

From Analysis of Metabolism to Systems Biology

Description

Interdisciplinary, 2 credit 960 level graduate course offered first during the Spring Semester 2006, Tuesdays and Thursdays, 9:10-10:00 am

Instructors

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Syllabus

Metabolic Network Basics

1. 1/10 General Network Theory KC
Introduction and review of cellular metabolism
2. 1/12 Principles of Metabolism I KC
Elementary flux mode analysis, flux balance analysis
3. 1/17 Principles of Metabolism II KC
Regulation of enzymatic activity and metabolic networks

Regulation of Metabolic Networks

- 4 1/19 Transcriptional Regulation CB
Gene structure, promoters, transcription factors
- 5 1/24 Post-transcriptional Regulation CB
RNA stability, RNA interference, protein modification
- 6 1/26 Enzyme Kinetics I CB
Basic principles of MM Kinetics
- 7 1/31 Enzyme Kinetics II CB
Allosteric regulation of enzymes, examples

Analysis of Metabolic Networks

- 8 2/2 Kinetic Analysis of Metabolism (Theory) YSH
The experimental analysis of kinetics in pathways, networks, and organisms (isotopic labeling methods incl MS and NMR)
- 9 2/7 Kinetic Analysis of Metabolism (Examples) YSH
Kinetic analyses in bacterial, plant, and animal primary and secondary metabolism
- 10 2/9 Modeling of Kinetic Data YSH
Principles and demonstration of computer-aided kinetic analysis
- 11 2/14 Midterm Exam 1 (100 pts KC, CB, YSH)
- 12 2/16 Metabolic Control Analysis (Theory) YSH
How flow through metabolic pathways is distributed
- 13 2/21 Metabolic Control Analysis (Examples) YSH
Identifying control points and their consequences for metabolism in bacteria plant and animals and the use of computerized tools
- 14 2/23 Analysis of Metabolic Network Structures I KC

		Control of flux distribution at a single branch point	
15	2/28	Analysis of Metabolic Network Structures II Grouping of reactions, identification of independent pathways, linear optimization	KC
16	3/2	Metabolic Flux Analysis I (Theory) How can metabolic fluxes through networks be determined using steady state labeling and biomass experiments?	YSH
	3/7	Spring Break	
	3/9	Spring break	
17	3/14	Metabolic Flux Analysis II (Theory) cont'd	YSH
18	3/16	Metabolic Flux Analysis III (Examples and Methods) Metabolic flux analyses in bacterial, plant, and animal primary and secondary metabolism	YSH
19	3/21	Demonstration of Flux Mapping from Labeling Data	YSH
20	3/23	Thermodynamics of Cellular Processes	SH
21	3/28	Midterm Exam II (100 pts, KC, YSH)	

Manipulation of Metabolic Networks

22	3/30	Metabolic Engineering (Methods and Principles) Recombinant DNA, plasmid vectors, cell transformation	CB
23	4/4	Metabolic Engineering (Examples, Bacteria I)	CV
24	4/6	Metabolic Engineering (Examples, Bacteria II)	CV
25	4/11	Metabolic Engineering (Examples, Plants)	CB
26	4/13	Metabolic Engineering (Examples, Mammalian Cells)	KC

Integration of -omics Technologies

27	4/18	Reconstruction of Metabolic Networks (Sequence Preparation)	SH
28	4/20	Reconstruction of Metabolic Networks (Network Building)	SH
29	4/25	Reconstruction of Metabolic Networks (Network Curation)	SH
30	4/27	Whole Genome Metabolic Modeling (Constraints-based analysis) What can you learn about the metabolic capabilities of an organism by analyzing genome-derived info theoretically?	YSH
31	5/2	Final Exam (100 pts, CB, SH, CV)	