Syllabus

Course Objective and Learning Outcomes:

The objective of this course is to develop students' competency in molecular bioscience research by providing hands-on experience with a basic set of laboratory techniques and equipment. In this way, it will prepare students for research positions in an academic or industrial laboratory and/or reinforce molecular concepts learned in other, lecture-based courses.

By the end of this course you'll be able to:

- independently and correctly use micro-pipettors, centrifuges, gel electrophoresis equipment, electroporators, and other common molecular biology laboratory equipment,
- follow standard protocols and perform common molecular biology procedures, such as purifying DNA from cells and solutions, PCR, transforming organisms with foreign DNA, and analyzing DNA and proteins by gel electrophoresis,
- perform common laboratory calculations and make mixtures of reagents,
- work independently or in a team in a laboratory setting,
- further develop the ability to think critically and solve problems,
- maintain an industry-standard lab notebook, and
- communicate your work through written reports and oral presentations.
Description

The course objective is to give students solid, foundational experience with a basic set of laboratory techniques and equipment that are used in various areas of biotechnology. Specifically, the labs will focus on techniques used in microbial (bacteria and yeast) and plant biotechnology, including DNA preparation, PCR, cloning genes into plasmids, transformation and transfection of organisms, DNA sequence analysis, protein gel electrophoresis, and enzyme assays. Most laboratory sessions will include a short introduction to the day’s procedures followed by hands-on laboratory activities. In the beginning of the semester, students will be closely guided through the procedures but over the course of the semester, students will increasingly become more independent. In the second half of the semester, students will work in pairs on a project that makes use of the techniques learned in the first half of the semester, culminating in an oral presentation of their work by each group.

Course format

The course format will include short preparatory presentations by the instructor to introduce the lab activities and then students will work on their own or in small groups to learn the techniques. In the second half of the semester, students will work in pairs on a laboratory project.

Texts, Articles, and Other Course Materials

You will need the following in order to participate in this course.

Texts:

- All readings will be supplied free-of-charge on the course D2L site.

Software and Hardware:

- Regular access to a computer that meets the minimum requirements for D2L.
- Ability to download a computer program called Geneious (information will be supplied) - the cost of the software is covered by the University, so there will be no charge to students for this semester. Note that you will likely not be able to download it onto the loaner computers from the library. If you do not have a computer to use with this software, you will be able to use the computer in the laboratory to run Geneious.

Materials:

- All needed materials will be supplied by the instructor, including personal protective equipment (PPE), notebook, and biological reagents

Recommended (not required) materials:

- In addition to the supplied laboratory notebook (which you may keep at the end of the semester), you may want to use a 3-ring binder or similar for storing protocols for future use or keep electronic notes on your own computer/tablet.
Your Instructors

Instructor Contact Information

Professor
Samantha Orchard, Ph.D. "Dr. Orchard" she/her/hers

Office Location
541D Marley (UA Tucson main campus)

Telephone Number
520.621.3969

Email Address
orchard@email.arizona.edu

Office Hours (when I will be available in my office for students to walk in to talk with me)
Wednesdays, 1:30-3 pm, or by appointment

Email Response Time
Within 24 hours on weekdays.

Note!
You will be notified, in advance, of any scheduling issues that may impact my response times.

Professor biography
Samantha Orchard is an Associate Professor of Practice at the University of Arizona, where she teaches courses about Biotechnology. She got a B.S. in Microbiology from the University of Washington (Seattle), a Ph.D. in Bacteriology from the University of Wisconsin (Madison), and post-doctoral experience in bacterial genetics from San Diego State University (California). After her postdoctoral training, she transitioned to working in the biotechnology industry, first at a small Biofuels start-up type company and then at a larger company that makes and sells enzymes for industrial applications. After more than 8 years in industry, she returned to academia in 2018, bringing her real-world biotechnology experience to the classroom to help prepare students for careers in Biotechnology. In her time in industry, she enjoyed working with people with varied backgrounds and in different positions (e.g. Legal, Regulatory, Safety, Manufacturing, Quality Control and Quality Assurance, etc.) and she encourages people to consider the varied career options in the Biotechnology industry.

Other Contact Information

Preceptor
Daniel Acosta

Email Address
danieljacosta@email.arizona.edu

Preceptor biography
Daniel was a PLS 340L student in Fall 2018 and a preceptor in the class in Spring 2019. He has worked in a University research lab and will be going to several graduate school interviews this semester, so he could be a good resource for you if you are considering doing research and/or applying to graduate school.
Please read the Announcements on the course home page before each class meeting, because they have very important background information and instructions on the techniques we will be doing.

<table>
<thead>
<tr>
<th>Class meeting</th>
<th>Day</th>
<th>Date</th>
<th>Activities</th>
<th>Items due</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Thursday</td>
<td>January 16</td>
<td>Scavenger Hunt, Notebook rules, Start culture of NEB5alpha + pET28a</td>
<td>Quiz 1</td>
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<tr>
<td>2</td>
<td>Tuesday</td>
<td>January 21</td>
<td>Prepare pET28a plasmid, NanoDrop readings</td>
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<tr>
<td>3</td>
<td>Thursday</td>
<td>January 23</td>
<td>Digest pET28a, Setup and run PUB4 PCR</td>
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<tr>
<td>4</td>
<td>Tuesday</td>
<td>January 28</td>
<td>Add DpnI to PCR, Pour and run gel and cleanup of digested plasmid and PCR</td>
<td></td>
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<tr>
<td>5</td>
<td>Thursday</td>
<td>January 30</td>
<td>NanoDrop readings on purified DNA, NEBuilder reaction to assemble plasmid + PCR, Pour selection plates</td>
<td>Quiz 2 (Friday)</td>
</tr>
<tr>
<td>6</td>
<td>Tuesday</td>
<td>February 4</td>
<td>Transform NEBuilder reaction and plate, Plan OneTaq PCR, Witness notebooks</td>
<td></td>
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<tr>
<td>7</td>
<td>Thursday</td>
<td>February 6</td>
<td>OneTaq PCR on colonies, Pour gel and store in fridge</td>
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<tr>
<td>8</td>
<td>Tuesday</td>
<td>February 11</td>
<td>Run gel to analyze PCR, Clean up DNA for sequencing, check on NanoDrop, and submit</td>
<td>Lab report 1 (Monday), Notebook check 1 (Tuesday, end of class)</td>
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<tr>
<td>9</td>
<td>Thursday</td>
<td>February 13</td>
<td>Geneious cloning activity, Analyze sequencing reactions and start cultures of positive colonies</td>
<td>Quiz 3+4 (start in class, submit by Sunday)</td>
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<tr>
<td>10</td>
<td>Tuesday</td>
<td>February 18</td>
<td>Prepare plasmids, Transform into expression host, Set up culture tubes for Dr. O. to inoculate on Wednesday</td>
<td></td>
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<tr>
<td>11</td>
<td>Thursday</td>
<td>February 20</td>
<td>Induce expression of cultures, Plant tobacco seeds, Glycerol stocks</td>
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<tr>
<td>12</td>
<td>Tuesday</td>
<td>February 25</td>
<td>Protein gel, Start DHFR culture</td>
<td>[Dr. O. will subculture and induce DHFR culture before Thursday]</td>
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<tr>
<td>13</td>
<td>Thursday</td>
<td>February 27</td>
<td>DHFR recovery</td>
<td></td>
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<tr>
<td>14</td>
<td>Tuesday</td>
<td>March 3</td>
<td>DHFR purification</td>
<td></td>
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<tr>
<td>15</td>
<td>Thursday</td>
<td>March 5</td>
<td>DHFR protein gel and enzyme assay</td>
<td>Lab report 2 due March 6</td>
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<tr>
<td>16</td>
<td>Tuesday</td>
<td>March 10</td>
<td>Spring Break</td>
<td></td>
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<tr>
<td>17</td>
<td>Thursday</td>
<td>March 12</td>
<td>Spring Break</td>
<td></td>
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<tr>
<td>Class meeting</td>
<td>Day</td>
<td>Date</td>
<td>Activities</td>
<td>Items due</td>
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<tr>
<td>18</td>
<td>Tuesday</td>
<td>March 17</td>
<td>CLASS CANCELLED</td>
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<tr>
<td>19</td>
<td>Thursday</td>
<td>March 19</td>
<td>CLASS CANCELLED</td>
<td></td>
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<tr>
<td>20</td>
<td>Week of March 23</td>
<td></td>
<td>DHFR lecture and gel analysis</td>
<td>Quiz 5</td>
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<tr>
<td>21</td>
<td>Week of April 6</td>
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<td>DHFR assay analysis</td>
<td>Quiz 6</td>
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Grading Policies

This course follows grading policies established by the University of Arizona.

Note!

Click here: for descriptions of grades given at the UA and to review the official university grading system.

Grading Scale
A = 90% and above
B = 80 - 89.9%
C = 70 - 79.9%
D = 60 - 69.9%
E = 59.9% and below

Grade definitions
A: Achievement that is outstanding relative to the level necessary to meet course requirements.
B: Achievement that is significantly above the level necessary to meet course requirements.
C: Achievement that meets the course requirements in every respect.
D: Achievement that is worthy of credit even though it fails to fully meet the course requirements.
E: Represents failure (no credit) and signifies that the work was not worthy of credit or was not completed.

Graded Activities [1000 points possible]
Additional information on the graded activities is provided in a separate section, below, and/or will be provided in separate documents as the semester progresses.

Lab reports [500 points total]
50% of your grade

Quizzes and Online activities [200 points total]
20% of your grade

Final oral presentation [100 points total]
10% of your grade

Notebooks [100 points total]
10% of your grade

Participation and Safety [100 points total]
10% of your grade

Final Exam/Project
There will not be a final exam in this course. Instead, students will submit a final laboratory report and present their findings in a group presentation in the last full week of classes.

Date and Time
Thursday, April 30th, 12:30-2:50 pm (in-class group presentations)

Links to more information:
- Final Exam Regulations and Information
- Final Exam Schedule

Additional Information on Graded Activities

Lab reports
I will provide additional information about the due dates and subject matter for the laboratory reports separately. Briefly, your typed laboratory reports must be submitted to the Assignments folder in the course D2L website.

I will grade and provide feedback on your laboratory reports within 2 weeks of the due date.

Quizzes and Online activities
I will periodically require you to take open-book Quizzes via D2L. Additionally, you will need to complete online activities and record your findings through the “Quizzes” feature of D2L, though I will refer to these as Activities. I will supply additional information separately.

Quizzes and Online Activities will be automatically graded in part after submission. You will be able to see your answers and the correct answers for any true/false, multiple choice, ordering, or matching question (but not the written response questions) 1 minute after the quiz availability ends. The Quizzes will be fully graded (including written responses, which I manually grade) within 72 hours (weekdays only) after the end of the availability period.

Final oral presentation
In the later part of the course, you will complete a laboratory procedure with a partner, with increased independence away from me, your instructor. In the final full week of classes, you and your partner will give an oral presentation to your instructors and classmates using presentation slides you will have made. The purpose of this activity is for you to practice oral presentations, which are a standard activity in academic and industrial research settings. I will provide further instructions and a grading rubric separately.
I will post your final oral presentation grade within 48 hours (weekdays only) from the time of your presentation.

Notebooks
In this course, I will train you to record your laboratory activities and findings in an industry-style notebook, which I will provide. Periodically, you will receive feedback on your notebook from your peers and I will also grade it. I will provide further instructions and a grading rubric separately.
I will grade your notebooks between two successive class meeting times or within 72 hours (weekdays only) at the end of the semester.

Participation and Safety
I will assign all students 100 points in this category early in the semester. If you are absent from a laboratory period without providing advanced notice to me of a reasonable excuse*, you will lose 10 points. Additionally, if you fail to maintain a safe working environment for you and/or your classmates after a warning or education on the topic from the instructor, you will lose additional points, depending on the severity of the infringement. For example, if you repeatedly fail to wear your laboratory coat and safety glasses in the laboratory room (except at times when the instructor has cleared you to remove them), you may lose 10 points per occurrence.
*Reasonable excuses include illness (no doctor’s note required), graduate school interviews/visits, and Dean’s Excuses.

Honors Credit
Please contact Dr. Orchard if you are interested in an Honors contract for this course.
About Policies

Policies are a set of guiding principles for how you (the student), we (the instructors), and the university should act in a given situation. Read these policies carefully so you know what is expected of you as well as what you can expect from the course and the UA.

Course Policies

I have the following expectations for students in this laboratory course:

- Attend all lab sessions, unless you have informed me in advance of an illness or other 'worthy' reason for not being able to attend.
- Participate in all lab sessions. In this course, you will learn by doing. In other words, participating in the course is vital to the learning process.
- Be respectful of your fellow students. For example, equipment and some reagents must be shared - do not take shared reagents to your bench until you are ready to use them and use equipment gently and appropriately, so that it remains usable by others.
- Watch out for your safety and the safety of others. When it comes to potentially unsafe conditions, "if you see something, say something".
- If you are not sure of what to do, ask for help.
- Come to lab prepared. Ensure you know what we will be doing for each lab session, in advance.

Attendance

Attend all lab sessions, unless you have informed me in advance of an illness or other 'worthy' reason for not being able to attend. You will lose 10 points in the "Participation and Safety" grade category for each unexcused absence.

UPDATE MARCH 2020:

- Students are strongly encouraged to stay at home if they feel sick, and most especially if they think they may have an infectious disease.
- Students that need to miss a class, or series of classes, due to illness, are responsible for emailing me at orchard@email.arizona.edu, with a copy to the Dean of Students at DOS-deanofstudents@email.arizona.edu, to let me know of the need, as soon as possible. There is NO need for a medical excuse to be provided, at least initially (see below).
- Students are responsible for completing any work that they might miss due to illness, including assignments, quizzes, tests and exams.
- Students are responsible for communicating with me via email (orchard@email.arizona.edu) to keep me updated if they anticipate being absent for multiple class meetings - email me before each meeting you will miss.
- Students who need to miss more than 1 week of classes in any one semester will be required to provide a doctor’s note of explanation to DOS-deanofstudents@email.arizona.edu. The Dean of Students Office will communicate the receipt of the note (with expected end date) out to the relevant faculty.

Elective Name and Pronoun Usage

I go by "Dr. Orchard" and use she/her/hers pronouns. Please email me at orchard@email.arizona.edu if you prefer that I address you using a name other than that listed in D2L and/or if there is a chance I will not automatically use your preferred pronouns.

Late policy

I will reduce your grade on items submitted late by 10% per day, or part thereof. I strongly recommend that you complete all quizzes and reports, even if you must submit them late, because they are an important part of the learning experience (and, of course, getting some points is better than getting no points).

Personal Protective Equipment (PPE)

You must wear a lab coat and laboratory safety glasses or goggles while you are in the laboratory. These will be loaned to you unless you prefer to provide your own. You will have a drawer and a hook in the laboratory for storing your notebook, glasses, and lab coat between class periods. Disposable gloves will be provided to protect you and your samples from each other. The majority of the gloves in the room are nitrile (not latex). Please inform the instructor in person or via email (orchard@email.arizona.edu) if you have latex or nitrile sensitivity or other contact allergies.

Talking and other distracting behavior

Be sure you always pay attention to instructor and preceptor instructions - do not talk to other students or engage in other distracting activities (e.g. phone usage) while the instructor or preceptor are issuing instructions.

Use of computers, phones, and other mobile devices

You may use computers, phones, and other mobile devices in the laboratory, to access the course D2L site or use the calculator feature, for example. However, care should be taken to protect your personal computer from chemicals, liquids, and biological specimens at your bench! If you are concerned about damaging your electronic devices, please do not use them in the laboratory and instead rely on printed protocols and the calculator in the laboratory. There is also a computer equipped with a printer available for students to use in the laboratory, to allow you to print out protocols for use during the class and to print out DNA and protein gel images, which you will need to paste into your notebooks (scissors, glue, and tape are provided for this purpose).

University Policies

Absences

Absences preapproved by the UA Dean of Students (or dean's designee) will be honored. Please read the university's attendance policy.

Accessibility

Classroom furniture

Please be aware that the accessible table and chairs should remain available for students who find that standard classroom seating is not usable.

Accommodations

DRC Contact Information

Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact the Disability Resource Center (520-621-3268) to establish reasonable accommodations. For additional information on the Disability Resource Center and reasonable accommodations, visit the DRC website.

Reasonable accommodations
If you have reasonable accommodations, please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.

**Administrative Drops**
Please refer to the UA's policy concerning Class Attendance, Participation, and Administrative Drops.

**Code of Academic Integrity**
Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog.

**Incompletes (I) and Withdrawals (W)**
Requests to complete this course in a future semester or to withdraw from this course must be made in accordance with university policies. To read the policies, click these links:
- Incomplete policy
- Withdrawal policy

**Nondiscrimination and Anti-harassment**
The university is committed to creating and maintaining an environment free of discrimination; please read the university’s Nondiscrimination and Anti-harassment policy.

**Religious Holidays**
Absences for any seriously held religious belief, observation, or practice will be accommodated where reasonable. Refer to the university’s Religious Accommodation Policy.

**Threatening Behavior**
The UA Threatening Behavior by Students Policy, prohibits threats of physical harm to any member of the University community, including to oneself.
Links to Additional Resources

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live and believes this may affect their performance in the course, is urged to contact the Dean of Students for support. In addition, the University of Arizona Campus Pantry is open for students to receive supplemental groceries at no cost. Please see their website at: campuspantry.arizona.edu.

Academic Policies and Procedures
Confidentiality of Student Records
Dean of Students Office
Health & Wellness for Students
Honors Courses
Student Assistance and Advocacy Information
Student Centers
The Think Tank
The Writing Center
The Writing Skills Improvement Program