BIOS E-30 Epigenetics
Fall 2015

Instructor:
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Location: Northwest B101
Meeting time: Tuesdays, 5:30-7:30 pm

Textbooks:
Below are two optional books you can use to supplement the lecture material. Exams will only cover topics discussed in class therefore these books are optional.

The Epigenetics Revolution: How Modern Biology Is Rewriting Our Understanding of Genetics, Disease, and Inheritance
By: Nessa Carey
This has a style geared more for the laymen. It is very well written and fun. It also references primary literature throughout, so it can be a great jumping off point to find more detail on a particular topic. The coarse follows most of the structure of this book so I include pages/chapter readings relevant to each lecture in the syllabus.

Epigenetics
Editors: Allis, Jenuwein, and Reinberg. Cold Spring Harbor Press, 2008
paperback edition.
This is a more traditional textbook. It contains a lot of detail that we will not cover and is a bit out of date.

Course Description:
Chromosomes are macromolecular polymers that undergo continuous alterations in structure and organization, which can influence gene expression. These physical variations can be attributed to DNA methylation, histone modifications, chromatin remodeling complexes, and the association of non-coding RNA molecules. Irregular patterns of inheritance that cannot be accounted for by changes in DNA sequence are often caused by epigenetic mechanisms. This course begins with a discussion of the histone code, chromatin associated proteins, the formation and maintenance of heterochromatin, experimental methods, and model organisms. This is followed by discussions of the role of epigenetics in biological phenomena such as imprinting, X-inactivation, cellular identity, cellular reprogramming, tumorigenesis, and the onset of certain types of neurological disorders.
Prerequisite: BIOS E-12, or the equivalent.

Section Meetings:

Weekly required sections meetings will be held for graduate credit students immediately after lecture (7:30-9:00pm). In section graduate students will present and discuss assigned readings from primary scientific literature.

An optional weekly section meeting may also be held for undergraduate students immediately after lecture (7:30-9:00pm) where students will work through practice problems and review lecture material. This is dependent on sufficient enrollment to allow a Teaching Fellow assignment.

Grades:

Undergraduate:
In-class quizzes and participation: 10%
Problem sets (PS): 30%
Exams: 60% total (20% each)

Graduate:
In-class quizzes and participation: 5%
Graduate paper: 20%
Section discussion: 15%
Exams: 60% total (20% each)

Exams are a mix of multiple choice and short answer with an emphasis on critical thinking through data interpretation. Problem sets will be short answer with one week to complete. No late assignments accepted unless under documented special circumstances. No extra credit. Graduate students will have access to problem sets for practice and exam prep.

Syllabus:

Date	Topic	Reading	UG Due	Grad Due
Sept. 1	Transgenerational effects, twins, and development as epigenetic processes	Chapter 1, 5 (pg 75-85, 90-96), 6 (pg 97-105)		
Sept. 8	Intro to histones, chromatin packing, transcription factors and gene expression	Chapter 3, 4		
Sept. 15	DNA methylation, histone modifications, and epigenetic regulators	Chapter 3, 4, 5 (pg 83-89), 6 (pg 106-114)		
Sept. 22	The epigenetic code for gene silencing	Chapter 3, 4	PS1	
Sept. 29	The epigenetic code for gene activation and long-distance regulation	Chapter 3, 4		Review articles 2006-2009
Oct. 6	Exam 1			
Oct. 13	PcG proteins and RNA-mediated heterochromatin formation	Chapter 10		

Oct. 20	Imprinting	Chapter 7-8		mini-review outline
Oct. 27	X-inactivation	Chapter 9		
Nov. 3	Development revisited: reprogramming in PGCs	Chapter 2		
Nov. 10	Exam 2			
Nov. 17	iPS cells and Ageing	Chapter 2, 13		optional 1st draft
Nov. 24	TBA			
Dec. 1	Cancer epigenetics	Chapter 11	PS2	
Dec. 8	Neuroepigenetics	Chapter 12		
Dec. 15	Cumulative Final Exam			**mini-review final draft**