Syllabus

Instructors:	Dr. Andrés Vidal-Gadea	TA:	Monica Tamrazi
Office:	SLB 339	Office:	SLB 338
Phone:	438-5220	Phone:	438- 2643
Email:	avidal@ilstu.edu	Email:	@ilstu.edu
Office hrs:	Mondays and Wednesdays 9-10	Office hrs:	Friday 10-11

Course objectives:

1) Gain exposure to modern approaches used in research labs studying cellular biology and genetics
2) Reinforce understanding of basic genetic and cell biological principles
3) Gain expertise in experimental design and execution, as well as data collection, analysis, and synthesis
4) Develop skills in written and spoken scientific communication
5) Become proficient in basic genetic and molecular techniques used in research labs around the world.

Course logistics:

A variety of methods will be used for learning and for evaluation.
• We will use lectures to explain the types of questions requiring a genetic or molecular approach.
• Available molecular/genetic approaches to address these questions will be learned in class.
• Inquiry-based learning will be facilitated by allowing students to become proficient with useful experimental techniques while conducting novel scientific research in projects that they will develop and care for throughout the semester.
• Prelab flowcharts for lab activities will encourage students to read the lab manual before class.
• There will be two practical exams (midterm and final) assessing student understanding, and ability to perform the techniques learned in the lab.
• Students will maintain a lab notebook which will be collected and graded.

Grading:

There will be 100 points in the course. The breakdown is as follows:

Weekly	**clarification**	**Points**
Prelab assignment (experimental flowchart)	0.5% ea x 20	10%
Lab		
Practical Performance	0.5% ea x 20	10%
Theoretical Understanding	0.5% ea x 20	10%
Lab Notebooks		20%
Group project/presentation		10%
(Bonus: µPublication submission available to qualifying groups)*		*5%*
Tests		
Midterm		15%
Final		25%
Total		100%

Course Grading Scale:

A 100-90% **B** 89-80% **C** 79-70% **D** 69-60% **F** 59%-below

(rounding will only be done for the final grade in the course: 79.0 = C, 79.1 → B etc)

Description of Course Grading Items:

Read the laboratory write-up before you arrive at the lab. Reading this material prior to coming to your lab section will not only provide you with a basic understanding of the experiment to be done, but will also help in the expedient execution of each of the labs.

Prelab Assignments (10% of final grade). You must complete a prelab assignment for the majority of the labs (see schedule below). These prelabs are **typed** experimental flowcharts that will expedite your performance of lab activities. **Students will not be permitted** to perform an experiment for which they did not submit a prelab flowchart. Students may write the prelab for any missing experiments after they arrive to class, however,

PRELAB POINTS ARE ONLY AWARDED TO PRELABS SUBMITTED PRIOR TO THE START OF THE LAB.

You are encouraged to look at Appendix 2 on this manual for a couple of examples of an acceptable prelab.

Practical Performance Points (10% of grade). The work conducted in this lab takes place in groups (2-3 students/group). However, practical performance points will be earned individually by each person. You will need to demonstrate proficiency with all the techniques. To this end, each individual in a group will perform technique. Your grade will be determined by your proficiency performing these techniques, and by the outcome of your experiments. This includes (but is not restricted to) the care and proficiency with which you conduct experimental steps, your ability to complete assigned activities in a timely manner, lab cleanliness and safety, and results obtained. Note that you **will not** be penalized if experiments go wrong due to circumstances **outside your control**.

Theoretical Understanding Points (10% of grade). Performing experiments successfully is of limited use to you, if you don't know when or why you would use a particular technique. Theoretical understanding points in this class will evaluate your intellectual understanding of each technique. You will want to know:

1) **how** a technique works (that means understanding what each step of the protocol is attempting to accomplish).
2) **why** would you choose to use one technique in one situation and not in another.
3) **what** are the variables that affect that technique's success (so you can troubleshoot).

In addition, in this class we will also learn about communicating science. You will therefore be responsible for learning about the different parts of a scientific report: what they are designed to communicate, and so on. Therefore, your theoretical understanding points will evaluate your understanding of this knowledge.

To evaluate your theoretical understanding, at the end of each lab period student will be asked one question regarding the knowledge acquired that day. Students will answer these question in their lab manual and submit it before leaving for the day. An example of a question you might be asked is to *explain why we perform a specific step, use a specific reagent, or when we would perform a technique (etc.)*? Your grade for this component will result from the sum of answers you provided during the semester.

Lab Notebook (20% of grade). Each student will keep a lab notebook during the semester. This item constitutes **20%** of your final grade. We encourage you to take your time and ensure that you do a good job and earn as many of those points as possible. The notebook should be a bound composition-style book, **not spiral bound**. Students will record activities and results within this notebook in such a fashion that a reader would be able to repeat the experiments and accurately interpret the data collected, even without the lab manual (pretend the lab manual doesn't exist). It helps to imagine that you are writing instructions so that a labmate that was absent could conduct the same experiment on their own just by following your directions. Notebooks do not need *to be written* in passive voice, since you are describing what you actually did. It is important to note that while your pre-lab assignments are written in your lab notebook, they are graded separately and they DO NOT CONTRIBUTE to your lab notebook's grade. Here are a few important items (based on Kallestinova, 2011) that each class you will want to write down in your notebook:

i) A table of contents at front of the notebook, diagram with freezer box contents at end.
ii) Start at the top of a new page. Each page should be dated, and numbered.
iii) writing must be clearly readable in order to be considered for grading
iv) do not rip pages from your lab book, you can cross over mistakes but leave each page in place
v) gel photos (or any data) must be descriptively labeled (e.g. "pBS/BamHI" rather than "lane 6")
vi) Information recorded: Write down one(two) sentence(s) describing the answer to each of the following questions **Intro: A)** why is this technique/work/question important? **B)** what is known about this topic? **C)** what are the hypotheses being tested? **D)** What are the objectives of these experiments? **Materials and Methods: A)** What materials were used? **B)** Who were the subjects/strains of your study? **C)** What was the research design? **D)** What procedure did you follow? **Results: A)** What was the most significant results? **B)**

What are the supporting results? **C)** Controls? **D)** Provide summary statistics (averages and means), as well as comparative statistics (t-test, etc.). **E)** Graph your data. **Discussion and conclusions: A)** what were the major findings? **B)** What is the significance/implication of the results?

Please read Kallestinova (2011) for a description of the type of information that you need to include

Lab notebooks will be collected at the end of each class. We will grade **lab notebooks** for their completeness and clarity, NOT the success of the experiments. **See Appendix 2 for grading rubric**.

Group Projects and Presentations (10% of grade). ***Projects:*** After you have learned the techniques taught in this class, you will embark in a group project where you will apply them to a question your group will have developed. The lab TA and Instructor will be available throughout the course to assist you in your efforts to develop an interesting and feasible project. This task will entail coming up with an interesting (unanswered) question, designing a hypothesis and thoughtful experiments using the techniques learned in our lab to test it (including appropriate controls). In general, grades on this assignment have correlated with how early students start working on it.

To qualify for full grades, ideas for group projects must be submitted by Halloween day. This will enable us to obtain reagents necessary for the completion of the project. Groups that have not obtained approval for a project by the due date will receive a 1% penalty every week until they have an approved project.

Students will have four lab periods to conduct their experiments, collect data, analyze it, and assemble a power point presentation which they will deliver in class. ***Presentation:*** Group presentations will be 20 minutes long and will include an introduction, methodology, results, and conclusion sections.

All students in a group must be equally engaged during the experimental phase and during the production and delivery of the presentation in order for all members of a group to obtain full points. Similarly, all students are responsible for understanding all parts of the project (not just the one they prepared or presented). The grade you will earn for this assignment will be a combination of your idea development (=**3%**, which implicitly includes your understanding of the techniques used), your experimental performance of the project (=**4%**, the execution), and your presentation (=**3%**, your ability to communicate your project).

Midterm (15% of grade). The midterm exam will have two distinct components. One component will test your intellectual understanding of the concepts learned in lab (similar to the questions for the theoretical understanding points). The second component of the midterm will involve practical performance of the techniques learned in lab. Please note that you will be evaluated on how well you can perform the the techniques you learned through the semester.

Final Exam (25% of grade). The final exam will take on the same format as the midterm with a theoretical and practical component reflecting the techniques you acquired throughout the semester.

Bonus Points: Get Published! (5% extra). Groups with projects producing high quality work (receiving a grade of A in their project) will qualify to submit their work to the peer-reviewed Journal *Micropublication*. To earn these points, student in a qualifying group will need to generate a two-page manuscript submission foillowing the examples and guidelines in the journal webpage (https://www.micropublication.org). The instructor and TA will provide feedback and grade the submission for up to 5% points based on the level of completion.

Student Responsibilities:

1. Read and follow the Equipment and Safety rules in the following pages
2. Read the relevant portion of the lab manual thoroughly before class and submit prelab assignment
3. Attend each class meeting for its full duration and complete assigned tasks
4. Clean up your area before you leave and complete post-lab cleanup checklist
5. Maintain a lab notebook, updated during and immediately after each lab
6. Create and present poster or oral presentation as instructed in class

Policies:

Attendance: Attendance is mandatory and will be recorded by your TA. You will be allowed only **1 excused** absence (doctors note, etc.). A second absence results in an automatic decrease in 5% of the final grade. A third absence will

result in a loss of 5% letter grade and so on. **Any more than 3 absences will result in an "F"** or an "I" for the semester and will require you to retake the course.

Please plan your med/grad-school interviews and vacation trips accordingly.

Office hours: See top of syllabus for office hours. If you are unable to meet during the scheduled times, please email the TA or instructor to set up an appointment.

Academic integrity: All students are expected to adhere to **all ISU policies on academic integrity**. We will restate only one part of that policy here:

"Anyone found to be giving or receiving information in **any form** during a test, assignment, or final exam will receive a score of zero, and the incident will be reported to SDRS for appropriate disciplinary action."

This is certainly the case during practical exams when students will be working on the same bench, each being evaluated independently. Limit interactions to requesting supplies (e.g. a pipettor, etc). It is important for you to understand that:

1) You presently have a written contract with ISU. You are therefore responsible for understanding the terms of this contract, and ignorance of these rules does not impact consequences associated with any violation.
2) Once an instructor established that a violation took place, their own contract with ISU demands they report the incident. Instructors cannot breach their contract in order to protect a student who breached theirs.

For complete ISU policy on academic integrity, see the current ISU Catalog (P.65).

Accessibility: Any student needing to arrange a reasonable accommodation for a documented disability should contact Disability Concerns at 350 Fell Hall, 438-5853 (voice), 438-8620 (TDD).

Week	Lab	Prelab	Lab Activity
08/19	1	×	Introduction, basic statistics, Lab safety, dilutions/solutions, **pipetting**, **sterile technique**
	2	✓	Genetics and *C. elegans*, how to read a scientific paper, **worms 101**, **DNA extraction 1**
08/26	3	✓	Genetic basis of sensation I: **chemotaxis assay**, Plasmids, **miniprep**
	4	✓	Genetic basis of sensation II: **mechanosensation**, **gel electrophoresis 1**
09/02	5	×	**Labor Day: no classes**
	6	✓	Genetic basis of disease I: **Cancer**, **filming mutants**
09/09	7	✓	Genetic basis of disease II: **Parkinson's**, **analyzing behavior**
	8	✓	Forward genetic screen I: **isolation of mutants**, **induction of males**, **worm DNA extraction**
09/16	9	✓	Forward genetic screen II: **Confirmation of F2s**, **backcrosses**, **cryopreservation**
	10	✓	Forward genetic screen II: **Confirm backcrosses**, **worm DNA extraction**, **spectrophotometry**
09/23	11	✓	PCR, Primer design, electronic DNA manipulation tools, **cryo-verification**
	12	✓	Identification of mutants through **PCR**, **electrophoresis 2**, **spectrophotometry**
09/30	13	✓	Translation and transcription: **PCR-fusion**, **electrophoresis 3**, **spectrophotometry**
	14	✓	Translation and transcription: **PCR-fusion**, **electrophoresis 4**, **spectrophotometry**
10/07	15	✓	Blunt end cloning: **promoter into GFP plasmid**. Transformation: **mix&go competent cells**
	16	✓	Digital genomic resources and in silico cloning, **colony PCR**
10/14	17	×	**Midterm**
	18	✓	Cellular manipulations I: targeted **neuronal ablation with Killer Red**
10/21	19	✓	Cellular manipulations II: targeted cellular **activation with ChR2**
	20	✓	Cellular manipulations II: measuring cellular activity with calcium indicators **GCaMP**
10/29	21	✓	**Restriction digestion**, **gel purification**
	22	✓	**Restriction cloning**, **PCR cleanup**
11/04	23	✓	Reverse genetics: **RNAi screen I**
	24	✓	Reverse genetics: **RNAi screen II**
11/11	25	×	Group projects I
	26	×	Group projects II
11/18	27	×	**Thanksgiving: no classes**
	28	×	**Thanksgiving: no classes**
11/25	29	×	Group projects III
	30	×	Group projects IV
12/02	*31*	×	Group Presentations (Lab Notebooks due today)
TBD	32	×	**Final**