

## The Institute of clinical dentistry has documented capacity in

Offering	certification programs for clinicians and biotechnologists.
Collaborating	with clinical institutions for hands-on training and research
Organizing	clinical workshops, seminars, and guest lectures
Facilitating	networking opportunities with industry professionals
Initiating	partnerships with biotechnology companies
Updating	curriculum to align with advancements
Encouraging	interdisciplinary collaboration
Promoting	student projects addressing practical challenges
Supporting	faculty's continuous professional development
Spinning	off innovative ideas ideas and has access to internal advisory board

and we now offer a new MSc degree entitled

### Biomaterials for functional tissue reconstruction

to attract students that seek to pursue a career path in academia, research, industry, or clinical settings

#### The Study Plan in context

We reach out to students that want to develop an advanced understanding of biomaterials and tissue engineering, complementing their BSc choice with a comprehensive awareness of the dynamic and exciting healthcare and medical device engineering landscape.

This degree includes elective courses that offer vast options to gain insight in regulatory and safety affairs, but also innovation and environmental and economic considerations, targeting the global market under a scientific and social prism. Thus, graduates will develop a diverse array of intellectual, practical, and transferable skills essential for success in this field.

Targeting future employability, the curriculum is designed to foster graduates with strong analytical skills who will be highly sought after across various sectors and industries, including medicine and biotechnology. Furthermore, our graduates having been introduced to the universality of the need for biomaterials, would be equipped to pursue further studies or explore employment opportunities in academia, research, or senior management roles within manufacturing or healthcare engineering, or pursue the policy making avenue.

This study program is thus addressing students aspiring to academic, research, or professional pathways, as well as those aiming for leadership positions, offering a comprehensive foundation for diverse career trajectories.

## The Learning Outcome Description

<p><b>Knowledge</b></p>	<ul style="list-style-type: none"> <li>• Acquire foundational knowledge of biomaterials fabrication, characterization, and testing</li> <li>• Learn about innovations in biomaterials fields, such as healthcare and medical devices</li> <li>• Understand basic principles of tissue engineering and its applications in healthcare</li> <li>• Become familiarized with technological advancements in biomaterials science</li> <li>• Be introduced to biomedical engineering and medical device regulation concepts</li> <li>• Understand relevant international regulatory bodies and policy-making</li> <li>• Learn methods to analyze both cells in 2D and 3D and the cell relevant necessary biomaterials properties</li> <li>• Explore technological advances in tissue engineering for developing novel solutions</li> <li>• Define and interpret mechanisms of tissue-specific immune responses.</li> <li>• Evaluate how specific cellular and molecular mechanisms determine the outcome of in vitro biocompatibility</li> <li>• Evaluate how basic immunological concepts determine in adverse effects</li> <li>• Become familiarized with the concepts of ISO</li> </ul>
<p><b>Skills</b></p>	<ul style="list-style-type: none"> <li>• Develop the ability to characterize interactions between biomaterials and cells for functional tissue engineering</li> <li>• Acquire skills in both quantitative and qualitative methods</li> <li>• Gain expertise in experimental design and characterization techniques.</li> <li>• Generate, process and analyse experimental data</li> <li>• Obtain hands-on experience with biomedical engineering tools and techniques</li> <li>• Investigate scientific and bioengineering aspects of biomaterial assessment</li> <li>• Assess and mitigate risks of working in a research laboratory</li> <li>• Work in groups exploring interdisciplinary concepts</li> </ul>
<p><b>Competence</b></p>	<ul style="list-style-type: none"> <li>• Compose a high-level critical literature review</li> <li>• Formulate research hypotheses based on documented literature gaps</li> <li>• Design and execute experiments to test tissue engineering hypotheses</li> <li>• Conduct comprehensive studies on biomaterials aiming to evaluate biocompatibility for tissue engineering applications</li> <li>• Perform qualitative and quantitative data analysis</li> <li>• Synthesize research findings into coherent essays</li> <li>• Communicate aims of research project, motivation, data management plan and outcomes to different audiences</li> <li>• Develop proficiency in scientific reporting</li> <li>• Create high-quality figures suitable for scientific publication</li> </ul>

## Resources:

### Suggested Reading Material / Academic Books

1. Biomaterials and tissue Engineering. 2023. Gunduz, Oguzhan Egles, Christophe Pérez, Román A. Springer.
2. Biomaterials Science: An Introduction to Materials in Medicine 4th edition. 2020. Wagner et al. (eds.)
3. Safety Risk Management for Medical Devices 2nd Edition. 2022. Elahi, Bijan. Academic Press.
4. A Laboratory Course in Tissue Engineering. 2016. Micou, Melissa Kurtis & Kilkenny, Dawn. CRC Press
5. Biocompatibility Protocols for Medical Devices and Materials. 2023. Shanmugam, Prakash Srinivasan Timiri & Sampath, Thamizharasan & Jagadeeswaran, Indumathy. Academic Press.
6. Cellular and Molecular Immunology International Edition, 2021. 10th Edition. Abbas, Abul K. & Lichtman, Andrew H. & Pillai, Shiv.
7. Biomaterials Science and Tissue Engineering: Principles and Methods. 2017. Basu, Bikramjit. (Cambridge IISc Series)
8. Tissue Engineering. Blitterswijk, Clemens van (Editor) & De Boer, Jan (Editor). 2022. Academic Press.
9. Injectable Hydrogels for 3D Bioprinting. 2021. Noh, Insup (Editor) & Wang, Xiumei (Editor) & Van Vlierberghe, Sandra (Editor) RSC Books.
10. Biomaterials Science: An Introduction to Materials in Medicine. 2013. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons (Academic Press)
11. Tissue Engineering: Principles and Practices. W. Mark Saltzman 2004. (Oxford University Press)
12. Principles of Tissue Engineering. 2014. Robert Lanza, Robert Langer, Joseph Vacanti (Academic Press)
13. Biomaterials: The Intersection of Biology and Materials Science. 2023. Johnna S. Temenoff, Antonios G. Mikos (Pearson)
14. Biocompatibility and Performance of Medical Devices (Woodhead Publishing Series in Biomaterials) 2nd Edition, 2019. Jean-Pierre Boutrand (Editor). Woodhead Publishing
15. 3D Printing in Medicine (Woodhead Publishing Series in Biomaterials) 2nd Edition, Kindle Edition. 2022. Deepak M. Kalaskar (Editor). Woodhead Publishing
16. Nanobiomaterials in Soft Tissue Engineering: Applications of Nanobiomaterials. edited by Alexandru Mihai Grumezescu (Elsevier)
17. Biomedical Engineering: Bridging Medicine and Technology. 2015. W. Mark Saltzman (Cambridge University Press)
18. Functional Nanomaterials for Bioanalysis, Nanomedicine, and Bioelectronic Devices Volume 1" . 2013. Edited Aiguo Wu, He Li (Springer)
19. Molecularly Imprinted Polymers (MIPs): Commercialization Prospects Paperback – 21 May 2023. Meenakshi Singh (Editor). Elsevier
20. Nanocarrier Vaccines - Biopharmaceutics-Based Fast Track Development. 2025. Vivek Chadva. Vasso Apostolopoulos.

Other books and articles will be categorized based on the application it targets, and the content (general, smart or special).

## **Information related to the quality system at UiO**

<https://www.uio.no/for-ansatte/arbeidsstotte/kommunikasjon/nettarbeid/veiledninger/tema/studier/program/foringer/kvalifikasjonsrammeverk/>  
<https://lovdata.no/dokument/SF/forskrift/2017-02-07-137>  
<https://www.uio.no/om/regelverk/studier/studier-eksamener/forskrift-studier-eksamener/nr-program.html>  
<https://www.uio.no/for-ansatte/arbeidsstotte/sta/kvalitetssystem/med/studier/prosjektverktoy.html>

## **Admission to the study programme**

This new master program falls under the category 1.5-2-year master program

This program will start in August 2025, as a pilot, admitting minimum 12, maximum 24 students, with a BSc or equivalent accreditation from NOKUT.

This program admits applicants from outside of EU/EEA, aiming for 20% with a set maximum of 20%

Language requirements: English.

All teaching will be given in English.

## Structure and implementation

The core structure of the study programme is presented below, denoting the **Mandatory (M)** and **Elective courses (E)** and student points per course.

**Elective courses** may be followed outside of the campus of UiO, as several universities in Circle U offer courses that is complementary with this program.

**The practical part of the scientific projects** can also be performed outside the campus of UIO. Contact with European universities, institutes and industry is established.

The colours describe the 3 different study directions the student may choose, that consist of elective courses or activities (**Tissue engineering** - **Biomaterials Development** - **Clinical applications**). The table describes the recommended order of the courses, but this is not mandatory.

The **Course Curriculum** and the 3 **Study Programmes** are shown below

<b>Semester 1</b>	<b>M1 (10)</b> Essential Biomaterials	<b>M2 (10)</b> Essential Tissue Engineering	<b>M2 (5)</b> Research Techniques 1 (+HSE)	<b>E1 (5)</b> <b>Biocompatibility and Implantable Materials</b> Regulatory Affairs Basic Epidemiology
<b>Semester 2</b>	<b>M3 (10)</b> Functional Surfaces for Cellular Interface	<b>E2 (5)</b> Research Techniques 2  Or Introduction to Clinical trials^	<b>M4 Literature Based Study related to Research Project (15)</b> Adverse Effects & Systems Biocompatibility Course Credits (5)  M4 is integral to the Research Project Project-Related literature essay (10)	
<b>Semester 3</b>	<b>E3 (5)</b> <a href="#">Introduction to Quantitative Methods</a> OR Biomaterials for Diagnostics OR Medical- and Bio-Ethics Or Medical and Health Related Research Ethics	<b>E4 (5)</b> <a href="#">Introduction to Qualitative Methods</a> OR <b>Advances in Stem Cells and Regenerative Medicine</b>	<b>MSc Research Project (20)</b>	
<b>Semester 4</b>	<b>MSc Research Project and Thesis Write-up (30)</b>			

## **Learning outcomes of the mandatory courses:**

**Tissue Engineering** will explore the applications of tissue engineering and regenerative medicine, including scaffold design, cell culture substrates, and organ-on-a-chip systems, are to:

- provide students dee understanding of tissue engineering strategies used to repair, replace and regenerate various tissues and organs.
- provide practical interdisciplinary experience of technologies relevant to tissue engineering.
- raise awareness of timely and crucial issues and approaches, associated with animal replacement and tissue engineering regulatory state of affairs.

**Functional surfaces for cellular interfaces** will explore the mechanisms and dynamics of interactions between cells and engineered surfaces, the state of affairs and techniques for biofunctionalization of surfaces with bioactive molecules, such as peptides, proteins, and growth factors, to regulate cellular behavior and function, and will target

- Cell-Surface Interactions
- Biofunctionalization Strategies
- Biocompatibility Assessment
- Tissue Engineering Applications
- Characterization of Surface Properties
- Understanding of Surface Modification Techniques
- Advanced Technologies

**Research Techniques 1 and 2 and among others will focus on**

- Biomaterials Selection and Design
- Experimental Design and Analysis
- Ethical and Regulatory Considerations

## Resources at the level of existing courses at UiO:

Please find below suggestions for available elective courses. Additional courses are available at the Department of Biosciences, MN. The list can be updated and expanded in 2024/2025.

[HELSEF4510 Medical and Health Related Research Ethics](#)

[HELSEF4410 Introduction to Qualitative Methods](#)

[HELSEF4020 Introduction to Quantitative Methods](#)

[BIOS4030 – Laboratory Methods in Cellular Biology](#)

[BIOS4010 – Methods in Molecular Biology and Biochemistry](#)

[PSY9510 – Introduction to Statistics with R](#)

[MAE4000 – Data Science](#)

\*Basic Epidemiology will be a standalone if students cannot join [INTHE4021 Introduction to Epidemiology](#) (currently the course is only available for students at the following master programmes: [International Community Health](#) and [Folkehelsevitenskap og epidemiologi](#))  
The same is true for, [INTHE4022 – Advanced Module in Qualitative Methods](#)

The following courses are currently only part of the studieprogram [Life Science Innovation \(honours certificate\)](#).

LSI4005 Introduction to innovation in life science

<https://www.uio.no/studier/emner/matnat/farmasi/LSI4005/index.html>

LSI4010 Business tools

<https://www.uio.no/studier/emner/medisin/med/LSI4010/index.html>

^Discontinued FRM9730 – Clinical Drug Trials

<https://www.uio.no/studier/emner/matnat/farmasi/nedlagte-emner/FRM9730/index-eng.html>

## Added Value content

Existing Master's programme in Bioscience

<https://www.uio.no/english/studies/programmes/bioscience-master/structure/>

## Mandatory courses

There are different requirements for mandatory courses within each programme option. Please see the programme structure for each programme option for more information. Common to all programme options are mandatory courses in Health, safety and environment (HSE) at the beginning of the first semester:

- [HMS0501 - Safety and Physical Environment](#)
- [HMS0502 - Positive Learning Environment](#)
- [HMS0507 - Fire Safety](#)
- [HMS0503 - Laboratory Safety](#)

HSE-courses do not give credits. If you have previously passed equivalent courses at the University of Oslo, you will not need to re-apply these.

## Teaching and Exams

Teaching form will consist of **synchronous and asynchronous teaching approaches**. The former includes mostly lectures, seminars, work-shops and activities that provide opportunity for students to gain first exposure prior to class and provide an incentive for students to prepare for class (mechanisms to assess student understanding - flipped classroom).

**Asynchronous Teaching:** Students will be instructed and supported to engage in self-preparation prior to synchronous activities (in class, or online)

- Completing individual coursework assignments
- Collaborating with a team on guided group case studies
- Producing a poster and delivering an oral presentation based on group assignments, e.g. a medical device or tooth implant failure case study
- Reading recommended textbooks, web resources, and electronic supporting information provided on Canvas

Further to essays, coursework understanding will be evaluated by written examinations and scored as approved or not approved (fail/pass)

**Safety first:** There is a compulsory HSE course, and a joint compulsory and self-selected teaching offer for generic competence in the first three semesters of the master's programme. There will be a combination of compulsory and optional assemblies.

**Working towards the selection and master's thesis,** an independent, time-limited research or development project must be carried out under supervision. The master's thesis is an independent, time-limited research or development project that must be carried out under supervision.

**Choice of thesis title:** One-to-one discussions with project supervisor about the individual MSc research project, then writing a critical literature review on the topic, designing a project plan and risk assessing the proposed research

Note: Any Project done outside of the faculty should have an internal supervisor in addition to the local one.

The work on the master's thesis may involve laboratory work. If the work on the thesis involves laboratory and/or mobility the candidates should consider taking out their own travel and personal injury insurance.

### **Compulsory activity:**

Completed HSE course and approved attendance at 70% of sessions in joint teaching in generic competence for the master's study.

Compulsory activities must be approved in order to sit for the exam.



**Exam:**

The exam consists of a master's thesis of 60 credits which must be submitted within a deadline. Then there is an oral presentation of the master's thesis and an examination. The project will be evaluated by one internal and one external sensor with basic knowledge of the specific field the given project is related to.

**Examination language: English.**

Grading scale: The master thesis will be evaluated using a grade scale from A to F, where A is the best grade and F is failing.

Information related to exams at UiO:

<https://www.uio.no/english/studies/examinations/sources-citations/>

<https://www.uio.no/english/studies/examinations/special-arrangements/apply-for-special-examination-arrangements/>

<https://www.uio.no/english/studies/examinations/withdrawal/>

<https://www.uio.no/english/studies/examinations/illness-postponed/index.html>

<https://www.uio.no/english/studies/examinations/explanation-appeal/>

<https://www.uio.no/english/studies/examinations/new-exam/index.html>

<https://www.uio.no/english/studies/examinations/cheating/index.html>

## Study quality

UiO and the Faculty of Dentistry's Quality System is based on professional activity and on research-based knowledge about learning and education. The quality system shall contribute to developing the quality of education and the learning environment by:

- establish a broad knowledge base for the quality work
- ensure input from students, PhD candidates and other stakeholders
- identify and collect data to support assessment of quality
- facilitate collegial involvement and interaction

<https://www.uio.no/for-ansatte/arbeidsstotte/sta/kvalitetssystem/odont/>

The routine descriptions relate to this study program describing

- how the activities are carried out
- who is responsible for the implementation
- how the results are processed (formal forums)
- who (which roles) is responsible for the follow-up will be made available on UiO's website by start-up in 2025.

The study program will be evaluated periodically according to guidelines, to assess the quality of the program and the possibilities for further development of the program.

The periodic program evaluation will consist of a self-evaluation and an external evaluation. The external evaluation will be carried out by an evaluation panel and based on the program management's own evaluation and other relevant material.

## **Internationalization**

- All teaching will be done in English to ensure participation from international students.
- Courses provided by universities at Circle U are electable, however the type of course and period must be approved by the academic coordinator of the master program. courses that a student has taken at another university in Circle u that offers the same program can be applied for approval.
- International guest lectures will also be invited to teach in several of the courses in the outline.
- Presentation of own work and participation in international conferences and workshops will be encouraged.

### **Erasmus internship/ placement for project work**

- Students within the EU can also have internships at other European educational institutions. For students who wish to come to the University of Oslo, the guidelines given for internships in Erasmus+ apply. <https://www.uio.no/english/studies/exchange/types-of-agreements/erasmus/traineeship.html>
- Erasmus also cover industrial placements for training, as the host organisation can be a company, research centre, or other organisation in one of the 27 EU countries, the three EEA countries, and partners in Macedonia, Serbia and Turkey. It is also possible to receive support for internships at Norwegian embassies in EU countries, Iceland, Turkey and Macedonia.

## **Diploma text and Diploma Supplement**

- The diploma for completed study programme will be issued automatically according to UiO guidelines. <https://www.uio.no/english/studies/examinations/diploma/programme/>
- When students receive a diploma for a degree, they will also be issued an English-language diploma supplement. Likewise when receiving a digital diploma, the diploma supplement is also digital. The diploma supplement follows a European standard and includes a description of the Norwegian educational system. Students who received a diploma before UiO began enclosing diploma supplements can order one separately, using an online order form.

### **Deferral of a diploma to improve grades**

If a student wish to improve results that are part of a degree; at most study programmes defer the diploma for up to two semesters.

<https://www.uio.no/english/studies/examinations/diploma/programme/deferral/>