UNIVERSITA' DEGLI STUDI DI MILANO
PROGRAMME DESCRIPTION - ACADEMIC YEAR 2020/21
BACHELOR
Biotechnology (Class L-2)
enrolled from 2014/15 academic year

HEADING

Degree classification - Denomination and code:	L-2 Biotechnologies
Degree title:	Dottore
Curricula currently available:	
Length of course:	3 years
Total number of credits required to complete programme:	180
Years of course currently available:	3rd
Access procedures:	
Course code:	K06

PERSONS/ROLES

Head of Interdepartmental Study Programme

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Degree Course website

https://biotecnologia.cdl.unimi.it/it

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CHARACTERISTICS OF DEGREE PROGRAMME

General and specific learning objectives

The Degree Course in Biotechnology aims to provide bachelor students with solid basic knowledge and practical skills in the different fields of biotechnology, favoring interdisciplinary approaches and proposing the study of a range of modern molecular biotechnologies used in the agro-food, environmental, industrial, pharmaceutical and veterinary fields. Notions in bioethics, patenting and legislation, fundraising and management will be also provided. Innovation is the driving force of this course since in a sector in rapid and active development like this, continuous and efficient updating is necessary to keep pace with the rapid increase in scientific knowledge.

Expected learning outcomes

At the end of the three years course, the graduated students must achieve basic knowledge and understanding of mathematics, physics, chemistry, general biology, cellular and molecular biology of prokaryotic and eukaryotic organisms, genetics, microbiology and biochemistry, as well as some skills of management and bioethical aspects.
The acquisition of this basic knowledge allows, in the following three semesters, the deepening of skills specific for the agro-food biotechnology, comparative animal biotechnology, pharmaceutical and molecular bioinformatics biotechnology es. Therefore, methods and applications in the biotechnological field of prokaryotic and eukaryotic organisms, isolated cells and biological macromolecules with the integrated tools of cellular and molecular biology, biochemistry, bioinformatics, genetics and microbiology for the development and implementation of biotechnological methods and processes will be acquired.
The Biotechnology graduate will also acquire knowledge that will enable him to perform assistance and support functions for research and development in the various fields of biotechnology.

Professional profile and employment opportunities

The graduate in Biotechnology will be able to fit into numerous professional contexts including: the agri-food industry, the animal feed and plant production sector, the pharmaceutical industry, the chemical industry, the cosmetic industry and scientific information , the industry and services for environmental biotechnology, reproductive biotechnology laboratories, both in the medical and veterinary fields, biotechnological service centers for the applications of information technology to genomics and proteomics, universities and research laboratories of public and private institutions , certification bodies, structures of the National Health System. Health regulatory agencies and national and international agencies for patent regulations for the exploitation of biotechnological products, including study centers for toxicological and environmental detection are also open sectors for the biotechnologists.
The specific roles and professions of the graduate in Biotechnology, based on the nomenclature and classification drawn up by ISTAT (2012), are identified by the following codes:
- Biochemical laboratory technicians (3.2.2.3.1)
- Food technicians (3.2.2.2.2)
- Agronomist and forestry technicians (3.2.2.1)
- Veterinary laboratory technicians (3.2.2.3.3)
- Zootechnicians (3.2.2.)

The degree course allows you to qualify for the following regulated professions:
- Agricultural biotechnologist (Agri-food curriculum)
- Junior biologist
- Medical-scientific informant (Pharmaceutical curriculum)

Notes

In order to get their degree, students are required to certify their knowledge of the English language at the B1 level. This level can be certified in one of the following ways:

· By submitting their language certificate, taken no more than 3
years before its submittal and attesting a B1 o higher level (for the list of the language certificates which are accepted by the University of Milan, please refer to the website: https://www.unimi.it/en/node/297/).
Students can submit their language certificate during the immatriculation procedure.

· By sitting the placement test run by SLAM, during the first year
exclusively, from September to December. Should they not pass the Placement Test, students will have to attend the English language course organized by SLAM. All students who do not have a valid language certificate must sit the Placement Test. Those students who do not sit the Placement test by December or do not pass the end of course test in one of the 6 attempts granted will have to get a language certificate outside the University of Milan within their degree.

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 30 different 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

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How to participate in Erasmus mobility programs

The students of the University of Milan can participate in mobility programmes, which last 3 to 12 months, through a public selection procedure.
Ad hoc commissions will evaluate:
• 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 generally begins around February each year with the publication of a call for applications specifying the destinations, with the respective programme duration, requirements and online application deadline.

Every year, before the deadline for the call, the University organizes informative meetings to illustrate opportunities and rules for participation to students.

Erasmus+ scholarship
The European Union grants the winners of the Erasmus+ programme selection a scholarship to contribute to their mobility costs, which is 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.

Learn more at https://www.unimi.it/en/international/study-abroad/studying-abroad-erasmus.

For assistance, please contact:
International Mobility Office
Via Festa del Perdono 7 (first floor)
Tel. 02 503 13501-12589-13495-13502
E-mail: mobility.out@unimi.it
Desk opening hours: Monday to Friday 9 am - 12 noon

1st COURSE YEAR (disactivated from academic year 2019/20) Core/compulsory courses/activities common to all curricula

Learning activity	Ects	Sector
English	1	L-LIN/12
Fundamentals of economy and Bioethics	7	(3) MED/02, (4) AGR/01
General and inorganic chemistry	8	CHIM/03
General e Cellular Biology	10	BIO/13
Genetics	8	AGR/07, BIO/18
Mathematics for Biotechnology	6	MAT/09, MAT/01, MAT/02, MAT/03, MAT/04, MAT/05, MAT/06, MAT/07, MAT/08
Organic chemistry	8	CHIM/06
Physics	6	FIS/08, FIS/07, FIS/06, FIS/05, FIS/04, FIS/03, FIS/02, FIS/01
Total compulsory credits	54	

2nd COURSE YEAR (disactivated from academic year 2020/21) Core/compulsory courses/activities common to all curricula

Learning activity	Ects	Sector
Biochemistry	9	BIO/10
General Microbiology	9	BIO/19
Molecular Biology	9	BIO/11
Total compulsory credits	27	

Further elective courses common to all curricula

Lo studente deve acquisire 12 crediti a scelta.

End of course requirements common to all curricula

FINAL EXAM		5	ND
	Total compulsory credits	5	

ACTIVE CURRICULA LIST

Agri-food and environmental Course years currently available: 3°
Bio-industrial Course years currently available: 3°
Pharmaceutical Course years currently available: 3°
Veterinary Course years currently available: 3°

Procedure for choosing a curriculum

The normal duration of the degree course in Biotechnology is three years.

The course is structured in six semesters, during which different types of didactic activities are foreseen for a total of 180 ECTS (European Credit Transfer and Accumulation System), organized in lectures, exercises, practical activities, laboratories, seminars, internship.

A formative credit (ECTS) corresponds to a standard load of 25 hours of activity for the student and is divided as follows:

- 8 hours of theoretical lesson and 17 hours of personal reworking;
- 16 hours of laboratory or training and 9 hours of personal reworking;
- 25 hours of internship and training activities related to the preparation of the final exam - 25 hours of individual study.

The course is divided into a common period, lasting three semesters, in which students acquire the basic molecular, cellular and methodological skills essential for further study. In the following three semesters, the student will be able to choose one of the following curricula to deepen some of their own and professionalising aspects of biotechnology:

- Agri-food and environmental curriculum
- Veterinary curriculum
- Pharmaceutical curriculum
- Bio-industrial curriculum

The choice of curriculum will be formalized with the presentation of the study plan at the end of the first semester of the second year. After that, the student will have the possibility to change the curriculum upon presentation of a motivated request to the Interdepartmental Didactic Board.

Each curriculum has the objective of offering students the opportunity to acquire skills and improve in the areas of Biotechnology that best meet their interests, as specified in the following paragraphs.

CURRICULUM: [K06-A] Agri-food and environmental

Qualifying Training Objectives

The aim of the curriculum is to prepare experts who have basic knowledge in plant and microbial systems interpreted in a molecular and cellular key.

Skills acquired

Graduates will have a detailed knowledge of physiology, biochemistry, genetics and molecular biology, related to development and reproduction of food and non-food crops.

The training will also include skills related to crop genetic improvement; sustainability in agricultural practices; phytopathology; transformation processes to obtain non-food plant products. Particular attention will be paid to the use of molecular techniques in plant and food production, with an emphasis on crop propagation, cultivation, protection, and genetic improvement.

Professional profile and employment possibilities

The agri-food curriculum provides the type of credits necessary to access the profession of agricultural biotechnologist. The agricultural plant biotechnologist will be able to find employment in the following:

- public and private research institutions (MIUR, MIPAF, Agency for New Technologies, Energy and Environment etc.) committed to the development of innovative crops having specific characteristics and reduced environmental impact;
- ARPA and private laboratories that perform GMOs detection in agro-food chains and in the environment;
- plant variety certification centers;
- industrial sectors for the reproduction of food and non-food plants (nursery gardening);
- industrial production of biofertilizers and plant inoculant symbiotic bacteria
- industrial production of high-value plant-based molecules (proteins, vitamins, drugs) and pesticides;
- public and private agencies for phytosanitary control and plant protection;
- public and private centers for environmental remediation and conservation;
- international cooperation

2nd COURSE YEAR (disactivated from academic year 2020/21) Core/compulsory courses/activities

Curriculum-specific features Agri-food and environmental			
Learning activity		**Ects**	**Sector**
Biomolecular methods		6	BIO/10
Botany and cropping systems		9	AGR/02, BIO/01, AGR/04
Chemistry and Biochemistry of Agri-Food Molecules		8	BIO/10, CHIM/06
Plant physiology and biochemistry		8	AGR/13
	Total compulsory credits	31	

3rd COURSE YEAR Core/compulsory courses/activities Curriculum-specific features Agri-food and environmental			
Learning activity		**Ects**	**Sector**
Careers in biotechnology		3	ND
Food Biotechnology		6	BIO/10
In vitro plant breeding		5	AGR/03
Integrated Plant Protection		10	AGR/11, AGR/12
Microbial agrobiotechnology		6	AGR/16
Plant genomics and breeding		12	AGR/07
	Total compulsory credits	42	

End of course requirements Curriculum-specific features Agri-food and environmental			
Lab training		9	ND
	Total compulsory credits	9	

CURRICULUM: [K06-B] Bio-industrial

Qualifying Training Objectives

The curriculum aims at providing detailed knowledge on the biotechnological use of eukaryotic and prokaryotic organisms, cells and biological macromolecules (proteins, both natural and engineered nucleic acids) for the development and improvement of processes and products for the chemical, pharmaceutical, diagnostic, food, personal care fields.

Skills acquired

The student will acquire all the basic tools and knowledge needed in biotechnological research groups, biomedical research support services as well as the field of technical-scientific dissemination and marketing.

Professional profile and employment possibilities

Specific employment opportunities for the molecular-bioinformatics curriculum include junior level positions in research laboratories or biotechnology companies, in particular in big data management for biological and biotechnological data. Students will attend orientation activities, such as meetings and seminars of experts in the various sectors of industrial biotechnology.

2nd COURSE YEAR (disactivated from academic year 2020/21) Core/compulsory courses/activities Curriculum-specific features Bio-industrial			
Learning activity		**Ects**	**Sector**
Animal cell biotechnology		6	BIO/06, BIO/13
Chemical methods for biotechnology		8	CHIM/02, CHIM/06
Fermentation Biotechnology		6	BIO/11, CHIM/11, BIO/18
Plant Biology and Physiology		8	BIO/18, BIO/01, BIO/04
	Total compulsory credits	28	

3rd COURSE YEAR Core/compulsory courses/activities Curriculum-specific features Bio-industrial			
Learning activity		**Ects**	**Sector**
Biochemistry and molecular biology: applications in biotechnology		12	BIO/11, BIO/10
Bioinformatics and biostatistics		9	MAT/09, FIS/08, MAT/01, FIS/07, MAT/02, FIS/06, MAT/03, FIS/05, MAT/04, MAT/05, FIS/04, MAT/06, FIS/03, MAT/07, FIS/02, MAT/08, FIS/01, SECS-S/02, SECS-S/01, INF/01
Careers in biotechnology		3	ND
Computational biology		6	BIO/11, BIO/10, INF/01
Microbial biotechnology		6	BIO/19, BIO/18
Plant industrial biotechnology		9	AGR/07, BIO/18
	Total compulsory credits	45	

End of course requirements Curriculum-specific features Bio-industrial			
Lab training		9	ND

	Total compulsory credits	9	

CURRICULUM: [K06-C] Pharmaceutical

Qualifying Training Objectives

The pharmaceutical curriculum is intended to train graduates to acquire specific knowledges in the methodologies useful to design, produce, test and develop biotechnological drugs, as well as in the information and clinical monitoring of biotechnological drugs.

Skills acquired

Graduates will be able to acquire operational and application skills that allow them to perform: biotechnological analysis and experimentation, production of biotechnological drugs, construction of vectors and engineered systems for the production of drugs, screening of drugs and biotechnological products, research on databases, technical coordination of research groups, development of biotechnological systems for toxicological studies related to drugs and environmental contamination.

Professional profile and employment possibilities

The pharmaceutical curriculum will prepare students for professional activities that involve the development and use of diagnostic tests, quality control in biotechnological industries, the use of biotechnological techniques in biomedical research as well as clinical monitoring of biotechnological drugs, specific skills in the patenting of biotechnological products. The pharmaceutical curriculum prepares for industrial marketing and provides the type of credits needed to access the profession of "medical-scientific informant "

2nd COURSE YEAR (disactivated from academic year 2020/21) Core/compulsory courses/activities Curriculum-specific features Pharmaceutical

Learning activity		Ects	Sector
Human physiology and basic anatomy		10	BIO/09
Informatics and Statistics for Biotechnologies		6	BIO/10, SECS-S/01, INF/01, CHIM/06
Methods in Cell Biology and Biochemistry		6	BIO/10, BIO/13
Pharmacology		8	BIO/14
	Total compulsory credits	30	

3rd COURSE YEAR Core/compulsory courses/activities Curriculum-specific features Pharmaceutical

Learning activity		Ects	Sector
ANALYTICAL METHODS FOR PHARMACEUTICAL BIOTECHNOLOGIES		7	CHIM/01, CHIM/08
Generale Pathology, Immunology and Medical Microbiology		10	(7) MED/04, (3) MED/07
Medicinal Chemistry and Bioprocesses		10	CHIM/11, CHIM/08
Pharmaceutical Technology and Legislation of Biotechnological Medicinal Products		6	CHIM/09
Pharmacological and toxicological biotechnology		10	BIO/14
	Total compulsory credits	43	

End of course requirements Curriculum-specific features Pharmaceutical

Lab training		9	ND
	Total compulsory credits	9	

CURRICULUM: [K06-D] Veterinary

Qualifying Training Objectives

The curriculum aims at training graduates with theoretical and practical skills in the main fields of biotechnology applied to cells, tissues and animal organisms.

Skills acquired

Learning of molecular and cell culture techniques, manipulation and cryopreservation of gametes and embryos of domestic animals and bioinformatics skills applied to the analysis of biological data, acquisition of knowledge of regulatory and bioethical aspects and related to the fields of interest of biotechnology. Students will also acquire techniques related to the development of animal models and in vitro models; principles and approaches of cell therapy and regeneration; cell biology methods such as 2D and 3D cultures and isolation and characterization of stem cells.

Professional profile and employment possibilities

The curriculum provides professional skills required to find employment:
- in public and private scientific research bodies;
- in public and private analytical laboratories;
- in public and private technological development laboratories;
- in pharmaceutical, food and feed industrial sectors;
- in international cooperation institutions.

2nd COURSE YEAR (disactivated from academic year 2020/21) Core/compulsory courses/activities

Curriculum-specific features Veterinary			
Learning activity		**Ects**	**Sector**
Animal physiology and assisted reproduction		9	VET/10, VET/02
Comparative and laboratory animal pathology		7	VET/03
Development, morphology and function of organs and systems		9	VET/01
Veterinary microbiology and immunology		7	VET/05
	Total compulsory credits	32	

3rd COURSE YEAR Core/compulsory courses/activities Curriculum-specific features Veterinary			
Learning activity		**Ects**	**Sector**
Biotechnology applied to animal nutrition and animal origin food		11	(6) AGR/18, (5) VET/04
Computer Science Course		3	INF/01
Infection diseases and zoonosis		5	VET/05
Molecular genetics and animal models		8	AGR/17, AGR/20
Molecular parasitology and parasitic diseases		6	VET/06
Veterinary pharmacology and biotechnology law		9	VET/07, VET/08
	Total compulsory credits	42	

End of course requirements Curriculum-specific features Veterinary			
Lab training		8	ND
	Total compulsory credits	8	

COURSE PROGRESSION REQUIREMENTS

The students have to successfully complete the propaedeutic exams listed in column 1, before those listed in column 2 of the following table.

In the event that the list of propaedeutic exams changes, the students will have to comply with the list approved in the previous Academic Year.

Learning activity	**Prescribed foundation courses**	**O/S**
Biochemistry	General and inorganic chemistry	Recommended
	General e Cellular Biology	Recommended
	Physics	Recommended
	Organic chemistry	Recommended
	Genetics	Recommended
Molecular Biology	Biochemistry	Recommended
	Genetics	Recommended
Bioinformatics and biostatistics	Molecular Biology	Recommended
	Genetics	Recommended
Plant Biology and Physiology	General and inorganic chemistry	Core/compulsory
	General e Cellular Biology	Core/compulsory
	Organic chemistry	Recommended
	Genetics	Recommended
Fermentation Biotechnology	Biochemistry	Recommended
	General Microbiology	Recommended
Biochemistry and molecular biology: applications in biotechnology	Biochemistry	Recommended
	Molecular Biology	Recommended
	General and inorganic chemistry	Recommended
	Genetics	Recommended
Plant industrial biotechnology	Genetics	Recommended
Microbial biotechnology	General Microbiology	Recommended
Molecular genetics and animal models	Genetics	Core/compulsory
Infection diseases and zoonosis	General Microbiology	Core/compulsory
Pharmaceutical Technology and Legislation of Biotechnological Medicinal Products	Pharmacology	Core/compulsory
	General and inorganic chemistry	Core/compulsory
	Methods in Cell Biology and Biochemistry	Core/compulsory
	Organic chemistry	Core/compulsory
ANALYTICAL METHODS FOR PHARMACEUTICAL BIOTECHNOLOGIES	Biochemistry	Core/compulsory
	General and inorganic chemistry	Core/compulsory
	Physics	Core/compulsory
	Organic chemistry	Core/compulsory
Pharmacological and toxicological biotechnology	Biochemistry	Core/compulsory
	Pharmacology	Core/compulsory
	Human physiology and basic anatomy	Core/compulsory
Pharmacology	General e Cellular Biology	Core/compulsory
Generale Pathology, Immunology and Medical Microbiology	Biochemistry	Core/compulsory
	Human physiology and basic anatomy	Core/compulsory
	General Microbiology	Core/compulsory

Medicinal Chemistry and Bioprocesses	Biochemistry	Core/compulsory
	General and inorganic chemistry	Core/compulsory
	Organic chemistry	Core/compulsory
Human physiology and basic anatomy	General e Cellular Biology	Recommended
	Physics	Recommended
Methods in Cell Biology and Biochemistry	Biochemistry	Recommended
	Molecular Biology	Recommended
	General e Cellular Biology	Recommended
Microbial agrobiotechnology	Biochemistry	Recommended
	Molecular Biology	Recommended
	General Microbiology	Core/compulsory
Integrated Plant Protection	General e Cellular Biology	Core/compulsory
	Plant physiology and biochemistry	Core/compulsory
	Botany and cropping systems	Core/compulsory
Food Biotechnology	Biochemistry	Recommended
	Biomolecular methods	Recommended
Plant genomics and breeding	Molecular Biology	Recommended
	Biomolecular methods	Recommended
	Genetics	Core/compulsory