



UNIVERSITÀ DEGLI STUDI DI TORINO

**MASTER IN CELLULAR AND MOLECULAR BIOLOGY - BIOLOGIA
CELLULARE E MOLECOLARE**
CLASS: LM-6



STUDENT'S GUIDE (MANIFESTO DEGLISTUDI)

Academic Year 2022-2023

The Master in **Cellular and Molecular Biology - Biologia Cellulare e Molecolare** is two years long.

The objective of the Master in **Cellular and Molecular Biology - Biologia Cellulare e Molecolare (CMB)** is to prepare Biologists endowed with a profound and integrated knowledge of the biological systems, going from the molecular and cellular level to complex organisms. Such Biologists will be able to spend their knowledge in specific areas of applied biology such as biotechnology, biomedicine and neurosciences.

The Master course, totally hold in English, will be organized with a common part and with three different tracks.

The common part includes activities aimed to enhance the education in fundamental biomolecular disciplines such as biochemistry, molecular biology, cell biology, cell physiology, microbiology, molecular pharmacology and also the knowledge about mathematical and computer tools.

Educational activities specific for each track (**biomolecular**, **biomedical** and **neurobiological**) will allow the students to deepen their knowledge and skills respectively in:

- biophysics, molecular structure, bioinformatics and system biology;
- in the areas of human anatomy, medical genetics and general pathology, with particular reference to the underlying mechanisms of diseases;
- in the areas of neuroanatomy, molecular and developmental neurobiology, biophysics.

Significant competences in advanced innovative and/or experimental methodologies will be provided by both curricular teachings and the large amount of time dedicated to the experimental Master thesis. This latter can be developed both in Italy or abroad, in view of internationalization agreements and student outgoing mobility.

On the whole these activities will provide the students with a good command of the scientific method of investigation, conferring a good degree of autonomy in planning and execution of scientific experiments, as well as in the interpretation, discussion and presentation of results.

Some courses also present and discuss bioethical issues as well as the impact on both society and environment of the proposed methodologies.

Educational activities can include lectures, laboratory activities, seminars. Training activity, when scheduled, will consist in spending a period of time in research, industry or hospital laboratories.

The Master in Cellular and Molecular Biology - Biologia Cellulare e Molecolare conforms to the national tuning criteria defined by the Italian University Corporation of Biologists.

ADMISSION REQUIREMENTS AND VERIFICATION MODALITIES

1. Students willing to enroll in the Master in Cellular and Molecular Biology - Biologia Cellulare e Molecolare must possess the following requirements:

- **Bachelor or University Degree** obtained with a three year course, or equivalent title obtained abroad.
- **Minimum curricular requirements (see comma 3)**
- **Adequate personal background (see comma 4)**. The enrollment without an appropriate background is not allowed.

2. The admission to The Master in Cellular and Molecular Biology - Biologia Cellulare e Molecolare is **not programmed**.

3. **Curricular requirements:** To be admitted to the test, candidates must possess at least 60 ECTS of basic/characterizing activities described in the Ministerial Table of L-13 class of degree (Biological Sciences), i.e. in one or more of the following disciplines (SSD): BIO/01, BIO/02, BIO/03, BIO/04, BIO/05, BIO/06, BIO/07, BIO/09, BIO/10, BIO/11, BIO/12, BIO/14, BIO/16, BIO/18, BIO/19, CHIM/01, CHIM/02, CHIM/03, CHIM/06, FIS/01-08, INF/01, MAT/01-09, ING-INF/05, MED/04, MED/42.

If the candidate is not in the possession of the above curricular requirements, she/he will have the opportunity to obtain the lacking ECTS by enrolling to single courses and passing the relative exams **before applying** for admission to the test.

4. **Adequate personal background.** Irrespective from possession of the curricular requirements, enrollment to the Master depends on getting through the admission test aimed to verify the adequate personal background in several topics (see ***Syllabus***). The written test comprises 60 multiple choice questions. To be directly admitted, at least 70% of questions must be correctly answered. In the case of an online exam, the entry test Committee, formed by at least three teachers of the Master course, reserves to verify the answers given by the students through an oral interview. Students with at least 50% of questions correctly answered will be interviewed by the Committee that will orally verify if their preliminary knowledge on the topics of the Syllabus

(see below) and their English level are appropriate for the admission to the Master course. In addition to the topics summarized by the Syllabus, that are included in the admission test, every single teaching can require specific knowledge. This is clearly indicated on the teaching webpage (<https://cmb.campusnet.unito.it/do/corsi.pl/Search?title=In%20alfabetical%20order>) and the possession of such prerequisites is on student responsibility.

5. If specifically required by the candidate, the Admission Committee could evaluate, on the basis of single courses program (Diploma Supplement) the equivalence of ECTS obtained in SSD different from those reported in the Syllabus.

Syllabus. Topics included in the online written admission test are indicated below. In addition, some textbooks and websites are provided to candidates willing to deepen their knowledge.

Anatomy and Physiology: Structure and function of the locomotor, cardiovascular, digestive, respiratory, excretory, genital endocrine and nervous systems. Structure and function of biological membranes. Diffusion fluxes.

Reference material:

- W. Bemis, W.F. Walker, K. Liem, 'Functional anatomy of the vertebrates: an Evolutionary Perspective', 4th edition, 2008, Thomson Brooks/Cole, or equivalent.
- K. Saladin, 'Human Anatomy', 3rd edition, 2013, McGraw-Hill, or equivalent.
- B. Alberts et al., 'Essential Cell Biology', 2013, 4th edition, Garland, or equivalent.
- P. Willmer et al. 'Environmental Physiology of Animals', 2004, 2nd edition, Wiley-Blackwell, or equivalent.

Biochemistry: Structure and function of biological macromolecules with particular emphasis on proteins (different levels of organization). Enzymes: basic concepts and mechanisms of enzymatic catalysis (Michaelis-Menten constant, allosteric regulation and inhibition). Principles of bioenergetics and metabolic pathways. Basic methods for purification and characterization of proteins (SDS-PAGE, chromatography, UV-vis spectroscopy).

Reference material: one of the following books

- D.L. Nelson, M.M. Cox, 'Lehninger, Principles of Biochemistry', 2012, 6th edition, W.H. Freeman
- C.K. Mathews, K.E. van Holde, Applin D.R., Anthony-Cahill S.J. 'Biochemistry', 2012, 4th edition, Pearson.
- J.M. Berg, J.L. Tymoczko, L. Stryer 'Biochemistry', 2012, 7th edition, W.H. Freeman
- D. Voet, J.G. Voet, C.W. Pratt: 'Fundamentals of Biochemistry', 2012, 4th edition, Wiley.

Cell Biology: Elements of cell communication and signal transduction. Cell junction and adhesion. Regulation of the cell cycle. Cell death and survival. Protein trafficking. Basic cell culture techniques.

Reference material:

- B. Alberts et al., 'Essential Cell Biology', 2013, 4th edition, Garland, or equivalent.

Cytology and Histology: Structure and function of eukaryotic cell (plasma membrane, organelles, mitosis, meiosis). General characteristics and functions of the main tissues (epithelial, connective, muscular, nervous). Immunohistochemistry.

Reference material:

- J. Kerr, 'Functional Histology', 2010, 2nd edition, Elsevier, or equivalent.
- R. Colombo, E. Olmo, 'Biologia - cellula e tessuti', 2014, Edi Ermes, or equivalent.

English Language: Common European Framework (CEF) B1 level.

Laboratory skills: Preparation of solutions. Basic knowledge of methods for solution and dilution. Notions of laboratory safety.

Microbiology: Structure and function of the prokaryotic cell. Microbial metabolism. Microbial growth. Microbial genetics. Basic knowledge of methods for cultivation, quantification, and identification of bacteria. Viruses: structures and replication strategies.

Reference material:

- Brock 'Biology of Microorganisms', 2014, 14th edition, Pearson.

Molecular Biology and Genetics: DNA and RNA structures. Structure of genomes. Replication, mutation and DNA repair. Transcription, RNA processing and protein synthesis. Principles of gene expression regulation. Basic recombinant DNA techniques. Genetic recombination and heredity. Fundamentals of population genetics. Basic knowledge of bioinformatics.

Reference material: one of the following books

- R. Raven, G. Johnson, K. Mason, J. Losos, S. Singer, 'Genetica e Biologia molecolare', 2012, Piccin, or equivalent.
- J.D. Watson et al. 'Recombinant DNA: Genes and Genomes — A Short Course', 3rd edition, Cold Spring Harbor Laboratory Press
- T.A. Brown, 'Introduction to Genetics: A molecular Approach', 2011, Garland Science.

6. Within the terms fixed by the Academic Senate, students getting their degree in the year can enroll during the same academic year (A.Y.).

7. Admission A.Y. 2022-2023

Candidates willing to enroll to the Master in Cellular and Molecular Biology - Biologia Cellulare e Molecolare must follow the rules reported on the Master website, section 'How to apply' (https://cmb.campusnet.unito.it/do/home.pl/View?doc=/edu/How_to_apply.html). The **windows to apply** to the Admission tests are: July 4 - September 2, for the one held on September 12, 2022 and July 4 - September 16 for the one held on September 26, 2022.

Admitted candidates must enroll online at www.unito.it and then submit the required registration application to the Student Secretariat together with the fee payment receipt (**until January 19th**).

ENROLLMENT RULES AND CAREER PLANNING

Every year the Master Board fixes in the Didactic Regulation, as well as in the present Student's Guide (Manifesto degli Studi), the suggested training route, leaving place to student's own choices.

The student presents her/his career planning according to the possibilities indicated in the present Student's Guide (Manifesto degli Studi) within the time frame fixed every year by the Academic Senate, and published on the University website (<http://www.unito.it/servizi/lo-studio/piano-carriera>).

According to the Students' Regulation, the enrollment to the Master in Cellular and Molecular Biology - Biologia Cellulare e Molecolare can be full-time or part-time. As for full-time enrollment, students must present a career planning with a minimum of 37 ECTS and a maximum of 60 ECTS/A.Y. Those ECTS that are not obtained one year after the first enrollment remain loaded into the career planning for the subsequent years. Part-time students

must present a career planning with a minimum of 20 and a maximum of 36 ECTS/A.Y. Part-time choice must be indicated at enrollment (such a choice can be modified every year).

The career planning can be organized taking into account a period longer than normal if the student is part-time, or shorter than normal if student's marks in the previous A.Y. are excellent.

The career plannings that do not conform to the suggested route, but conforming to the didactic regulation, are submitted for approval to the Master Board. Board decisions are taken at least 40 days before the deadline to present the career planning.

ECTS/CFU

The whole Master comprises 120 ECTS. The ECTS measures the learning work required to a student according to decree 87/327/EEC, June 15, 1987, and corresponds to 25 hours of educational/training activity. **One ECTS is normally equivalent to:**

- 8 h lectures + 17 h personal study, or
- 14-16 h single place practice + 9-11 h personal study, or
- 14-16 h laboratory practice with data elaboration + 9-11 h personal study, or
- 25 h group practice or laboratory practice without data elaboration.

Didactic activity typology

B. Characterizing activities;

C. Related and integrative activities;

D. Student's choice activities (free ECTS);

E. Master thesis preparation and final exam;

F. Further training activities.

Total: 120 ECTS

Requirements to obtain the Master Degree

The student must obtain at least 120 ECT, according to the indications included in the two-year Master schedule of training activities and curricular ECTS.

Time reserved to personal study

The time reserved to personal study and/or to other individual training activities is about 60% of total time commitment. Such percentage can decrease in the presence of training activities endowed with very high experimental or practical implications.

ATTENDANCE TO TRAINING ACTIVITIES

Attendance to practice exercises is due for at least 70% of total time. As for further training activities, attendance is required for 100% of total time. Training activities related to the Master thesis are certified by the Supervisor.

Duty of attendance to each course are fixed by teachers and published on the Master website

(http://lmbiologia.campusnet.unito.it/do/home.pl/View?doc=LM_BiologiaCellulareMolecolare.html).

EXAM REGISTRATION

Exams must be taken within the three session indicated in the A.Y. 2016-2017 calendar. To apply to the exams the students must use the University Portal (<http://www.unito.it>), by logging in to [login - MyUniTO](#) with their own credentials and entering the menu 'Esami > Appelli disponibili'. The application can be done from any internet point. Exam official registration is through an online software: marks will be directly entered on the system by teachers, and imported into the student's career. More information can be found on the Master website at this link: http://cmb.campusnet.unito.it/do/home.pl/View?doc=ForThose_ExamInfo.html

ORIENTATION E TUTORING

Study counseling is provided by reference teachers of the Master (Attachment A). Active counseling can be provided, in particular to students enrolled in the first year of the Master, also to verify the results of the admission test as well as of the retaken of failed exams. Tutoring to students working to their thesis is remitted to the Supervisor. As for counseling aimed to employment, students can refer to the Job Placement office, pertaining to the School of Nature Science.

ADVANCEMENT VERIFICATION

A conclusive test, in English language, to ascertain student training is required at the end of every didactic activity. The test for training activities organized into modules is unique and not split into the different modules. In case of integrated verifications among different courses, the final mark derives from the weighed mean of the marks obtained in every module, independently from the success in the single module test. By passing the exam the student acquires the ECTS attributed to the course. The evaluation is provided by Committees including the teacher responsible for the single specific course, according to the rules reported in the University Didactic Regulation. The exams consist in a written test with multiple choice questions and at least one open question, that can be followed, at student's choice, by an oral exam. Modality of this final evaluation and the possibility of *in itinere* verifications are declared every year by the responsible teacher at the beginning of the specific didactic activity. Evaluation modality must be the same for each student, and must conform to what declared at the beginning of the A.Y. Verification for 'F' activities (see above) consists in attendance check.

MASTER THESIS PREPARATION AND FINAL EXAM

Since a.y. 2021/22 to present the experimental thesis project student must have acquired at least 40 credits including Advanced Cell Biology and Biotechnology.

After passing all the verifications of the educational and training activities included in the study planning and acquiring 120 ECTS, included those dedicated to the Master thesis, the student, independently from the number of years since enrollment, is admitted to the final exam, consisting in the public discussion, in front of a judging committee, of a Master thesis in Cellular and Molecular Biology.

Master thesis characteristics and preparation. The Master thesis is a dissertation written in English, developed by the candidate. It must be organized according to the rules accepted by the international scientific community, describing in details and conformingly to the scientific standard: the state of the art of the selected topic, the scientific problem addressed, the experimental approach adopted, the methodology used and the results obtained. The thesis must include a discussion of the results and a reference section.

On the whole the training activity corresponds to 35 ECTS (875 h) for the Neurobiological track and to 39 ECTS (975 h) for the Biomedical and Biomolecular tracks. The experimental work must be developed in a field coherent with the objectives of the Master, to be performed in laboratories pertaining to a University Department or to external entities, national or international, public or private, provided the existence of an agreement with the University of Turin. The experimental activity is under the responsibility of a teacher of the Master in Cellular and Molecular Biology - Biologia Cellulare e Molecolare or a teacher of another Master, belonging to a SSD included among the 'characterizing' or the 'related and integrative disciplines' of the Master. Such a teacher, defined *Supervisor*, is responsible for the research activity developed by the student. The status of Supervisor for a teacher of another Master and not belonging to one of the above mentioned SSDs must be evaluated and approved by the track Coordinator.

Final exam evaluation. The final evaluation of student's career will take into account the marks obtained in both the single courses and the Master thesis. The judging committee, composed by at least 7 teachers, will give to one of these members the duty of *Examiner*, in charge of evaluating the scientific level of the thesis. This latter will be discussed by the candidate in English or Italian, in a public dissertation, in the presence of the judging committee. Taking into account both the Supervisor and the Examiner opinions, the committee will give a mark from 0 to 10, taking into account the written text and the oral presentation (8 marks as a whole) and efficiency (2 marks if the student is discussing her/his thesis in the first or second working sessions). Moreover, the judging committee will evaluate study vacations abroad lasting at least 3 months (1 mark for 3 month stay, 2 marks from 4 month on; these marks will be assigned only if not exceeding the 0-10 range derived from the evaluation of the written test, the oral presentation and the efficiency, as reported above). Total point is calculated by adding marks given to the final exam to the mean of all the other exams passed during the Master, applying the following formula: $\text{SUM}(\text{mark_single_exam} \times \text{ECTS_single_exam}) / (\text{total ECTS exams})$, expressed on a scale of 110. Only exams evaluated with marks, including those chosen by the student, can enter the weighed mean reported above. The *cum laude* of single exam marks are not used to calculate the weighed mean, while they are taken into account to reach the final *summa cum laude* evaluation. This latter is possible only if the total point (final exam + mean of exam marks) is 110/110 or above. Each *cum laude* will be calculated 2 marks that will be added to the total point of 110/110. Students who reach or go over 115/110, even if in the absence of *cum laude* marks, will receive a *summa cum laude* evaluation. This modality of calculation for the final *summa cum laude* evaluation will be adopted starting from the degree session of July 2021. In addition, but only in the presence of a *summa cum laude* mark, with a unanimous vote, the committee can confer the honorable mention to the excellent study career, or the printing dignity (through the publication on the Master website of the thesis abstract) to recognize the excellent quality of the scientific work presented.

ECTS ACKNOWLEDGMENT FOR ADMISSION TO PROFESSIONAL REGISTER AND TO III LEVEL UNIVERSITY EDUCATION

The Master in Cellular and Molecular Biology - Biologia Cellulare e Molecolare provides 120 ECTS that allow the graduate to:

- enroll in the 'A' Biologist National Register, after passing the State exam;
- be introduced to professional activities and projects in basic and applied research institutes, in private and public biomedical laboratories, in pharmaceutical companies, and also to activities aimed at promoting and developing scientific and technological innovation, and management and design of molecular and cellular technologies;

- enter pertinent PhD Schools, in Italy or abroad;
- enter Specialty Schools pertaining to the School of Medicine, possibly opened to people graduated in LM-6 class.

A.Y. 2022-2023: DIDACTIC ACTIVITY SCHEDULE AND ORGANIZATION

Educational/training activities in the Master are distributed into two periods (semesters) of 14-15 weeks, followed by a period of 5-6 weeks for exams. Additional evaluation periods are July (1-31) and September (1- 24), with two calls for each course. Table 1 shows the didactic windows fixed for the A.Y. 2022-2023.

Table 1. A.Y. 2022-2023: DIDACTIC WINDOWS

PERIOD	LECTURES	EXAMS
I semester	from October 3rd 2022 to January 20th 2023	from January 23rd 2023 to March 3rd 2023
II semester	from March 6th 2023 to June 16th 2023	from June 19th 2023 to July 31st 2023 and from 1st to 22nd September 2023

EXAM CALLS A.Y. 2022-2023

- From 01/23 to 03/03 - two calls for each course;
- From 06/19 to 07/31 - two calls for each course;
- From 09/01 to 09/22 – one call for each course.

ACTIVITY DISTRIBUTION IN THE MASTER IN CELLULAR AND MOLECULAR BIOLOGY - BIOLOGIA CELLULARE E MOLECOLARE.

I° YEAR						
Period	Track	Typology	Course	SSD	ECTS	Teacher
I°	Common	B	Advanced Cell Biology and Biotechnology	BIO/06	9	Perroteau Gambarotta
	Biomedical Biomolecular	B	Virology	BIO/19	6	Gribaudo
	Biomedical Biomolecular	B	Cell Physiology	BIO/09	6	Munaron
	Common	B	Oncology and Molecular Pathology	MED/04	6	Costelli Tamagno
	Neurobiological	B	Neuroanatomy and Imaging (modulo Neuroanatomy)	BIO/16	5	Gotti
	Neurobiological	B	Cellular Neurobiology	BIO/06	5	Bovolin

II°						
	Common	B	Advanced Molecular Biology	BIO/11	9	De Bortoli
	Biomedical Biomolecular	B	Metabolic Biochemistry	BIO/10	6	Di Nardo Sadeghi
	Common	B	General and Molecular Pharmacology	BIO/14	6	Canaparo
	Common	C	Bioinformatics	INF/01	6	Beccuti Cordero
	Neurobiological	B	Developmental Neurobiology	BIO/06	6	De Marchis
	Neurobiological	B	Neuroanatomy and Imaging (modulo Imaging)	BIO/16	4	TBD
	Common	E	Thesis preparation	-	10	-
II° YEAR						
Period	Track	Typology	Insegnamento	SSD	ECTS	Teacher
	Biomedical					
I°		B	Human Anatomy	BIO/16	6	Gotti
		B	Immunopathology and Pathophysiology	MED/04	6	Autelli Penna
		B-C	Medical and Cancer Genetics	MED/03:3CFU MED/08:3CFU	6	Giachino TBD
*		E	Thesis preparation	-	29	-
*		F	Further training activities	-	1	-
**		D	Optional courses	-	8	-
	Biomolecular					
I°		C	System Biology	INF/01:3CFU FIS/02:3CFU	6	Cordero Caselle Osella
		B	Structure of Macromolecules and Proteomics	BIO/10	6	Sadeghi Di Nardo
		B	Biophysics	BIO/09	6	Fiorio Plà Munaron
*		E	Thesis preparation	-	29	-
*		F	Further training activities	-	1	-
**		D	Optional courses	-	8	-
	Neurobiological					
I°		B	Neurophysiology	BIO/09	6	Fiorio Plà Buffo
		B	Structure of Macromolecules and Proteomics	BIO/10	6	Sadeghi Di Nardo
		B	Neural plasticity and behavior control	PSI-02	6	Buffo
*		E	Thesis preparation	-	26	-
*		F	Further training activities	-	4	-
**		D	Optional courses	-	10	-

TBD: to be defined

* II° year, no period restrictions.

**** second period of the I° year, or every period in the II° year.**

Students must obtain 8 (Biomedical and Biomolecular tracks) or 10 (Neurobiological track) free ECTS with optional courses, chosen among those offered by the University of Turin or other partner Universities, provided these are coherent with the objectives of the Master.

Optional courses providing 4 ECTS activated by the Master Cellular and Molecular Biology - Biologia Cellulare e Molecolare for the A.Y. 2022-2023 are:

- FORENSIC GENETICS AND LEGAL MEDICINE (prof. Robino)
- IMAGING (to be named)
- BEHAVIORAL NEUROENDOCRINOLOGY (prof. Panzica)
- CELLULAR NEUROBIOLOGY (prof. Bovolin)
- MEDICAL GENETICS (prof. Giachino)
- CANCER GENETICS (prof. Roetto, to be named)
- NEUROPHARMACOLOGY (prof. Canaparo)
- GOOD MANUFACTURING PRACTICE IN A HOSPITAL LABORATORY (to be named)
- TRANSLATIONAL BIOMEDICINE (prof. Lo Iacono)

The choice of the optional courses to include in the career plan is under students' responsibility, who must verify the didactic period of the course as well as if the specific course will be activated in the A.Y. 2022-2023.

Detailed program of each course is available from teachers and is published on the Master website (<http://cmb.campusnet.unito.it/do/home.pl/View?doc=CourseSynopsis.html>).

Students can complain about teaching activities, including lectures, practice, exams, etc., by informing their representatives who should send an email to the President of the Master and to the Didactic manager.

Attachment A

Student Secretary

Responsible Ms. Maria Pina Bombino - via Santa Croce 6, phone 011.6704634

President of the Master:

Prof. Giovanna Di Nardo
Department of Life Science and Systems Biology
Via Accademia Albertina, 13
Tel. 011 670 4689
Fax 011 670 7753
e-mail giovanna.dinardo@unito.it
Reception: appointment by phone call or e-mail.

Monitoring and Reassessment Committee of the Master in Cellular and Molecular Biology - Biologia Cellulare e Molecolare:

- Paola Costelli
- Silvia de Marchis
- Giovanna Di Nardo
- Giovanna Gambarotta
- Stefano Gotti
- Marco Guenza (Student)
- Rachele Temponi (Student)

Reference teachers

Patrizia Bovolin
Francesca Cordero
Paola Costelli
Michele De Bortoli
Silvia De Marchis
Giovanna Di Nardo
Giovanna Gambarotta
Claudia Giachino
Giorgio Gribaudo

Tutor teachers

Paola Costelli
Michele De Bortoli
Giovanna Di Nardo
Giovanna Gambarotta
Giorgio Gribaudo
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