will perform a project to learn how to solve a biomedical research question with advanced imaging.

The distinctive (molecular) imaging infrastructure at the Maastricht University Medical Center + is available for the students, who will have the opportunity to meet and interact with experts in the imaging field.

Course 2: *Clinical Imaging*
This second course in this specialisation will focus on the application of imaging to address physiological and pathological disease processes in man in a clinical (research) setting.

Imaging technologies provide increasingly accurate detail on morphology, structure, function and dynamics of living systems. In life sciences and (translational) clinical research, the use of (diagnostic) imaging technologies has become increasingly widespread and has now also entered the area of prevention and therapy/treatment monitoring.

This course focuses on imaging in treatment decisions based on molecular clinical diagnostic information and patient images. Clinical imaging focuses on in vivo imaging, image guided interventions/biopsies and molecular tissue pathology and morphology. This course addresses translational aspects from systems biology to in vivo imaging of the patient with MRI/MRS and other radiological methods. You will be introduced to the concept of radiomics in which imaging features are extracted from medical images and used as biomarkers for patient stratification and treatment response. Intraoperative diagnostics and image-guided surgery are studied as innovative approaches that put molecular analytical information in the hands of medical practitioners. This course teaches biomedical scientists to be the interface between imaging technology and the clinic. Moreover, this course provides a translational / clinical environment to teach students to work side-by-side with clinicians on innovations in systems medicine.

Contact
For more information on this specialisation, please contact dr Tiffany Porta (t.porta[at]maastrichtuniversity[dot]nl) or prof.dr. Eline Kooi (eline.kooi[at]mumc[dot]nl).

This video gives you an impression of the specialisation *Imaging from Molecule to Man*. It is a show and tell by three people who are in one way or another involved in this specialisation: dr Tiffany Porta Siegel, student Rob Janssen and senior principal scientist at Janssen Pharma Rob Vreeken.

Master BMS, specialisation Imaging from Molecule to Man

Inflammation and Pathophysiology

Introduction
Our aging society is facing many threats, including oncologic, neurologic and cardiovascular

problems. Frequently, these problems are of inflammatory nature or are caused by infections. Therefore, this specialisation aims to develop a thorough, clinically relevant understanding of different mechanisms of development of disease. The specialisation also describes current relevant animal models.

Is this the right specialisation for me?
We aim to prepare you to contribute to the understanding of inflammation and pathological threads, and develop new treatment strategies. The development includes engineering of the immune system to develop cell therapies, antibody therapy, vaccination, drug development and gene therapy.

This is the specialisation for you:
if you are interested in manipulation of the immune system, and
if you wish to pursue a career either in industry (biotechnology) or academia.

What will I learn?
You will:
- learn pathophysiology of relevant organs,
- learn techniques for the study of molecules, cells and organisms,
- obtain clinically relevant understanding of different mechanisms of disease,
- learn to target immunological threads,
- create new therapeutic strategies targeting the immune system,
- get prepared for working in academy and industry,
- read and think in a critical way,
- design, conduct, analyse, explain and defend your research (via research papers, essays, presentations), and
- collaborate in small teams.

Goals of this specialisation are:
- to understand path·o·phys·i·ol·o·gy:
the study of structural and functional changes in tissue and organs that lead to disease;
- to evaluate different types of therapies, vaccination and immune system effector functions;
- to engineer the immune system, treatment of disease.

What are my career prospects?
This specialisation prepares you for a research career in the field of inflammation and pathophysiology in academia, hospitals, and industry (biomedical companies) et cetera (e.g. PhD, embedded scientists, R&D).

Programme
This specialisation combines an education in concepts with a sophisticated training in immunological techniques.

Course 1: *Inflammation and Pathophysiology*
- learn sterile inflammation and other pathological threats leading to degeneration
- explain hypersensitivity disorders
- explain immunity to tumors
- appraise immunity to microbes

Course 2: *Inflammation and Pathophysiology - Engineering the Immune System, Treatment of Disease*
- explain and design antibody engineering
- explain and design cell therapy

evaluate and design vaccination
discuss organ transplantation
appraise gene-therapy techniques
assess the potential of microbiome targeting

Contact
For more information on this specialisation, please contact dr Pilar Martinez (p.martinez[at]maastrichtuniversity[dot]nl).

This video gives you an impression of the specialisation *Inflammation and Pathophysiology*. It is a show and tell by three people who are in one way or another involved in this specialisation: prof.dr Pilar Martinez, student Jan Gaede and VP Biologics Research at Bayer AG (and professor in Biopharmaceutics at UM) dr. René Hoet.

Master BMS, specialisation Inflammation and Pathophysiology

Nutrition, Physical Activity and Metabolism

Introduction
A lifestyle characterised by overnutrition of macronutrients and underconsumption of micronutrients, along with physical inactivity translates into derailments in metabolic health and ultimately into deteriorated function and health. A wide range of currently prevalent disorders in westernised societies find common ground in metabolism that goes awry.

The aim of this specialisation is to understand the physiology and the mechanisms underlying these derailments to provide the basis for the ultimate design and optimisation of preventive and therapeutic nutritional and life-style interventions that improve metabolic health and alleviate the diseased state.

Is this the right specialisation for me?
If you have a genuine interest in how diet, physical activity and a sedentary lifestyle affect health…
If you are interested in the mechanisms (from molecule to man) governing the (mal)adaptive responses of the human body to changes in energy availability and demand…
If you would like to know the state-of-the-art on how exercise and physical activity interventions can promote health…
If you are eager to gain the knowledge needed to design novel life-style interventions to promote health…

Than this is the specialisation of your choice!

What will I learn?
In this specialisation you will study deeply into:
the integrative and interorgan physiology of key metabolic processes;
the biochemical and cellular basis for diet- and exercise-induced alterations in health;
the biochemical and cellular basis for the health threatening effects of a sedentary life-style;
how nutrition and physical activity affect non-communicable diseases;

identification of routes fundamental to the design of non-exercise related life-style interventions to promote energy turnover and health.

What are my career prospects?
To halt the progressive increase in prevalence of disorders that find common ground in disturbed metabolism, we need highly skilled people to identify potentially successful targets and routes for intervention via scientific research. This includes research in academia, hospitals and industry (ranging from biomedical and pharmaceutical companies to companies developing wearables to monitor health and physical activity). You can also apply the knowledge acquired in (academic) teaching or in public health settings to provide new scientific background to novel health promotion programmes.

Programme
Course 1: *Nutrition, Physical Activity and Metabolism: Fundamental Aspects*
This course will provide in-depth insight into the major systems of human nutritional and exercise physiology and metabolism. With basic knowledge on nutrient uptake across the gastrointestinal tract as the starting point, the course will focus on cell and organ specific routes for conversion of macromolecules into their oxidizable derivatives. Importantly, the pivotal role of intermediary metabolism, metabolites and small circulatory hormones like peptides in metabolic control and inter-organ cross-talk (muscle-liver-adipose tissue-cardiovascular system-brain) will be thoroughly studied in the fasted, post-prandial and exercised state. This course will provide the mechanistic basis to understand how aberrations in energy and substrate metabolism can be the common denominator in multiple highly prevalent disorders like Alzheimer's disease, Parkinson, some types of cancer or metastases, COPD, sarcopenia, obesity, type 2 diabetes and related cardiovascular disorders. Alterations in energy status, energy sensing and energy turnover have all been associated with these disorders. These alterations may originate from compromised nuclear receptor signaling, post-transcriptional modulation via e.g. micro RNA's, post-translational modification (acetylation, glycosylation, phosphorylation) hampering protein function and metabolic processes altering NAD+/NADH and ADP/ATP related energy status of the affected cells. With mitochondria being the subcellular hub in energy turnover, detailed knowledge on the dynamics of the mitochondrial network is considered an essential part of this course.

Course 2: *Lifestyle Interventions and Metabolism; a Translational Perspective*
In this course the role of diet and physical activity to prevent chronic disease in humans will be considered. Lifestyle factors modulating metabolism on a micro (cellular) and macro (organ) scale will be studied via a translational approach. This course will take conventional strategies to promote health (like nutritional and exercise interventions) to the next level by exploring the underlying mechanisms and how these interventions may prevent chronic diseases like cardiovascular disease, cancer, chronic respiratory diseases and diabetes. Interventions like weight loss, (nutritional) compounds, exercise, sedentary behaviour, sleep, stress management promoting metabolism will be topic of study. The basis for inter-individual differences in responsiveness, including genetics, will be studied in the light of personalised interventions to promote health and prevent disease.

Contact
For more information on this specialisation, please contact prof Matthijs Hesselink (matthijs.hesselink[at]maastrichtuniversity[dot]nl).

This video gives you an impression of the specialisation *Nutrition, Physical Activity and Metabolism*. It is a show and tell by three people who are in one way or another involved in this specialisation: prof.dr Matthijs Hesselink, student Marvin Feldmann and nutrition and movement sciences researcher at UM Marlies de Ligt.

Master BMS, specialisation Nutrition, Physical Activity and Metabolism

Regenerative Medicine

Introduction
An increasingly ageing population in the industrialised world is accompanied by a number of new challenges. For example, as ageing is combined with a more active lifestyle, the demand for treatments for damaged and diseased organs and tissues also increases.
The interventions that are used to successfully restore the function of damaged organs or tissues have also changed in the past decades. While some thirty years ago implants were used to passively take over the function of a poorly functioning tissue, nowadays the focus is on developing methods that temporary 'trigger' the body to repair or regenerate itself. Furthermore, such interventions need to be affordable, as the burden to our healthcare system is also growing.

To be able to develop successful and affordable regenerative strategies, knowledge must be integrated from different disciplines. An active collaboration between chemists, materials scientists, physicists, biologists, computational scientists and clinicians is required to make a true difference in the biomedical field.

Is this the specialisation for me?
This specialisation is developed for students with an interest in a multidisciplinary field aiming at creating solutions to restore structure and function of permanently damaged tissues and organs by using a combination of science and technology. Regenerative medicine (RM) is inherently translational and uses basic scientific knowledge to solve real clinical problems. Within this specialisation, topics will focus on both the molecular biological (including stem cell biology and gene therapies) and technological (including tissue engineering and bio-fabrication technologies) aspects, and the combination thereof within a clinical context.

What will I learn?
You will:
- obtain an overview of the science and technology in the field of RM;
- be exposed to the essence of multi-disciplinarity within RM;
- understand the difference between basic science and translational science;
- learn how to bring novel inventions within the field of RM to the market;
- make the scientific journey from basic science and technology towards a clinical application; and
- learn to communicate specialised knowledge to a group of scientists with different background and specialisations.

What are my career prospects?
This specialisation prepares you for a research-oriented future in the field of regenerative medicine in academia, biomedical companies, et cetera (e.g. PhD, embedded scientists, R&D).

Programme
In the first course the basic principles of RM are taught. This course serves as the basis for work in the second course, which focuses on translation and application of the knowledge obtained in course 1 to solve challenging clinical problems.

Master Biomedical Sciences

Course 1: *The Science and Technology of Regenerative Therapeutics*
This course is about exposure to the essence of multi-disciplinarity of RM. You will increase your level of knowledge on the technology and science behind regenerative medicine such as cell therapy, material science, fabrication technologies and combinations of these, within a clinical context.

Course 2: *Translating Therapies into the Clinic and onto the Market*
In this course, we will make the scientific journey from science and technology to the clinic and products. Using actual clinical challenges, you have to work out a new solution to that clinical problem supported by experts in the field. You will know where to put biomedical solutions in the Technology Readiness Level chain and you will learn how to take it a step further and learn to communicate specialised knowledge to a group of scientists from different disciplines.

This video gives you an impression of the specialisation *Regenerative Medicine*. It is a show and tell by three people who are in one way or another involved in this specialisation: prof.dr Jan de Boer, student Daphne Eussen and entrepreneur Niloofar Tahmasebi.

UM 01 Regenerative Medicine (2).mp4

Additional specialisations

Hasselt University (Belgium)
Hasselt University offers two additional specialisations:
Bio-electronics and Nanotechnology, which focuses on biomaterials, the interface between biological and electronic systems, and the broad domain of biosensors.
Environmental Health Sciences, which focuses on the molecular interaction between the environment and cells, toxicology, and risk assessment.

Learn more about these specialisations on Hasselt University's website.

Tomsk State University (Russia) and Maastricht University
Biomedical Sciences and BioPhysics: a double-degree master's programme at Maastricht University and Tomsk State University.

Learn more about this specialisation.

First year courses

Biomedical Sciences Year 1

Fac. Health, Medicine and Life Sciences

Biomedical Challenges

Full course description

Biomedical Science helps us understand living biological systems. The insight and lessons learned can be then used in designing medical interventions. Biomedical Science specifically translates knowledge from the natural sciences to medical applications. In this first course of the master programme students will be introduced to the diverse topics biomedicine deals with. The course will address the disease onset, progression, prevention, diagnostics, and therapies. The students will gain insight in diverse molecular processes that underlie diseases, the pathophysiology, risk factors and societal burden. Understanding of these fundamental principles is necessary to facilitate the development of diagnostics and therapies to better cope with the diseases.

Course objectives

The course's Intended Learning Goals (ILOs):

ILO1 Distinguish different mechanisms and factors behind molecular dysfunction in

1. Neuromuscular and mitochondrial disorders
2. Mental and neurodegenerative disorders
3. Metabolic disorders including obesity and diabetes mellitus
4. Disease of choice in the context of the group work

ILO2 For aforementioned disorders describe the current knowledge of

1. Etiology of disease including risk factors and lifestyle
2. Biomolecular basis of disease
3. Manifestation of the molecular dysfunction in the form of phenotype
4. Diagnostics (including molecular read-outs)
5. Innovative and personalized treatment options

ILO3 Elucidate challenges in aforementioned aspects of disease

ILO4 Work according to the scientific method

ILO5 Synthesize and present complex scientific information on state-of-the-art knowledge and challenges in biomedical field

ILO6 Explore future applications of biomedical knowledge

MBS1001
Period 1
4 Sep 2017
27 Oct 2017
Print course description
ECTS credits:
11.0
Instruction language:
English
Coordinator:

Master Biomedical Sciences

- R.J. Szklarczyk

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), Paper(s), PBL, Presentations, Working visit(s)
Assessment methods:
Assignment, Attendance, Final paper, Participation, Presentation, Written exam
Keywords:
biomedical breakthroughs, biological systems, natural sciences, medical applications, disease
Fac. Health, Medicine and Life Sciences

Advanced Principles of Genetics and Genomics

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

For this course specific book chapters and scientific articles will be used. Necessary literature will be timely made available through the student portal (EleUM).

MBS1101
Period 2
30 Oct 2017
22 Dec 2017
Print course description
ECTS credits:
12.0
Instruction language:
English
Coordinator:

- E.C.M. Mariman

Teaching methods:
Assignment(s), Lecture(s), Paper(s), PBL, Skills, Working visit(s)
Assessment methods:
Assignment, Final paper, Participation, Written exam
Keywords:
advanced genetics genomics bioinformatics epigenetics gene-environment interaction gene expression analytical techniques data handling/analysis ethical/societal issues
Fac. Health, Medicine and Life Sciences

Pathophysiology of Disease

MBS1201
Period 2
30 Oct 2017
22 Dec 2017
Print course description
ECTS credits:
12.0
Instruction language:
English
Coordinator:

- M.P. Martinez Martinez

Fac. Health, Medicine and Life Sciences

Nutrition, Physical Activity and Metabolism; Fundamental Aspects

MBS1301
Period 2
30 Oct 2017
22 Dec 2017
Print course description
ECTS credits:
12.0
Instruction language:
English
Coordinator:

- M.K.C. Hesselink

Fac. Health, Medicine and Life Sciences

Science and Technology of Regenerative Therapeutics

Full course description

The Research Track Regenerative Medicine is a specialization of the Biomedical Sciences Master track of Maastricht University. The general aim of this first block within the Research Master Regenerative Medicine is to provide the students with a solid foundation of knowledge in the field of regenerative medicine (RM). RM is a multidisciplinary field, combining fundamental biomedical sciences with technology, and aimed at replacing, engineering or regenerating tissues and organs in order to restore or establish normal function. As such, RM is inherently translational and uses basic scientific knowledge to solve real clinical problems. In this track, students will be exposed to both the biological science of regeneration, including stem cell biology and pathophysiology, as well as to the technology behind RM such as materials science, biofabrication technologies, chemistry and computational modeling. Students will learn to work in teams, to think critically and to communicate across the borders of disciplines. Moreover, already in this first block, the acquired knowledge will directly be applied to real-life, state-of-the-art RM study cases.

Course objectives

Course ILO's:

- Understands the molecular processes of wound healing in adult versus fetus versus amphibians, and how this can help us developing regenerative therapies.
- Understands how tissues maintain their homeostasis during life and how to apply this knowledge to develop a regenerative therapy.
- 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.
- Describe the composition and organization of ECM and understand the synthesis, structure and degradation of different biomaterials; metals, ceramics, polymers, and composites thereof.
- Describes processing technologies used to fabricate scaffolds for tissue engineering, including

how to introduce surface modifications, and can identify what important factors of scaffold design are.
- Describes microfabrication techniques and the main concepts and functions of bioreactors and organ-on–a-chip.
- Describes the importance of cell-material interface for tissue engineering and materiomics by understanding the importance of material properties to modulate biological processes of adhesion and signalling.
- Be able to critically assess the quality aspects of a research question, methodology, and results. Makes supported decisions/ balanced choices when designing a regenerative medicine experiment.
- Be able to clearly present and discuss scientific research in the field of regenerative medicine.

Recommended reading

The basic literature for the course:

- Clemens Van Blitterswijk and Jan de Boer (2015). Tissue Engineering, 2nd edition, ISBN 978-0-12-420145-3.
- Anthony Atala et al. (2011). Principles of Regenerative Medicine, 2nd edition, ISBN 978-0-12-381422-7
- Jan de Boer and Clemens van Blitterswijk (2013). Materiomics – High-throughput Screening of Biomaterial Properties, 1st edition, ISBN 978-1-10-701677-4

During the journal clubs the students will receive a number of publications related to the topic of the week.

The students are also encouraged to search for additional information using other resources (i.e. the internet), the quality of which will be discussed in the tutorial groups.

MBS1401
Period 2
30 Oct 2017
22 Dec 2017
Print course description
ECTS credits:
12.0
Instruction language:
English
Coordinator:

- S.H. van Rijt

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations, Training(s), Working visit(s)
Assessment methods:
Final paper, Participation, Presentation, Written exam
Keywords:
Organ and tissue regeneration Tissue engineering Stem cell therapy interdisciplinary Regenerative medicine
Fac. Health, Medicine and Life Sciences

Pre-clinical Imaging

Full course description

“A picture is worth a thousand words”. Imaging approaches are essential to visualize the key (molecular) players of health and disease at the molecular, cellular, tissue, and organ levels. Imaging also gives the unique opportunity to study animal models noninvasively at multiple time points and to obtain functional information, in order to provide more insight in health and disease. The first block on “Imaging from molecule to men” is focused on pre-clinical imaging, which ranges from ex vivo imaging of a single molecule to in vivo imaging of animal models.
The goal of this course is to educate students in the interdisciplinary field of preclinical biomedical imaging and to prepare them for a future in a technology-driven multidisciplinary biomedical research environment. The course aims to give students insight into the basic principles as well as the biomedical applications of ex vivo and noninvasive in vivo imaging techniques. Imaging techniques that will be discussed are mass spectrometry imaging (MSI), electron and light microscopy (EM and LM), ultrasonography, Magnetic Resonance Imaging (MRI), Computed Tomography (CT), and nuclear imaging (Single Photon Emission Computed Tomography (SPECT) and Positron Emission Tomography (PET)).
Students will be taught to prepare, acquire, transform, analyze and utilize complex image structures at multiple spatial scales that originate from various imaging modalities. Combined, these preclinical research methods pave the way for new diagnostic approaches required for personalized and systems medicine.
The unique molecular imaging infrastructure at the MUMC+ will be available for the students, who will have the opportunity to meet and interact with professionals and experts in preclinical imaging.

Course objectives

At the end of the course students should be able to:

ILO1. Explain the principles of preclinical imaging a. Explain the principles of mass spectrometry imaging, optical and electron microscopy, ultrasound imaging, MRI/MRS, CT, PET/SPECT, and multimodal and hybrid imagingb. Identify a relevant sample preparation technique for different imaging modalities

ILO2. Characterise the multidisciplinary nature of the preclinical imaging field a. Explain the complementarity between different imaging techniquesb. Explain the opportunities of multimodal and hybrid imaging and integration of different techniques into an imaging workflowc. Explain the opportunities of interdisciplinary collaborations within preclinical research

ILO3. Review the current opportunities and limitations of preclinical imaginga. Describe the opportunities of each techniqueb. Describe the technological limitations to each techniquesc. Describe the main challenges for translation towards clinical practice

ILO4. Analyse quantitative aspects of preclinical imaging, for example in pharmaceutical sciences and biomarker discovery

ILO5. Integrate various imaging techniques to characterize and identify molecules at different levels (i.e. single molecule, macromolecular complex, metabolite concentrations, sub-cellular structures, cell, tissue, organ, animal)

ILO6. Describe the factors that determine the properties and prospects of existing and innovative preclinical imaging techniquesa. Describe the translation from preclinical to clinical imagingb. Name examples of success and failure stories about real applications from preclinical to clinical imagingc. Identify the benefits of a multidisciplinary team within preclinical imaging research

ILO7. Make a plan for the application of preclinical imaging to different research areas (i.e. cardiovascular, oncology, metabolism, neuro sciences)

ILO8. Apply both descriptive ethics and normative ethics to a case study relevant within his/her specialisation.

Recommended reading

1. Liu et al, MSI of therapeutics from animal models to three-dimensional cell cultures. Anal Chem, 2015. 87:9508-19. 2. Quanico et al, Integrated MSI and omics workflows on the same tissue section using grid-aided, parafilm-assisted microdissection. Biochim Biophys Acta, 2017. 3. Pol et al, Age-related changes in the lateral lipid distribution in a human lens described by MSI. Eur J Mass Spectrom, 2015. 21(3):297-303. 4. Mascini et al, MSI of the Hypoxia Marker Pimonidazole in a Breast Tumor Model. Anal Chem, 2016. 88(6):3107-14. 5. Jiang et al., High-resolution sub-cellular imaging by correlative NanoSIMS and EM of amiodarone internalisation by lung macrophages as evidence for drug-induced phospholipidosis. Chem Commun, 2017. 53:506-1509. 6. Ablonczy et al., The utilization of fluorescence to identify the components of lipofuscin by imaging mass spectrometry. Proteomics, 2014. 14(7-8):936-44. 7. de Boer et al, Correlated light and electron microscopy: ultrastructure lights up! Nature Methods 12, 503–513 (2015) 8. http://ammrf.org.au/myscope/ 9. http://zeiss-campus.magnet.fsu.edu/ 10. Hartley CJ et al, Doppler velocity measurements from large and small arteries of mice. Am J Physiol Heart Circ Physiol. 2011 Aug;301(2):H269-78. 11. Hermans et al, Murine pressure overload models: a 30-MHz look brings a whole new "sound" into data interpretation. J Appl Physiol (1985). 2014 Sep 1;117(5):563-71. 12. Clark et al, Micro-CT of rodents: state-of-the-art and future perspectives. Phys Med. 2014 30(6):619-34. 13. Zanzonico P. Principles of nuclear medicine imaging: planar, SPECT, PET, multi-modality, and autoradiography systems. Radiat Res. 2012 Apr;177(4):349-64. 14. Gammon et al, Preclinical anatomical, molecular, and functional imaging of the lung with multiple modalities. Am J Physiol Lung Cell Mol Physiol. 2014 May 15;306(10):L897-914. 15. van Geuns et al, Basic principles of MRI, Progress in Cardiovascular Diseases. 1999; 42(2):149-156. 16. Vanhoutte et al, High field MRI of rodents in cardiovascular research, Basic Res Cardiol (2016) 111:46 Shah et al, Hybrid PET/MR imaging: physics and technical considerations, Abdom Imaging (2015) 40:1358–1365.

MBS1501
Period 2
30 Oct 2017
22 Dec 2017
Print course description
ECTS credits:
12.0
Instruction language:
English
Coordinator:

- M.E. Kooi

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

Master Biomedical Sciences

Assessment methods:
Assignment, Attendance, Computer test, Observation, Participation, Presentation
Keywords:
preclinical imaging, MSI, EM, LM, MRI, US, SPECT, PET, CT
Fac. Health, Medicine and Life Sciences

Biosafety

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 practical assignments the participants can train some basic biosafety principles for proper handling of microorganisms. In the case studies some realistic laboratory situations are depicted by which the participants are forced to think about how to handle these situations in a (bio) safe way.
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

MBS1103
Period 3
8 Jan 2018
2 Feb 2018
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinator:

- N. Kisters

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

Master Biomedical Sciences

Assessment methods:
Written exam
Fac. Health, Medicine and Life Sciences

Clininal and Applied Genetics and Genomics

MBS1102
Period 3
8 Jan 2018
2 Feb 2018
Print course description
ECTS credits:
12.0
Instruction language:
English
Coordinator:

- E.J.M. Speel

Fac. Health, Medicine and Life Sciences

Engineering the Immune System; Treatment of Disease

Full course description

Building on the knowledge that has been gathered by the student in the MBS1202 course, MBS1203 course will follow roughly the same roadmap through the various fields of research and clinical medicine, in which immunology, inflammation and the pathophysiology of infectious and non-infectious disease are specifically involved in diagnosis and therapy. Attention will be given to experimental medicine approaches and technologies as well as to the more general translational aspects related to the topics that are relevant to fields of sterile and non-sterile (infectious) inflammation, neurodegeneration, atherosclerosis and vascular disease, autoimmunity and tumor development.

The goal of this course is to provide a basic understanding of several important techniques and technologies in the field and create an awareness of experimental and approved methods for treatment 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 health
- Student is able to apply both descriptive ethics and normative ethics to a case study relevant within his/her specialisation.

Recommended reading

The course will not use a single advised textbook on immunology/biochemistry/pathology, instead, recent scientific literature will be used. Given the wide variety of topics and relative fast developments in the field, the use of few textbook sources is not advised, nor is it sufficient. The literature as used in the preceding 1201 block, should be continued where general mechanisms are concerned. Individual teachers and experts however are being encouraged to deviate from the basic knowledge from 1201, to extend this and present the lastest views and knowledge from the respective fields involved in this block. Good starting points for basic knowledge are: Janeways - Immunology (Garland Science) Peter Parham - The Immune System (Garland Science) Doan et al - Immunology - Lippincott's Illustrated Reviews (Wolters Kluwer/Lippincott Williams & Wilkins)

MBS1202
Period 3
8 Jan 2018
2 Feb 2018
Print course description
ECTS credits:
12.0
Instruction language:
English
Coordinator:

- G.A.F. Nicolaes

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentation(s), Skills
Assessment methods:
Assignment, Attendance, Final paper, Observation, Participation, Presentation, Written exam
Keywords:
Immunology Therapy Immune response Immune Disease Immune Modulation Immune suppression Immune therapy Pharmacotherapy Antibody therapeutics
Fac. Health, Medicine and Life Sciences

Lifestyle Interventions and Metabolism; a Translational Perspective

MBS1302
Period 3
8 Jan 2018
2 Feb 2018
Print course description
ECTS credits:
12.0
Instruction language:
English

Master Biomedical Sciences

Coordinator:

- C.J.H. van der Kallen

Fac. Health, Medicine and Life Sciences

Translating Therapies into Clinic and onto the Market

Full course description

Using often a combination of advanced microfabrication technologies, biomaterials, and (stem)cells followed by implanting or transplanting these into the patient. We will discuss and work out the latest advances in technology and medicine to replace tissues and organs damaged by disease or traumatic injuries and develop new potential therapies for previously untreatable conditions. Examples of chronic diseases(not exclusive) are type 1 diabetes, cardiovascular diseases, orthopedics, opthalmological diseases, and renal failure which will serve as starting points to work with the help of a research expert and clinicians in a dedicated team on a project proposal. This module is setup around different challenging clinical cases which need to be solved with your team members and by interaction with different experts using Regenerative medicine strategies. During the course you will get in depth knowledge on different aspects of Regenerative Medicine strategies and how to develop your new regenerative medicine research idea into a clinical viable therapy. There will be weekly interactions during dedicated tutor sessions with your research tutor to work on different aspects of a research proposal. We will have expert lectures on "state of the art" scientific research regarding technology and regenerative medicine on a weekly basis. In addition, there will be special lectures on IP (patent related issues and regulations), Clinical trials and several companies will be invited to discuss what is required to bring an idea to the market and ultimately to patients.in vitro,, or growing tissues and organs in vivoVirtually any disease that results from malfunctioning, damaged, or failing tissues can potentially be cured through regenerative medicine therapies. Regerative medicine involves either regenerating the damaged tissues You are expected to have followed the precedeing module on Regenerative medicine in which the basic knowledge about the field is taught. You are expected to use the knowledge aqcuired in that module for solving the clinical case in this module The module will be graded on writing a research proposal, presenting your new idea during a minisymposium and professional behavior.

Course objectives

- Students should know how to present and defend a new project proposal
- Students should know how to design a translational biomedical study, and write a project proposal
- Students should know about the regulatory affairs involved in product development for biomedical applications (animal, human, GLP/GMP)
- Students should know about when and how to protect a new innovation and what is required to create a patent
- Students should be able to develop 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

MBS1402
Period 3
8 Jan 2018
2 Feb 2018

Master Biomedical Sciences

Print course description
ECTS credits:
12.0
Instruction language:
English
Coordinator:

- A.A. van Apeldoorn

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), Paper(s), Presentations, Research, Working visit(s)
Assessment methods:
Assignment, Participation, Presentation
Fac. Health, Medicine and Life Sciences

Clinical Imaging

Full course description

This second course in the “Imaging from molecule to man” specialization will focus on the application of imaging to address physiological and pathological disease processes in man in a clinical (research) setting. This course focuses on application of imaging in a clinical (research) setting. This means that all imaging modalities discussed during this course can be applied on humans. It is not the intention to go in depth on the physics principles of the imaging techniques, but we will focus on the application of the techniques in daily clinical routine/research. It is important for the student to learn what are advantages and disadvantages of the different imaging modalities, with the aim that students will be able to independently make a (grounded) choice for one or multiple imaging strategies to solve or answer clinical questions or questions arising in a (clinical) research setting.

Course objectives

After this course the student:

- identifies what imaging modalities are (regularly) being used at the moment in the typical clinical (research) setting and which methodology is state-of-the-art (and/or is being developed)
- knows what information is within an image and can extract this information from the image (image processing and analysis).
- imaging modalities in a clinical (research) setting.in vivo and ex vivo- specifies the opportunities and limitations of
- chooses the appropriate imaging modality/modalities (e.g. MRI/MRS, PET, CT, Ultrasound, microscopy) for specific use in a clinical (research) setting.

Recommended reading

1. Radiomics: extracting more information from medical images using advanced feature analysis.Lambin P, Rios-Velazquez E, Leijenaar R, Carvalho S, van Stiphout RG, Granton P, Zegers CM, Gillies R, Boellard R, Dekker A, Aerts HJ.; Eur J Cancer. 2012 Mar;48(4):441-6.
2. Next-generation scans: Seeing into the future. Peter Gwynne, Nature 2013; 502, S96–S97.

3. In Vivo NMR Spectroscopy, 2nd Edition. De Graaf. Literature will be provided to the students via Eleum.

It is expected that students will find further relevant literature themselves.

MBS1502
Period 3
8 Jan 2018
2 Feb 2018
Print course description
ECTS credits:
12.0
Instruction language:
English
Coordinator:

- L. Lindeboom

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, PBL, Presentations, Research, Skills, Training(s), Working visit(s)
Assessment methods:
Assignment, Attendance, Oral exam, Participation, Presentation
Keywords:
Clinical imaging, MRI/MRS, CT, US, Radiomics, pathological imaging
Fac. Health, Medicine and Life Sciences

Biomedical Approaches

MBS1002
Period 4
5 Feb 2018
6 Apr 2018
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- A.W. Boots

Fac. Health, Medicine and Life Sciences

Junior Practical Training

Full course description

This 12-week internship (JPT: junior practical training) period provides students with their first practical experience of setting up and conducting scientific research. It emphasises the exploration of new and relevant research techniques and methodologies. Students are introduced to and gain practical experience in several state-of-the-art techniques/methodologies. This also gives them the

opportunity to get an overview over ongoing research lines. However, students may take their research project outside Maastricht University too.Students are encouraged to explore more than one experimental technique/methodology (e.g. recombinant DNA technology, gene expression analysis, protein analysis, western blotting, cell cultivation, immunohistochemistry, analysis of DNA variation, transfection, etc.). The period lasts 12 weeks and is supervised by a tutor/researcher, who acts as a supervisor for the entire internship. Passing the Biosafety coutse (MBS1103) is required to start the JPT (MBS1003).

Course objectives

Set up experimental research/focused experiments 1.Get practical understanding of modern research techniques and methodologies (possibilities and limitations) 2.Participate in an ongoing research project 3.Get Exposure to the real-life research environment 4.Keep a laboratory journal (if applicable) 5.Participate in academic discussions in professional practice 6.Present and discuss newly acquired knowledge to the host research group 7.Write a report 8.

MBS1003
Period 5
9 Apr 2018
6 Jul 2018
Print course description
ECTS credits:
17.0
Instruction language:
English
Coordinator:

- H.R. Gosker

Teaching methods:
Presentation(s), Research, Skills, Training(s)
Assessment methods:
Attendance, Final paper, Observation, Participation, Presentation
Keywords:
Internship, placement, research project
Fac. Health, Medicine and Life Sciences

Laboratory Animal Science

MBS1203
Year
1 Sep 2017
31 Aug 2018
Print course description
ECTS credits:
0.0
Instruction language:
English
Fac. Health, Medicine and Life Sciences

Historical Development and Ethics in Bio

MBS1004
Year
1 Sep 2017
6 Jul 2018
Print course description
ECTS credits:
2.0
Fac. Health, Medicine and Life Sciences

Practical Engineering the Immune System; Treatment of Disease

MBS1212
Period 3
8 Jan 2018
9 Mar 2018
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinator:

- G.A.F. Nicolaes

Fac. Health, Medicine and Life Sciences

Practicals Biomedical Approaches

MBS1012
Period 4
12 Mar 2018
6 Apr 2018
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinator:

- A.W. Boots

Second year courses

Biomedical Sciences Year 2

Fac. Health, Medicine and Life Sciences

Designing Scientific Research

Full course description

1. **Course summary** course focusing on the various aspects of writing an academic research proposal. Eight-week
2. **Content** This theoretical course aims at familiarising students with setting up fundamental or applied research and writing an academic research proposal. The central theme of the second year of the master's programme is the practical application of the scientific process: hypothesis/problem definition/experiment/result/interpretation/conclusions. The general point of departure is the setup of a follow-up study which relates to ongoing research at UM or UH, or elsewhere (Internship abroad). This provides students with preparation for the senior practical training (course 2.2), which concludes the master's programme.
3. **Skills training** The course pays explicit attention to English academic writing (by way of practical exercises) and presentation skills. Students also gain an understanding of study design (e.g. epidemiology, control groups, the setup of statistical analysis, and the evaluation of results).

Course objectives

- Understanding of the scientific process
- Ability to formulate a hypothesis to be tested and set up an executable research project using the concept of the scientific process
- Ability to draw up various research strategies to approach certain research questions
- Ability to formulate expected end results (preparation for course 2.2)
- Ability to defend a research proposal, and in doing so enter into academic discussions with colleagues and supervisors
- Ability to comment critically on other research proposals

Recommended reading

Science Research Writing: A Guide for Non-Native Speakers of English by Hilary Glasman-Deal
Grant Writing For Dummies by Beverly A. Browning

BMS2001
Period 1
4 Sep 2017
27 Oct 2017
Print course description
ECTS credits:
12.0
Instruction language:
English
Coordinators:

- R.C.J. Langen
- R. Shiri - Sverdlov

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

Master Biomedical Sciences

Assessment methods:
Final paper, Presentation
Keywords:
designing research proposal, scientific english, epidemiology
Fac. Health, Medicine and Life Sciences

Poster Presentation

Full course description

Present your research from the senior practical training for fellow students at the MOSA conference on a poster. Best abstracten will be selected for oral presentations. Posters and orale will be scored and are part of the SPT mark. Be part of the jury and score posters of other students from other masters.

Course objectives

making a poster, presenting your results, scientific discussion

BMS2102
Period 2
30 Oct 2017
22 Dec 2017
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinator:

- R.C.J. Langen

Teaching methods:
Paper(s), Presentation(s)
Assessment methods:
Assignment, Attendance, Participation, Presentation
Keywords:
poster, oral, discussion
Fac. Health, Medicine and Life Sciences

Senior Practical Training - Internship

Full course description

A 30 week practical training period in a lab setting.

Course objectives

performing experiments, participating in a research group

Recommended reading

http://www.vsnu.nl/files/documenten/Domeinen/Onderzoek/Code_wetenschapsbeoefening_2004_(2012).pdf (in Dutch)

BMS2202
Period 2
30 Oct 2017
22 Dec 2017
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinator:

- R.C.J. Langen

Teaching methods:
Research, Skills, Training(s), Working visit(s)
Assessment methods:
Final paper, Attendance, Participation, Presentation
Keywords:
practical work full participation in research
Fac. Health, Medicine and Life Sciences

Thesis

Full course description

1. Course summary During this 30-week internship, students participate in ongoing scientific research at UM or UH, at other knowledge centres in the Netherlands/Belgium, or in other countries (see below). The internship is prepared during course 2.1. 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. The internship in the CMS specialisation consists of subjects related to clinical diagnostics and therapy of chronic diseases, while that in the MHS specialisation looks at the relationship between exogenous circumstances and chronic diseases. Students following the ODB specialisation will work on a project relating to cancer or developmental biology. 2. Content Students work individually and take part in ongoing research projects, supervised by a tutor or researcher. In this framework, they also participate in the regular meetings of the relevant research team. Further, they return to the university three times during the internship period to present their progress and comment on other students' projects. The internship period concludes with a final presentation to the other students as well as tutors and other experts. The final internship report is prepared in the form of an extensive scientific paper, which constitutes the master's thesis. The optional courses are integrated into the internship period.

Course objectives

Objectives (Applying) knowledge and understanding o Ability to carry out a research project independently in a research environment o Experience in adhering to a research plan (in terms of content and time management) o Experience in problem solving during research o Ability to revise or set up follow-up research (adjusted to the results obtained) Forming an opinion o Ability to process, interpret and report results Communication o Active participation in regular discussions in the research environment o Ability to present and discuss interim and final results to and with colleagues and supervisors

Recommended reading

Science Research Writing: A Guide for Non-Native Speakers of English by Hilary Glasman-Deal
http://www.vsnu.nl/files/documenten/Domeinen/Onderzoek/Code_wetenschapsb
eoefening_2004_(2012).pdf (in Dutch)

BMS2002
Period 2
30 Oct 2017
22 Dec 2017
Print course description
ECTS credits:
48.0
Instruction language:
English
Coordinators:

- H.R. Gosker
- R.C.J. Langen

Teaching methods:
Paper(s), Presentation(s)
Assessment methods:
Final paper
Keywords:
practical lab work, research project