



**UNIVERSITA' DEGLI STUDI DI MILANO**  
**PROGRAMME DESCRIPTION - ACADEMIC YEAR 2022/23**  
**MASTER DEGREE**  
**Pharmaceutical Biotechnology (Classe LM-9)**  
**enrolled from 2014/15 academic year**

### HEADING

<b>Degree classification - Denomination and code:</b>	LM-9 Pharmaceutical, veterinary and medical biotechnologies
<b>Degree title:</b>	Dottore Magistrale
<b>Curricula currently available:</b>	Biotechnology in drug research and development / Development and production of biotechnological drugs / PHARMACOGENOMICS AND PRECISION THERAPEUTICS
<b>Length of course:</b>	2 years
<b>Credits required for admission:</b>	180
<b>Total number of credits required to complete programme:</b>	120
<b>Years of course currently available:</b>	1st , 2nd
<b>Access procedures:</b>	Open, subject to entry requirements
<b>Course code:</b>	E51

### PERSONS/ROLES

#### Head of Interdepartmental Study Programme

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#### Degree Course website

<https://www.unimi.it/it/corsi/corsi-di-laurea/biotecnologie-del-farmaco>

#### Course management for the Department of Pharmacological and Biomolecular Sciences - Dr. Antonella Masi

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### CHARACTERISTICS OF DEGREE PROGRAMME

#### General and specific learning objectives

The Master of Science in Pharmaceuticals Biotechnology aims to prepare graduates with advanced skills in the development and application of new scientific methodologies, who can actively participate in study and research projects at national and international level and have in-depth expertise in the scientific and technical-productive aspects of biotechnology applied to human health, with reference to the design and planning of innovative biotechnological drugs. For these purposes, the degree course in Pharmaceutical Biotechnology is organized in three programs, two held in Italian and one in English. The two programs in Italian include training activities common to all students organized in the first two semesters of the course, which will allow to acquire essential knowledge for the training of pharmaceutical biotechnologists and characterizing training activities specific to the two curricula: a) "Biotechnology in research and development of drugs"; b) "Development

and production of biotechnological drugs". The curriculum "Pharmacogenomics and Precision Therapeutics", delivered in English, is designed to train graduates who can face future challenges in the field of biotechnological drugs.

### **Expected learning outcomes**

Graduates will achieve knowledge and comprehension skills that extend and reinforce the theoretical-practical competences acquired in the first level degree courses with scientific characterization and more specifically biotechnology, addressing them specifically to the application of biotechnology in the pharmaceutical field. In particular, they will acquire in-depth knowledge of biochemistry, biology, physiology, molecular and cellular biotechnology, pharmacology, and the fundamentals of pathological processes of human interest, with particular reference to those in which it is possible to intervene with a biotechnological approach. Altogether, the acquired knowledge and skills will allow the deepening of peculiar aspects of pharmaceutical biotechnology and will be further improved with the disciplines of application in which they will address problems related to issues and innovative technologies useful in the most specialized areas of pharmaceutical biotechnology. In this field both biological and chemical-pharmaceutical courses are included, which provide the necessary knowledge and technologies in the different phases ranging from research, development and clinical trials of biotechnological drugs, to their preparation, purification, analysis and formulation, up to marketing. In particular, graduates will acquire:

- ability to apply the acquired knowledge and skills to problems related to the identification of new therapeutic targets and to the design, production, analysis and formulation of biotechnological drugs, diagnostics and vaccines;
- ability to address innovative issues such as gene and cell therapy;

- ability to apply the acquired knowledge also in interdisciplinary contexts not directly related to their specific field of study. The ability to apply the acquired knowledge will be stimulated during the practical exercises in the laboratory, through a ? problem-solving? approach and verified during the whole training course through individual examination tests. The practical-experimental work on specific research topics will be developed during the preparation of the thesis. Graduates in Pharmaceutical Biotechnology will be able to integrate the basic knowledge acquired during the first level studies with the more specialized knowledge provided in the second level training and will be able to insert the complex of knowledge acquired in interdisciplinary areas and not limited to the technical areas of pharmaceutical biotechnology.

### **Professional profile and employment opportunities**

The Master's Degree in Pharmaceutical Biotechnology is awarded to students with advanced skills in the development of scientific methodologies, able to coordinate national and international research projects and with specialized knowledge in the field of applied biotechnology, development and application of drugs, diagnostics, vaccines and nutraceuticals produced through biotechnological processes. The specific roles and professionalism of the graduate in the Master's Degree in Pharmaceutical Biotechnology, according to the nomenclature and classification drawn up by ISTAT are:

- Chemist representatives and disseminators;
- Biologists and related professions;
- Biotechnologists;
- Pharmacologists.

The main professional career includes:

- researcher at public and private research institutions;
- researcher in industry (research and development sector);
- industry operator (production sector);
- industry operator (marketing sector);
- clinical monitor.

Graduates will be able to find employment in the following professional fields:

- Teaching activity in the scientific disciplinary field in secondary level education institutions;
- Teaching and research activities in public and private universities;
- Scientific research and technological development activities in public companies (National Health Institute, CNR, AIFA, National Environmental Agency, Research Institutions, etc), in both national and international public and private companies aimed at preclinical activities in the biomedical field;
- Scientific research and development activities in the biotechnological, pharmaceutical, diagnostic and cosmetic industry, in the food and food processing industry;
- Scientific research and technological development activities;
- Clinical monitoring and pharmaceutical technical scientific information activities;
- Management activities in quality assurance and environmental safety assessment and assurance;

Graduates will also be able to be involved in activities connected to the development, management and regulation of biotechnological companies in the public and private sectors, with managerial and consultancy functions in the following fields:

- therapeutic, with particular regard to the development and testing of products with innovative therapeutic potential to be applied to human and animal pathology;
- production and planning, in connection to patents in the health field;
- formulation, with reference to the preparation of vectors, cells and advanced pharmaceutical forms for the administration of new therapeutic products;
- diagnostic, through the management of molecular analysis technologies and cellular biotechnologies applied to the medical, pharmacological, toxicological, cosmetological and environmental fields;
- experimentation in the biomedical field, with reference to the use of in vivo and in vitro models for the understanding of

the action mechanism of new drug.

The course allows to obtain the qualification to the profession of biologist.

### **Initial knowledge required**

#### **Admission requirements**

The following candidates are eligible for the Master's degree programme in Pharmaceutical Biotechnology:

- Graduates of class L-2, as well as the corresponding classes pursuant to Ministerial Decree 509/99;
- Graduates of other classes, provided they meet the following requirements:
  - at least 9 academic credits (CFU) across the following subject areas (SSD): CHIM/01, CHIM/03 and/or CHIM/06;
  - at least 12 academic credits (CFU) across the following subject areas (SSD): BIO/10, BIO/11 and/or BIO/13;
  - at least 6 academic credits (CFU) in the following subject area (SSD): BIO/14;
  - at least 6 academic credits (CFU) across the following subject areas (SSD): BIO/09, BIO/16 and/or MED/04;
- Holders of a qualification obtained abroad and recognized as suitable who prove that they have acquired the same level of knowledge and skills in biology, chemistry, biochemistry, molecular biology, pharmacology and physiology, as specified above.

#### **Admission assessment**

In addition to curricular requirements, admission to the programme is subject to an assessment test. Curricular requirements will be assessed by an admissions board appointed by the Academic Board and composed of at least 3 faculty members, based on the candidate's previous academic records, and possibly an interview. The curricular assessment will ascertain the level of knowledge (credits earned and grade achieved) in the following subjects: general and inorganic chemistry (CHIM/03), analytical chemistry (CHIM/01) and organic chemistry (CHIM/06); biochemistry (BIO/10), molecular biology (BIO/11) and biology (BIO/13); pharmacology (BIO/14); anatomy (BIO/16), physiology (BIO/09) and pathology (MED/04). Please note that the knowledge of the aforementioned disciplines may also have been achieved by attending single courses.

The interview, if any, may be held in person (in the classrooms of the Department of Pharmacological and Biomolecular Sciences, Via Balzaretti 9, Milan) or online.

Upcoming graduates are also eligible for the interview.

The dates, time and place of in-person interviews will be posted to the degree programme website: <https://biotecnologiafarmaco.cdl.unimi.it/en>

The interview dates will be agreed by e-mail with individual candidates.

#### **Language skills**

Proficiency in English at a B2 level or higher, under the Common European Framework of Reference for Languages (CEFR), is required for admission.

The B2-level requirement will be ascertained by the University Language Centre (SLAM) upon admission as follows:

- Language certificate obtained no more than 3 years earlier, of B2 or higher (for the list of language certificates recognized by the University, see the website: <https://www.unimi.it/en/node/39267/>). The certificate must be uploaded when submitting the online application;
  - Language proficiency achieved over a Bachelor's degree programme of the University of Milan through SLAM. The test must have been passed within the last four years. Our offices will perform an internal check, without the applicant having to attach any statements;
  - Placement test delivered by SLAM. The test schedule will be posted to the website: <https://www.unimi.it/en/node/39267/>.
- All those who fail to submit a valid certificate or do not meet the language proficiency requirement will be invited to the test through the admission procedure.

Candidates who do not sit or pass the placement test will have until 31 October 2022 to obtain and submit a recognized certificate to SLAM.

Students who do not meet the requirement by 31 October will not be admitted to the Master's degree programme and may not sit further tests.

In case of transfer from another degree programme or from another university, the procedures for admission to years subsequent to Year I will be set out by the Academic Board.

For further details, see the section: "How to enrol".

### **Compulsory attendance**

Attendance is compulsory for teaching laboratories, and strongly recommended for all courses.

### **Internship criteria**

You can undertake your thesis internship at the University or other public or private institutions or companies. During your second year, you will be required to attend an interdisciplinary laboratory covering theoretical and practical biotechnology skills. You can apply for your thesis internship starting from the second semester of the 1st year of the programme, provided you have earned at least 30 academic credits (CFU). To start your thesis internship, you must have earned:

- at least 64 CFU, if you have enrolled in the Biotechnology in Drug Research and Development curriculum or in the Development and Production of Biotechnological Drugs curriculum;
- at least 56 CFU, if you have enrolled in the Pharmacogenomics and Precision Therapeutics curriculum.

Upcoming graduates are required to fill out the internship completion form and submit it to their supervisor, who will validate it and send it to the Student Registrar. If you wish to undertake your thesis internship at an external research institution, you must first identify an academic tutor from among the faculty of Pharmacy, who will ensure that you achieve the required learning objectives. Then you can submit your application with your thesis project attached to the Academic Board for approval. This also applies to thesis internships at other universities.

Internships at external research institutions and companies are governed by agreements with COSP. You will have to start a procedure through a dedicated platform. Learn more at <https://www.unimi.it/en/node/483/>

### **Degree programme final exams**

Upcoming graduates must pass a final exam by presenting and defending a written paper on their internship. The paper may be in Italian or English. The final paper completes the student's training as part of the Master's degree programme.

The degree boards will assess the student's entire course of study and, in particular, the consistency between learning objectives and professional goals, as well as cultural, intellectual and oral skills.

### **Campus**

Course venue: Città Studi teaching facilities

### **Laboratories**

The degree programmes is laboratory-intensive. Laboratory courses are compulsory and must be attended in the relevant year. During laboratory practicals, students will learn the rules of safe behaviour.

### **Notes**

ADMISSION CRITERIA: 1ST YEAR OPEN, SUBJECT TO ENTRY REQUIREMENTS

Application for admission is mandatory and must be made electronically from March 15 to August 26, 2022. (<https://www.unimi.it/en/node/92/>).

Applicants already in possession of a bachelor's degree and those who will receive it by October 31, 2022 are eligible to apply.

Full details on curricular requirements and personal background can be found in the "Initial knowledge required" section.

### **Enrolment**

At the end of the evaluation procedures, candidates admitted and already in possession of the degree will have to matriculate online by September 30, 2022.

Only for candidates who will graduate after September 30, 2022 and in any case by October 31, 2022, the deadline for matriculation is November 30, 2022.

For procedures: <https://www.unimi.it/en/study/bachelor-and-master-study/degree-programme-enrolment/enrolment-masters-programme/open-admission-master-programmes>

N° of places reserved to non-EU students resident abroad: 15

## **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 organizations.

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

### **Study and internships abroad**

To increase internationalization, students will be informed on the Erasmus and Erasmus Mundus programs activated within the master course. Lectures of foreign teachers and stages in foreign laboratories will be also proposed. Some of the classes will be given in English to give the students the opportunity to improve the English knowledge, with specific focus on scientific terminology.

More info is available at the link:

<https://www.unimi.it/it/internazionale/studiare-allestero>

<https://www.unimi.it/it/internazionale/studiare-allestero/partire-con-erasmus/come-partecipare/erasmus-aree/erasmus-scienze-del-farmaco>

Procedure for the recognition of study periods abroad: each student must propose a Learning Agreement regarding training activities that lead to the recognition of a number of credits adequate to the period spent abroad. Specifically, 20 CFU for a three-month period; 30 CFU for a six-month period; 45 CFU for a nine-month period.

Evaluation of the period spent abroad: the period of study abroad will be recognized as valid after obtaining at least 70% of the credits specified in the learning agreement, while the activity of the thesis or internship will be valid only after acquisition of all credits.

Incentives: for students who have accomplished satisfactorily the training program, additional points are added to the final

degree mark. Up to a maximum of 3 points can be added depending on the duration of the study period, the amount of credits attained, and the overall results obtained by the student.

### 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 organizes 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; [mobility.out@unimi.it](mailto:mobility.out@unimi.it)

## ACTIVE CURRICULA LIST

Biotechnology in drug research and development Course years currently available: 1st , 2nd

Development and production of biotechnological drugs Course years currently available: 1st , 2nd

PHARMACOGENOMICS AND PRECISION THERAPEUTICS Course years currently available: 1st , 2nd

### Procedure for choosing a curriculum

The choice among the three offered curricula must be done at admission. It is possible to change the curriculum only between the two held in Italian, and only before the end of the first semester.

## CURRICULUM: [E51-C] Biotechnology in drug research and development

### Qualifying Training Objectives

The disciplines and educational activities of the curriculum deal with peculiar aspects of biotechnological research in the biomedical field, with reference to the identification of new therapeutic targets and the design of new biotechnological drugs and innovative therapies, also with the help of computational methodologies.

## 1st COURSE YEAR Core/compulsory courses/activities Curriculum-specific features Biotechnology in drug research and development

Learning activity	Ects	Sector
Biology of development and differentiation	6	BIO/13
Biotechnology in Pharmacology	8	BIO/14
Integrated Systems Physiology	6	BIO/09
Metabolic and Functional Biochemistry	6	BIO/10
Molecular basis of hormone and drug action	8	MED/13, BIO/14
MOLECULAR VIROLOGY	6	BIO/19, MED/07
Organ Pathophysiology	6	MED/04
Purification and formulation of biotechnological drug products	8	CHIM/09, CHIM/08
Structural Bioinformatics and Molecular Modeling	10	BIO/10, CHIM/06,

		CHIM/08
	Total compulsory credits	64
<b>2nd COURSE YEAR Core/compulsory courses/activities Curriculum-specific features Biotechnology in drug research and development</b>		
<b>Learning activity</b>	<b>Ects</b>	<b>Sector</b>
Advanced course in Biotechnology and Pharmacology	7	BIO/14
Innovative biotechnological drugs	9	(3) CHIM/06, (6) BIO/14, (6) CHIM/08
	Total compulsory credits	16
<b>Further elective courses Curriculum-specific features Biotechnology in drug research and development</b>		
Experimental laboratory of Biotechnology	9	ND
<b>End of course requirements Curriculum-specific features Biotechnology in drug research and development</b>		
FINAL EXAM	21	ND
Lab training	10	ND
	Total compulsory credits	31

**CURRICULUM: [E51-D] Development and production of biotechnological drugs**

**Qualifying Training Objectives**

The curriculum is aimed at the acquisition of skills necessary for the production, analysis and formulation of biotechnological drugs, diagnostics and vaccines, more closely related to the phases from the development and clinical testing of biotechnological drugs to their industrial production, up to their release on the market.

<b>1st COURSE YEAR Core/compulsory courses/activities Curriculum-specific features Development and production of biotechnological drugs</b>		
<b>Learning activity</b>	<b>Ects</b>	<b>Sector</b>
Biology of development and differentiation	6	BIO/13
Biotechnology in Pharmacology	8	BIO/14
Clinical Pharmacology and Applied Biochemistry	9	MED/03, BIO/10, BIO/14
Integrated Systems Physiology	6	BIO/09
Metabolic and Functional Biochemistry	6	BIO/10
MOLECULAR VIROLOGY	6	BIO/19, MED/07
Organ Pathophysiology	6	MED/04
Preparation and development of drugs with biotechnological methods	9	CHIM/11, CHIM/08
Purification and formulation of biotechnological drug products	8	CHIM/09, CHIM/08
	Total compulsory credits	64
<b>2nd COURSE YEAR Core/compulsory courses/activities Curriculum-specific features Development and production of biotechnological drugs</b>		
<b>Learning activity</b>	<b>Ects</b>	<b>Sector</b>
Manufacturing of biotechnological drug products	7	CHIM/09
Quality control and analysis for biopharmaceuticals	9	(6) BIO/14, (3) CHIM/06, (6) CHIM/08
	Total compulsory credits	16
<b>Further elective courses Curriculum-specific features Development and production of biotechnological drugs</b>		
Experimental laboratory of Biotechnology	9	ND
<b>End of course requirements Curriculum-specific features Development and production of biotechnological drugs</b>		
FINAL EXAM	21	ND
Lab training	10	ND
	Total compulsory credits	31

**CURRICULUM: [E51-E] PHARMACOGENOMICS AND PRECISION THERAPEUTICS**

**Qualifying Training Objectives**

The curriculum, delivered in English and aimed at foreign and Italian students, is designed to train graduates who are able to face the future challenges in the field of biotechnological drugs.

<b>1st COURSE YEAR Core/compulsory courses/activities Curriculum-specific features</b>		
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<b>PHARMACOGENOMICS AND PRECISION THERAPEUTICS</b>		
<b>Learning activity</b>	<b>Ects</b>	<b>Sector</b>
Bioinformatics and molecular modeling	8	BIO/10, CHIM/06, CHIM/08
Communicable and non-communicable diseases	8	MED/04, BIO/19
Integrated systems physiology	6	BIO/09
Molecular biochemistry and functional biology	10	BIO/10, BIO/13
Omics: from bench to bedside	6	BIO/10, MED/04
Pharmacogenomics, clinical pharmacology, and orphan drugs	7	BIO/14
Protein engineering, drug delivery and regulatory aspects	11	CHIM/09, CHIM/08
	Total compulsory credits	56
<b>2nd COURSE YEAR Core/compulsory courses/activities Curriculum-specific features PHARMACOGENOMICS AND PRECISION THERAPEUTICS</b>		
<b>Learning activity</b>	<b>Ects</b>	<b>Sector</b>
Biomarkers: from identification to exploitation	10	(4) MED/13, (6) BIO/14, (6) CHIM/08
Cell therapy and gene silencing	7	BIO/19, BIO/14, BIO/13
Nanotechnology based medicinal products	7	CHIM/06, BIO/14, CHIM/09
	Total compulsory credits	24
<b>Further elective courses Curriculum-specific features PHARMACOGENOMICS AND PRECISION THERAPEUTICS</b>		
Experimental Laboratory of Biotechnology	9	ND
<b>End of course requirements Curriculum-specific features PHARMACOGENOMICS AND PRECISION THERAPEUTICS</b>		
Final Exam	21	ND
Lab Training	10	ND
	Total compulsory credits	31