Master of Science in Quantitative and Computational Biology (QCB)

The Master of Science degree in Quantitative and Computational Biology (QCB) is a multidisciplinary degree that formally integrates quantitative sciences and applied biology, thanks to the involvement of the following organizations at the University of Trento:

- CIBIO, Centre for Integrative Biology
- Department of Physics
- Department of Mathematics
- Department of Information Engineering and Computer Science

The course focuses on a strategic area where technology and methodology enable students to face essential questions at the interface between fundamental research and clinical and pre-clinical areas, through analytical and quantitative approaches.

The course - entirely taught in English - is designed to capture the increasing need for researchers and experts able to transform the enormous amount of biological information (“big data”) into knowledge, and to gain quantitative insight into the behaviour of biological systems by means of bio-mathematical and bio-physical models.

Key target areas include pharmacogenomics, biotechnology, food science, and precision medicine, which represent applied research fields where the growing availability of multidimensional data demands high interdisciplinarity.

The QCB course is designed to train experts in biotechnology, computational biology, bioinformatics and biological data and systems biology analysis, who will have the opportunity to learn in a multidisciplinary context, interacting with students with different experiences. Strong emphasis will be given to quantitative and computational aspects, with a focus on tools to analyse, model and understand biological systems and phenomena.

The course consists of two tracks, the “Biotechnological Track” and the “Computational Track”.

Admitted students will follow one of the two tracks based on their educational background acquired in previous studies. The two different tracks offer the opportunity for students to integrate their background based on their first-level degree and individual preparation. In the first, second and third semesters, students will take different courses with a focus on biotechnological or computational topics. The fourth semester is entirely dedicated to the preparation of the thesis.

Students will have the chance to carry out research projects within the University of Trento organizations involved in the Master’s Degree, at other Italian or European Universities, or in companies operating in the biotechnology, bioinformatics and computational areas.
Programme overview

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<th>Degree Awarded</th>
<th>Master of Science in Quantitative and Computational Biology</th>
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<td>Intake</td>
<td>September</td>
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<td>Duration</td>
<td>2 years</td>
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<td>Teaching Language</td>
<td>English</td>
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<td>Maximum number of admitted students</td>
<td>30</td>
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<td>Location</td>
<td>Centre for Integrative Biology (CIBIO)</td>
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<td>Application deadlines</td>
<td>non-EU citizens living abroad: January/February each year</td>
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<td></td>
<td>EU citizens and non-EU citizens living in Italy: June each year</td>
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<td>Admission requirements</td>
<td>Bachelor’s degree in biotechnologies, computer science,</td>
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<td>mathematics, physics or related fields; B1 English language</td>
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<td>knowledge</td>
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<td>Tuition fees and funding</td>
<td>Students may benefit from partial or total exemption from</td>
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<td>university tuition fees and grants to cover part of the living</td>
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<td>international.unitn.it/mqcb</td>
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<td>Contacts</td>
<td><a href="mailto:masterbio@unitn.it">masterbio@unitn.it</a></td>
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Career opportunities

Students of the QCB Master will be trained for the following professional profiles:

- Biotechnologist
- Computational Biologist
- Bioinformatics technician
- Biologists data and systems biology analyst

The profiles are characterized by a set of shared competences and by specific expertise in the field of biotechnology, information technology and/or mathematics and physics.

Graduates, trained for the above mentioned professions, will be able to use publicly available biological data and to work closely with biologists, clinicians, pharmacologists, engineers, epidemiologists in experimental research and pre-clinical context, in analysis/hospital laboratories, by using a common language.

Admission requirements

To be admitted to the QCB Master, students must have a first-level university degree, or another degree recognized as valid, in the fields of Biotechnology, Information Engineering, LifeSciences, Science and agro-food Technology, Sciences and Chemical Technologies, Pharmacy, Physics, Computer Science, Mathematics and have obtained at least 6 ECTS in the following area: Biology or Chemistry, Mathematics, Physics and Computer Science or Information Engineering.

More details are available on the website: international.unitn.it/mqcb
An English language certificate of B1 level or equivalent is required if the Bachelor’s degree courses were not taught in English. Each student must submit a complete online application package, which provides the University with fundamental information that the Admissions Committee will use to evaluate candidates on the basis of their proficiency, as well as on their potential to further develop their skills.

Language

All courses are taught in English. The University of Trento offers English courses at different levels (general and technical) for students who wish to improve their English.

Courses

Biotechnological Track

**Mandatory courses**

1st year: Biostatistics; Scientific Programming; Genomics; Biotechnology Engineering 1st year  
English B2 level (3 credits)

**Three elective courses among:**

1st year: Modern Physics; Bioinformatics; Biological Networks  
2nd year: Computational Biophysics; Data Mining; Mathematical Modelling; Biotechnology Management and Regulations

Computational Track

**Mandatory courses:**

1st year: Molecular Biology of the Cell; Chemistry and Biochemistry; Biological Networks  
2nd year: Mathematical Modelling  
English B2 level (3 credits)

**Three elective courses among:**

1st year: Modern Physics; Bioinformatics  
2nd year: Computational Biophysics; Data Mining; Mathematical Modelling; Biotechnology Management and Regulations

**Additional credits for both tracks:**

One free choice course  
Traineeship  
Thesis

Complete Programme 120 ECTS
The last ten years have witnessed an unprecedented revolution in biology. The availability of complete and annotated genome sequences for many species and the increasing affordability of high-throughput approaches for the global monitoring of macromolecules in cells are providing the basis for the mechanistic understanding of living tissues, both in their physiology and in the determinants of their diseased state.

This understanding is starting to allow a rational reengineering of regulatory networks underlying organismal metabolism, a prediction of the onset and progression of diseases, and a systematic exploration for new and effective therapeutic principles.

The pace at which these goals will be pursued, and their degree of success, depend primarily on the ability of life science researchers to foster a radically new way to carry out the investigation of biological systems. This new way should be largely integrative, strongly relying on a combination of different expertise, and strongly independent from the domain knowledge in which the expertise have been developed.

The Centre for Integrative Biology – CIBIO – at the University of Trento pursues the task of creating a suitable environment for merging classical cellular and molecular biology approaches with the new powerful tools of systems and synthetic biology, and with the contribution of chemistry, physics, informatics, mathematics, and engineering in an integrative view of basic biological processes and of their derangement in disease.
Living in Trento

The city of Trento, the provincial capital of the Trentino region, is a prominent cultural centre, and has been for centuries – and still is – a bridge between the Mediterranean and the northern Germanic culture. Trento is a versatile city, able to constantly change features and yet maintaining close links to tradition. The region offers a wide range of cultural events at all times of the year such as exhibitions, cultural meetings inside several prestigious museums, festivals, musical and theatre seasons, and many chances to enjoy a great culinary and winery tradition.

If you are keen on sports, you have a very wide range of possibilities to choose among: mountain climbing, trekking, canoeing, rafting, mountain biking, horse-riding, skiing, ice skating, speleology, fishing, windsurfing, sailing, tennis, etc.
Contacts
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international.unitn.it/biomolecular-sciences