Biotechnology Laboratory II, BIOL 5504 Spring 2018 Policies and Syllabus

Instructors: Dr. Richard Waring and Dr. Gaetano Romano

Office Hours:
For Dr. Richard Waring (Biology, Rm 307, 204-8877; email: waring@temple.edu): 11.00 -12.20 Tuesdays and Thursdays or by arrangement.
For Dr. Gaetano Romano (Biology, Rm 456B, 204-5767; email: gromano@temple.edu): by arrangement.

Labs will be held on Mondays, 5:30 – 9:30 PM, in Room 128, BioLife Sciences Building, unless otherwise notified.

Course Design:

BIOL 5504 is the second laboratory course in a two semester sequence established primarily for students in the PSM Biotechnology program. It is assumed (but not required) that participants have already completed Biotechnology Laboratory I (BIO 5503). You must participate in a review of lab safety rules and complete the Bloodborne Pathogen training provided by EHRS (Environmental Health & Radiation Safety Department). This course requires some background knowledge in microbiology, cell biology and molecular biology.

The first half of the course is designed to study current techniques for the detection of soluble tumor markers and epithelial-derived malignant cell that circulate in the peripheral blood of oncological patients. These experiments will utilize a blood-derived human cell line to simulate blood samples. The first half of the semester will also include a guided virtual tour of stem cell transplantation techniques in a rat model for Parkinson’s disease and the use of a PROTAC inhibitor for the selective induced protein degradation of the androgen receptor in a human prostate cancer cell line. The latter is a novel strategy in the sector of drug design and development.

Student field trip: nucleic acid facility at Thomas Jefferson University.

The second half of the course is structured around two elements both of which span several weeks. The first examines conditions and microbes used to sustain a microbial fuel cell (MFC) power generation. Students construct Mudwatts (MFCs), operate them under different conditions and then use potentiometry to measure overall power production. Microbial communities from the MFCs undergo metagenomics examination using 16S rDNA sequencing (Illumina) and taxonomic analysis (Qiime). To complement the metagenomics work, metabolic fingerprints are obtained via multi-well EcoPlates. The second element looks at the role of synthetic genomes in biotechnology. Students will use the Gibson Assembly technique to construct a DNA sequence bearing two genes. Gibson Assembly has been used to join as many as six DNA fragments together simultaneously. The major emphasis of this segment will be student participation. Students will not only carry out the required experiments but also design key components.

We wish to acknowledge Dr. Michelle McGowan as the original author of the MWC laboratory exercises and to thank her for facilitating their incorporation into this syllabus.

This course requires teamwork and the ability to analyze and present data. It is designed to develop critical thinking, and to plan, execute, modify and troubleshoot experiments as reflected in your lab notebook.
Laboratory Materials:
Bound notebook (you may use one from BIOL 5503.)
Lab coat, gloves, and safety glasses will be provided in lab.
You are encouraged to bring a flash drive.
Laptops will be provided when necessary but you are welcome to bring your own (please ensure that web cams are shut off).

Class Communication (Blackboard aka Bb): Class documentation will be posted on Blackboard in a variety of folders. Please conduct all email communication using your Temple e-mail account. If your email address does not include your full name, ensure that it is included in the signature line.

Preparation:
You should read assigned material beforehand and review lab notebooks as necessary. Some labs are quite detailed and require adequate preparation.

Grading:
Your grade for this course will be based on a total of 400 points, based on four (4) criteria.

1. Four quizzes (25 pts each) = 100 pts.
2. Laboratory notebook = 125 pts.
3. Written/Oral evaluation of research article = 50 pts.
4. Multimedia seminar (125 pts total)
   a. One page summary/bibliography = 25 pts.
   b. Uploaded seminar file = 25 pts.
   c. Seminar presentation = 50 pts.
   d. Participation = 25 pts.

Quizzes and presentations must be completed during their scheduled time. There are no makeups for quizzes or presentations. If you miss any for an acceptable reason, you will receive a weighted average of the other components of the grade. Suitable documentation must be submitted to one of the instructors within 72 hours.

1. Quizzes will consist of short-answer questions based on background, strategies, mechanisms, and concepts covered in earlier lab exercises.

2. All laboratory work will be entered into a bound notebook. The notebook will be submitted for grading mid-semester and on the last day of lab. A lab notebook is an essential component of a research curriculum, and it serves as a record of intellectual property.

3. You will be given a current research article to evaluate. A copy of the article will be posted on Bb along with several questions that you must answer for the written part of the evaluation. The written critique must be submitted through SafeAssign on Bb by the deadline. Your oral score will be determined by the quality of your participation in an active discussion of the article in lab.

4. Pairs of students will research a topic related to one introduced in lab and give a twenty (20) minute power point seminar at the end of the semester. The quality of the presentation should reflect weeks of topic research and include such items as research articles, figures, tables, brief video clips, quotes, etc.
Below are some ideas / questions that may help you organize thoughts in selecting a research topic.

- Clearly define the topic and its significance in research and / or industrial applications.
- What techniques, methods, and equipment are used in this technology? Describe components that are innovative or novel.
- What applications exist for this technology?
- What problems are solved / created using this technology?
- Who or what benefits from this technology? Are ethical issues involved? What costs are involved?
- What are the future directions of this technology?

Additional guidelines and recommendations/expectations pertaining to content and delivery will be discussed in class.

There are three tentative deadlines for this project. They will be finalized during the semester but none occur before Spring break:

- April 9 or 16, 2018: A hard copy submission of a one-page written summary and bibliography of research seminar is due. The bibliography must include at least three refereed journal articles. The written summaries of the entire class will then be posted on Bb so that you can access them. You must come to the seminars prepared to ask questions. NOTE: Active participation will figure into your overall seminar score.
- April 23, 2018: Submission of actual seminar presentation to Bb
- April 30, 2018: Oral presentation of seminar to the class.

**Academic Code of Conduct**


You are responsible for following this policy for all assignments, tests and exams; students who do not will be penalized. The penalty will vary with the nature of the offense, and will involve, as necessary, the lab coordinator and lecture instructors, the department, and the college.

Although you will conduct lab experiments with a group of people, and discuss your results with them, the interpretation and conclusion with supporting argument should be your work, your thoughts, in your own words.
Biotechnology Laboratory II, BIOL 5504, Spring 2018

Monday 5:30 – 9:30 pm  BiLife Sciences Building, Rm 128
Instructors: Richard Waring and Gaetano Romano
The schedule is subject to change.

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<tr>
<th>Wk</th>
<th>Experiment</th>
<th>Microbial Metagenomics</th>
<th>Synthetic Genomes: Gibson Assembly (G.A.)</th>
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<tbody>
<tr>
<td>1/22/17</td>
<td>Detection of soluble tumor markers (PSA – prostate cancer).</td>
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| 1/29/18 | PROTAC inhibitor for induced protein degradation of the androgen receptor in a human prostate cancer cell line.  
Stem cell transplantation techniques for tissue regeneration and/or repair.  
Guided virtual tour for stereotactic transplantation in a rat model for Parkinson’s disease. |                         |                                           |
| 2/5/18  | Setting up conditions for immunocytochemistry [EpCAM and CD45 (Protein tyrosine phosphatase, receptor type, C also known as PTPRC)].  
Visit to the microscope facility of Dr. Weidong Yang. |                         |                                           |
| 2/12/18 | Immunological-based isolation and characterization of epithelial tumors-derived cells from human blood – derived K562 cells.  
**Quiz 1** |                         |                                           |
| 2/19/18 | Physical method of separation of epithelial tumors-derived cells from human blood – derived K562 cells.  
Immunodetection of epithelial and hematological markers in isolated cell populations. | Set up Micro Fuel Cells (MFC-a.k.a. Mudwatts) | Learn ApE software Week 3, 4 or 5 |
| 2/26/18 | Nucleic acid facility at Thomas Jefferson University (next generation sequencing and microarray technology). |                         |                                           |
| 3/5/18  | **Spring Break**                                                                                      |                         |                                           |
| 3/12/18 | Quiz 2 OR Research Article Discussion  
MFC potentiometers.  
Plan Gibson Assembly (G.A.) strategy to express two genes. |                         |                                           |
| 3/19/18 | Quiz 2 OR Research Article Discussion  
MFC soil genomic DNA prep  
Finalize Gibson Assembly design.  
Order oligonucleotides. |                         |                                           |
| 3/26/18 | Quantify MFC DNA (nano drop)  
Send for sequencing.  
Conduct PCR reactions for G. A.  
Cleanup DNA fragments |                         |                                           |
| 4/2/18  | Bioinformatics.  
Metagenomics computer analysis |                         |                                           |
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<tr>
<th>Date</th>
<th>Day</th>
<th>Task</th>
<th>Quiz</th>
<th>Task</th>
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<tbody>
<tr>
<td>4/9/18</td>
<td>11</td>
<td>Submit one-page summary and bibliography of research seminar to Bb.</td>
<td>Quiz 3</td>
<td>Microbial Ecology of MFC. Inoculate EcoPlates</td>
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<td>Quantify PCR products by DNA gel electrophoresis</td>
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<td>4/16/18</td>
<td>12</td>
<td>Read and analyze EcoPlates</td>
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<td>Set up Gibson Assembly reactions. Transform cells.</td>
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<tr>
<td>4/23/18</td>
<td>13</td>
<td>Submission of seminar presentation to Blackboard</td>
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<td>Analyze Gibson Assembly Experiment: Colony PCR. Quantify DNA. Set up Sequencing reactions</td>
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<tr>
<td>4/30/18</td>
<td>14</td>
<td><strong>Student Presentations</strong></td>
<td>Student Presentations</td>
<td>Student Presentations</td>
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