**Biology 31121: Introduction to Epigenetics Syllabus**

**Location:** MR 506

**Time:** Thursdays 9:30AM-12:15PM

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

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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. Reading material will be from current literature. 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. Class participation and attendance are required.

**Text:** There is none, all readings are from the primary scientific literature. See the syllabus and visit the class blackboard website for assignments. Each assignment will have at least one review and one primary research article. I will be posting PDFs of assigned papers on blackboard.

Course Objectives: Bio 31121 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

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| **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**: Here is my suggestion on how to read a scientific paper:

• 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.

• The reviews on the class website may be helpful for additional information.

**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 how they are being addressed experimentally.

**Attendance**: Attendance is mandatory. If you miss more than two classes without a documented medical excuse, you will receive a grade of WU for the class.

**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/up>load/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.

**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%) –* The HWs correspond to the assigned papers for a given class. Choose one of the two assigned primary readings to write up. You must hand them in at the start of class prior to the presentations. If you wish to turn in homework but will not be in class, make sure I get it before class (emails are ok). Assignments received after the class will not be accepted and receive a grade of zero. If more than one paper is listed, choose one of the primary research papers instead of a review, but read and be prepared to discuss all of the papers. Each assignment should be no more than 1 page of 11 point Ariel font, single spaced with half inch margins, 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 (15%) -* Each class will begin with a 10 minute short-answer quiz to assess your understanding of the previous classes and the topic of today’s class. The quiz will begin 5 minutes after class time and will count towards your attendance.

*Class Participation (15%)* - You are expected to be present for class and to take an active part in discussing the assigned topic and provide constructive feedback to your class mates. Do not worry about being wrong, you are here to learn and making mistakes is part of the learning process. Your participation grade is based on your willingness to discuss class material.

*Student Presentations (25%) -* Every student will give a presentation about one of the scientific publication assigned to be discussed in the lecture that day. Presentations should be approx. 15 minutes long and include **background information, a thorough and critical discussion of the findings and future directions**. The presentation will be followed by 10 minutes of discussion and Q&A. 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 primary papers assigned for reading

*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 the problem I pose and how to use the methods covered in the papers in well controlled experiments, you’ll do well.

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| Lecture | Topic |
| 1 | Introduction to epigenetics, basic concept overview and brief history of the field  <http://learn.genetics.utah.edu/content/epigenetics> |
| 2 | Epigenetic modifications and gene expression: DNA methylation |
| 3 | Epigenetic modifications and gene expression: Histone modifications |
| 4 | Lost in translation: Non-coding RNAs in Epigenetics |
| 5 | Linking epigenetic modifications to chromatin remodeling and transcription |
| 6 | Model animal systems for studying epigenetic regulation |
| 7 | Genomic imprinting in mammals |
| 8 | Studying multiple layers of epigenetic regulation; genome-wide analysis of epigenetic marks |
| 9 | Epigenetics and the environment: Nature vs. Nurture, Mother’s Love,  Sins of the fathers and ghosts in your genes |
| 10 | Something eXtra: X inactivation |
| 11 | Epigenetic programming in cell renewal and pluripotency |
| 12 | Epigenetics in disease I: Imprinting disorders, Rett syndrome, ICF syndrome, etc |
| 13 | Epigenetics in disease II: Epigenetics and the brain |
| 14 | Cancer Epigenetics & Epigenetics in drug discovery |
| Final | **Final Exam** |