

BIO380 – Molecular Biology Spring 2014

Meeting Times and Locations:

Classroom: Tuesday and Thursday 10:00am – 11:20am in Science - Rm. 1021

Laboratory: Tuesday (380L-01) or Thursday (380L-02) 1:15pm – 4:05pm in Science - Rm. 1011

Contact Information:

Professor: Laura Burrack

Office Location: Science - Rm. 1202

Phone: x4695

Email: burrackl@grinnell.edu (Email is the preferred way to reach me. I try to respond to emails within 24 hours.)

Office hours: Mon. 2:30 – 4pm, Wed. 10 – 11:30am, or by appointment.

I welcome talking with students outside of class. Feel free to come to me with specific questions about the class or with general questions about science or your future. You can drop by my office hours or e-mail to set up a separate appointment.

Course Materials:

- Primrose, S.B. and Twyman, R.M. 2006 *Principles of Gene Manipulation and Genomics*. 7th edition, Blackwell Publishing. ISBN: 1405135441
- Additional readings from the primary and secondary literature will be provided via P-web
- Lab handouts
- *Investigations* available at:
<http://www.grinnell.edu/academics/areas/biology/resources/investigations>
- You must purchase a bound notebook or a three ring-binder to use as a lab notebook.
- Please regularly check our class Pioneer Web course area for updated announcements and documents.

Course Description:

The goals of this class are for you to understand molecular biology techniques and approaches, including large-scale methods used in genomics and proteomics. We will also address the importance of bioinformatics and computational biology to allow analysis of the available biological data. We will focus on understanding the structure and maintenance of the genome and regulation of gene expression at the level of RNA and protein. Throughout the class, critical evaluation of primary literature will be emphasized. Additionally, the course will focus on development of oral and written communication skills.

Weekly Summary Sheets:

A summary sheet will be handed out at the end of each week. The summary sheet is meant to highlight readings, assignments and laboratory details for the following week. Please note that the readings given for a particular day are to be completed in advance of the lecture for that day. A typical weekly summary sheet will contain:

1. Details on reading assignments for the upcoming week
2. Indication of upcoming assignments and exams
3. Laboratory activities for the week

Assessment:

Take-home exams (4x50pts)	200 points
Assignments/short papers	175 points
Class discussion participation/discussion leading	50 points
Lab notebooks	25 points
Lab participation and citizenship	25 points
Lab meeting presentations	25 points
Group oral presentation	25 points
Research grant proposal	125 points
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Total =	650 points

Further explanation of assessment categories:

Take-home exams: There will be 4 take-home exams covering specific content related to the concepts, techniques and application of Molecular Biology. Each exam will build on content and techniques as we move throughout the semester, but will focus on material covered more recently. Three exams will be due throughout the semester with the fourth exam due during finals week.

Assignments/Short Papers: There will be 7 short written assignments pertaining to the primary research journal articles throughout the semester. Each paper assignment will be worth up to 15 points. The lowest paper assignment grade will be dropped at the end of the semester. Additionally, you will be writing a short paper on a topic of your choosing related to the ethical and/or policy implications of human genomics (35 points possible). There will be additional assignments throughout the semester, the nature of which will vary and may include material from lecture and/or lab.

Class discussion participation/discussion leading: Participation in class discussions and activities is essential. I am not counting the number of times each student speaks, but rather participation is meant to reflect preparation and active engagement with the material. I will try to structure discussions so that each member of the class has an opportunity to participate in a way that works for them. During the semester, each student will work in a small group to provide background information and lead the discussion of a primary literature article (JC #1-#6 on schedule below).

Lab notebooks: Several times throughout the semester, I will check lab notebooks without warning. Make sure you are following the format and suggestions found in the lab manual handout given out on the first day of lab and in the "Investigations" manual.

Lab participation and citizenship: This category will include both lab effort, such as coming in outside of scheduled time when necessary and being prepared and focused during lab time, and lab citizenship, such as keeping your bench organized and clean, being courteous and helpful toward your peers, having a positive attitude, keeping pipette tip boxes filled, etc. I will give you feedback on partway through the semester, after you have spent some time in lab.

Lab meeting presentations: Just like academia or industry, we will have occasional lab meetings in order to discuss results and future plans. During lab meeting, each group will prepare a concise oral and written summary of results so far, difficulties with the project, and plans for the immediate future. Meet with your group before lab to get organized and prepare your report for lab meeting. Points will be earned for a thorough yet concise summary of work done and work planned.

Research grant proposal: During the second half of the semester, you will be working individually on a concise NIH-style grant proposal describing the independent research projects you will carry out with a lab partner. The proposal will be written in parts and each part must be revised and compiled for the final research proposal, due at the end of the semester. As you are writing your proposal you will also be carrying out the beginning stages of your proposed project and your final research proposal will include a section on your preliminary results. See the course schedule for deadlines. Detailed instructions for each of these parts will be distributed at a later date.

Grading Scale:

93-100%	A	77-79%	C+
90-92%	A-	70-76%	C
87-89%	B+	60-69%	D
83-86%	B	below 60%	F
80-82%	B-		

Final grades will be based on the percentage scale provided above and not on a “curve”. Thus, you will not be competing with your fellow students for a pre-determined allocation of grades. You can calculate your current grade at any time during the semester. At my discretion, if you are close to the border of two grades, your final grade may be raised for reasons such as significant improvement during the course of the semester.

Computers and Software:

Some portions of this class require manipulation of DNA sequences and bioinformatics analysis of DNA, RNA and protein sequences. Many of the tools we will use are web-browser based. Commonly used websites include: www.ncbi.nlm.nih.gov and www.candidagenome.org. Nucleic Acids Research has an excellent collection of available databases at: <http://www.oxfordjournals.org/nar/database/c/>. However, some manipulations are much easier with a dedicated DNA sequence manipulation program. In this class, we will use a free program available for use on Mac, Windows or Linux operating systems called Serial Cloner. The software can be downloaded from: http://serialbasics.free.fr/Serial_Cloner.html and installed by following the installation instructions.

Attendance Policy:

Attendance and participation in class is required. Please notify me *at least* one week in advance if you anticipate a scheduled absence (such as an approved athletic event or a graduate school interview) or as soon as possible in case of illness. Absences for medical or other emergencies may be considered excused at my discretion if they are verified by documentation from the Health Center and/or the Office of Student Affairs. I encourage students who plan to observe holy days that coincide with class meetings or assignment due dates to consult with me in the first three weeks of classes so that we may reach a mutual understanding of how you can meet the terms of your religious observance and also the requirements for this course. For all pre-arranged absences, any classwork due during the time of the absence must be turned in by the scheduled due date.

Late Policy:

Late assignments will be penalized 20% of the possible points per day. If an assignment is due at the beginning of class and you are late for class, your assignment will be considered late. Computer problems do not constitute a legitimate excuse for late work. Each student will be allowed one extension per semester for any reason – use it wisely! To use this extension, you must contact me via email at least 12 hours before the assignment is due.

Group Work and Academic Honesty:

As science is a collaborative process, it is my hope that you will discuss your readings, assignments, and laboratory work with each other. Take-home exams, however, are to solely represent your effort and are not to be discussed with classmates. It is expected that all graded work should be the unique product of the individual turning it in unless otherwise specified. Any material that you obtain from outside sources such as websites and journal articles must be correctly cited. Please carefully read the Grinnell College policy on *Honesty in Academic Work* and see me if you have questions.

Accessibility:

If formal accommodations need to be made to meet your specific learning or physical abilities, please contact me soon as possible to discuss appropriate accommodations. Please also contact the Dean for Student Success and Academic Advising, Joyce Stern (x3702) to provide documentation of your needs. We will work together to ensure this class is as accessible and inclusive as possible.

Tentative Class Schedule and Readings (Subject to change if necessary)

<u>Date</u>	<u>Discussion Topic</u>	<u>Reading (from textbook or P-web)</u>
Tues 1/21	Intro to molecular biology and techniques	PGMG pg. 1-8, 15-35
Thurs 1/23	Molecular biology – fundamentals and history	P-web
Tues 1/28	DNA sequencing	PGMG pg. 126-134, 362-371 and P-web
Thurs 1/30	Applications of next-generation sequencing, JC #0	P-web
Tues 2/4	Bioinformatics (analysis of DNA)	PGMG pg. 157-176
Thurs 2/6	Chromosome structure and analysis	PGMG pg. 323-345
Tues 2/11	Chromosome segregation, JC #1	P-web
Thurs 2/13	Recombination	P-web
Tues 2/18	Mutation analysis	PGMG pg. 141-157, 394-404
Thurs 2/20	Genetic basis for disease/SNP analysis, JC #2	P-web
Tues 2/25	Comparative genomics	PGMG pg. 373-383 and P-web
Thurs 2/27	Metagenomics	P-web
Tues 3/4	Cloning – overview and history	PGMG Pg. 36-66
Thurs 3/6	Cloning – improvements and applications, JC #3	P-web
Tues 3/11	Gene manipulation – bacteria and fungi	PGMG Pg. 179-184, 202-217
Thurs 3/13	Gene manipulation – animals	PGMG Pg. 218-236, 251-266
SPRING BREAK from 3/15 – 3/30		
Tues 4/1	Regulation of transcription – promoters	P-web
Thurs 4/3	Measuring transcription levels	PGMG Pg. 407-421, P-web
Tues 4/8	Regulation by transcription factors, JC #4	P-web
Thurs 4/10	Chromatin/DNA modifications	P-web
Tues 4/15	Epigenetics	P-web
Thurs 4/17	Transcriptional processing and ribozymes	P-web
Tues 4/22	Non-coding RNAs, JC #5	PGMG Pg. 404-406
Thurs 4/24	Translational and post-translational regulation	P-web
Tues 4/29	Protein interactions/structure	P-web

Thurs 5/1	Proteomics	PGMG Pg. 425-437, 441-452
Tues 5/6	Proteomics – continued, JC #6	PGMG Pg. 453-471 and P-web
Thurs 5/8	Future of molecular biology	P-web

*All “P-web” readings will be posted under the “Additional Readings” folder on P-web and marked with the class date.

Exam dates

Take-home exam 1 – assigned Tuesday 2/11 in class, due Friday 2/14 at 9am

Take-home exam 2 – assigned Thursday 3/6 in class, due Monday 3/10 at 9am

Take-home exam 3 – assigned Tuesday 4/15 in class, due Friday 4/18 at 9am

Take-home exam 4 – assigned Thursday 5/7 in class, due Tuesday 5/13 at 5pm (end of scheduled final exam period)

Tentative Lab Schedule (Subject to change if necessary)

<u>Week</u>	<u>Lab activities</u>
Jan 21 st /23 rd	Lab safety, primer design, streak strains
Jan 28 th /30 th	gDNA prep, set up PCRs
Feb 4 th /6 th	Check PCRs, precipitate DNA, primer design
Feb 11 th /13 th	Precipitate DNA, transformation
Feb 18 th /20 th	gDNA prep from putative transformants and control strain, set up PCR
Feb 25 th /27 th	Check PCRs, send PCR for sequencing, lab meeting
Mar 4 th /6 th	Prepare RNA and cDNA for qRT-PCR, analyze sequencing results
Mar 11 th /13 th	Microscopy, qRT-PCR
Apr 1 st /3 rd	Analysis of qRT-PCR, Independent projects
Apr 8 th /10 th	Independent projects, lab meeting
Apr 15 th /17 th	Independent projects
Apr 22 nd /24 th	Independent projects, lab meeting
Apr 29 th /May 1 st	Independent projects
May 6 th /8 th	Student presentations

Research grant proposal dates

Pre-proposal (one per lab group) – due Friday 3/14 at 9am

Preliminary annotated bibliography – due Thursday 4/10 10am

Specific aims – due Thursday 4/17 10am

Research design and methods – due Thursday 4/24 10am

Background and significance – due Thursday 5/1 10am

Final proposal (including preliminary results) – due Friday 5/16 at 5pm (last day of finals week)