
CHEM 4360 **Signalling and Regulation of Gene Expression**

CHEM 4360 Signalling and Regulation of Gene Expression (3) The biochemistry of cell response to external stimuli, with emphasis on animals. Cell surface receptors and ligands; signalling to the nucleus; phosphorylation and proteolysis; transcription; gradients in cell patterning. Prerequisite: CHEM 2370 (CHEM 2370) (or the former 002.235 (060.235)) (C).

Course Outline - 2018

Contact Information : Dr. J. Stetefeld

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Course Information:

- Lecture Slot 7
- MWF 12:30-1:20 p.m.
- 306 Buller Building

Course Description:

This newly-revised course focuses on the current state-of-the-art knowledge in Signal Transduction and Gene regulation. We focus on all of the most informative signaling pathways, their biochemical components methods and regulatory mechanisms. In addition, we will extensively discuss the use of role of miRNA as well as siRNA and their importance in biomedical applications. In each section of the course, the theoretical underpinnings and the practical applications are covered. The course is designed to provide a basic familiarity with the most common signaling pathways and their applications to challenging problems in biology.

Recommended Textbooks:

- Biochemistry of Signal Transduction and Regulation, 3rd edition
by Gerhard Krauss
Wiley-VCH, 2003
ISBN 3-527-30591-2
- Lehninger Principles of Biochemistry, 4th edition
by Nelson, D. L. and Cox, M. M.
Worth Publishers, 2004
Available in the Bookstore.

Evaluation:

- Mid-Term Test (50 min.) tbd ; 12:30 Buller #306----- 30%
- Final Exam (3 hr.) tba----- 70%
- Final exams (100%) just upon written request

Scripts:

- available via D2L for registered students only!

Topics:

- Introduction - the nature of signalling.
- Retroviruses and the discovery of oncogenes
- Developmental mutations as hints about signalling pathways; model organisms
- Bioinformatics; databases and web sites
- Protein families and domains
- G-protein coupled signal transmission
- Second messages & protein kinases
- Signalling of sensory information
- Tyrosine protein kinase receptors; receptor dimerization
- SH2 domains; the Ras pathway
- Ras as an oncogene; SOS and Raf kinase
- The MAPK cascade
- Cytokines and the JAK/STAT pathway
- Stat proteins and transcription
- Transcription in eukaryotes; gene structure
- Transcription - chromatin structure and remodelling
- Transcription - initiation complex
- Regulation of transcription - sequence-specific transcription factors
- Transcription factors; mechanisms of activation of transcription by signalling pathways
- "Direct" signalling to the nucleus: nuclear receptors
- Signalling in the immune system
- The TGF-beta pathway
- TGF-beta pathway; NF-kappaB pathway
- NF-kappaB pathway; ubiquitination and the proteasome; gene targets and biomedical aspects; interactions between signalling pathways
- Apoptosis; TNF and Fas receptors; death domains
- Apoptosis; caspases
- Apoptosis; extrinsic and intrinsic pathways

Expected Outcome:

The course is intended to provide a fundamental understanding of the recent knowledge in Signal Transduction at the atomic level up to signaling pathways in model organisms. This is not intended to be a course covering any one method or field in detail. The expectation is that students will be able to use the knowledge gained in this course to apply in their potential graduate student projects and is designed to help students use published work to effectively further their own research, regardless of their field of research whether in biology, immunology, biophysics or chemical biology. The course is suitable for biologists, biophysicists, and chemists, or anyone interested in gaining a good understanding of basic mechanisms in signal transduction and gene regulation.

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