Master Biomedical Sciences

First year courses

Biomedical Sciences Year 1

Fac. Health, Medicine and Life Sciences

Biomedical Challenges

Full course description

Biomedical Sciences help us to better understand how the human body works. The insights and lessons learned can then be used in understanding, diagnosing, treating and preventing human diseases. Biomedical Sciences specifically translate knowledge from the natural sciences to medical applications. In this first course of the master program, students will be introduced to the diverse topics Biomedical Sciences deal with. The course will tackle the pathophysiology, diagnostic, therapy and current research of several diseases, with a focus on their biomedical challenges. Understanding of these fundamental principles is necessary to facilitate the development of diagnostics and therapies to better cope with the diseases.

The focus of this course lies with current biomedical challenges. Several diseases have been selected for this course, giving students ample opportunity to discuss a wide range of challenges to be tackled in unraveling the pathophysiology, diagnostic, therapy and current research of these diseases. The course is divided into 3 Themes (mitochondrial disorders, neurological and mental disorder, metabolic disorders) and a Biomedical Project. The 3 themes will be addressed during lectures, PBL cases, journal clubs, workshops and practicals. For the Biomedical Project, students will choose a disease to work on during the course in a team of 3 to 4 students. The state-of-the-art biomedical knowledge and challenges will be presented for this topic. The Biomedical Project focuses on defining a single biomedical challenge, and will be presented during a symposium, as well as described in the project report. Finally, regular meetings with biomedical professionals and a site visit to the Chemelot campus will offer the students perspective on the employment and challenges in various biomedical fields.

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

Master Biomedical Sciences

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
5 Sep 2022
28 Oct 2022
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:

- L.C.C. de Nijs

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

Biomedical Approaches

Full course description

Big Data plays a central role in modern biomedical research. A common misconception is that simply generating a large dataset is the end-stage of a research project. However, this is just the beginning! The scientific backlash on genome-wide association studies demonstrate that a large table of statistical associations without biological interpretation and validation is useless. Instead, Big Data should be analysed to generate hypotheses and postulate mechanisms that are explicitly tested or validated in follow-up experiments.

In this course, students will gain hands-on experience with multiple data analysis tools and procedures. Within small groups, student will use this experience and apply these tools and procedures to identify targets from big data sets, both from data-driven as well as knowledge driven perspectives. Analysis choices and interpretation are left at the discretion of the project groups. Based on the identified targets, generated hypotheses and postulated mechanisms, students formulate a follow-up study that they present at the end of the course.

The field has shifted towards a focus on patient-specific research and quick implementation of knowledge to directly benefit end-users (citizens, patients, health professionals). Hence, during this course, students will become aware of the models available and the ethical constrains of biomedical research. Moreover, the identification of potential stakeholders and the patentability of intellectual

property is increasingly important. Students will be educated to identify and evaluate these important additional aspects in biomedical research in both an academic as industrial setting.

Course objectives

Identify and evaluate the risks and stakeholders associated with a research project

B-ILO1002.9

Evaluate the patentability of intellectual property developed within a research project

B-ILO1002.8

Explain the biological relevance of results obtained from Big Data

B-ILO1002.7

Discuss ethical constrains when working with both animals and human participants (GDPR, off target findings)

B-ILO1002.6

Describe and discuss the design of a scientific study based on results/candidates obtained from Big Data analysis (for validation)

B-ILO1002.5

Discuss novel research questions/hypothesis based on Big Data

B-ILO1002.4

Know how to apply various data analysis methods on Big Data

B-ILO1002.3

Know how to access and interpret knowledge available from biological databases

B-ILO1002.2

Understand how and why Big Data is used in biomedical research

B-ILO1002.1

Recommended reading

tba

MBS1002
Period 2
31 Oct 2022
23 Dec 2022
Print course description
ECTS credits:

Master Biomedical Sciences

10.0
Instruction language:
English
Coordinator:

- R.J. Szklarczyk

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentation(s), Skills
Assessment methods:
Assignment, Attendance, Computer test, Final paper, Presentation
Keywords:
BigData, omics, data analysis, Association studies, functional validation
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 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

MBS1103
Period 2

Master Biomedical Sciences

31 Oct 2022
23 Dec 2022
Print course description
ECTS credits:
1.0
Instruction language:
English
Coordinator:

- R.J. Szklarczyk

Teaching methods:
Assignment(s), Lecture(s)
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 3
9 Jan 2023
10 Mar 2023
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:

- L.M.T. Eijssen

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

Full course description

During the course, an introduction to normal immune system physiology will be given in the form of overview lectures to ensure the same (bachelor) level of knowledge. In addition, during weeks 2 to 7, the focus will also be on understanding inflammation and pathophysiology. Every week has a different theme and the students will be challenged with different diseases where immune system dysregulation plays a role. Students will be given their weekly assignments at the beginning of each week, with a prediscussion session where the expected learning goals of the week will be outlined. Thereafter, they will start pre-discussing a case in smaller groups. During the week, they will have

expert lectures, e.g. workshops, technical and practical/training skills and journal club discussions. Time will be given for self-study during the week, for both team and individual work. At the end of the week the students will discuss the case they have been working on and the practical/training skill assignment. Theme week 1 Introduction to the immune system: normal physiology.Theme week 2 Immunity to bacteria Theme week 3 Immunity to viruses Theme week 4 Sterile inflammation and other pathological threats Theme week 5 Immunity to tumors Theme week 6 Hypersensitivity disorders and autoimmunity Theme week 7 Microbe-host interactions in (immune) homeostasis Theme week 8 Project discussions, posters and exam

Course objectives

B-ILO1202.1 Explain immunity to microbes and viruses a) Recognize and compare innate and adaptive immunity to extracellular and intracellular bacteria and viruses. b) Explain immune evasion by extracellular and intracellular bacteria and viruses. c) Know how the functional output of the microbiota regulates metabolic and immune homeostasis d) Recognize microbial dysbiosis and its role in immune-mediated disease predisposition b) Recognize the induction of (innate) immune responses by microbes at mucosal interfaces a) Discuss interplay between microbial colonization and the development of the immune system/induction of tolerance B-ILO1202.5 Explain microbe-host interactions in (immune) homeostasis c) Explain IgE and mast cell-dependent reactions and allergic reactions in humans: pathogenesis and therapy. b) Discuss immunological diseases, their pathogenesis and current therapy. a) Recognize diseases caused by antibodies against membrane receptors and extracellular antigens, immune-complex mediated diseases and disease caused by T-lymphocytes. B-ILO1202.4 Explain hypersensitivity disorders and autoimmunity d) The role of the immune system in promoting tumor growth/tumor progression. c) Effect of the tumor microenvironment on anti-tumor immune responses. b) Explain evasion of the immune response by tumors.a) Differentiate tumor immunity, tumor antigens and immune response to tumors. B-ILO1202.3 Explain immunity to tumors b) Discuss pathological threats such as neurodegeneration, atherosclerosis, and metabolic inflammation. a) Analyze the role of sterile inflammation in trauma and ischemia–reperfusion. B-ILO1202.2 Explain sterile inflammation and other pathological threats c) Discuss injurious effects of immune responses to extracellular bacteria: inflammation, septic shock.

Recommended reading

- Immunobiology Janeway and Travis 8th edition - Control of Metastasis by NK Cells, López-Soto A1, Gonzalez S2, Smyth MJ3, Galluzzi L4. Cancer Cell. 2017 Aug 14;32(2):135-154 - Exosomes in cancer: Use them or target them? Bastos N, Ruivo CF, da Silva S, Melo SA. Semin Cell Dev Biol. 2017 Aug 11 - Gut microbiota: Role in pathogen colonization, immune responses, and inflammatory disease. Pickard JM, Zeng MY, Caruso R, Núñez G. Immunol Rev. 2017 Sep;279(1):70-89. - Host-microbiota interactions and adaptive immunity. McCoy KD, Ronchi F, Geuking MB. Immunol Rev. 2017 Sep;279(1):63-69. - Regulation of inflammation by microbiota interactions with the host. Blander JM, Longman RS, Iliev ID, Sonnenberg GF, Artis D. Nat Immunol. 2017 Jul 19;18(8):851-860. - Understanding the Holobiont: How Microbial Metabolites Affect Human Health and Shape the Immune System. Postler TS, Ghosh S. Cell Metab. 2017 Jul 5;26(1):110-130. - Chan YK, Gack MU. Viral evasion of intracellular DNA and RNA sensing. Nat Rev Microbiol. 2016;14(6):360-73. - Christensen MH, Paludan SR Viral evasion of DNA-stimulated innate immune responses. Cell Mol Immunol. 2017;14(1):4-13. - Ivashkiv LB, Donlin LT Regulation of type I interferon responses. Nat Rev Immunol. 2014;14(1):36-49. - Orzalli MH, Knipe DM. Cellular sensing of viral DNA and viral evasion mechanisms. Annu Rev Microbiol. 2014;68:477-92. - Levinson W. Review of medical microbiology and immunology (12th ed., Lange medical books). Part II/VII - Benoit et al. J Immunol

2008. Macrophage polarization in bacterial infections - Mege et al. Curr Opin Inf Dis 2011. Macrophage polarization in bacterial infections - Netea et al. Science 2016. Trained immunity: a program of innate immune memory in health and disease. - Guilliams Nat Rev Immunol 2017. Does Niche competition determine the origin of tissue-resident macrophages? - de Oliveira et al. Nat Reve Immunol 2016. Neutrophil migration in infection and wound repair: going forward in reverse.

MBS1201
Period 3
9 Jan 2023
10 Mar 2023
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:

- M.P. Martinez Martinez

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations, Research, Skills, Working visit(s)
Assessment methods:
Assignment, Attendance, Final paper, Presentation, Written exam, Participation
Keywords:
Pathophysiology/Animal models Infections: virus, bacteria Sterile inflammation Microbiota Metastasis, tumor evasion Exosomes Innate/Adaptive immune responses Auto-antibodies/Autoimmunity Allergy
Fac. Health, Medicine and Life Sciences

Nutrition, Physical Activity and Metabolism; Fundamental Aspects

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.

MBS1301
Period 3
9 Jan 2023
10 Mar 2023
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:

- M.K.C. Hesselink

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

Science and Technology of Regenerative Therapeutics

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.
- 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

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 3
9 Jan 2023
10 Mar 2023
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:

- S.H. van Rijt

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

Pre-clinical Imaging

Full course description

Imaging is increasingly and widely applied in biomedical studies and clinical practice. Imaging enables visualisation of 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 (e.g. contraction of the heart and blood flow) in order to provide more insight in health and disease, to assess the effectiveness of treatment and to develop new treatments . This course focuses on pre-clinical imaging, which ranges from ex vivo imaging of a single molecule to in vivo imaging of animal models.
You will be prepared for a future in a multidisciplinary biomedical research environment. We will train the students as a key person, linking physiological questions to novel imaging methods. You will be able to communicate within an interdisciplinary team including clinicians and engineers. You will be able to apply state-of-the art imaging methods to biomedical research questions related to oncology, cardiovascular diseases, neuro sciences or metabolism. You will make sure that novel imaging methods can be directly applied in a preclinical research environment.
The course aims to give insight into the basic principles and the biomedical applications of imaging

techniques. 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), nuclear imaging (Single Photon Emission Computed Tomography (SPECT) and Positron Emission Tomography (PET)) and hybrid and correlative imaging.
Students will be taught to acquire, analyze and utilize complex images 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.

Course objectives

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 couse, students 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, to be able to make correct choices of imaging methods for specific questions.

This course offers interactive teaching, hands-on experiments through practicals, lab visits, workshops, project and interactions with experts.

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.

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

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

Recommended reading

• Kagadis, G., et al (Eds.). (2016). Handbook of small animal imaging: Preclinical imaging • Liu, X. et al. Anal Chem, 2015. 87(19): p. 9508-19. • Quanico, J., et al., Biochim Biophys Acta, 2017. • Fernandes, A.M., et al., J Am Soc Mass Spectrom, 2016. 27(12): p. 1944-1951. • Fernandes, A.M., et al., J Am Soc Mass Spectrom, 2016. 27(12): p. 1944-1951. • Santagata, S., et al., IProc Natl Acad Sci U S A, 2014. 111(30): p. 11121-6. • Anderson, D.M., et al., J Am Soc Mass Spectrom, 2014. 25(8): p. 1394-403. • Pol, J., et al., Eur J Mass Spectrom (Chichester), 2015. 21(3): p. 297-303. • Mascini, N.E., et al., Anal Chem, 2016. 88(6): p. 3107-14. • Mascini, N.E., et al., J Proteome Res, 2015. 14(2): p. 1069-75. • Jiang, H., et al., Chem Commun (Camb), 2017. 53(9): p. 1506-1509. • Ablonczy, Z., et al., Proteomics, 2014. 14(7-8): p. 936-44. • de Boer, P., et al, Nature Methods 12, 503–513 (2015) • http://ammrf.org.au/myscope/ • http://zeiss-campus.magnet.fsu.edu/ • Hartley CJ, et al, Am J Physiol Heart Circ Physiol. 2011 Aug;301(2):H269-78. • Hermans H, et al, J Appl Physiol (1985). 2014 Sep 1;117(5):563-71. • Clark DP, et al, Phys Med. 2014 Sep;30(6):619-34. doi: 10.1016/j.ejmp.2014.05.011. • Zanzonico P. Radiat Res. 2012 Apr;177(4):349-64. • Gammon ST, et al, Am J Physiol Lung Cell Mol Physiol. 2014 May 15;306(10):L897-914. • van Geuns R-J M et al, Progress in Cardiovascular Diseases. 1999; 42 (2): 149-156. • Vanhoutte L et al, Basic Res Cardiol

Master Biomedical Sciences

(2016) 111:46 • Shah SN et al, Abdom Imaging (2015) 40:1358–1365

MBS1501
Period 3
9 Jan 2023
10 Mar 2023
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:

- L.J. Dubois

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), Paper(s), PBL, Presentations, Skills, Working visit(s), Training(s)
Assessment methods:
Assignment, Observation, Participation, Presentation, Written exam
Keywords:
preclinical imaging, MSI, EM, LM, MRI, US, SPECT, PET, CT
Fac. Health, Medicine and Life Sciences

Fundamental Neuromodulation

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

MBS1601
Period 3
9 Jan 2023
10 Mar 2023
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:

- A. Jahanshahianvar

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentation(s), Skills
Assessment methods:
Assignment, Final paper, Presentation, Written exam
Keywords:
Neuroscience; neuromodulation; neurophysiology; neuroanatomy; deep brain stimulation; transcranial magnetic stimulation
Fac. Health, Medicine and Life Sciences

Clinical and Applied Genetics and Genomics

Full course description

In conjunction with course 1101 ‘Advanced Principles of genetics and genomics’, course 1102 (Clinical and applied genetics and genomics) makes up the specialization track ‘Genetics and Genomics’. This course aims at providing the students with a broad knowledge and expertise in the field of genetics and genomics, and more specifically how these technologies can be applied to scientific research questions, the diagnosis of human diseases in the clinic, and forensics.

This course will elaborate further on genetic fundamentals discussed in the previous courses (1001 and 1101) and includes amongst others currently applied analyses in the clinic as well as some

unusual genetic phenomena. Furthermore, state-of-the-art technologies applied in genetic and genomic studies will be discussed including their applications in clinical practice, which, as students will learn, is not as straightforward as seen in certain popular media (eg. CSI, Flikken Maastricht and other TV-series). Moreover, researchers in the fields of genetics and genomics are confronted with numerous ethical issues restraining their studies. The students will be introduced to some of these ethical problems and challenged how to handle these in practice.

models, cellular models and animal models).in silico An interesting additional skill the student will learn is to implement acquired knowledge from the courses (1001, 1101 and 1102) in the study of different model systems in genetic research (

Based on this knowledge as well as the input of expert staff lectures, the students will get the chance to work in groups on a scientific project application. This will make them aware of the complexities involved in the project writing process, but also will prepare them for a future role in the scientific community.

Course objectives

- ILO1102.1 Explain genetic and genomic technology used in precision medicine and diagnostics of genetic disorders.
- ILO1102.2 Know the main genomic mechanisms and involved signalling pathways underlying cancer development, cardiovascular and neurological diseases.
- ILO1102.3 Explain advantages/disadvantages when utilizing genetic testing in research and clinical applications.
- ILO1102.4 Know which tools are available to model genetic disorders, and apply them to modelling genetic disorders for research and clinical applications.
- ILO1102.5 Apply the concepts of molecular genetics to design novel research projects in genetics and precision medicine.

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.

Recommended reading

Books; EleUM; papers; other resources

MBS1102
Period 4
13 Mar 2023
12 May 2023
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:

- E.J.M. Speel

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

Master Biomedical Sciences

Working visit(s)
Assessment methods:
Assignment, Attendance, Final paper, Participation, Presentation, Written exam
Keywords:
advanced genetics genomics epigenetics clinical diagnostics research applications gene expression data analysis ethical societal issues forensics
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 MBS1201 course, MBS1202 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

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. Moreover, students will themselves produce documents each week in expert groups, that collectively will serve as an additional source for reading, in preparation of the final course test. 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)

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 -

Master Biomedical Sciences

Immunology - Lippincott's Illustrated Reviews (Wolters Kluwer/Lippincott Williams & Wilkins)

MBS1202
Period 4
13 Mar 2023
12 May 2023
Print course description
ECTS credits:
10.0
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

Practical Engineering the Immune System; Treatment of Disease

Full course description

see description of MBS1202

Course objectives

see description of MBS1202, together MBS1202 and MBS1212 form one coherent course

MBS1212
Period 4
13 Mar 2023
12 May 2023
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinator:

- G.A.F. Nicolaes

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

Master Biomedical Sciences

Assignment, Attendance, Final paper, Observation, Participation, Presentation, Written exam
Fac. Health, Medicine and Life Sciences

Lifestyle Interventions and Metabolism; a Translational Perspective

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

MBS1302
Period 4
13 Mar 2023
12 May 2023

Master Biomedical Sciences

Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:

- C.J.H. van der Kallen

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), Paper(s), PBL, Presentation(s), Research, Skills, Training(s), Working visit(s)
Assessment methods:
Assignment, Attendance, Final paper, Participation, Presentation, Written exam
Keywords:
Lifestyle intervention Metabolism Translation approach Personalized approach Diet Exercise
Fac. Health, Medicine and Life Sciences

Translating Therapies into Clinic and onto the Market

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

MBS1402
Period 4
13 Mar 2023
12 May 2023
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:

- M.M.J. Caron

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), Presentation(s), Research, Working visit(s)
Assessment methods:
Assignment, Participation, Presentation
Keywords:
Regenerative Medicine Biomaterials Medical practice Innovation Patent Valorization Regulatory affaires Project proposal Biomedical study Clinical trial
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 4
13 Mar 2023
12 May 2023
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:

- A.M. Blanchet - Smolinska

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

Translational Neuromodulation

Full course description

Building on the fundamental principles covered during the first course of the specialization in neuromodulation, “Translational Neuromodulation” focuses on currently available treatment approaches and the principles underlying the development of future applications. Throughout lectures, PBL tutorials, practicals, and journal clubs the students will get a comprehensive overview of the current state-of-the-art and will learn about the key principles that drive translational research to discover novel ways of utilize the potential of neuromodulation techniques. It showcases how insights into the pathophysiology of the central nervous system can be translated into clinical applications of neuromodulation in neurology and psychiatry.

Course objectives

Intended Learning Outcomes (ILO) in this course:

ILO1602-1: To describe and discuss the applications of TMS in psychiatry
--> understanding current treatment approaches in psychiatry

ILO1602-2: To describe and discuss the applications of TMS in neurology and neurorehabilitation
--> understanding the use of TMS as a diagnostic and prognostic tool and explaining current treatment approaches in neuro-rehabilitation with TMS

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

--> familiarity with advanced concepts of non-invasive neuromodulation and discussing current limitations of the field and identifying ways forward

ILO1602-4: To learn about the latest advances in applying DBS for treatment of neurological and psychiatric symptoms
--> knowing the clinical indications of DBS and understanding the advantages and limitations of invasive neuromodulationILO1602-5: To learn about the latest development in clinical application of sacral and spinal neuromodulation
--> explaining the current theories behind the working mechanism of sacral and spinal stimulation and learning about current clinical research attempts to improve its clinical practice

ILO1602-6: To understand the basic principles of signal processing and machine learning in context of neuromodulation
--> understanding the difference between standard statistics and closed-loop prediction, describing the basics of signal processing of electrophysiological data, and understanding basics of machine learning in neuroscience

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.

MBS1602
Period 4
13 Mar 2023

Master Biomedical Sciences

12 May 2023
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:

- H.P. Leunissen

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

Designing Scientific Research

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.

MBS1005
Period 5
15 May 2023
7 Jul 2023
Print course description
ECTS credits:
10.0
Instruction language:
English
Coordinator:

- A. Romano

Teaching methods:
Assignment(s), Work in subgroups, Lecture(s), Paper(s), Presentation(s)
Assessment methods:
Final paper, Participation, Presentation
Keywords:
scientific method, Research proposal
Fac. Health, Medicine and Life Sciences

Ethics in Biomedical Science

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 discussion 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.

MBS1004
Year
5 Sep 2022
31 Aug 2023
Print course description
ECTS credits:
1.0
Instruction language:
English
Coordinator:

- S.M.G. Segers

Teaching methods:
Lecture(s), Assignment(s), Work in subgroups, Paper(s)
Assessment methods:
Assignment
Keywords:
Research Ethics Research Integrity Normative Frameworks Contributory expertise
Fac. Health, Medicine and Life Sciences

Managing a Biomedical Innovation I

Full course description

"Managing a Biomedical Innovation I" introduces students to aspects which are relevant for the translation of research findings to the clinic and onto the market. These aspects pertain to various stages of the product development life cycle: clearly formulating the unmet need and the product's value proposition is an essential first step to make sure the developed product serves a need from the market. When proof-of-concept has been demonstrated and preclinical evidence has been gathered, intellectual property protection is a crucial prerequisite for further investment of capital and resources. Quality assurance and regulatory affairs must also be considered during the preclinical studies to facilitate future clinical trials. National reimbursement policies must also be considered early on in the product development life cycle to ensure that the product is economically viable. Creativity and formulating a value proposition are the central themes during a one-week Design Sprint, where students design a Biomedical Innovation from scratch. All of these aspects are covered during various workshops that are offered throughout the academic year. This course is thus intertwined with the general MBS courses "Biomedical Challenges," "Biomedical Approaches," and " Designing Scientific Research."

Course objectives

- ILO1 – Identify user needs for the clinical problem
- ILO2 – Determine the market potential of a biomedical innovation
- ILO3 – Assess the IP landscape
- ILO4 – Apply relevant Regulations and Quality Assurance guidelines
- ILO5 – Identify and involve all stakeholders during the innovation development process

Master Biomedical Sciences

MBS1006
Year
5 Sep 2022
31 Aug 2023
Print course description
ECTS credits:
5.0
Instruction language:
English
Coordinator:

- A.K. Roth

Teaching methods:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), Presentation(s)
Assessment methods:
Assignment, Presentation
Keywords:
Biomedical Innovation, Value Proposition, Valorization, Intellectual Property, Regulatory Affairs
Fac. Health, Medicine and Life Sciences

Career Skills (Portfolio) I

MBS1007
Year
5 Sep 2022
31 Aug 2023
Print course description
ECTS credits:
3.0
Instruction language:
English
Coordinators:

- H. Roebertsen
- J. Theys

Second year courses

Biomedical Sciences Year 2

Fac. Health, Medicine and Life Sciences

Ethics in Biomedical Sciences

MBS2001
Year
5 Sep 2022
31 Aug 2023
Print course description
ECTS credits:
1.0

Master Biomedical Sciences

Coordinator:

- B. Penders

Fac. Health, Medicine and Life Sciences

Managing a Biomedical Innovation II

Full course description

In MBS 2002 "Managing a Biomedical Innovation II," students will apply the lessons learned in "Managing a Biomedical Innovation I" to the topic of their "Senior Practical Training." As part of their Master's thesis, students write an "Impact" or "Valorization" Chapter in which the societal impact and valorization/commercialization of their research is discussed. The framework for this Chapter is laid down in MBS2002 by offering students tools to highlight the unique selling points of their research and articulate the the potential societal impact of their biomedical innovation.

Course objectives

ILO1 - Articulate the potential societal impact of a biomedical innovation

MBS2002
Year
5 Sep 2022
31 Aug 2023
Print course description
ECTS credits:
5.0
Instruction language:
English
Coordinator:

- A.K. Roth

Teaching methods:
Assignment(s), Work in subgroups
Assessment methods:
Assignment
Keywords:
Biomedical Innovation, Valorization, Societal Impact
Fac. Health, Medicine and Life Sciences

Career skills (Portfolio) II

MBS2003
Year
5 Sep 2022
31 Aug 2023
Print course description
ECTS credits:
4.0

Master Biomedical Sciences

Instruction language:
English
Fac. Health, Medicine and Life Sciences

Thesis

Full course description

MBS2104 (Internship) and MBS2004 (Thesis) are intertwined. During the1-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

MBS2004
Year
5 Sep 2022
31 Aug 2023
Print course description
ECTS credits:
50.0
Instruction language:
English
Coordinator:

- H.R. Gosker

Teaching methods:
Paper(s), Research
Assessment methods:
Final paper
Keywords:

Master Biomedical Sciences

Thesis, Research, biomedical
Fac. Health, Medicine and Life Sciences

Internship

Full course description

MBS2104 (Internship) and MBS2004 (Thesis) are intertwined. During the1-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

MBS2104
Year
5 Sep 2022
31 Aug 2023
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinator:

- H.R. Gosker

Teaching methods:
Work in subgroups, Paper(s), Patient contact, Presentation(s), Research, Skills, Training(s)
Assessment methods:
Assignment, Attendance, Observation, Participation, Presentation

Master Biomedical Sciences

Keywords:
undefined
Fac. Health, Medicine and Life Sciences

Poster Presentation

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

MBS2204
Year
5 Sep 2022
31 Aug 2023
Print course description
ECTS credits:
0.0
Instruction language:
English
Coordinator:

- J. Theys

Teaching methods:
Assignment(s), Presentation(s)
Assessment methods:
Assignment, Oral exam, Presentation