

# Bemidji State University

## BIOL 4449: Gene Expression

### A. COURSE DESCRIPTION

Credits: 4

Lecture Hours/Week: \*.\*

Lab Hours/Week: \*.\*

OJT Hours/Week: \*.\*

Prerequisites: None

Corequisites: None

MnTC Goals: None

While mutations in genomic DNA play a major role in human health and disease, the control of gene expression plays the pivotal role in establishing developmental patterning, cellular differentiation, responsiveness to environmental stimuli, and defense against pathogens and invasive genetic elements. Changes in genomic DNA over time are a key driver of evolution, but the control of gene expression is also a major generator of species diversity and a driver of genome structure and function. Chromosomes in eukaryotic nuclei are made up of a combination of DNA and proteins packaged and compacted into a composite called chromatin-in turn, chromatin structure and modification determines whether a gene is "open" for transcription or closed.

One of the most efficient and well-characterized systems for studying the relationship between chromatin and gene expression is the so-called position effect variegation (PEV) in the compound eye of *Drosophila melanogaster*, in which the variable expression of a reporter transgene allows reproducible measurement of gene expression in response to genetic and environmental factors. We will use a combination of classroom and laboratory approaches to understand and complete original research projects using this system.

Successful completion of this course satisfies BSU Biology's capstone requirement. Prerequisite: BIOL 2360.

### B. COURSE EFFECTIVE DATES: 08/21/2017 - Present

### C. OUTLINE OF MAJOR CONTENT AREAS

1. Data Analysis
2. Fly husbandry, P-elements, transgenes, and position effect
3. Measurement of gene expression
4. Molecular biology of gene silencing

#### **D. LEARNING OUTCOMES (General)**

1. . propose and test hypotheses about the regulation of chromatin state using *Drosophila* to generate specific genotypes required for testing genetic hypotheses.
2. . understand the unique historical importance and continued relevance of the fruit fly in genetic research.
3. . describe the genetic mechanisms by which *Drosophila* and other organisms defend against mobile and repetitive DNA elements, and the impact of genetic attack-and-defense on genome structure and evolution and on the idea of "junk" DNA.
4. . describe the biochemical and functional difference between heterochromatin and euchromatin and the molecular methods by which these differences are investigated.
5. . prepare high quality summary reports, posters, and presentations explaining the work and summarizing the results.
6. . use a variety of morphometric, biochemical, and molecular methods to reproducibly measure gene expression in *Drosophila*.
7. . work in scientific teams to compare and analyze data, troubleshoot experimental approaches, and contribute to shared scientific goals.

#### **E. Minnesota Transfer Curriculum Goal Area(s) and Competencies**

None

#### **F. LEARNER OUTCOMES ASSESSMENT**

As noted on course syllabus

#### **G. SPECIAL INFORMATION**

None noted