

Biology 104 - Molecular Biology - Spring 2010

Lecture: TTh 11:10-12:30pm

Instructor: Dr. Jim Doohan

Office Hours: M 10-12pm, W 10-1pm

Web site: www.biosbcc.net/doohan/bio104/index

Discussion Sections: T or Th 9:35-10:30am

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Course Description

Lecture topics will focus on four related, but distinct areas: basic concepts of gene expression, manipulation of DNA through recombinant DNA technology, the application of molecular biology to biotechnology, and the use of specific organisms as model systems for research. The discussion portion of the course is centered on a guest lecture series. I have invited 5 UCSB professors and post-doctoral fellows to come to our class and present their research. In preparation for these lectures, we will read and discuss relevant journal articles.

Recommended Textbook: *Essential Cell Biology by Alberts et al. 3rd edition*

Reading assignments will be posted on the class website.

Required Book: *The Best American Science Writing 2006*

Lecture exams will be composed of multiple choice and short-answer questions, plus 1 essay question. One week prior to the exam I will post a list of potential essay questions.

Article Summaries. You are required to write 3 summaries of 3 journal articles. These articles are recommended by our UCSB guest lecturers. The articles will be posted online. A guideline for writing a summary is included at the end of this syllabus and is posted on the class website.

Discussion Work Sheets. We will be discussing journal articles and other science writings in the discussion section that meets once a week. Prior to class you will submit the work sheet due that day. Work sheets ask specific questions related to that week's reading assignment. Work sheets will be posted online. You must print them, complete them and submit them on the appropriate due dates. They will not be accepted late.

Guest Lecture Attendance. You are required to attend the research talks presented by our guest lecturers. Attendance will be taken.

Grading

Determination of grades will be based on points earned in the following categories:

2 Midterm Exams (100 pts each)	200
Final Exam (150 pts)	150
13 Discussion work sheets (5 pts each)	65
3 Journal Article Summaries (25 pts each)	75
Attendance of 5 Guest Lectures (5 pts each)	<u>25</u>
Total points possible	515

Grading Scale: 463-515 = A 412-462 = B 335-411 = C 257-334 = D 256 and below = F
(90-100%) (80-89%) (65-79%) (50-64%) (<50%)

Molecular Biology-104 Lecture Schedule

Date	Lecture Topic
T 1-26	Proteins
TH 1-28	DNA, Chromosomes and Replication
T 2-2	DNA Repair and Recombination
TH 2-4	Prokaryote - Transcription
T 2-9	Prokaryote - Translation
TH 2-11	Regulation of Gene Expression in Prokaryotes – Lac Operon
T 2-16	Bacterial Genetics - Conjugation
TH 2-18	Exam #1 (material from 1-26 to 2-11)
T 2-23	Bacterial Genetics – Transduction and Transformation
TH 2-25	Research Seminar (Mike Mahan)
T 3-2	Eukaryote – Transcription and RNA Processing
TH 3-4	Eukaryote – Translation and Post-translational Modifications
T 3-9	Cloning Genes and Producing Pharmaceuticals
TH 3-11	Transgenic Animals and Gene Therapy
T 3-16	Stem cells and Animal Cloning
TH 3-18	Research Seminar (Wendy Bevier)
T 3-23	Genetic Engineering of Plants
TH 3-25	Exam #2 (material from 2-16 to 3-16)
3-29 to 4-3	Spring Break
T 4-6	Mitosis and Regulation of the Cell Cycle
TH 4-8	Classical Genetics - Yeast and the Cell Cycle
T 4-13	Research Seminar (Ken Kosik)
TH 4-15	Cell Communication - Signal Transduction
T 4-20	Reverse Genetics – Stat Knockout
TH 4-22	Apoptosis – Programmed Cell Death
T 4-27	MicroRNAs
TH 4-29	Research Seminar (Pradeep Joshi)
T 5-4	Molecular Biology of Cancer
TH 5-6	Research Seminar (Erkki Ruoslahti)
T 5-11	Molecular Biology of Cancer
TH 5-13	Genome Evolution – From the RNA World Forward
TH 5-20	Final Exam 11-1pm (material from 3-23 to 5-13)

Discussion Section

We will read and discuss science journal articles and other science writings. You are required to read the article and complete a work sheet. The worksheets provide a systematic approach to understanding the article and ensure that students come to section prepared to engage in class discussion. Worksheets, which are worth 5 points each, are submitted at the beginning of the class period. Worksheets are graded based on completion, legibility, effort and accuracy.

Discussion Section Schedule - Spring 2010

Day	Date	Discussion Topic	Work Sheet
T Th	1-26 & 1-28	Introduction	None
T Th	2-2 & 2-4	BASW Autism's Cause pg 104 BASW Devolution pg 194	1
T Th	2-9 & 2-11	BASW The Coming Death Shortage pg 177 BASW Clone Your Troubles Away pg 152	2
T Th	2-16 & 2-18	An Essential Role for DNA Adenine Methylation in Bacterial Virulence	3
T Th	2-23 & 2-25	An Essential Role for DNA Adenine Methylation in Bacterial Virulence	4
T Th	3-2 & 3-4	In vivo reprogramming of adult pancreatic exocrine cells to β -cells	5
T Th	3-9 & 3-11	In vivo reprogramming of adult pancreatic exocrine cells to β -cells	6
T Th	3-16 & 3-18	MicroRNA-145 Regulates OCT4, SOX2, and KLF4 and Represses Pluripotency in Human Embryonic Stem Cells	7
T Th	3-23 & 25	MicroRNA-145 Regulates OCT4, SOX2, and KLF4 and Represses Pluripotency in Human Embryonic Stem Cells	8
M-F	3-29 to 4-3	Spring Break	None
T Th	4-6 & 4-8	MicroRNA-145 Regulates OCT4, SOX2, and KLF4 and Represses Pluripotency in Human Embryonic Stem Cells	9
T Th	4-13 & 4-15	Joshi Paper TBA	10
T Th	4-20 & 4-22	Joshi Paper TBA	11
T Th	4-27 & 4-29	Tissue-Penetrating Delivery of Compounds and Nanoparticles into Tumors	12
T Th	5-4 & 5-6	Tissue-Penetrating Delivery of Compounds and Nanoparticles into Tumors	13
T Th	5-11 & 5-13	open	None

Guest Speaker Series

Lecture date	Speaker	Required Reading	Summary Due Date
2-25	Mike Mahan	An Essential Role for DNA Adenine Methylation in Bacterial Virulence	3-2
3-18	Wendy Bevier	In vivo reprogramming of adult pancreatic exocrine cells to b-cells	3-23
4-13	Ken Kosik	MicroRNA-145 Regulates OCT4, SOX2, and KLF4 and Represses Pluripotency in Human Embryonic Stem Cells	No summary required
4-29	Pradeep Joshi	Joshi Paper TBA	5-4
5-6	Erkki Ruoslahti	Tissue-Penetrating Delivery of Compounds and Nanoparticles into Tumors	No summary required

How to read and understand a science journal article.

Articles from science journals such as Nature and Science are very challenging to read and understand. They are written by scientists for scientists. They are written above the knowledge level of the typical college undergrad, yet college students are often expected to read and write reports based on such articles. How does one tackle this challenging task? We need to break the article down into its component parts and focus on the most important facts.

Typically an article will have 5 parts:

1. **Abstract:** This is a summary of the article. It briefly states the goal of the research and the results obtained by the study. Quite often it is so abbreviated and contains so much scientific jargon that it is very difficult to understand. Do not be discouraged if, at first, you don't understand the abstract. You should reread the abstract after you have read the remainder of the paper. It will make more sense then.
2. **Introduction:** The introduction describes the current state of knowledge of this particular field of science and provides relevance for the experiments described in the article. Toward the end of the introduction, the author typically states his/her hypothesis, the general approach to testing the hypothesis, and then tells you the essential experimental results.
3. **Results:** The results section describes the experiments, in detail, while constantly referring to the figures. The figures are the key to understanding the paper. The figures contain the data on which the author's base their claims. To critically evaluate a research article, we must closely examine the figures. 90% of your time and effort should be directed toward understanding the figures. Every figure displays data derived from an experiment. And every experiment begins with a question. If you first identify the question an experiment is attempting to answer, then the experiment will make much more sense. Each experiment involves some type of assay (a procedure that measures something). You are currently ignorant regarding most of the assays used in molecular biology, but we will discuss these assays in discussion section. Once you understand the question being asked and the assay being employed, you should be able to critically evaluate the data in the figures and decide for yourself if the data supports or refutes the author's hypotheses.
4. **Discussion:** In the discussion section, the author will restate their results, tie all the experiments together into an integrated whole and then relate their results to other findings in the field. They will attempt to reiterate the importance of their work and suggest future directions. Quite often the discussion section and the results section are combined as one.
5. **Methods:** The methods section describes the experimental assays in great detail. Typically the reader can ignore this section. However, you may want to read parts of the methods section to further your understanding of a particular experiment.

How to write a summary of a science article

Your summary should have 3 parts; an introduction, a body and a conclusion.

Introduction:

- Give background information about the field of research addressed in this paper.
 - What is the process being studied? Examples include bacterial pathogenesis, regulation of stem cell development, diabetes research, cancer therapies, etc.
 - What is the experimental organism or type of cells being used? Examples include mice, rats, virus, plants, cultured cells.
 - What is the goal of the research? What fundamental question are they trying to answer? What is their hypothesis?
 - What is the most important outcome of their experiments? What did they find out?

Body:

- The body of your summary will address each and every figure (unless I state otherwise). For each figure you should provide the following:
 - State why they are performing the experiment. Every experiment is intended to answer some question.
 - Briefly describe the experiment. You need not describe all aspects of the experiment in detail, rather you should give a general description (rats were infected with 500 cfu of RB50 bacteria ..., cells were infected with virus then..., protein was extracted from cells and visualized by Western blot...)
 - State the most important result of the experiment. How does one determine the important result? Often the author will state something like “these results demonstrate that...”, or “these results clearly show that...”. Do not copy down exactly what the author says (that’s plagiarism), rather paraphrase, in your own words, what the author has stated.

Conclusion:

- Restate the goal of the research.
- State the most important results of the experiments.
- State the importance of the research as it relates to our knowledge of biology and to the well being of mankind.

Summary Format and Length

- The length of the summary will vary with the length of the article. Typically 2-4 pages will do the job.
- The summary must be typed, #12 font, double-spaced, 1 inch margins.

Hint: The work sheets you complete in discussion section should prove very useful while writing the summary.