Master Biomedical Sciences

Eerstejaarsvakken

Biomedical Sciences Year 1

Fac. Health, Medicine and Life Sciences

Biomedical Challenges

Volledige vakbeschrijving

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.

Doelstellingen van dit vak

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
Periode 1
2 sep 2019
25 okt 2019

Master Biomedical Sciences

Vakbeschrijving afdrukken
Studiepunten:
12.0
Taal van de opleiding:
Engels
Coördinator:

- R.J. Szklarczyk

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

Advanced Principles of Genetics and Genomics

Volledige vakbeschrijving

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.

Doelstellingen van dit vak

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

Aanbevolen literatuur

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
Periode 2
28 okt 2019
20 dec 2019
Vakbeschrijving afdrukken
Studiepunten:
12.0
Taal van de opleiding:
Engels
Coördinator:

- E.C.M. Mariman

Onderwijsmethode:
Assignment(s), Lecture(s), Paper(s), PBL, Skills, Working visit(s)
Evaluatiemethoden:
Assignment, Final paper, Participation, Written exam
Trefwoorden:
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

Volledige vakbeschrijving

During the first week of the course, an introduction to normal immune system physiology will be given in the form of an overview lecture to ensure the same (bachelor) level of knowledge, whereas during weeks 2 to 7, the focus will 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

Doelstellingen van dit vak

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.

Aanbevolen literatuur

- 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
Periode 2
28 okt 2019
20 dec 2019
Vakbeschrijving afdrukken
Studiepunten:
12.0
Taal van de opleiding:
Engels
Coördinator:

- M.P. Martinez Martinez

Onderwijsmethode:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentations, Research, Skills, Working visit(s)
Evaluatiemethoden:
Assignment, Attendance, Final paper, Presentation, Written exam
Trefwoorden:
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

Volledige vakbeschrijving

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.

Doelstellingen van dit vak

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
Periode 2
28 okt 2019
20 dec 2019
Vakbeschrijving afdrukken
Studiepunten:
12.0
Taal van de opleiding:
Engels
Coördinator:

- M.K.C. Hesselink

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

Science and Technology of Regenerative Therapeutics

Volledige vakbeschrijving

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.

Doelstellingen van dit vak

- 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.

Aanbevolen literatuur

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
Periode 2
28 okt 2019
20 dec 2019
Vakbeschrijving afdrukken
Studiepunten:
12.0
Taal van de opleiding:
Engels
Coördinator:

- S.H. van Rijt

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

Pre-clinical Imaging

Volledige vakbeschrijving

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.

Doelstellingen van dit vak

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.

Aanbevolen literatuur

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

MBS1501
Periode 2
28 okt 2019
20 dec 2019
Vakbeschrijving afdrukken
Studiepunten:
12.0
Taal van de opleiding:
Engels
Coördinator:

- M.E. Kooi

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

Biosafety

Volledige vakbeschrijving

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)

Master Biomedical Sciences

Doelstellingen van dit vak

- 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
Periode 3
16 jan 2020
7 feb 2020
Vakbeschrijving afdrukken
Studiepunten:
1.0
Taal van de opleiding:
Engels
Coördinator:

- N. Kisters

Onderwijsmethode:
Assignment(s), Lecture(s), Skills
Fac. Health, Medicine and Life Sciences

Clininal and Applied Genetics and Genomics

Volledige vakbeschrijving

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.

Doelstellingen van dit vak

- 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.

Aanbevolen literatuur

Books; EleUM; papers; other resources

MBS1102
Periode 3
6 jan 2020
6 mrt 2020
Vakbeschrijving afdrukken
Studiepunten:
12.0
Taal van de opleiding:
Engels
Coördinator:

- E.J.M. Speel

Onderwijsmethode:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), PBL, Presentation(s), Skills, Training(s), Working visit(s)
Evaluatiemethoden:
Assignment, Attendance, Final paper, Participation, Presentation, Written exam
Trefwoorden:
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

Volledige vakbeschrijving

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.

Doelstellingen van dit vak

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)

Aanbevolen literatuur

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
Periode 3
6 jan 2020
6 mrt 2020
Vakbeschrijving afdrukken
Studiepunten:
12.0
Taal van de opleiding:
Engels
Coördinator:

- G.A.F. Nicolaes

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

Master Biomedical Sciences

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

MBS1212
Periode 3
6 jan 2020
6 mrt 2020
Vakbeschrijving afdrukken
Studiepunten:
0.0
Taal van de opleiding:
Engels
Coördinator:

- G.A.F. Nicolaes

Fac. Health, Medicine and Life Sciences

Lifestyle Interventions and Metabolism; a Translational Perspective

Volledige vakbeschrijving

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.

Doelstellingen van dit vak

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
Periode 3
6 jan 2020
6 mrt 2020
Vakbeschrijving afdrukken
Studiepunten:
12.0
Taal van de opleiding:
Engels
Coördinator:

- C.J.H. van der Kallen

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

Translating Therapies into Clinic and onto the Market

Volledige vakbeschrijving

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.

Doelstellingen van dit vak

- 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
Periode 3
6 jan 2020
6 mrt 2020
Vakbeschrijving afdrukken
Studiepunten:
12.0
Taal van de opleiding:
Engels
Coördinator:

- A.A. van Apeldoorn

Onderwijsmethode:
Assignment(s), Lecture(s), Work in subgroups, Paper(s), Presentation(s), Research, Working visit(s)
Evaluatiemethoden:
Assignment, Participation, Presentation
Fac. Health, Medicine and Life Sciences

Clinical Imaging

Volledige vakbeschrijving

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.

Doelstellingen van dit vak

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.

Aanbevolen literatuur

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
Periode 3
6 jan 2020
6 mrt 2020
Vakbeschrijving afdrukken
Studiepunten:
12.0
Taal van de opleiding:
Engels
Coördinator:

- A.M. Blanchet - Smolinska

Master Biomedical Sciences

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

Biomedical Approaches

MBS1002
Periode 4
9 mrt 2020
3 apr 2020
Vakbeschrijving afdrukken
Studiepunten:
5.0
Taal van de opleiding:
Engels
Coördinator:

- M. Gerards

Fac. Health, Medicine and Life Sciences

Practicals Biomedical Approaches

MBS1012
Periode 4
9 mrt 2020
3 apr 2020
Vakbeschrijving afdrukken
Studiepunten:
0.0
Taal van de opleiding:
Engels
Coördinator:

- M. Gerards

Fac. Health, Medicine and Life Sciences

Junior Practical Training

Volledige vakbeschrijving

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 course (MBS1103) is required to start with (and pass for) the JPT (MBS1003).

Doelstellingen van dit vak

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
Periode 5
6 apr 2020
3 jul 2020
Vakbeschrijving afdrukken
Studiepunten:
17.0
Taal van de opleiding:
Engels
Coördinator:

- H.R. Gosker

Onderwijsmethode:
Presentation(s), Research, Skills, Training(s)
Evaluatiemethoden:
Attendance, Final paper, Participation, Presentation
Trefwoorden:
internship, placement, research project
Fac. Health, Medicine and Life Sciences

Historical Development and Ethics in Bio

Volledige vakbeschrijving

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.

Doelstellingen van dit vak

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
Jaar
1 sep 2019
3 jul 2020
Vakbeschrijving afdrukken
Studiepunten:
1.0
Coördinator:

- B. Penders

Onderwijsmethode:
Lecture(s), Assignment(s), Work in subgroups
Evaluatiemethoden:
Assignment
Trefwoorden:
Research Ethics Research Integrity Normative Frameworks Contributory expertise
Fac. Health, Medicine and Life Sciences

Fundamental Neuromodulation

MBS1601
Periode 2
28 okt 2019
20 dec 2019
Vakbeschrijving afdrukken
Studiepunten:
12.0
Taal van de opleiding:
Engels
Coördinator:

- A. Jahanshahianvar

Fac. Health, Medicine and Life Sciences

Translational Neuromodulation

MBS1602
Periode 3

Master Biomedical Sciences

6 jan 2020
6 mrt 2020
Vakbeschrijving afdrukken
Studiepunten:
12.0
Taal van de opleiding:
Engels
Coördinator:

- F. Dücker

Tweedejaarsvakken

Biomedical Sciences Year 2

Fac. Health, Medicine and Life Sciences

Designing Scientific Research

Volledige vakbeschrijving

Course summary
Eight-week course focusing on the various aspects of writing an academic research proposal.

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 elsewhere (Internship abroad). This provides students with preparation for the senior practical training (course BMS2002), which concludes the master's programme.

Skills training
The course pays explicit attention to English academic writing (by way of practical exercises), presentation skills and valorisation potential of research ideas.

Doelstellingen van dit vak

- Understanding of the scientific processo 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

Aanbevolen literatuur

Science Research Writing: A Guide for Non-Native Speakers of English by Hilary Glasman-Deal

Master Biomedical Sciences

Grant Writing For Dummies by Beverly A. Browning

BMS2001
Periode 1
2 sep 2019
25 okt 2019
Vakbeschrijving afdrukken
Studiepunten:
12.0
Taal van de opleiding:
Engels
Coordinators:

- R. Shiri - Sverdlov
- J. Theys

Onderwijsmethode:
Assignment(s), Work in subgroups, Lecture(s), Research, Presentation(s), Training(s), Paper(s)
Evaluatiemethoden:
Final paper, Presentation, Participation
Trefwoorden:
designing research proposal, scientific english, study design
Fac. Health, Medicine and Life Sciences

Historical Development and Ethics in Biomedical Sciences

BMS2003
Periode 2
28 okt 2019
12 jun 2020
Vakbeschrijving afdrukken
Studiepunten:
1.0
Taal van de opleiding:
Engels
Coördinator:

- B. Penders

Fac. Health, Medicine and Life Sciences

Thesis

Volledige vakbeschrijving

Course summary

During this 30-week internship, students participate in ongoing scientific research at UM , 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.Internships can consist of subjects related to clinical diagnostics and therapy of chronic diseases, relationship between exogenous circumstances and chronic diseases, topics relating to cancer or developmental biology, depending on the speciality of the student and his/her interests.

Content

Students work individually and take part in ongoing research projects, supervised by a researcher. In this framework, they also participate in the regular meetings of the relevant research team. Further, they return to the university during the internship period to present their progress and comment on other students' projects. The internship period concludes with a final presentation at the Mosa Conference to the other students as well as supervisors/examiners/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.

Doelstellingen van dit vak

Objectives (Applying) knowledge and understanding:

- 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 supervisors

Aanbevolen literatuur

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
Periode 2
28 okt 2019
12 jun 2020
Vakbeschrijving afdrukken
Studiepunten:
47.0
Taal van de opleiding:
Engels
Coordinators:

- R. Shiri - Sverdlov
- J. Theys

Onderwijsmethode:
Paper(s), Presentation(s), Research
Evaluatiemethoden:
Final paper, Participation, Presentation

Master Biomedical Sciences

Trefwoorden:
practical lab work, research project
Fac. Health, Medicine and Life Sciences

Poster Presentation

Volledige vakbeschrijving

Present your research from the senior practical training for fellow students at the MOSA conference on a poster. Best abstracts will be selected for oral presentations. Posters will be scored and are part of the SPT mark.

Doelstellingen van dit vak

making a poster, presenting your results, scientific discussion

BMS2102
Periode 2
28 okt 2019
21 jun 2020
Vakbeschrijving afdrukken
Studiepunten:
0.0
Taal van de opleiding:
Engels
Coordinators:

- R. Shiri - Sverdlov
- J. Theys

Onderwijsmethode:
Paper(s), Presentation(s)
Evaluatiemethoden:
Assignment, Attendance, Participation, Presentation
Trefwoorden:
poster, oral, discussion
Fac. Health, Medicine and Life Sciences

Senior Practical Training - Internship

Volledige vakbeschrijving

A 30 week practical training period in a lab setting.

Doelstellingen van dit vak

performing experiments, participating in a research group

Aanbevolen literatuur

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

BMS2202
Periode 2
28 okt 2019
12 jun 2020
Vakbeschrijving afdrukken
Studiepunten:
0.0
Taal van de opleiding:
Engels
Coordinators:

- R. Shiri - Sverdlov
- J. Theys

Onderwijsmethode:
Research, Training(s), Paper(s)
Evaluatiemethoden:
Final paper, Attendance, Participation, Presentation
Trefwoorden:
practical work full participation in research