

Appendix: Programme Specifics for the MSc Programme Nanobiology

Part of the Course and Exam Regulation of the Master's Programme
As referred to in Paragraph 2 of the Teaching and Exam Regulations

Faculty of Medicine (Erasmus MC)
Erasmus University Rotterdam

and

Faculty of Applied Sciences
Delft University of Technology

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Section 1 Appendix to the TER

TER Article 3 Admissions

The Master's degree programme in Nanobiology is a multidisciplinary programme with mathematics, physics and biology as core subjects. Due to the multidisciplinary content of the programme we require a solid background in university mathematics (calculus, linear algebra and differential equations), physics and molecular biology. How to complete the requirements for admission depend on the educational background of the applicant.

TER Article 3.1 A Dutch University BSc degree

The master's degree programme is accessible to students without further requirements after completion of their bachelor's degree in Nanobiology.

Students holding a Dutch University BSc degree from another programme can be admitted, but will be required to take additional courses to compensate for any gaps in prior education. More information can be found below under Bridging Programme (TER Article 3.4 and section 5 article 8).

TER Article 3.2 A Non-Dutch University Bachelor's

Applicants with degrees from non-Dutch universities seeking admission to the MSc programme in Nanobiology must in most cases possess a Bachelor of Science degree covering the required coursework. Their application will be evaluated by the Admission Committee, based upon academic scores and may include an interview. Perceived deficiencies will be identified in the review process and will need to be addressed by taking appropriate courses before the applicant can be admitted into the MSc programme.

TER Article 3.3 Dutch University of Applied Sciences (HBO)

A Bachelor's degree from a university of applied sciences does not qualify you for direct admission to the Master's degree programme in Nanobiology.

TER Article 3.4 Bridging Programmes Eligibility

Applicants who have a Bachelor's degree from a Dutch University may be eligible to complete a bridging programme to remediate any gaps in prior education. The bridging programme for the MSc programme is always customised to the students' specific situation in consultation with the programme coordinator and Admission Committee. Students will have up to two years to complete their bridging programme. See Section 5 article 8 for more information about bridging programmes.

TER Article 5 Goal of the Programme

The Nanobiology Master's programme has the following specific learning goals for our students.

TER Article 5.2

5.2.a. Knowledge

- 1 The student has theoretical and practical knowledge of the physics of biological processes and the methods to observe them.
- 2 The student is able to build mathematical models of physical and biological systems, and can solve them numerically and/or analytically.
- 3 The student can apply their knowledge to quantify biological processes from experimental results.
- 4 The student understands ethical issues in research.

5.2.b Research skills

- 5 The student is able to identify a problem and translate this into a research question.
- 6 The student is able to conduct comprehensive literature investigations, related to the research question.

- 7 The student is able to translate a research question into a research proposal.
- 8 In collaboration with other research group members, the student is able to set up and conduct a research project, collect data, analyse data, and come to conclusions.
- 9 The student is able to perform ethically responsible research.

5.2.c Communication skills

- 9 The student is able to write research findings in the form of a draft manuscript, which in collaboration with a research supervisor may be developed into a scientific article, suitable for publication in an international, peer-reviewed journal.
- 10 The student can communicate his or her results in oral and written form to audiences of specialists and non-specialists.
11. The student understands ethical considerations in communicating science.

Section 2 Programme Composition

Article 1 Obligatory Courses

The Nanobiology programme is a two-year master's programme and comprises 120 EC.

Courses that form part of the student's bachelor programme cannot be part of the Master's programme.

Columns 1-11 in the tables below indicate the programme goals above in TER 5.2.a-c

Article 1.1 Obligatory Courses of the first year

Course	Code	EC	Assessment method	1	2	3	4	5	6	7	8	9	10	11
Analytical Mechanics	NB4011	3	Homework, Written		X									
Biology of Cancer	NB4040	4	Report, Written	X		X	X		X				X	X
Engineering Genetic Information	NB4030	3	Written	X		X	X							
High-Resolution Imaging	NB4020	4	Homework, Written	X	X	X	X						X	X
Modeling Dynamical Systems	NB4050	3	Report, Group Work, Digital	X	X							X	X	X
Physics of Biological Systems: Mathematical Modelling in Systems Biology*	AP3162	6	Homework, presentation, written	X	X	X			X				X	
Soft Matter*	NB4070	6	Homework, written	X	X	X								
Stochastic Processes With Applications	NB4012	3	Homework, Written		X									
Internship**	NB4060	18	Report					X	X		X	X	X	X
Academic Research Project**	NB4065	18	Report					X	X		X	X	X	X

*Students may take either NB4070 or AP3162 to meet this requirement. They may choose to take the other as an elective.

**Students must select to do either an Internship or an Academic Research Project. They may only do one. Details about the procedures for these are in the Study Guide and from the Stagebureau TNW Internship Brightspace (NB4060) or TNW Thesis Bright Space (NB4065).

Article 1.2 Obligatory Courses of the second year

Course	Code	EC	Assessment method	1	2	3	4	5	6	7	8	9	10	11
Master End Project Nanobiology	NB5900	44	Presentation, Oral					X	X	X	X	X	X	X
Seminars	NB5015	2											X	X
Literature Review Report	NB5020	4							X				X	X
Project proposal writing	NB5030	2						X		X				
Research presentation	NB5040	2											X	X

Article 1.3 Elective courses

In addition to the obligatory courses in the first and second year, students must earn at least 22 EC of elective courses.

Article 1.3.a contains a list of the electives currently approved by the Board of Examiners for inclusion in the Nanobiology Master's programme. Students may request to include electives to their degree audit which are not on the approved list. Students must submit this request to the Board of Examiners before beginning the course(s).

Students may take one elective (no more than 6 EC) that is not related to Nanobiology content. It may be taken at any university but must be approved by the Board of Examiners to ensure appropriate level of study.

Article 1.3.a Currently BoE approved electives

Course code	Course name	EC
4373MUBI6	Multiscale Mathematical Biology (Leiden University)	6
4423CHEIM	Chemical Immunology (Leiden University)	6
AP3021	Advanced Statistical Mechanics	6
AP3032	Continuum Physics	6
AP3122	Advanced Optical Image Processing	6
AP3162	Physics of Biological Systems: Mathematical Modeling in Systems Biology ¹	6
AP3232	Medical Imaging Signals and Systems	6
AP3371	Radiological Health Physics	6
AP3582	Medical Physics Of Photon And Proton Therapy	6
BM41035	Biomaterials	4
BM41050	Applied Experimental Methods: Medical Instruments	4
BM41060	Physiology and Engineering	3
BM41075	Regenerative Medicine	4
BM41090	Computational Mechanics Of Tissues And Cells	6
BM41155	3d Printing	4
CH3142	Molecular Thermodynamics (MTD)	6
CH3372A	Soft Matter For Chemical Products (SMP)	3
CH3681A	Reactors And Kinetics	6
CS4220	Machine Learning 1	5
CS4230	Machine Learning 2	5
CS4255	Algorithms for Sequence-Based Bioinformatics	5
CS4329	Recent Topics in Bioinformatics	5
EE4650	Advanced Magnetic Resonance Imaging	5
IN4086-14	Data Visualization	6
LM3311	Green Chemistry And Sustainable Technology	3
LM3432	Analysis Of Metabolic Networks	6

¹ In 2020-2021 this course may be taken as either a required course or an elective.

Course code	Course name	EC
LM3442	Metabolic Reprogramming	6
LM3451	Bioprocess Integration	5
LM3512NB	Systems Biology	6
LM3581	Metabolic Systems Biology	3
LM3561	Ethical, Legal And Social Issues In Biotechnology	3
LM3601	Molecular Biotechnology And Genomics	6
LM3691	iGem	18
LM3611	Microbial Community Engineering	6
LM3701	Advanced Enzymology	6
LM3741	Fermentation Technology & Environmental Biotechnology	6
LM3751	Transport & Separation	6
LM3771	Protein Engineering	6
ME41035	Special Topics in Sports Engineering	3
ME41095	Bio Inspired Design	4
ME45025	Introduction To Multiphase Flow	6
ME45043	Advanced Fluid Dynamics (Ap)	5
ME46000	Nonlinear Mechanics	4
ME46072	Nonlinear Dynamics	4
NB4070	Soft Matter ¹	6
NB4080	Protein Quality Control Mechanisms	3
NB4090	Stem Cells	3
NB4100	Nuclear Architecture	3
NB4110	Geometry Of Physics	6
NB4120	Biological Networks; A Data Driven Approach To Discovery And Understanding	3
NB4150	The Origin and Synthesis of Life	6
NB4160	Engineering Of Living Systems	3
NB4170	Molecular Virology & Immunology	3
SC42030	Control for High Resolution Imaging	3
WI4011-17	Computational Fluid Dynamics	6
WI4014TU	Numerical Analysis	6
WI4019	Non-Linear Differential Equations	6
WI4201	Scientific Computing	6
WI4204	Advanced Modeling	6
WI4212	Advanced Numerical Methods	6
WI4430	Martingales, Brownian Motion, And Stochastic Processes	6
WM0201TU-Eng	Technical Writing	2
WM0320TU	Ethics and Engineering	3
WM-ITAV-4010	Scientific Writing	2
WM-ITAV-4020	Presenting for large audiences	2

Not all electives are offered every year.

Section 3 Examinations

Article 2 The form of examinations and methods of assessment

The form of the exams and the assessment strategy is described for each course in the studyguide:
<https://www.studiegids.tudelft.nl/>

Examinors may specify different exam formats for the resits.

Attendance requirements are specified for each course in the studyguide or on Brightspace at the start of the course.

Rules on the composition of the final course grade can be found in the Master's programmes "Rules and Regulations of the Board of Examiners."

Article 3 Schedule of the exams

Timing for exams is included in each course's information in the study guide. Precise details of date and time is available in the TU Delft TimeTable.

Retake examinations are planned general in the next exam week after the regular exam. The schedule for this is published before courses begin in the TU Delft timetable.

Article 4 Master's End Project

Students may start their Master's End Project if they:

- have been admitted to the Nanobiology Master's programme,
- have passed bridging/homologation requirements or other obligations from the bachelor programme,
- have passed at least 35 EC of Nanobiology MSc courses, not including Internship, Academic Research project. This does include electives.
- have submitted and had approved the appropriate approval form.

Students are responsible for finding a supervisor for their project. Supervisors must be an approved Nanobiology programme supervisor, the list of approved supervisors is called the "Green List" and is available from the TNW Thesis Office Brightspace page. The green list designates the research groups as specified in article 21a and b of the Rules and Guidelines of the Board of Examiners.

Before beginning the Master's End project, the MEP application form must be completed and submitted to the TNW Thesis office.

The date and time of the Master's End Project presentation is determined by the end project supervisor, in consultation with the student. In exceptional cases, the programme director may be involved in setting the date and time.

Further rules governing the Master's End Projects can be found in the Rules and Guidelines of the Board of Examiners and on the TNW Thesis office BrightSpace page.

Article 4.a Projects outside of Delft

Students may complete either their MEP, their Academic research project or Internship at a location outside of the Nanobiology programme, but only one of them. They must have a Nanobiology greenlist supervisor. Academic research projects and Master End Projects must be approved in advance by the Board of Examiners.

Section 4 Special programmes

Article 5 Bridging programmes

At the time a student applies to join the Master's program, a decision is made whether they need to complete some additional coursework (homologation) to qualify to begin the programme. This set of courses is determined individually for each student in consultation with the programme. If their prior degree is from a Dutch university they may be able to complete these courses in a TU Delft bridging programme. The bridging programme may not consist of more than 60EC. When planning their bridging program up to 9 EC may be completed after they enroll in the Master's programme. All others must be completed before enrolling in the Master's programme. Successful completion of the bridging programme qualifies the student for admission into the Master's programme.

Article 5.1 Required bridging/homologation courses for TU Delft BSc Life Science and Technology

Course	Code	EC
Analysis 3	NB1210	3
Linear Algebra	NB1230	3
Differential equations	NB2191	3
Electronic Instrumentation	NB2211-14	6
Physics 2	NB2141	3
Signals and Systems	TN2545	6
Optics & Microscopy	NB2041	3
Statistical Physics	NB2220	3
Computational Science	NB2181	3
Image Analysis	NB2121	3
Nanotechnology	NB2081	2

Students may wish to include Physics 1b NB1143.

Article 5.2 Required bridging/homologation courses for TU Delft BSc Applied Physics

Course	Code	EC
Chemistry 1	NB1102	3
Chemistry 2	NB1110	3
Biochemistry	NB1012	3
Molecular Biology	NB1016	3
Genetics	NB1022	4
Labcourse A1 or B1	NB1151 or NB1163	3
Physical Biology of the Cell 1	NB1072	3
Bioinformatics	NB2161	4.5
Evolution	NB2111	3
Evolutionary & Developmental Biology	NB2032	6
Image Analysis	NB2121	3
Microscopy/Nanoscopy Practice or Optics & Microscopy	NB2046 or NB2041	1.5/3
Physical Biology of the Cell 2	NB2071	3

Students will be placed into either NB1150 or NB1163 as there is room.

Article 6 Honour's programme (HPM)

The Honour's Programme consists of at least 20 EC in addition to the Master's programme of 120 EC. It is an individualized programme that contains a 5 EC course for all TU Delft honours programme students plus a coherent package of at least 15 EC of challenging course modules or projects composed by the student.

Students receive an honour's certificate with their diploma if they have completed their MSc Programme and completed all HPM courses within two years of completing the first MSc exam. More details are available in the Study Guide.

Collective Part (5 EC)
UD2010, Critical Reflection on Technology, 5 EC, obligatory
Individual Part (15 EC)
Possibilities:
AS1011HPM, Applied Sciences Company Project, 12EC plus AS1021HPM course
AS1021HPM, Applied Sciences Honours Classes, 15 EC
AS1031HPM, Applied Sciences Research Project, 9-15 EC plus 0-6 EC related coursework for a total of 15 EC
Design PDEng Project

Section 5 Additional Rules

Article 7 Transition rules

Per academic year 2016-2017, elective courses are not divided in different categories. Student can choose any elective from the proposed list in article 3. In retrospect this also counts for the students from cohort 2015.

Per academic year 2019-2020:

- Soft matter physics (NB4070) will be a mandatory course for all students starting the Nanobiology Master's programme in September 2019 and later.
- The Seminars course (NB5010) has become a 2 EC course (NB5015) for all students starting the Nanobiology Master's programme in September 2019 and later. Students from the 2019 cohort will need to complete this requirement for their programme and an additional 2 EC of electives (22 total). Students from 2018 or earlier, can receive 4 EC under the old course code of NB5010.

Per academic year 2020-2021:

- NB4010 has been divided into two courses NB4011 and NB4012. Completion of both of these will fulfill requirements for NB4010 for prior cohorts.
- Students beginning in 2020 and later may select between AP3162 and NB4070 to fulfil the Physics requirement. Students from the 2019 cohort may request this option from the Board of Examiners.

Per academic year 2021-2022:

- Change to the language of how many credits are required for starting MEPs. The new rule is a clarification and simplification of the calculation of the previous requirement. If exceptions are needed they can be discussed with the programme coordinator.

Article 8 Degree supplement

An overview of the study modules taken is given on the certificate. The degree supplement is issued in English.

Article 9 Date of commencement

These regulations will come into effect on 30 August 2021.