Molecular Genetics: Genes, Circuits, and Behavior
Matthew DeGennaro, Ph.D.

Deuxieme Maison 193
Tu/Th 12:30PM - 1:45PM

Fall 2017 office hours AHC1 319A Tuesday 3 to 6pm and by appointment

Objective: This course for senior undergraduate and graduate students is designed to give an understanding of the fundamentals of molecular genetics. Molecular genetics is a powerful way of seeing nature that has uncovered many mysteries about how living things function. You will learn how to interpret, present, and discuss data from the primary literature.

Overview: How we perceive and respond to our environment is governed by the nervous system. The task of understanding how this network of specialized cells functions is a daunting one. Over the past 30 years, molecular genetic analysis of neural function in model organisms has greatly expanded our knowledge. By using the primary literature, we will discuss classic experiments that have made important contributions to neuroscience. These fundamental works will serve as a foundation for our discussion of more current papers. Although this course will focus on neurobiology, the molecular genetic approaches and techniques discussed are applicable to many biological questions.

The primary goals of this course are to improve student's comprehension of the primary literature and ability to think critically about research. Each week we will discuss papers covering the topics listed below that will be posted on the course Blackboard. The papers will be presented by teams led by graduate students. The team is required to make a PowerPoint presentation for the paper that includes all the figures of the paper and a background slide or two at the beginning of the presentation. Undergraduates students will assist the graduate students with making the presentation and will present the figures of the paper with their group to the rest of the class. During the presentation, each member of the team will present figures to the class on a rotating basis. Two papers presentations will occur each class. Depending on enrollment, a team will likely make a least 6 presentations over the semester. The presentation needs to be emailed to me prior to each class or brought into class on a usb drive.

All students are required to read these papers and be prepared for a detailed discussion of the experiments presented within them. Review articles included in the syllabus will not be presented, they are provided to give you additional background. The recommended text book, Decoding the Language of Genetics, is a useful primer on both basic and advanced genetics concepts. Presentations will be graded by the instructor and will constitute 50% of the final grade. Class participation and attendance will count as 20% of the final grade.

There will be a take home midterm exam and an in-class final exam that will account for the remaining 30% of the final grade. The take home exam questions will be run through
the Turn-it-in program to assure original answers. The exams will cover molecular genetic techniques and terminology as well as concepts presented in the paper presentations.

**Recommended textbook:** Decoding the Language of Genetics by David Botstein

**Course codes:**
- Undergraduate: PCB 4133-U01 O (79994)
- Graduate: BSC 6936-U01 O (79995)

**Grading Criteria for Presentations**

Undergraduates: Undergraduate students must be able to demonstrate that they read the paper and have a general understanding of the discoveries being put forward. The in-class presentation of the paper must include all main figures and include some background information from the introduction to the paper (2 to 4 slides). Some guidelines:

- Use the Powerpoint files from class 2 & 3 as a model for their presentations. These files can be found on blackboard.
- Breakup the figures if necessary on to different slides to ensure legibility
- Identify the technique(s) used to produce the data in the figure
- Identify the control and experimental data sets or images
- Discuss how the data leads to the conclusions the authors make
- Discuss potential problems with the approach used
- Assess whether the data supports the title of the article

Graduates: In addition to the undergraduate requirements, graduate students should include these elements in the presentation or discussion:

- Discuss alternative approaches to the ones used in the article if possible
- Discuss why these findings appeared in a high-profile journal
- Add a slide to the presentation at the end summarizing the findings
- Discuss the unanswered questions that the researchers could address next

**Grading Criteria for Exams**

Midterm: Students will be given a short research article and will be asked a series of short-answer questions about it. The exam will be a take home exam. The test is open book and open notes. Undergraduates and graduate students will be given different articles and asked different questions.

Final exam: All students will be asked 15 multiple choice questions about molecular genetics (30% of exam). They will also have to match 20 genetic terms or concepts with their definitions (40% of exam). The last part of the exam will be different for undergraduates and graduate students (30% of the exam). Undergraduates will choose between one of the two
online lectures given by the HHMI investigators and be asked a series of 15 short-answer questions about them. Graduate students will have to answer questions about both online lectures.

For **5 points of extra credit on the final exam**, students will choose between one of two fictitious abstracts and outline 4 experiments that the paper supporting the abstracts conclusions might include.

**No questions will be answered by the instructor during the final exam.**

**Groups:**

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<thead>
<tr>
<th>Name</th>
<th>Group #</th>
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<td>Joshua Raji</td>
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<td>Bryan Alexander Solano</td>
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<td>Elina Barredo</td>
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<td>Kevin Dourado</td>
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<td>John Castillo</td>
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<td>Clara Karam George</td>
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<td>Fredis Mappin</td>
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<td>Nicholas Franco</td>
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<td>Moises Camacho</td>
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<td>Krystal Blanca Fernandez</td>
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<td>Nirvan Ramphall</td>
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<td>Andre Silva</td>
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<td>Renata Gallegos</td>
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<td>Hiram Anthony Duarte</td>
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<td>Wissam Khalaf</td>
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<td>Lilia Amel Curbelo Jalil</td>
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<td>Robert Seitter</td>
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<td>Sebastian Garcia-Umpierre</td>
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<td>Mariluz Soula</td>
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<td>Pamela Karina Bermudez</td>
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<td>Jessica Blanco</td>
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<td>Brian Garcia</td>
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Weekly meeting topics and readings:

**Week 1 Aug 21**

**Concepts in Molecular Genetics**

**Class 1: Tuesday**
- Lecture on molecular genetic concepts and terms
- Organization of groups for paper presentations
- Chapter 1 of *Decoding the Language of Genetics* by David Botstein

**Forward Genetics**

**Class 2: Thursday**


**Week 2 August 28**

**Genome Editing**

**Class 3: Tuesday**


**Transgenesis & Binary systems for cell manipulation**

**Class 4: Thursday**


**Week 3 September 4**

**Initial molecular genetic approaches to neuroscience**

**Class 5: Tuesday**
S. Benzer (1971) From the gene to behavior. *JAMA* 218 (7): 1015-22. *Background article*
**Presented by Group #3**

**Presented by Group #4**

**Class 6: Thursday**


**Presented by Group #6**

**Week 4 September 11th**

**Ion channels & synaptic transmission**

**Class 7: Tuesday**

**Presented by Group #7**

**Presented by Group #8**

**Class 8: Thursday**

Special seminar at the University of Miami Medical School for EXTRA CREDIT

- Thursday, September 7th at noon at University of Miami Medical School, RMSB (Rosensteil Medical Sciences Building) room 6018
- if you attend and write a 1 paragraph synopsis you can get up to 4 points added to your final grade for the course
- If you have trouble getting to the University of Miami Medical school that day please contact me

**Week 5 September 18th**

**Learning and memory**

**Class 9: Tuesday**


**Presented by Group #9**

**Class 10: Thursday**


**Written take home exam questions given out, exam must be returned to me via email by September 25th (10% of final grade).**

**Week 6 September 25th**

**Visual perception**

**Class 11: Tuesday**


**Olfactory receptors**

**Class 12: Thursday**


**Week 7 October 2nd**

**Olfactory receptor expression**

**Class 13: Tuesday**


Olfactory receptor evolution

**Class 14: Thursday**


**Week 8 October 9th**
Olfactory circuits

**Class 15: Tuesday**


**Class 16: Thursday**


**Week 9 October 16th**
Gustation

**Class 17: Tuesday**


Appetite

Class 18: Thursday


Week 10 October 23rd
Patterning the nervous system

Class 19: Tuesday


Class 20: Thursday


Week 11 October 30th
Fear

Class 21: Thursday


Class 22: Thursday
No in-class presentation, view two online seminars on Molecular genetics
These videos will also be available for download on BlackBoard along with their transcripts. Content presented in lectures will be asked about in the final exam

Sizing up the Brain Gene by Gene: http://www.hhmi.org/biointeractive/sizing-brain-gene-gene

Unwinding Clock Genetics: http://www.hhmi.org/biointeractive/unwinding-clock-genetics
**Week 12 November 6th**

**Circadian Rhythm & Sleep**

**Class 23: Tuesday**
**Presented by Group #2**

**Presented by Group #3**

**Social behavior**

**Class 24: Thursday**
**Presented by Group #4**

**Presented by Group #5**

**Week 13 November 13th**

**Imaging neurons**

**Class 25: Tuesday**
**Presented by Group #6**

**Presented by Group #7**

**Optogenetics & Chemogenetics**

**Class 26: Thursday**
**Review article**

**Presented by Group #8**

**Presented by Group #9**
Week 14 November 20th
Mating behavior

Class 27: Tuesday


Week 15 November 27th
Addiction & Thirst

Class 28: Tuesday


Class 29: Thursday
Review Session

In-class final exam (20% of final grade): December 5th from 12 to 2pm

Final Grade calculations:

Attendance & class participation: 20%
Presentations: 50%
Midterm and final exam: 30%

Grading Scale: A 100-94 A- 93-90 B+ 89-87 B 86-84 B- 83-80 C+ 79-77 C 76-74 C- 73-70 D+ 69-67 D 66-64 D- 63-60 F < 60

Academic Misconduct: Florida International University is a community dedicated to generating and imparting knowledge through excellent teaching and research, the rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and honestly demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational mission of the University. All students are deemed by the University to
understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook.

Full handbook and information can be found at:
http://www.fiu.edu/~oabp/misconductweb/1acmisconductproc.htm

**DEFINITION OF ACADEMIC MISCONDUCT:** Academic Misconduct is defined as the following intentional acts or omissions committed by any FIU student:

1.01 Cheating: The unauthorized use of books, notes, aids, electronic sources; or assistance from another person with respect to examinations, course assignments, field service reports, class recitations; or the unauthorized possession of examination papers or course materials, whether originally authorized or not. Any student helping another cheat may be found guilty of academic misconduct.

1.02 Plagiarism: The deliberate use and appropriation of another's work without any indication of the source and the representation of such work as the student's own. Any student who fails to give credit for ideas, expressions or materials taken from another source, including internet sources, is guilty of plagiarism. Any student helping another to plagiarize may be found guilty of academic misconduct.

1.08 Academic Dishonesty: In general, by any act or omission not specifically mentioned above and which is outside the customary scope of preparing and completing academic assignments and/or contrary to the above stated policies concerning academic integrity.

If found cheating, YOU WILL RECEIVE AN “F” FOR THE CLASS, NO EXCEPTIONS.

***Syllabus subject to change***