The Molecular Basis of Life

Fac. Health, Medicine and Life Sciences

RMT1001

Period 1:
1 Sep 2025 **24 Oct 2025**

Credits:
8.0

Coordinator:
J. BauerG.G.H. van den Akker

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

Assessment methods:
Written exam, Presentation, Assignment

Keywords:
regeneration, stem cells, chemistry, biology, Biochemistry

Full course description

The course 'The Molecular Basis of Life' relies on the students' existing knowledge and understanding of biology and chemistry. It aims to provide insight into the structure and function of living and non-living matter. New concepts are introduced in the context of regenerative medicine and directly applied in solving problems and addressing challenges in the field. The period partly focuses on the structure and function of living tissues. The emphasis is on how cells interact with biologically relevant molecules, such as growth factors and extracellular matrix molecules, and how their interplay determines tissue development and homeostasis. The role of stem cells and their potency will be introduced in the context of these processes. Distinctions are made between several cell types and tissues (bone, cartilage) that highlight the structure-function relationship. Basic chemistry concepts are introduced in a biological context. Students are trained in applying key concepts of organic, inorganic and physical/analytical chemistry, such as stability, reactivity, functional groups, reaction/mechanism types, structure, kinetics, thermodynamics, and chemometrics to understand complex biological systems as well as to design materials for biomedical applications. The newly taught concepts are integrated in multidisciplinary cases/problems, which are discussed and worked out in small groups.

Course objectives

Upon completion of the course, the RMT student is able to:

1. Elaborate how matter is built, which chemical bonds and supramolecular interactions can be present in matter as well as the molecular and physical differences between gases, liquids, solids and solutions;
2. Describe the concepts of acids and bases, nucleophiles and electrophiles, the reactivity of functional groups and their most important chemical reaction types.
3. Explain the interaction between cells and their extracellular environment (natural or synthetic) and cells.
4. Explain the key concepts of cell biology and the corresponding biochemistry that lead to cell proliferation, differentiation, homeostasis and cell death.
5. Explain the structure and functioning of proteins, nucleic acids, carbohydrates, lipids and other biologically relevant molecules.
6. Explain how tissue build-up relies on precise spatiotemporal regulation.
7. Present and discuss the breakdown of tissue properties to chemical, cellular and signal composition.
8. Apply the working principles of regeneration (e.g. cells, signals and scaffolds) in various cases.
9. Explain the laws of thermodynamics, the principles of chemical kinetics and the differences between the thermodynamic and kinetic control of reactions, and understands and applies the very basics of chemo metrics in analytical and physical chemistry (errors, significant figures, signal to noise ratios, accuracy vs precision).
10. Elaborate how the learned basic concepts of general, physical, organic and inorganic chemistry can be applied to understand biological processes and to design materials for biomedical applications with specific physico-chemical properties.

Recommended reading

This is the link to Keylinks, our online reference list.

Foundations of Engineering

Fac. Health, Medicine and Life Sciences

RMT1002

Period 2:
27 Oct 2025 **19 Dec 2025**

Credits:
8.0

Coordinator:
P.A. WieringaC.M. Domingues Mota

Teaching methods:
PBL, Lecture(s), Assignment(s), Presentation(s)

Assessment methods:
Written exam, Presentation, Attendance

Keywords:
mathematics, Physics, Movement, Interfaces, Dynamic systems, Modeling, Thermodynamics, Rheology

Full course description

The Foundations of Engineering runs over a period of 8 weeks in period 2 and the course is worth 8 ECs.
The content of this course will also overlap and emphasize the activities within the Lab Skills line, aligning the timing of specific lab activities with the associated theoretical content taught in this course.This also provides a crucial basis for the clinical design project, with coordination with this longitudinal line such that relevant examples are used to teach content within this course that also connects with the clinical orientation of the projects. This course is designed to have students comprehend and transcend different traditional disciplines (maths, physics, engineering) within a regenerative medicine focus so they can derive unique solutions based on fundamental principles. This course will focus heavily on framing the more fundamental topics within an applied setting, specifically providing a context for mathematical concepts and showing why they are relevant to describe the underlying physics involved, and then how to translate this knowledge to solve real world problems. and 2) how to take these concepts into account when addressing practical engineering problems and implementing design approaches. This course will: 1) introduce students to fundamental physics concepts and teach students with the mathematical tools to describe physical phenomena;

Course objectives

Upon completion of the course, the RMT student is able to:

- Represent a static physical system in terms of a vector diagram and derive a governing equation based on fundamental principles (ie force, acceleration, velocity, etc.) (SE.5)
- Mathematically derive a description of a time-dependent system, including differential equations, integration, and sinusoidal waveforms (SE.5)
- Apply system of equations and polynomial operations to simplify and resolve a physical system description (SE.5)

the RMT student will also be able to:

- Define stress, strain, and the underlying principles of Mechanics of Materials within the context of human biomechanics (SE.7)
- Define rheology, describe shear stress and shear strain and provide an explanation for rate loading dependent phenomenon (SE.7)
- Describe the working principles of analog electronic components and derive the operation of a basic (L)CR circuit (SE.7)
- State the laws of motion, describe the underlying phenomenon and derive their mathematical equations (SE.7)
- Describe, in practical terms, the underpinnings of thermodynamics, fluid dynamics, and mass transfer (SE.7)
- Define (electro)magnetic radiation (SE.7)
- Understand and use computer aided design and finite element modeling (SE.7)

These learning goals fall under the following final qualifications of the Bachelor RMT:

- Scientist & Engineer (SE.5): Has knowledge and understanding of the basic concepts of mathematics and statistics, necessary to apply and develop technology for applications in regenerative medicine.
- SE.7: Has knowledge and understanding of the basic concepts of physics, engineering and materials science, necessary to apply and develop technology for applications in regenerative medicine.

Recommended reading

This is the link to Keylinks, our online reference list.

Regenerative Medicine in Society

Fac. Health, Medicine and Life Sciences

RMT1003

Period 3:
5 Jan 2026 **30 Jan 2026**

Credits:
4.0

Coordinator:
S. Bolognin

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

Assessment methods:
Written exam, Attendance

Keywords:
Regenerative Medicine; Cells; Biomaterials; Scaffolds; Biofabrication; Biological factors; Cell Signaling Pathways

Full course description

This course is propaedeutic to the longitudinal lines of the overall Bachelor's. The course will give the students an idea of the scope of the field and the wide range of possible applications. The objectives of the course "Regenerative Medicine in Society" are to introduce students to classic and novel concepts at the base of strategies to regenerate tissues and organs. In this course, students will learn more about the broad definition of Regenerative Medicine (RM) and its application areas with an emphasis on translation and valorization. The content will focus on the history, current practice, and challenges in the RM field as illustrated by the R3-paradigm: replacement, regeneration, and rejuvenation, which constitute the general strategy triad in RM. These three strategies can be employed to achieve the central goal in RM, namely tissue or organ repair. In addition, this course aims to provide the basic knowledge for the more advanced courses of the Bachelor's program in year 2. The historical development of RM will be illustrated based on these three strategies from several medical specialties. Each week of the course will focus on another medical specialty (application). A researcher specialized in the field will introduce the topic and provide historical RM examples from their respective fields. In addition, ethics of regenerative medicine applications will be discussed in the final lecture, where an open debate with the students will also be stimulated to assess their understanding of the learning objectives and provide further input on the RM cases dealt with in the lectures and tutorials. We foresee having additional educational material in the form of video lectures on topics that are instrumental to understanding the fundamental principles of regenerative medicine and that will help the students to better understand the lectures and to get prepared for the tutorials. The additional educational material will be a way to further refresh more basic concepts seen in previous courses, yet placed in the application perspective now, namely briefly overviewing cell sources and cell nutrition, the biomaterial classes used to fabricate scaffolds, and the processing technologies used for fabrication. Different applications will be further introduced as case studies and RM solutions proposed and discussed by the students in the tutorials (2 tutorials per case study, thus providing a first intake brainstorming case and a second solution case), spanning from neural to organ regeneration.

Course objectives

The course objectives are defined based on the following intended learning outcomes (ILOs):

- ILO 1. Understands historical perspectives in regenerative medicine in terms of requirements and challenges illustrated by successes and failures
- ILO 2. Understand the 3R-paradigm of Regenerative Medicine: Replace, Regenerate, Rejuvenate
- ILO 3. Understands the key elements that constitute an innovation in regenerative medicine

Recommended reading

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

Principles of Medicine

Fac. Health, Medicine and Life Sciences

RMT1004

Period 4:
2 Feb 2026 **2 Apr 2026**

Credits:
8.0

Coordinator:
C.H.M.J. van Elssen

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

Assessment methods:
Written exam, Participation, Portfolio

Keywords:
Physiology, anathomy, Immunology, vascularisation, nervoussystem, gastrointestinal system, cardiopulmonary system

Full course description

During this course, students will gather basic knowledge on Anatomy, Physiology and Immunology where the interfaces are with regenerative medicine. Basic anatomical knowledge will be given on organs or anatomical structures, which are familiar to be able to heal/regenerate such as liver, fascia-tendon, bone, bone marrow, bowel and structures which are difficult to heal/regenerate such as heart, brain and cartilage. Basic physiological processes will be discussed like circulation, respiratory system, locomotor system, immune system and the digestive tract.
The emphasis will be on understanding of the physiological function of the body and its major organ systems targeted by principles like inflammation, regeneration and remodeling as described in the field of regenerative medicine. Therefore, the physiology of immunological processes, inflammation, foreign body response by both the innate and adaptive immune system to understand the limitations and complexity of regenerative medicine are included.
During the course the students will confront several patient cases where regenerative medicine is applied. During biweekly tutorials, students will elucidate the anatomical and physiological mechanisms involved in the cases where regenerative medicine is used in disease. In the tutorial group the students will discuss the problem described in the cases (7-step model). Students will formulate learning goals to be analyzed individually and to be presented in their next tutorial.

Biweekly lectures will give more insights and background in the anatomy and physiology of the different organ systems. The use of regenerative medicine will be illustrated during these lectures, by examples of daily practice and from research. Practicals during this block will include anatomy lessons at the dissecting rooms and microscopy. Furthermore, students will visit the hospital for more interactive lectures to get some real-life experience with regenerative medicine.

Course objectives

At the end of the course the student will have basic knowledge of anatomy and physiology of the major organ systems and processes also described in the field of regenerative medicine to understand the normal anatomy/physiology versus pathology and a start for understanding regenerative medicine as potential therapy.

Learning Goals:

1. Describe the basic principles and nomenclature of the anatomy of the human body.
2. Outline the organ systems often targeted in regenerative medicine
3. Demonstrate basic knowledge of physiological and pathological inflammation
4. Integrate basic principles foreign body responses and transplant immunology
5. Synthesize basic knowledge of wound healing and vascularization

Recommended reading

This is the link to Keylinks, our online reference list.

Coding and Data Crunching

Fac. Health, Medicine and Life Sciences

RMT1005

Period 5:
7 Apr 2026 **5 Jun 2026**

Credits:
9.0

Coordinator:
B. SpronckF. Ehrhart

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

Assessment methods:
Participation, Presentation, Attendance, Assignment, Computer test

Keywords:
statistics, programming, data analysis, R (programming language)

Full course description

This course teaches the basics of scripting, data analysis and statistics. Statistical tools for modern data analysis are used across a range of industries to help guide organisational, societal and scientific advances. This course uses the software package R for numerical reasoning and predictive data modelling, with an emphasis on conceptual rather than theoretical understanding. Topics include description of populations, distribution of data, inferential statistics (based on simple tests such as t- and chi-square tests), introduction to linear regression analysis and concept of probability (including Bayes' rule, disjoint and independent events (multiplicative rules), law of total probability). These will be introduced in cases related to regenerative medicine.
To apply the theoretical statistics concepts, students will become familiar with general concepts in computer science, gain an understanding of the general concepts of programming, and obtain a solid foundation in scripting. The cases used in the programming activities will be related to regenerative medicine. This course is envisioned as an introduction to scripting; its goal is that students learn how to handle data sets and to automate the analysis thereof using a programming language. The students will learn to plan and think carefully about why a particular analysis is needed, what should be done etc. before starting to write the script. Topics include basic control structures, graphical data presentation, biomedical data handling (including legal and ethical aspects thereof). Additionally, this

course will contribute highly to the personal development line of the students with focus on problem solving.

Course objectives

Aim and learning methods:
This course will be application-driven and you will learn the necessary theory in lectures while also focusing on hands-on exercises in computer practicals, problem based coding and pen & paper seminar sessions to learn how to analyse the data and represent it in a correct way in the context of regenerative medicine. In the group project you will have the chance to train and demonstrate your skills in R programming and statistics on one large dataset.

Recommended reading

This is the link to Keylinks, our online reference list.

The Intrinsic Regenerative Capacity of the Human Body

Fac. Health, Medicine and Life Sciences

RMT1006

Period 6:
8 Jun 2026 **3 Jul 2026**

Credits:
4.0

Coordinator:
M. van Griensven

Teaching methods:
Lecture(s), Work in subgroups

Assessment methods:
Written exam

Keywords:
healing stem cells time scale regeneration vs repair senescence

Full course description

In the course “The Intrinsic Regenerative Capacity of the Human Body”, students will complement their obtained knowledge on biology and medicine as they are exposed to the ability the human body has to regenerate. Defects due to injuries or diseases disrupt tissues. Many tissue and organs possess an endogenous ability to regenerate. For example, skin, bone, and gut all have the ability to heal after injury in case the defects are not too large. Conversely, some tissues like the heart have a very low capacity to regenerate. Studying the biological mechanisms underlying endogenous healing will lead to an improved understanding of what we aim to mimic in regenerative medicine. Thereby, the students will learn that there is a tissue-dependent wound healing with different time scales and degrees of regeneration. Resident differentiated cells and stem cells moderate these processes and the translation to their usage in regenerative medicine therapies is envisioned. The role of inflammation is also conveyed, besides the importance of vascularization. Within these processes, the concept of functional repair versus complete regeneration will be elucidated as well. This is further discussed in the context of regenerative boundaries (diffusion, signal molecules, cell senescence). These processes depend on patient specific factors such as ageing and co-morbidities.

Course objectives

The learning goals are achieved by different forms of teaching. Each week there will be a lecture. During this session, students can ask any doubts and unclarities. The information from lectures is further expanded in two tutorials per week, where cases are discussed. Each tutorial has a pre-discussion and post-discussion. The students should spend time in self-study to prepare for the tutorials.

In total there will be three lectures and 6 tutorials.

Upon completion of the course, the RMT student is able to:
- Define and explain potential causes and consequence of failed regeneration
- Elaborate upon the different regeneration potentials of different tissues and why the regenerative potential differs
- Describe the effect of ageing and other co-morbidities on the regenerative capacity
- Summarise the intrinsic wound regeneration phases including different scales and important factors
- Evaluate and reflect upon the limits of regeneration and which factors do contribute to that

Recommended reading

This is the link to Keylinks, our online reference list.

Academic Development Line Year 1

Fac. Health, Medicine and Life Sciences

RMT1101

Year:
1 Sep 2025 **31 Aug 2026**

Credits:
8.0

Coordinator:
D.G.J. Jennen

Assessment methods:
Final paper, Participation, Presentation, Portfolio, Attendance, Assignment

Keywords:
Self-regulated learning skills Professional behavior Scientific storytelling Personal development

Full course description

Next to the Orientation Design Project (RMT1103) and the Lab Skills Line (RMT1102), the Academic Development Line (ADL) is one of the longitudinal lines in the RMT programme. ADL deals with the following general competences: knowing yourself, understanding what acceptable standards and values are, being able to express yourself, organise your study and work, and building relations. The activities in the academic development are subsumed under four competency domains:

1. **Self-regulated learning skills.** These skills will help students to develop adequate learning strategies (Study Smart Training) and find their way in the ever-growing data and information jungle (Information Literacy);
2. **Professional behavior.** Within this domain, students will become aware of their personal behaviour in teams and how this will affect the functioning of that team and its other members. As a future professional and global citizen, working in teams will be an important skill;
3. **Scientific storytelling.** In this domain, students will learn how to share and communicate their results, visions, etc. both in writing and in oral to a specific audience or readership, which includes fellow students, teachers and peers;
4. **Personal development.** To help students finding and developing their personal path in the wealth of opportunities that RMT is offering, the ADL contains a series of activities and assignments that stimulate and support students in their personal and academic growth and development.

Course objectives

Self-regulated learning skills.

- Be able to reflect on personal learning strategies;
- Be able to reflect on planning and management of study;
- Be able to appreciate the presence of refresher courses and be able to argue whether or not they need to follow (parts of) them;
- Be able to appraise the various topics and specializations of RMT;
- Be able to reflect on following the steps of a Creative Problem Solving (CPS) approach (or something similar) when dealing with new challenges.

Professional behavior

- Be able to show awareness of different roles and their function in a diversely composed team; provides feedback;
- Be able to identify with appropriate social behaviour towards peers and staff;
- Be able to describe the conventions of scientific integrity and ethical standards.

Scientific storytelling

- Be knowledgeable of the different formats scientific research can be written in and be capable of writing the different sections of a scientific report;
- Be knowledgeable of different ways to present information and be able to put this into practice by presenting information (e.g. learning goals, summary within tutorial group or project) with the support of slides.

Personal development

- Be able to accept feedback and be able to critically reflect on their learning;
- Be able to formulate SMART learning goals – with help of mentor - in order to take adequate action with a view to raising the student's competencies up to the desired level.

Recommended reading

This is the link to Keylinks, our online reference list.

Lab Skills Line Year 1

Fac. Health, Medicine and Life Sciences

RMT1102

Year:
1 Sep 2025 **31 Aug 2026**

Credits:
5.0

Coordinator:
T. RademakersC.M. Domingues Mota

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

Assessment methods:
Participation, Presentation, Portfolio, Attendance, Assignment, Observation

Full course description

The practical skills longitudinal line is one of the three longitudinal lines, and runs through the first two years, as Laboratory Skills I (year 1) and Laboratory Skills II (year 2), each worth 7 ECs. Lab skills trainings are mainly concentrated in the 8-week periods, in which the experiments are aligned with the content of the courses. Every 8-week course, students need to demonstrate sufficient skills in preparing experiments (preparing the practical, performing lab-related calculations) and carrying them out, keeping a lab journal, and basic lab skills (weighing, pipetting, etc.). As the practical sessions are all part of the lab skills line, repeated practice of skills, with increasing degree of complexity throughout the bachelor is achieved, and longitudinal tracking of development of lab skills is possible. Importantly, students will also be able to practice and further develop their practical skills in a self-directed manner within the design project; this is aligned with the lab skills line.
Students receive regular formative feedback by staff and peers on these skills, which will be added to the portfolio at the end of each 8-week course. Next to this, students are assessed on their performance by means of a summative practical exam consisting of two parts (in periods 3 & 6 each year). The lab skills line formally ends at the end of year 2.

Course objectives

- Be able to work according to principles of GLP and GMP, safely work with chemicals, and work in sterile environment
- Be able to do lab calculations, and implement these in combination with basic lab skills

- Be able to synthesize and purify a product, follow reaction kinetics, and know how to steer a chemical reaction
- Be able to measure receptor-ligand and cell-cell interactions in biological experiments
- Be able to apply knowledge and understanding of mathematical and physics problems in designing, executing, and interpreting experiments
- Be able to apply sensors, computer modelling, and 3D printing for designing and interpreting experiments
- Be able to examine and analyze tissues based on anatomy, clinical imaging & microscopy, pathology, and measure functional parameters in these tissues
- Be able to work with and show skills for working with lab journal and SOPs
- Be able to apply analysis and visualization of data (RMT1005)
- Be able to apply statistics to experimental data and report on experimental data

Orientation Design Project

Fac. Health, Medicine and Life Sciences

RMT1103

Year:
27 Oct 2025 **31 Aug 2026**

Credits:
4.0

Coordinator:
M. van Griensven

Teaching methods:
Lecture(s), Assignment(s), Work in subgroups, Working visit(s)

Assessment methods:
Presentation

Keywords:
clinical problem research problem industry problem planning designing

Full course description

The aim of this project is for students to experience the full research and development cycle from analysing a clinical problem / identifying potential solutions / techniques to address the problem, conducting (clinical) research and developing (part of) a new clinical application/device/material/therapy themselves. An orientation on -and preparations for the conduct of- the design project will be launched in year 1. During the first year, students may visit research labs and they will interview experts being clinicians and scientists involved in regenerative medicine (working in hospital, labs, industry). Moreover, ample attention in the year 1 'design project orientation' will be provided to gain insight in examples of clinical applications in regenerative medicine and to learn how these applications have travelled and will travel 'from bench to bed' and have been implemented 'into the market'. This will also be achieved by doing journal clubs where specific articles on the themes of the experts interviewed are scrutinized to enhance the student's understanding. This line interacts closely with the academic line and the practical skills line.

The Design Project line's main activities in year 1 are therefore:

- Interview with expert
- Site visits (partially in combination with visiting the expert)
- Journal clubs
- Project pitch after choosing the expert/project

The (orientation on) the design project line thus introduces aspects of entrepreneurship & marketisation and encompasses an initial labour market orientation. At the end of year 1, the students select a project to work on in year 2. There are two main project orientations which students can choose from; a clinical or technological track. In the clinical track, the students interact with an expert from the clinic on a direct clinical problem. In the technological track, the students perform their project in an academic laboratory setting or in an industrial research & development setting. The projects of both tracks are on designing a regeneration project, but the emphasis is different depending on the expert.

Course objectives

The learning goals will be achieved through expert interviews, journal clubs, and pitching the project to be carried out in year 2.

After this the student:

- Is able to independently apply relevant laboratory skills and techniques to conduct research in regenerative medicine.
- Understands, appreciates and critically assesses the process of scientific research to obtain academic knowledge and insight, and is able to draw conclusions based on evidence in a logically structured fashion.
- Readily evaluates, selects and applies scientific methodology and available technology to address current challenges and problems in regenerative medicine or in a related biomedical field, and contributes to finding an innovative solution.
- Based on obtained research results or applied technologies, contributes to the realisation of novel, innovative and marketable clinical or biomedical products/therapies.
- Organises study, work and research efficiently and effectively, and within given time constraints.
- Shows awareness of various team roles, functions efficiently in multidisciplinary and otherwise diverse teams, values diversity in a broader sense, and takes into account ethical standards and societal, economic and regional and global contexts.

Communicates professionally and adjusts style and type of communication and argumentation to the audience and the occasion.

Recommended reading

This depends on which expert is interviewed. But examples of papers are: Eur Cell Mater. 2020;39:183-192. doi: 10.22203/eCM.v039a12. Enhancement of fracture healing after citrulline supplementation in mice D M Meesters , P F Hannemann, H M van Eijk, V T Schriebl, P R Brink, M Poeze, K A Wijnands (Trauma Surgery) PLoS One 2020;15(10):e0241296. doi: 10.1371/journal.pone.0241296 A comparison of the corneal biomechanics in pseudoexfoliation glaucoma, primary open-angle glaucoma and healthy controls using Corvis ST Zia Sultan Pradhan, Sujit Deshmukh, Shivani Dixit, Shruthi Sreenivasaiah, Sujani Shroff, Sathi Devi, Carroll A B Webers, Harsha Laxmana Rao (Opthalmology) Sci Rep 2019;9(1):12076. doi: 10.1038/s41598-019-48369-w. Electrical stimulation promotes the angiogenic potential of adipose-derived stem cells Jip Beugels, Daniel G M Molin, Daan R M G Ophelders, Teun Rutten, Lilian Kessels, Nico Kloosterboer, Andrzej A Piatkowski de Grzymala, Boris W W Kramer, René R W J van der Hulst, Tim G A M Wolfs (plastic surgery and pediatric research) Sci Rep 2021;11(1):19663. doi: 10.1038/s41598-021-99096-0. BMP7 reduces the fibrocartilage chondrocyte phenotype Ellen G J Ripmeester, Marjolein M J Caron, Guus G H van den Akker, Jessica Steijns, Don A M Surtel, Andy Cremers, Laura C W Peeters, Lodewijk W van Rhijn, Tim J M Welting (cartilage research) Control Release 2011;152 Suppl 1:e10-1. doi: 10.1016/j.jconrel.2011.08.090. Amino acid based polyesteramides and polyesterurethanes: cell responsive matrices for drug delivery Aylvin A Dias, Bart Plum, G Mihov, Bill Turnell (company DSM)

Attendance Lab Skills Line Year 1

Fac. Health, Medicine and Life Sciences

RMT1112

Year:

1 Sep 2025 **31 Aug 2026**

Credits:

2.0

Coordinator:

T. RademakersC.M. Domingues Mota

Cells: From Lab to Production

Fac. Health, Medicine and Life Sciences

RMT2001

Period 1:
1 Sep 2025 **24 Oct 2025**

Credits:
5.0

Coordinator:
M. van Griensven

Teaching methods:
PBL, Lecture(s)

Assessment methods:
Written exam, Participation

Keywords:
upscaling differentiation biomaterial constructs translation

Full course description

This course will expand the basic knowledge of cells previously learned and introduce the concepts of cell potency, self-renewal capacity and lineage commitment of cells from different sources in different regenerative medicine applications. The specific properties, potencies, opportunities and limitations will be introduced for different cell sources (e.g. embryonic, amniotic, mesenchymal, fetal, adult progenitor, adult mature and induced pluripotent cells). In that context the concept of autologous vs allogenic use is discussed. The cells can secrete factors and influence the host cells or they can differentiate. The concept whether cells need to be (partially) differentiated or can be applied as “native” stem cells will be elucidated. For practical application in regenerative medicine, knowledge will be obtained on how to isolate, process, grow, manufacture and characterize cells as well as introduce important factors (small molecules, proteins, gene therapy) to steer a differentiation process into a specific lineage. For the cells to be able to optimally function at the pathologic site, the issue of retaining the cells is an important subject. Therefore, cells can be combined with (bio)materials. For this, the students will learn how to combine cells with engineered constructs and which properties can be applied to enhance successful regeneration of tissue in such a construct. Finally, the translational aspect with the need of having enough cells (upscaling, bioreactor cultivation etc.) cultured under good manufacturing production will be mentioned. Advantages and challenges will be discussed for usage of cells in regenerative medicine therapies.

Course objectives

Upon completion of the course, the RMT student:

1. Has thorough knowledge and understanding of the key principles and various technologies of regenerative medicine.
   - The student needs to be able to identify the potency of different cell sources
   - The student knows when to use stem cells and when not
   - The student understands the different ways of actions stem cells can influence a pathology
   - The student can determine the advantages and disadvantages of autologous vs allogenic cells including the possibility of correcting stem cells
2. Has knowledge and understanding of the basic concepts of cell biology and chemistry necessary to apply and develop technology for applications in regenerative medicine.
3. The student has knowledge on how to differentiate stem cells and how this relates also to cell cycle, differentiation and proliferation
4. The student is able to understand the mutual interaction of cells, molecules and materials on cellular actions

Recommended reading

This is the link to Keylinks, our online reference list.

Materials Science in Biological Applications

Fac. Health, Medicine and Life Sciences

RMT2002

Period 2:
27 Oct 2025 **19 Dec 2025**

Credits:
8.0

Coordinator:
J. BauerG.G.H. van den Akker

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

Assessment methods:
Written exam, Presentation, Assignment

Keywords:
Materials, structure-property-activity relationships, synthesis, characterization, responsivity, cell-material interactions, regenerative medicine, aterials

Full course description

The course ‘Materials Science in Biological Applications’ relies on the concepts introduced in the first-year courses The Molecular Basis of Life and Foundations of Engineering. These concepts are now further integrated to train students in solving challenges in the application of materials in regenerative medicine. The course aims to provide insight into the design, preparation and physico-chemical characterisation of organic, inorganic, composite and biological materials. The focus is on (smart) biomaterials relevant to the biomedical field and especially regenerative medicine. The emphasis will be on the structure-property-activity and composition-property-activity relationships of materials as well as the cell-material interaction. The new (in)organic chemistry concepts necessary for understanding the properties, the preparation and the behaviour of materials are also explained in the context of real-life cases. Students not only learn how to prepare and characterise a biomaterial but also how to select the right materials for an application within regenerative medicine.

Course objectives

Upon completion of the course, the RMT student is able to:

1. Compare, critically discuss and appraise the design and use of different types of biomaterials for the purpose of tissue growth.

2. Describe the chemical identity and structure of organic, inorganic and composite biomaterials, the effect thereof on their physico-chemical properties, their preparation (synthetic vs biological) and characterization and their applicability in regenerative medicine.
3. Explain the organic reactions and reaction types most relevant for the synthesis and modification of polymer biomaterials.
4. Elaborate what is meant by stimuli-responsive and smart biomaterials and why they are relevant in the field.
5. Use the known structure-property relationships to propose (new) organic, inorganic, composite and biological biomaterials for various biomedical and more specifically regenerative medicine applications.
6. Demonstrate knowledge and understanding of what biomaterials are, what their features are and what their relevance is in biomedical engineering and more specifically in regenerative medicine.
7. Demonstrate knowledge and understanding of the application of organic, inorganic, composite and biological biomaterials in the clinic, as well as of material-cell interactions and is able to use that to advantage when designing new biomaterials for applications in regenerative medicine.
8. Select a biomaterial with desired physico-chemical properties for a certain biomedical, clinical or regenerative medicine application, and to propose suitable preparation and characterization strategies.
9. Demonstrate knowledge and understanding of the design of experiments and modelling in materials science as well as of standardizing and scaling up the production of (bio)materials.
10. Demonstrate and apply knowledge and understanding of polymer physics, various physico-chemical characterisation techniques in materials science, the influence of structure and composition on the physico-chemical and biological properties of a material, and degradation (mechanisms) of biomaterials in various biomedical and more specifically regenerative medicine applications.

Recommended reading

This is the link to Keylinks, our online reference list.

Technological Trends in Regenerative Medicine

Fac. Health, Medicine and Life Sciences

RMT2003

Period 3:

5 Jan 2026 **30 Jan 2026**

Credits:

4.0

Coordinator:

B.J. Benedikter

Teaching methods:

PBL, Lecture(s), Work in subgroups

Assessment methods:

Presentation, Computer test

Keywords:

Cell Therapy Immunotherapy Gene Therapy Implant Physiology

Full course description

In this course, students will focus on the most relevant current medical technologies and how they interact with the human body. The knowledge obtained in course 1.4 will be applied in the context of regenerative medicine. This course includes 4 examples of regenerative medicine in the field of cell therapy, immunotherapy, gene therapy and biomaterials and tissue engineering. There will also be an emphasis on the limitations of regenerative medicine and formulation of problems that should be solved in the future to make regenerative medicine more applicable. The students will study the cell, physiological and immunological interactions with implants and medical devices. Interaction between tissues/cells and (bio)materials will be discussed in this context.

During the course, the students will confront several patient cases where regenerative medicine is applied. During biweekly tutorials, students will elucidate the technology behind and the application of regenerative medicine in disease. The emphasis is on regenerative medicine techniques with limited focus on pathophysiology. In tutorial groups, the students will discuss the problem described in the cases (7-step model). Students will formulate learning goals to be analysed individually and to be presented in their next tutorial. Weekly lectures will give more insights and background of regenerative medicine. The use of regenerative medicine will be illustrated during these lectures, by examples of daily practice and from research.

Course objectives

1. Identify basic principles of technological trends in regenerative medicine applied to target disease.
2. Generate deeper understanding of wound healing and vascularization as applied in regenerative medicine.
3. Integrate knowledge and understanding of the concepts of transplant immunology and cell-based immunotherapy.
4. Recognise major applications of technological trends in regenerative medicine.
5. Distinguish and explain the role of physiological and pathological inflammation in regenerative medicine therapies.
6. Summarise the current state of the art in clinical therapy, including limitations and opportunities

Recommended reading

Gray's Anatomy: The Anatomical Basis of Clinical Practice
Marieb human anatomy and physiology
Roitt's Essential Immunology 11th Edition.
Guyton and Hall textbook of medical physiology 14th Edition
Braunwald's Heart Disease, Single volume, 12th Edition
Abbass Basic Immunology, 6th Edition

Data Analysis & Modelling of Biosystems

Fac. Health, Medicine and Life Sciences

RMT2004

Period 4:
2 Feb 2026 **2 Apr 2026**

Credits:
9.0

Coordinator:
C.E. HerffA.M.F. Carlier

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

Assessment methods:
Participation, Attendance, Assignment, Computer test

Keywords:
calculus, programming, data analysis, Modeling

Full course description

In course 2.4 "Data Analysis & Modeling of Biosystems", students delve into the realms of advanced calculus, differential equation modeling, and data-driven computational modeling. The application of these theoretical concepts is contextualized within problems from the field of regenerative medicine, emphasizing mechanistic and data-driven approaches to modeling and simulation. Topics include multivariable calculus (partial derivatives, differential equations, integration), linear models (linear regression, LDA), non-linear models (kernel-based, decision forests) and a small intro of deep learning and neural networks. Students will gain understanding of the general concepts of these approaches, including their benefits and limitations.
This course aims to introduce computational modeling and simulation as a complementary method to experimental approaches. Students will use the acquired knowledge of mathematics, engineering and biology to predict cell-biomaterial interactions, biological processes and the functionality of (bio)medical devices and products. To apply the theoretical concepts, students will engage in problem-based coding, programming practicals and a course project. The students will learn to plan and think carefully about why a particular analysis is needed, what should be done etc. before starting to write the code. As such, this course will contribute highly to the personal development line of the students with focus on problem solving.

Course objectives

This course will be application-driven and you will learn the necessary theory in lectures while also focusing on hands-on exercises in computer practicals, problem based coding and pen & paper seminar sessions to learn how to apply differential equation and data-driven modeling in the context of regenerative medicine. In the group project you will have the chance to train and demonstrate your data analysis and modeling skills.

Advanced Technologies for Regeneration

Fac. Health, Medicine and Life Sciences

RMT2005

Period 5:
7 Apr 2026 **5 Jun 2026**

Credits:
8.0

Coordinator:
P.A. WieringaC.M. Domingues Mota

Teaching methods:
PBL, Lecture(s), Presentation(s)

Assessment methods:
Written exam, Participation, Presentation

Keywords:
Microfabrication, Nanofabrication, Lithography, biofabrication, Microfluidics, Cell Patterning, Microphysiological Systems, Bottom-up Tissue Engineering, Microbiomaterials, Microfibers, Cell sheet technology.

Full course description

The course begins with an exploration of the fundamentals of micro- and nanofabrication techniques, including lithography, etching, and replication methods. It then progresses to examine microengineered culture substrates, microfluidics and microphysiological systems/organ-on-chips, micropatterning of cells. Special emphasis is placed on applied approaches such as cell sheet technology, fiber-based tissue engineering, microbiomaterial production and bottom-up tissue engineering strategies. Biofabrication technologies and how these are applicable to tissue and organ models and implants will also be covered. Throughout the course, students will also explore clinical applications and emerging trends in the field.

Course objectives

1. Understand the principles and techniques of conventional micro- and nanofabrication.
2. Evaluate the suitability of different micro- and nanofabrication methods for specific regenerative medicine applications.
3. Analyze the significance of microengineered culture substrates in cell culture and tissue engineering, and design suitable culture substrates for specific tissue engineering cases.

4. Understand the principles of microfluidics and explain the implications of microfluidic devices for controlled cell culture and analysis.
5. Assess the potential of microphysiological systems/organ-on-chips for applications such as drug testing and disease modeling.
6. Investigate micropatterning techniques for precise manipulation of cell behavior.
7. Understand how to apply cell sheet technology in the context of regenerative medicine and tissue repair.
8. Explore biofabrication and fiber-based tissue engineering approaches and their clinical applications.
9. Critically evaluate emerging trends in microbiomaterials and bottom-up tissue engineering.

From Research to Market Value

Fac. Health, Medicine and Life Sciences

RMT2006

Period 6:

8 Jun 2026 **3 Jul 2026**

Credits:

4.0

Coordinator:

A.K. Roth

Academic Development Line Year 2

Fac. Health, Medicine and Life Sciences

RMT2101

Year:
1 Sep 2025 **31 Aug 2026**

Credits:
8.0

Coordinator:
D.G.J. Jennen

Teaching methods:
Lecture(s), Paper(s), Assignment(s), Training(s)

Assessment methods:
Written exam, Final paper, Participation, Presentation, Portfolio, Attendance, Assignment

Full course description

In the 2nd year the Academic Development Line (ADL) continues to deal with the following general competences: knowing yourself, understanding what acceptable standards and values are, being able to express yourself, organise your study and work, and building relations. The activities in the academic development are subsumed under four competency domains:

1. **Self-regulated learning skills.** These skills will help students to develop adequate learning strategies (Study Smart Training) and find their way in the ever-growing data and information jungle (Information Literacy);
2. **Professional behavior.** Within this domain, students will become aware of their personal behaviour in teams and how this will affect the functioning of that team and its other members. As a future professional and global citizen, working in teams will be an important skill;
3. **Scientific storytelling.** In this domain, students will learn how to share and communicate their results, visions, etc. both in writing and in oral to a specific audience or readership, which includes fellow students, teachers and peers;
4. **Personal development.** To help students finding and developing their personal path in the wealth of opportunities that RMT is offering, the ADL contains a series of activities and assignments that stimulate and support students in their personal and academic growth and development.

Course objectives

Self-regulated learning skills.

- Be able to reflect on personal learning strategies;
- Be able to reflect on planning and management of study;
- Be able to choose and motivate minor and internship topic;
- Be able to apply a Creative Problem Solving (CPS) approach (or something similar) when dealing with new challenges.

Professional behavior

- Be able to efficiently and professionally communicate within a diversely composed team; be able to provide constructive feedback;
- Be able to apply the conventions of scientific integrity and ethical standards to identified professional situations.

Scientific storytelling

- Be capable to produce an overview of scientific research by designing and creating a poster or graphical abstract (different styles, e.g. diagram, visual abstract, infographic);
- Be capable of writing a full scientific report
- Be able to present and pitch results (on a conference) using a poster or graphical abstract;
- Be is acquainted with different media formats and knows when and how to use them.

Personal development

- Be able to accept feedback and be able to critically reflect on personal values and priorities with minor help of mentor and develops strategies to promote personal growth;
- Be able to formulate SMART learning goals – with minor help of mentor - in order to take adequate action with a view to raising the student's competencies up to the desired level.
- Be able to choose electives, minor courses and bachelor thesis subject based on future career plans

Lab Skills Line Year 2

Fac. Health, Medicine and Life Sciences

RMT2102

Year:
1 Sep 2025 **31 Aug 2026**

Credits:
5.0

Coordinator:
T. RademakersC.M. Domingues Mota

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

Assessment methods:
Participation, Portfolio, Attendance, Assignment, Observation

Full course description

The practical skills longitudinal line is one of the three longitudinal lines, and runs through the first two years, as Laboratory Skills I (year 1) and **Laboratory Skills II (year 2)**, each worth 7 ECs. Lab skills trainings are mainly concentrated in the 8-week periods, in which the experiments are aligned with the content of the courses. Every 8-week course, students need to demonstrate sufficient skills in preparing experiments (preparing the practical, performing lab-related calculations) and carrying them out, keeping a lab journal, and basic lab skills (weighing, pipetting, etc.). As the practical sessions are all part of the lab skills line, repeated practice of skills, with increasing degree of complexity throughout the bachelor is achieved, and longitudinal tracking of development of lab skills is possible. Importantly, students will also be able to practice and further develop their practical skills in a self-directed manner within the design project; this is aligned with the lab skills line.
Students receive regular formative feedback by staff and peers on these skills, which will be added to the portfolio at the end of each 8-week course. Next to this, students are assessed on their performance by means of a summative practical exam consisting of two parts (in periods 3 & 6 each year). The lab skills line formally ends at the end of year 2.

Course objectives

- Be able to work in sterile environment for culturing of cells, and perform functional assays with cultured cells.

- Be able to synthesize and purify a product, follow reaction kinetics, and know how to steer a chemical reaction.
- Be able to characterize a material using various techniques like FTIR, mechanical testing, and rheology.
- Understand and review the link between in situ computational models (RMT2004) and applied models in the lab.
- Understand and apply principles of advanced regenerative medicine technology (e.g. on chip-technology, microfluidics & nanofabrication) in a lab setting.
- Be able to work with and show skills for working with lab journal and SOPs.
- Be able to apply analysis and visualization of data.
- Be able to apply statistics to experimental data and report on experimental data.

Design Project: Clinical Track

Fac. Health, Medicine and Life Sciences

RMT2103

Year:
1 Sep 2025 **31 Aug 2026**

Credits:
7.0

Coordinator:
M. van Griensven

Teaching methods:
Research, Work in subgroups, Working visit(s)

Assessment methods:
Presentation, Assignment

Keywords:
clinical translation bench to bedside

Full course description

In year 1, the students have conducted 4 interviews with experts. A project pitch was given in period 6. Now in year 2, the students will actually work on the problem and possible solutions with on of the experts. Therefore, the students can choose one of the four expert themes to work on. Ideally 4 groups are formed that do not have to be the group composition as in year 1. The students that choose the expert/project in the clinical track are in RMT2103.
This course deals with clinical regenerative medicine issues:

- Clinical problem
- Interaction with clinician/scientist with clinical theme

The students will then design a regeneration project, and the emphasis is more towards clinic application.
This line interacts closely with the academic line and the practical skills line.

The Design Project line's main activities in year 2 are therefore:

- Close interaction with expert
- Defining the problem
- Designing a project (state-of-the-art, hypothesis, experimental set up)

- Performing the experiments with the expert
- Project presentation of the project including results

The design project thus introduces aspects of clinical valorization.

Course objectives

The learning goals will be achieved through expert interaction and designing the project.

After this the student:

- Is able to independently apply relevant laboratory skills and techniques to conduct research in regenerative medicine.
- Understands, appreciates and critically assesses the process of scientific research to obtain academic knowledge and insight, and is able to draw conclusions based on evidence in a logically structured fashion.
- Readily evaluates, selects and applies scientific methodology and available technology to address current challenges and problems in regenerative medicine or in a related biomedical field, and contributes to finding an innovative solution.
- Based on obtained research results or applied technologies, contributes to the realisation of novel, innovative and marketable clinical or biomedical products/therapies.
- Organises study, work and research efficiently and effectively, and within given time constraints.
- Shows awareness of various team roles, functions efficiently in multidisciplinary and otherwise diverse teams, values diversity in a broader sense, and takes into account ethical standards and societal, economic and regional and global contexts.
- Communicates professionally and adjusts style and type of communication and argumentation to the audience and the occasion.

Recommended reading

depending on the expert

Attendance lab skills line year 2

Fac. Health, Medicine and Life Sciences

RMT2112

Year:

1 Sep 2025 **31 Aug 2026**

Credits:

2.0

Coordinator:

T. RademakersC.M. Domingues Mota

Design Project: Technological Track

Fac. Health, Medicine and Life Sciences

RMT2104

Year:
1 Sep 2025 **31 Aug 2026**

Credits:
7.0

Coordinator:
M. van Griensven

Keywords:
industrial research technological challenges

Full course description

In year 1, the students have conducted 4 interviews with experts. A project pitch was given in period 6. Now in year 2, the students will actually work on the problem and possible solutions with on of the experts. Therefore, the students can choose one of the four expert themes to work on. Ideally 4 groups are formed that do not have to be the group composition as in year 1. The students that choose the expert/project in the technological track are in RMT2104.

This course deals with technological issues for regenerative medicine:

- Scientific or industrial problem
- Academic/industrial laboratory setting
- Industrial research and development setting

The students will then design a regeneration project, and the emphasis is more towards technological application.

This line interacts closely with the academic line and the practical skills line.

The Design Project line's main activities in year 2 are therefore:

- Close interaction with expert
- Defining the problem
- Designing a project (state-of-the-art, hypothesis, experimental set up)
- Performing the experiments with the expert
- Project presentation of the project including results

The design project thus introduces aspects of technological/industrial valorization.

Course objectives

The learning goals will be achieved through expert interaction and designing the project.

After this the student:

- Is able to independently apply relevant laboratory skills and techniques to conduct research in regenerative medicine.
- Understands, appreciates and critically assesses the process of scientific research to obtain academic knowledge and insight, and is able to draw conclusions based on evidence in a logically structured fashion.
- Readily evaluates, selects and applies scientific methodology and available technology to address current challenges and problems in regenerative medicine or in a related biomedical field, and contributes to finding an innovative solution.
- Based on obtained research results or applied technologies, contributes to the realisation of novel, innovative and marketable clinical or biomedical products/therapies.
- Organises study, work and research efficiently and effectively, and within given time constraints.
- Shows awareness of various team roles, functions efficiently in multidisciplinary and otherwise diverse teams, values diversity in a broader sense, and takes into account ethical standards and societal, economic and regional and global contexts.
- Communicates professionally and adjusts style and type of communication and argumentation to the audience and the occasion.

Recommended reading

depending on the expert

Thesis

Fac. Health, Medicine and Life Sciences

RMT3010

Period 4:

2 Feb 2026 **3 Jul 2026**

Credits:

30.0

Coordinator:

Internship

Fac. Health, Medicine and Life Sciences

RMT3011

Period 4:

2 Feb 2026 **3 Jul 2026**

Credits:

0.0

Coordinator:

Presentation/Defence

Fac. Health, Medicine and Life Sciences

RMT3012

Period 4:

2 Feb 2026 **3 Jul 2026**

Credits:

0.0

Coordinator: