The different specializations in the Master programs Biomedical Engineering and Medical Engineering

Version: October 2022

Summary of the master possibilities in the different specializations

Professor	Specialization abbreviation	Master BME	Master ME	RMT	MIx
Cluster Regenerative Engineering and Materials					
Ito	OB	X	X	X	
Bouten	STEM	X		X	
Loerakker	MMB	X			
De Boer	BiS	X		X	
Cluster Chemical Biology					
Brunsveld	CB	X	X		
Dankers	BioM	X		X	
Merkx	PE	X			
Prins	MB	X			
Albertazzi	N4N	X			
Van Hest	BOC	X			
Mulder	PME	X			
Cluster Biomedical Imaging and modelling					
Van Riel	CBio	X	X		
De Greef	SBio	X			
Pluim	MIA	X	X		X
Van de Vosse	CVB	X	X		X
Lopata	PULS	X	X		X

Specialization abbreviations

Abbreviation	Full
OB	Orthopeadic biomechanics
STEM	Soft tissue engineering and mechanobiology
MMB	Modeling in mechanobiology
BiS	Biointerface science
CB	Chemical biology
BioM	Biomedical materials (closely linked to REM cluster)
PE	Protein engineering
MB	Molecular biosensing for medical diagnostics
N4N	Nanoscopy for nanomedicine
BOC	Bio-organic chemistry
PME	Precision medicine
CBio	Computational biology
SBio	Synthetic biology (part of CBIO group)
SBMD	Systems biology and metabolic diseases (part of CBIO group)
MIA	Medical image analysis
CVB	Cardiovascular biomechanics
PULS	Photoacoustics and ultrasound

Tracks

Tracks in collaboration with Utrecht University (UU)

Abbreviation	Full
RMT	Regenerative medicine and technology
MIx	Medical imaging

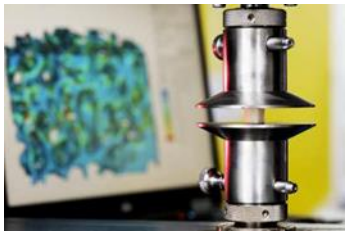
On the following pages you can find a description of the possibilities and demands for all groups (in the same order as in the table).

Note:

For **Medical Engineering** students who did the major Biomedical Engineering (BME) are eligible. Students with a major in Medical Science & Technology (MST) need to take additional courses. More information can be found in the education guide.

Cluster
Regenerative Engineering and Materials

Orthopaedic Biomechanics (Prof. Ito)



Scientific Staff Ito, Castilho, van Donkelaar, van Rietbergen, Arts

Research focus

In the Orthopaedic Biomechanics research group, the disciplines of engineering and biology are combined to expand our understanding of the biomechanical function of musculoskeletal tissues as well as their adaptive developmental and physiological nature. This knowledge is then applied to explore and develop regenerative treatment strategies, currently applied to musculoskeletal tissues, i.e. bone, articular cartilage, tendons and ligaments, and the intervertebral disc. The projects within the group vary from more biology oriented to mechanics oriented studies, from laboratory work with cells to numerical work with computer models and biofabrication.

BSc majors BME or MST
Master(s) BME and ME
Tracks RMT

Courses taken in bachelor

Engineering-oriented students preferably did: Systems in time and Space 8VB40, Mechanics 8MB00, Transport Physics 8VB00, Numerical Analysis of Continua 8MC00, Medical Image Analysis 8DC00, Measurements and models in the clinic 8VB10.
For biology-oriented students some recommended courses are: Biomechanics 8TB00 or Mechanics 8MB00, Regeneration 8WC00, Immunology and Infection 8TC00, Basic Tissue Engineering 8TC20, Project Tissue Engineering 8P350.

*Dependent on the degree of orientation of the student to one direction or the other, a mixture of the above courses may be appropriate.

Courses typically taken in the master

All students: Orthopaedic soft tissues 8TM10, Bone structure and function 8TM00, Biomaterials 8SM20, Structure and function of joints 8TB10 (If not taken in bachelor)
Plus for those with a more biological interest: Host Response to Biomaterials 8MM50, Cell biological techniques and engineering detection 8MM20.
Plus for those with a more engineering interest: NAC II 8MM30, Cell mechanobiology and engineering 8MM40
For RMT students: Introduction to RMT

ME specifics

For ME in Orthopaedics only 7-8 students are selected per year. These students are directly advised by dr. B. van Rietbergen. Most students will conduct their final projects in Maastricht in Bone Structure/Function (B. van Rietbergen). In some years, projects in Articular Cartilage (R. van Donkelaar) or Intervertebral Disc (K. Ito) may be possible. Recommended courses are the same as for engineering oriented students.

Link

Orthopaedic Biomechanics at TU/e (tue.nl)

Soft Tissue Engineering and Mechanobiology (Prof. Bouten)

Scientific Staff Bouten, Conte, Smits, Kurniawan,
Guest staff Sahlgren, Van Rijn

Research focus

Research is centred on cell-matrix interactions in cardiovascular and other soft tissues, with emphasis on their role in tissue morphogenesis, adaptation, degeneration and regeneration. Next to fundamental discoveries, this knowledge is typically used to design material-based in-situ regeneration therapies that harness the natural foreign body response and lead to the (re)generation of load-bearing tissues inside the human body. As a master student, you will perform multi-disciplinary research (e.g. combining mechanobiology and tissue culture) and apply various research fields (cell signaling, cell mechanics, immunology, biophysics) and enabling technologies (microfabrication, scaffold fabrication, bioreactors, microscopy, modeling) to understand and design stem cell niches, engineered tissue models, or in-situ tissue engineering approaches. Special attention is given to integrating computational modelling with molecular, cell and tissue biological concepts. To this end, the group also closely collaborates with the MMB group. To translate regenerative medicine concepts to the patient, the group further collaborates with clinical and industrial partners.

BSc majors BME or MST (advised to take additional engineering/numerical courses)
Master(s) BME
Tracks RMT

Courses taken in bachelor

Strongly advised: Basic Tissue Engineering 8TC20, Regeneration 8WC00, Mechanics 8MB00, and Numerical Analysis of Continua 8MC00, Project Tissue Engineering 8P350.
Additional advised course: Immunology and Infection 8TC00
For the mechanobiology direction, students need to take the BME course Mechanics 8MB00.
For experimental studies in mechanobiology and cell-matrix interaction the optics part in the course Electromagnetism and Optics 8NC00 and Material Science 8SC00 are strongly advised and Biomechanics 8TB00 is sufficient.

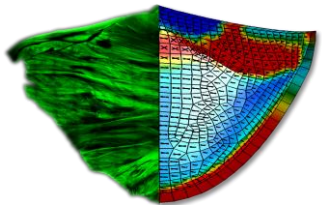
Courses typically taken in the master

Host Response to Biomaterials 8MM50, Cell Biological Techniques 8MM20, Cell Mechanobiology and Engineering 8MM40, Microscopy for Biological Samples 8MM10, NAC II 8MM30, Biomaterials 8SM20. The choice of courses depends on the student's orientation towards experimental work, numerical work, or the combination thereof.

Link

Soft Tissue Biomechanics & Tissue Engineering (tue.nl)

Modeling in Mechanobiology (Dr. Loerakker)



Scientific Staff Loerakker, Ristori

Research focus

The research of the Modeling in Mechanobiology (MMB) group is focused on understanding and predicting the growth and adaptation of cardiovascular tissues in response to mechanical factors, with primary applications in cardiovascular regenerative medicine (e.g. tissue engineering). We mainly develop experimentally-informed computational models covering different spatiotemporal scales, ranging from subcellular signaling pathways to macroscopic tissue growth. Via this approach, we aim to understand how mechanobiological mechanisms determine cardiovascular development and adaptation, and to identify novel strategies to steer cardiovascular regeneration via model predictions. As a master student, you can do projects that involve computational methods only, or projects in which computational and experimental work are combined. The MMB group closely collaborates with the Soft Tissue Engineering and Mechanobiology group and clinical collaborators to facilitate the integration of computational and experimental research.

BSc majors BME or MST (only in case of additional engineering/numerical courses)
Master(s) BME

Courses taken in bachelor

Required courses: Mechanics 8MB00 / Biomechanics 8TB00, Numerical Analysis of Continua 8MC00. Recommended courses: Project Biomechanics 8P340, Systems in time and Space 8VB40, Transport Physics 8VB00.

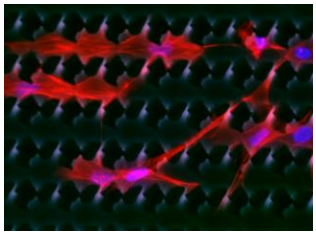
Courses typically taken in the master

Numerical Analysis of Continua II 8MM30, Cell Mechanobiology and Engineering 8MM40, Host Response to Biomaterials 8MM50, Cardiac Function 8VM20, Vascular Mechanics 8VM30.

Link

Modeling in Mechanobiology (tue.nl)

Biointerface Science of Regenerative Medicine (Prof. Jan de Boer)



Scientific Staff de Boer, Gumuscu Sefunc

Research focus

Research in the Biointerface Science group is aimed at investigating the interplay between cells and biomaterials at the molecular and cellular level. Our research is characterized by a holistic approach to both discovery and application, aiming at combining high throughput technologies, computational modeling and experimental cell biology to streamline the wealth of biological knowledge to real clinical applications. Also, we integrate biological, chemical and microfluidic technologies to robustly interrogate, characterize and manipulate cellular activities. Have a look at www.jandeboerlab.com for a more complete description of the things that we do in Jan de Boer's group and https://gumuscuslab.com/ for a more complete description of the work in Burcu Gumuscu's group.

BSc majors BME or MST
Master(s) BME
Tracks RMT

Courses taken in bachelor

At BiS, we focus on cells and invite everyone who shares our passion. Some basic knowledge on cell biology is useful but come by and show us what your skills are and we can see how this fits in our multidisciplinary research team.

Courses typically taken in the master

Courses depend on the orientation of the student but could typically include Host response to biomaterials 8MM50, Machine learning in medical imaging and biology 8DM50, Cell mechanobiology and engineering 8MM40, Cell Biological Techniques 8MM20 and Microscopy for Biological Samples 8MM10, and when interested in Burcu Gumuscu's research then 8P380 Lab on a Chip Microdevices is highly recommended.

If not taken in the bachelor: Applied cell biology 8LC00, Applied biostatistical modelling 2DBM90

For RMT: introduction to RMT

Link

Biointerface Science (tue.nl)
https://jandeboerlab.com/
https://gumuscuslab.com/

Cluster
Chemical Biology

Chemical Biology (Prof. Brunsveld)

Scientific staff Brunsveld, Ottmann, Scharnhorst

Research focus

In this group, research deals with chemical biology approaches to study protein-protein interactions. Novel chemistry is being developed (molecules, proteins, techniques) and applied to study proteins and their functional interactions. The two general lines that are being followed are supramolecular architectures, with the aim to make synthetic signaling systems, and proteins drug discovery, such as nuclear receptors and 14-3-3 proteins, to establish novel concepts and small molecules for drug discovery and the molecular biosciences.
Students can specialize more in the direction of clinical chemistry (Scharnhorst), proteins (Ottmann, Brunsveld, Merkx), drug discovery (Ottmann, Brunsveld) or supramolecular systems (Brunsveld, Meijer).

BSc majors BME or MST
Master(s) BME and ME (Scharnhorst, clinical chemistry)

Courses taken in bachelor

Course Bio-organic Chemistry 8RB10 is required. In addition, Macro-organic Chemistry 6E3X0 is needed. Often Pharmacology 8RC00 is taken.

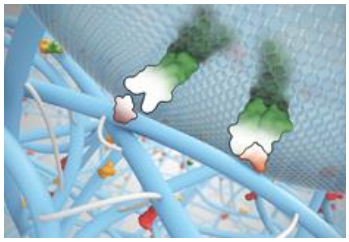
Courses typically taken in the master

Advanced Organic Chemistry 6EMA56, Physical Organic Chemistry 6MSM10, Protein Engineering 8SM10, Clinical Chemistry 8SM00 and some other molecular oriented courses.

Link

Chemical Biology (tue.nl)

Biomaterials (Prof. Dankers)



Scientific staff Dankers, van Genderen

Research focus

The Biomaterials research group develops new material concepts for translational biomedical science. The primary focus is on the synthesis, development and characterization of supramolecular biomaterials in the field of regenerative medicine and oncology. Our particular interests are on engineering the cell-material interface and the cell-synthetic molecule interaction. Research topics vary from the design of synthetic extracellular matrices for cell culture, to the development and application of new ways to deliver drugs into cells and into tissues. The research is driven by questions from the field, i.e. medical doctors, cell biologists, and companies. Close collaboration with specialists is therefore of utmost importance, and is the basis of our research.

Students that are interested in chemistry (materials science, organic chemistry, supramolecular chemistry and biochemistry) and in the use of molecules and materials in a biomedical setting are more than welcome to join our research group. It is particular important that you develop your expertise in chemistry with strong interests in biology and biomedical applications.

BSc majors BME or MST
Master(s) BME
Tracks RMT

Courses taken in bachelor

Courses Bio-organic Chemistry 8RB10, Materials Science 8SC00 and the coherent package Chemical Biology are required, as well as Macro-organic Chemistry 6E3X0.

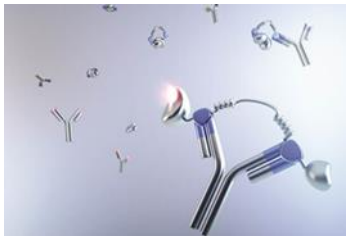
Courses typically taken in master

Courses that students in this group do in the master phase include:
Biomaterials 8SM20, Advanced Organic Chemistry 6EMA56, Physical Organic Chemistry 6MSM10.
Depending on the interest some students take Protein Engineering 8SM10, a microscopy course 8MM10 or Clinical Chemistry 8SM00 or the course Cell Biological Techniques and Cell-material interactions 8MM20 or the project Molecular Biology 8PM01 and/or the project course Organic Chemistry 8PM01.

Link

Biomedical Materials and Chemistry (tue.nl)
https://www.dankerslab.nl/

Protein Engineering (Prof. Dr. Merkx)



Research focus

The Merkx group is active in the fields of protein engineering, molecular biology, bionanotechnology, chemical biology and synthetic biology. Research ranges from the development of new concepts in the engineering of proteins and smart biomacromolecular devices to the development of biosensors for applications in molecular diagnostics, intracellular imaging and antibody-based targeting. Topics include FRET-based sensor for intracellular imaging, bioluminescent sensor proteins for point-of-care diagnostics, light-switchable proteins, peptide- and protein-DNA conjugates and DNA-based molecular computing. Techniques range from molecular biology, protein chemistry, peptide-, DNA- and bioconjugation chemistry, a broad variety of biophysical and analytical techniques, cell biology and optical life cell imaging.

Collaborations

The Merkx group closely collaborates within the laboratory of Chemical Biology with the groups of Brunsveld, van Hest, and Mulder bysharing facilities, education and joint group meetings. Strong research collaborations exist with the groups of De Greef, Prins/Zijlstra , Albertazzi, and Dankers. The Merkx group is also a core member of Institute for Complex Molecular Systems. Students that want to do something extra can therefore participate in the master programs offered by either the ICMS (1 or 2 year).

BSc majors BME or MST
Master(s) BME

Courses taken in bachelor

Students should have taken the coherent package Chemical Biology

Courses typically taken in the master

Typical courses taken by our students: Protein Engineering 8SM10, Molecular Biosensing 8NM10, Chemical Biology, Advanced Organic Chemistry 6EMA56, Physical Organic Chemistry 6MSM10, Clinical Chemistry 8SM00, Organic Chemistry Project 8PM01, Molecular Biology Project 8PM00 or project Cell Biological Techniques and Cell-Biomaterial Interactions 8MM20.

Link

https://merkxlab.nl/

Molecular Biosensing for Medical Diagnostics (Prof. Prins)

Research focus

The MBx group develops technologies based on micro- and nanoparticles for monitoring patients and for treating diseases. Combining nanotechnology, molecular engineering and single molecule imaging technologies, we aim to measure with ultimate sensitivity biomolecules implicated in a variety of diseases, such as cancer, immunology, and cardiology.

The MBx group is based in the Department of Biomedical Engineering, the Department of Applied Physics, and the Institute for Complex Molecular Systems.

Students with diverse orientations (chemistry, biochemistry, physics, and cell biology) are welcome in the group. We offer collaborative projects with e.g. groups Merkx, Brunsveld, Greef, Dankers, Tel.

BSc majors BME or MST
Master(s) BME

Courses taken in bachelor

Advised electives in the bachelor to go in this specialization in the master: Chemistry courses from elective package, Chemical Biology 8RB20, Bio-organic Chemistry 8RB10, or modelling courses.

Courses typically taken in master

Molecular Biosensing 8NM10, Advanced Microscopy 3MN160, and depending on the orientation more (bio-)chemistry/physics/modelling courses.

Link

Molecular Biosensing (tue.nl)

Nanoscopy for Nanomedicine – N4N (Dr. Albertazzi)

Research focus

The research of our group focuses on the development of new drug delivery systems for the treatment of cancer (***Nanomedicine***). In particular we synthesize and functionalize nanoparticles (polymeric, lipidic, inorganic) to recognize and target selectively cancer cells and release their therapeutic payload.
To guide the design of such nanomedicines we employ advanced optical microcopies such as super-resolution microscopy, single molecule imaging and tracking and spectral imaging. These techniques go beyond the classical microscopy resolution allowing to visualize objects on the nanoscale, i.e. from microscopy to ***Nanoscopy***. With these powerful techniques we are able to visualize our nano-objects with nanometric resolution in the biological environment and track them during the interactions with cancer cells.
Due to the multidisciplinary nature of our group students with diverse orientations are welcome. Topics for our projects include synthesis and formulation of nanoparticles, biological evaluation of nanomedicines in cells and organ-on-a-chip, development of microscopy methods to study cells and nanoparticles, use of super-resolution microscopy to track nanoparticles in cells.
We closely collaborate with other groups of the chemical biology cluster (Merkx, Meijer, de Greef, van Hest) and we are core members of the Institute for Complex Molecular Systems (ICMS). Collaborative projects between groups are possible.

BSc majors BME or MST
Master(s) BME

Courses typically taken in bachelor

OGO Het Lab in 8QB10/02, coherent package Chemical Biology

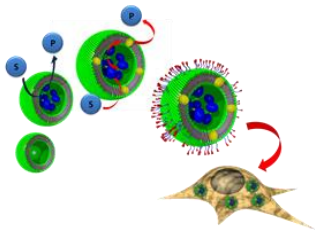
Courses typically taken in the master

Depending on the orientation: Nanomedicine 8SM40, Biomaterials 8SM20, Microscopy courses 8MM10/3MN210, Protein Engineering 8SM10, Cell Biological Techniques and Cell-material interactions 8MM20, Molecular Biosensing 8NM10, and some other molecular oriented courses.

Link

https://www.n4nlab.eu

Bio-organic Chemistry (Prof. van Hest)



Research focus

The research of the bio-organic chemistry group focuses on nanomedicine and artificial cell research. We develop tailor-made nanocompartments which are used to effectively transport and deliver biologically active compounds to target cells and tissues. Students will be active in a multidisciplinary environment, in which synthetic techniques varying from protein engineering to polymer chemistry are used to construct particles with control over size, shape and surface functionality. Particles will be characterized with regard to their physicochemical properties and their interaction with cell cultures. With our clinical collaborators, we investigate the efficacy of our particles as devices for the treatment of cancer and to modulate the immune system. We furthermore use our artificial cells in the field of tissue engineering to control the growth of organoids.

BSc majors BME or MST
Master(s) BME

Courses taken in bachelor

The coherent package Chemical Biology is required.

Courses typically taken in the master

Advanced Organic Chemistry 8RM00, Physical Organic Chemistry 6MSM10, Bio-organic Chemistry 2 8RM10, Protein Engineering 8SM10, Nanomedicine 8SM40, and Pharmacology 8RC00 (or in bachelor).

Link

Bio-Organic Chemistry (tue.nl)

Precision Medicine (Prof. dr. Mulder)

Scientific staff Mulder, Van der Meel

Research focus

The Precision Medicine group focuses on the development, evaluation and translation of precision imaging and nano-immunotherapy approaches in cardiovascular disease, cancer and transplantation. We integrate chemistry, library technology, bioengineering, immunology, and advanced noninvasive imaging methods to iteratively design nano-immunotherapies. Such nano-immunotherapies can be applied to empower the immune system's ability to fight disease, by promoting or inhibiting an immune response, by polarizing macrophage function, or by targeting myeloid cell dynamics.

Students will be part of a cross-disciplinary research environment, in which nano-immunotherapeutic libraries are established, physicochemically analyzed, and subsequent evaluation of therapeutic effects in cell cultures at TU/e and ultimately in animal models in Mulder's Nanomedicine Laboratory at the Icahn School of Medicine in New York, USA.

Collaborations

The Precision Medicine group closely collaborates with other groups within the Laboratory of Chemical Biology and the Institute for Complex Molecular Systems (Brunsveld / Van Hest / Merkx / De Greef / Dankers / Meijer).

For translational research using sophisticated imaging techniques and disease models, we collaborate intensively with Mulder's Nanomedicine Laboratory at the Icahn School of Medicine at Mount Sinai in New York.

BSc majors BME or MST
Master(s) BME

Courses taken in bachelor BME

Recommended are Bio-organic chemistry (8RB10), Macro-organic chemistry (6E3X0), and Pharmacology (8RC00).

Courses typically taken in the master

A required course is Nanomedicine (8SM40, starting in curriculum 19/20). Recommended courses include Advances in molecular chemistry (6EMA61), Cell biological techniques and cell-biomaterial interactions (8MM20), Protein Engineering (8SM10), and Single molecule microscopy of nano materials (8NM20).

Links

https://www.mulderlab.com/
Precision Medicine (tue.nl)

Cluster
Biomedical Imaging and Modelling

Computational Biology (Prof. van Riel)

Including System biology and metabolic disease (van Riel) and Synthetic Biology (de Greef)

Scientific staff van Riel, Markvoort, de Greef, Eduati

Research focus

The aim of the Computational Biology group is to understand biomedical processes in living systems by using a variety of computational modeling techniques and/or experimental work. The systems range from atomic interactions within a single molecule, membranes and vesicles, to cellular interactions, metabolic pathways and networks of organisms. Current research areas comprise systems biology, synthetic biology, modeling self-assembly of biomaterials, and modeling drug delivery and radiation therapy. This is not necessarily associated to a disease, but diseases that are being studied in the group include diabetes, cancer, psoriasis and metabolic disorders such as tryptophan deficiencies in patients suffering from autism.

BSc majors BME or MST
Master(s) BME and ME

Courses taken in bachelor

Required course is Systems in Time and Space 8VB40.
Required is a course in Computational Biology in the bachelor: Simulation of Biochemical Systems 8CB10 or Synthetic and Systems Biology 8CB20. There is the possibility to do these courses in the free space in the master (but mind the scheduling of these courses in Q3 and 4).
Students that want to go more in the direction of Tom de Greef (Synthetic Biology) in this group and would like to perform experimental work also need knowledge of molecular biology and chemistry. The chemical biology package in the bachelor is advised for these students. Also collaborations exist with Brunsveld, Merkx and Bouten if students are interested.

Courses typically taken in the master

Depending on specialization: Systems Biology 8CM00 and/or Molecular Modelling 8CM20.

Link

Computational Biology (tue.nl)

Medical Image Analysis (Prof. Pluim), group page IMAG/e

Scientific staff Pluim, Breeuwer, Veta, Raaijmakers, Scannell

Research focus

The Medical Image Analysis group at TU/e focusses on developing AI methods for both the acquisition of medical images and the automatic analysis of those images. The aim is to support clinicians in their decisions and during treatments, to provide safer and better care. Research on image acquisition aims to improve medical images, for instance, by reducing artefacts and noise, by reducing acquisition times, by reducing the dose required for acquisition. Research on image analysis aims to automatically detect disease in images, to classify what is found into categories, to measure structures or to track moving objects. Examples are methods that can support large screening studies for early detection of diseases or methods that classify suspicious lesions in the breast into type of tumour to help decide on the optimal treatment.

BSc majors BME or MST
Master(s) BME and ME
Tracks MIx

Courses taken in bachelor

Required courses are Systems in Time and Space 8VB40 and Images 8DB00. Furthermore at least one advanced Imaging course is required: Advanced Imaging Techniques 8VC00, Medical Image Analysis 8DC00 or Project AI for Medical Imaging 8P631.

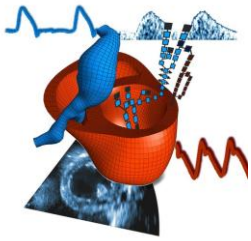
Courses typically taken in master

Courses that students in this group often take in the Master: Machine Learning in Medical Imaging and Biology 8DM50, Capita Selecta of Medical Image analysis 8DM20, Electromagnetic Fields in MRI 5LPE0, Radiation Physics 8CM10, Advanced MR Physics BMB 502717(UU), Programming for Medical Imaging BMB502417 (UU).

Link

Medical Image Analysis (tue.nl)

Cardiovascular Biomechanics (Prof. van de Vosse)
Including Photoacoustics and Ultrasound (Lopata)



Scientific staff van de Vosse, Rutten, Bovendeerd, Lopata, Huberts

Research focus
The Cardiovascular Biomechanics group performs research in the field of computational and experimental biomechanical analysis of the cardiovascular system. Aim is to develop both computational models and medical devices for clinical diagnosis, decision support, and intervention. The research is directed along the three following topics; blood in motion, heart at work, vessels under stress.

BSc majors BME or MST
Master(s) BME and ME
Tracks MIx (Lopata)

Courses taken in bachelor
Mechanics 8MB00 and NAC 8MC00 are strongly advised both for ME and BME students. For ME students Clinical Measurements 8VB10 and Model Based Cardiovascular Pathophysiology 8VB20 are advised.

Courses typically taken in the master
Cardiovascular Fluid Mechanics 8VM00, Pathophysiology of the Cardiovascular System 8VM10, Cardiac Function 8VM20, Vascular Mechanics 8VM30, Cardiovascular Fluid-Structure Interaction 8VM40, Ultrasound 8VM60/70. Courses depend on the specialization.

Link
Cardiovascular Biomechanics (tue.nl)

Photoacoustics and Ultrasound (Dr. Lopata)

Scientific staff Lopata, Wu, Schwab, Thirugnanasambandam

Research focus

The PULS/e group (Photoacoustics & Ultrasound Laboratory Eindhoven) is a multidisciplinary group that focuses on the development of sonographic medical imaging devices and (model-based) analysis techniques for early and precise diagnosis, disease progression monitoring and personalized decision support.
The group's research areas can be divided in: 1) image formation and reconstruction methods using novel ultrasound devices; 2) imaging the molecular composition of tissues using photoacoustics; 3) functional imaging and image analysis, and 4) the development of computational models of diseased organs based on imaging (image-informed digital twins).
The research spans a large range of engineering domains, from ultrasound physics to finite element modeling, from bench (fundamental / experimental work) to bedside (applied / clinical research).

BSc majors BME or MST
Master(s) BME and ME
Tracks MIx

Courses taken in bachelor

- For the imaging side, courses like Clinical Measurements 8VB10, Imaging 8DB00, the OGO on Blood Oxygenation 8QB06, and electives in the field of image acquisition (Advanced Imaging Techniques 8VC00) and analysis (8DC00) are strongly advised.
- Mechanics 8MB00 and NAC 8MC00 are strongly advised both for ME and BME students that will focus on modeling.
- For ME students Clinical Measurements 8VB10 (will be replaced after 2024-2025) and Model Based Cardiovascular Pathophysiology 8VB20 are advised.

Courses typically taken in the master

Courses depend on the specialization.

- For imaging, students are advised to focus on courses on imaging physic (Ultrasound 8VM60/70, Radiation Physics 8CM10, Radioisotopes 8NM00, MRI 5LP30, and Mix courses), image analysis (8DM10, 8DM20, 8DM50), clinical physics (0LM120, 3MA100), or signal processing / data science (5SSC0, 5SSD0, 8VB10, 8CM30).
- For modeling oriented students, cardiovascular Fluid Mechanics 8VM00, Vascular Mechanics 8VM30, Cardiovascular Fluid-Structure Interaction 8VM40, Numerical Analysis of Continu II 8MM30 are strongly advised.