BioS 323: Molecular Biology Laboratory
Tuesday & Thursday 2PM to 5PM, 3068 SEL
Prerequisites: BioS220

Instructors:
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Course Description:
This is an advance molecular biology laboratory course that builds on the basic techniques taught in the BioS 200-level lecture courses. You will be involved in a semester long research project allowing an intensive exposure to the principles and techniques used in molecular biology: Bioinformatics, nucleic acid isolation, DNA cloning into bacterial cells, restriction endonuclease digestion, agarose gel electrophoresis, polymerase chain reaction, DNA sequencing, gene fusions, protein isolation and analysis. *Tetrahymena thermophila*, a single cell eukaryotic ciliate, will be the model organism used in the class.

Learning Objectives and Goals:
- Exposure to a “hands on” research experience
- Gain understanding of techniques used in molecular biology
  - Potentials and limitations of each technique
  - Understand the application of these techniques
  - Understand the type of information/data generated by these techniques
- Gain experience in critical thinking, data analysis
- Gain experience in understanding primary research literature
- Gain experience in scientific communication (orally and in written form)

Textbook and Materials:
In this course, a *LabArchives* electronic laboratory notebook (ELN) will be maintained as part of the course. The fee for the ELN is $15.00. All laboratory protocols will be provided via *LabArchives* along with supporting materials and research articles related to the experiments. The ELN will be introduced the first week of the course.

*iClicker*- Available at the UIC bookstore will be used in this course. You must register your iClicker through the Blackboard site for this course.

There are no formal textbooks for this course. For reference materials, the online versions of "Current Protocols in Molecular Biology" and “Methods in Cell Biology Vol. 109” are available from our library. Additional, research articles related to the experiments are referenced at the end of each laboratory protocol and posted to Lab-Archives.

Grading:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
<th>Points</th>
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<tbody>
<tr>
<td>Lab Notebooks</td>
<td>20%</td>
<td>100</td>
</tr>
<tr>
<td>Exam 1</td>
<td>15%</td>
<td>75</td>
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<tr>
<td>Exam 2</td>
<td>15%</td>
<td>75</td>
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<tr>
<td>Class Assignments</td>
<td>30%</td>
<td>150</td>
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<tr>
<td>Class Presentation</td>
<td>10%</td>
<td>50</td>
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<tr>
<td>Research Participation</td>
<td>10%</td>
<td>50</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>500</strong></td>
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Letter grades are assigned based on total grade points accumulated throughout the semester. Course grades will be based on the percentage of earned points/ **500 points**: 85-100% A, 75-84% B, 60-74% C, 50-59% D, 49-0% F.
Laboratory Notebook:

All students will be required to keep an electronic laboratory notebook (ELN) via LabArchives. Instructions for obtaining a LabArchives account will be explained the first day of class. This is a project-based course and we will be doing actual research. The lab notebooks are very important and are a record of the research performed. During the semester, the instructor and the teaching assistant will be monitoring the ELN. At the end of the semester, a copy of the ELN will remain with the instructor and the student. Lab protocols must be printed before coming to the laboratory. The maintaining of an ELN is part of the grade of this course.

Exams:

Exam materials will cover lectures/discussions, reading assignments, and laboratory experiences. The primary focus of exams in a course of this nature is in problem solving and the demonstration of critical thinking skills.

Class Presentation:

There will be one oral presentation in the course. Students will give a summary talk of their completed research. The instructors and teaching assistant will evaluate these talks. Instructions for these presentations will be given in class and the information will be posted on LabArchives.

Class Assignments:

There will be four written assignments during the semester related to the research project. The final written assignment will be a formal scientific paper reporting your results of your project. Instructions for these assignments will be given in class and posted to LabArchives.

Written assignments:

- Background paper (30 pts)
- Figures (30 pts)
- Outline of research paper (30 pts)
- Research paper (60 pts)

Late Assignments:

I will accept late work (i.e. work turned in after the due date/time) for assignments ONLY, but will deduct 20% of the point value for each day that it is late (after 5 days the maximum point value is zero). This includes assignments that are forgotten on the day the assignment is due. All days of the week are included in the late policy (including Saturday & Sunday). This policy does not include presentations or exams.

Research Participation:

Students must demonstrate an effort in actively participating and conducting their laboratory experiments in an accurate and timely manner. Students will be graded on their performance and outcome of experiments. Experiments that do not show satisfactory results may need to be repeated outside of class time. If the instructor has to conduct the experiment to complete an experiment it will result in an automatic reduction of one letter grade in your participation grade.

Students are expected to come to class prepared for discussion of experimental design and will loose points if not prepared. Answering iClicker questions will be the means to evaluate your preparedness for the laboratory work.

iClicker points: An iClicker remote will be used during the lecture part of each lab. A total of 50 points can be earned with the iClicker. The iClicker is a response system that allows you to respond to questions posed during class. You will be graded on that feedback (the proportion of correct responses from the total questions posed adjusted to a 50 point scale). iClicker will be used in most lectures but the number of questions asked may vary from class to class. You are responsible for bringing your iClicker remote to class daily and making sure that it is working properly. If you forget to bring your iClicker to class you will not receive any iClicker points for that class.
Laboratory Safety:
- **NO** eating or drinking is allowed in the laboratory
- **Attire** - shorts and sandals/open toes are not permitted
- **Protective clothes** - lab coats or old an old shirt are highly recommended
- **Protective gloves** - will be provided and MUST be worn when handling hazardous materials
- **Glass** must be disposed of in the glass disposable box (Do NOT put glass in the regular garbage).
- "sharps" (razors blades, needles) must be disposed of in the red sharp con-tainers. (DO NOT put “sharps" in the regular garbage).
- **Organic waste** must be collected in a separate container and NOT disposed down the sink
- **Biological waste** must be disposed into the red biohazard bags.

**DISABILITY ACCOMMODATION**
The University of Illinois at Chicago is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at UIC. Students with disabilities who require accommodations for access to and/or participation in this course are welcome, but must be registered with the Disability Resource Center (DRC). You may contact DRC at 312-413-2183 (v) or 773-649-4535 (VP/Relay) and consult the following: [http://drc.uic.edu/guide-to-accommodations](http://drc.uic.edu/guide-to-accommodations).

**Course Policies in Accordance with University and College Policies:**

**Enrollment:**
Students may earn academic credit only for courses in which they are properly registered. **Officially enrolled students will be listed on the class roster. Students will not be permitted to attend any course unless they are officially enrolled.**

**Course Drops:**
Students may drop courses and/or terminate their enrollment status consistent with University and college deadlines. To officially drop a course, a student must use the web-based Web for Student System to enter the drop request no later than the first two weeks in Fall. Students may drop courses through the tenth week with College permission. For courses dropped after the second week of the semester, a grade of W will appear on the student's record. **A student who fails to officially drop a course may be assigned a grade of F.** As they apply to 15-week terms or summer sessions, see [http://grad.uic.edu/cms/?pid=1000222](http://grad.uic.edu/cms/?pid=1000222)

**Attendance:**
The University expects students to attend all class sessions and to arrive **promptly.** The University expects instructors to be reasonable in accommodating students whose absence from class resulted from: (1) participation in University-sanctioned activities and programs (Written letter of absence is needed from program coordinator); (2) Observance of University recognized religious holidays (notification by the 10th day of the term), (3) personal or family illness and/or other compelling circumstances (detailed documentation is required). In all scheduled absence from class, the instructor should be notified at least a week in advance if feasible. Sudden absences require notification by **email to the instructor and lab partner.**

**Academic Integrity:**
University of Illinois at Chicago is a community of scholars committed to developing educated persons who accept the responsibility to practice personal and academic integrity. You are responsible for knowing and following the university’s student honor code, Student Academic
Integrity Policies and Procedures, including plagiarism. Instances of academic misconduct by students will be handled pursuant to the Student Disciplinary Policy:
http://dos.uic.edu/docs/Student%20Disciplinary%20Policy.pdf

Academic dishonesty includes, but is not limited to:
1. Cheating. Either intentionally using or attempting to use unauthorized materials, information, people, or study aids in any academic exercise or extending to or receiving any kind of unauthorized assistance on any examination or assignment to or from another person.
2. Fabrication. Knowing or unauthorized falsification, reproduction, lack of attribution, or invention of any information or citation in any academic exercise.
3. Academic dishonesty/plagiarism. Intentionally or knowingly representing the words or ideas of another as one’s own in any academic exercise.
4. Bribes, favors, thefts. Bribing or attempting to bribe, promising favors to or making threats against, any person, with the intention of affecting a record of a grade or evaluation of academic performance. Any conspiracy with another person who then takes or attempts to take action on behalf of or at the direction of the student.
5. Examination by proxy. Taking or attempting to take an exam for someone else other than the student is a violation by both the student enrolled in the course and the proxy or substitute.
6. Grade tampering. Any unauthorized attempt to change, actual change of, or alteration of grades or any tampering with grades.
7. Non-original works. Submission or attempt to submit any written work authored, in whole or part, by someone other than the student. This is plagiarism.

Observance of Religious Holidays:
Students who wish to observe their religious holidays shall notify the faculty member by the tenth day of the semester of the date when they will be absent unless the religious holiday is observed on or before the tenth day of the semester. In such cases, the student shall notify the faculty member at least five days in advance of the date when he/she will be absent. The faculty member shall make every reasonable effort to honor the request, not penalize the student for missing the class, and if an examination or project is due during the absence, give the student an exam or assignment equivalent to the one completed by those students in attendance. If the student feels aggrieved, he/she may request remedy through the campus grievance procedure. http://oae.uic.edu/docs/ReligiousHolidaysFY20152017.pdf

Cell Phone:
As a member of the learning community, each student has a responsibility to other students who are members of the community. When cell phones or pagers ring and students respond in class it disrupts the class. All such devices must be turned off or put in a silent (vibrate) mode and ordinarily should not be taken out during class. A laboratory class is long and it may have times when you are in an incubation period. If you want to briefly check your phone, you may leave the laboratory and check your phone in the hallway. As a general rule, your phone should not be out during laboratory class. Given the fact that these same communication devices are an integral part of the University’s emergency notification system, an exception to this policy would occur when numerous devices activate simultaneously. When this occurs, students may consult their devices to determine if a university emergency exists. If that is not the case, the devices should be immediately returned to silent mode and put away.
### Course Outline
(This is a tentative schedule and may change due to progress in the experiments. Exam dates and student presentations are NOT subject to change and will be given on the designated date.)

<table>
<thead>
<tr>
<th>DATE</th>
<th>Research Plan</th>
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| **W1 8/23** | • Introduction to course  
• Laboratory safety  
• *Tetrahymena* as a model organism  
• Searching for Scientific Articles |
| **8/25** | • Introduction to LabArchives, an Electronic Laboratory Notebook (ELN)  
• Introduction to Benchling, a DNA editing and analysis software program  
• Introduction to the *Tetrahymena* Genome Database |
| **W2 8/30** | • Aseptic Technique  
• Micropipetting Practice  
• Making solutions |
| **9/1** | • Identify your Gene of Interest (GOI)  
• Use the *Tetrahymena* Genome Database to collect gene sequence and related information about your GOI |
| **W3 9/6** | • Design PCR primers to clone GOI into pENTR/D vector  
• Use additional databases to gain information about GOI (cont.)  
• Generate a plasmid map of pENTR/D-*Tt*GOI vector |
| **9/8** | • DNA concentration determination of genomic DNA  
• Agarose gel electrophoresis  
• Design PCR reactions of *Tt*GOI |
| **W4 9/13** | • PCR amplification of *Tt*GOI using gDNA as template  
• Agarose gel electrophoresis analysis of PCR products of GOI  
• "Clean-up" PCR products  
• Quantify PCR products |
| **9/15** | • TOPO clone PCR products for *Tt*GOI into pENTR/D-TOPO vector  
• Transform chemically-competent *E. coli* and plate onto selective plates to isolate transformants  
• **Background Assignment Due** |
| **9/20** | • Inoculate cultures of transformants  
• Quick-screen plasmid DNA preps, Restriction enzyme (RE) digests |
| **W6 9/18** | • Gel analysis of RE digests  
• Proteinase K treat samples  
• Transform fusion plasmid into bacterial cells |
| **10/4** | • Recombination based cloning  
• LR reactions to transfer pENTR-D-*Tt*GOI to generate GFP fusion in pIGF-gtw vector |
| **10/5** | • Prepare sample for DNA sequencing analysis  
• **Figures Assignment Due** |
| **10/11** | • Examine cultures of transformants |
| **10/12** | • Inoculate cultures of transformants  
• Quick-screen plasmid DNA preps  
• Restriction Enzyme Analysis of pIGF-gtw-*Tt*GOI clones |
| **W9 10/18** | • Gel analysis of RE digests  
• Inoculate culture for large scale plasmid prep  
• Large scale plasmid prep of pIGF-gtw-*Tt*GOI-fusion clone |
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<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Activities</th>
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<tbody>
<tr>
<td>W10</td>
<td>10/25</td>
<td>• Quantify DNA and prepare for transformation</td>
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<td>10/27</td>
<td>• Electroporate pIGF-gtw- TiGOI vectors into Tetrahymena cells</td>
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<td>• Plate electroporated cells into microtiter dishes</td>
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<td>10/28</td>
<td>• Add selective medium to electroporated Tetrahymena cells</td>
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<td>W11</td>
<td>11/1</td>
<td>• Score and reselect pIGF-gtw- TiGOI transformed Tetrahymena cells</td>
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<td>11/3</td>
<td>• Induce expression of GFP-tagged TiGOI in Tetrahymena transformants and observe localization (induced and uninduced cells)</td>
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<td>W12</td>
<td>11/8</td>
<td>• Protein isolation from Tetrahymena transformants containing pIGF-gtw-TiGOI (induced and uninduced cells)</td>
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<td></td>
<td>11/10</td>
<td>• Outline of Research Paper Due</td>
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<tr>
<td>W13</td>
<td>11/15</td>
<td>• SDS Protein gel electrophoresis</td>
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<td>11/17</td>
<td>• SDS Protein gel electrophoresis, Western blot</td>
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<td>W14</td>
<td>11/22</td>
<td>• Catch-up day</td>
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<td>• Cryopreservation of all strains generated</td>
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<td>No Class</td>
<td>11/24-25</td>
<td>• Happy Thanksgiving</td>
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<tr>
<td>W15</td>
<td>11/29</td>
<td>• Oral Presentations</td>
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<td></td>
<td>11/30</td>
<td>• Exam 2</td>
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<tr>
<td></td>
<td></td>
<td>• Final Research Paper Due</td>
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