3 hours credit, prerequisite: Undergraduate course in molecular biology

Instructors:  
R. Curtis Bird (Course Director)  
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Course Description
Eukaryotic Molecular Biology (3). Lec. 3 Pr. none. Genetic mechanisms by which eukaryotic cells select and regulate expression of genes and use these mechanisms to control replication, communicate and differentiate, including important examples of biomedical dysfunction, will be covered. Current literature will be used extensively.

Course Objectives: This course is designed as a first offering in a series of proposed graduate level courses in molecular biology and genetics primarily for M.S. and Ph.D. students in Biomedical Sciences (BMS). Eukaryotic Molecular Biology will present the fundamental aspects of control of cellular processes such as the cell cycle, interactions between cells, and differentiation of cells into organized tissues. This course will include important examples of biomedical dysfunction to illustrate these concepts. The material in this course will be presented at an advanced level not suitable for undergraduates. The course will focus on a mechanistic approach to understanding these processes and will require considerable effort and participation from the student, including the discussion of weekly literature assignments and presentation of some class lectures.

Students enrolled in this course will:
1. Gain an in depth knowledge of basic molecular biology and genetics,
2. Become comfortable with critically reviewing and presenting molecular genetics papers, to include understanding the methods used to generate the data, and comprehending the implications of the results presented in the papers,
3. Learn how to write and present a review paper on a pertinent topic in molecular biology and genetics.

Texts or Major References
Current Literature, assigned weekly.

Lectures will be Monday and Wednesday from 11-11:50 and Thursday from 11:00-1:00 in Room 203 Greene Hall. Each week there will be 3 hours of lecture and one hour of research paper discussion (generally on Wednesday).

Term Paper: Each student will select a topic from a list (or of their choice with approval of the instructors) at the beginning of the course and will do a term paper and presentation on the topic during the last weeks of the course. Instructions for this are at the end of the syllabus.

Graduate Credit Justification: Eukaryotic Molecular Biology is the first course in a rigorous two course graduate series on this topic. The course delves into such topics as gene organization and structure, mapping, and the mechanisms involved in gene regulation of eukaryotic organisms. A major aim of the course is to introduce to graduate students the essential skills of being able to critically read and review the primary literature. Because these topics are presented at an advanced level, Eukaryotic Molecular
Biology is inappropriate for undergraduate students. The paper discussion sessions are generally more intensive than lecture and require more preparation on the part of students and therefore warrant the allotted credit hours.

Course Content and Schedule: The format of this course will consist of 2 hours of lecture and 2 hours of discussion each week. The proposed syllabus includes 30 topics of ~1 hour each and the lectures will follow the syllabus (see below). Discussions will utilize selected papers from the current literature to both enhance the topics covered in lecture and emphasize the mechanisms behind the important concepts. Papers that emphasize novel concepts, technology, and ideas will be presented, evaluated and interpreted by the students in class. For the last third of the course, the students enrolled will be assigned lecture topics to present and will select the journal articles to be discussed.

Syllabus - Eukaryotic Molecular Genetics I

1. Class Orientation - Molecular Genetics and the Evolution of LifeBird
2. Eukaryotic Gene Structure & Evolution
3. Combinatorial Strategies Regulating Transcription
4. Structure & function of DNA and Chromosomes
5. Eukaryotic DNA Replication
6. Mutations/Mutagenesis
7. DNA Repair, Recombination
8. Telomerase and the Biology of Aging
9. Heredity by Mendelian Mechanisms
10. Non-Mendelian Inheritance
11. Behavior of Genes in Populations
12. Inherited Disease and Gene Therapy
13. Transcription Initiation & Elongation
14. Chromatin Modification & Regulation of Transcription
15. RNA Processing I- Splicing
16. RNA processing II – alt. Splicing
17. RNA Processing III – 5' & 3' processing
18. RNA processing IV-RNA editing
19. RNA Processing V –RNA export
20. Stability and Fate of mRNAs in the Cytoplasm
21. Transport and Trafficking of mRNA in the Cytoplasm
22. Regulatory Mechanisms in Translation and RNAi
23. Site-specific recombination
24. General Recombination
25. Heat shock/stress response
26. Cell Cycle regulation
27. Transitions In/Out of Cell Cycle
28. Genetics of Cancer
29. Human Evolution
30. RNA-World & Evolution in Real-Time

Course Requirements/Evaluation: The course will include a midterm and final exam that will focus on the student’s ability to synthesize the material presented and to solve problems not previously discussed. Additionally, data analysis and interpretation will be stressed. The student will be required to prepare a 10 page essay on a topic relating to the mechanisms of cell and developmental biology of the student’s
choosing (with the consent of the course coordinator). The student will be expected to conduct a review of the current literature in the topic area, evaluate the data presented, and draw supportable conclusions based on that data. Students will be expected to prepare and present lectures and select journal articles for discussion as assigned by the course instructors during the final third of the course. All students will be assessed by letter grade based on the following formula.

Class presentations of literature 25%
Midterm examination 20%
Research paper 25%
Final examination 30%

Faculty will be evaluated yearly using the standard College of Veterinary Medicine Graduate Course Assessment form.

Special Accommodations: Students requiring special accommodations should make an appointment to discuss the Accommodations Memo with the course director as soon as possible. If a student does not have an Accommodations Memo, they are directed to contact The Program for Students with Disabilities (1244 Haley Center, 844-2096).

Class Policy Statement: Eukaryotic Molecular Biology is designed for small group discussion. This course is a graduate level course, and as such students are expected to be current with class materials at all times. The course director reserves the right to provide oral or written quizzes and include the grades for these in the grades for class presentation and midterm examinations. Attendance is mandatory as class participation is an integral part of the course, and unexcused absences will result in a lowered or failing grade for that component of the grade. A deduction of 2% per unexcused absence will be applied.

Academic integrity and honesty are of the highest importance. Documented cheating of any type will not be tolerated and will result in referral to the University Academic Honesty Committee for disciplinary action. Cheating includes, but is not limited to, copying the work of other individuals in the class, using source material on closed book exam questions, and plagiarism (use of published material without proper citation).