<table>
<thead>
<tr>
<th><strong>name</strong></th>
<th><strong>Sequence Analysis</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>code</strong></td>
<td>Prof. Dr J. Heringa/Dr. J. Kleinjung</td>
</tr>
<tr>
<td><strong>coördinator</strong></td>
<td>Prof. Dr J. Heringa, Dr. J. Kleinjung, and other lecturers</td>
</tr>
<tr>
<td><strong>lecturers</strong></td>
<td></td>
</tr>
<tr>
<td><strong>ECTS</strong></td>
<td>6</td>
</tr>
<tr>
<td><strong>Time period</strong></td>
<td>November/December 2004</td>
</tr>
<tr>
<td><strong>aim</strong></td>
<td>A theoretical and practical bioinformatics course about biological sequence analysis. The course provides an introduction to the algorithmic and biological principles of sequence analysis, as well as practical implications.</td>
</tr>
</tbody>
</table>

**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 in sequence analysis.

**contents**
- **Theory:**
  - Dynamic programming, database searching, pairwise and multiple alignment, probabilistic methods, pattern matching, evolutionary models, and phylogeny.

**Practical:**
- Assignment programming own alignment software based on dynamic programming
- Assignment homology searching and pattern recognition using biological and disease examples
- Assignment multiple alignment of biological sequences

**methodology**
- 13 Lectures (2 two-hour lectures per week)
- Assignment introductions
- Computer practicals
- Hands-on support

**literature**
- E-course material: [http://ibivu.cs.vu.nl](http://ibivu.cs.vu.nl)

**teaching**
- Active participation (November/December 2004).

**test**
- Assignment results and oral or written exam (depending on number of course students)

**target group**
- Students with Bachelor Physics, Chemistry, Mathematics, Computer Science, Biology, or Medical Natural Sciences, with a strong interest in Bioinformatics

**remarks**
- The course is taught in English

**required knowledge**
- Bachelor Physics, Chemistry, Mathematics, Computer Science, Biology, Medical Natural Sciences. Some experience in programming is required.
DNA/Protein Structure-Function Analysis and Prediction

Prof. Dr J. Heringa/Dr. J. Kleinjung

Prof. Dr J. Heringa, Dr. J. Kleinjung, and other lecturers

ECTS

6

January/February 2005

A theoretical and practical bioinformatics course on the analysis and prediction of structure-function relationships of DNA and protein molecules. The course provides an introduction to the molecular principles of structure and function, available bioinformatics analysis and prediction techniques, and biological databases.

Goals:

• At the end of the course, students will be aware of the major issues, methodology and .
• At the end of the course, the student will have hands-on experience in molecular modeling and studying structure-function relationships.

Theory:

• Protein folding and energetics, experimental structure determination, protein fold families, protein structure databases, protein secondary structure prediction, fold prediction, molecular modeling, protein-protein interactions, DNA/RNA structure/function, DNA/RNA structure prediction

Practical:

Assignment homology modelling
Assignment immunocomplex modelling

13 Lectures (2 two-hour lectures per week)
Assignment introductions
Computer practicals
Hands-on support

E-course material: http://ibivu.cs.vu.nl

Active participation (January/February 2005).
Assignment results and oral or written exam (depending on number of course students)

Students with Bachelor Physics, Chemistry, Mathematics, Computer Science, Biology, Medical Natural Sciences or Medicine, with a strong interest and some basic knowledge in Bioinformatics

The course is taught in English.
Bachelor Physics, Chemistry, Mathematics, Computer Science, Biology, Medical Natural Sciences. A completed course Sequence Analysis is a strong advantage.
**Bioinformatics data analysis and tools**

**Name code**

Prof. Dr J. Heringa/Dr. J. Kleinjung

**coördinator lectures**

Prof. Dr J. Heringa, Dr. J. Kleinjung, Dr. D. Lukatsky (AMOLF, Amsterdam) and other lecturers

**ECTS**

6

**Time period aim**

May/June 2005

A theoretical and practical bioinformatics course on the fundamentals of bioinformatics tools and tool creation for biological data mining.

**Goals:**

- At the end of the course, students will be aware of the issues, methodology and available bioinformatics tools for
- At the end of the course, students will have hands-on experience in molecular modeling and studying structure-function relationships.

**contents**

Theory:

- Inverse protein folding, introduction to statistical thermodynamics of soft and biological matter (5 lectures), genetic algorithm, repeat recognition tools and concepts (e.g. transitivity), molecular mechanics simulations, (hidden) Markov models, pattern recognition, machine learning techniques

Practical:

Assignment Statistical Thermodynamics
Assignment hidden Markov modelling

**methodology**

13 Lectures (2 two-hour lectures per week)
Assignment introductions
Computer practicals
Hands-on support

**literature**

E-course material (slides, assignment material, papers):
http://ibivu.cs.vu.nl


**teaching test**

Active participation (April/May 2005).
Assignment results and oral or written exam (depending on number of course students)

**target group**

Students with Bachelor degree in Physics, Chemistry, Mathematics, Computer Science, Biology, Medical Natural Sciences or Medicine, with a strong interest and some basic knowledge in Bioinformatics

**remarks**

The course is taught in English.

**required knowledge**

A completed course Sequence Analysis and DNA/Protein Structure-Function Analysis and Prediction is a strong advantage. Some experience in programming is required.
Genome Analysis

**code**
dr. R. van Spanning / prof. dr. J. Heringa
dr. D. Bald, dr. R. Govers, dr. A.S. Groffen, prof.dr. J. Heringa,
dr.ir. B.W. Kooi, dr. K.W. Li, dr. J.M. Kooter, prof.dr. A.B. Smit,
dr. J.L. Snoep, dr. R.J.M. van Spanning (course section leader), dr. O.
Stiedl, dr. I.H.M. van Stokkum, Dr. R.F. Toonen,
dr. H.S. van Walraven, prof.dr. M. Verhage (course section leader),
prof.dr. H.V. Westerhoff (course section leader), dr. H. de Wit

**ECTS**
6

**Time period**
September 2004

**aim**
A 1-month intensive course for introduction to genomics and
bioinformatics techniques used to analyse and integrate genomics
data sets.

**contents**
Static genome analyses: DNA, RNA and protein primary, secondary,
tertiary en quaternary structures; genome sequencing, methods and
annotation; genome projects (bacteria, yeast, plant, animal, human),
bioinformatics and databases; COG, EST, SNP, motifs

Dynamic genome analyses: transcriptome (arrays en clustering,
QPCR, SAGE); proteomics (mass spectrometry, arrays, 2D gel
electrophoresis, homology modeling); metabolomics (methods,
interpretation, databases)

Functional genetics: knock-out, reporter genes, expression vectors,
promoter-probe studies; reverse genetics, RNAi, transgenese

Integrative genome analyses: network modelling, Metabolic Control
Analysis, biochemical databases; physiomics

Application areas: medical genomics; ecogenomics; sociogenomics;
pharmacogenomics; biotechnological genomics; ethical aspects

**methodology**
15 short modules, each including a lecture, (computer) practical and
self study

Tutorials/discussions of book material, lecture notes

Computer practicals

Lab demonstrations: Students follow and assist an experienced
postdoc/Ph D student performing a key experiment. Data evaluation
and interpretation on site.

**literature**
Powerpoint presentations via Blackboard

Book: *A primer of genome science*. Gibson G and Muse, SV, Sinauer

E-course material: [http://ibivu.cs.vu.nl](http://ibivu.cs.vu.nl)

**teaching**
Active participation

**test**
Exam (50%), assignments (25%) and computer analyses (25%)

**target group**
Students with Bachelor Physics, Chemistry, Mathematics, Computer
Science, Biology, or Medical Natural Sciences, with a strong interest
in Bioinformatics

**remarks**
The course will be taught in Dutch; provisions can be made for
English speakers.

**required knowledge**
Bachelor Physics, Chemistry, Mathematics, Computer Science,
Biology, Medical Natural Sciences.
<table>
<thead>
<tr>
<th><strong>name</strong></th>
<th><strong>Integrative Bioinformatics - Intracellular networks</strong></th>
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<tbody>
<tr>
<td><strong>code</strong></td>
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<tr>
<td><strong>coördinator</strong></td>
<td>Prof. dr H.V. Westerhoff/ Prof. dr. J. Heringa</td>
</tr>
<tr>
<td><strong>lecturers</strong></td>
<td>Prof. Dr H.V. Westerhoff, Dr B.M. Bakker, Prof. Dr J. L. Snoep, and guest lecturers</td>
</tr>
<tr>
<td><strong>ECTS</strong></td>
<td>5 (course) +1 (extra integrative bioinformatics assignment)</td>
</tr>
<tr>
<td><strong>Time period</strong></td>
<td>April 2005</td>
</tr>
<tr>
<td><strong>aim</strong></td>
<td>A 1-month intensive course providing an introduction to cell biological networks.</td>
</tr>
</tbody>
</table>

**contents**

**Theory:**

The course gives an introduction to the behavior of intracellular networks, including metabolic pathways, signal transduction chains, gene expression pathways and their hierarchical organization. Metabolic and Hierarchical Control Analysis, Biological Non Equilibrium Thermodynamics, Genetic Network Analysis, Elementary Mode Analysis, Flux (Balance Analysis) will be explained and practiced.

The levels of genomics (genome, transcriptome, proteome, metabolome and function) and their interrelationships will be clarified, both theoretically and experimentally.

**Practical:**

- inspection experiments performing flux and metabolite; measurements and subsequent regulation analysis; inspection experiments; designing network targeted inhibitors of parasites; flux analysis on the basis of a set of computer data; control analysis on the basis of earlier experimental results;
- extra assignment integrative bioinformatics for bioinformatics master students (1 ECTS)

**methodology**

Lectures

Tutorials/discussions of book material, lecture notes

Web-courses ([www.siliconcell.net](http://www.siliconcell.net))

Computer practicals

Lab-inspection work: Students follow and assist an experienced postdoc/Ph D student performing a key experiment. Data evaluation and interpretation on site.

**literature**

Reader (10 euro)

E-course material:

http://www.bio.vu.nl/hwconf/teaching/Mathbiochemie/;

www.siliconcell.net

Books: Chapters from:Understanding the Control of Metabolism (Fell, D) Portland Press; Metabolic Engineering in the Postgenomic Era (Kohlodenko & Westerhoff, Editors), Horizon Bioscience;
Thermodynamics and Control of Biological Free-energy transduction (Westerhoff and Van Dam), Elsevier

**teaching**  
Active participation (March/April 2005)

**test**  
Written exam

**target group**  
Students with Bachelor Physics, Chemistry, Mathematics, Biology, Medical Biology with a strong interest in the interface between these disciplines and bioinformatics

**remarks**  
The course is taught in the English language and involves extensive direct contact with the professors and associate professors.

**Required knowledge**  
Bachelor Physics, Chemistry, Mathematics, Informatics, Biology, Medical Natural Sciences, or equivalent;