BIOLOGY 106 - 2009

MICROBIOLOGY

1. Class meets Monday and Wednesday 1:30-2:45. The laboratory is Tuesday, 1:20-4:20. Laboratory begins on January 29.

2. Laboratory Manual
   Leboffe, M.J. and Pierce, B.E. Microbiology Laboratory Theory and Application, 2nd ed., ISBN 0-89582-708-5

3. Textbook
   Brock Biology of Microorganisms. You can use either the 11th or 12th edition.

   12th ed.

   Madigan, M.T., Martinko, J.M., Dunlap, P.V., and Clark, D.P. *Brock Biology of Microorganisms*, 12th ed. Hardbound – ISBN 0132324601 or 978013234601, Paperbound – ISBN 0321536150 or 9780321536150, A la carte, three-hole punched – ISBN 0321550781.

   11th ed.

   Madigan, M.T. and Martinko, J.M. *Brock biology of Microorganisms*, 11th ed. Hardbound - ISBN 0-13-219226-8 or 0-13-144329-1 or 9780132192262. A fair price is less than $50. Paberbound international edition, ISBN 0-13-196893-9. Supposedly not for sale in the U.S. or Canada, but copies might be found by searching Google for ISBN 0131968939

4. *Biology 106 Supplement* – This is sold by the department; cost, times, and place to be announced.

5. Assignments outside the text can be read online through the Tisch Library's electronic journal site.

6. Useful websites:

   Course syllabus - http://ase.tufts.edu/biology/courses/courses.html
   Blackboard site - http://blackboard.tufts.edu

   Online textbook from the University of Wisconsin
   http://textbookofbacteriology.net/index.html

   The Microbial World, profiles of microorganisms
   http://www.biology.ed.ac.uk/research/groups/jdeacon/microbes/index.htm#choice

7. Non-Tufts students must follow the Tufts calendar.

8. Most of the bacterial strains used in lab are not virulent. However, many can be opportunistic pathogens in people with compromised immune systems as a result of disease or treatment with drugs such as steroidal anti-inflammatory agents that depress the immune response. If you have concerns, ask your physicians if you should take this course.

9. Tests from 2007 are available on the course's Blackboard site.

10. **POLICY ON MISSED TESTS OR LABS IN BIOLOGY 106**

a. A verifiable illness or a serious family emergency are considered the only valid reasons for missing a test or lab.

b. If a test is missed for a valid reason (defined above), a make-up test will be given.

c. If one lab is missed for a valid reason, the student can use information from his or her partner to complete the laboratory without penalty. If a second lab is missed for any reason, a penalty of thirty points will be applied to the lab report as well as any late penalties.

d. Attendance is taken at each lab session.

e. A missed lab report will receive a grade of zero; however, a student who fails to hand in two or more lab reports or hands them in after the deadline will receive an INCOMPLETE for the course and must retake the laboratory in a subsequent year.

11. **CALCULATING THE BIO 106 SEMESTER GRADE**

a. Laboratory grade distribution

Reports	75%
Weekly Quizzes	25%
	100%

b. The final semester grade will be calculated using these percentages.

Laboratory	25%
Test 1	20% (80 points)
Test 2	25% (100 points)
Test 3	30% (120 points)

12. All students must read the safety precautions that precede the lab schedule.

13. Two books that are useful guides to writing about biology are on reserve:

Pechenik, J. A. *A Short Guide to Writing About Biology*
McMillan, V. *Writing Papers in the Biological Sciences*

BIOLOGY 106 MICROBIOLOGY SPRING 2009

Lecture and test schedule

Lecture – Monday and Wednesday – 1:30 – 2:45
Suppl. – supplement

All assigned websites are linked on Blackboard (BB)

The text is *Brock Biology of Microorganisms*, 12th ed.

January	14	**Introduction,** 2.5, 2.7, 2.8
	21	**Basic techniques** 2.1, 2.4, 5.1 - 5.3, 25.3, 27.1 - 27.3
	26	**Cell structure** 3.4, 4.1 – 4.15 Wuethrich, B. Giant sulfur-eating microbe found. Science 284:415 (1999). Schulz, H.N. et al. Dense populations of a giant sulfur....Science 284:493 (1999)
February	2	**Metabolism** 5.4 – 5.14, 20.4 – 20.6, 20.8, 21.6 Glycolysis animation (linked on BB) Lactate and alcoholic fermentation (linked on BB) Citric acid cycle animation (linked on BB)
	4, 9	**Metabolism (continued)** Suppl. p. 62-65 (photosynthesis) Anoxygenic photosynthesis animation (linked on BB) Oxygenic photosynthesis animation (linked on BB)
	11	**Growth** 6.1 to 6.7, 6.9-6.18, 9.5 (sensor kinases, response regulators, two component signaling), 9.6 (quorum sensing) Kashefi, K. and Lovley, D.R. Extending the upper temperature for life. Science 301: 934 (2003)
	18	**Viruses, viroids, prions** 10.1 – 10.5, 10.7, 10.ll, 10.12, 10.14, 10.15, 19.7 – 19.9, 19.11 – 19.15, 27.10. Suppl. p. 108-110 (influenza) Suppl. p. 118, 120 (prions) Prions (linked on BB)

	19	**Viruses** (continued) Suppl. p. 101, 102 (AIDS chemotherapy) Pearson, H. "Virophage" suggests viruses are alive. Nature 454:677 (2008)
	23	**Test 1**
	25	**Evolution and systematics** Suppl. p. 122, 123 (Miller-Urey) Chap 14 (entire) PCR animation (linked on BB) PCR animation II (linked on BB) Johnson, A.P. et al. The Miller volcanic spark discharge experiment. Science 322:404 (2008)
March	2	**Evolution and systematics (continued)**
	4	**Bacterial genomes** 13.2, 13.3 Chivian, D. et al. Environmental genomics reveals a single-species ecosystem....Science 322:275 (2008)
	9,11	**Selected bacterial groups** 15.1, 15.7 (Pseudomonads), 15.10 (*Neisseria*), 15.11 (enteric bacteria), 15.12 (*Vibrio*), 15.13 (*Rickettsia*), 15.14 (Spirilla), 15.16 (Budding bacteria), 12.7 (Myxobacteria), 16.1 (Low G+C gram pos.), 16.2 (Endospore formers), 16.3 (Mycoplasma), 16.4 (High G+C gram pos.), 16.5 (Mycobacteria), 16.6 (Actinomycetes), 16.7 (Cyanobacteria), 16.8 (Prochlorophytes), 16.9 (*Chlamydia*), 16.10 (*Planctomyces*), 16.12 (*Bacteroides),* 16.16 (Spirochetes)
	23	**Archaea** 17.1, 17.2 Suppl. p. 154-156 Haq, B.U. Methane in the deep blue sea. Science 285: 543 (1999).
	25	**Microbial Ecology** 22.8, 23.1 -23.3, 23.6, 24.3, 24.4, 24.10, 24.11, 24.14, 24.15 *Bacillus thuringiensis* (linked on BB) *Agrobacterium tumifaciens* (linked on BB)
	30	**Test II**
April	1	**Host-pathogen interactions** 28.1 - 28.12 Gut microbes and obesity (linked on BB) Callahan, G.N. Madness. Emerging Infectious Disease 8:998 (2002) Kristof, N.D., Japan confronting war atrocity. NY Times, March 17, 1995, p. A1.

Tyler, P.E., Germ war, a current world threat…NY Times, Feb. 4, 1997, p. A6

6,8 **Immunology**
28.13, 28.14, Chap. 29 (entire), 30.4, 30.5, 30.6
Suppl. p. 200, 201 (DNA vaccines)

13 **Antimicrobial agents**
27.6 - 27.9, 27.12
Suppl. p. 206-208
Payne, D. J. Desperately seeking new antibiotics. Science 321: 1644 (2008)

15 **Antimicrobial agents (continued)**
Jones, S. Antibiotics and death-the Fenton connection. Nature Reviews Microbiology 5:829 (2007)

22,27 **Industrial Microbiology**
25.1 – 25.3, 25.5 – 25.9

May 4 **Test III, 12 noon**

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Corresponding sections of Brock listed in order of their assignment

12th ed.	11th ed.
2.5, 2.7, 2.8	2.1, 2.3, 2.4
2.1, 2.4	4.1, 4.3
5.1, 5.2, 5.3	same
27.1 – 27.3	20.1 – 20.3
3.4, 4.1 – 4.15	3.4, 4.4 – 4.16
5.4 – 5.14	same
20.4 – 20.6	17.4 – 17.6
20.8, 21.6	17.8, 17.13
6.1 – 6.7, 6.9 – 6.11	6.1 – 6.8
6.12 – 6.18	6.10 – 6.16
9.6	8.10
9.5	8.12
10.1 – 10.5, 10.7	9.1 – 9.5, 9.7
10.11 – 10.12, 10.14, 10.15	9.12 – 9.14
19.7 – 19.9, 19.11 – 19.15	16.8 – 16.15
27.10	20.10
Chap. 14	Chap. 11
13.2, 13.3	15.4, 15.5
15.1, 15.7, 15.10, 15.11, 15.12	12.1, 12.7, 12.10, 12.11, 12.12
15.13, 15.14, 15.16, 15.17	12.13, 12.14, 12.16, 12.17
16.1, 16.2, 16.3, 16.4, 16.5	12.19, 12.20, 12.21, 12.22, 12.23
16.6, 16.7, 16.8, 16.9	12.24, 12.25, 12.26, 12.27
16.10, 16.12, 16.16	12.28, 12.30, 12.33
17.1, 17.2	13.1, 13.2
22.8, 23.1, 23.3, 23.4	18.8, 19.1 – 19.3
24.11, 24.10, 24.3, 24.4	19.8, 19.11 – 19.13

24.14, 24.15	19.21, 19.22
28.1 – 28.12	21.1 – 21.12
28.13, 28.14, Chap. 29 (entire), 30.4-30.6	21.13, 21.14, 22.1 – 22.14
27.6 – 27.9, 27.12	20.6 – 20.9, 20.12
25.1 – 25.3	30.1 – 30.3
25.5 – 25.9	30.5 – 30.9

Bio 106 **Disease Table** **Spring 2009**

Diphtheria
Tetanus
African Trypanosomiasis
Plague
Yellow fever
Gangrene
Lymphogranuloma venereum
Plasmodium falciparum malaria
Pneumocystis pneumonia
Gonorrhea
Typhoid fever
Measles
Tuberculosis
Trachoma
Creutzfeldt-Jakob disease
Lyme disease
Mumps
Poliomyelitis
Botulism
Influenza
West Nile fever
Leprosy
Legionnaire's disease
Cholera
Herpes simplex
Small pox
Giardiasis
Listeriosis
Hepatitis C
Pertussis
Epidemic typhus
Anthrax
Rabies
Toxoplasmosis
Salmonella enterocolitis
Traveler's diarrhea
Rotavirus gastroenteritis
Soft chancre
Ebola virus infection
Hepatitis A
AIDS
Syphilis
Hepatitis B
Chlamydial urethritis or cervicitis
Chicken pox
Rubella
Tularemia
Meningococcal meningitis
Eastern equine encephalitis
Mononucleosis
Streptococcal pneumonia
Shigellosis
Dengue or breakbone fever
E. coli O157:H7 hemorrhagic colitis
Condyloma acuminatum

To help you study for TEST 3, it is suggested that you make a table having the following headings for the diseases listed above:

Disease; Organism; Type; Symptoms and systems involved; Mode of transmission; Treatment of choice; Primary control.

Under organism, give the scientific name. Under type, indicate whether the organism is a bacterium, rickettsia, virus, etc. If the organism is a bacterium, indicate its shape and gram reaction. Rearrange the diseases so as to list them according to the phylogenetic relationships of the causative organisms. For example, you might want to list viral diseases first and then within the viruses, group together diseases caused by biologically related viruses; within the bacteria, for example, group the Gram negatives together, and within them, group the Enterobacteriaceae, etc.

The disease table is not handed in and **NOT** graded.

The 19th ed. of *Control of Communicable Diseases Manual* (on reserve), edited by D.L. Heymann, is very helpful in making this table.

Other books on reserve that may be useful are:

Brooks, G.F. *et al. Jawetz, Melnick, and Adelberg's Medical Microbiology*, 24rd ed.
Chin, J. *Control of Communicable Diseases Manual*, 17th ed.
Heymann, D.L. *Control of Communicable Diseases Manual*, 18th ed.

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Biology 106 Laboratory 2009

TIMES

Time block 6+ – Tuesday, 1:20 – 4:20

INSTRUCTOR

Eli Siegel, eli.siegel@tufts.edu

TEACHING ASSISTANT

Anne Madden, Anne.Madden@tufts.edu

TEXT

Microbiology Laboratory Theory and Application, 2nd ed. by M.J. Leboff and B.E. Pierce

PREPARATION

Do the required readings for the exercises in advance. Each laboratory session will be preceded by a short quiz about that day's work. Students who come to the lab late will receive a zero in that day's quiz. A student's lowest 25 point quiz score of the semester will be discarded when calculating the semester quiz average. There will be a cumulative 50 point quiz at the last lab session.

GENERAL SAFETY REGULALTIONS

1. Sponge off the desk top with disinfectant solution (alcohol) and minimops at the **BEGINNING AND END** of each lab period, then wipe the table dry.

2. Do not eat or drink in the laboratory.

3. Place only your laboratory manual on the lab bench. Hang your coat in the hall.

4. Development of good aseptic technique is essential and will be expected.

5. Report all personal-injury accidents or spilled cultures to the instructor immediately. This is to protect the health of the students. Bacteria are safe to work with only if accepted methods are employed, but if instructions are not followed, bacteria may become dangerous. Handle each culture as if it were a pathogen. Occasional accidents do *not* indicate poor technique.

6. Keep the sinks clean and free of debris.

7. When the lab period is completed, all cultures should be discarded in the place designated by the instructor.

8. Culture tubes to be placed in the incubator should be marked with your group's initials. Petri dishes should be kept together with a minimum amount of tape and similarly marked.

9. **AT THE END OF THE LAB PERIOD**, properly dispose of cultures, glassware, slides, and paper towels. Failure to do this will adversely affect your laboratory instructor's evaluation (grade). When your area has been cleared, spread disinfectant on the bench tops and wipe dry! Wash your hands before leaving the laboratory.

PERSONAL CARE IN THE LABORATORY

1. IN THE EVENT OF AN ACCIDENT, report it to your instructor immediately. Note the position of the fire-blanket and fire-extinguisher BEFORE you need them. Accidents will not affect your grade.

2. SUGGESTED APPAREL: Old clothes and lab coat or apron. Stains can only be removed with scissors! Spilled cultures should be treated with large quantities of disinfectant, and this is hard on clothes. No open-toed shoes!

3. Tie long hair back! Do you know where to find the fire-blanket and fire-extinguisher?

4. We work with no virulent pathogens in Microbiology, but some are opportunistically pathogenic. This means that they may cause an infection if they are given the right conditions (such as an open wound or contact with a person whose immune system is severely debilitated). Do not fear your cultures, but treat them with respect. If you spill a culture, first let your instructor know, then flood the spill with a disinfectant solution, blot up the solution with paper towels, and discard those towels in the contaminated-waste container (NOT the waste basket!) ALWAYS LET YOUR INSTRUCTOR KNOW WHEN A CULTURE HAS BEEN SPILLED!

5. In the laboratory, always wear regular glasses or safety goggles to prevent eye injuries.

DISCARDING CULTURES & CONTAMINATED MATERIALS

1. **Culture Tubes:** Take them to the discard area.

2. **Culture Plates:** Take them to the discard area. Carefully place the covered plate in the bag marked "BIOHAZARD." Make sure that the plate remains covered. The bags will be autoclaved before they are discarded.

3. **Microscope Slides and other disposable glassware:** Place these in the special container provided.

4. **Hypodermic needles** should be discarded in the sharps container. Don't clip or recap needles.

GENERAL LABORATORY OPERATION POLICY

1. The LABORATORY MANUAL is for sale at the university book store. You should purchase it and read the first assignment prior to coming to lab. YOU WILL BE EXPECTED TO HAVE READ EACH DAY'S ASSIGNMENT BEFORE COMING TO THE LABORATORY.

2. CULTURES will be handed out by the instructor just prior to beginning an exercise. MEDIA AND MATERIALS will be placed at designated locations around the room for your selection as needed. A slight excess is provided for accidents, but please take only what the experiments call for. If you take more, you will possibly be depriving someone else. Label each culture with the species name.

3. YOUR INSTRUCTOR and the teaching assistant will be available primarily for individual attention when needed during the lab period. At other times, please observe the posted office hours. We see the instructor's function primarily as one who assists in the development of technique, one who stimulates students to question, and one who helps students seek the answers to their questions.

4. Cultures do not keep; therefore, MAKE-UP LABS are not allowed.

LABORATORY REPORTS

1. Written, hard copy reports are due in laboratory on the scheduled due date. Reports will be penalized 5 points on a scale of 0 to 100 for each school day that they are late, with the exception of <u>verified</u> illness or serious family emergency. <u>No</u> report can be handed in <u>after</u> the graded reports are returned to the class.

2. A missed report will receive a grade of zero; however a student who fails to hand in more than two lab reports or hands them in after the final deadline will receive an INCOMPLETE for the course and must retake the laboratory in a subsequent year.

3. Turnitin – Turnitin compares reports to those written this year and in all previous years. Within 72 hours of a report's due time, an electronic version must be submitted to Turnitin. Failure to submit will result in a grade of zero. Go to http://turnitin.com/static/index.html, log in as either a new or old user, and then use class ID 2555675 and class enrollment password – Pasteur.

   Don't be upset if Turnitin does not accept your drawings. It is designed to compare text.

4. Although you will work in laboratory with a partner on most exercises, the reports must be written independently. Read the booklet *Academic Integrity @ Tufts* so that you are aware of what is considered plagiarism. There must not even be the appearance of plagiarism such as unusually similar tables, figures, or references when comparing one person's report with another's.

   Plagiarism also can involve any use of another's words or ideas without citation.

   Fake references are also considered academic dishonesty.

5. The *report* consists of the Title of the exercise, a brief statement of Purpose, Materials and Methods, Results, Discussion/Conclusion, and References. All statements of facts must be properly referenced. Usually, the most convenient references are a textbook and the lab manual. At times, you will need to use and cite *Bergey's Manual* (on reserve) or other books. The statement of Purpose briefly states the principle, characteristic, or technique to be demonstrated along with its importance. The Materials and Methods section can simply cite the manual. Note in this section any differences in procedure from the manual. The Results section can use a table format similar to what is in the lab manual but must also have some narrative referring the reader to the figures and tables. Include drawings if requested by the instructor or the lab book. The Discussion/Conclusion section should compare your results to the expected (properly referenced). Any differences from the expected should be explained. References should list the sources cited.

   Two books on reserve that will be very helpful in writing reports are:

   McMillan, A. *Writing Papers in the Biological Sciences.*

   Pechenik, J.A. *A Short Guide to Writing About Biology.*

6. Use a blue or red pencil to color the stained cells drawn for your report.

7. A sample lab report is posted on the course's Blackboard site.

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Biology 106 LABORATORY - SPRING 2009

L = Lab manual, Microbiology Laboratory Theory and Application, 2nd ed. by Leboffe and Pierce
T11 = text, Brock Biology of Microorganisms, 11th ed.
T12 = text, Brock Biology of Microorganisms, 12th ed.
The weekly lab quiz covers the Reading, Lab Manual Exercise, and the Additional Exercise, if any.

Date	Reading	Lab Manual Exercise	Additional Exercise	Continue Exercise	Report Due
Jan. 27	Introduction – L, p. 1-5, 13-19 Streaks – L, p. 30–37 Microscopy - L, p.64-68 Stains - L, p. 77-80	2–4 Broth 1–3 Streaks 3-4 Stains			
Feb. 3	Gram stain – T11, p. 58-59, 81 T12, p. 27-28, 84 Wet mount – L, p. 100-101	3–6 Gram stain 3–3 Eukaryotic microbes		2-4 1-3	
Feb. 10	Media – L, p. 9-12 Plate Count – L, p. 217-221 Growth Curve – L, p. 230-232 Methods – L, p. 349-359		Media preparation Viable count and absorbance		(1-3 + 2-4 combined)
Feb. 17	Growth – T12, p. 149-150 T11, p. 142-144 Turbidity – T12, p. 156, 157 T11, p. 147		Growth curve	Viable count and absorbance	(3-3 + 3-4 + 3-6 combined)
Feb. 24	Oxygen – L, p. 42 T12, p. 168-172 T11, P. 160-164 Sel. Media – L, p. 107 Streptomyces – T12, p. 459-463 T11, p. 390-394 Antibiotics – T12, p. 740 T11, p. 949	2-8 Thioglycollate 2-9 Anaerobic jar 4-1 Mannitol salt agar 4-5 EMB agar	Soil microbiology	Growth curve	Viable count and absorbance

Date	Reading	Lab Manual Exercise	Additional Exercise	Continue Exercise	Report Due
March 3	Spores and heat survival – L, p. 233-234 T12, p. 91-95 T11, p. 87-91 Normal flora of skin and mouth - T12, p. 813-817 - T11, p. 703-706		Endospores Bacteria of skin and teeth	2-8, 2-9, 4-1, 4-5 Soil microbiology	Growth curve
March 10		5-5 Catalase 5-6 Oxidase 5-20 SIM medium		Endospores Soil microbiology	(2-8 + 2-9 combined)
March 24	Fermentation – L, table A-6, figure A-5, p. 131	5-2 Phenol red 5-4 MR/VP		Soil microbiology Bacteria of skin and teeth SIM medium	(4-1 + 4-5 combined)
March 31	Kirby-Bauer – T12, p. 908-911 T11, p. 788-789	7-3 Kirby-Bauer 5-30 Enterotube Δ		Phenol red MR/VP Bacteria of skin and teeth Soil microbiology	Endospores
April 7		8-7 Yogurt		Kirby-Bauer Soil microbiology Bacteria of skin and teeth	(5-2 + 5-4 combined) (5-5 + 5 -6 + 5-20 combined)
April 14				Soil Microbiology* Yogurt	7-3
April 21	Cumulative lab quiz				5-30± 8-7 Bacteria of skin and teeth

Δ Enterotubes must be read on the afternoon of the next day.
* Report due May 1, 2009
± Can be handed in April 27 without penalty