

# Biology 468: Gene Structure

## **INSTRUCTOR**

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## **COURSE DESCRIPTION**

Biol 468 is an advanced level undergraduate course designed for students with a good working knowledge of molecular biology. Biol 468 students will acquire an overview of our present understanding of the regulatory mechanisms controlling gene expression at the transcriptional and post-transcriptional levels. The following topics will be covered; transcriptional regulation (enhanceosomes, imprinting, epigenetics, chromatin remodelling), pre-mRNA processing, mRNA degradation, regulation of translation, RNA interference and posttranslational modifications. Students will learn about how the global profiling of mRNA expression, gene/gene interactions, gene/protein interactions, protein/protein interactions, chromatin modification and chromatin remodelling is used to understand how organisms function as integrated systems. The course will also involve the critical reading and discussion of published research and the preparation of a paper on a specific issues or topic.

## **COURSE OBJECTIVES**

The students will develop: a knowledge and understanding of the regulatory mechanisms that control gene expression in eukaryotes; an understanding of the molecular approaches used to study gene expression; the ability to design and critically interpret experimental results; learn about hypothesis testing including experimental design and data assessment, and; develop oral and written scientific communication skills.

## **COURSE OUTLINE AND SCHEDULE (tentative)**

### Introduction (Week 1 and 2 background)

- Molecular Cloning Methods
- Molecular Tools for Studying Genes and Gene Activity
- Eukaryotic RNA Polymerases and Their Promoters
- General Transcription Factors in Eukaryotes
- Transcription Activators in Eukaryotes
- Chromatin Structure and its Effects on Transcription

### RNAi and Post-Transcriptional Events (Weeks 3 and 4)

- Splicing
- Capping and polyadenylation
- RNA interference
- Other processing events and posttranscriptional control of gene expression

### Translation (Week 5 and 6)

- The Mechanism of translation initiation elongation and termination
- Ribosomes (structure, composition and assembly) and transfer RNA (structure and function)
- Aminoacyl-tRNA synthetases (linking the genetic code with protein sequence)

DNA Replication, Recombination And Transposition (Week 7 and 8)

DNA replication damage and repair  
Homologous recombination  
Transposition

Genomic Approaches To Biological Function (Week 9 and 10)

Genomics part 1 (sequencing methods and DNA assembly)  
Bioinformatic tools  
Databases and database searching (in silico insights into gene function)  
Genomics part 2 (transcription profiling, parallel analysis of gene function)  
Autoregulation  
Protein-protein interactions  
Chip and Chip on Chip analysis of gene regulation  
Epigenetics

Analysis Of Original Literature (Weeks 10, 11, 12 and 13)

Transcriptional regulation  
Posttranscriptional regulation  
Chromatin structure  
Enhancer characterization using Chip on Chip  
Epigenetic regulatory mechanisms  
Protein -protein interactions

**Additional information**

Biol 468 is a 3-credit course with Biol 367 as the prerequisite.

Date of midterm: October 22, 11.45-1:00

Grading: Midterm, 25%; Final, 45%; class quizzes and assignment(s), 30%. The midterm and final are open book exams, students can bring and use textbooks, written notes and solved problems.

Grading scale: F to A+

Midterm exam: Length 1 hour 15 minutes.

Final exam: 3 hours.

Texts: Recommended, Molecular Biology by Weaver (Edition 5), Molecular Biology of the Gene, a good Biochemistry text.

Web based course materials available on Moodle: Review notes, lecture power points and problem set.

Lecture time: 11:45 - 13:00, Wednesday and Friday

Lecture room location: CC 314

Office hours: Thursday 2:30 to 5:00 PM and Wednesday 2:30 to 4:30 PM