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Semester description for:

2. semester - Master of Science in Medicine with Industrial Specialisation – Spring 2026

Preface

The semester description is prepared by the semester coordinator together with course supervisors/module supervisors.

Indhold

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Semester details

Study Board of Medicine, The Faculty of Medicine, Aalborg University.

CURRICULUM OF MASTER OF SCIENCE IN MEDICINE WITH INDUSTRIAL SPECIALISATION 2020: https://studieordninger.aau.dk/2021/29/2498

Semester framework theme

The programme is structured into three profiles: Biomedicine, BM; Translational Medicine, TM; Medical Market Access, MMA.

Biomedicine focuses on the understanding of causes and treatment of disease at the molecular and cellular level. It builds upon the understanding of whole-body functions. The students will learn how to perform hypothesis-driven experiments in order to understand human pathophysiology and to identify new targets for treatment. Therefore, a substantial part is devoted to experiments on cells or laboratory animals. In this semester the courses Regenerative medicine, Disease Processes and Diagnostics – Personalized Medicine and Immuno- and Molecular Therapy will support this.

Translational medicine is driven by the objective of improving clinical outcomes by efficiently moving results from basic science to clinical application and back. In this semester this is supported by the courses Immuno- and Molecular Therapy, Translational Research Principles, and Advanced statistics.

Medical Market Access is driven by the objective to improve market access of industry within the biotechnological, pharmaceutical, and medical devices markets. They will be done through the courses Decision-Analytic Modelling and Trial-Based Evaluations in Health Economics, Organisation and Financing in Healthcare and Advanced Statistics.
All profiles will make a project in Applied Project Management within Medicine with Industrial Specialisation.

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Semester organisation and time schedule

Definitions of course activities
The semester applies a combination of academic, problem-oriented and interdisciplinary approaches and organised based on the following work and evaluation methods that combine skills and reflection (depends on the course and topic). See below list. All forms are included in this semester.

- Lecture – a 45–90-minute presentation by teacher
- Workshop/Exercise – a scheduled activity allowing students to solve and discuss problems in small groups with the option of feedback from teachers.
- Discussion – a scheduled timeslot for discussion of specific subjects among students and teacher(s)
- Student presentation – lectures prepared by students typically presenting how they have solved a specific problem.
- Problem solving – students solve problems defined by the teacher and related to a subject.
- Self-Study – Student is responsible for reading up on a selected topic of interest that is not covered during lectures that will assist them in their case presentations.
- Case exercises – Question-driven discussions and evaluation of content for selected readings, including journal articles and patient case examples.
- Case presentations – Presentation of a journal article or patient case example
- Seminar - scheduled study activity in which students present the task they are doing, in order to feedback from teachers and fellow students.
- Mini Project - students prepare in small groups a project - a self-chosen task, which allows them to train skills in project management.

Semester coordinator and secretariat assistance

Semester coordinator: Kristian Kjær-Staal Petersen, KKP@hst.aau.dk, Department of Health, Science and Technology

Semester secretary: Emma Louise Nørgaard Reberholt, elnr@hst.aau.dk, Department of Health, Science and Technology

Semester representative (student): See Moodle page.

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APPLIED PROJECT MANAGEMENT WITHIN MEDICINE WITH INDUSTRIAL SPECIALISATION / Anvendt projektledelse indenfor medicin med industriel specialisering
Profile: BM/TM/MMA
15 ECTS
Code: MEDMS20K2_1

Location
Master of Science in Medicine with Industrial Specialisation, 2nd semester
Study board for medicine

Module coordinator
Kristian Kjær-Staal Petersen, KKP@hst.aau.dk, Department of Health, Science and Technology

Type and language
Project module
English

Objectives
From Curriculum:
SKILLS

- Extract relevant information from the scientific literature and interpret that information in relation to the problem.
- Apply selected scientific methods to the identified problem and argue for the relevance of these methods.
- Evaluate the planning of the project work and reflect on the significance of planning for the accomplishment of the project.
- Identify own need for learning and knowledge to conduct the project.

Academic content and conjunction with other modules/semesters
Overall, the students should identify their own need for learning and knowledge to conduct the project. Furthermore, the project will enable the students to extract and interpret relevant information from the scientific literature, apply selected scientific methods and argue for the relevance of these. Additionally, the planning of the project and the significance of this for the accomplishment should be evaluated.
The subject of the projects will vary since there are different research topics represented in the sections of
BM, TM, and MMA.

Scope and expected performance

Type of activity	Number of lessons (45 min lecture or 1 h prep)	Obligatory elements

Confrontation activities (i.e. with a teacher/supervisor)		
Supervisor meetings, exam, etc	25 lessons*	
Practical exercises (e.g. lab)	23 lessons*	
Confrontation lessons total	**48 lessons***	
Activities without confrontation		
Theoretical research	50 lessons*	
Practical exercises (e.g. lab)	250*	
Report writing	75*	
Preparation (meetings, exam)	27 lessons*	
Lessons in total	**15 ECTS = 450 lessons**	

*depending on the group size. Example here is for a four-student group.

Participants
2nd semester students of the Master of Science in Medicine with Industrial Specialisation with the BM, TM, and MMA profile.

Prerequisites for participation
Participation in all exams of the 1st Semester is required.

Module activities (course sessions etc.)
Depending on the profile, BM, TM, or MMA, the students are expected to choose a project proposed for their profile. They are expected to be able to implement knowledge from the courses of this and earlier semesters.
The supervisors are mainly affiliated to (but not limited to) The Department of Health Science Technology (HST) and Department of Clinical Medicine. External co-supervisors can be involved when relevant for the project.

Examination
1. Oral group examination
2. During the exam the supervisor will be present together with an external examiner. If the project includes a co-supervisor, the co-supervisor can choose to be present.
3. During the project period, the students will write a project and hand it in using “Digital Eksamen” –
   date TBA. The exam is initiated by the students giving a scientific presentation of their project,
   followed by questioning by the examiners.

4. There is 45 min available in total for each student covering: student presentations, questioning by
   examiners and grading. As an example, a group of 4 students will be examined for 4 x 45 min = 3
   hours covering: student presentations, questioning by examiners, and grading.
5. The project will be evaluated using the 7-point grading scale and the grade will be given individually.
   and based on an overall assessment of:
   a) The written project
   b) The individual student presentation of the project
   c) The individual performance of the students during the oral examination

For further information about examination, we refer to Digital Eksamen (DE).

Regenerative Medicine / Regenerativ medicin

Profile: BM
5 ECTS course module
Module code: MEDMS20K2_2

Location
Master, Science in Medicine with Industrial Specialisation, 2nd semester
Board of Studies for Medicine

Module coordinator
Simone Riis Porsborg, sriis@hst.aau.dk, HST (Inst. 21)

Type and language
Course module in English

Objectives
From Curriculum:
After attending this course, the student is expected to:

Knowledge
- Demonstrate knowledge about developmental, molecular biological, biological, medical and engineering concepts relevant for cell-based regenerative approaches

Skills
- Apply an understanding of the processes that determine the molecular level cellular responses into schemes that aim to replace human tissues or organs, or aim at the restoration of physiological state of thereof
- Design rational biotherapies for relevant human diseases using appropriate set of molecular biological and engineering tools

- Assess the prospective value of proposed solutions, including medical significance and feasibility, both at the theoretical and empirical levels
- Apply different cell-based regenerative and tissue engineering approaches to treat intractable human diseases

Competences

- Demonstrate insight into molecular processes that underlie cell-cell as well as cell-material interactions and understand how knowledge of these processes can be applied for the benefit of tissue regeneration in-vivo and engineering of tissues in-vitro
- Research, synthesise, and critically appreciate knowledge available across different fields to account for treatment options that are viable from the point of currently established medical criteria
- Evaluate and identify novel areas of interest, the theoretical and practical knowledge of which is necessary, in order to accomplish a successful regenerative therapeutic paradigm.

Academic content and conjunction with other modules/semesters

The module addresses in the first part interactions between the cells and biomaterials and the properties of stem cells. In the second part, the previous knowledge is used to obtain a deeper understanding of cell-based and tissue engineering approaches to treat pathological conditions of major organ systems.

Scope and expected performance.
Total student load is 5 ECTS = 150 hours.
Each of 10 topics are introduced by a 2x45 min lecture followed by 90 mingroup work, working with topic-specific assignments. Giving a total of 40 lessons combining lecture and group work..
Furthermore, there are in total 7 hrs for individual study per topic, incl. exam preparation.

Type of activity	**Number of lessons (45 min lecture or 1 h prep)**	**Obligatory elements**
Confrontation activities (i.e. with a teacher/supervisor)		
Lectures	20 lectures á 45 min = 20 lessons	
Assignments/Seminars	10 assignments á 90 min = 20 lessons	
Supervisor meetings, exam, etc		
Confrontation lessons total	40+40 = 80	
Activities without confrontation		
Preparation	70 hrs	
Load in total (must match ECTS)	5 ECTS = 150 lessons or prep	

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Participants
MedIS students

Prerequisites for participation

Participation in exams on 1st semester

Module activities (course sessions etc.)

	Activity - type and title	Planned instructor*		Learning goals from curriculum
1	Lecture: Intro + Cell fate + group work	S. Porsborg RMG	Introduction to the course - Introduction to Regenerative Medicine as research area - Basic cell responses - Signal transduction, cell survival	Demonstrate knowledge about developmental, molecular biological, biological, medical and engineering concepts relevant for cell-based regenerative approaches Apply an understanding of the processes that determine the molecular level cellular responses into schemes that aim to replace human tissues or organs, or aim at the restoration of physiological state of thereof Demonstrate insight into molecular processes that underlie cell-cell as well as cell-material interactions and understand how knowledge of these processes can be applied for the benefit of tissue regeneration in-vivo and engineering of tissues in-vitro
2	Lecture: Extracellular matrix and environment + group work	C. P. Pennisi RMG	Basic cell responses - Extracellular molecules - Cell responses to environment	Demonstrate knowledge about developmental, molecular biological, biological, medical and engineering concepts relevant for cell-based regenerative approaches Apply an understanding of the processes that determine the molecular level cellular responses into schemes that aim to replace human tissues or organs, or aim at the restoration of physiological state of thereof Demonstrate insight into molecular processes that underlie cell-cell as well as cell-material interactions and understand how knowledge of these processes can be applied for the benefit of tissue regeneration in-vivo and engineering of tissues in-vitro
3	Lecture: Biomaterials and biocompatibility + group work	A. Banu RMG	Cell-material interactions - Chemistry of biomaterials, - Surface topography and physical properties - Biocompatibility	Demonstrate knowledge of the developmental, molecular biological, biomedical, and engineering concepts relevant to cell- and biomaterial-based regenerative approaches. Understand the fundamental principles, classifications, and definitions of biomaterials and their relevance in regenerative medicine. Explain how biomaterial properties including physical, mechanical, and surface topographical characteristics influence cell behaviour, adhesion, and tissue integration. Discuss the applications of natural and synthetic biomaterials and their translational potential in various tissue engineering and regenerative medicine contexts. Describe the concepts of cell–material interactions and biocompatibility. Explain evaluation criteria and methods used to assess the biocompatibility and performance of biomaterial scaffolds.
4	Lecture: Tailoring biomaterials	C. P. Pennisi RMG	Cell-material interactions	Demonstrate knowledge about developmental, molecular biological, biological, medical and

	+ group work		- Cell responses to 2- and 3-dimensional matrices - Manufacturing of scaffolds	engineering concepts relevant for cell-based regenerative approaches Apply an understanding of the processes that determine the molecular level cellular responses into schemes that aim to replace human tissues or organs, or aim at the restoration of physiological state of thereof Demonstrate insight into molecular processes that underlie cell-cell as well as cell-material interactions and understand how knowledge of these processes can be applied for the benefit of tissue regeneration in-vivo and engineering of tissues in-vitro
5	Lecture: Somatic stem cells + group work	Q. Peng RMG	Cell and molecular responses - Types and biology of somatic stem cells - Differentiation strategies	Apply an understanding of the processes that determine the molecular level cellular responses into schemes that aim to replace human tissues or organs, or aim at the restoration of physiological state of thereof Assess the prospective value of proposed solutions, including medical significance and feasibility, both at the theoretical and empirical levels Apply different cell-based regenerative and tissue engineering approaches to treat intractable human diseases Demonstrate insight into molecular processes that underlie cell-cell as well as cell-material interactions and understand how knowledge of these processes can be applied for the benefit of tissue regeneration in-vivo and engineering of tissues in-vitro Research, synthesise, and critically appreciate knowledge available across different fields to account for treatment options that are viable from the point of currently established medical criteria Evaluate and identify novel areas of interest, the theoretical and practical knowledge of which is necessary, in order to accomplish a successful regenerative therapeutic paradigm
6	Lecture: Probiotics and regeneration + group work	F. Dardmeh RMG	Specific regenerative approach - Probiotics - Types and mode of action of probiotics	Demonstrate knowledge about developmental, molecular biological, biological, medical and engineering concepts relevant for cell-based regenerative approaches Apply an understanding of the processes that determine the molecular level cellular responses into schemes that aim to replace human tissues or organs, or aim at the restoration of physiological state of thereof Assess the prospective value of proposed solutions, including medical significance and feasibility, both at the theoretical and empirical levels Apply different cell-based regenerative and tissue engineering approaches to treat intractable human diseases Demonstrate insight into molecular processes that underlie cell-cell as well as cell-material interactions and understand how knowledge of these processes can be applied for the benefit of tissue regeneration in-vivo and engineering of tissues in-vitro Research, synthesise, and critically appreciate knowledge available across different fields to account

				for treatment options that are viable from the point of currently established medical criteria Evaluate and identify novel areas of interest, the theoretical and practical knowledge of which is necessary, in order to accomplish a successful regenerative therapeutic paradigm
7	Lecture: Cartilage regeneration + group work	S. Khan RMG	Specific regenerative approach - Stem cells in bone and cartilage, - Approaches to regenerate cartilage	Demonstrate knowledge of the developmental, molecular, biological, and engineering principles underlying cell-based regenerative strategies for cartilage. Apply fundamental concepts of tissue engineering to design strategies for restoring the structure and function of damaged cartilage. Critically evaluate current regenerative approaches, including the use of stem cells, biomaterials, and bioactive molecules, in the context of cartilage repair and osteochondral regeneration. Design and propose rational regenerative therapies for cartilage-related disorders using appropriate molecular and engineering tools. Assess the translational potential, medical significance, and feasibility of proposed regenerative solutions from both theoretical and experimental perspectives. Integrate and synthesize interdisciplinary knowledge from developmental biology, molecular medicine, and bioengineering to identify viable treatment options for cartilage defects. Recognize and explore emerging research areas and challenges in cartilage and osteochondral tissue regeneration that may advance future therapeutic paradigms.
8	Lecture: Corneal regeneration + group work	S. Aghazadeh RMG	Specific regenerative approach - Structure and physiology of corneal limbus - Approaches to regenerate cornea	Understand the cellular structure, physiological function, and homeostasis of the cornea (Transparency maintenance) Describe the limbal epithelial stem cell (LESC) niche with a focus on its location, structure, function, and cellular markers. Describe the limbal stem cell deficiency (LSCD), and the currently available cell-based therapies for this condition. Outline the methods of LESC isolation and culture.
9	Lecture: Smooth muscle regeneration + group work	C. P. Pennisi RMG	Specific regenerative approach - Structure of smooth muscle - Approaches to regenerate smooth muscle	Demonstrate knowledge about developmental, molecular biological, biological, medical and engineering concepts relevant for cell-based regenerative approaches Apply an understanding of the processes that determine the molecular level cellular responses into schemes that aim to replace human tissues or organs, or aim at the restoration of physiological state of thereof Design rational biotherapies for relevant human diseases using appropriate set of molecular biological and engineering tools Assess the prospective value of proposed solutions, including medical significance and feasibility, both at the theoretical and empirical levels Apply different cell-based regenerative and tissue engineering approaches to treat intractable human diseases Demonstrate insight into molecular processes that underlie cell-cell as well as cell-material interactions and understand how knowledge of these processes

				can be applied for the benefit of tissue regeneration in-vivo and engineering of tissues in-vitro Research, synthesise, and critically appreciate knowledge available across different fields to account for treatment options that are viable from the point of currently established medical criteria Evaluate and identify novel areas of interest, the theoretical and practical knowledge of which is necessary, in order to accomplish a successful regenerative therapeutic paradigm
10	Lecture: Cell-based therapies for wound healing + group work	S. Porsborg RMG	Specific regenerative approach - Quality considerations for cell-based medicinal products - Understand and evaluate cell-based options for wound healing	Demonstrate knowledge about developmental, molecular biological, biological, medical and engineering concepts relevant for cell-based regenerative approaches Apply an understanding of the processes that determine the molecular level cellular responses into schemes that aim to replace human tissues or organs, or aim at the restoration of physiological state of thereof Design rational biotherapies for relevant human diseases using appropriate set of molecular biological and engineering tools Assess the prospective value of proposed solutions, including medical significance and feasibility, both at the theoretical and empirical levels Apply different cell-based regenerative and tissue engineering approaches to treat intractable human diseases Research, synthesise, and critically appreciate knowledge available across different fields to account for treatment options that are viable from the point of currently established medical criteria Evaluate and identify novel areas of interest, the theoretical and practical knowledge of which is necessary, in order to accomplish a successful regenerative therapeutic paradigm

** All rights reserved for changes during the semester due to e.g. illness, cancellations etc.*

Examination

1. The exam is written with grading.
2. The exam is based on assay type questions, each covering a module.
3. The exam will be graded by the module coordinator.
4. The exam is done through “Digital Eksamen”
5. The duration of the exam is 2 hours.
6. Aids are not permitted.

For further information about examination, we refer to Digital Eksamen (DE).

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Immuno- and Molecular Therapy / Immun- og molekylærterapi

Profile: BM+TM
5 ECTS course module
Module code: MEDMS20K2_3

Location
Master of Science in Medicine with Industrial Specialisation, 2nd semester
Study board for medicine

Module coordinator
Coordinator Maj Schneider Thomsen, mst@hst.aau.dk and and Emil Kofod-Olsen, ekol@hst.aau.dk, Department of Health Science and Technology

Co-coordinator for course and exam in Molecular Therapy: Maj Schneider Thomsen, mst@hst.aau.dk, Department of Health Science and Technology

Co-coordinator for course and exam in Immunotherapy: Emil Kofod-Olsen, ekol@hst.aau.dk, Department of Health Science and Technology

Type and language
English

Objectives
KNOWLEDGE

- Explain how manipulations of the immune system may alleviate, stop or avoid disease processes
- Describe how proteins and products of the immune system (antibodies, cytokines and cells) can be utilised as therapeutic agents
- Describe the mechanism of viral and non-viral gene therapy and how they can be used to treat diseases
- Describe nanocarriers and their formulation
- Explain how nanocarriers can be used to deliver therapeutic agents
- Evaluate strength and weaknesses of various nanocarriers for drug delivery

SKILLS

- Read scientific papers, extract the important findings and present these to an audience
- Propose own form of immuno- or molecular therapy and present the idea using a poster

COMPETENCES

- Compare and suggest suitable forms of immuno- and molecular therapy for various diseases

Academic content and conjunction with other modules/semesters
The course builds on the qualifications in biochemistry, cell biology, pathology, and immunology acquired in the bachelor program of Medicine with Industrial Specialization or in similar bachelor programs. Furthermore, the course draws on the course on molecular and cellular methods in

biomedicine taught on the 1st semester of the master programme in Medicine with Industrial Specialization.

Scope and expected performance

Type of activity	Number of lessons (45 min lecture or 1 h prep)	Obligatory elements
Confrontation activities (i.e. with a teacher/supervisor)		
Lectures	18 lectures á 45 min = 18 lessons	
Assignments/Seminars	9 assignments á 90 min = 18 lessons	
Poster presentation	2 lessons	
Confrontation lessons total	**38 lessons**	
Activities without confrontation		
Creation of poster	25	
Preparation incl. exercises	87 lessons	
Load in total (must match ECTS)	**150**	

Participants
Indication of the participants in the module, particularly if they include several year groups, programmes or another type of co-teaching.

Prerequisites for participation
Passed course in basic immunology (module 2.3 of the AAU medicine/medIS bachelor programme or equivalent).

Module activities (course sessions etc.)

Level 1		
Activity - type and title*	**Lecturer* including department affiliation**	**Learning goals from curriculum**
Immunotherapy session Lecture: "Transplantation immunology and	Emil Kofod-Olsen, , HST, AAU	KNOWLEDGE • Explain how manipulations of the immune system may alleviate, stop or avoid disease processes • Describe how proteins and products of the immune system (antibodies, cytokines and cells) can be utilised as therapeutic agents

immunosuppressive drugs - with an introduction to immu-notherapy" Clinical lecture: “Kidney transplantation and how to avoid rejection" (Titles of lectures are preliminary) Work with study problems and discussion in plenum	Birgitte Bang Pedersen, consultant, Dept. of Nephrology, Aalborg University Hospital.	COMPETENCES • Compare and suggest suitable forms of immuno- and molecular therapy for various diseases
Immunotherapy session **Lecture:** "Immunostimulatory and immunomodulatory drugs (-imex and -imod)" **Clinical lecture:** "Immune therapy in MS" (Titles of lectures are preliminary)” Work with study problems and discussion in plenum	Emil Kofod-Olsen, HST, AAU Aspects in immunotherapy in multiple sclerosis. Jakob Schäfer, Dept. of Neurology, Aalborg University Hospital.	KNOWLEDGE • Explain how manipulations of the immune system may alleviate, stop or avoid disease processes • Describe how proteins and products of the immune system (antibodies, cytokines and cells) can be utilised as therapeutic agents COMPETENCES • Compare and suggest suitable forms of immuno- and molecular therapy for various diseases
Immunotherapy session **Lecture:** "New and experimental forms of immunotherapy in cancer" **Clinical lecture:** "Immune checkpoint blockade as a treatment for cancer"	Ralf Agger, HST, AAU Andreas Carus, Dept. of Oncology, Aalborg University Hospital	KNOWLEDGE • Explain how manipulations of the immune system may alleviate, stop or avoid disease processes • Describe how proteins and products of the immune system (antibodies, cytokines and cells) can be utilised as therapeutic agents COMPETENCES • Compare and suggest suitable forms of immuno- and molecular therapy for various diseases

(Titles of lectures are preliminary)" Work with study problems and discussion in plenum		
Immunotherapy session **Lecture:** "Tissue damage induced by the immune system" **Clinical lecture:** "Biologic treatment in rheumatoid arthritis" (Titles of lectures are preliminary)" Work with study problems and discussion in plenum	Emil Kofod-Olsen, HST, AAU Line Uhrenholt, Dept. of Rheumatology, Aalborg University Hospital	KNOWLEDGE • Explain how manipulations of the immune system may alleviate, stop or avoid disease processes • Describe how proteins and products of the immune system (antibodies, cytokines and cells) can be utilised as therapeutic agents COMPETENCES • Compare and suggest suitable forms of immuno- and molecular therapy for various diseases
Immunotherapy session **Lecture:** "Tolerance and autoimmunity" **Clinical lecture:** "Autoimmune diseases with focus on SLE and ANCA-associated vasculitis" (Titles of lectures are preliminary)" Work with study problems and discussion in plenum	Emil Kofod-Olsen, HST, AAU Jon Waarst Gregersen, Dept. of Nephrology, Aalborg University Hospital.	KNOWLEDGE • Explain how manipulations of the immune system may alleviate, stop or avoid disease processes • Describe how proteins and products of the immune system (antibodies, cytokines and cells) can be utilised as therapeutic agents COMPETENCES • Compare and suggest suitable forms of immuno- and molecular therapy for various diseases
Molecular therapy - Peptide and protein therapeutics	Maj Schneider Thomsen, HST, AAU	KNOWLEDGE • Describe how proteins and products of the immune system (antibodies, cytokines and cells) can be utilised as therapeutic agents • Evaluate strength and weaknesses of various nanocarriers for drug delivery SKILLS

		• Read scientific papers, extract the important findings and present these to an audience
Molecular therapy – Gene therapy	TBA, KI, AAU Eva Hede Olsen, HST, AAU	KNOWLEDGE • Describe the mechanism of viral and non-viral gene therapy and how they can be used to treat diseases SKILLS • Read scientific papers, extract the important findings and present these to an audience
Molecular therapy – Targeted therapy	Maj Schneider Thomsen, HST, AAU Torben Moos, HST, AAU	KNOWLEDGE • Explain how nanocarriers can be used to deliver therapeutic agents • Evaluate strength and weaknesses of various nanocarriers for drug delivery SKILLS • Read scientific papers, extract the important findings and present these to an audience
Molecular therapy – Nano carriers and their formulation Online Lecture 1 and 2: "Multifunctional Nanocarrier systems, their formulations and clinical value" Work with study problems and discussion in plenum	Kasper Bendix Johnsen, Enheden for Videnskab og Etik Maj Schneider Thomsen, HST, AAU	KNOWLEDGE • Describe nanocarriers and their formulation • Explain how nanocarriers can be used to deliver therapeutic agents • Evaluate strength and weaknesses of various nanocarriers for drug delivery SKILLS • Read scientific papers, extract the important findings and present these to an audience
Molecular therapy – Poster presentation Student poster presentations and discussion in plenum.	Maj Schneider Thomsen, HST, AAU	SKILLS • Propose own form of immuno- or molecular therapy and present the idea using a poster COMPETENCES • Compare and suggest suitable forms of immuno- and molecular therapy for various diseases

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Examination

1. Written exam and Digital Exam (www.de.aau.dk) will be used.

2. The students will be tested in their knowledge, skills, and competencies obtained through the module by answering multiple choices, short and long essay questions, and cases.
3. The exam will be evaluated by the module coordinators and is graded
4. The exam:
    a. Duration: 2 hours
    b. Remember to bring your student identification card
    c. Please make sure to install the program ITX-Flex. AAU takes no liability if there arise problems with your electronic equipment Dataset and written materials.
    d. Digital Exam Questions are in English (NB! There will be no dictionaries available).
    e. The answers may be in English or Danish
    f. No form of communication with other examinees is allowed
    g. No aids of any kind are allowed

For further information about examination, we refer to Digital Eksamen (DE).

Applied Statistics

Profile: TM+MMA
5 ECTS
Module code: MEDMS20K2_4

Location
Master of Science in Medicine with Industrial Specialisation, 2nd semester
Study board for medicine

Module coordinator
Kristian Kjær Petersen, KKP@hst.aau.dk, Department for Health Science and Technology

Type and language
English

Objectives
From Curriculum:
KNOWLEDGE

- Describe and understand advanced statistical methods
- Understand how clinical trial design affect statistical choices

SKILLS

- Explain the principles of decision-making for evidence-based healthcare
- Identify different types of data sources and apply appropriate statistical methods
- Write a statistical analysis plan (SAP) for a clinical trial

- Perform selected statistical tests including multi-factorial analysis
- Prepare a statistical report

COMPETENCES
- Develop appropriate designs for clinical research
- Select appropriate statistical analysis
- Critically discuss differences in outcomes using different clinical trial designs (case, cohort, parallel, un-controlled, RCT etc)

Academic content and conjunction with other modules/semesters
This module is focused on providing students with the needed skills for conducting statistical analysis plans and therefore a large part of the module is dedicated towards this goal. This module adds to the pre-existing module on “Statistics and Study Design (MEDIS bachelor)”.

Scope and expected performance
The module comprises lectures and classroom activities on various theoretical subjects, work with study problems, presentations by students, and lectures by experts in clinical trials. Students are required to actively participate in module and to write a statistical analysis plan (SAP), which is to be presented at the end of the course during a workshop. Additionally, the students are encouraged to actively participate in the assignments following each lecture, since these assignments are part of the exam.

The module program will be STATA and a full lecture is assigned to introduce this program.

Workload will correspond to the 5 ECTS credits (i.e. 150 hours) provided by the course and the workload is described as follow:

There are nine lectures followed by assignments are planned (36 hours). Preparing for the lectures and exam correspond to 54 hours of workload. Students (alone or in groups) are to prepare a SAP, which should be evaluated to pass the module and presented during a workshop. The preparation and workshop participation correspond to 60 hours of work.

Type of activity	**Number of lessons (45 min lecture or 1 h prep)**	**Obligatory elements**
Confrontation activities (i.e. with a teacher/supervisor)		
Lectures	10 lectures á 2 x 45 min = 20 lessons	
Assignments	10 assignments á 90 min = 20 lessons	
Workshop	Full day program = 8 lessons	
Confrontation lessons total	**(20 + 20 + 8 =) 48 lessons**	
Activities without confrontation		

Report writing (statistical analysis plan)	44 hours	Yes
Preparation (including exam)	54 hours	No
Load in total	**150 lessons**	

Participants
Students on the MEDIS Master program with a Translational Medicine or Medical Market Access specialization.

Prerequisites for participation
Participation in all exams of the 1st semester is required.

Module activities (course sessions etc.)

Level 1		
Activity - type and title	**Lecturer including department affiliation***	**Learning goals from curriculum**
Introduction to the course, and the statistical analysis plan (1)	Kristian Kjær Petersen	- Can write a statically analysis plan (SAP) for a clinical trial - Can select appropriate statistical analysis - Principles of decision-making for evidence-based healthcare
Introduction to STATA (2)	Jan Brink Valentin	- Can perform selected statistical tests including multi-factorial analysis - Can select appropriate statistical analysis
Lecture (3) Reproducibility and sample size estimation	Carsten Dahl Mørch	- Understand how statistical choices affect clinical trial designs
Lecture (4) Multifactorial ANOVA and Repeated measures ANOVA	Carsten Dahl Mørch	- Understand how statistical choices affect clinical trial designs - Can perform selected statistical tests including multi-factorial analysis
Lecture (5)	Carsten Dahl Mørch	- Understand how statistical choices affect clinical trial designs

Multiple linear regressions		- Can perform selected statistical tests including multi-factorial analysis
Lecture (6) Multiple logistic regressions	Carsten Dahl Mørch	- Understand how statistical choices affect clinical trial designs - Can perform selected statistical tests including multi-factorial analysis
Lecture (7) Survival analysis	Jan Brink Valentin	- Understand how statistical choices affect clinical trial designs -
Lecture (8) Generalized linear models	Jan Brink Valentin	- Can select appropriate statistical analysis
Lecture (9) Metaanalysis	Jan Brink Valentin	- Overview of different types of data sources and statistical methods - Principles of decision-making for evidence-based healthcare - Critical discuss differences in outcomes using different clinical trial designs (case, cohort, parallel, un-controlled, RCT etc). -
Lecture (10) Network metaanalysis	Jan Brink Valentin	- Overview of different types of data sources and statistical methods - Principles of decision-making for evidence-based healthcare - Critical discuss differences in outcomes using different clinical trial designs (case, cohort, parallel, un-controlled, RCT etc). -
Preparation of workshop	Students	- Can write a statically analysis plan (SAP) for a clinical trial
Workshop (11) Student presentations of assignment work	Kristian Kjær Petersen, Carsten Dahl Mørch, Jan Brink Valentin	- Can develop appropriate designs for clinical trials. - Can report statistical results - Critical discuss differences in outcomes using different clinical trial designs (case, cohort, parallel, un-controlled, RCT etc).

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Examination

Prerequisite for enrolment for the exam requires active participation and approval of presentation during the course, meaning that each student should participate in the following obligatory activities:

1) Prepare and upload a statistical analysis plan
2) Participate in a workshop where the statistical analysis plan is presented and constructive criticism is provided to other statistical analysis plans

The exam will be an oral exam, where the students draw and explains a topic from the module. The questions will focus on the statistical analysis plan and the exercises conducted during the module and therefore the submission of the statistical analysis plan is mandatory. The students are advised to have prepared a portfolio of solutions to the exercises. The exam lasts for 20 min including assessment. The course responsible and lectures will be examiner and internal censor. Students are welcome to bring the statistical analysis plan and exercise portfolio to the exam. The course will be graded Passed/Not Passed.

Decision-Analytic Modelling and Trial-Based Evaluations in Health Economics /
Beslutningsanalytisk modellering og forsøgsbaserede evalueringer indenfor sundhedsøkonomi
Profile: MMA
5 ECTS
Module code: MEDMS20K2_5

Location
Master of Science in Medicine with Industrial Specialisation, 2nd semester
Study board for medicine

Module coordinator
Cathrine Elgaard Jensen, celga@dcm.aau.dk
Department of Clinical Medicine

Type and language
English

Objectives
From Curriculum:

Knowledge

- Understand what decision-analytic modelling implies and its relation to prioritisation in healthcare
- Demonstrate knowledge of different types decision-analytic models and their application in health economic evaluation
- Demonstrate knowledge of the design and methods for economic analysis conducted alongside clinical trials
- Understand the importance of uncertainty and how it may affect decision making

- Understand the potential value of future research in relation to the decision making process
- Demonstrate basic knowledge of cutting-edge methods within economic evaluation

Skills

- Extract, present and analyse relevant data for the construction of decision-analytic models by conducting a systematic search of the existing literature
- Design and apply decision-analytic models for the evaluation of new interventions
- Analyse real-world data in relation to economic evaluation using statistical software
- Produce a probabilistic sensitivity analysis

Competences

- Differentiate between different types of uncertainty and assess the importance for economic evaluation
- Critically assess the methods and results of health economic evaluations based on decision-analytic modelling

Academic content and conjunction with other modules/semesters

Evidence of 'value for money' is increasingly requested when healthcare technology is introduced in healthcare systems in many countries, including Denmark. The construction and understanding of sound economic evaluation are pivotal for making informed prioritization in healthcare. Consequently, the knowledge, skills, and competencies needed to both execute and evaluate advanced economic evaluation are increasingly valuable for businesses and the public sector as it may substantiate informed decision making.

The course provides knowledge, skills, and competencies for decision-analytic modelling and economic evaluation alongside clinical trials. It builds on the 1st-semester course "Methods of Economic Evaluation in Healthcare" in the master of Medical Market Access, in which the basic principles of economic evaluation were introduced.

The course provides the students with hands-on experience of how to construct advanced economic evaluations. This experience includes knowledge, skills, and competencies relevant to the construction of evidence-based decision-analytic models using relevant software programs such as TreeAge and Excel. Furthermore, the students will become acquainted with and gain hands-on knowledge of advanced methods used for economic evaluation alongside clinical trials, using relevant statistical software, such as Stata. Also, the students will be introduced to cutting-edge, currently applied research within economic evaluation used in research and business practice.

In short, the students attending the course will learn how to conduct advanced economic evaluation and analyses using decision-analytic models and statistical methods using large data sets. The underlying focus of the course is the use of the methods and analyses in research and business with a particular emphasis on medical market access.

Scope and expected performance

'Decision-analytic Modelling and Trial-based Evaluation in Health Economics' is a 5 ECTS course and the students can expect a workload of approximately 150 hours. These may be distributed as follows or as according to the students' own volition and judgement:

- **Lectures**: 7 lectures á 4 hours = 28 hours (the lectures contain lecture delivery with the use of intermittent supporting exercises to ensure coherence between and understanding of the introduced theory and its practical application).
- **Workshops**: 3 workshops á 4 hours = 12 hours, providing hands-on experience with decision-analytic models and the execution of trial-based evaluations.
- **Preparation during the semester:** the students should expect to use approximately 86 hours for preparations during the semester. The time should be used for, particularly, reading, but also exercises presented during lectures.
- **Preparation for the exam:** 3 working days x 7,4 hours/working day, including time for reading a text in preparation for the exam = approx. 22 hours.
- **Exam**: 2 hours.

Type of activity	**Number of lessons (45 min lecture or 1 h prep)**	**Obligatory elements**
Confrontation activities (i.e. with a teacher/supervisor)		
Lectures	7 lectures á 4 hours = 28 hours	
Supervisor meetings, exam, etc	2 hour written exam	Yes
Practical exercises (e.g. lab)	3 workshops á 4 hours = 12 hours	
Confrontation lessons total	**(28 + 2 + 12) = 42 lessons**	
Activities without confrontation		
Preparation	(150 total lessons for five ECTS – 42 total confrontation =) 108 lessons	
Load in total (must match ECTS)	5 ECTS = 150 lessons	

Participants
The course is a part of the Medical Market Access programme, and participants are primarily students who have enrolled at the Medical Market Access programme. It builds on the 1st-semester course 'Methods of Economic Evaluation in Healthcare', and students from other educations should not participate without a basic understanding of health economic evaluation from that or similar courses.

Prerequisites for participation
Prerequisites for participation in the course include participation in the courses taught at the 1st semester of the master Medical Market Access, with a particular emphasis on the course

'Methods of Economic Evaluation in Healthcare' OR the attained competencies, skills, and knowledge equivalent to what is taught in the 1st semester of the master Medical Market Access.

Module activities (course sessions etc.)

Level 1

Activity - type and title	**Lecturer including department affiliation***	**Learning goals from curriculum**
Lecture 1: *Introduction to decision theory and decision-analytic modelling*	Cathrine Elgaard Jensen, Department of Clinical Medicine	• Understand what decision-analytic modelling implies and its relation to prioritisation in healthcare • Demonstrate knowledge of different types decision-analytic models and their application in health economic evaluation • Design and apply decision-analytic models for the evaluation of new interventions
Lecture 2: *Markov modelling and advanced topics within decision-analytic modelling*	Cathrine Elgaard Jensen, Department of Clinical Medicine	• Demonstrate knowledge of different types of decision-analytic models and their application in health economic evaluation • Design and apply decision-analytic models for the evaluation of new interventions • Understand the potential value of future research in relation to the decision making process • Demonstrate basic knowledge of cutting-edge methods with economic evaluation
Lecture 3: *Investigating uncertainty: Deterministic sensitivity analysis*	Lars Børty Nielsen, Department of Clinical Medicine	• Understand the importance of uncertainty and how it may affect decision making • Differentiate between different types of uncertainty and assess the importance for economic evaluation • Understand the potential value of future research in relation to the decision making process
Lecture 4: *Investigating uncertainty:*	Cathrine Elgaard Jensen, Department of Clinical Medicine	• Understand the importance of uncertainty and how it may affect decision making

Probabilistic sensitivity analysis		• Differentiate between different types of uncertainty and assess the importance for economic evaluation • Produce a probabilistic sensitivity analysis
Workshop session I: *Building decision trees, making them probabilistic and interpreting the results from probabilistic sensitivity analyses*	Lars Børty Nielsen, Department of Clinical Medicine	• Design and apply decision-analytic models for the evaluation of new interventions • Produce a probabilistic sensitivity analysis • Understand the importance of uncertainty and how it may affect decision making
Workshop session II: *Practical introduction to Markov modelling*	Lars Børty Nielsen, Department of Clinical Medicine	• Demonstrate knowledge of different types decision-analytic models and their application in health economic evaluation Design and apply decision-analytic models for the evaluation of new interventions • Produce a probabilistic sensitivity analysis
Lecture 7: *Finding evidence for decision-analytic modelling and interpreting published evaluations*	Lars Børty Nielsen, Department of Clinical Medicine	• Extract, present and analyse relevant data for the construction of decision-analytic models by conducting a systematic search of the existing literature • Critically assess the methods and results of health economic evaluations based on decision-analytic modelling
Lecture 8: *Conducting trial-based evaluations used in health economics I*	Sabrina Storgaard Sørensen and Jan Brink Valentin, Department of Clinical Medicine	• Demonstrate knowledge of the design and methods for economic analysis conducted alongside clinical trials • Analyse real-world data in relation to economic evaluation using statistical software
Lecture 9: Conducting *trial-based evaluations used in health economics II*	Jan Brink Valentin, Department of Clinical Medicine	• Demonstrate knowledge of the design and methods for economic analysis conducted alongside clinical trials • Analyse real-world data in relation to economic evaluation using statistical software

Workshop session III: *Exercises*	Cathrine Elgaard Jensen, Department of Clinical Medicine	• Demonstrate knowledge of the design and methods for economic analysis conducted alongside clinical trials • Demonstrate knowledge of different types decision-analytic models and their application in health economic evaluation

** All rights reserved for changes during the semester due to e.g. illness, cancellations etc.*

Examination

- The exam will be an individual written exam of 2-hour duration.
- Seventy-two hours before the exam starts, a written text, for instance, a report or a scientific paper, will be made available to the students via the Moodle page for the course. A part of the exam questions will take their starting point in this text.
- The written exam questions will be framed so that the students' skills, competencies, and knowledge will be tested with respect to the construction, interpretation and use of decision-analytic models and trial-based evaluations in health economics as covered in the learning objectives. Approximately half of the questions will relate to the students' knowledge with respect to the curriculum, and the other half will relate to their acquired skills and competencies, respectively. Some questions may necessitate the employment of more learning objectives simultaneously. There will be short answer questions and essay questions. The questions will be based on the stated curriculum covered in lectures, in exercises in the workshops, and the stated literature.
- The exam will be assessed using the 7-point grading scale. The exam will be evaluated by the module coordinator or a teacher in the course and an internal examiner. The internal examiner will have the appropriate competencies and knowledge of the academic content related to the course and knowledge of the master Medical Market Access to enable fair assessment of the exam.
- "Digital Eksamen" will be used for distribution and handing in the written exam.
- All aids are allowed during the exam, except for the use of the Internet, AI tools, and any means of communication. The Internet may be used for download and upload of the assignment only. It is the students' responsibility to ensure that no communication takes place during the exam.
- If the exam format for the re-examination is changed before the re-examination, this will be announced no later than 14 days before the re-examination takes place.

For further information about examination, we refer to Digital Eksamen (DE).

AALBORG UNIVERSITET

Organization and Financing in Healthcare

Profile: MMA
5 ECTS

Location
Master of Science in Medicine with Industrial Specialisation, 2nd semester
Study board for medicine

Module coordinator
Flemming Witt Udsen, fwu@dcm.aau.dk

Type and language
English

Objectives
From Curriculum:

Knowledge

- Understand the financing and organization of healthcare systems including differences between the Danish and international healthcare systems
- Understand how different types of financing and organization creates different incentives in healthcare
- Understand theory of health system governance
- Understand how organization and management of healthcare influence patient outcomes.
- Demonstrate knowledge of the primary instruments used in governance of the Danish healthcare system both financial and quality related
- Understand the linkages between quality, economics and governance

Skills

- Use theoretical models and methods for analysis and interpretation of specific quality, economical and governance problems in the healthcare system
- Apply methods for stakeholder analysis within healthcare

Competences

- Analyse and assess the consequences of different forms of governance and financing

Academic content and conjunction with other modules/semesters
Healthcare is organised and financed in different ways across the world. The organisation and financing of healthcare is often taken for granted within a country, with little reflection on the alternative governance models, or the implications of different forms of organisation, management and financing on provider performance and patient outcomes.

This module gives an introduction to the organisation and financing of health care from a health economic perspective. It introduces the analytical tools necessary to understand the choices countries make and are faced with when designing the organisation and financing of healthcare, the incentives created by different design choices, and the consequences of different forms of governance.

The module is designed with a high degree of student interaction, ensuring that students develop their analytical competences throughout the module.

Scope and expected performance
'Organization and Financing in Healthcare' is a 5 ECTS course and the students can expect a workload of approximately 150 hours. These may be distributed as follows or as according to the student's own volition and judgement:

Type of activity	**Number of lessons (45 min lecture or 1 h prep)**	**Obligatory elements**
Confrontation activities (i.e. with a teacher/supervisor)		
Lectures	5 lectures á 4x 45 min and 3 lectures á 2x 45 min = 26 lessons	
Practical exercises (e.g. lab)	3 workshops á 2x 45 min = 6 lessons 1 workshop á 4x 45 min = 4 lessons	
Confrontation lessons total	**22+10+4 =36 lessons**	
Activities without confrontation		
Preparation for the exam + exam	The exam will take 20 mins and it is expected that students will need 37 hours of preparation time prior to the exam.	Preparation for the exam + exam
Preparation	The students are expected to prepare for each lecture/workshop by reading the course material posted on Moodle and preparing a presentation for the last lecture. This preparation is expected to have a duration of approximately 10 hours per lecture/workshop, a total of around 80 hours.	
Load in total (must match ECTS)	5 ECTS = 150 lessons	

Participants
The course is a part of the Medical Market Access programme, and participants are primarily students who have enrolled at the Medical Market Access programme, although other students that fulfil the prerequisites can also participate.

Prerequisites for participation

AALBORG UNIVERSITET

Prerequisites for participation in the course include microeconomic principles introduced in the 1st semester course “Marketing and Market Access for Healthcare”. Students from other educations should not participate without a basic understanding of microeconomics from that or similar courses.

Module activities (course sessions etc.)
Flemming Witt Udsen (fwu@dcm.aau.dk)
Anne Gulbech Ording (a.ording@rn.dk, annego@dcm.aau.dk)

Topic	Description	Lecturer	Activity	Learning goals from curriculum
1	Introduction to the module, health system governance and organization and financing of healthcare	Flemming Witt Udsen, Department of Clinical Medicine	Lecture	• Understand theory of health system governance • Apply methods for stakeholder analysis within healthcare • Demonstrate knowledge of the primary instruments used in governance of the Danish healthcare system both financial and quality related
2	The demand for healthcare and implications for the organization and financing of care	Anne Gulbech Ording, Department of Clinical Medicine	Lectures	• Understand how different types of financing and organization creates different incentives in healthcare • Understand theory of health system governance
			Workshop	• Use theoretical models and methods for analysis and interpretation of specific quality, economic, and governance problems in the healthcare system
3	Supply and organization of healthcare	Flemming Witt Udsen, Department of Clinical Medicine	Lectures	• Understand the financing and organization of healthcare systems including differences between the Danish and international healthcare systems

				• Understand the linkages between quality, economics and governance • Analyze and assess the consequences of different forms of governance and financing • Use theoretical models and methods for analysis and interpretation of specific quality, economical and governance problems in the healthcare system
4	Financing healthcare	Flemming Witt Udsen, Department of Clinical Medicine	Lectures	• Understand the financing and organization of healthcare systems including differences between the Danish and international healthcare systems • Understand how different types of financing and organization creates different incentives in healthcare
			Workshop	• Analyse and assess the consequences of different forms of governance and financing
5	Provider reimbursement	Flemming Witt Udsen, Department of Clinical Medicine	Lectures	• Understand how different types of financing and organization creates different incentives in healthcare • Understand the linkages between quality, economics and governance • Understand how organization and management of healthcare influence patient outcomes
			Workshop	• Demonstrate knowledge of the primary instruments used in governance of the

				Danish healthcare system both financial and quality related • Apply methods for stakeholder analysis within healthcare
6	Equity in healthcare	Anne Gulbech Ording, Department of Clinical Medicine	Lectures	• Understand the linkages between quality, economics and governance • Understand how organization and management of healthcare influence patient outcomes
7	Assessing variation in healthcare use and outcomes	Anne Gulbech Ording, Department of Clinical Medicine	Lectures	• Analyze and assess the consequences of different forms of governance and financing • Demonstrate knowledge of the primary instruments used in governance of the Danish healthcare system both financial and quality related
8	Comparative country analyses (group presentations)	Flemming Witt Udsen, Department of Clinical Medicine	Workshop	• Analyse and assess the consequences of different forms of governance and financing

The core reading is:

- Olsen, J.A., 2017. Principles in Health Economics and Policy, 2nd ed. Oxford University Press.
- Supplemented with academic papers and relevant book chapters as listed in the module reading list
-

1. **Examination** Oral individual exam without preparation time.
2. The exam is passed/not passed. and there will be internal censorship

3. In the exam students draw and explain a topic from the module. The questions will focus on the workshops conducted during the module using theoretical models and tools covered in the curriculum.
4. The duration of the exam is 20 mins including assessment.
5. Exam topics are formulated in English, but the oral examination can be in both Danish and English depending on the preference of the student.
6. No aids are allowed.
7. Re-examination is also a 20 min oral exam without preparation time and aids including assessment.
8.

For further information about examination, we refer to Digital Eksamen (DE).

AALBORG UNIVERSITET

Human Genomics

Profile: BM
5 ECTS
Module code: MEDMS20K2_7

Location
Master of Science in Medicine with Industrial Specialisation, 2nd semester
Study board for medicine

Module coordinator
Coordinator: Palle Duun Rohde palledr@hst.aau.dk, Department of Health Science and Technology

Type and language
Course module in English

Objectives
From Curriculum:
Purpose of the course:
The course provides the students insight into human genetics and genomics with application in personalised medicine. **LEARNING OBJECTIVES**

KNOWLEDGE

- Explain organisation of the human genome.
- Explain different types of genetic variation.
- Understand the relationship between genotype and phenotype.
- Understand which forces affect alleles in a population.
- Explain how genetic variation regulates and affect disease with monogenic and polygenic aetiology.
- Describe genetic and proteomic biomarkers in diagnostics, biomarker discovery and validation in a personalised medicine context.

SKILLS

- Apply advanced molecular methods in genetics.
- Evaluate a choice of method or technology to detect and analyse genetic variation.
- Choose appropriate databases, algorithms, statistics and parameters in a bioinformatics analysis.
- Use bioinformatical and analytical strategies to solve problems in personalised medicine. Understand the genetic architecture of monogenic and complex traits.
-

COMPETENCES

- Understand the genetic architecture of monogenic and complex traits
- Perform simple genetic analyses.

- Evaluation of scientific articles at the highest international level.

Academic content and conjunction with other modules/semesters
The course gives the students an understanding on the fundamental differences in disease aetiology between monogenic and common complex diseases, how genetics and genomics is being used to improve our understanding of the underlying mechanism of complex diseases, and how molecular data can be used within personalized medicine.

Scope and expected performance
The expected workload of 150 hours for this 5 ECTS module:

- **Lectures**: 7 lectures of 2 hours = 14 hours.
- **Exercises**: 7 session of 2 hours = 14 hours. Lectures and exercises are combined in sessions of 4 hours with shorter lectures and intermittent supporting exercises.
- **Workshops**: 3 workshops á 4 hours = 12 hours, providing hands-on experience with analysis of genetic data and use of multiple online resources (databases, browsers ect.).
- **Preparation during the semester:** the students should expect to use approximately 80 hours for preparations during the semester. The time should be used for, particularly, reading, but also exercises presented during lectures.
- **Preparation for the exam:** the students should expect to use approximately 30 hours for preparations for the exam.

Type of activity	**Number of lessons (45 min lecture or 1 h prep)**	**Obligatory elements**
Confrontation activities (i.e. with a teacher/supervisor)		
Lectures	7 lectures á 2x45 min = 14 lessons	
Assignments/Seminars	7 assignments á 2x45 min = 14 lessons	
Practical exercises (e.g. lab)	3 workshops á 4 hours = 12 lessons	
Confrontation lessons total	**(14 +14 + 12 =) 40 lessons**	
Activities without confrontation		
Preparation	110 lessons	
Load in total	5 ECTS = 150 lessons	

Participants
Mandatory course for MedIS students who have chosen BM track.

Prerequisites for participation
Participation in all exams of the 1st semester MedIS master education is required.

Module activities (course sessions etc.)

Activity - type and title	**Lecturer including department affiliation***	**Learning goals from curriculum**
Lecture and exercises (2+2h): **1. Introduction to genetic variation and personalised medicine**	Palle Duun Rohde, Department of Health Science and Technology	▪ Explain organisation of the human genome. ▪ Understand the relationship between genotype and phenotype ▪ Explain different types of genetic variation.
Lecture and exercises (2+2h): **2. Population genomics**	Palle Duun Rohde, Department of Health Science and Technology	▪ Understand which forces affect alleles in a population. ▪ Apply advanced molecular methods in genetics. Perform simple genetic analyses.
Workshop (4h): **3. Risk estimation from pedigrees**	Palle Duun Rohde, Department of Health Science and Technology	▪ Explain how genetic variation regulates and affect disease with monogenic and polygenic aetiology. ▪ Apply advanced molecular methods in genetics. Evaluate a choice of method or technology to detect and analyse genetic variation.
Lecture and exercises (2+2h): **4. Complex traits and quantitative genetics**	Palle Duun Rohde, Department of Health Science and Technology Fenfen Ge, Department of Health Science and Technology	▪ Explain how genetic variation regulates and affect disease with monogenic and polygenic aetiology. ▪ Apply advanced molecular methods in genetics. ▪ Evaluate a choice of method or technology to detect and analyse genetic variation. Understand the genetic architecture of monogenic and complex traits
Workshop (4h): **5. Estimation of genetic parameters**	Palle Duun Rohde, Department of Health Science and Technology Fenfen Ge, Department of Health Science and Technology	▪ Understand the genetic architecture of monogenic and complex traits. Evaluation of scientific articles at the highest international level
Lecture and exercises (2+2h): **6. Genome-wide association studies**	Palle Duun Rohde, Department of Health Science and Technology	▪ Apply advanced molecular methods in genetics. ▪ Evaluate a choice of method or technology to detect and analyse genetic variation.

	Fenfen Ge, Department of Health Science and Technology	▪ Perform simple genetic analyses. ▪ Evaluation of scientific articles at the highest international level
Workshop (4h): **7. Risk estimation from genome-wide data**	Palle Duun Rohde, Department of Health Science and Technology Fenfen Ge, Department of Health Science and Technology	▪ Choose appropriate databases, algorithms, statistics and parameters in a bioinformatics analysis ▪ Apply advanced molecular methods in genetics. ▪ Use bioinformatical and analytical strategies to solve problems in personalised medicine. ▪ Perform simple genetic analyses. Evaluation of scientific articles at the highest international level
Lecture and exercise (2+2h): **8. Somatic cancer genomics**	Anne Krogh Nøhr, Department of Clinical Medicine Palle Duun Rohde, Department of Health Science and Technology	▪ Choose appropriate databases, algorithms, statistics and parameters in a bioinformatics analysis ▪ Evaluate a choice of method or technology to detect and analyse genetic variation. Understand the genetic architecture of monogenic and complex traits.
Lecture and exercises (2+2h): **9. Germline cancer genomics**	Anne Krogh Nøhr, Department of Clinical Medicine Palle Duun Rohde, Department of Health Science and Technology	▪ Choose appropriate databases, algorithms, statistics and parameters in a bioinformatics analysis ▪ Evaluate a choice of method or technology to detect and analyse genetic variation. Understand the genetic architecture of monogenic and complex traits.
Lecture and exercises (2+2h): **10. Integrative genomics**	Peter Loof Møller, Department of Health Science and Technology Palle Duun Rohde, Department of Health Science and Technology	Explain how genetic variation regulates and affect disease with monogenic and polygenic aetiology.

** All rights reserved for changes during the semester due to e.g. illness, cancellations etc.*

Examination

- Individual, oral examination
- Exam questions will be based on learning objectives
- Duration: 20 min including assessment
- Preparation time: 20 min with aids
- Internal examiners. Course coordinator(s) will be responsible for the exam.

- Grading: Passed/Not passed

Translational Research Principles/Translationelle forskningsprincipper

Profile: TM
5 ECTS
Module code: MEDMS20K2_8

Location
Master of Science in Medicine with Industrial Specialisation, 2nd semester
Study board for medicine

Module coordinator
Coordinator: Laura Petrini lap@hst.aau.dk Department of Health Science and Technology;
Co-coordinator: Lars Arendt-Nielsen lan@hst.aau.dk Department of Health Science and Technology

Type and language
English

Objectives
Purpose of the course:
The course provides students to cutting-edge translational research principles and methods that are related to practice-led research.

From Curriculum:

KNOWLEDGE

- Demonstrate knowledge of core theories and principles of translational research.
- Demonstrate an in depth understanding of different translational models and approaches from a multi-and interdisciplinary perspective.
- Understand scientific problems and challenges in translational research.
- Understand on how to transfer laboratory discoveries into new methods for diagnosis, preventing and treating diseases and testing these methods in humans.

SKILLS

- Select suitable principles and methods in the context of translational research.
- Identify relevant translational biomarkers to be applied in translational research.
- Investigate and critically assess relevant scientific literature.
- Apply translational research knowledge in a multi- and interdisciplinary environment.
- Explain topics essential translational biomedicine and drug/medical device development.
- Apply research questions to translational biomedical research.
- Assessing relevant markers related to translational research.
- Apply basic science methodology.

COMPETENCES

- Formulate, plan and execute translational research.

- Scientifically reflect over the relevant knowledge and identify scientific problems in translational research.
- Being able to critically evaluate the importance of basic research into a translational context.
- Being able to participate into translational science discussions, which explore a variety of approaches in order to solve big-real world problems.

Academic content and conjunction with other modules/semesters
The course prepares the students in understanding how to transfer laboratory knowledge from basic research into new methods for diagnosis, preventing and treating disease in humans. The course equips the students with relevant knowledge to pursuing a career as “state-of-the-art” into translational science. The course requires an active participation of the students where the students engage discovery process by tackling on-going research.

Scope and expected performance
The expected workload of 150 hours for this 5 ECTS module:

Type of activity	**Number of lessons (45 min lecture or 1 h prep)**	**Obligatory elements**
Confrontation activities (i.e. with a teacher/supervisor)		
Lectures	13 lectures x 2h = 26 h	
Assignments/Seminars	13 assignments x 2h = 26 h 3 Seminar(workshop) x 4 h=12h	
Supervisor meetings, exam, etc	Exam 2 h	
Practical exercises (e.g. lab)	5 practical exercises (lab-work) x 8h = 40 h	
Confrontation lessons total	**(26+26+12+2+40) = 106 h**	
Activities without confrontation		
Preparation	(150 total lessons for five ECTS – 106 total confrontations + preparation 44h) =150 h	
Load in total (must match ECTS)	5 ECTS = 150 lessons	

Participants
Mandatory course for MedIS students who have chosen TM track.

Prerequisites for participation
It is required that the students have previously participated in all exams of the 1st semester.

Recommended literature
Literature material will be provided by each individual lecturer prior the beginning of the course. It will primarily consist of journal articles.

Module activities (course sessions etc.)
The course consists of different modules: (i) general lectures covering core theories and principles related to translational research; (ii) presentations from main translational areas and related models: pain, neurophysiology and neuropsychology, and ad hoc presentations covering translational models of neurorehabilitation, motor control, and brain imaging; (iii) hands-on laboratory exercises, where the students are presented to a variety of methodological approaches and techniques related to translational research; and (iv) workshops where students can critically discuss and actively present different thematic assignment.

Lectures: 90 min (2x45 min) presentation by lecturer with theory and case presentations.
Exercises: 90 min (2x45) where the students work in small groups on different thematic assignments provided by the individual lecturers.
Laboratory work: mix of theory and practical laboratory introduction (2 h) and work group assignment (16 h) provided by each individual lecturer.
Workshop: Students' critical discussion and presentation of their laboratory work (4 h).

Activity	Title	Teacher	Time consumption
Lecture	Intro to the course & Neuropsychological biomarkers in humans and possible correlates to pre-clinical models	LP	2 x 45 minutes + student assignments
Lecture	Translational medicine approaches in proteomics and genetics: From bench to bed	AS	2 x 45 minutes + student assignments
Lecture	Translating mechanistic profiling in animals to volunteers and patients: coetaneous pain and itch	SLV/LAN	2 x 45 minutes + student assignments
Lecture	Practical hands-on assessing itch	SLV	2 x 45 minutes + student assignments
Lecture	Probiotics and diabetes, cardiovascular health, and fertility	FD	2 x 45 minutes + student assignments

Lecture	Translating mechanistic profiling in animals to volunteers and patients: Rehabilitation	SM	2 x 45 minutes + student assignments
Lecture	Medicine in extreme environments: navigate unfamiliar challenges in healthcare	EDM	2 x 45 minutes + student assignments
Lab-work	Practical hands-on on assessing neuropsychological biomarkers I	LP	2 hours + 8 hours for group-based lab assignment
Workshop	Presenting laboratory work and relevant literature in a plenary session	LP	4 hours
Lecture	Cortical neuroplasticity and neurorehabilitation	DBL/AJTS	2 x 45 minutes + student assignments
Lab-work	Assessing cortical neuroplasticity in humans I	DBL/AJTS	2 hours + 8 hours for group-based lab assignment
Lab-work	Assessing cortical neuroplasticity in humans II	DBL/AJTS	2 hours + 8 hours for group-based lab assignment
Workshop	Student presentations of lab assignments and clinical literature related to neurorehabilitation	DBL/AJTS	4 hours
Lecture	Assessing central pain mechanisms in humans: can they predict outcome?	KKP	2 x 45 minutes + student assignments
Lab-work	Assessing pain and pain sensitivity	KKP	2 hours + 16 hours for group-based lab assignments
Workshop	Results from pain mechanism assignment	KKP	4 hours

** All rights reserved for changes during the semester due to e.g. illness, cancellations etc.*

Examination

9. Written individual exam.
10. The exam is graded based on the 7-point scale and it is with an internal examiner. Course coordinator(s) will be responsible for the exam
11. The examination is a mix form of essay type, open and multiple choice questions. The exam questions are based on course learning objectives.
12. The exam takes place in Digital Exam.
13. The duration of the exam is 2 hours.
14. Permitted aids are personal notes (available during the exam as a physical copy and / or as digital material downloaded on PC and / or via access to Moodle).
15. Re-examination can be written or oral.

For further information about examination, we refer to Digital Eksamen (DE).