



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 2020-2021

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 *curricula*.

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

Educational activities specific for each curriculum (**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 50 multiple choice questions. To be admitted, at least 60% of the proposed questions must be correctly answered. At the end of the admission procedure, candidates will be allowed to access the system in order to check how many correct answers they provided.

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%20alphabetical%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 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 proteins (allosteric regulation). Enzymes: basic concepts and mechanisms of enzymatic catalysis. Principles of bioenergetics and metabolic pathways. Basic methods for purification and characterization of proteins.

Reference material: one of the following books

- D.L. Nelson, M.M. Cox, 'Lehninger, Principles of Biochemistry', 2012, 6th edition, W.H. Freeman http://bcs.whfreeman.com/lehninger6e/#t_824263
- 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 http://bcs.whfreeman.com/berg7e/#t_644431
- 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.
- <http://www.ncbi.nlm.nih.gov/books/?term=cell+biology>
- <https://www.youtube.com/watch?v=kbhQ29vRqs4>
- <https://www.youtube.com/watch?v=pP0xERLUhyc>

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.

Reference material:

- https://www.youtube.com/watch?v=UJPv2JVO_9Y;
- <https://www.youtube.com/watch?v=A2Yylo8vSCA;>
- https://www.youtube.com/watch?v=MG86IFZi_XM;
- <https://www.youtube.com/watch?v=v6dnEp58mVk;>
- <https://www.youtube.com/watch?v=8p8c-BfWZVY>

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.
- <https://www.hhmi.org/biointeractive>

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. 2020-2021

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 'Admission test enrollment' (<http://cmb.campusnet.unito.it/do/home.pl/View?doc=HowToEnroll.html>). The **windows to apply** to the Admission tests are: July 2 - September 3, for the one held on September 11, 2020 and July 2 - September 18 for the one held on September 24, 2020.

The Admission tests will be held on line via webex.

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 20th**).

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://Imbiologia.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. 2020-2021 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

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. Generally, 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.

Due to the Covid-19 health emergency, the laboratory activity (both in Italy and abroad) has been interrupted few times during the A.Y. 2019-2020, making difficult for students to work on their experimental thesis. For this reason, thesis not conforming to the schedule reported above will be accepted during the whole A.Y. 2019-2020. In this regard, no specific standard is required: the final dissertation might remain an experimental thesis (wherever possible), or might be a review of existing literature, or a research project, or the critical analysis of existing data, etc. It is however mandatory that the thesis reflects the student's original contribution. No thesis proposal form is required for the A.Y. 2019-2020 degree sessions.

On the whole the training activity corresponds to 35 ECTS (875 h) for the Neurobiological curriculum and to 39 ECTS (975 h) for the curricula Biomedical and Biomolecular. 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. For the Neurobiological curriculum, at least 10 ECTS must be obtained with training in neuroscience research. 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 Consultive Paritetic Committee of the Master.

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 in every degree session of the A.Y. 2019-2020). 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). 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: $SUM (mark_single_exam \times ECTS_single_exam) / (total \ ECTS \ exams)$, 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. Students who reach or go over 110/110, and are endowed with a curriculum including at least three exam marks *cum laude*, or reach a total point of at least 115 in the absence of *cum laude* marks will receive a *summa cum laude* evaluation. 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. 2020-2021: 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. 2020-2021.

Table 1. A.Y. 2020-2021: DIDACTIC WINDOWS

PERIOD	LECTURES	EXAMS
I semester	from September 28th 2020 to January 15th 2021	from January 18th 2021 to February 26th 2021
II semester	from March 1st 2021 to June 11th 2021	from June 14th 2021 to July 31th 2021 and from 1st to 24th September 2021

EXAM CALLS A.Y. 2020-2021

- From 01/18 to 02/26 - two calls for each course;

- From 06/14 to 07/31 - two calls for each course;
- From 09/01 to 09/24 – one call for each course.

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

I° YEAR						
Period	Curriculum	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 Cutrupi
	Biomedical Biomolecular	B	Metabolic Biochemistry	BIO/10	6	Di Nardo Sadeghi
	Common	B	Molecular Pharmacology	BIO/14	6	Canaparo Serpe
	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	Curriculum	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	6	Cordero

				FIS/02:3CFU		Caselle
		B	Structure of Macromolecules and Proteomics	BIO/10	6	Sadeghi Di Nardo
		B	Biophysics	BIO/09	6	Fiorio Pla Munaron
*		E	Thesis preparation	-	29	-
*		F	Further training activities	-	1	-
**		D	Optional courses	-	8	-
	Neurobiological					
I°		B	Neurophysiology	BIO/09	6	Fiorio Pla Buffo
		B	Structure of Macromolecules and Proteomics	BIO/10	6	Sadeghi Di Nardo
		B	Cognitive Neuroscience	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 curricula) or 10 (Neurobiological curriculum) 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. 2020-2021 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 (to be named)

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. 2020-2021.

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. Paola Costelli
Department of Clinical and Biological Sciences
Corso Raffaello 30
Tel. 011 670 7766
Fax 011 670 7753
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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 - paola.costelli@unito.it - 011 670 7766
- Riccardo Autelli - riccardo.autelli@unito.it - 011 670 7761
- Silvia de Marchis - silvia.demarchis@unito.it - 011 670 6605
- Giovanna Di Nardo - giovanna.dinardo@unito.it - 011 670 4689
- Fabio Grieco (Student)
- Cristina Fiameni (Student)

Reference teachers

Marco Beccuti
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
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