

CEDAR CREST COLLEGE
Biology 227 Microbiology
Course Syllabus - Part I - Overview
Fall 2009

I. INSTRUCTOR INFORMATION

Instructor: Dr. Amy J. Reese
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Office Hours: Office hours:
Other hours by appointment.

II. GENERAL COURSE INFORMATION

Biology 227: Microbiology, 4 credits (lab and lecture must be taken together)
Electronic features: This course has an Ecompanion component and will make use of “clicker” technology. My website is: <http://www2.cedarcrest.edu/academic/bio/areese/>.
Course Prerequisites: Completion of Bio 121, Bio 122, Che 111, Che 112, Bio 235 and 236 is required. Completion of Che 205 & 206 is highly recommended.

Course Description:

A survey of microbial life including bacteria, fungi, protozoa, and viruses (with an emphasis on bacteria). Topics covered include microbial characteristics, physical and chemical control, metabolism, enzymes, regulation of enzyme activity, bacterial genetics, bacterial diversity, host-microbe interactions, and applications of microbiology. The laboratory includes aseptic technique, staining procedures, culture methods, cultural and physical characteristics, microbial control, microbiology of food, water and soil, microbiology of the body, and identification of unknowns. Lecture three hours, laboratory three hours.

Textbooks and materials:

- **Required for lecture:** Marjorie Kelly Cowan and Kathleen Park Talaro, *Microbiology: A Systems Approach*, 2nd ed., McGraw Hill, 2009 (ISBN 978-0-07-299528-2).
- **Required for lecture:** Radio frequency (RF) keypad “clicker” sold at the bookstore. Register your device ID through <https://my.cedarcrest.edu/ics>
- **Required for lab:** Michael J. Leboffe and Burton E. Pierce’s *Microbiology: Laboratory Theory and Application*, 2nd ed., Morton, 2006 (ISBN: 978-0-89582-708-1).
- **Required for lab:** W.H. Freeman & Company paperback Laboratory Notebook with copying carbonless grid paper (ISBN: 0716739003) or an equivalent carbonless notebook.
- Highly recommended: Index cards for study flash cards, colored pencils for descriptive laboratory drawings, a two pocket folder or binder to hold removed lab notebook copy pages.

Format:

Lecture 3 hours per week in Oberkotter Center for Health and Wellness, lecture hall (OBC-1)

Laboratory 3 hours per week (in two 1.5 hour sections) in OBC-2

Schedule:

The specific lecture and laboratory schedule and topics list can be found on the separate handouts *Biology 227 Microbiology– Course Syllabus – Part II - Lecture Schedule & Assignments* and *Biology 227 Microbiology – Course Syllabus – Part III – Laboratory Schedule & Assignments*

Course Objectives:

At the successful completion of the course, you should be able to:

1. Explain the general characteristics of archaea, bacteria, protozoa, algae, yeast/mold, and viruses.
2. Understand the roles that microorganisms have in the scheme of life, and that they are ubiquitous.
3. Cultivate bacteria and understand their nutritional and physical requirements.
4. Understand the general aspects of bacterial enzymes, their regulation, and their energies.
5. Understand the general aspects of microbial metabolism and be aware of the metabolic diversity that exists.
6. Understand the basic principals of bacterial genetics.
7. Select the proper physical and chemical methods to control microorganisms.
8. Be aware of the roles that microbial life plays in the environment, in various biotechnical applications, in human health, and the careers and jobs that study and address these roles.
9. Perform laboratory techniques aseptically and safely.
10. Perform various staining techniques.
11. Perform bacterial dilutions and plate counts.
12. Recognize different bacterial types, protozoa, and fungi microscopically.
13. Prepare bacteriological media.
14. Isolate and identify a Gram+ or Gram- organism unknown.

III. COURSE OUTCOMES & ASSESSMENT

Course Outcomes:

1. With a successful completion of the course, you will learn the principles of microbiology that are in line with the goals of the Education Division of the American Society for Microbiology. You will also be introduced to a range of careers and applications in microbiology.
2. You will use and demonstrate critical thinking and reasoning skills to isolate and identify a bacterial unknown sample.
3. With successful mastery of the laboratory, you will be able to function in a laboratory requiring

media preparation, aseptic technique, and the isolation, staining and culturing of bacteria. You will also have been exposed to other microbiological techniques.

Assessment:

1. Throughout the semester, you will be given the opportunity to complete class preparation questions, homework assignments, class quizzes, projects, on-line resources, and several in-class activities (for which you must prepare out of class) to practice and apply your skills in preparation for lecture exams.
2. You will take three major lecture exams and a comprehensive final exam on the microbiology content areas.
3. You will submit one unknown report that includes the laboratory tests performed, the results of the tests and a discussion that analyzes the methodology and suitability of the identification of your unknown.
4. Throughout the semester, I will evaluate your laboratory notebook and pre-lab preparation on unannounced occasions. I will also inspect the stains and tests of your unknown organism and other samples to provide feedback on your note-keeping skills and laboratory techniques.
5. Six quizzes and two practical exams will be given in the laboratory to assess your ability to properly interpret microbial tests.
6. During the time scheduled for the comprehensive final, the laboratory component of the exam will be open notebook.

IV. STUDENT ASSESSMENT & EVALUATION

Grading:

Course work will be evaluated on a percent scale as follows.

30%	3 lecture exams
17.5%	Homework assignments, in-class quizzes, class preparation & participation, project presentation on adopted prokaryote, eukaryotic creative activity, virus letter
10%	Laboratory unknown report
10%	2 laboratory practicals
12.5%	6 lab quizzes, evaluation of lab safety & performance, notebooks & prelabs
20%	Cumulative final exam (including a laboratory component that is open notebook)
100% total	

Your percentages from the above list will be totaled and used to compute your final grade.

Final grade %	A	A-	B+	B	B-	C+	C	C-	D+	D	F
	93-100	90-92.9	87-89.9	83-86.9	80-82.9	77-79.9	73-76.9	70-72.9	67-69.9	60-66.9	<60

V. COURSE POLICIES AND STUDENT RESPONSIBILITIES

A. Academic Policies:

1. I fully support the “Honor Code” and “Honor Philosophy” set out by the *Cedar Crest College Student Handbook*.
2. I fully support the “Academic Standards of Integrity” and the “Statement on Academic Dishonesty or Plagiarism” set out by the *Cedar Crest College Student Handbook*. This includes but is not limited to the following statements.
 - Plagiarism will result in a zero for the assignment.
 - Cheating in lecture or lab will result in a zero for the test/assignment.
 - Plagiarism and cheating violations will be reported to the Provost, Academic Services, and/or the Honor & Judicial Board, and may result in failure of the course.
 - Violations or violation intensions of these statements should be brought to my attention.
 - I will report violations of “Academic Standards of Integrity” and incidents of “Academic Dishonesty or Plagiarism” as necessary.
3. I fully support the “Classroom Protocol” addressed in the *Cedar Crest College Student Handbook* (“Community Standards for Academic Conduct” Section A, part I). I expect the classroom to be an environment in which all students can participate and learn. Behaviors that detract from this ideal environment (as listed in the “Classroom Protocol,” mentioned below and as decided upon by the class should be avoided at all costs.
4. Please refrain from all activities that detract from the learning of others around you. This includes but is not limited to the following areas. Please silence cell phones during class unless there is an impending emergency, do not routinely come to class late, do not eat or talk in ways that are distracting to those around you, and do not leave the classroom except for the bathroom or related emergencies. Reasonable interruptions should be cleared in advance.
5. If the College is canceled for weather or other reasons and it is an exam day, we will plan on having the exam on the next scheduled class day unless I notify you otherwise. If the College is canceled the lecture before we have an exam, the exam will remain as scheduled if we have new section material scheduled for the lecture immediately proceeding each exam. If the College is delayed (say until 10 am), we will adhere to the delayed timeframe, even on an exam day.

B. Lecture Attendance Policies:

1. You are expected to attend lecture and to come to class prepared. Attendance will be documented. Extended unexcused absences may result in up to a 10% reduction of the total lecture grade. Unexcused absences for lecture exams or finals will result a zero for that exam.
2. In the unfortunate event of an unplanned absence due to a personal or family medical emergency, you must contact the Acting Dean of Student Affairs (Denise O’Neill: 610-437-4471, x4680; doneill@cedarcrest.edu) to obtain appropriate documentation for an excused absence. These offices will contact me. You should also contact me to make alternative coursework plans.
3. For expected absences or early departures due to Cedar Crest-sanctioned events, please notify me as soon as possible and see your coach or instructor for official documentation in advance.
4. You are expected to be at lecture on either side of Thanksgiving break. Scheduling family vacations during the non-break sections of the semester is highly undesirable.
5. It is your responsibility to obtain notes and handouts from a classmate for lecture absences.

C. Laboratory Attendance Policies:

1. Laboratory attendance is mandatory by college policy. Each unexcused absence will result in a 10% reduction of your total laboratory grade. Each excused absence without made up work will result in a 5% reduction of your total laboratory grade. Each unexcused absence with made up work will also result in a 5% reduction of your total laboratory grade. See point #4 and its sub-bullets below. Unexcused absences on the day of a practical will result in a zero for that exam.
2. For expected absences or early departures due to Cedar Crest-sanctioned events, please notify me as soon as possible and see your coach or instructor for official documentation in advance. You are responsible for coordinating with me as to how to make up any missed lab work.
3. You are expected to be at lab on either side of Thanksgiving break. Scheduling family vacations during the non-break sections of the semester is highly inadvisable.
4. Only emergencies or special circumstances will be allowed as reasons for any make-up lab. Any adjustments must fulfill the following 3 requirements:
 - You must notify me on the day of or before the lab. This should happen before the time of the scheduled lab, pending valid emergencies.
 - I receive official documentation (such as an email from the Health Center, Dean of Academic Affairs, or Academic Services) that is considered valid (at my discretion) within one week of the absence.
 - The lab must be completed within 48 hours of the absence. It is your responsibility to contact me as soon as possible to schedule any approved make-up lab. Due to the nature of lab work and supplies, some labs may not be able to be made up as performed in class.

D. Lecture & Lab Assignment Policies:

1. Assignments are to be done as scheduled and work to be handed in at the beginning of the class during which it is due unless otherwise instructed. Late penalties are 5% per day and 20% per week, of the total points possible for the assignment.
2. If you miss class on a day on which an assignment is due, it is your responsibility to get the assignment in on time or as soon as possible (to minimize your deducted points). If you miss class on a day on which an assignment is passed out, it is your responsibility to get a copy of the uncompleted assignment from a classmate.
3. Do not use pink or red ink/pencil for assignments you will be turning in.
4. You may work with a friend on class preparation questions. You must write up separate work and should indicate the student with whom you worked. These will be collected periodically.
5. You can access any review questions and additional suggested readings associated with the class through Cedar Online (cedarcrestonline.net) and the Ecompanion system. You may be asked to submit assignments or other work through Ecompanion.
6. Your laboratory unknown work is to be handed in and picked up as instructed. This work is only your own, although you may seek guidance from the instructor and course IA.

E. Lecture & Laboratory Quiz, Exam & Final Exam Policies:

1. As with other laboratory courses, there are different lab sections. You are expected to not share or discuss any laboratory quiz, practical, or related materials with others in another section.

2. If you miss a “clicker” quiz, you will forfeit the points associated with that quiz. These quizzes cannot be made up. There may be extra points associated with this portion of your grade or the lowest quiz score may be dropped.
3. You are expected to sit with a space between you and the next student whenever possible and may be given exam seat assignments.
4. You are expected to be at each exam on time and as scheduled. If you arrive late for an exam or quiz, in lab or lecture, you forfeit that time in taking the test. Unexcused absences on the day of an exam will result in a zero for that exam. Excused exam absences must fulfill the requirements listed above for excused laboratory absences (see C.4 policy for excused lab absences).
5. Some make-up exams may not necessarily correspond to the regular test format. They will be given at a designated time and may also be scheduled during the week of final exams.
6. Before each exam, all material must be placed in the front or side of the room as directed. Purses, papers, notebooks, books, PDAs, cell phones, headphones, guests, calculators or other devices are not allowed unless otherwise directed. Exams should be in ink (not red or pink).
7. Your obligation for this course includes attendance at the final exam on the day and time scheduled by the Registrar’s Office. You should not make travel arrangements (nor should anyone else make them for you) until the final exam schedule is published. If you must make plans early, you should schedule your travel after the last final exam day.
8. Final exam times cannot be rearranged unless three or more exams occur within a 24-hour period. Any exception must be petitioned and reviewed by the Department of Biological Sciences within a week of when the final exam schedule is announced in class.

F. Academic Services:

1. Disabilities Services:

- Students with disabilities who wish to request accommodations should contact the Advising Center or visit http://www2.cedarcrest.edu/acadadvising/ada_file.html within the first two weeks of class.

2. Academic Support:

- The Advising Center provides many resources, such as study skills resources and peer tutoring, via email at advising@cedarcrest.edu, on campus site in Curtis 109, their website <http://www2.cedarcrest.edu/acadadvising/index.html>, or by phone at 610-606-4628.

3. Course resources:

- There is an Instructional Assistant (IA) associated with both Bio 127 and Bio 227 lecture sections and all lab sections. Her hours and locations will be posted and announced.
- There are no bonus points associated with the course.
- A sense of microbial fun and wonder is associated with the course!

STRATEGIES FOR SUCCESS

1. *Do come to class and lab ready to participate.*

- Read assigned text material & answer questions before class to be prepared to go beyond the basics and practice applying the information.
- Review notes on a regular basis to be prepared to build on that material.
- Review notes from previous classes before the next class.
- Make sure to be prepared to discuss specific assignments in the next class as directed.
- Know what lab tests you'll be doing that day and why when you come to lab.

2. *Do ask for help if you are having trouble.*

- An instructional assistant (IA) for lab and teaching assistant (TA) for lecture is available.
- The IA is named _____ and the hours/locations are:

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- Some of the best students have been ones that have used this resource regularly.
- Individual tutors are also available, contact the Academic Advising Center.
- If you are having troubles preparing for the course, email me or visit during office hours.

3. *Do make comprehensive connections, which goes beyond memorization.*

- Use homework assignments to help review and connect material.
- Memorization is step one. Connection of the material and concepts is step two.
- Think of it this way. A recital is like memorization and you practice specifically for it. Science is always changing. I want you to learn to sightread!

4. *Do regularly attend classes*

- You can read the book (and you should), but you wouldn't want to rely on the book alone.
- In class we'll highlight the points that you should focus on. I test from my class notes.
- Tips and key information may also be given in class.
- Besides, I say and do silly things in class that you don't want to miss!

5. *Do study every day and along the way!*

- Avoid "binge studying"
- If you practice, you'll know where you have troubles before the exam.
- Write your own test questions to help you review one day, try to answer them the next.
- Flash cards may be good for some, but they are only a start to memorization.
- Study with someone else (see if s/he can answer your questions), it helps with connections and makes it fun.

CEDAR CREST COLLEGE
Biology 227 Microbiology
Course Syllabus – Part II - Lecture Schedule & Assignments

- Lecture textbook: Marjorie Kelly Cowan and Kathleen Park Talaro, *Microbiology: A Systems Approach*, 2nd ed., McGraw Hill, 2009.
 - We will focus on about half of the book for this class. I hope you'll be intrigued by microbial life so much that you'll want to keep it as a reference. I also hope some of you will take my upper level Bio 327 Microbial Pathogenesis and Human Immunology course in the future, where the other half of the book will be an excellent resource!
 - I expect you to have read before class so that we do not have to dwell on basics.
 - To help you prepare for class, I will be issuing **“Write to learn (WtoL),” Concept Mapping (CM)** or other questions for most days. You are encouraged to discuss these with a study buddy, but should write or type up your own responses. Be prepared to discuss these in class. I will collect them on unannounced occasions for class preparation points.
- From time to time, you may also be advised to view links through the American Society of Microbiology or other web resources for supplemental information.
- As you collect information about your adopted prokaryote for class, remember to track your resources so that you have everything you need later for your presentation.
- Lecture schedule subject to change if needed.

Date	Lecture topics & assignments	Read or do before class
Aug 24, M Lecture 1	<ul style="list-style-type: none"> • Microbes in your daily life • Practice clicker quiz on Chap 1 • Brief course overview & tips • Discuss Adopt-A-Microbe project 	<ul style="list-style-type: none"> • Chapter 1.1 – 1.6 • Register clicker • Chap1: WtoL = 1-3
Aug 26, W Lecture 2	<ul style="list-style-type: none"> • Be prepared to share (& spell) your adopted prokaryote & its impact category (apply Chap 1) • Complete discussions of Chap 1 	<ul style="list-style-type: none"> • Chapter 1.7 • Find a prokaryote to adopt & love! • Chap1: WtoL = 4,7; CM = 1
Aug 28, F Lecture 3	<ul style="list-style-type: none"> • Discuss macromolecules in the context of building of microbial structures • <u>Clicker quiz 1</u>: on Chapter 2.2 	<ul style="list-style-type: none"> • Chapter 2.2 • Focus on the 4 types of macromolecules, their building blocks, their linkages, where they are found in microbes, and how they are used; types of glucose-linked structures
Aug 31, M Lecture 4	<ul style="list-style-type: none"> • Discuss the 5 I's and the how's and why's of culturing methods 	<ul style="list-style-type: none"> • Chapter 3.1 • Chap 3: WtoL = 1, 3, 5 • How can your adopted prokaryote be cultured?
Sept 2, W Lecture 5	<ul style="list-style-type: none"> • Cell staining & a review of microscopy types in ungraded “quiz” format 	<ul style="list-style-type: none"> • Chapter 3.2 • Chap 3: WtoL = 6, 8, 9 • Are there images available for your prokaryote? Record them, but you don't need to bring them to class.

Sept 4, F Lecture 6	<ul style="list-style-type: none"> • What is resolving power and how is it different from magnification? • Cell sizes, shapes & arrangements. • <u>Pass out Assignment 1</u>: Chapter 3, due _____ 	<ul style="list-style-type: none"> • Chapter 3.2 • Chap 3: WtoL = 7, CM = 1 • Chapter 4.1 & 4.5 • Chap 4: WtoL = 10 • Know your prokaryote's size, cell morphology & arrangement.
Sept 7, M	NO CLASS, LABOR DAY	
Sept 9, W Lecture 7	<ul style="list-style-type: none"> • Cell envelope & the Gram stain • <u>Cell wall handout</u> 	<ul style="list-style-type: none"> • Chapter 4.3 • Chap 4: WtoL = 4-6 • Know how your prokaryote stains.
Sept 11, F Lecture 8	<ul style="list-style-type: none"> • External prokaryotic features • <u>Clicker quiz 2</u>: on Chap 4.1-4.5 at the end of class 	<ul style="list-style-type: none"> • Chapter 4.2 • Chap 4: WtoL = 1-3 • Does your prokaryote have interesting external features?
Sept 14, M Lecture 9	<ul style="list-style-type: none"> • Endospores & internal features 	<ul style="list-style-type: none"> • Chapter 4.4 • Chap 4: WtoL = 7-9 • What internal structures does your prokaryote possess?
Sept 16, W Lecture 10	<ul style="list-style-type: none"> • Classifying & naming; phenotypic & genotypic approaches to identification 	<ul style="list-style-type: none"> • Chapter 4.6 (recall Chap 1.7) • Chap 1: WtoL = 6 • Chap 4: WtoL = 11, Visual Und. = 2 • How is your prokaryote classified?
Sept 18, F Lecture 11	<ul style="list-style-type: none"> • Archaea and microbial diversity • <u>Clicker quiz 3</u>: through Chapter 4, at the end of lecture • Discuss "glycolysis in action" using organic model kits 	<ul style="list-style-type: none"> • Chapter 4.7 • Chap 4: WtoL = 12, create your own version of Table 4.3 to study
Sept 21, M Lecture 12	<ul style="list-style-type: none"> • Metabolism, enzymes & energy • Glycolysis "in action" with model kit glucose molecules, • <u>Glycolysis handout</u> 	<ul style="list-style-type: none"> • Chapter 8.1 – 8.3 • Chap 8: WtoL = 1-3, study Fig. 8.11 • Bring to class a glucose model made from an organic modeling kit
Sept 23, W	EXAM 1 Chapters 1 – 4	
Sept 25, F Lecture 13	<ul style="list-style-type: none"> • Aerobic respiration pathways. 	<ul style="list-style-type: none"> • Chapter 8.3 • Chap 8: WtoL = 4-6 • Does your prokaryote do the TCA cycle; if not, what does it do instead?
Sept 28, M Lecture 14	<ul style="list-style-type: none"> • Anaerobic respiration and fermentation pathways. 	<ul style="list-style-type: none"> • Chapter 8.3 • Chap 8: WtoL = 7-9 • Can your prokaryote do any of these and if so which and how?
Sept 30, W Lecture 15	<ul style="list-style-type: none"> • Biosynthesis & Anabolic pathways • <u>Pass out Assignment 2</u>: Chapter 8, due _____ 	<ul style="list-style-type: none"> • Chapter 8.4 • Chap 8: CM = 2, study Fig 8.22 • Does your prokaryote do any special anabolic reactions?

Oct 2, F Lecture 16	<ul style="list-style-type: none"> • Photosynthesis & related reactions. 	<ul style="list-style-type: none"> • Chapter 8.5 • Chap 8: WtoL = 10, Others = explain light-dependent vs. light-independent reactions, when does the Calvin cycle occur and why? • Does your prokaryote do any of these?
Oct 5, M Lecture 17	<ul style="list-style-type: none"> • Microbial nutrition (we are doing this after metabolism to make more metabolism/nutrition connections) 	<ul style="list-style-type: none"> • Chapter 7.1 • Chap 7: WtoL = 1-3 • What nutritional type is your prokaryote?
Oct 7, W Lecture 18	<ul style="list-style-type: none"> • Environmental factors & their impact on growth • <u>Pass out Assignment 3</u>: Chapters 8 & 7, due _____ 	<ul style="list-style-type: none"> • Chapter 7.2 • Chap 7: WtoL = 7-9 • Know where your prokaryote lives, what it eats and its needs in terms of oxygen, temperature, pH, and ecological associations
Oct 9, F Lecture 19	<ul style="list-style-type: none"> • Microbial growth 	<ul style="list-style-type: none"> • Chapter 7.3 • Chap 7: WtoL = 10; Other = compare & contrast methods of measuring culture growth (for ease, accuracy, and if dead cells counted, etc.)
Oct 12, M	NO CLASS, FALL BREAK	Ponder the marvels of microbes around you....
Oct 14, W Lecture 20	<ul style="list-style-type: none"> • Environmental and Applied & Industrial Microbiology overview • <u>Clicker quiz 4</u>: Chapters 7, 24 & 25, at end of class 	<ul style="list-style-type: none"> • Chapters 24 & 25 • Chap 24: WtoL = 4 • Chap 25: WtoL = 1
Oct 16, F Lecture 21	<ul style="list-style-type: none"> • Adopted prokaryote presentations: environmental 	<ul style="list-style-type: none"> • Chapter 24
Oct 19, M Lecture 22	<ul style="list-style-type: none"> • Adopted prokaryote presentations: applied/industrial • <u>Eukaryotic handout</u>: to help prepare for clicker quiz 5 	<ul style="list-style-type: none"> • Chapter 25
Oct 21, W Lecture 23	<ul style="list-style-type: none"> • Adopted prokaryote presentations: normal & pathogenic biota/clinical 	
Oct 23, F	NO CLASS, PRESIDENT'S INAUGURATION	
Oct 26, M Lecture 24	<ul style="list-style-type: none"> • Eukaryotic history & structure • <u>Clicker quiz 5</u>: on handout and Chapter 5.1-5.3, Bio 236 review • <u>Fungal handout</u> • <u>Adopt eukaryotic microbe</u> 	<ul style="list-style-type: none"> • Chapter 5.1 – 5.3 • Chap 5: WtoL = 1-3
Oct 28, W Lecture 25	EXAM 2 Chapters 8, 7, 24-25, and adopted prokaryote examples	

Oct 30, F Lecture 26	<ul style="list-style-type: none"> • Fun with fungi. • <u>Protist/helminth</u> handout 	<ul style="list-style-type: none"> • Chapter 5.4 • Chap 5: WtoL = 4-7 • If you adopted a fungus, be prepared to share highlights about its habitat, classification, reproductive life cycle, and impact/applications.
Nov 2, M Lecture 27	<ul style="list-style-type: none"> • Peculiar protists & helminths • <u>Pass out Assignment 4</u>: Compare & contrast eukaryotic microbes, due _____ • <u>Adopt virus in pairs</u> 	<ul style="list-style-type: none"> • Chapter 5.5 – 5.6 • Chap 5: WtoL = 8-10 • If you adopted a protist or helminth, be prepared to share highlights about its habitat, classification, reproductive life cycle, and impact/applications.
Nov 4, W Lecture 28	<ul style="list-style-type: none"> • Intro to viruses, structure & classification • <u>Virus handout</u> 	<ul style="list-style-type: none"> • Chapter 6.1 – 6.4 • Chap 6: WtoL = 1-2 • Know how your adopted virus is classified based on its nucleic acid type.
Nov 6, F Lecture 29	<ul style="list-style-type: none"> • Animal virus replication 	<ul style="list-style-type: none"> • Chapter 6.5 – 6.7 • Chap 6: WtoL = 3-6 • If you adopted an animal virus, what does it infect & what is the result, how does it replicate?
Nov 9, M Lecture 30	<ul style="list-style-type: none"> • Bacteriophages & other viral-like oddball things • <u>Pass out Assignment 5</u>: Compare & contrast viruses, due _____ • <u>Bacterial genetics handout</u> 	<ul style="list-style-type: none"> • Chapter 6.5 – 6.7 • Chap 6: WtoL = 9, 10, 13 • If you have one of these, what does it infect & what is the result, how does it replicate?
Nov 11, W Lecture 31	<ul style="list-style-type: none"> • Bacterial genetics 1: why & how regulation at different times, how microbes do things differently, tryptophan operon 	<ul style="list-style-type: none"> • Chapter 9.1 – 9.2 (not dwelling on DNA structure but rather how microbes can do things differently) • Chap 9: WtoL = 8
Nov 13, F Lecture 32	<ul style="list-style-type: none"> • Bacterial genetics 2: Catabolic regulation, lactose & arginine operon systems 	<ul style="list-style-type: none"> • Chapter 9.3 • Chap 9: WtoL = 9
Nov 16, M	<ul style="list-style-type: none"> • Presentation of fungal creative projects & viral letters 	
Nov 18, W	<ul style="list-style-type: none"> • Bacterial genetics 3: Mutagenesis and selection 	<ul style="list-style-type: none"> • Chapter 9.4 • Chap 9: Study Figs 9.20 & 9.22 and consider their applications
Nov 20, F	<ul style="list-style-type: none"> • Bacterial genetics 4: DNA recombination 	<ul style="list-style-type: none"> • Chapter 9.5 • Chap 9: WtoL = 10
Nov 23, M	<ul style="list-style-type: none"> • GE highlights w/ microbial focus • <u>Clicker quiz 6</u>: bacterial genetics & GE highlights (, at class end • <u>Microbial control handout</u> 	<ul style="list-style-type: none"> • Chapter 10.3 – 10.6 (Figs 10.8, 10.10, 10.12, & 10.14 are key) • Chap 10: WtoL = 3-6 • UK report in lab due Tues. Nov 24th
Nov 25, W	NO CLASS	
Nov 27, F	THANKSGIVING BREAK	

Nov 30, M	<ul style="list-style-type: none"> • Microbial Control – physical 	<ul style="list-style-type: none"> • Chapter 11.1 – 11.2 • Chap 11: WtoL = 1-3
Dec 2, W	EXAM 3 Chapters 5, 6, 9, 10 and adopted eukaryotes & viruses	
Dec 4, F	<ul style="list-style-type: none"> • Microbial Control – chemical • <u>Pass out Assignment 6-</u> microbial control, due _____ 	<ul style="list-style-type: none"> • Chapter 11.3 • Chap 11: WtoL = 8-10
Dec 7, M	<ul style="list-style-type: none"> • Mechanisms of drug action overview • Bugs vs. drugs • Intro to microbial resistance 	<ul style="list-style-type: none"> • Chapter 12.1; 12.2 only pg 346 & Fig 12.1; pg 362 – 367-368 Interactions Between Microbes & Drug; Insight 12.3 • Chap 12: WtoL = 3 • Be prepared to discuss what does and doesn't contribute to drug resistance.
Dec 8, T (Friday schedule)	<ul style="list-style-type: none"> • Normal biota, biota acquisition, introduction to microbes & hosts • Course evaluations 	<ul style="list-style-type: none"> • Chapter 13.1 & pg 383 of 13.2, & Insight 13.1 • Chap 13: WtoL = 1-3
TBA	<p>FINAL EXAM</p> <ul style="list-style-type: none"> • First part of the final exam will be an open lab notebook exam. • Second part will be for lecture. 	<ul style="list-style-type: none"> • Chapters 11-13 tested for the first time • The rest of the final will be cumulative over the entire semester.

CEDAR CREST COLLEGE
Biology 227 Microbiology, Fall 209
Course Syllabus – Part III – Laboratory Schedule & Assignments

- Required: *Microbiology: Laboratory Theory & Application*, 2nd ed., 2006 & a carbonless notebook that produces a copy
- Recommended: Index cards, colored pencils, and a two pocket folder or 3-ring binder
- *Labs, lab strains, and materials subject to change as needed.*

Week	First lab	Second lab
Aug 24 – Aug 28	<u>Lab 1</u> <ul style="list-style-type: none"> • Introduction to lab procedures, safety rules • Lab notebooks, study aids, review microscope use & cleaning & lab resources • 2-1 Ubiquity of bacteria (2 plates, environmental & body) • “Pre”-lab 1, safety quiz 	<u>Lab 2</u> <ul style="list-style-type: none"> • Pre-Lab 2 • 2-1 Record observations • 1-2 Aseptic technique (transfer to nutrient broth, agar slant & agar plate) • 3-1 Bright-field microscopy, focus in oil w/ prepared slides
Aug 31 – Sept 4	<u>Lab 3</u> <ul style="list-style-type: none"> • Pre-Lab 3 • 2-2, 2-3 & 2-4 Growth on plate, slant & broth • 3-4 Smear preparation & Simple stain • 3-5 Negative stain 	<u>Lab 4</u> <ul style="list-style-type: none"> • Pre-Lab 4 • 3-6 Gram stain • 3-8 Observe pre-made capsule stains
Sept 7 – Sept 11	NO LAB Labor Day holiday	<u>Lab 5</u> <ul style="list-style-type: none"> • Quiz I (through lab 4) • Pre-Lab 5 • 3-7 Acid-fast staining [with cold carbolfuchsin] • 1-3 Pure cultures, quadrant streak
Sept 14 – Sept 18	<u>Lab 6</u> <ul style="list-style-type: none"> • Pre-Lab 6 • 3-9 Spore stain (Schaeffer-Fulton method) • 3-11 Observe pre-made flagella stains • 1-3 Evaluate quadrant streak 	<u>Lab 7</u> <ul style="list-style-type: none"> • Pre-Lab 7 • Discuss unknown project • 1-1 Prepare media (with assigned media type) • 5-31 Inoculate nutrient plate with unknown mix and work on separating • Slant pure unknown 16-24 hr before next lab

Sept 21 – Sept 25	<u>Lab 8</u> <ul style="list-style-type: none"> • Slant pure unknown 16-24 hr before next lab • Pre-Lab 8 • Inoculate unknown (UK) working & reserve cultures, nutrient broth • Gram stain of 16 hour culture • 16-24 hr macroscopic plate colony observations & measurements of unknown on nutrient agar 	<u>Lab 9</u> <ul style="list-style-type: none"> • Pre-Lab 9 • Quiz II (labs 5-8) • Observe, describe & record characteristics of UK in broth, slant, & plate (keep age in mind) • Respiration tests <ul style="list-style-type: none"> ○ 5-5 Catalase ○ 5-6 Oxidase (swab, read in 30 sec) ○ 5-7 Nitrate reduction (both broth & plate for fall09)
Sept 28 – Oct 2	<u>Lab 10</u> <ul style="list-style-type: none"> • Pre-Lab 10 • Respiration analysis • Oxidation/Fermentation & other fermentation tests & <ul style="list-style-type: none"> ○ 5-1 Glucose oxidative fermentation, OF ○ 5-2 Phenol red broth fermentations (glucose, lactose, mannitol) ○ 5-4 Methyl Red (no VP) • Utilization media test <ul style="list-style-type: none"> ○ 5-8 Citrate test 	<u>Lab 11</u> <ul style="list-style-type: none"> • Pre-lab 11 • Catch-up, endospore or acid-fast stains if needed • 5-20 Combo differential media for sulfur reduction, indole production & motility (SIM) • 5-28 Motility test • Ferm/ox, fermentation & utilization test analysis • Discuss unknown strategy (3-12, 7-6, 7-7), writeup, flow charts, <i>Bergey's Manual</i>, metabolism chart, additional tests & [write-up handout]
Oct 5 – Oct 9	<u>Lab 12</u> <ul style="list-style-type: none"> • Quiz III (on labs 9-11) • Pre-Lab 12 • Discuss pGlo activity • Aerotolerance (of UK), check tubes in 24 hrs <ul style="list-style-type: none"> ○ 2-7 Modified for tryptone glucose yeast extract (TGYA) ○ 2-8 (FTM) Fluid thioglycollate medium ○ 2-9 Anaerobic agar & GasPak jar 	<p style="text-align: center;">LAB PRACTICAL I (on labs 1 – 11)</p> <ul style="list-style-type: none"> • Analysis of aerotolerance

Oct 12 – Oct 16	NO LAB Fall break	<u>Lab 13</u> <ul style="list-style-type: none"> • Pre-Lab 13 • Combo. diff. media <ul style="list-style-type: none"> ○ 5-23 Litmus milk • 2-10 Temp. effects on UK growth (5 tubes) • Discuss 8-4 lab • Detection of Hydrolytic enzymes (UK) <ul style="list-style-type: none"> ○ 5-13 Starch hydrolysis ○ 5-15 Urease test (modified) ○ 5-17 Gelatinase test ○ 5-19 Lipase test (modified)
Oct 19 – Oct 23	<u>Lab 14</u> <ul style="list-style-type: none"> • Pre-Lab 14 • Analysis of 2-10 temp. effects and hydrolytic & litmus milk reactions • 2-12 Osmotic pressure effects on growth (nutrient agar, glucose & NaCl plates, 4 strains/ plate using UK + controls: <i>S.c.</i>, <i>E.c.</i>, & <i>S.e.</i> etc. @ RT) 	<u>Lab 15</u> <ul style="list-style-type: none"> • Pre-Lab 15 • Evaluate osmotic plates & group chart, analyze combo. diff. media tests • 8-4 Soil microbial count • <i>Candida</i> plate swab •
Oct 26– Oct 30	<u>Lab 16</u> <ul style="list-style-type: none"> • Pre-Lab 16 • 8-4 Evaluations • 11-1 The Fungi: yeasts & molds, make a slide from <i>Candida</i>, 8-4 plates or other sample & look at prepared slides 	<u>Lab 17</u> <ul style="list-style-type: none"> • Pre-Lab 17 • Quiz IV (labs 12-15) • 11-2 Protozoans & algae, hay infusion
Nov 2 – Nov 6	<u>Lab 18</u> <ul style="list-style-type: none"> • Pre-Lab 18 • 6-4 Plaque assay, bacteriophage titering • 3-2 Ocular micrometers & UK measurements 	<u>Lab 19</u> <ul style="list-style-type: none"> • Pre-lab 19 • 6-4 analysis • 9-4 pGlo bacterial; transformation as a group
Nov 9 – Nov 13	<u>Lab 20</u> <ul style="list-style-type: none"> • Pre-Lab 20 • 8-1 Membrane filter method (3 groups/lab) • 8-2 Multiple tube fermentation method for total coliform detection (3 groups/lab) • Inoculate broths for 7-3 • Inoculate broth w/ GI sample 	<u>Lab 21</u> <ul style="list-style-type: none"> • Pre-Lab 21 • Quiz V (on material from labs 16-19) • Analysis of membrane filter and tube method of coliform determination • 8-5 Reductase test • 7-3 Antimicrobial & antiseptic/disinfectant testing

Nov 16 – Nov 20	<u>Lab 22</u> <ul style="list-style-type: none"> • Pre-Lab 22 • Kirby-Bauer analysis • Gastrointestinal sample <ul style="list-style-type: none"> ○ 4-5 (EMB) Eosin methylene blue agar ○ 4-7 MacConkey agar • 4-1 Inoculate Mannitol Salt Agar (MSA) with skin sample • 5-26 Inoculate Blood Agar Plate (BAP) with throat culture 	<u>Lab 23</u> <ul style="list-style-type: none"> • Pre-Lab 23 • Analyze GI plates • Skin sample <ul style="list-style-type: none"> ○ Analyze MSA plate ○ 5-27 Coagulase test ○ BAP • Throat sample <ul style="list-style-type: none"> ○ Analyze BAP & study 3 normal/ pathogenic biota from the throat
Nov 23 – Nov 27 UK WRITE- UP DUE TUESDAY NOV. 24 BEFORE BREAK	<u>Lab 24</u> <ul style="list-style-type: none"> • Pre-lab 24 • Quiz VI (on material from labs 20-23) • Analyze coagulase and BAP skin sample tests • pGlo transformation write-up due (1/group) • 8-7 Making yogurt 	NO LAB Thanksgiving break
Nov 30 – Dec 4	<u>Lab 25</u> <ul style="list-style-type: none"> • Clean drawer, incubator & fridge • GloGerm demonstration • Evaluations • Yogurt taste-testing 	PRACTICAL TEST II (on labs 12 – 24)

GRADING

Lab grading policies:

1. Your lowest laboratory quiz grade will be dropped in the final laboratory component calculation.
2. You must observe proper laboratory technique and laboratory behavior and safety rules as described below and as instructed by the professor. Failure to observe these rules will result in a lower grade and possible expulsion from the laboratory for the day or permanently.
3. Laboratory attendance is mandatory, as described in the syllabus. Failure to observe these rules will result in a lower grade.
4. Students must observe the policies outlined in *Bio227 Syllabus – Part I – Overview* handout, the Honor Code Philosophy, the Academic Standards of Integrity & the Statement on Academic Dishonesty or Plagiarism. Cheating and plagiarism will result in failure of the assignment and may be reported to the Vice President for Academic Affairs and the Dean of Faculty.

LABORATORY NOTEBOOKS

General Advice:

I have been known as a notebook stickler. There are useful notebook examples in a binder in the drawer in the front of the room. If you section and label your notebook in the following way for each day, you and I will be able to read your notebook with greater ease and this will be a good thing for your notebook grade. It will also help you find information. Spend time on your notebook while you have small bits of down time in lab. Don't be afraid to leave spaces in your notebook. We will often have several experiments going on, so you should establish a good method early on in the semester. You may group labs together in your conclusions etc. At the beginning of most labs, I will do a pre-lab introduction with board notes. These notes are often appropriate to incorporate later into your procedures, but I do not recommend trying to write it all in the beginning of your notes for the day. If you do record these notes, I would label them as "prep notes" etc.

Table of Contents:

1. The more details you put here, the easier it will be for you to find material in lab, when working on your unknown, and at the end of the semester on the final.
2. List the experiment number and a name for the experiment for easy reference.
3. I recommend you list certain techniques from the labs separately to find them easily later.
4. The best TOCs I have seen include additional information, such as the sub-sections of the experiment (such as where the conclusions can be found) or the lab purpose.

Date, time & personnel:

1. Record the date that the experiment (or part of the experiment) was started. You also must date any subsequent entries made for each experiment.
2. Your lab times will be the same every day, but sometimes you will come into lab between classes. You will want to keep track of the time when you began and ended incubation of a sample, so recording times will be helpful.
3. You should indicate when you do work with labmates. This will also help you track samples.

Project number and a brief title:

1. You might want to use the experiment number from the lab manual for easy referencing.
2. Some students also want to label all of their experiments in numerical order.
3. It will also help you find a particular experiment later if you give it a descriptive title.

Purpose, goal or aims of the experiment(s):

1. This can help you clarify what you are trying to do. If you aren't sure, find out!
2. On days when we do several experiments, it may be useful to connect them if they are related, or have separate aims that relate to each experiment.
3. Example: "We will use plate quadrant streaking to isolate pure strains from a mixed culture."

Procedure:

1. Do not simply write out what is in the lab manual. You also do not need complete sentences. You should record enough information that you would be able redo the experiment from your notebook. Do not simply refer to the lab manual (that won't be available during an exam). How you phrase the information will be in a way that is best for you to redo the work.
2. If you follow a standard protocol, such as a Gram stain, it needs to appear at least once in your notebook (probably the first day you did it). If it appears in your table of contents, it will be easy to find later. In later experiments of your notebook, you can refer back to it.
3. You should reference a protocol source if it is different from the laboratory manual.
4. Do not write these in advance of the lab. You will almost always make adaptations. Record incubation times and temperatures, and record any deviations from the intended protocol.

Observations and Results:

1. Record what you observe while you are in lab. Include the color of the result, and how long it took, then record your interpretations of these results (either with results or with conclusions).
2. If you only record an interpretation, how do you know what the result would look like again? This is an important distinction in this class (result vs. interpretation).
3. For example, what will "The test was positive for indole production" mean if you don't describe what led you to decide it was positive?
4. Pretend you are writing notes you will need to read and interpret 2 years from now in Bio 327 Microbial Pathogenesis and Human Immunology. It has worked well for some folks to use their Bio 227 Microbiology notebook later on in that class.

Conclusions.

1. The conclusions of an experiment can be the easiest to skip, but it can be the most useful later. I think section is when students learn most about what they did. I have found when students don't do much thought for this part, they often didn't get anything out of the experiment.
2. You may want to summarize what you learned or how you might do a particular technique differently next time or what worked well. For your unknown data, you might be able to make a statement about what you learned about your unknown.
3. Perhaps you will address statements like: How well did the experiment work? Did you get the expected outcome? Why or why not? If not, why? What could be done next time?
4. For some experiments, there won't be much to say because it is part of a larger project, but you should say something at the end of each protocol, such as – "Streaked plate was placed in 35 °C incubator. Check tomorrow and record time then."
5. It may be helpful to refer to notes you made in your pre-lab while writing up this section. You may want to readdress a question from the pre-lab now that you have done the lab.
6. The questions at the end of the lab manual may also be useful to address here. This way you might better tie the material together and help yourself remember the experiment performed.

NOTEBOOK AND PRE-LAB POLICIES

1. In a scientific research lab, notebooks belong in to the lab itself, not the researcher. Notebooks must remain in the lab and entries are made only while in the laboratory. We will follow the second part of this policy where your laboratory notebook must remain in the lab during the course. By only make entries when in the lab, this maintains the integrity of the data.
2. By using a carbonless notebook you can and should remove the tear-out pages for study purposes.
3. By keeping your notebook in the lab, you also do not accidentally remove microorganisms from the lab that might adhere to your notebook. At the conclusion of the semester, you may clean the front and back of the notebook and remove it from the lab.
4. Your notebook will be graded on at least 2 unannounced occasions. If your notebook is not in your lab drawer at the time of grading, a zero will be recorded for a notebook grade.
5. Pre-laboratory assignments (pre-labs) or quizzes are to help you prepare for lab. If you know what you are doing, you will know better what you are doing and why, you will be safer when you do it, and you will also be more efficient. These will be available through Ecompanion and should be completed at least one hour before your scheduled lab period. At any point in time, completion of the pre-labs may be monitored and a zero recorded for missing pre-labs. You may also be asked to leave the lab to complete the pre-lab before being able to proceed.
6. You are not required to do and turn in the report sheets at the end of the lab manual that correspond to each lab, but you may find the questions useful in guiding your understanding of the lab and may help you in writing up conclusions.

SAFETY REGULATIONS

No eating or drinking in the lab:

1. **No food or drink of any kind is ever allowed in the laboratory.** Imagine all the things we grow in the lab. Now imagine them in your food.
2. **No closed beverages in the lab.** This goes for beverage bottles as well. I don't care if you don't plan to keep it closed in the lab. Leave it in the hallway. I don't want to see it in the lab.
3. **No lipstick or gum chewing.** Putting on lip balm or lipstick and gum chewing is not far from eating. Neither of these is a good idea either. Consider what is in the lab.

Laboratory dress:

4. **A laboratory coat is mandatory whenever working with live organisms or hazardous chemicals.** For biological safety reasons, your lab coat must also not leave the lab. Disposable coats will be provided. Your coat should be left in a designated location in the lab. Work in the lab will not be allowed without a lab coat unless advised by the instructor.
5. **Covered toed-shoes are required for lab activity.** Flip-flops will not be allowed in the lab. You know when you have lab and should plan your footwear accordingly.
6. **Your pants must not be too short nor too long.** Shorts are not ideal. If a test tube of media and bacteria drops (and trust me, it will), you want to protect your feet and below your lab coat.

Long pants that drag on the floor are dangerous as well. If you spill a culture, you may pick it up on your pants and track it elsewhere. Also, tripping is more likely with dragging pants.

7. **Long hair should be tied back when in lab.** Pony-tails on top of the head are not as safe as on the back. I've seen one hair fire and I never need to see another.

Laboratory safety:

8. Above laboratory food, drink & dress rules must be followed. Any additional verbal or written instructions must also be followed.
9. Learn where the eye-wash, shower, first-aid, and other safety devices of the room are placed.
10. Do not touch your hands to your face during the laboratory period. This increases the chance of self-contamination. Before any personal intervention, remove any gloves and wash hands. If you must answer your phone with your gloves on, you may wish to disinfect it after use.
11. Mouth pipetting is obviously strictly forbidden. When needed for pipets, you will use bulb or other mechanical devices.
12. When you are doing any procedures that may splash hot or dangerous liquids, or acids or bases, you should wear safety goggles or glasses.
13. Your fingernails should not be so long that you cannot work safely in the lab.
14. Igniting objects on fire during lab is grounds for dismissal.
15. In addition to this list, you should review the "OBC2 Laboratory Operation & Safety Precaution Statement."

Laboratory spills:

16. If you spill bacteria on your lab coat, notify me, and it will be autoclaved.
17. Report all accidents or breakage immediately. This is for your safety, not to place blame.
18. Blood and blood products can be involved in disease transmission. Place any blood-contaminated materials in the large red biohazard canister by the entrance.
19. Report all spills immediately. If biological, cover with paper towels, and spray down with bleach or 70% ethanol. Leave for 15 minutes before discarding. Spray and wipe the area down again.
20. Gloves are available. Whenever handling cultures or stains, gloves are recommended. Specialty gloves are available upon request to those with special allergies.

Daily laboratory preparation & lab work:

21. Lab benches should be clear of other items not needed for the day. Do not put purses or backpacks on the lab surface. Use the hanger and floor space near the entrance of the room.
22. At the beginning of the laboratory session, you should clear and wipe your bench area with cleaning solutions available.
23. Keep papers neat and tidy on your desk to reduce fire or contamination possibilities.
24. You should not be using your favorite pen in the lab and then taking it back to your room to chew on it (and any bacteria you took with you). A pen has been assigned to your desk drawer for use in lab. Do not chew on lab pens or remove them from the lab.

25. A microscope will be assigned to you. It is your job to keep the microscope clean for both your use and those who share that microscope with you. If you get oil on the dials, clean them off.
26. During aseptic technique, you must remember to flame loops at the end of your sample inoculation to kill off remaining bacteria from your loop.
27. To avoid sample contamination during aseptic technique, you should keep caps between fingers pointing down towards the counter and you must not place Petri dish lids on the table.

Laboratory clean-up and disposal:

28. At the end of the laboratory session, you should clear and wipe your bench area with cleaning solutions provided.
29. If you used a microscope, clean off any oil from the lenses and dials of your microscope.
30. Tube cultures for disposal should have tape removed and placed in racks on the cart at the front of the room. Plates can be directly written upon and do not need tape. They can go in the autoclave bins on the cart in the front. If these spaces are full, please notify me.
31. Broken glass or heat-fixed slides, on which organisms have been killed, can go in the broken glass disposal containers near the eye-wash station.
32. Slides that have not been heat-fixed, plastic loops, and other organism-contaminated items should go in the grey plastic binds in each laboratory quadrant, as these are periodically autoclaved. If these get full, notify me.
33. Glass pipettes are to be placed, tips up, in the pipette container in the front of the room. If this gets full, please notify me.
34. At the completion of the laboratory session, you should clear and wipe your bench area with cleaning solutions provided, clean and put away microscopes appropriately, and push in chairs completely beneath the laboratory bench.
35. Hands should be thoroughly with soap before leaving the laboratory. You may even wish to wash them again after leaving the laboratory.

Materials that must remain in lab and being in lab outside of lab hours:

36. Your lab notebook must remain in the lab for proper recording purposes and so you do not accidentally remove microorganisms from the lab that might adhere to your notebook. You may come in between lab sessions to review your work and add to conclusions etc.
37. Slides, plates, and other laboratory objects must not be removed from the laboratory without permission from the instructor.
38. During your unknown work, you may wish to come into the lab to check your samples. Please remember the appropriate dress rules. You must also adhere to a buddy system. At all level of lab work, it is safer to work with someone else.
39. If you enter the lab after hours the Bunsen burners do not light easily, check that the gas is on by the entrance door. This can be reset in this lab only (other parts of the building reset for the whole wing). It is safer to turn the gas back off when you leave. If you smell gas in the lab, shut off all gas lines in the front of the room immediately and notify me or campus security.
40. If friends come in with you after hours, instruct them appropriately. They should not be handling anything with which they are not familiar.