MOLECULAR GENETICS (Fall, 2021)

BIOSCI 490, 3 cr. U/G

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Classes Meet: TR 11:00am-12:15pm, 09/02/2021-12/14/2021; Lapham Hall 252

Course Description: Molecular Genetics is a course for advanced undergraduates and graduate students. The course covers a broad array of topics primarily in eukaryotic Genetics, including gene structure, genetic and genomic analysis, gene expression and regulation. Supplementary reviews or original research papers will be discussed. 2 hrs lec, 1 hr dis/pre.

Prerequisite: Bio Sci 325(P); Bio Sci 315(C) & 316(C) or graduate standing.

Textbook and Required Readings: Text: Lewin's Genes X or XI by Jocelyn E. Krebs, Elliott S. Goldstein, and Stephen T. Kilpatrick, Jones and Bartlett Publishers, ISBN: 978-0-7637-6632-0 (alk-paper)

Required Readings: assigned review articles.

Lecture slides and reading articles will be distributed via the Canvas website (https://uwm.edu/canvas/).

Canvas Website: All course materials will be distributed via the Canvas course website (https://uwm.edu/canvas/). From the "Home" of the "Molecular Genetics [BIO SCI 490/490G (001)]" course, you will find THREE modules: "Syllabus", "Lecture Slides", and "Schedule and Papers for Discussion and Presentation". In the "Syllabus" module, an e-copy of the syllabus is available. Slides of PowerPoint presentations will be posted in advance of lectures in the "Lecture Slides" module. In the "Schedule and Papers for Discussion and Presentation", you will find the schedule for paper discussion and presentation, as well as assigned papers.

Learning Goals:

- Understand the structures and components of genes, genomes, chromosomes, and chromatin (2).
- Know the molecular mechanisms of gene transcription and posttranscription. understand the molecular mechanisms of genetic and epigenetic regulation of gene expression. Learn how to study growth and development using forward genetic and reverse genetic approaches (2).
- Understand modern technologies used for analyzing structure and function of genes (1).
- Demonstrate an understanding of how genes and genomes evolve (5).

- Describe the fundamental principles related to molecular genetics and apply these principles to biological questions of today (6).
- Learn how to review literature in the field of molecular genetics and develop the ability to synthesize, integrate, and communicate scientific information (3, 4).

Syllabus objectives that the course will engage and assess:

(1) Apply scientific method to biological questions, (2) Investigate scientific questions, (3) Retrieve scientific information, (4) Synthesize, integrate, communicate scientific information, (5) Demonstrate and articulate evolutionary concept, and (6) Describe/apply biological information and concepts

Schedule and Topics

WEEK	DATE	TOPICS (L: Lecture; D/P: Discussion/Presentation)
1	09/02R	Welcome and introduction to the course
2	09/07T	**I. Genes, Genomes, and Chromosomes** L1. Basic Concepts about Genes (I, Ch 1,2, 4)
	09/09R	L2. Basic Concepts about Genes (II, Ch 1,2, 4)
3	09/14T	L3. Genomes (I, Ch 5, 6, 8)
	09/16R	L4. Genomes (II, Ch 5, 6, 8)
4	09/21T	D/P1: **tentative** Mudge, J.M. & Harrow, J. The state of play in higher eukaryote gene annotation. Nature Rev. Gen. 2016, 17, 758-772.
	09/23R	L5. Methods in Molecular Biology and Genetic Engineering (I, Ch 3)
5	09/28T	L6. Methods in Molecular Biology and Genetic Engineering (II, Ch 3)
	09/30R	D/P2: **tentative** Ozsolak, F. & Milos, P.M. RNA sequencing: advances, challenges and opportunities. Nature Rev. Gen. 2011, 12, 87-98.
6	10/05T	L7. Chromosomes (Ch 9)
	10/07R	L8. Chromatin (I, Ch10)
7	10/12T	L9. Chromatin (II, Ch10)
	10/14R	D/P3: **tentative** Cuvier, O. & Fierz, B. Dynamic chromatin technologies: from individual molecules to epigenomic regulation in cells. Nature Rev. Gen. 2017, 18, 457-472.
8	10/19T	**II. Transcription and Posttranscriptional Mechanisms** L10. Prokaryotic Transcription (Ch 19)
	10/21R	L11. Eukaryotic Transcription (Ch 20)
9	10/26T	**Exam I**
	10/28R	D/P4: **tentative**

		Furey, S. ChIP–seq and beyond: new and improved methodologies to detect and characterize protein–DNA interactions. Nature Rev. Gen. 2012, 13, 840-852.
10	11/02T	L12. RNA Splicing and Processing (Ch 21)
	11/04R	L13. mRNA Stability and Localization (Ch 22)
11	11/09T	D/P5: **tentative** Schmid, M. & Jensen, T.H. Controlling nuclear RNA levels. Nature Rev. Gen. 2018, 19, 518-529.
	11/11R	**III. Gene Regulation** L14. Eukaryotic Transcription Regulation (Ch 28)
12	11/16T	D/P6: **tentative** Spitz, F. & Furlong, E.E. Transcription factors: from enhancer binding to developmental control. Nature Rev. Gen. 2012, 13, 613-626.
	11/18R	L15. Epigenetic Effects Are Inherited (Ch 29)
13	11/23T	D/P7: **tentative** Tang, W.W.C. et al. Specification and epigenetic programming of the human germ line. Nature Rev. Gen. 2016, 17, 585-600.
	11/25R	Thanksgiving Holiday No Lecture
14	11/30T	L16. Regulatory RNA (Ch 30)
	12/02R	D/P8: **tentative** Morris, K.V. & Mattick, J.S. The rise of regulatory RNA. Nature Rev. Gen. 2014, 15, 423-437.
15	12/07T	**IV. Molecular Genetics of Development** L17. Genetic and Reverse Genetic Analysis
	12/09R	D/P9: **tentative** Shalem, O. et al. High-throughput functional genomics using CRISPR–Cas9. Nature Rev. Gen. 2015, 16, 299-311.
16	12/14T	L18. Genetic Regulation of Flower Development
		Exam II

*Lecture Topics and Exam schedule might be subject to minor changes.

Lectures: The corresponding textbook readings for each lecture are listed in the table above. PowerPoint files will be made available on the Canvas course website (https://uwm.edu/canvas/) before the lecture. You are welcome to print out slides before class to use for note taking, but slides might be revised until the lecture.

Discussion/Presentation sessions: Reviews or research papers related to lecture topics will be distributed on Canvas. Undergraduate students will be divided into several groups. Each group will be assigned an article. The discussion leader elected by the group members will assign topics to each

member (including the discussion leader) and lead the discussion. Each group member will thoroughly read the article and present her/his assigned part to all class members. You are encouraged to add more background materials for a better understanding of your paper. All group members are required to be prepared and active in answering questions. You may use PowerPoint slides, transparencies, or hand drawings along with your discussion. Graduate students are required to participate in all the Discussion sessions.

All the graduate students need to give a 50-minute PowerPoint talk and lead a following 15-minute discussion based on the assigned main article.

Examinations and Grading: There will be TWO non-cumulative exams. The exams will be a combination of short answers and essay questions mainly covering lecture materials. Graduate students will have several more questions. The presentation by the graduate students is also graded.

Grading	Undergraduate	Graduate
Exam I	35%	25%
Exam II	35%	25%
Discussion	20%	10%
Presentation		30%
Attendance	10%	10%

Make-Up Exams: Students must have a physician's note to make up a missed exam. If illness is not the reason for missing an exam, you must contact the instructor at least ONE week before the exam. Accommodations will be made for conflicts due to religious observances, but the instructors still must be notified at least ONE week in advance. If you have not made prior arrangement, you will not be permitted to take a make-up exam. The make-up exams will not be the same ones taken by the rest of the class, and they may be in a different format.

Seating Arrangements: Students requesting special seating or exam arrangements, please contact the instructor during the first class meeting or at least one week before the exam. You may contact the Student Accessibility Center (Mitchell Hall, Room 112, 414-229-6287, https://uwm.edu/arc/) for more information.

Academic Conduct Policy: The university has a responsibility to promote academic honesty and integrity and to develop procedures to deal effectively with instances of academic dishonesty. Students are responsible for the honest completion and representation of their work, for the appropriate citation of sources, and for respect of others' academic endeavors. This course follows the guidelines and procedures related to students with disabilities**,** religious observances, students called to active military duty, incompletes, discriminatory conduct (such as sexual harassment), academic misconduct, complaint procedures, and grade appeal procedures. Detailed information about can be found online at www.uwm.edu/Dept/SecU/SyllabusLinks.pdf.

COVID Statement: Please check the COVID Statement at https://uwm.edu/cetl/covid-19-syllabus-statements/, if you take in-person and online classes.

Strategies for Success: Because we will cover a great deal of materials in a short time, it is important to keep up with the work on a regular basis.

1. Pre-read the textbook and required readings.
2. Attend every class, solve puzzles and digest materials during each lecture.
3. Go over your lecture notes after each lecture to consolidate your learning and clarify principles and details while materials are still fresh in your mind.
4. Consult the professor during office hours if something still confuses you.
5. Carefully study sample questions.
6. Prepare and practice your discussion/presentation and be active during discussion.