

# **Syllabus for Biotechnology Laboratory II, BIOL 5504 Spring Semester 2014**

## **Instructor and Contact Information:**

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## **Course Description:**

This course is designed to introduce students to some of the major research areas of microbial biotechnology. They will discover how genetically modified or engineered microbes are used to enhance performance qualities. Students will study functions of yeast, mold, and bacteria in the production of fermentation products. Uses of bacteria and algae for bioremediation and green fuel alternatives, respectively, will be explored. Further, students will utilize molecular diagnostics for detection of human pathogens and water contamination. The class will attend field trips throughout the semester to gain first-hand knowledge on how basic microbial biotechnological principles are utilized on an industrial scale. This lab course will complement the lecture course, Microbial Biotechnology (BIOL 5502).

## **Laboratory:**

All labs meet in Room 128, BioLife Science Bldg unless otherwise noted by the instructors. Labs are held on Wednesdays from 4:00 – 8:00 p.m.

## **Laboratory Materials:**

Bound notebook (You may use one from BIOL 5503.)  
Lab coat, gloves, and safety glasses will be provided in lab.

## **Preparation:**

You must come to lab prepared by reading the assigned material beforehand. Students who come to lab unprepared are more liable to make mistakes and perhaps cause accidents.

## **Blackboard:**

Please check Bb frequently. There you will find announcements, grades and material pertaining to course content. In the "Content" section, you can access lab exercises in labeled folders. In addition, folders contain background information and supplemental material.

## **Grading:**

Your grade for this course will be based on a total of 300 points. It is based on three (3) criteria.

1. Announced quizzes will be given at the beginning of the lab period. Quizzes will consist of short-answer questions based on background, strategies, mechanisms, and concepts studied in previous lab exercises. NOTE: There are no make-up quizzes.
2. All laboratory work will be entered into a bound notebook. The notebook will be submitted and graded at the end of the semester. A lab notebook is an essential component of a research curriculum, and it serves as a record of intellectual property. The following are guidelines for record keeping.
  - Ø Use blue or black permanent ink.
  - Ø Include a table of contents and list exercises by title, date, and page number.
  - Ø Write in the first person.
  - Ø Entries are written in chronological order.
  - Ø Write a title and date for each set of entries.
  - Ø Each lab exercise should contain: a brief introduction, objectives, hypothesis, materials and methods, data and analyses, and a summary discussion. Answer any applicable questions.
  - Ø Entries are signed and dated at the bottom right of the page.
  - Ø Each new exercise begins on a new page. Large blank areas after the previous exercise should be crossed out with an "X."
  - Ø Never remove pages, erase, or use whiteout. Draw a single line through the mistake and initial and date it.
  - Ø If you are conducting two procedures at once, use continuation notes. As you go along, use the term "Continued, page \_\_\_\_." Then enter the

title and date of the project, and continue to record information. When you resume work on a project, use "Continued from page \_\_\_\_."

- Each student will research a topic of choice in microbial biotechnology and give a twenty (20) minute power point presentation at the end of the semester. A one-page written summary and bibliography (including at least three refereed journal articles) will be submitted to the instructors and classmates one week prior to the oral presentation. The quality of the presentation should reflect months of topic research and include such items as research articles, photos, figures, tables, videos, quotes, interviews, and the like. The instructors and fellow students will grade presentations via a grading rubric. Detailed rubric criteria pertaining to content, delivery, multimedia, questions and answers, etc. will be distributed and discussed in class early in the semester. Below are some ideas / questions that may help students 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?

### **Point Breakdown:**

|  |                   |
|--|-------------------|
| 1. Five (5) quizzes @ 20 pts. / quiz   | = 100 pts.        |
| 2. Laboratory notebook                 | = 100 pts.        |
| <u>3. Multimedia oral presentation</u> | <u>= 100 pts.</u> |
| Total Point Value                      | = 300 pts.        |

### **Lab Schedule:**

|      |  |  |
|------|--|--|
| 1/22 | Introduction<br>Safety<br>Enumeration of Yeast Cells (1 of 2):         | Direct counts with hemacytometer<br>Viable cell count (Standard Plate Count)<br>Rate of CO <sub>2</sub> production   |
| 1/29 | Enumeration of Yeast Cells (2 of 2):<br><br>Yeast Metabolism (1 of 1): | Compare viable counts to total cell count values<br><br>Determination of aerobic and limited air effects on cell growth – set up cultures in advance. Then determine concentration of cells, residual glucose concentration, and ethanol concentration |

|             |   |  |
|-------------|---|--|
| 2/5         | Preparation of a Malt Beverage (1 of 3): Wort production and fermentation |  |
|             | Yogurt and Probiotics (1 of 3):   | Food fermentation - prepare yogurt with probiotic starter culture  |
| <b>2/12</b> | <b>Trip to Yards Brewing Company:</b>                                     | <b>Industrial fermentation</b>   |
| 2/19        | Preparation of a Malt Beverage (2 of 3): Racking and bottling             |  |
|             | Yogurt and Probiotics (2 of 3):   | Cultivation of bacteria from prepared and commercial yogurt: aseptic dilution streak   |
|             | Production of Penicillin and Analyses (1 of 3):                           | Make media and inoculate with <i>P. chrysogenum</i>  |
| 2/26        | Preparation of a Malt Beverage (3 of 3):                                  | Observe  |
|             | Yogurt and Probiotics (3 of 3):   | Observe colonies and perform Gram stain  |
|             | Production of Penicillin and Analyses (2 of 3):                           | Set up analyses for antibiotic identification, potency, and its effect on different bacteria   |
| 3/5         | Production of Penicillin and Analyses (3 of 3):                           | Observations and analyses  |
|             | MRSA Screening (1 of 3):  | Replica plating onto TSA and Oxacillin plates  |
| <b>3/12</b> | <b>Spring Break – No classes</b>  |  |
| 3/19        | MRSA Screening (2 of 3):  | Select colonies from master plate; perform multiplex PCR; Run 2% agarose gel and analyze; Perform E-test with Penicillin G and Oxacillin |
| 3/26        | MRSA Screening (3 of 3):  | Determine the MIC from the E-test  |
|             | Bioremediation  | Oil-eating bacteria  |
|             | Biodiesel Production from Oil   | Titration of oil; production of biodiesel and purification   |
| <b>4/2</b>  | <b>Trip to USDA:</b>  | <b>Sustainable biofuels and co-products</b>  |
| 4/9         | Water Analysis (1 of 2):  | Most Probable Number (MPN) test – inoculations; Membrane Filter (MF) test<br>Titration for O <sub>2</sub> density in water sample        |
| 4/16        | Water Analysis (2 of 2):  | Analyses of MPN and MF tests<br>Immunological detection of microcystin toxin   |
| <b>4/23</b> | <b>Trip to Philadelphia Water Department:</b>                             | <b>Wastewater treatment</b>  |
| 4/30        | Presentations   |  |