

The Scripps Research Institute
Graduate Program
Molecular Biology

Contact Information

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Course Information

Semester, Year: Fall 2010

Meeting day, time: Monday and Wednesday, 11:30-1:00

Meeting Location: Committee Lecture Hall

Course Description

The course will cover major scientific questions and experimental approaches in contemporary molecular biology, involving areas of:

- a) chromosomes and genomes,
- b) transcription and RNA processing,
- c) translation and post-translation control and proteomics, and
- d) integration of genetic regulatory systems.

Background Preparation (Prerequisites)

Students are encouraged to review background material relevant to each class that can be found in *Molecular Biology of the Cell* (Alberts et al, 5th Edition). Students typically have taken an undergraduate-level course in molecular biology, but this is not required.

Texts and Journal References

Required reading: One recent original research paper in the relevant area of molecular biology will be provided for each class, and will be the basis for the class discussion. The required reading list will be posted on the Graduate Office website www.scripps.edu/phd/biograd/coursedescribio.html.

Recommended reading: One short, topical review to accompany each research paper will be provided, as appropriate. The recommended reading list will be posted on the Graduate Program website www.scripps.edu/phd/biograd/coursedescribio.html.

Text: *Molecular Biology of the Cell* (Alberts et al, 5th Edition)

Course Learning Outcomes

By the end of this course, students will be able to:

1. Understand the strengths and limitations of various experimental approaches for studying molecular biology and genetics.
2. Judge when the stated scientific conclusions derived from original experimental data are justified and when they are not justified.
3. Devise alternative scientific approaches to allow more robust conclusions on specific molecular biological questions.
4. Anticipate a range of experimental outcomes that can arise from use of a particular experimental approach in molecular biology.
5. Conceive of new experimental questions that are inspired by specific scientific results.
6. Develop and present succinct oral presentations describing the background of specific molecular biology papers and their relationship to other work in the field.

Course Requirements, Assignments, & Grading

50%: **Written text for “next experiments”** related to each discussion paper.

Learning Purpose: Supports points 3, 4, 5 of learning outcomes, and allows assessment of mastery of course material.

30%: **Participation in class discussions** of each discussion paper.

Learning Purpose: Supports points 1, 2, 3, 4 of learning outcomes, involves active learning, and allows assessment of mastery of course material.

20%: **Short PowerPoint presentations** of “introduction” and “perspectives” for each discussion paper. Each student will make at least two presentations during the course.

Learning Purpose: Supports points 1, 3, 6 of learning outcomes, involves active learning and allows assessment of mastery of course material.

Letter Grade	Grade Point	Description	Learning Outcome
A	4.0	Superior Achievement	Exemplary
B	3.0	Satisfactorily demonstrated ability in field of study	Proficient
C	2.0	Below average, work not at level expected of a TSRI graduate student	Developing
F	0.0	Not acceptable	Fail

Attendance

Attendance is mandatory and a portion of the grade is based upon class participation. Failure to participate will result in a reduction in credit for that portion of the course.

The “next experiments” must be submitted prior to the presentation of the paper to which they pertain.

No late papers will be allowed except under extenuating circumstances that are approved by the course director. If a student does not submit the “next experiments” page for a particular class the points for that portion of the material will be lost.

All students will be required to make at least one PowerPoint presentation.

Scientific and Professional Ethics

The work for this course must be that of the student. The student must explicitly acknowledge the ideas of others. The course instructor will address all questions concerning the line between others' work and the student's own work.

Expectations and Logistics

Student teams: The class will be divided into teams of two students each. These teams will rotate over the duration of the course, such that every team will lead 1-2 classes. The student team assigned to each paper will meet with the relevant faculty discussant 1-2 weeks before the paper is presented, to get help and suggestions in identifying and understanding the literature that will be used to prepare the "introduction" and the "perspectives" Powerpoint presentations for each class (below). It is critical that the students contact the faculty discussant early in the course to coordinate schedules as faculty members often have busy travel schedules. It is preferred that students meet with faculty as a team. Each of the students in the team should plan to send their Powerpoint presentation to the faculty discussant at a prearranged interval prior to the presentation (at least 3 days before) so the faculty can give them feedback for modifying it, if necessary.

Class preparation: Every student in the class will be responsible for reading the day's discussion paper prior to class. Every student should be prepared to discuss each figure. Each student must also submit a "*next experiments*" document upon arrival to class (below). A short review(s) related to the topic of the discussion paper will be provided for most papers on the reading list. More basic background may be obtained by reading relevant section of the text book, *Molecular Biology of the Cell* (Alberts et al., fifth edition).

For every class (except for the first two classes of the course, see below), students will submit a written document describing *two* "*next experiments*" that are suggested by the paper of the day. These will be graded by the faculty discussant of the day, and the composite scores from these submitted papers (for a total of 18 classes) will comprise each student's course grade. *No late submission of these "next experiments" will be allowed, except under extenuating circumstances previously approved by the course director. If you do not submit the "next experiments" page for a particular class, your grade will be diminished by 1/18th.* Each "next experiment" should produce an amount of data that would be expected to fit into one figure. The short description of each "next experiment" should include a) a rationale for doing the experiment, b) a brief description of the experiment, including experimental methods, and c) the expected outcome(s) and a rationale of why they are expected. The description of the two "next experiments" should be short (e.g. ~4-6 sentences each), and together, the text for both "next experiments" should be about ½ page of single-spaced printed text (12 point, Times New Roman). Concise, focused descriptions that cover the points above will be rewarded.

Class format: At the beginning of each class the faculty member overseeing the discussion will present a 10-15 minute overview of the field alluding to the major questions and how this paper addresses one or more of them. Next, *one member of each student team* will give an introduction to the paper of ~5-10 minutes (Powerpoint format) to provide background material for the discussion paper and to frame the specific problem being studied. Next, the student presenters will project slides, selected from the paper by the faculty discussant, and briefly describe the relevant technical aspects of the experiment being shown. The faculty discussant will then elicit discussion from all members of the class to evaluate the data and the conclusions that can be drawn from them. After the figures have been discussed, the *second member of the student team* will make a short "perspectives" presentation of ~5-10 minutes, in which the overall conclusion, approaches used, and conflicting conclusions from other studies, will be presented. Finally, the faculty discussant will lead a discussion of "next experiments", which students will already have proposed on documents that they submitted at the beginning of class.

Selection of Papers/Student Teams: The discussion paper for each class (together with a related short review) will be posted on the Graduate Program website at least two weeks before the beginning of the course. Students are asked to review this list, and send an email to the Course Director's Administrative Assistant collinsb@scripps.edu indicating 1st, 2nd, 3rd and 4th choices **by the first day of class, September 14th**. Every effort will be made to assign students to the paper(s) of their choice; however, decisions will be made on a first come/first served basis. Students may submit choices as individuals (and end up with a second team member arbitrarily) or as a team with a second person with whom they would like to work. Everyone will have the chance to present 1-2 times. *If students do not sign up for specific papers the Course Director will assign them a paper randomly.*

Model Presentations: The goal of these first two classes is to provide everyone with a clear sense of the class format, by providing a guided template. We will assign one discussion paper for each class (to be read by all class members beforehand), but our two teaching assistants (instead of class members) will perform the job of the student team. Moreover, class participants are **not** asked to submit written "next experiments" documents for these first two classes. Instead, we will present and discuss examples of appropriate next experiments.

Additional Help in Understanding Papers: Students who would like additional help for understanding any paper prior to the designated class meeting are asked to directly contact one of the following people: the TAs for the course (Mari Gantner, mgantner@scripps.edu or Zinada Polonskaya, zinada@scripps.edu)

Schedule

Unit 1 - DNA, Chromosomes and Genomes

- Session 1 *DNA replication*
- Session 2 *Chromatin structure and function*
- Session 3 *Chromosome Structure/Function – Telomeres*
- Session 4 *Chromosome Structure/Function - Centromeres*
- Session 5 *Mouse gene manipulation*

Unit 2 – Transcription and RNA Processing

- Session 6 *Regulation of transcription*
- Session 7 *RNA World*
- Session 8 *RNAi and micro-RNA*

Unit 3 - Translation and Post-Translational Control and Proteomics

- Session 9 *Proteolysis, protein ubiquitination and the proteasome*
- Session 10 *Control of translation*
- Session 11 *Ribosomes/Translation*
- Session 12 *Proteomics/Metabolomics*

Unit 4 – Integration of Genetic Regulatory Systems

- Session 13 *Cell Cycle: G1/S*
- Session 14 *Cell Cycle: G2/M Transition*
- Session 15 *Stability and Instability of the Genome: DNA damage & repair*
- Session 16 *DNA replication and damage Checkpoints*
- Session 17 *Recombination, gene conversion, and genome rearrangement*
- Session 18 *Molecular biology of the immune system*
- Session 19 *Molecular Basis of Learning and Memory*
- Session 20 *Viruses*