GÖTEBORG UNIVERSITY **COURSE PLAN MSA850**
Faculty of Sciences
Mathematical Sciences

MSA850, MATHEMATICAL MODELING OF CELLULAR PROCESSES, 15 credit points

Level: advanced

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1. Authorisation.

The course plan has been authorised by the vice-dean of the Department of Mathematical Sciences on November 9, 2006, to be valid from July 1, 2007.

Educational field: Mathematical Sciences

2. Educational context.

The course is part of the International Master's Programme in Systems Biology. It is also open for students outside the program who meet the course prerequisites.

3. Prerequisites.

Basic course in biochemistry and cell biology.
Basic course in statistics.
Basic course in programming.

4. Goals and learning outcomes.

After passing the course, students should

- be able to apply currently used mathematical modelling approaches for cellular processes
- be able to suggest experimental and modelling approaches to investigate the underlying biological problems
- be able to use some of the available computer tools in the area of cellular modelling
- have acquired a deeper understanding of the studied biological processes and the way these are analysed and optimised for various purposes.

- be able to identify rational protein targets for optimizing cellular properties.

5. Course description.

Analysis and technical aspects of gene expression data:

- Transcriptomics and DNA microarrays.
- Proteomics - expression, modification, localisation and interactions.
- The interpretion of large scale data.
- Clustering algorithms.

Modelling of cellular processes:

- Protein complex formation.
- Genetic networks and regulatory circuits.
- Stochastic mechanisms in gene expression.
- Mathematical models of the cell cycle.
- Biochemical oscillations and cellular rhythms.
- Models of evolution.

Metabolic processes:

- Energy metabolism and "black-box"-modelling of cellular growth.
- Linear rate laws, yield coefficients and mass balances.
- Analysis and control of metabolic networks.
- Statistical methods for increasing the accuracy of experimental data.
- Metabolic flux analysis based on mass balances and isotope distributions.
- Metabolic control analysis.

6. Literature.
See separate list.

7. Assessment.

The course consists of lectures, compulsory computer exercises, compulsory discussion sessions and project work.
The student is examined by exercises, project work and written exam.

8. Grades.

The grade levels are Fail (U), Pass (G), and High Pass (VG). A wish for an ECTS grade should be reported to the examiner at the beginning of the course.

9. Course evaluation.

In the middle of the course the teacher arranges a feedback discussion with the students and at the end of the course the students will be asked to answer a questionnaire. The results of the questionnaire will be processed by the teacher together with student representatives.

10. Additional information.