2022

Introduction to Epigenetics

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Biology 48100: Introduction to Epigenetics; Mondays 10:00-12:30 PM, MR-506

Instructor: **Dr. Yevgeniy Grigoryev, Lecturer**

Office hours Wed 2:00-3:15pm Zoom Meeting ID 896 275 8889

Office Hour Zoom link Password: spring2022

https://ccny.zoom.us/j/8962758889?pwd=THYzL2krekxWOWttRUxOT2lBeXZ2UT09

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Overview: This course will examine selected epigenetic phenomena described in several eukaryotes, mechanisms controlling these effects and their phenotypic consequences when normal regulation is lost. This is a Zero Textbook Cost (ZTC) course and reading materials will be from primary articles and other OER resources. By the end of the course, students should understand the differences between genetic and epigenetic influences on gene expression, epigenetic mechanisms that regulate gene expression, how epigenetic modifications are propagated, and the phenotypic consequences of normal vs. abnormal epigenetic regulation in disease, development and evolution.

Assigned OER material: primary articles and other resources will be posted on our Blackboard section

Optional (but NOT required) reading: *The Epigenetics Revolution: How Modern Biology Is Rewriting Our Understanding of Genetics, Disease, and Inheritance* by Nessa Carey. 2013. ISBN: **9780231161176**

Course Objectives: Bio 48100 is an elective course for Biology majors. The objective of this course is to provide students with a solid foundation in both the principles of epigenetics and experimental research by emphasizing the use of primary research articles and focusing on developing analytical scientific reading and writing skills to focus on the current questions in epigenetics and how they are being addressed experimentally. During the course: 1) students will *analyze* primary research articles to extract the main conclusions from the text and figures and summarize the experimental approaches; 2) Students will *identify* connections between the epigenetic mechanisms in each paper and their larger implications in terms of regulation of gene expression, inheritance, and the phenotypic consequences of normal vs. abnormal epigenetic regulation; 3) students will *present* their findings orally, making use of literary evidence to illustrate and support their claims; 4) students will *write* about their interpretations in carefully researched and sustained arguments.

Course learning outcomes

After completing this course, students should be able to:
1. Understand differences between Mendelian and epigenetic inheritance
2. Understand DNA methylation regulates gene expression
3. Understand how chromatin modifications and remodeling regulate gene expression
4. Understand the role of non-coding RNAs in epigenetic regulation
5. Understand how epigenetic modifications are propagated
6. Understand the research process from hypothesis generation to final presentation of results
7. Be able to generate testable research questions from observations
8. Be able to design a controlled experiment to test a hypothesis
9. Be able to present findings of a primary research paper and indicate their significance/limit

Tips on reading primary scientific papers:

• Begin by reading the abstract so you understand what the authors want you to conclude but do not

automatically accept the authors' conclusions as correct.

- Then look at the figures. With well-labeled figures, you can identify the methods used, what experiment was done and draw your own conclusions. Read the legend if you need clarification.
- With this overview, now read the entire paper. If you properly interpreted the figures, your reading of the text will go fast. If the figures were confusing, the text should make things clear.

Class Format: Mix of lecture, in-class discussion focusing on specific papers, and student presentation of current topics in epigenetics. This course format emphasizes critical analysis of the papers being discussed and will focus on the current questions in Epigenetics and experimental design.

Attendance: Attendance is mandatory and will be recorded via class quiz submission. If you miss more than **two** classes without a documented medical excuse, you will receive a grade of WU for the course.

Communication: This is a Blackboard course. Announcements, course schedule, syllabus and other pertinent information will be posted on our class blackboard page. Please check it regularly and make sure you have active access to it.

Academic integrity: Students are expected to know and follow the academic integrity policy of CCNY and CUNY. Please visit the website for more details. http://www.ccny.cuny.edu/about/upload/academic_integrity.pdf

"Plagiarism is the act of presenting another person's ideas, research or writings as your own. The following are some examples of plagiarism, but by no means is it an exhaustive list:

1. Copying another person's actual words without the use of quotation marks and footnotes attributing the words to their source.
2. Presenting another person's ideas or theories in your own words without acknowledging the source.
3. Using information that is not common knowledge without acknowledging the source.
4. Failing to acknowledge collaborators on homework and laboratory assignments.
5. Internet plagiarism includes submitting downloaded term papers or parts of term papers, paraphrasing or copying information from the internet without citing the source, and "cutting and pasting from various sources without proper attribution."

The City College Faculty Senate has approved a procedure for addressing violations of academic integrity, which can also be found in Appendix B.3 of the CCNY Undergraduate Bulletin. Be aware that if we suspect plagiarism we will report your conduct to the College's Academic Integrity Official. Disciplinary sanctions range from failing the class to expulsion from the college.

All submitted work will be checked for plagiarism with **SafeAssign (SA)** algorithm. Anything with a SA score of 30% or more will raise serious doubts about the authenticity of your work and will warrant a discussion with me. Students get two attempts to upload their work into Blackboard, so make sure to check your SA score (which may take a while to process, so pay attention to the deadline time).

Disability Policy: In compliance with CCNY policy and equal access laws, appropriate accommodations are administered by the AccessAbility Center. Students who register with AccessAbility, and are entitled to specific accommodations, must request a letter from AccessAbility to present to the Professor that states what their accommodations are. If specific accommodations are required for a test, students must present an "Exam Administration Request Form" from AccessAbility, at least one week prior to the test date in order to receive their accommodations.

Grading:

Homework (20%) – HWs correspond to the assigned papers for a given class. Choose one of the two assigned primary readings to write up. You must type up (no hand written) and submit one copy

electronically to Blackboard by 10pm the day before the class AND also hand in a printed copy at the start of class prior to the presentations. Online Assignments received after 10pm up to the class start time will receive a 10% deduction in grade and assignments submitted after class will not be accepted and receive a grade of zero. There are no make-ups for missed HWs but **I will drop the lowest two scores for the semester**. You must choose one of the primary research papers (not a review article) but read and be prepared to discuss both papers. Each assignment should be no more than 1 page of **at least 11 point font**, single-spaced with **1-inch margins**, have a title corresponding to the primary paper and include the answers to the following 3 sections:

Primary Paper HW assignment format

1. In your own words, state the essential take home message of the paper assigned – choose just one paper if I assigned more than one for that class (primary paper, not the review). Importantly, do not simply restate abstract (2-3 sentences max!)
2. State how the authors demonstrated the essential point of the paper: what experiments and what methods they used to prove the point – do not make this a restatement of what is shown each figure. Bullet points are acceptable.
3. Discuss the strengths and significance of the paper and also the weaknesses – Feel free to rip a paper apart. If you don't find weaknesses worth mentioning, indicate additional lines of investigation that you think would be worth pursuing that were opened up by the paper. An example of a primary research paper you might be assigned: Greer E et al, 2014 "*A Histone Methylation Network Regulates Transgenerational Epigenetic Memory in C. elegans*"

In Class Quizzes (20%) - Each class will have a 10 minute short-answer quiz to assess your understanding of the previous classes and the topic of today's class. The quiz will count towards your attendance as well. There are no quiz make-ups but I will drop the **lowest two grades**.

Class Participation (10%) - You are expected to take an active part in discussing the assigned topics in class and BB discussions. Do not worry about being wrong, you are here to learn and making mistakes is part of the learning process.

Student Presentations (25%) - Every student will give a presentation about one of the scientific publication assigned for the lecture that day. Presentations should be no more than 20 minutes long (I will stop you after 20 mins). A presentation should include **background information**, a thorough and **critical discussion of the findings** and **future directions,** as well as interactive activities for the audience (Q&A, pop quiz, etc). The presentation will be followed by 10 minutes of discussion and Q&A from the audience. Your grade will be based on your understanding and interpretation of the material presented, the organization of your presentation, and the clarity of the visual aids you use. We will have two presentations per class on the two assigned primary papers. All students are expected to be present for entire duration of class, and participate in presentation Q&A.

Presenters are required to schedule a consultation prior to presenting in class. No student will be allowed to present without a prior consultation. I can meet you on Zoom during office hours or mutually agreeable time to go over your presentation draft and answer your questions. If you are not available during my office hours, contact me to set an appointment based on my availability. I require at least a 48 hour advance notice. You must also email me your presentation prior to the meeting.

Final Exam (25%) - There will be an in class exam to test your understanding of the topics we covered in class as well as your ability to propose experiments to address specific research problems. If you understand how to answer the questions I posed in quizzes and how to use the methods covered in the papers in well-controlled experiments, you'll do well. Check the Exam Review Sheet on BB.

Spring 2022 Schedule

Lec	Date	Topic	**Pre-Class** BB module	Primary Articles
1	1/31	Introduction to epigenetics, basic concept overview and brief history of the field	**Module 1**	None
2	2/7	DNA methylation	**Module 2**	1;2
3	2/14	Histone modifications	**Module 3**	3;4
4	2/28	Linking epigenetic modifications to chromatin remodeling and transcription	**Module 5**	7;8
5	3/7	Non-coding RNAs	**Module 6**	5;6
6	3/14	Model animal systems	**Module 7**	9;10
7	3/21	Genomic Imprinting	**Module 8**	11;12
8	3/28	Genome-wide analysis of epigenetic marks	**Module 9**	13;14
9	4/4	Epigenetics and the environment	**Module 10**	15;16
10	4/11	X inactivation	**Module 11**	17;18
4/15-4/22 Spring Break				
11	4/25	Epigenetics of Health	**Module 12**	19;20
12	5/2	Imprinting disorders & Rett syndrome	**Module 13**	21;22
13	5/9	Epigenetics and the brain	**Module 14**	23;24
14	5/16	Cancer Epigenetics	**Module 15**	25;26
	TBD	Final Exam		