MASTER OF SCIENCE IN BIOINFORMATICS

MAIN SUBJECTS: BIOSCIENCE ENGINEERING • SYSTEMS BIOLOGY • ENGINEERING

Jointly offered by three faculties of Ghent University - Faculty of Sciences / Bioscience Engineering / Engineering and Architecture

120 ECTS CREDITS – LANGUAGE: ENGLISH – DEGREE: MASTER OF SCIENCE

COURSE CONTENT

Recent technological advances have dramatically changed our view on life science research. Huge amounts of system-wide data such as transcriptome, proteome, and metabolome data are being produced on an almost daily basis, while whole genome sequences are being determined at an ever increasing pace. Genes and proteins are no longer studied as isolated entities, but as part of complex regulatory and interacting biological networks. Retrieving from these data emergent properties of the studied biological system, or the entirety of processes occurring in a system on multiple scales of organisation, from genomes to cells and from organs to organisms, depends on the use of computational and statistical modeling approaches.

It is in this context that bioinformatics, a booming interdisciplinary field, has evolved from a new research domain to a basic discipline in only 15 years (it is sometimes called 'the New Biology'). Bioinformatics aims at gaining a better and preferentially more quantitative molecular understanding of cellular processes by integrating and modeling high throughput molecular data (omics data). This requires the use and development of state of the art techniques for storing, retrieving, organising, analysing and interpreting biological data.

It is self-evident that this ever increasing data avalanche, together with the need for highly interdisciplinary approaches to use these data, have created an urgent need for highly trained scientists with an interdisciplinary mind set.

COURSE STRUCTURE

The two year Master of Science in Bioinformatics at Ghent University seeks a balance between generalisation and specialisation. In addition to a common package designed for the acquisition of interdisciplinary competences, we try to respect the individuality of the different students' backgrounds by offering numerous specific courses in each of the specialisations.

Specifically, there are three specialisations, each with its own focus.

- Bioscience Engineering (leads to the degree of Bio-ir.)
- Systems Biology
- Engineering (leads to the degree of Ir.)

> Master of Science in Bioinformatics: Bioscience Engineering

The specialisation 'Bioscience Engineering' focuses on the application, combination and integration of existing (bio)-informatics tools and techniques for solving complex problems with industrial/practical finality. It is aimed at students with a biological training (Bachelor of Science in Bioscience Engineering (cell and gene biotechnology), Bachelor of Science in Biochemistry and Biotechnology) who also want to delve into technical engineering aspects.

A strong interest in mathematically oriented subjects is expected. Students follow besides a package of 'Applied Mathematics and Informatics' (21 credits), which is common with the 'Systems Biology' specialisation, also a 'technical engineering broadening' package of 31 credits. Here mathematical and technical engineering skills are further accentuated. To ensure sufficient theoretical knowledge of students from the Bachelor of Science in Bioscience Engineering, they must follow an 'Advanced Molecular Biology' package. Students from the Bachelor in Biochemistry and Biotechnology do have this basic knowledge, but need to follow a redirection package with technical engineering subjects (Bachelor of Bioscience Engineering courses) to ensure a base in engineering competencies.
In this track, students will obtain the degree of Bio-ir.

> Master of Science in Bioinformatics: Systems Biology

The second specialisation 'Systems Biology' aims at selecting and applying existing (bio)informatics tools and techniques for common bioinformatics problems. The focus is on the design of interesting biological questions for which the analysis of 'omics' and public data is required, in support of the wet lab or to answer fundamental biological questions. It is aimed at students with a biologically oriented education (Bachelor of Science in Bioscience Engineering (cell and gene biotechnology), Bachelor of Science in Biochemistry and Biotechnology). Since the 'biological problem' is central, more depth is required in the fundamentals of physiology, evolution, ecology. The track offers a scientifically oriented package of 30 credits in which the foundations of biology are taught.

> Master of Science in Bioinformatics: Engineering

The third specialisation, 'Engineering' is aimed at training bioinformaticians to develop on an independent basis new algorithms and complex software implementations to improve current techniques or to respond to new developments in the domain. Students with a math/informatics oriented background (Bachelor of Science in Engineering: Computer Science, Bachelor of Science in Informatics) with a strong interest in biologically oriented courses will follow this track. It consists of an engineering module (42 credits) and 'biologically oriented' courses (9 credits). The latter have been specifically prepared for this course. Taking into account the absence of biologically oriented courses in the curriculum of the bachelor, these courses provide an introduction with sufficient depth based on relatively few credits. The engineering module consists of a number of compulsory courses with a strong link to the bioinformatics application domain (24 credits), supplemented by a number of elective courses taken from engineering-oriented courses within the Faculty of Engineering (18 credits).
In this track, students will obtain the degree of Ir.

In each track an internship or university-wide elective courses can be chosen. The university-wide courses can include societal subjects.

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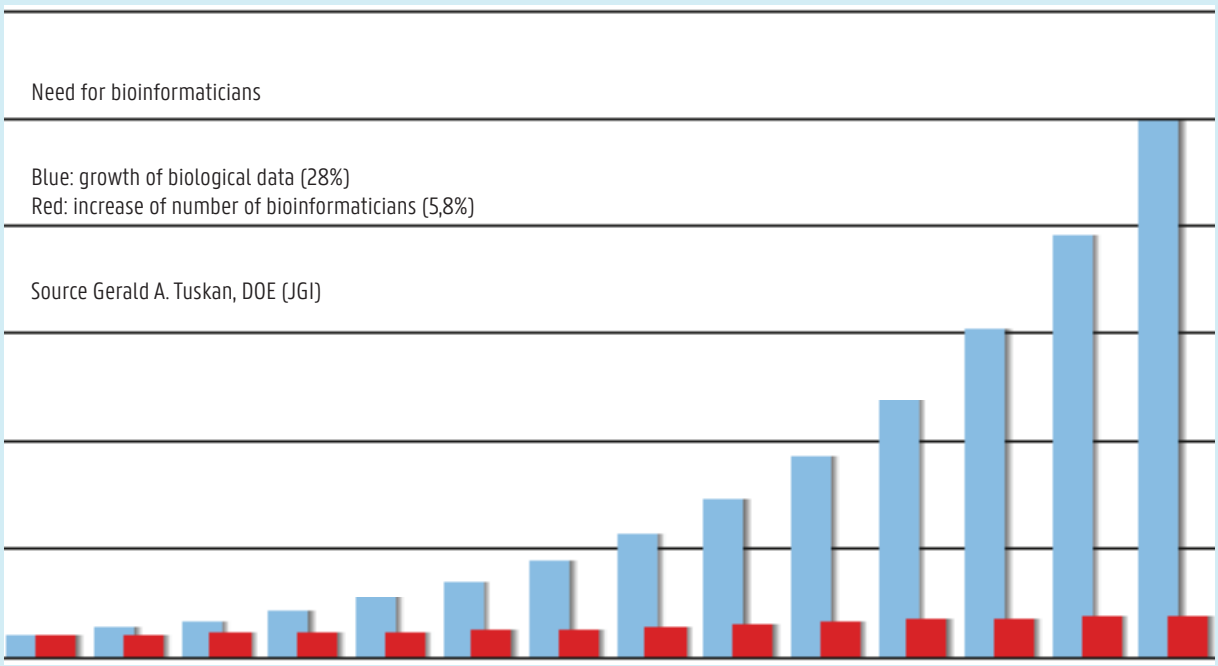
The master's dissertation (30 credits), compulsory for all students of the master, is intended to learn some general skills (teamwork, planning, communication, presentation skills, technical programming skills and scientific knowledge, etc.), but also to refine specialisation specific competencies. For the 'Bioscience Engineering' bioinformatician, the focus is on demonstrating analytical, generic resolution ability with practical objectives. For the specialisation 'Systems Biology', the emphasis is on solving a specific biological problem. This student should be able to select appropriate bioinformatics tools from the literature based on biological and methodological insights, and possess sufficient computer skills to use and combine them in an analysis pipeline. For the specialisation 'Engineering', software development, a minimum of biological insight and demonstrating sufficient theoretical mathematical and statistical knowledge and skills to formulate new solution methods to an existing or new biological problem are essential.

CAREER PERSPECTIVES

The following graph illustrates the need for bioinformaticians, since there is a large discrepancy between the exponential increase of biological data (28% each year) and the number of newly educated bioinformaticians (increase of only 5,8%). Obviously, there is a huge demand for bioinformaticians both in pharmaceutical, agronomical and biotechnological companies, and at universities and (governmental) research institutions. Rooted within the Bioinformatics Institute Ghent N2N, renowned for its expertise and impact, the Master of Science in Bioinformatics at Ghent University prepares its students for a future full of challenge and job security.



FACULTY OF SCIENCES

2017–18

WE07

MASTER OF SCIENCE IN BIOINFORMATICS

120 ECTS CREDITS – LANGUAGE: ENGLISH – DEGREE: MASTER OF SCIENCE

TOELATINGSVOORWAARDEN TOT AFSTUDEERRICHTING BIOSCIENCE ENGINEERING VOOR HOUDERS VAN EEN VLAAMS DIPLOMA

Rechtstreeks:
- Ba bio-ingenieurswetenschappen
- Ba biochemie en biotechnologie

Via uitgebreid voorbereidingsprogramma:
- Ba biologie
- Ba chemie
- Ba biomedische wetenschappen
- Ba informatica
- Ba computerwetenschappen
- Ba ingenieurswetenschappen (alle)
- Ba/Ma biowetenschappen
- Ba/Ma industriële wetenschappen: biochemie/chemie/milieukunde

TAAL
Je voldoet aan de taalvoorwaarden op basis van je Vlaams diploma.

TOELATINGSVOORWAARDEN TOT AFSTUDEERRICHTING SYSTEMS BIOLOGY VOOR HOUDERS VAN EEN VLAAMS DIPLOMA

Rechtstreeks:
- Ba biochemie en biotechnologie
- Ba bio-ingenieurswetenschappen (afstudeerrichting cel- en genbiotechnologie of zwaartepunt 'cel- en gentechnologie')

Via voorbereidingsprogramma:
- Ba bio-ingenieurswetenschappen (andere dan vermeld bij rechtstreeks)
- Ba biologie
- Ba chemie
- Ba biomedische wetenschappen
- Ba geneeskunde
- Ba informatica
- Ba computerwetenschappen
- Ba ingenieurswetenschappen (alle)
- Ba/Ma biowetenschappen
- Ba/Ma industriële wetenschappen: biochemie/chemie/milieukunde

Via schakelprogramma:
- Ba biomedische laboratoriumtechnologie, afstudeerrichting: farmaceutische en biologische laboratoriumtechnologie
- Ba chemie, afstudeerrichting chemie
- Ba chemie, afstudeerrichting biochemie
- Ba bioinformatica (Ba-na-Ba)

TAAL
Je voldoet aan de taalvoorwaarden op basis van je Vlaams diploma.

TOELATINGSVOORWAARDEN TOT AFSTUDEERRICHTING ENGINEERING VOOR HOUDERS VAN EEN VLAAMS DIPLOMA

Rechtstreeks:
- Ba ingenieurswetenschappen: computerwetenschappen
- Ba informatica
- Ba computerwetenschappen

Rechtstreeks: (naar brugprogramma - 120 studiepunten)
- Ma industriële wetenschappen: elektronica-ICT, afstudeerrichting ICT of MIT
- Ma industriële wetenschappen: informatica
  opleiding(en) oude structuur:
  - industrieel ingenieur elektronica, optie: ICT
  - industrieel ingenieur informatica
  - industrieel ingenieur bouwkunde

Via voorbereidingsprogramma:
- Ba ingenieurswetenschappen: elektrotechniek
- Ba wiskunde (enkel indien minor informatica of minor biowetenschappen)
- Ba biochemie en biotechnologie
- Ba bio-ingenieurswetenschappen

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PRAKTISCHE INFORMATIE

Studieprogramma:
https://studiegids.ugent.be
> faculteiten > opleidingstypes > ga naar de opleiding van je keuze

Infomomenten
Masterbeurs
www.ugent.be/masterbeurs

Contact
Ghent University
Prof. dr. Kathleen Marchal - kathleen.marchal@intec.ugent.be
www.bign2n.ugent.be/master

Meer info
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200 YEARS
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ADMISSION REQUIREMENTS FOR INTERNATIONAL DEGREE STUDENTS

Diploma equivalence of international bachelor's degree students will be checked by the OC on the base of their individual dossier.

LANGUAGE

More information regarding the required knowledge of English:
www.ugent.be/specificlanguage

PRACTICAL INFORMATION

Study programme:

www.ugent.be/coursecatalogue
> by Faculty > Programme types > select your programme

Application deadline

- for students who need a visa: 1st of March
- for students who do not need a visa: 1st of June

www.ugent.be/deadline

Enrolling institution

Ghent University

Tuition fee

More information is to be found on:
www.ugent.be/tuitionfee

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