Chemistry 204L Syllabus
Spring 2019

Instructor: Deepika Das
Office: OSB 402
Email: deepika.das@emory.edu
Office Hours: Mon, Wed: 4-5 pm, Tue: 11-12 or by appointment

*Contact regarding any questions or issues with the CANVAS site
dee@.ika.das@emory.edu

“In theory, there is no difference between theory and practice.
In practice, however, there is.”
- Jan van de Snepscheut

Required materials
- Pre-lab reading materials and background information will be made available via CANVAS. You may print the background material for use during lab, or bring your own device to lab. Understanding of the background material (handouts and video links) are key to follow the material/experiments being done in class.
- Electronic lab-notebooks
- Safety glasses
- Basic four function calculator

Course Description
Students will learn to work with biomolecules like DNA and protein and engage in their isolation, structural, and functional characterization via different laboratory techniques and assays. Students who withdraw from the co-requisite lecture course (CHEM 204) must withdraw from laboratory course.

Fundamental Laboratory Techniques
- **Protein and DNA handling**
  - Micro-pipette usage
  - Buffer preparation
- **Protein and DNA quantification**
  - UV-Vis Spectroscopy
  - Spectrophotometric assay (Bradford assay)
- **Gene manipulation**
  - Transformation (uptake of external genetic material by cells)
  - Polymerase Chain Reaction (PCR)
- **Protein purification and isolation**
  - Recombinant protein synthesis via gene over-expression in E.coli
  - Sonication (Use of sound waves to lyse cells)
  - Fast Protein Liquid Chromatography (FPLC) to isolate protein of interest

Student Learning Outcomes
With successful completion of this course, you should be able to demonstrate the ability to:
**Technical Skills**
- Prepare buffers and cell growth media
- Effectively handle and quantify DNA and protein samples
- Modify DNA via mutagenesis using PCR and incorporate them into cells
- Express, purify, characterize and estimate purity of a protein
- Design and run functional assays

**Cognitive skills**
- Construct a valid and well-supported scientific argument using data and reasoning.
- Evaluate the quality of laboratory evidence using quantitative reasoning (% error, % recovery, % yield, etc.) and qualitative reasoning (number of colonies, physical appearance etc.) whichever applicable. Analyze data and perform some fundamental aspects of statistical analysis, including the calculation of averages and standard deviations.
- Report protocols and results in a manner that would enable others to reproduce your work
- Write a lab-report in the form of a scientific publication.

**Broader Laboratory Program Goals**
- **Molecular level understanding**: Making the connections between the chemical structure of a biomolecule like DNA or protein and their properties and functions.
- Develop technical skills useful for a biochemical or cell biology lab set-up
- **Ask good questions** while carrying out procedures and investigations.
- Observe closely and use scientific insight.
- Practice scientific record keeping skills in a laboratory notebook.
- Display ethical practices in recording evidence.
- Identify important factors that affect the execution of an experiment (particularly in experimental design/redesign)
- **Identify questionable data** (data that does not follow the expected pattern). Repeat/redesign trials that produce questionable data
- Prioritize time and multi-task to meet the needs of the laboratory time constraints.
- **Display teamwork** in group activities, practice oral communication skills
- Show self-reliance and confidence when working independently.
- Recognize dangers and practice appropriate laboratory safety precautions
- Learn safe handling and disposal of biohazard waste (like bacterial cells etc.)

**Experience using laboratory software**
Microsoft Excel; ChemBioDraw; Vernier, PyMOL

**Experience using laboratory instrumentation**
- Micro-pipette
- UV-Vis spectrometer
- pH meter
- UV visualization cabinets
- Gel electrophoresis (horizontal and vertical)
- Sonicator
- Fast Protein Liquid Chromatography (FPLC)
Grading Methods and Course Requirements

<table>
<thead>
<tr>
<th>Course Requirement</th>
<th>Portion of course grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-lab Quizzes</td>
<td>20%</td>
</tr>
<tr>
<td>Laboratory Notebooks</td>
<td>10%</td>
</tr>
<tr>
<td>Laboratory Safety and Professionalism</td>
<td>10%</td>
</tr>
<tr>
<td>Quality Checks</td>
<td>25%</td>
</tr>
<tr>
<td>Post-lab quizzes/assignments</td>
<td>5%</td>
</tr>
<tr>
<td>Post-Lab reports</td>
<td>10%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>15%</td>
</tr>
<tr>
<td>Mid-Term</td>
<td>5%</td>
</tr>
</tbody>
</table>

Your final letter grade will be determined by the usual scale. *There is no automatic rounding or curve to course grades.*

<table>
<thead>
<tr>
<th>Grade</th>
<th>Marks Range</th>
<th>Grade</th>
<th>Marks Range</th>
<th>Grade</th>
<th>Marks Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>&gt;93-90</td>
<td>B-</td>
<td>80-77</td>
<td>D+</td>
<td>67-60</td>
</tr>
<tr>
<td>A-</td>
<td>90-87</td>
<td>C+</td>
<td>77-73</td>
<td>D</td>
<td>&lt;60</td>
</tr>
<tr>
<td>B+</td>
<td>87-83</td>
<td>C</td>
<td>73-70</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>83-80</td>
<td>C-</td>
<td>70-67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Laboratory Notebooks
In this course, you will be using electronic notebook. Most of the notebook for each experiment will be graded using a mastery system. You can copy procedure/ parts of it from the student handout if necessary. **However, copying data from others or waiting till the end of class to complete the note-book will lead to loss of points.** See the Canvas document for Notebooks. To encourage learning from feedback, if your lowest notebook grade is one of the first two labs, it will be dropped.

Pre-lab quizzes
A short quiz, available on Canvas, will be due **before each lab period** to determine your level of understanding of the material on which the laboratory session is based. Hence, completing the pre-lab quiz will help you prepare better for the class. **You will be awarded zero for the pre-lab quiz if you fail to complete the quiz before the beginning of the lab.**
Laboratory safety and professionalism

Safety and Stewardship: As safety in the laboratory is of utmost importance, you must adhere to the safety policies in the lab. *You will never be penalized for an accident,* but you will lose safety points for coming to lab underprepared or disobeying safety rules. A large number of separate sections shares the laboratory space; to be good stewards of the communal space, we expect you to maintain your lab bench and hood in a safe, clean, and organized manner. The chemistry lab can be a dangerous place, but with the proper training, caution, and care, it can be an exceptionally effective learning environment. Some of the most important safety guidelines are listed here; the complete safety policy will be covered during the first course meeting.

**Professionalism:** Coming to lab unprepared - *without:* either a means of accessing the handout, or your lab notebook, or safety glasses, or closed-toed shoes, or hair that falls below the shoulders tied back, or lab appropriate clothing (*long pants*) - sends the message that you do not take lab seriously and do not understand the requirements of professional behavior. This is especially true if any of this happens more than once. Students who arrive to lab without the appropriate attire will be sent back to their dorm to change.

You should be prepared to start work as soon as you get into the laboratory. It is important that you keep updating your electronic notebook as you collect data throughout the class. **Failure to do so and waiting until the end of class to complete the notebook will lead to loss of safety and professionalism points.** Additionally, if you frequently take longer than everybody else to finish the experiment and writing in your lab notebook, you should examine the way you are preparing for lab and how you are working in lab.

Your approach to safety, stewardship, and professionalism will impact your grade in this course. Egregious or repeated violations of safe practices may result in exclusion from the course, after verbal and written warnings from the instructor.

**Quality Checks**

Many of the laboratory experiments will be performed in pairs and in working in teams. However, to encourage personal responsibility and to ensure that you are gaining fundamental laboratory skills, **your individual performance on certain techniques will be evaluated holistically by your ability to complete the process of the laboratory procedure** as well as how you demonstrate your conceptual understanding. This includes how you apply the procedure, your decisions during the procedure, how you answer questions, and questions you ask. Other important
Factors for the evaluation include the amount of time for completion of both the procedure and your notebook (was it beyond average?), your level of independence, and your technique. The lowest quality check grade will be dropped.

**Post-lab quizzes**
A quiz will be given at the end of some laboratory sessions focusing on the learning goals for the course. These quizzes will cover the course concepts behind the experiments or techniques just completed and may include concepts from previous experiments. Much of the information learned in this lab class is cumulative; therefore, you will be held responsible for these thematic concepts throughout the semester.

**Post-lab Report**
Writing is crucial to the accurate dissemination of scientific knowledge and hence scientific writing is helpful to your development as a scientist. In this course, you will be writing post-lab reports focusing on specific sections of a scientific journal (namely Introduction, Materials and methods, Results and Discussion) one section per experiment as instructed in the class. Through this exercise, you will learn to select, summarize, and evaluate laboratory data - communicate it in a concise and formal manner, back-up your arguments using the scientific principles and discuss possible ramifications/applications they may have.

Additional information will be provided on Canvas site providing more detail about the expectations and requirements for individual sections.

**Final Exam**
Everything you learn in this course is interconnected and builds on previously learned techniques and concepts. Consequently, you will be tested on your understanding and application of the student learning goals for the course in a written final exam held near the end of the semester during your regular lab period.

**Attendance**
The only acceptable reasons for missing a lab session are serious illness/emergency, a religious holiday, or a college-related activity (such as a field trip or a trip where you are representing the school). If you miss a lab for any other reason, you will receive a zero. If you do not follow the procedure below for obtaining permission for the absence, you will receive a zero regardless of the reason:

In the case of a serious illness or emergency, you must let your instructor know the reason BEFORE the day and starting time of the lab. If the reason is acceptable, you may be allowed to make up the lab another day that week or if that is not possible, the instructor will make other arrangements.

If you know you are going to need to miss lab for a religious holiday or a college-related activity, you must talk to your instructor at least a week before the lab. You may be allowed to make up the lab another day that week or if that is not possible, your instructor will make other arrangements.

**Only one lab may be missed** (including any pre-approved reason) without a course grade penalty.
**Honor Code Policy**

Lab sessions are a perfect place to promote and utilize collaborative learning. You are encouraged to discuss the experiments with others before lab and while in lab. However, your **post-lab reports and Quality Checks are to be your work alone**. You should not work with another student after the lab is over. **Collaboration on any write-up or Quality Check is a violation of the Oxford College Honor Code and will be treated as such.** This rule applies to any portion of reports from previous semesters as well as papers available over the internet. Your name on your write-up or Quality Check is your pledge that the work is yours and that you did not give or receive unauthorized assistance. **The usual penalty for students who are found to have violated the honor code is an F in the course.**

**Accommodations**

If you have a documented disability and have anticipated barriers related to the format or requirements of this course, or presume having a disability (e.g. mental health, attention, learning, vision, hearing, physical or systemic), and are in need of accommodations for this semester, we encourage you schedule a meeting to discuss this with your instructor. You will also need to contact the Office of Access, Disability Services, and Resources (ADSR) to learn more about the registration process and steps for requesting accommodations.

If you are a student that is currently registered with ADSR and have not received a copy of your accommodation notification letter within the first week of class, please notify ADSR immediately by emailing Megan Bohinc at ADSROxford@emory.edu. Students who have accommodations in place are encouraged to coordinate a face to face meeting with me during the first week of the semester, to communicate your specific needs for the course as it relates to your approved accommodations. All discussions with ADSR and faculty concerning the nature of your disability remain confidential.

For additional information regarding ADSR, please visit the website: equity.emory.edu/access.