MB311
Molecular Microbiology Laboratory

Spring 2017: Tuesday/Thursday 9:00-11:50 am; Nash 304

Instructor:
Dr. Walt Ream reaml@science.oregonstate.edu ALS1081 737-1791
Office Hours: by appointment.

Teaching Assistants:
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Corequisite: MB310

Required Texts:
Mueller, R. and Ream, W. (2017). *Molecular Microbiology Laboratory*, 3rd edition (draft).

Day, R. A., and Gastel, B. **(**2011). *How to Write and Publish a Scientific Paper*. **7**th ed. Santa Barbara, CA: Greenwood. ISBN 978-0-313-39197-2.

Bruslind, L., Burke, M. and Ream, W. (2001). *Scientific Writing for Microbiology Majors*. http://microbiology.science.oregonstate.edu/files/micro/WIC_WritingManual.pdf

Attendance:
Attendance is **mandatory**. Each unexcused absence reduces your final grade 5%. Three absences result in an **I**ncomplete. Arrival more than 15 minutes late counts as half an absence. I consider requests for an excused absence on a case-by-case basis. Acceptable reasons for an excused absence include illness, a family emergency, or interviews for admission to graduate or professional schools. **Please do not attend class if you have influenza or another contagious illness.** To request an excused absence, contact the instructor **before** class. Students with an excused absence must complete all missed assignments.

Grading:
Final Grade

A	= 94-100% of top score	C	= 70-75%	Report drafts (50 points)	150
A-	= 90-93%	C-	= 65-69%	Reports (200 points each)	600
B+	= 87-89%	D	= 50-65%	*Genome Announcement*	200
B	= 83-86%	F	= <50%	Test	50
B-	= 80-82%			Total	1000
C+	= 76-79%				

Partial Credit:
Do not expect partial credit for incorrect answers to questions that involve calculations. These simple arithmetic problems will teach you to prepare reagent solutions correctly. Attention to detail is important in science and medicine. A careless error when converting units can cause a 1,000-fold error in the concentration of a solution. An error of this magnitude will ruin an experiment.

Laboratory Reports:
Submit drafts and final versions of laboratory reports by e-mail before the start of class on the dates indicated on the schedule. Bring three paper copies of drafts to class for peer review. Drafts must be complete and formatted properly; completed drafts are worth 50 points. **Do not expect credit for laboratory reports submitted after the deadline.**

Laboratory Rules:
You must prepare a flow chart prior to each experiment. You may not begin an experiment without a flow chart. The flow chart is due at the start of class. Ask questions when you do not understand the instructions or the principles involved.

Observe the following safety rules at all times:

1. Proper attire is required. **Wear a laboratory coat, safety glasses, and closed shoes.** Do not wear shorts or sandals. Lab coats and protective eyewear are required.

2. **Do not eat, drink, or chew gum in the laboratory.**

3. Disinfect bench surfaces and contaminated equipment before and after you work.

4. **Assume that all bacteria you use may cause disease.**

5. Place used liquid cultures, supernatant solutions, and glassware in autoclave containers. Discard contaminated plates, pipette tips, and plastic tubes in autoclave bags.

6. **Wash your hands after you finish working.**

Schedule:

Class	Date	Experiment	Lecture	In-class writing	Hand-in
1	4-April	1- Pick colonies & streak	Overview; Use active voice.	Revise sentences	
2	6-April	1- Colony PCR 16S rDNA Inoculate broth culture Gram stain	Phylogeny; PCR	Describe bacterium	Flow chart 1
3	11-April	1- Purify amplicon; gel Measure concentration	Amplicon DNA purification Sanger sequencing	Answer questions	
4	13-April	1- Purify genomic DNA; gel Measure concentration	Genomic DNA purification Illumina MiSeq sequencing	Answer questions	**Take-home test**
5	18-April	1- Identify bacterium	Sequence alignment (BLAST)	Select genomes to sequence; Discuss editorials	**Editorial**
6	20-April	2- Purify DNA from soil PCR mixed 16S rDNAs	Microbial communities	Answer questions	Flow chart 2
7	25-April	2- Purify amplicon; gel Measure concentration	Peer review	Peer review report 1	Report 1 – draft 1
8	27-April	3- Purify plasmid DNA Restriction	Restriction mapping	Restriction mapping	Flow chart 3
9	2-May	3- Agarose gel Transformation	Transformation; Reporter genes	Revise report 1	Report 1 – draft 2
10	4-May	3- View Lux+ transformants	Titles & topic sentences	Discuss Abstracts	**Abstract**
11	9-May	2- Analyze mixed rDNA sequences from MiSeq	MiSeq analysis (Mothur); PCR-generated chimeras	Peer review report 3	Report 3 – draft 1
12	11-May	2- Analyze bacterial communities	Community analysis (PRIMER)	Find chimeric amplicons	**Report 1 – final**
13	16-May	1- Genome assembly	Genome assembly (Spades)	Revise report 3	Report 3 – draft 2
14	18-May	1- Genome annotation	Genome annotation (RAST)	Peer review report 2	Report 2 – draft 1
15	23-May	1- Retrieve contigs	Comparative genomics	*GenomeA* paper	**Report 3 – final**
16	25-May	2- Revise report 2	Sentence fragments & misplaced modifiers	Revise report 2	Report 2 – draft 2
17	30-May	1- Review *GenomeA* paper	Run-on & nonsense sentences	Peer review *GenomeA* paper	*Genome A* draft
18	1-June	1- Practice talks	Guidance for talks	Prepare talks	Presentation-draft
19	6-June	1- Revise *GenomeA* paper	Which ≠ that; pretentious words	Revise *GenomeA*	**Report 2 –final**
20	8-June	1- Student talks	Farewell	Student talks	***Genome Announcement***

Writing-Intensive Course:
Students enrolled in this course complete written assignments that develop scientific writing, editing, and reading skills. In completing these assignments, students review one another's writing and revise drafts. Students use sources outside this manual to complete laboratory reports, to write an abstract and an editorial, and to solve a thought problem.

Goals:
This ten-week course teaches undergraduate students molecular biology techniques commonly used in the life sciences and develops the students' scientific writing skills.

Means:
The course contains three units that introduce procedures most life scientists will encounter during their careers. The methods in this course are common techniques that introduce the fundamental principles of molecular biology and microbial ecology.

Unit 1. Each student cultures an unknown bacterium, examines it by light microscopy, and identifies it by DNA sequence analysis of small subunit (SSU) ribosomal RNA (rRNA) genes. **Report 1** identifies the bacterium and describes its characteristics.

Students also extract genomic DNA from the bacterium and prepare it for whole genome sequencing. The class selects eight samples for sequencing. Students assemble and annotate a draft genome sequence, and each student writes a ***Genome Announcements*** **paper**. Groups of students prepare **oral presentations** describing the bacterium's genome.

During this experiment, students learn to isolate genomic DNA, perform polymerase chain reaction (PCR), purify PCR products, and analyze genome sequences. Students learn to write a scientific paper that conforms to the instructions specified by a journal.

Unit 2. Each student extracts microbial DNA from an environmental sample (soil). Students use high-throughput DNA sequencing to characterize SSU rRNA genes amplified from uncultured microbial communities. Students compare microbial communities present in different samples and assess the effects of environmental variables on the composition of bacterial communities. **Report 2** discusses in detail (>**2,000 words**) the effects of environmental conditions on the bacterial communities.

Unit 3. Students prepare plasmid DNA, construct a restriction map of the plasmid, and transform it into *E. coli*. The plasmid contains a luciferase reporter gene, which introduces the concept of reporter genes through first-hand experience.

This **writing-intensive course** trains students in scientific writing and critical reading, and students prepare and peer review laboratory reports. Writing exercises based upon journal articles accompany each unit. The studies in these articles employ techniques used in the laboratory exercises. By evaluating these papers, students reinforce their understanding of the technology. Students see how authors report their findings and how formats differ from one journal to another, and they discover that scientific papers share several essential components. The required text "How to Write and Publish a Scientific Paper" by Robert Day and Barbara Gastel discusses each section of a scientific paper in detail. To build their writing skills and enhance their understanding of molecular microbiology, students compose and revise laboratory reports, edit their peers' reports, critique journal articles, and write papers for publication in *Genome Announcements*.

Learner Outcomes:

Students shall acquire:
1. Proficiency in molecular biology techniques commonly used in the life sciences.
2. The ability to communicate scientific concepts, experimental results, and analytical arguments clearly and concisely, both orally and in writing.
3. An understanding of research methods that permits students to read articles from current journals, to extract pertinent information, and to judge the quality of the work described.
4. The ability to prepare a clear written summary of a research topic.
5. The ability to provide constructive peer review of other students' writing.
6. The ability to write and publish a scientific paper.

Learner Expectations:

1. Attend class on time, and stay the entire class period.
2. Read assignments and experimental procedures before they are discussed in class.
3. Bring to class your lab manual and other required texts and reading.
4. Participate in reading and writing activities, and complete all assignments on time.

Course Policies:

Students who need accommodations due to disabilities, who have emergency medical information the instructor should know, or who need special arrangements in the event of evacuation, should inform the instructor as early as possible.

We follow the university rules on civility and honesty. Cheating, plagiarism, and disruptive behavior are subject to disciplinary measures.

WIC Learning Outcomes:

Every WIC course at OSU is required to include these learning outcomes on the syllabus and indicate how students will demonstrate that the outcomes are achieved.

1. Develop and articulate content knowledge and critical thinking in the discipline through frequent practice of informal and formal writing.

2. Demonstrate knowledge/understanding of audience expectations, genres, and conventions appropriate to communicating in the discipline.

3. Demonstrate the ability to compose a document of at least 2000 words through multiple aspects of writing, including brainstorming, drafting, using sources appropriately, and revising comprehensively after receiving feedback on a draft.