

# Lecture Syllabus for Microbial Biotechnology (Biol 5502)

## Instructor:

**Mark Feitelson, Ph.D.**

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Office hours by appointment.

Lectures/presentations: Tuesday, January 12, 2016 - Thursday, April 21, 2016  
5:30 PM-6:50 PM Room Gladfelter 839

Text for lectures: please see below on syllabus (multiple sources)

Microbial Biotechnology is a graduate student level course that provides an overview of how microbes (e.g., bacteria, viruses and yeast) are manipulated to solve practical problems through biotechnology. Topics include basics in microbial life, ecology and metabolism, methods used in microbial technology, industrial microbiology, microbes in drug development, interactions between microbes, plants and animals; food microbiology, the gut microbiota, metagenomics and others. Lectures will be provided with the understanding that students have a general background in biology, chemistry (inorganic and organic) and cell structure/function. **Students without these prerequisites will be at a competitive disadvantage.**

In order to better understand the materials presented in the lectures, each power point presentation lecture will be placed on blackboard (Bb) for inspection prior to the corresponding lecture in class, so that students will be able to download the material and bring it to lecture to take additional notes. There will be material presented and discussed which is not in the power point presentations, and questions will be presented during the lectures that may well come up again in midterms and/or in homework assignments. The questions raised in the lectures are intended to be thought provoking, so as to reinforce the principles that are being discussed in the lectures. There will also be limited time for discussion in the lectures, so don't be afraid to ask questions. Periodic homework will be assigned to prepare students for the midterms and final. Since the course is also information intensive, students should come prepared for each lecture (look at the power point presentation in advance) and not wait until a few days before the midterms to start looking at the material. Every effort will be made to return homework assignments to you prior to the each upcoming midterm exam so that you could benefit from what was done right and wrong.

As your instructor, I will do my best to communicate the principles and concepts in Microbial Biotechnology to you. If there are concerns you have about the way materials are being presented, or do not understand concepts being presented, or have comments about presentation format or content, please email me, and I will endeavor to make things clearer. Alternatively, we could discuss matters confidentially in my office or over the phone. Please do not be shy: this is your education and your future. Care enough to meet me half way and I will try to do the same. Please consider seeing me early in the semester if you would like me to consider changes in course presentation. In addition, you should see me if your performance on the first homework set or first midterm is not up to expectations. Do not wait until the end of the course to see me on these matters.

**Blackboard (Bb):** All course announcements, lectures, assignments and grades will be posted online using Bb. Updates to this syllabus will be posted; please check periodically. If you have not used Bb, ask a fellow student to spend a few minutes helping you or ask your instructor in Bio5504 to help you after

your first lab meeting. Homework assignments will be forwarded to students via Bb, and completed assignments should be returned via Bb. Please refer to the "assignments" section on Bb for detailed instructions on how to view and submit homework assignments. If you do not use your Temple email account, you need to activate it. If you have forgotten your password, you need to go to Computing Services and have them assign you a new password.

**Final Grades:** Letter grades will not be assigned until the end of the semester but you may expect that the letter grade will correspond, roughly, to a percentage scale with 94-100% = A, 89-93% = A-, 86-88% = B+, 83-86 = B, 79-82 = B- and so on. All of your grades will be posted on Blackboard so you can keep a running tab of your class average. **Grades will be awarded based upon the achievement of each student: there is no curve and rarely extra credit.** If you are unable to take an exam at the appointed time/day, please let me know in advance so that other arrangements could be made. Usually, I would require a doctor's note or other firm documentation as to why you will not be able to take an exam at the scheduled time/day.

### **Grades will be determined as follows:**

**Homework Assignments (160 points total).** There will be 4 homework assignments (4 points/question x 10 questions per homework x 4 homework assignments). These assignments are open book, could be completed individually or in groups. Assignments will be posted on Bb with more detailed instructions. The questions will be short answer in format. Most of the time an answer of 3-5 sentences is sufficient, demonstrating your understanding of the question. It is important to be serious about doing homework assignments, because they reflect the same types of questions that will be asked on the exams, and if you have questions on the homework, you should get them answered prior to the exam.

**Mid-term exams.** There will be 4 exams of 100 points each (**400 points total**). The first three exams will be taken in class; the fourth and last midterm will be take-home. **The exams are challenging in that they will stress concepts, not memorization.** We will discuss the format of the exams as the first exam approaches. **IF YOU UNDERSTAND THE CONCEPTS PRESENTED IN THE FIGURES AND TABLES IN THE POWER POINT PRESENTATIONS, YOU WILL PROBABLY DO WELL ON THE EXAMS.** The last midterm exam will cover materials only from the previous midterm to the end of the course. It is not comprehensive.

**Independent semester project (250 points total).** Each student does some independent reading in an area of microbial biotechnology that he/she is interested in learning more about, identifying a problem in this area, and suggesting ways that a solution might be approached. For those interested, this will get them thinking about possible independent research experiences/projects in this area. The project will be developed from discussions between the student and instructor within the first few weeks of the course. Each student will then develop an outline and then a rough first draft, which will be submitted and critiqued for further revision and refinement. At the end of the course, the students will submit a written document as evidence of their research. This will be graded (150 points). This will contain background (including significance of the problem and rationale for pursuing it), the question(s) to be addressed, the way (methods) used to address the questions, the expected results, and alternative outcomes. References used to develop the project will be cited within the text and listed at the end of the proposal. This should be on the order of 5-6 pages (font 12, double spaced). These projects will be presented orally by each student, followed by discussion, near the end of the class. The oral presentation should be polished and will be graded (100 points).

The total number of points for the course will be 810.

**IMPORTANT: There are NO MAKEUP TESTS OR QUIZZES.** In the case of illness, sports competitions or other excused absences, you will be excused and the exam will not factor into your final grade. You must have a note from your physician, a coach or whoever is appropriate for explaining a legitimate absence. If you are not excused, you will receive a zero. Plagiarism and "copy-paste" of answers from a text-book, journal, powpoint slides used in lecture, from other students or other internet sources is unacceptable, since this defeats the purpose of the homework assignments. Accordingly, each homework

assignment will be screened by SafeAssign, and if such features are found, the corresponding points will not be awarded. So, please do your own work. You will get more out of it and do better on the exams since they are the same format as the homework assignments.

**Honesty and Civility:** You must abide by Temple's Code of Conduct (see <http://www.temple.edu/assistance/udc/coc.htm>), which prohibits:

1. Academic dishonesty and impropriety, including plagiarism and academic cheating.
2. Interfering or attempting to interfere with or disrupting the conduct of classes or any other normal or regular activities of the University.

Do not cheat; avoid all appearance of cheating. Do not copy other people's homework assignments. There is a "zero tolerance" policy. The Temple Honor code provides disciplinary action for cheating which may include expulsion from the University.

Please do not disrupt lectures with conversation. Everyone who registers for this class is an adult. You are legally able to marry without parental consent, buy a home, pay taxes, vote, and work, budget your money, defend your country in military service, etc. You should also be adult enough not to disturb others. Mindless chatter during class is distracting to other students and to the instructor. Please ask questions or make comments if you didn't follow something. It helps the instructor set a pace that is appropriate for students who are listening.

Avoid entering lectures late. If you are late, enter as quietly as possible.

**Attendance:** If you miss a class meeting for any reason, you will be held responsible for all material covered and announcements made in your absence. Attending EVERY class enhances your educational experience and gives you the most value for your tuition dollar.

**Disabilities:** Any student who needs accommodation because of a disability should contact the instructor privately to discuss the specific situation as soon as possible. The Office of Disability Resources and Services (215-204-1280) in Ritter Annex 100 will coordinate reasonable accommodations for students with documented disabilities. Students who are eligible for extra time on exams need to talk with the instructor well in advance of the exam to make arrangements for extended time.

#### **A word of advice....**

Every student should meet with their instructor once in the semester during office hours or by appointment. You may come any time in the semester but the goal of the meeting is to talk about your performance and let the instructor give you suggestions about your study habits, review your exam with you to make suggestions on how to become a better exam taker, and/or talk about your homework or lab assignments. This may seem like a small thing, but it may have a large impact upon the way you perform in the class. Please do not wait until the end of the course to do something about it.

## Syllabus for Microbial Biotechnology 5502, Spring 2016

1. Tues, Jan. 12 Fundamentals of Scientific Written and Oral Communication
2. Thurs, Jan. 14 Fundamentals of Microbial Biotechnology (Chapter 27)<sup>2</sup>
3. Tues, Jan. 19 Microbial life: Microbial Cell Cultivation Systems (Chapter 7)<sup>5</sup> (Chapters 3 and 5)<sup>2</sup>
4. Thurs, Jan. 21 Cycles of Matter/Microbial Ecology (C, N, S, Fe, Cu, etc.) (Chapter 2)<sup>5</sup> (Chapter 11),<sup>2</sup> Thermal adaptation of decomposer communities to global warming.<sup>10</sup>
5. Tues. Jan. 26 Methods in Microbial Biotechnology I: Recombinant Gene Expression in Prokaryotes and Eukaryotes (Chapters 4, 6 and 7)<sup>1</sup>
6. Thurs, Jan. 28 Methods in Microbial Biotechnology II. Protein Engineering (Chapter 8)<sup>1</sup>; (Chapter 11)<sup>3</sup> (Chapter 8)<sup>1</sup>  
**Homework set 1 (lectures 1-5) due by email on Thurs., Jan. 28 at 11 PM**  
**Tues. Feb. 2 Midterm 1 on lectures 1-5, inclusive**
7. Thurs. Feb. 4 Industrial Microbial Biotechnology I: Commercial Products (Chapter 12),<sup>1</sup> (Chapter 10)<sup>5</sup> (Chapter 42)<sup>7</sup> (Chapter 26)<sup>2</sup>
8. Tues. Feb. 9 Industrial microbiology II: biopolymers, biosensors, biosurfactants, bioconversion, biopesticides, biofertilizers (Chapter 42)<sup>7</sup>
9. Thurs. Feb. 11 Microbial biotechnology for pharmaceutical needs I: drugs (Chapter 10)<sup>1</sup>  
**Objective and aims of semester project [1 page] due by email on Thurs., Feb. 11 at 11 PM.**
10. Tues. Feb. 16 Microbial biotechnology for pharmaceutical needs II: Recombinant vaccines (Chapter 11)<sup>1</sup>, (Chapter 6)<sup>3</sup>, therapeutic live vaccines<sup>8</sup>
11. Thurs. Feb. 18 Metabolic and Pathway Engineering (Chapter 13)<sup>3</sup> (Chapter 13)<sup>6</sup>  
**Homework set 2 (lectures 6-10) due by email Thurs., Feb. 18 at 11 PM**  
**Tues. Feb. 23 Midterm 2 on lectures 6-10, inclusive.**
12. Thurs. Feb. 25 Interactions with Microorganisms, Plants and Animals (Chapter 2)<sup>5</sup> (Chapter 42).<sup>7</sup>  
**Mon., Feb. 29 – Sun., Mar. 6: Spring Break**
13. Tues. Mar. 8 Beneficial Microbes I: Plant Growth Promoting Bacteria (Chapters 14 and 15).<sup>1</sup>  
**Outline of written presentation due by email on Thurs., Mar. 8, at 11 PM.**
14. Thurs. Mar. 10 Beneficial microbes II: Bacteriophages in control of bacteria (assorted papers)
15. Tues. Mar. 15 Beneficial microbes III: The Gut Microbiota<sup>9</sup>  
**Homework set 3 (lectures 11-14) due by email Tues., Mar. 15 at 11 PM**

<b>Thurs. Mar. 17</b>	<b>Midterm 3 on lectures 11-14, inclusive</b>
16. Tues. Mar. 22	Cancer and the microbiota <sup>12</sup>
17. Thurs. Mar. 24	Functional Metagenomics (2009), <sup>4</sup> syntrophic biodegradation of hydrocarbon contaminants; <sup>11</sup>
18. Tues. Mar. 29	Bio-refinery (Chapters 19 & 20). <sup>5</sup>
Thurs. Mar. 31	Practice student oral presentations: identifying a problem in microbial biotechnology and ways to address it (~4 presentations)
	<b>First draft of written presentation due Fri., Apr 1 by email at 11 PM.</b>
Tues. Apr. 5	Practice student oral presentations: identifying a problem in microbial biotechnology and ways to address it (~4 presentations)
	<b>Homework set 4 (lectures 15-18) due by email Tues, Apr. 5 at 11 PM</b>
Thurs. Apr. 7	Practice student oral presentations: identifying a problem in microbial biotechnology and ways to address it (~4 presentations)
<b>Tues. Apr. 12</b>	<b>Midterm 4 on lectures 15-18, inclusive</b>
Thurs. Apr. 14	Student oral presentations (graded) <b>15 min./present; 5 min. discussion</b>
Tues. Apr. 19	Student oral presentations (graded) <b>15 min./present; 5 min. discussion</b>
Thurs. Apr. 21	Student oral presentations (graded) <b>15 min./present; 5 min. discussion</b>
	<b>Final written presentations due Wed, Apr. 27 by email at 11 PM</b>

These reference materials will either be provided online, available for loan from the instructor, or are in the library. Online materials will be posted on Bb. Please inquire if you can't find the reference material.

<sup>1</sup>Molecular Biotechnology, 3rd Ed. (ISBN: 1-55581-224-4) 2003.

<sup>2</sup>General Microbiology, Symbiosis, The Pearson Custom Library for the Biological Sciences (ISBN: 13:978-1-256-25043-2) 2009.

<sup>3</sup>Biotechnology. Academic Cell update (ISBN: 978-0-12-385063-8) 2012.

<sup>4</sup>Biotechnology & Genetic Engineering Reviews, Volume 26 (ISBN 978-1-904761-91-4) 2010.

<sup>5</sup>Microbial Metabolism and Biotechnology

<sup>6</sup>Modern Biotechnology (ISBN 978-0-470-11485-8) 2009

<sup>7</sup>Industrial Microbiology and Biotechnology, 2002

<sup>8</sup>Science Translational Med 6(249):249ra111, 2014

(<http://stm.sciencemag.org/content/6/249/249ra111>); Int. J. Cancer 131:1733-43, 2012 (doi: 10.1002/ijc.27640); Trends in Molec Med 18(7):417-25, 2012 (<http://dx.doi.org/10.1016/j.molmed.2012.05.006>)

<sup>9</sup>Science 336(6086) issue of June 8, 2012;

J Immunol Res 2014. doi: <http://dx.doi.org/10.1155/2014/462740>

<sup>10</sup>Frontiers in Microbiology 4:article 333, Nov. 12, 2013. (doi: 10.3389/fmicb.2013.00333)

<sup>11</sup>Current Opinion in Microbiology 27:21-29, 2014

(<http://dx.doi.org/10.1016/j.copbio.2013.09.002>); Computational & Structural Biotech J 13:390-401, 2015; Frontiers in Microbiol 6:672, 2015. doi: 10.3389/fmicb.2015.00672.

<sup>12</sup>Science 348(6230):80-86, 2015. (10.1126/science.aaa4972); Cell Host & Microbe 15:317-28, 2014. (<http://dx.doi.org/10.1016/j.chom.2014.02.007>)

\*Each student does some independent reading in an area of microbial biotechnology that he/she is interested in learning more about, identifying a problem in this area, and suggesting ways that a solution might be approached. For those interested, this will get them thinking about possible independent research experiences/projects in this area.