



## **Didactic offer of the Master of Science in Quantitative and Computational Biology A.Y. 2023/2024**

Approved by the Board of the CIBIO Department updated 06/04/2023  
Approved by the Board of the Department of Engineering and Information Science on 16/03/2023  
Approved by the Board of the Department of Mathematics on 15/03/2023  
Approved by the Board of the Department of Physics on 15/03/2023

### **Activation**

In the academic year 2023/2024, the Master of Science in Quantitative and Computational Biology belonging to the class LM-8 - Industrial Biotechnologies is activated at the Department of Cellular, Computational and Integrated Biology – CIBIO. The course of study is activated with three associated departments: the Department of Information Engineering and Computer Science, the Department of Mathematics, and the Department of Physics.

### **Course eligibility, requirements, and admission standards**

To be admitted to the Master's Degree Programme in Quantitative and Computational Biology, you must hold a Bachelor's degree in the following disciplines and related degree classes: Biotechnology (L-2), Information Engineering (L-8), Biological Sciences (L-13), Agri-food Sciences and Technologies (L-26), Chemical Sciences and Technologies (L-27), Pharmaceutical Sciences and Technologies (L-29), Physical Sciences and Technologies (L-30), Computer Sciences and Technologies (L-31), Mathematical Sciences (L-35), or another qualification obtained abroad and recognized as suitable. For detailed information, see the didactic regulations on the Master of Science website ([www.unitn.it/clm/qcb](http://www.unitn.it/clm/qcb)).

Given the innovative nature of the contents and methods of the course, the limited availability of equipment and scientific laboratories for the internship, and therefore the limited number of internships that can be activated, the Board of the CIBIO Department, the Department of Information Engineering and Computer Science, the Department of Mathematics and the Department of Physics of the University of Trento have determined that the availability to fit students for this Degree Course in the academic year 2023/2024 cannot exceed the number of 45.

### **Educational activities planned for the a.y. 2023/2024 for students enrolled from the a.y. 2023/2024.**

The educational offer is organized into two paths called "Biotechnological Track" and "Quantitative Track", which provide opportunities for students to integrate their backgrounds according to their prior preparation. The educational offer proposed in the courses focuses more on biotechnological and quantitative content.

**Students enrolled in the academic year 2022/2023 must refer to the section "Final and transitional rules" of this Didactic offer.**

**First-year lessons will begin on September 25<sup>th</sup>, 2023 while second-year lessons will start on September 11<sup>th</sup>, 2023. First-year courses borrowed from other departments may have different starting dates.**



**Compulsory Courses - Biotechnological Path**

Year	Code	Name of the course	T.A.F.	Hours	Credits	SSD (SCIENTIFIC DISCIPLINARY SECTOR)	Semester	Professor
1	146202	<b>Biostatistics</b>		<b>96</b>	<b>12</b>			
		Mod. Mathematical Methods for Biostatistics	Related	48 classroom hours	6	MAT/06	1	M. Spreafico
		Mod. Probability and Computing for Statistics <i>LM Data Science cod. 145679</i>	Related	36 classroom hours 12 laboratory hours	6	MAT/06	1	M. Coghi
1	145547	<b>Data Mining</b>		<b>96</b>	<b>12</b>			
		Mod. Machine Learning <i>LM Informatica cod. 145062</i>	Related	48 classroom hours	6	INF/01	1	A. Passerini
		Mod. Laboratory of Biological Data Mining	Related	24 classroom hours 24 laboratory hours	6	ING-INF/05	1	E. Blanzieri T. Tebaldi
<b>Students who did not accumulate sufficient credits* in their previous career in Programming and Algorithms and Data Structures courses will be assigned the following class instead of Data Mining:</b>								
1	145540	<b>Scientific Programming</b>		<b>96</b>	<b>12</b>			
		Mod. Programming	Related	24 classroom hours 24 laboratory hours	6	INF/01	1	A. Passerini E. Dassi
		Mod. Algorithms and Data Structures	Related	24 classroom hours 24 laboratory hours	6	INF/01	1	A. Romanel L. Marchetti
1	145542	<b>Genomics</b>		<b>96</b>	<b>12</b>			
		Mod. Computational Microbial Genomics	Characterizing	24 classroom hours 24 laboratory hours	6	BIO/19	2	N. Segata
		Mod. Computational Human Genomics	Characterizing	24 classroom hours 24 laboratory hours	6	BIO/11	2	F. Demichelis TBD
1	145541	<b>Biotechnology Engineering</b>		<b>96</b>				
		Mod. Genetic and Metabolic Engineering	Characterizing	36 classroom hours 12 laboratory hours	6	ING-IND/34	2	M. Hanczyc
		Mod. Tissue Engineering	Characterizing	40 classroom hours 8 laboratory hours	6	ING-IND/34	2	A. Motta
<b>Students who did not accumulate sufficient credits* in Chemistry and Biochemistry courses in their previous careers will instead be assigned the following class in place of Biotechnology Engineering:</b>								
1	145551	<b>Chemistry and Biochemistry</b>		<b>96</b>	<b>12</b>			
		Mod. Organic and Biological Chemistry	Characterizing	48 classroom hours	6	CHIM/06	1	M. Hanczyc
		Mod. Experimental Biochemistry	Characterizing	48 classroom hours	6	CHIM/06	1	F. Chiacchiera M. Hanczyc
1	146046	<b>English C1</b>	Further activities	<b>33</b>	<b>3</b>	L-LIN/12	1	CLA



\*When assessing applications for admission, the committee will select, based on the candidates' skills in their previous careers, the course they should follow. This decision will be communicated to the candidates before the beginning of the academic year.

Year	Code	Name of the course	T.A.F.	Hours	Credits	SSD	Semester	Professor
1	145550	<b>Molecular Biology of the Cell</b>		<b>96</b>	<b>12</b>			
		Mod. Molecular Basis of Cell Structure and Function	Characterizing	48 classroom hours	6	BIO/10	1	L. Tiberi
		Mod. Cellular and Molecular Dynamics	Characterizing	48 classroom hours	6	BIO/09	1	G. Piccoli
1	145551	<b>Chemistry and Biochemistry</b>		<b>96</b>	<b>12</b>			
		Mod. Organic and Biological Chemistry	Characterizing	48 classroom hours	6	CHIM/06	1	M. Hanczyc
		Mod. Experimental Biochemistry	Characterizing	48 classroom hours	6	CHIM/06	1	F. Chiacchiera M. Hanczyc
2	146089	<b>Mathematical Modeling and Simulation</b>		<b>96</b>	<b>12</b>			
		Mod. Network Modeling and Simulation	Related	24 classroom hours 24 laboratory hours	6	INF/01	1	L. Marchetti
		Mod. Mathematical Modeling in Biology	Related	36 classroom hours 12 laboratory hours	6	MAT/05	1	A. Pugliese
<b>As an alternative to the Mathematical Modeling and Simulation course, the student may choose the following course:</b>								
1	145737	<b>Molecular Physics</b>		<b>96</b>	<b>12</b>			
		Mod. Quantum Mechanics	Related	48 classroom hours	6	FIS/01	2	G. Lattanzi P.H.J. Hauke
		Mod. Quantum Chemistry	Related	48 classroom hours	6	FIS/02	2	P.L. Cudazzo
1	146044	<b>Advanced Data Analysis</b>		<b>96</b>	<b>12</b>			
		Mod. Regression and Classification Models <i>LM Data Science cod. 145675</i>	Related	36 classroom hours 12 laboratory hours	6	MAT/06	2	V. Vinciotti
		Mod. Network-based Data Analysis	Related	32 classroom hours 16 laboratory hours	6	INF/01	2	M. Lauria
1	146046	<b>English C1</b>	Further activities	<b>33</b>	<b>3</b>	L-LIN/12	1	CLA

**Compulsory lessons for the "Quantitative Track" course**



**Restricted-choice courses for both paths**

At least 36 credits of restricted choice among the subjects listed in the following table **if not already provided as compulsory subjects**

Anno	Codice	Denominazione dell'insegnamento	T.A.F.	Ore	CFU	SSD	Semestre	Docente
1	145540	<b>Scientific Programming*</b>		<b>96</b>	<b>12</b>			
		Mod. Programming <i>cod. 145742</i>	Characterizing	24 classroom hours 24 laboratory hours	6	INF/01	1	A. Passerini E. Dassi
		Mod. Algorithms and Data Structures <i>cod. 145741</i>	Characterizing	24 classroom hours 24 laboratory hours	6	INF/01	1	A. Romanel L. Marchetti
1	145544	<b>Bioinformatics</b>		<b>96</b>	<b>12</b>			
		Mod. Algorithms for Bioinformatics <i>LM Informatica cod. 145765</i>	Characterizing	32 classroom hours 16 laboratory hours	6	ING- INF/05	2	E. Blanzieri
		Mod. Bioinformatics Resources <i>cod. 145767</i>	Characterizing	32 classroom hours 16 laboratory hours	6	INF/01	2	A. Romanel
1	146044	<b>Advanced Data Analysis</b>		<b>96</b>	<b>12</b>			
		Mod. Regression and Classification Models <i>cod. 146045</i>	Characterizing	36 classroom hours 12 laboratory hours	6	MAT/06	2	V. Vinciotti
		Mod. Network-based Data Analysis <i>cod. 145573</i>	Characterizing	32 classroom hours 16 laboratory hours	6	INF/01	2	M. Lauria
1	145542	<b>Genomics</b>		<b>96</b>	<b>12</b>			
		Mod. Computational Microbial Genomics <i>cod. 146203</i>	Characterizing	24 classroom hours 24 laboratory hours	6	BIO/19	2	N. Segata
		Mod. Computational Human Genomics <i>cod. 146204</i>	Characterizing	24 classroom hours 24 laboratory hours	6	BIO/11	2	F. Demichelis TBD
1	145541	<b>Biotechnology Engineering</b>		<b>96</b>				
		Mod. Genetic and Metabolic Engineering <i>cod. 145658</i>	Characterizing	36 classroom hours 12 laboratory hours	6	ING- IND/34	2	M. Hanczyc
		Mod. Tissue Engineering	Characterizing	40 classroom hours 8 laboratory hours	6	ING- IND/34	2	A. Motta
1	145737	<b>Molecular Physics</b>		<b>96</b>	<b>12</b>			
		Mod. Quantum Mechanics	Characterizing	48 classroom hours	6	FIS/01	2	G. Lattanzi
		Mod. Quantum Chemistry	Characterizing	48 classroom hours	6	FIS/02	2	P.L. Cudazzo



1	146205	<b>Theoretical Methods for Soft Matter</b>		<b>104</b>	<b>12</b>			
		Mod. Quantum Computing <i>LM Fisica cod. 145948</i>	Characterizing	48 classroom hours	6	FIS/03	2	P. Hauke
		Mod. Multi-scale Methods in Soft Matter Physics <i>LM Fisica 145889</i>	Characterizing	48 classroom hours	6	FIS/03	2	R. Potestio
2	145547	<b>Data Mining</b>		<b>96</b>	<b>12</b>			
		Mod. Machine Learning <i>LM Informatica cod. 145062</i>	Characterizing	48 classroom hours	6	INF/01	1	A. Passerini
		Mod. Laboratory of Biological Data Mining <i>cod. 145053</i>	Characterizing	24 classroom hours 24 laboratory hours	6	ING- INF/05	1	E. Blanzieri T. Tebaldi
2	146089	<b>Mathematical Modeling and Simulation</b>		<b>96</b>	<b>12</b>			
		Mod. Network Modeling and Simulation <i>cod. 146100</i>	Characterizing	24 classroom hours 24 laboratory hours	6	INF/01	1	L. Marchetti
		Mod. Mathematical Modeling in Biology <i>cod. 146101</i>	Characterizing	36 classroom hours 12 laboratory hours	6	MAT/05	1	A. Pugliese
2	145546	<b>Computational Biophysics</b>		<b>96</b>	<b>12</b>			
		Mod. Physical Modeling in Biomolecules	Characterizing	48 classroom hours	6	FIS/02	1	G. Lattanzi
		Mod. Computer Simulations of Biomolecules	Characterizing	48 laboratory hours	6	FIS/03	1	L. Tubiana
2	146103	<b>Foundations of Entrepreneurship in Biotech and Pharma</b>	Characterizing	<b>48</b> 48 ore classroom hours	<b>6</b>	SECS- P/07	1	A. Nucciarelli
2	145190	<b>Digital Signal Processing</b> <i>LM Information Engineering - 146224/1</i>	Characterizing	<b>48</b> 48 ore classroom hours	<b>6</b>	MAT/05	1	L. Demi
2	146114	<b>Knowledge Graph Engineering</b> <i>LM Ing. Inf. e Com.</i>	Characterizing	<b>48</b> 48 ore classroom hours	<b>6</b>	ING- INF/05	1	F. Giunchiglia

NOTE: Individual modules (6 credits), which are part of a 12 credits course and which are coded, may be chosen as restricted-choice courses and included in the **curriculum** as 6 credits courses as long as the maximum number of examinations laid down in the course regulations (12 reviews) is complied with.

\*Students in the Biotechnological Track who have been assigned the Data Mining course cannot choose Scientific Programming as a restricted-choice course.



### Students' free-choice courses

The list of examinations is completed with at least 12 free-choice credits from all active courses in the CIBIO Department, the Department of Engineering and Information Science, the Department of Physics, and the Department of Mathematics. **Courses from the 'Biotechnological Track' and 'Quantitative Track', which are not included in one's curriculum, or active courses at other Departments or Centers may also be chosen, subject to the approval of the curriculum.** Teachings offered by three-year degrees may not be chosen as free-choice teachings. The free-choice courses offered to students are:

Year	Code	Name of the course	Hours	Credits	SSD (SCIENTIFIC DISCIPLINARY SECTOR)	Semester	Professor
2	145964	<b>Genomics Technologies</b> <i>LM Biotecnologie Cellulari e Molecolari</i>	50	6	BIO/13	1	M. Denti
2	145914	<b>Statistical Models</b> <i>LM Matematica</i>	42	6	MAT/06	1	V. Vinciotti
2	145858	<b>Signal Image and Video</b> <i>LM Artificial Intelligence Systems</i>	48	6	ING-INF/03	1	G. Boato
2	145649	<b>Computational Physics</b> <i>LM Fisica</i>	48	6	FIS/02	2	F. Pederiva
2	145561	<b>Bayesian Statistics</b> <i>LM Matematica</i>	42	6	MAT/06	2	P. Novi Inverardi TBD
2	146090	<b>Single Cell and Spatial Omics</b>	48	6	BIO/11	2	T. Tebaldi
2	145763	<b>Bio-Inspired Artificial Intelligence</b> <i>LM Informatica</i>	48	6	ING-INF/05	2	G. Iacca
2	145747	<b>Genomics and Drug Discovery</b> <i>LM Biotecnologie Cellulari e Molecolari</i>	48	6	BIO/10	2	E. Domenici
2	146200	<b>Digital Epidemiology</b> <i>LM Informatica</i>	48	6	ING-INF/05	2	M. Tizzoni
2	146195	<b>Biotechnology Challenge*</b> <i>LM Biotecnologie Cellulari e Molecolari</i>	48	6	BIO/13	1	M. Basso

The courses listed above and those suggested by the ESSE3 curriculum compilation tool are approved automatically. In all other cases, a paper curriculum must be completed and will be assessed by the responsible teaching structure.

The CIBIO Department Board reserves the right not to activate the elective courses listed in the above chart for which there are not at least 5 options. Students will be required to submit their curriculum in due time.

\*The Biotechnological Challenge will only be activated if willing companies are found.



## Examples of curricula

To help students construct a curriculum, we list below a number of plans (tracks) that meet the criteria listed above. This list only provides examples that match the courses provided by the Master's degree with the different exit profiles. **All examples for all profiles can be customized according to students' preferences as long as the above criteria and course order are respected.**

Example of plan for **Bioinformatics** profile from 'Biotechnological Track' (Example 1)

<b>Course</b>	<b>Semester</b>	<b>Year</b>	<b>Credits</b>	<b>T.A.F</b>	<b>SSD (SCIENTIFIC DISCIPLINARY SECTOR)</b>
<i>Biostatistics</i>	1	1	12	Related	MAT/06
<i>Scientific Programming</i>	1	1	12	Related	INF/01
<i>Genomics</i>	2	1	12	Characterizing	BIO/11 – BIO/19
<i>Biotechnology Engineering</i>	2	1	12	Characterizing	ING-IND/34
Bioinformatics	2	1	12	Characterizing	INF/01 – ING-INF/05
Data Mining	1	2	12	Characterizing	INF/01 – ING-INF/05
Mathematical Modeling and Simulation	1	2	12	Characterizing	MAT/05 – INF/01
Bio-inspired Artificial Intelligence	2	2	6	Free choice	ING-INF/05
Single Cell and Spatial Omics	2	2	6	Free choice	BIO/11

Example of plan for **Bioinformatics** profile from 'Biotechnological Track' (Example 2)

<b>Course</b>	<b>Semester</b>	<b>Year</b>	<b>Credits</b>	<b>T.A.F</b>	<b>SSD (SCIENTIFIC DISCIPLINARY SECTOR)</b>
<i>Biostatistics</i>	1	1	12	Related	MAT/06
<i>Data Mining</i>	1	1	12	Related	INF/01 – ING-INF/05
<i>Genomics</i>	2	1	12	Characterizing	BIO/11 – BIO/19
<i>Biotechnology Engineering</i>	2	1	12	Characterizing	ING-IND/34
Bioinformatics	2	1	12	Characterizing	INF/01 – ING-INF/05
Knowledge Graph Engineering	1	2	6	Characterizing	ING-INF/05
Mathematical Modeling and Simulation	1	2	12	Characterizing	MAT/05 – INF/01
Digital Signal Processing	1	2	6	Characterizing	MAT/05
Bayesian Statistics	2	2	6	Free choice	MAT/06
Single Cell and Spatial Omics	2	2	6	Free choice	BIO/11

Example of plan for **Bioinformatics** profile from "Quantitative Track"

<b>Course</b>	<b>Semester</b>	<b>Year</b>	<b>Credits</b>	<b>T.A.F</b>	<b>SSD (SCIENTIFIC DISCIPLINARY SECTOR)</b>
<i>Molecular Biology of the Cell</i>	1	1	12	Characterizing	BIO/09 – BIO/10
<i>Chemistry and Biochemistry</i>	1	1	12	Characterizing	CHIM/06
<i>Advanced Data Analysis</i>	2	1	12	Related	MAT/06 – INF/01
Bioinformatics	2	1	12	Characterizing	INF/01 – ING-INF/05
Genomics	2	1	12	Characterizing	BIO/11 – BIO/19



Data Mining	1	2	12	Characterizing	INF/01 – ING-INF/05
<i>Mathematical Modeling and Simulation</i>	1	2	12	Related	MAT/05 – INF/01
Bayesian Statistics	2	2	6	Free choice	MAT/06
Single Cell and Spatial Omics	2	2	6	Free choice	BIO/11

Example of plan for **Biological Analyst and Modeller** profile from "Biotechnological Track" (Example 1)

<b>Course</b>	<b>Semester</b>	<b>Year</b>	<b>Credits</b>	<b>T.A.F</b>	<b>SSD (SCIENTIFIC DISCIPLINARY SECTOR)</b>
<i>Biostatistics</i>	1	1	12	Related	MAT/06
<i>Scientific Programming</i>	1	1	12	Related	INF/01
<i>Genomics</i>	2	1	12	Characterizing	BIO/11 – BIO/19
<i>Biotechnology Engineering</i>	2	1	12	Characterizing	ING-IND/34
Advanced Data Analysis	2	1	12	Characterizing	MAT/06 – INF/01
Data Mining	1	2	12	Characterizing	INF/01 – ING-INF/05
Mathematical Modeling and Simulation	1	2	12	Characterizing	MAT/05 – INF/01
Foundations of Entrepreneurship in Biotech and Pharma	1	2	6	Free choice	SECS-P/07
Genomics and Drug Discovery	2	2	6	Free choice	BIO/10

Example of plan for **Biological Analyst and Modeller** profile from "Biotechnological Track" (Example 2)

<b>Couse</b>	<b>Semester</b>	<b>Year</b>	<b>Credits</b>	<b>T.A.F</b>	<b>SSD (SCIENTIFIC DISCIPLINARY SECTOR)</b>
<i>Biostatistics</i>	1	1	12	Related	MAT/06
<i>Data Mining</i>	1	1	12	Related	INF/01 – ING-INF/05
<i>Genomics</i>	2	1	12	Characterizing	BIO/11 – BIO/19
<i>Biotechnology Engineering</i>	2	1	12	Characterizing	ING-IND/34
Advanced Data Analysis	2	1	12	Characterizing	MAT/06 – INF/01
Knowledge Graph Engineering	1	2	6	Characterizing	ING-INF/05
Mathematical Modeling and Simulation	1	2	12	Characterizing	MAT/05 – INF/01
Foundations of Entrepreneurship in Biotech and Pharma	1	2	6	Characterizing	SECS-P/07
Digital Epidemiology	2	2	6	Free choice	ING-INF/05
Genomics and Drug Discovery	2	2	6	Free choice	BIO/10

Example of plan for **Biological Analyst and Modeller** profile from "Quantitative Track"

<b>Couse</b>	<b>Semester</b>	<b>Year</b>	<b>Credits</b>	<b>T.A.F</b>	<b>SSD (SCIENTIFIC DISCIPLINARY SECTOR)</b>
<i>Molecular Biology of the Cell</i>	1	1	12	Characterizing	BIO/09 – BIO/10
<i>Chemistry and Biochemistry</i>	1	1	12	Characterizing	CHIM/06
<i>Advanced Data Analysis</i>	2	1	12	Related	MAT/06 – INF/01
Bioinformatics	2	1	12	Characterizing	INF/01 – ING-INF/05
Molecular Physics	2	1	12	Characterizing	FIS/01 – FIS/02
Data Mining	1	2	12	Characterizing	INF/01 – ING-INF/05
<i>Mathematical Modeling and Simulation</i>	1	2	12	Related	MAT/05 – INF/01





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Statistical Models	1	2	6	Free choice	MAT/06
Genomics and Drug Discovery	2	2	6	Free choice	BIO/10



Example of plan for **Computational Biologist** profile from "Biotechnological Track" (Example 1)

<b>Course</b>	<b>Semester</b>	<b>Year</b>	<b>Credits</b>	<b>T.A.F</b>	<b>SSD (SCIENTIFIC DISCIPLINARY SECTOR)</b>
<i>Biostatistics</i>	1	1	12	Related	MAT/06
<i>Scientific Programming</i>	1	1	12	Related	INF/01
<i>Genomics</i>	2	1	12	Characterizing	BIO/11 – BIO/19
<i>Biotechnology Engineering</i>	2	1	12	Characterizing	ING-IND/34
<i>Molecular Physics</i>	2	1	12	Characterizing	FIS/01 – FIS/02
<i>Machine Learning</i>	1	2	6	Characterizing	INF/01
<i>Network Modeling and Simulation</i>	1	2	6	Characterizing	INF/01
<i>Computational Biophysics</i>	1	2	12	Characterizing	FIS/02 – FIS/03
<i>Bayesian Statistics</i>	2	2	6	Free choice	MAT/06
<i>Bio-inspired Artificial Intelligence</i>	2	2	6	Free choice	ING-INF/05

Example of plan for **Computational Biologist** profile from "Biotechnological Track" (Example 2)

<b>Course</b>	<b>Semester</b>	<b>Year</b>	<b>Credits</b>	<b>T.A.F</b>	<b>SSD (SCIENTIFIC DISCIPLINARY SECTOR)</b>
<i>Biostatistics</i>	1	1	12	Related	MAT/06
<i>Data Mining</i>	1	1	12	Related	INF/01 – ING-INF/05
<i>Genomics</i>	2	1	12	Characterizing	BIO/11 – BIO/19
<i>Biotechnology Engineering</i>	2	1	12	Characterizing	ING-IND/34
<i>Molecular Physics</i>	2	1	12	Characterizing	FIS/01 – FIS/02
<i>Digital Signal Processing</i>	1	2	6	Characterizing	MAT/05
<i>Network Modeling and Simulation</i>	1	2	6	Characterizing	INF/01
<i>Computational Biophysics</i>	1	2	12	Characterizing	FIS/02 – FIS/03
<i>Bayesian Statistics</i>	2	2	6	Free choice	MAT/06
<i>Bio-inspired Artificial Intelligence</i>	2	2	6	Free choice	ING-INF/05

Example plan for **Computational Biologist** profile from "Quantitative Track"

<b>Course</b>	<b>Semester</b>	<b>Year</b>	<b>Credits</b>	<b>T.A.F</b>	<b>SSD (SCIENTIFIC DISCIPLINARY SECTOR)</b>
<i>Molecular Biology of the Cell</i>	1	1	12	Characterizing	BIO/09 – BIO/10
<i>Chemistry and Biochemistry</i>	1	1	12	Characterizing	CHIM/06
<i>Advanced Data Analysis</i>	2	1	12	Related	MAT/06 – INF/01
<i>Molecular Physics</i>	2	1	12	Related	FIS/01 – FIS/02
<i>Bioinformatics</i>	2	1	12	Characterizing	INF/01 – ING-INF/05
<i>Machine Learning</i>	1	2	6	Characterizing	INF/01
<i>Network Modeling and Simulation</i>	1	2	6	Characterizing	INF/01
<i>Computational Biophysics</i>	1	2	12	Characterizing	FIS/02 – FIS/03
<i>Bayesian Statistics</i>	2	2	6	Free choice	MAT/06
<i>Bio-inspired Artificial Intelligence</i>	2	2	6	Free choice	ING-INF/05



Example of plan for **Computational Biologist** profile from "Biotechnological Track" (Example 1)

<b>Course</b>	<b>Semester</b>	<b>Year</b>	<b>Credits</b>	<b>T.A.F</b>	<b>SSD (SCIENTIFIC DISCIPLINARY SECTOR)</b>
<i>Biostatistics</i>	1	1	12	Related	MAT/06
<i>Scientific Programming</i>	1	1	12	Related	INF/01
<i>Genomics</i>	2	1	12	Characterizing	BIO/11 – BIO/19
<i>Biotechnology Engineering</i>	2	1	12	Characterizing	ING-IND/34
Molecular Physics	2	1	12	Characterizing	FIS/01 – FIS/02
Data Mining	1	2	12	Characterizing	INF/01 – ING-INF/05
Computational Biophysics	1	2	12	Characterizing	FIS/02 – FIS/03
Computational Physics	2	2	6	Free choice	FIS/02
Genomics and Drug Discovery	2	2	6	Free choice	BIO/10

Example of a plan for **Computational Biophysicist** profile from "Biotechnological Track" (Example 2)

<b>Course</b>	<b>Semester</b>	<b>Year</b>	<b>Credits</b>	<b>T.A.F</b>	<b>SSD (SCIENTIFIC DISCIPLINARY SECTOR)</b>
<i>Biostatistics</i>	1	1	12	Related	MAT/06
<i>Data Mining</i>	1	1	12	Related	INF/01 – ING-INF/05
<i>Genomics</i>	2	1	12	Characterizing	BIO/11 – BIO/19
<i>Biotechnology Engineering</i>	2	1	12	Characterizing	ING-IND/34
Molecular Physics	2	1	12	Characterizing	FIS/01 – FIS/02
Digital Signal Processing	1	2	6	Characterizing	MAT/05
Mathematical Modeling in Biology	1	2	6	Characterizing	MAT/05
Computational Biophysics	1	2	12	Characterizing	FIS/02 – FIS/03
Computational Physics	2	2	6	Free choice	FIS/02
Genomics and Drug Discovery	2	2	6	Free choice	BIO/10

Example of plan for **Computational Biophysicist** profile from "Quantitative Track"

<b>Course</b>	<b>Semester</b>	<b>Year</b>	<b>Credits</b>	<b>T.A.F</b>	<b>SSD (SCIENTIFIC DISCIPLINARY SECTOR)</b>
<i>Molecular Biology of the Cell</i>	1	1	12	Characterizing	BIO/09 – BIO/10
<i>Chemistry and Biochemistry</i>	1	1	12	Characterizing	CHIM/06
<i>Advanced Data Analysis</i>	2	1	12	Related	MAT/06 – INF/01
<i>Molecular Physics</i>	2	1	12	Related	FIS/01 – FIS/02
Theoretical Methods for Soft Matter	2	1	12	Characterizing	FIS/03
Data Mining	1	2	12	Characterizing	INF/01 – ING-INF/05
Computational Biophysics	1	2	12	Characterizing	FIS/02 – FIS/03
Genomics Technologies	1	2	6	Free choice	BIO/13
Computational Physics	2	2	6	Free choice	FIS/02

NOTE: Compulsory courses are shown in italics.



### **Internship 6 credits – code 145933**

The internship represents a professional training experience, consistent with the study path followed by students enrolled in the Master of Science in Quantitative and Computational Biology. The internship has the purpose of allowing the student feedback and enrichment of the notions learned during university studies and of orienting future professional choices; it consists of a training or research collaboration activity carried out at the departments of the University of Trento (internal internship) or a company, other universities or other affiliated institutions outside the University, Italian or foreign (external internship).

The internship is awarded 6 credits. The internship is mandatory and usually linked to the completion of the final exam. The procedures for accessing, carrying out, and evaluating the placement are governed by the Rules of Internship Activities, approved by the Councils of the academic structures involved.

For more information on procedures and regulations, please visit

<https://offertaformativa.unitn.it/en/lm/quantitative-and-computational-biology/internship>

### **Final exam 15 credits – code 145934**

To be admitted to the final examination, it is necessary to have obtained all the credits provided in the other educational activities of the curriculum. 15 credits are reserved for the final examination. The final examination consists of an experimental project, the writing of a thesis, and the final examination. The thesis work aims to bring the student into direct contact with a frontier topic of research in Quantitative and Computation Biology and provides an opportunity for the student to contribute personally to the advancement of research. In general, the final test is intended to verify the scientific maturity achieved by the student at the end of the Master of Science.

Procedures for admission to the final exam, criteria for the final grade calculation, methods for submitting the final paper, and the composition of the board of examiners are regulated by the Final examination guideline, approved by the Boards of academic departments involved (<http://www.unitn.it/clm/qcb>).

Detailed course schedules and assessment methods are made public at the beginning of the academic year. For everything not expressly written in the didactic offer, the didactic regulations of the Master of Science in Quantitative and Computational Biology shall prevail.



**FINAL AND TRANSITIONAL RULES for students enrolled in the academic year 2022/2023**

**Restricted-choice teachings for the "Biotechnological Track"**

Year	Code	Name of the course	T.A.F.	Hours	Credits	SSD (SCIENTIFIC DISCIPLINARY SECTOR)	Semester	Professor
2	145547	<b>Data Mining</b>		<b>96</b>	<b>12</b>			
		Mod. Machine Learning <i>LM Informatica cod. 145062</i>	Characterizing	48 classroom hours	6	INF/01	1	A. Passerini
		Mod. Laboratory of Biological Data Mining <i>cod. 145053</i>	Characterizing	24 classroom hours 24 laboratory hours	6	ING-INF/05	1	E. Blanzieri T. Tebaldi
2	146089	<b>Mathematical Modeling and Simulation</b>		<b>96</b>	<b>12</b>			
		Mod. Network Modeling and Simulation <i>cod. 146100</i>	Characterizing	24 classroom hours 24 laboratory hours	6	INF/01	1	L. Marchetti
		Mod. Mathematical Modeling in Biology <i>cod. 146101</i>	Characterizing	36 classroom hours 12 laboratory hours	6	MAT/05	1	A. Pugliese
2	145546	<b>Computational Biophysics</b>		<b>96</b>	<b>12</b>			
		Mod. Physical Modeling in Biomolecules	Characterizing	48 classroom hours	6	FIS/02	1	G. Lattanzi
		Mod. Computer Simulations of Biomolecules	Characterizing	48 laboratory hours	6	FIS/03	1	L. Tubiana
2	146103	<b>Foundations of Entrepreneurship in Biotech and Pharma</b>	Characterizing	<b>48</b> 48 ore classroom hours	<b>6</b>	SECS-P/07	1	A. Nucciarelli
2	145190	<b>Digital Signal Processing</b> <i>LM Information Engineering 146224/1</i>	Characterizing	<b>48</b> 48 ore classroom hours	<b>6</b>	MAT/05	1	L. Demi



Characterizing **courses** for the "Computational Track"

Year	Code	Name of the course	T.A.F.	Hours	Credits	SSD (SCIENTIFIC DISCIPLINARY SECTOR)	Semester	Professor
2	146089	Mathematical Modeling and Simulation		96	12			
		Mod. Network Modeling and Simulation <i>cod. 146100</i>	Related	24 classroom hours 24 laboratory hours	6	INF/01	1	L. Marchetti
		Mod. Mathematical Modeling in Biology <i>cod. 146101</i>	Related	36 classroom hours 12 laboratory hours	6	MAT/05	1	A. Pugliese

Restricted-choice courses for **the** "Biotechnological Track"



Restricted-choice courses for the Biocomputational Track”

Year	Code	Name of the course	T.A.F.	Hours	Credits	SSD (SCIENTIFIC DISCIPLINARY SECTOR)	Semester	Professor
2	146089	<b>Mathematical Modeling and Simulation</b>		<b>96</b>	<b>12</b>			
		Mod. Network Modeling and Simulation <i>cod. 146100</i>	Characterizing	24 classroom hours 24 laboratory hours	6	INF/01	1	L. Marchetti
		Mod. Mathematical Modeling in Biology <i>cod. 146101</i>	Characterizing	36 classroom hours 12 laboratory hours	6	MAT/05	1	A. Pugliese
2	145963	<b>Stochastic Models</b>		<b>84</b>	<b>12</b>			
		Mod. Statistical Models <i>LM Matematica cod. 145914</i>	Characterizing	42 classroom hours	6	MAT/06	1	V. Vinciotti
		Mod. Stochastic Processes <i>LM Matematica cod. 145157</i>	Characterizing	42 classroom hours	6	MAT/06	1	S. Mazzucchi
2	145546	<b>Computational Biophysics</b>		<b>96</b>	<b>12</b>			
		Mod. Physical Modeling in Biomolecules	Characterizing	48 classroom hours	6	FIS/02	1	G. Lattanzi
		Mod. Computer Simulations of Biomolecules	Characterizing	48 laboratory hours	6	FIS/03	1	L. Tubiana
2	146103	<b>Foundations of Entrepreneurship in Biotech and Pharma</b>	Characterizing	<b>48</b> 48 ore classroom hours	<b>6</b>	SECS-P/07	1	A. Nucciarelli
2	145190	<b>Digital Signal Processing</b> <i>LM Information Engineering 146224/1</i>	Characterizing	<b>48</b> 48 ore classroom hours	<b>6</b>	MAT/05	1	L. Demi
2	146114	<b>Knowledge Graph Engineering</b> <i>LM Ing. Inf. e Com.</i>	Characterizing	<b>48</b> 48 ore classroom hours	<b>6</b>	ING-INF/05	1	F. Giunchiglia
		Biomolecules	Characterizing	48 classroom hours	6	FIS/02	1	G. Lattanzi
		Mod. Computer Simulations of Biomolecules	Characterizing	48 laboratory hours	6	FIS/03	1	L. Tubiana
2	146103	<b>Foundations of Entrepreneurship in Biotech and Pharma</b>	Characterizing	<b>48</b> 48 ore classroom hours	<b>6</b>	SECS-P/07	1	A. Nucciarelli
2	145190	<b>Digital Signal Processing</b> <i>LM Information Engineering 146224/1</i>	Characterizing	<b>48</b> 48 ore classroom hours	<b>6</b>	MAT/05	1	L. Demi



Characterizing **courses** for the "Physical Track

Year	Code	Name of the course	T.A.F.	Hours	Credits	SSD (SCIENTIFIC DISCIPLINARY SECTOR)	Semester	Professor
2	145062	<b>Machine Learning</b> <i>LM Informatica</i>	Related	<b>48</b> 48 ore classroom hours	6	INF/01	1	A. Passerini
2	145546	<b>Computational Biophysics</b>		<b>96</b>	<b>12</b>			
		Mod. Physical Modeling in Biomolecules	Related	48 classroom hours	6	FIS/02	1	G. Lattanzi
		Mod. Computer Simulations of Biomolecules	Related	48 laboratory hours	6	FIS/03	1	L. Tubiana

Year	Code	Name of the course	T.A.F.	Hours	Credits	SSD (SCIENTIFIC DISCIPLINARY SECTOR)	Semester	Professor
2	146089	<b>Mathematical Modeling and Simulation</b>		<b>96</b>	<b>12</b>			
		Mod. Network Modeling and Simulation <i>cod. 146100</i>	Characterizing	24 classroom hours 24 laboratory hours	6	INF/01	1	L. Marchetti
		Mod. Mathematical Modeling in Biology <i>cod. 146101</i>	Characterizing	36 classroom hours 12 laboratory hours	6	MAT/05	1	A. Pugliese
2	145053	<b>Laboratory of Biological Data Mining</b>	Characterizing	24 classroom hours 24 laboratory hours	<b>6</b>	ING-INF/05	1	E. Blanzieri T. Tebaldi
2	146103	<b>Foundations of Entrepreneurship in Biotech and Pharma</b>	Characterizing	<b>48</b> 48 ore classroom hours	<b>6</b>	SECS-P/07	1	A. Nucciarelli
2	145190	<b>Digital Signal Processing</b> <i>LM Information Engineering 146224/1</i>	Characterizing	<b>48</b> 48 ore classroom hours	<b>6</b>	MAT/05	1	L. Demi

**Constrained choice** teachings for the "Physical Track"





### Students' free-choice subjects

The exam list is completed with at least 12 free-choice credits from all active courses in the CIBIO Department, the Department of Engineering and Information Science, the Department of Physics, and the Department of Mathematics. Courses from the "Biotechnological Path", "Biocomputational Path", "Computational Path" or "Physics Path" that are not included in one's curriculum or active courses at other Departments or Centers may also be chosen by approval of the curriculum. Teachings offered by three-year degrees may not be chosen as free-choice teachings. The free-choice courses offered to students are:

Year	Code	Name of the course	Hours	Credits	SSD (SCIENTIFIC DISCIPLINARY SECTOR)	Semester	Professor
2	145964	<b>Genomics Technologies</b> <i>LM Biotecnologie Cellulari e Molecolari</i>	50	6	BIO/13	1	M. Denti
2	145256	<b>Statistics of Stochastic Processes</b> <i>LM Matematica</i>	48	6	MAT/06	1	C. Agostinelli
2	146114	<b>Knowledge Graph Engineering</b> <i>LM Ing. Inf. e Com.</i>	48	6	ING-INF/05	1	F. Giunchiglia
2	145858	<b>Signal Image and Video</b> <i>LM Artificial Intelligence Systems</i>	48	6	ING-INF/03	1	G. Boato
2	145649	<b>Computational Physics</b> <i>LM Fisica</i>	48	6	FIS/02	2	F. Pederiva
2	145561	<b>Bayesian Statistics</b> <i>LM Matematica</i>	42	6	MAT/06	2	P. Novi Inverardi TBD
2	146090	<b>Single Cell and Spatial Omics</b>	48	6	BIO/11	2	T. Tebaldi
2	145747	<b>Genomics and Drug Discovery</b> <i>LM Biotecnologie Cellulari e Molecolari</i>	48	6	BIO/10	2	E. Domenici
2	146195	<b>Biotechnology Challenge*</b> <i>LM Biotecnologie Cellulari e Molecolari</i>	48	6	BIO/13	1	M. Basso

The courses listed above and those suggested by the ESSE3 curriculum compilation tool are approved automatically. In all other cases, a paper curriculum must be completed and will be assessed by the responsible teaching structure.

The CIBIO Department Board reserves the right not to activate the elective courses listed in the above chart for which there are not at least 5 options. Students will be required in a due time to submit their study plan.