
Bioinformatics

Course code	Course name	Cr.	Period
	Fundamentals of Bioinformatics	6	September
	Basic Models of Biological Networks	6	October
UvA/FALW	Biosystems Data Analysis	6	January
430045	Algorithms in Sequence Analysis	6	Nov/Dec (period 2)
405019	Structural Bioinformatics	6	March
	Bioinformatics of Large Systems	6	April
400594	Seminar series and writing a research proposal	6	Variable

Optional courses (at least 18 cp has to be choosen) are provided by the [IBIVU](#), and the Biology, Mathematics, Chemistry, Physics and Computer Science Departments and Institutes at the VU. The list below is not exhaustive.

Course code	Course name	Cr.	Period
400132	Neural Networks	6	1
470145	Protein Science	6	31.08.2009-25.09.2009
470701	Principles of Neuroscience	6	31.08.2009-25.09.2009
470614	Genomes and Gene Expression	6	28.09-2009-24.10.2009
400161	Parallel Programming	6	1
400111	Evolutionary Computing	6	1
400296	Statistical Genetics	6	1 and 2
400418	Statistical Models	6	1 and 2
400154	Machine Learning	6	2
470616	Molecular Cell Physiology and Function	6	23.11.2009-18.12.2009
FALW	Advanced Models in Systems Biology	6	February
400108	Data Mining Techniques	6	5

Overview of the internship codes

The first internship (Major) can consist of 30 till 42 ects in steps of 3 ects.

Course code	Course name	Credits	Period
405027	First internship (Major)	30	variable
405028	First internship (Major)	33	variable
405029	First internship (Major)	36	variable
405030	First internship (Major)	39	variable
405031	First internship (Major)	42	variable

The second internship (Minor) can consist of 18 till 30 ects in steps of 3 ects.

Course code	Course name	Credits	Period
405032	Second internship (Minor)	18	Variable
405033	Second internship (Minor)	21	Variable
405007	Second internship (Minor)	24	variable
405034	Second internship (Minor)	27	Variable
405035	Second internship (Minor)	30	Variable

A selection (up till 12 cp) of the courses below will be determined to address deficiencies identified upon enrolling in the master's programme.

Course code	Course name	Cr.	Period
435051	Biochemie	6	2
401036	Inleiding bioinformatica I	3	3
400554	Inleiding programmeren	6	4

course name**Fundamentals of Bioinformatics**

credits

6

course code (if known)

?

period

September

lecturer

Heringa, Feenstra, Abeln (and other lecturers)

aim

Fundamentals of Bioinformatics (FoB) is the starting course of the Bioinformatics master. It aims to give a broad overview of important topics relevant to the field, with a focus on current open problems. Students will be made aware of these open problems during practical sessions that aim to let the student 'stumble upon' these problems by him/her self.

Goals:

- To make the students aware of gaps in their own background knowledge.
- The student will be aware of the major issues, methodology and available algorithms in bioinformatics.
- To work together in a group of diverse backgrounds
- To gain hands-on experience in scripting and handling basic mathematical equations as a means of solving bioinformatics problems

content

Theory:

- Evolution, Genomes, Sequences, Biomolecular Structure, Thermodynamics, Statistics, Protein-Protein Interactions

Practical:

- Exercises during/inbetween lectures
- Project in groups to solve major bioinformatics problems

form of tuition

- 12 Lectures (three hour lecture each morning, four days per week for three weeks)
- 12 Computer practicals (three hour sessions each afternoon, four days per week for three weeks), partially supervised.

literature

- course material on bb.vu.nl
- Marketa Zvelebil and Jeremy O. Baum *Understanding Bioinformatics* Garland Science 2008 ISBN-10: 0-8153-4024-9

mode of assessment

oral or written exam (depending on number of course students) to assess:

- exercises
- project results
- lecture topics

target audience

MSc Bioinformatics Students. The course is also open for third-year Bachelor students in Physics, Chemistry, Mathematics, Computer Science, Biology, Biomedical Sciences, or Medical Natural Sciences.

Coordinator

Feenstra

entry requirements

Bachelor in any science discipline (including medicine), or strong programming background.
An interest in programming and biological problems.

recommended background knowledge

'Inleiding Bioinformatica I' or equivalent

remarks.

Signing up via bb.vu.nl is mandatory.
The course is taught in English.

course name

Algorithms in Sequence Analysis

credits

6

course code (if known)

430045

period

Period 2 (nov/dec)

lecturer

Heringa (and other lecturers)

aim

A theoretical and practical bioinformatics course about biological sequence analysis, with an emphasis on the algorithms. Algorithmic and biological principles of sequence analysis, as well as practical implications are covered.

Goals:

- At the end of the course, the student will be aware of the major issues, methodology and available algorithms in sequence analysis.
- At the end of the course, the student will have hands-on experience in tackling biological problems using sequence analysis algorithms.
- At the end of the course, the student will be able to implement several of the most important algorithms in sequence analysis.

content

Theory:

- Dynamic programming, database searching, pairwise and multiple alignment, probabilistic methods including hidden markov models, pattern matching, entropy measures, evolutionary models, and phylogeny.

Practical:

- Programming own alignment algorithm based on dynamic programming
- Reverse translation and dynamic programming
- Homology searching and pattern recognition using biological and disease examples
- Multiple alignment of biological sequences
- Entropy-based functional residues prediction
- Programming own implementation of Hidden Markov Models

form of tuition

- 13 Lectures (2 two-hour lectures per week)
- 6 computer practicals (two hours per week)

literature

- course material on bb.vu.nl
- Books: Durbin, R., Eddy, S.R., Krogh, A., Mitchison, G.. *Biological Sequence Analysis*. Cambridge University Press, 1998, 350 pp., ISBN 0521629713.
- Recommended reading: Marketa Zvelebil and Jeremy O. Baum *Understanding Bioinformatics* Garland Science 2008 ISBN-10: 0-8153-4024-9

mode of assessment

Assignment results and oral or written exam (depending on number of course students).

target audience

Students with Bachelor Physics, Chemistry, Mathematics, Computer Science, Biology, Biomedical Sciences, or Medical Natural Sciences.

Coordinator

Heringa

entry requirements

Bachelor in any science discipline (including medicine).

Basic programming skills and an interest in biological problems.

recommended background knowledge

remarks.

Signing up via bb.vu.nl is mandatory.

The course is taught in English.

course name**Structural Bioinformatics**

credits

6

course code (if known)

405019

period

March

lecturer

Feenstra, Abeln (and other lecturers)

aim

A theoretical and practical bioinformatics course on the comparison, prediction and simulation of proteins. The course provides an introduction to macro-molecular simulation.

Goals:

- Understanding currently available structural data sources and validation methods
- Learning how and when to use structure prediction methods
- Being able to write scripts that connect different Structural Bioinformatics methods.
- Understanding different simulation techniques for biological macro-molecules, and be able to implement a simple simulation algorithm

content

Theory:

Protein and DNA structure sources, experimental methods, structure validation, protein fold prediction (from homology modelling to ab initio prediction), structural classification, structural alignment, protein folding and energetics, Molecular Dynamics simulation, Monte Carlo simulation, RNA structure prediction, function from structure

Practical:

- Obtaining geometric features from PDB files
- Homology modelling with Modeller
- Writing a small Monte Carlo simulation

form of tuition

- 13 Lectures (4 two-hour lectures per week)
- 6 computer practicals (2 two-hour sessions per week)

literature

- course material on bb.vu.nl
- Marketa Zvelebil and Jeremy O. Baum *Understanding Bioinformatics* Garland Science 2008 ISBN-10: 0-8153-4024-9

mode of assessment

Assignment results and oral or written exam (depending on number of course students).

target audience

Students with Bachelor Physics, Chemistry, Mathematics, Computer Science, Biology, or Biomedical Sciences, or 3rd year Bachelor Biophysics or Medical Natural Sciences students.

Coordinator

Abeln

entry requirements

Bachelor in any science discipline (including medicine).

Basic scripting skills and an interest in biological problems.

recommended background knowledge

Structural Biology

Basic Thermodynamics

remarks.

Signing up via bb.vu.nl is mandatory.

The course is taught in English.

course name**Bioinformatics of Large Systems**

credits

6

course code (if known)

?

period

April

lecturer

Heringa, Feenstra, Abeln (and other lecturers)

aim

A theoretical and practical bioinformatics course on computational methods in proteomics, genomics, gene regulation, signalling, microarray experiments, protein-protein interactions, and data-mining.

Goals:

- At the end of the course, students will be aware of the issues, methodology and available bioinformatics tools, so to become a creative bioinformatics problem solver and tools creator.
- At the end of the course, students will have hands-on experience in handling large biological datasets.

content

Theory:

- proteomics (mass spectrometry), genomics, gene regulation, signalling, microarray experiments, protein-protein interactions, and data-mining, next-generation sequencing, pattern recognition, ontologies, and GRID computing, Petri nets.

Practical:

- Assignment biological data clustering (in R)
- Assignment Gene regulation / Signalling network modelling using Petri nets.
- Assignment Pattern detection
- Assignment PPI networks

form of tuition

- 13 Lectures (4 two-hour lectures per week)
- 6 computer practicals (2 two-hour sessions per week)

literature

- course material on bb.vu.nl
- Marketa Zvelebil and Jeremy O. Baum *Understanding Bioinformatics* Garland Science 2008 ISBN-10: 0-8153-4024-9

mode of assessment

Assignment results and oral or written exam (depending on number of course students).

target audience

Students with Bachelor Physics, Chemistry, Mathematics, Computer Science, Biology, Biomedical Sciences, or Medical Natural Sciences.

Coordinator
Heringa

entry requirements

Bachelor in any science discipline (including medicine), or third-year BSc students.
Basic programming skills (R) and an interest in biological problems.

recommended background knowledge

remarks.

Signing up via bb.vu.nl is mandatory.
The course is taught in English.

course name

Seminar Series and Writing a Research Proposal

credits

6

course code (if known)

400594

period

variable

lecturer

Heringa, Feenstra, Abeln (and other lecturers)

aim

Seminar Series and Writing a Research Proposal is intended to make students acquainted with the academic practice of writing and defending research proposals.

Goals:

- The student will be aware of the major issues and methodology in a selected bioinformatics topic area.
- The student will have hands-on experience in writing a Bioinformatics research proposal.
- The student will have some exposure to semi-realistic a proposal procedure.

content

Practical:

- Attendance of a minimum of three scientific seminars on bioinformatics topics, and short report
- Design of a one million euro research proposal on a selected bioinformatics topic

form of tuition

- on individual basis

literature

- course material www.ibi.vu.nl/teaching

mode of assessment

- Proposal/report
- Oral proposal defence including 10 minute presentation in front of a mock committee.

target audience

MSc Bioinformatics Students.

Coordinator

Abeln

entry requirements

All compulsory courses in the MSc Bioinformatics programme

recommended background knowledge

remarks.

Starting the course must be done by making an appointment with the coordinator.
The course is taught in English.