



UNIVERSITA' DEGLI STUDI DI MILANO
PROGRAMME DESCRIPTION - ACADEMIC YEAR 2025/26
MASTER DEGREE
QUANTITATIVE BIOLOGY (Classe LM-8 R)
Enrolled in the 2025/2026 academic year

HEADING

Degree classification - Denomination and code:	LM-8 R
Degree title:	Dottore Magistrale
Length of course:	2 years
Credits required for admission:	180
Total number of credits required to complete programme:	120
Years of course currently available:	1st
Access procedures:	Open, subject to entry requirements
Course code:	FBT

PERSONS/ROLES

Head of Study Programme

Prof. Carlo Camilloni

Tutors - Faculty

Academic guidance advisors - Thomas Vaccari and Marco Buscaglia

Erasmus and International Mobility advisors - Veronica Gregis

Study plan advisor - Matteo Brilli

Internship advisor and Thesis advisors - Anna Moroni

Master's Degree admission advisor - Anna Moroni, Matteo Brilli

Educational Credit (CFU) recognition - Anna Moroni

Degree Course website

<http://qbio.cdl.unimi.it>

<http://www.unimi.it/en/education/faculties-and-schools/science-and-technology/industrial-biotechnology>

Academic Services Office

Milan - Via Celoria, 26 By appointment. <https://informastudenti.unimi.it/>

Boards

Anna Moroni, Matteo Brilli (Master's degree admission); Marco Buscaglia (Student Mobility); Matteo Brilli (Study Plan).

Disability manager

Matteo Chiara

International Students Office

Milan - Via S. Sofia, 9/1 <https://www.unimi.it/en/international/coming-abroad/international-students-office-welcome-desk>

Student administrative office

Milan - Via Celoria, 18 Phone 0250325032 The front offices receive in the days and times indicated on the following webpage:

<https://www.unimi.it/en/study/student-services/welcome-desk-informastudenti/student-desks-locations-and-opening-hours>

CHARACTERISTICS OF DEGREE PROGRAMME

General and specific learning objectives

The Master's degree course in Quantitative biology (QB) prepares graduates in biological and biotechnological disciplines to operate at the intersection between biology and physics. The quantitative approach requires a physical understanding of biological phenomena and the development of mathematical and computational tools for the analysis, understanding, and redesign of biological systems. The aim is to train a new generation of experts with integrated skills in biology, chemistry, physics, mathematics and computer science, able to perform accurate experimental measurements and apply predictive theoretical models, to explain biological complexity. Quantitative biology uses emerging technological and computational capabilities to model biological processes for biotechnological applications such as protein and metabolic engineering, drug

discovery and synthetic biology. It is therefore proposed a path that includes training activities aimed at acquiring in-depth knowledge of:

- Molecular, cellular, and structural biological area: provides in-depth knowledge of basic biological processes, both cellular and molecular, and identifies macromolecular complexes and regulatory networks that require quantitative analysis.
- Biophysics-chemistry area: provides thermodynamic and statistical knowledge of the behavior of individual molecules and covers the most innovative investigation and data analysis techniques in this area (such as, for example, atomic force microscopy, super resolution microscopy, single particle electron cryo microscopy).
- Mathematics-informatics-logic area: provides the tools for formulating predictive and descriptive mathematical models of the behavior of cellular and molecular systems and teaches programming languages for data analysis. It also introduces the concepts and methods of artificial intelligence used to represent and solve logical and computational problems.

Expected learning outcomes

Knowledge and understanding

Master's graduates in Quantitative Biology combine a solid preparation in the biomolecular-cellular field with the knowledge of mathematical, chemical and physical tools and of the logical bases of scientific reasoning. This knowledge will enable them to understand and apply an interdisciplinary experimental approach to the study of complex systems, such as dynamic biological systems. Students are guided in the generation of predictive models, simulations and their experimental analysis and verification.

Ability to apply knowledge and understanding

The main goal of the Master's degree in Quantitative Biology is to apply experimentally the theoretical knowledge acquired. Teaching includes hands on laboratory practice and the mandatory experimental thesis includes 33 CFU of lab work. Teaching will further include problem solving aspects to help students choosing appropriate methodological tools to achieve an objective.

Making judgements

The autonomy of judgement will be encouraged reading and discussing research articles in the class, to stimulate students to evaluate experimental results critically. Autonomy of judgement will also be fostered by the problem-based learning teaching method. This approach involves small groups of students tackling the subject of study by discussing it among themselves in the presence of a tutor who intervenes only if required.

Communication skills

The problem-based learning mentioned above helps to develop communication skills, including the confidence in expressing oneself in English, and the ability to relate to other students, including international students. Presentation and discussion of experimental data, in journal clubs and seminars, are among the activities of the compulsory and student-led courses that foster the acquisition of communication skills.

Learning skills

Development of appropriate skills for the acquisition of new knowledge, including through research and reading of scientific articles in English, bibliographic consultations, consultation of databases and other information on the web. The use of alternative and complementary teaching/learning methodologies complementary to the lecture alone, such as problem-based learning, group work, presentations by students, exercises on real case studies, will be encouraged. The didactic means of verification are oral and/or written examinations, practical tests for the presentation of scientific articles and presentation of research projects carried out individually or in small groups

Professional profile and employment opportunities

The Master's degree in Quantitative Biology provides employment opportunities in research institutes and industry in the areas of bio-nano-technologies, bio-pharmaceutical research, and in the development of high-tech research instrumentation.

Job profiles

Product scientist, Bio-nanotechnologist

- Applies laboratory procedures relating to cellular and molecular processes by identifying and resolving any critical issues.
- Uses non-standard, high-tech scientific instrumentation.
- Manages the IT aspects of the use of machines for generating experimental data.
- Analyses raw experimental data and converts them into various formats.
- Writes codes to analyze biological data using a programming language.
- Interacts effectively with both experimental laboratory staff and developers of high-tech instrumentation and facilitates their communication.

Employment

In bio-nanotechnology startups, pharmaceutical and biotechnology industry, public and private research institutes with the following assignments:

Junior research scientist - biotechnology/biophysics research laboratory

- Knows the biological system under study, understands the experimental question and helps to identify the appropriate experimental measure to provide adequate answers.

- Designs and carries out experiments independently using high-tech instrumentation.
- Carries out data analysis using specific software.
- Confidently presents scientific data and methods to internal and external partners.

Employment

Public and private scientific institutes, research and development in pharmaceutical, biotechnological and startups industries or companies developing scientific instrumentation with high technological content and innovation.

Initial knowledge required

Students willing to enroll in the Master Course in Quantitative Biology must possess the following requirements:

Bachelor or University Degree obtained with a three-year course, or equivalent title obtained abroad.

Minimum English level, assessed by interview

Adequate basic knowledge, assessed by interview

Bachelor's Degree

Eligible for admission to the master's degree program in Quantitative Biology are graduates in the classes:

L-02 Biotechnology

L-05 Philosophy

L-07 Civil and Environmental Engineering

L-08 Information Engineering

L-13 Biological Sciences

L-27 Chemical sciences and technology

L-29 Pharmaceutical sciences and technologies

L-30 Physical sciences and technology

L-31 Computer science and technology

L-32 Science and technology for the environment and nature

L-33 Economic sciences and statistics

L-35 Mathematical Sciences

L-41 Statistics

who have attained sufficient knowledge (at least 12 CFU) in basic disciplines of biological area relevant for QB (SSD BIO/06, BIO/09, BIO/10, BIO/11, BIO/18). If the candidate is not in possession of the above curricular requirements, the interview will evaluate if he/she needs to acquire them, prior enrollment.

Language Requirement

Knowledge of English (B2 level) is a requirement for the access to the QB master's degree. Students should have acquired beforehand a B2 level certification (vantage or upper intermediate, as defined by the Common European Framework of Reference for Languages: Learning, Teaching, Assessment). Students without a B2 level certification may be accepted on condition that their level of English proficiency, assessed during the entry interview, is evidently good.

Adequate basic knowledge:

The adequate personal background of the candidates and their ability to communicate in English are decisive elements for the acceptance to QB and they are going to be verified and tested during the entry interview. Knowledge of Italian is not required. Particular attention will be given to the knowledge in biological subjects of candidates with non-biological backgrounds. In this case, the entry interview will identify gaps requiring extra study to be levelled off by the student with the support of tutors before enrollment.

Compulsory attendance

Attendance at lectures and practical courses is compulsory. The attendance threshold for exam admission is 75%. Below this threshold, admission to the exam is at the discretion of the teacher, who may require additional activities before admission to the exam.

Internship criteria

The experimental thesis accounts for 33 CFU and represents a major part of the Master degree program. Thesis internship: the student will carry out an original experimental project in a research laboratory during an internship of, at least, 9 months (33 cfu). The experimental thesis project can be carried out in a laboratory at the University of Milan or in another research laboratory, upon previous authorization of the Coordinator of the Master degree. At the end of the internship, the Student will write a dissertation in English that will be approved by an internal tutor (relatore interno). The 120 CFU required to take the final test for the achievement of the master's degree are acquired, in compliance with these regulatory rules.

Degree programme final exams

The final exam consists of the oral presentation of the main results of the thesis project and discussion with a committee. It contributes maximum 10 points to the final grade. The final grade will be assigned as the weighted average of the grades in the lecture courses, calculated on a scale of 110, to which the points of the final dissertation will be added.

Campus

Lecture rooms and laboratories are located in the campus "Città Studi" , in the University buildings of Via Celoria, 26 (Edifici Biologici); Via Celoria, 20 (Settore Didattico); Via Golgi, 19 (Edificio Golgi). The course of Logic (Department of

Philosophy) is held in the University headquarter, via Festa del Perdono 7 and Via Santa Sofia. The Department of Biosciences is the reference structure for all teaching activities related to the QB course.

EXPERIENCE OF STUDY ABROAD AS PART OF THE TRAINING PROGRAM

The University of Milan supports international mobility by providing its students with the opportunity to spend study and internship periods abroad. It is a unique chance to enrich your educational path in a new exciting environment.

The agreements entered into by the University with over 300 universities from the 27 EU member countries under the European Erasmus+ programme allow regularly enrolled students to carry out part of their studies at one of the partner universities or to undertake internships at companies, training and research centres and other organisations.

Similar international mobility opportunities are provided outside Europe, through agreements with a number of prestigious institutions.

The University of Milan is a member of the 4EU+ European University Alliance that brings together eight public multidisciplinary universities: University of Milan, Charles University of Prague, Heidelberg University, Paris-Panthéon-Assas University, Sorbonne University of Paris, University of Copenhagen, University of Geneva, and University of Warsaw. The 4EU+ Alliance offers integrated educational pathways and programmes to promote the international mobility of students (physical, blended and virtual).

Study and internships abroad

The QB degree program supports the international mobility of the University program: QB lecturers (for the academic year 2025/2026, Veronica Gregis and Marco Buscaglia) act as tutors for students interested in the Erasmus + program, to guide students in their choice of the most suitable program for their formation. Every January, the Erasmus + program is presented to the QB students through a local event organized by the coordinator of the Erasmus + program of the Industrial Biotechnology area (Prof. Veronica Gregis).

In the framework of the Erasmus+ program, the QB Master course has in place agreements with Universities in Germany, Spain, France, Norway, Denmark and The Netherlands, all offering courses in English.

Calls for participation to Erasmus Studio can be found at the following link: <https://www.unimi.it/en/international/study-abroad/studying-abroad-erasmus>.

The time spent abroad can be used to attend courses and pass the relative exams, thus collecting credits towards the Master's degree, as well as to carry out the experimental project for the dissertation. Students admitted to the mobility program must submit a study plan detailing the training activities that they plan to carry out, with the corresponding credits.

The number of credits should correspond as much as possible to the number of credits that the student should acquire in a similar time at the home University. The proposed activities must be consistent with the goals and the contents of the Master's degree. The study plan must be approved by the QB Student Mobility Committee, which can request changes or integrations. At the end of the mobility program, according to the guidelines provided by the University of Milan, the courses attended (with a passed exam) by the student are registered in his/her career record, preferably with its original name and with an indication of the ECTS (European Credit Transfer and Accumulation System) and their conversion in CFU (usually 1 ECTS= 1 CFU). The students willing to carry out their dissertation work as part of a mobility program abroad must have an internal supervisor (chosen among the QB lecturers) and the study plan must be approved by the QB board.

How to participate in Erasmus mobility programs

The students of the University of Milan can participate in mobility programmes, through a public selection procedure.

Ad hoc commissions will evaluate:

- Academic career
- the candidate's proposed study programme abroad
- his/her foreign language proficiency
- the reasons behind his/her application

Call for applications and informative meetings

The public selection for Erasmus+ mobility for study generally begins around February each year with the publication of a call for applications specifying destinations and requirements. Regarding the Erasmus+ Mobility for Traineeship, the University of Milan usually publishes two calls a year enabling students to choose a destination defined by an inter-institutional agreement or to find a traineeship position on their own.

The University organises informative meetings to illustrate mobility opportunities and rules for participation.

Erasmus+ scholarship

The European Union grants the winners of the Erasmus+ programme selection a scholarship to contribute to their mobility costs, which may be supplemented by the University funding for disadvantaged students.

Language courses

Students who pass the selections for mobility programmes can benefit from intensive foreign language courses offered each year by the University Language Centre (SLAM).

<https://www.unimi.it/en/node/8/>

Learn more at <https://www.unimi.it/en/node/274/>

For assistance, please contact:

International Mobility Office

Via Santa Sofia 9 (second floor)

Tel. 02 503 13501-12589-13495-13502

Contacts: InformaStudenti;

Student Desk booking through InformaStudenti

1st COURSE YEAR Core/compulsory courses/activities common		
Learning activity	Ects	Sector
Advanced molecular biology	9	(6) BIO/11, (3) BIO/18
Cell biophysics	6	BIO/09
Imaging in living cells	5	(1) FIS/07, (4) BIO/04
Integrated structural biology	6	BIO/10
Mathematical modeling for Biology	6	(3) MAT/05, (1) MAT/06, (1) MAT/07, (1) MAT/08
Measurement of nanoscale interactions in biological systems and data analysis	6	(4) FIS/03, (1) FIS/02, (1) FIS/01
Molecular biophysics	6	FIS/07
Principle of spectroscopy and applications to quantitative biology	10	(2) CHIM/01, (1) CHIM/03, (2) CHIM/02, (5) CHIM/06
Programming in Python	6	INF/01
Total compulsory credits		60
2nd COURSE YEAR (available as of academic year 2026/27) Core/compulsory courses/activities common		
Learning activity	Ects	Sector
Artificial Intelligence in Quantitative Biology	6	(2) FIS/07, (4) INF/01
Other training activities <i>Chosen among Italian language course, attending seminars, workshop, short internship (75h) in a research lab, others activity related to job placement</i>	3	ND
Total compulsory credits		9
Elective courses		
The student must choose one of the following courses:		
Cell population dynamics	6	(1) BIO/06, (5) BIO/13
Introduction to Logic	6	M-FIL/02
Non linear dynamics in quantitative biology	6	(4) BIO/11, (1) BIO/19, (1) BIO/18
Structural bioinformatics	6	FIS/07
Synthetic biology	6	(3) BIO/11, (3) BIO/04
Further elective courses		
Open choice courses: 12 CFU		
End of course requirements		
Thesis project and final dissertation	33	ND
Total compulsory credits		33