Master’s programme in Bioinformatics

Bio-tools for the Future
International 2-year Bioinformatics Master’s Programme

Centre for Integrative Bioinformatics VU
vrije Universiteit Amsterdam
The structure of the Bioinformatics master

Programme outlook:

- Compulsory courses 30 ects
- Optional courses 18 ects
- First traineeship (Major) 36–42 ects
- Second traineeship (Minor) 18–24 ects
- Writing M.Sc. Thesis (major/minor) and presenting major/minor seminar 6 ects
- Colloquium series and writing research proposal 6 ects

Total: 48 ects (Compulsory + Optional) = 60 ects
The structure of the Bioinformatics master

**Five compulsory courses:**

- Trans-interdisciplinary: Genomics or Databases/Data Structures (6 ects)
- Sequence Analysis (6 ects)
- DNA/Protein Structure-Function Analysis and Prediction (6 ects)
- Intracellular networks (6 ects)
- Bioinformatics Data Analysis and Tools (6 ects)
The structure of the Bioinformatics master

Optional courses:

- Computational Genomics and Proteomics
- Data Mining Techniques
- Evolutionary Methods
- Statistical Genetics
- Statistical Models
- Machine Learning
- Neural Networks
- Scientific Visualisation
- Principles of Neuroscience
- Molecular Cell Physiology and Function

...
The structure of the Bioinformatics master

Optional courses:

• Optional courses are provided by the IBIVU, and the Biology, Mathematics and Computer Science Departments at the VU.

• You also have the option to choose courses at other departments/universities, in consultation with your mentor.
The structure of the Bioinformatics master

Two MSC Internships:

- Major (36 – 42 ECTS)
- Minor (18 – 24 ECTS)
- Extra 6 ECTS for scientific report writing and giving end seminars for both the major and minor projects

*Bioinformatics is a wide field, so we think it is important you get practical experience in two different settings*

‘versatility and flexibility’
Colloquium series and writing research proposal (6 ects)

Writing a research or project proposal is business as usual today in academy as well as in industry. For this 6-ects subject you will select a number of seminars you attend in an area of your interest, read some papers, and then write a research proposal on the topic, involving 1M€, in which you explain why you should receive the funding. The ‘successful applicant’ will defend the research proposal during interview in front of a committee (just like in real life). Of course, you will get advice along the way.
Planning the Bioinformatics master:

1. Most courses are organised on a half-time basis as they typically take two months for 6 ects.
2. Courses do not involve many fixed contact hours: typically two 2-hour lectures per week.
3. Courses involve assignments, varying from question sheets to scientific mini-projects, that you will need to report on. We have an open door policy in the bioinformatics group for this, and we expect you to come to us with all your queries (private tuition).
4. Together this means there is a lot of flexibility for you to arrange your bioinformatics master’s.

“Versatility and flexibility”
Internships Bioinformatics master:

Our MSc Bioinformatics students have visited:

• Other Dutch Centres: CMBI, UMC, UvA, MRC-Holland

• Foreign Centres: Sloan Kettering Foundation NYC, Oakland, NZ
Stockholm Bioinformatics Centre
INRIA Strasbourg
RIKEN Tokyo, Japan

*Getting an open and eager mind*

*“Versatility and flexibility”*
Continuing with a Bioinformatics master

• Broad and also deep area
• Interdisciplinary
• About understanding life
• New area: in the limelight
• Huge application domain
• Many different skills / competencies
Enrolling in the Bioinformatics master

- Former education: you will need to be able to prove experience in *molecular biology and computer science* *during intake interview*

- Deficiency programme (*≤12 ects*)
  - A single area of deficiency (e.g. programming) can be brought up to scratch during the master by attending courses such as:
    - Course ‘Inleiding programmeren’
    - Course Molecular Biology and Genetics

- Registration procedure
The job market: this is what others say..

Bioinformatics plays an essential role in:

– Molecular Biology
– Pharmacology (drug design)
– Agriculture
– Biotechnology
– Clinical medicine
– Anthropology
– Forensic science
– Chemical industries
  (detergent industries, etc.)

Excellent job opportunities
Why studying bioinformatics at the “Vrije Universiteit” (VU University Amsterdam)?

- Personal mentoring
- Everything close at one compact campus
- Located at popular Zuid–as (‘South axis’)
- Close to Amsterdam’s old centre (15 min.)
- Easily accessible with public transport (e.g. from Utrecht 23 min. by direct train)
Want to know more about the bioinformatics master?

www.vu.nl
www.few.vu.nl/masteropleidingen
ibi.vu.nl/teaching/

Or contact the master coordinators:

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www.ibi.vu.nl
The MSc Bioinformatics is embedded in a special research centre

The Centre for Integrative Bioinformatics (IBIVU)

Faculty of Sciences

Faculteit of Earth and Life Sciences

VU Medical Centre (VUMC)
Partners at VU:

Institute for Molecular Cell Biology (Systems Biology)
Center for Neurogenomics and Cognitive Research
Center for research on Biocomplex Systems

VUMC Oncoproteomics Laboratory
VUMC Microarray Core Facility
The Centre for Integrative Bioinformatics (IBIVU)

Partners in large (inter)national projects:

- Centre for Medical Systems Biology
- Ecogenomics
- Netherlands Bioinformatics Centre
- EU Network of Excellence “ENFIN”
The Centre for Integrative Bioinformatics (IBIVU)

- Interdisciplinary
- Core Bioinformatics group (enabling technologies/Tools directed)
- Systems Biology/Genomics/Neurobiology
- Mathematics/Computer Science
Some of our research projects:

- Multiple sequence alignment of TM proteins
- Protein-Protein interaction prediction
- Protein function discriminating site prediction (Sequence Harmony, Multi-RELIEF)
- Fluxomics
- Evolutionary fuzzy clustering of aCGH and Ecogenomics data
- Analysis of proteomics mass spectrometry data
- RNA evolutionary analysis and structure prediction
- Systems Biology of Alzheimer’s disease
- ...
What is Bioinformatics all about?

Bioinformatics is concerned with informatic processes in living systems

It deals with converting large scale data into understanding of complex processes in living systems
From anatomy to dynamics to (bio)informatics

- Anatomy, architecture
- Dynamics, mechanics
- Informatics

(Cybernetics – Wiener, 1948)

(Cybernetics has been defined as the science of control in machines and animals, and hence it applies to technological, animal and environmental systems)

- Bioinformatics, Systems
- Biology

Meer perspectief
Bioinformatics as an interdisciplinary science

Bioinformatics

Chemistry

Mathematics

Statistics

Biology

Molecular biology

Computer Science

Informatics

Physics

Medicine
“The big bang” -- 26 June 2000 – announcing the human genome
Genomics example: measuring gene expression

This is a microarray measuring the expression of many genes in one experiment.
Sequence–Structure–Function relationships

*From gene to function*

Genome → Expressome → Proteome → Metabolome
Sequence–Structure–Function relationships

*From gene to function*

Genome → Expressome → Proteome → Metabolome
Bioinformatics: analysing data and making methods