Biology 240AA/AB: GENERAL MICROBIOLOGY

Syllabus: Lecture & Laboratory, Cañada College, Fall 2009

Lecture (Room 22-114): MW, 11:10-12:30 PM.
Labs (Room 16-204): AA: MW, 9:40 - 11:00 AM; **AB:** TR, 12:40-2:00 PM.

Professor: Dr. Nathan Staples

- **Bldg. 16, Room 207**. E-mail: **staplesn@smccd.edu**. Phone: **(650) 306-3251**
- **Office Hours and Open Lab:** MW 8:40-9:40 AM, 2-3 PM; Tue 10-11AM, Thur 1-2 PM.
  - ***Office hours also available by appointment! Please don't hesitate to ask!!*** ☺

➢ **Course Website: http://www.smccd.edu/accounts/staplesn/biol240/.**
- *Visit often for class news and information, daily lecture slides, biweekly lab quizzes, and informative links.*

A. Course Information:

❖ **Required Materials:**
- Tortora, Funke & Case. (2010), *Microbiology: An Introduction,* 10th ed. OR (2007) 9th ed.
- Staples, N.C. (2009), *General Microbiology Laboratory Manual*, **August 2009 (5th Edition)**.
- 4 *Red/Orange Scantrons (long, 100 questions on each side, A-E)*; Sharpened #2 or HB pencils.
- Composition lab notebook.

❖ **Optional Reference**: **Leboffe, M.J. & Pierce, B.E. (2004), *A Photographic Atlas for the Microbiology Laboratory*, 3rd ed.**

- **GOAL:** To establish a strong fundamental understanding of microbial biochemistry, cellular structures, metabolism, and genetics, as well as the defense mechanisms our bodies use to fight infectious diseases. In the laboratory, we will practice techniques of microbial isolation, cultivation, identification, and control of microbial growth. We will explore how these microbes are a part of our daily lives – from the bacteria and fungi that create or spoil our food and medicines, to varieties that strongly impact human health and agriculture. We will consider beneficial symbiotic bacteria in and on our bodies, and microbes in soil and waste that are SO important in acquiring and recycling elements and nutrients to provide nourishment for all species worldwide!
  - ♦ ***Have fun delving into the mysterious and wonderful world of microscopic life!!***

➢ **Answer on your notecard:** *What is your Name, career plan, & favorite (G-rated!) hobby?*
→ What are your 3 main educational goals for this course??

COURSE LEARNING OUTCOMES: Upon completion of this course, the student should be able to……

1. Describe and distinguish between the major macromolecules and subcellular structures in bacteria and eukaryotic cells, and explain how these structures determine associated functions in an organism.
2. Describe and explain how enzymes function in metabolic pathways during the transformation of energy and organic matter (especially carbon) by cells.
3. Compare and contrast the various processes of genetic transfer, gene expression, and gene regulation in microbial cells and relate them to microbial evolution, growth and metabolism.
4. Compare and contrast the major classes of bacterial, archaeal, eukaryotic, and acellular microbes, and their relationships to human and/or environmental health.
5. Compare and contrast specific mechanisms of innate and acquired immunity in humans, and describe how each aids in defense against specific infectious diseases of major organ systems.
6. Use proper laboratory procedures to successfully culture, isolate, and characterize various species of bacteria.
7. Organize and analyze qualitative and quantitative data into cohesive and well-written laboratory reports that properly reference relevant scientific literature.

A. STUDENT REQUIREMENTS:

1. *STUDENTS are expected to keep-up with ALL the* ***reading*** ***BEFORE each day's lecture***. Also, be sure to complete any *Study questions, practice problems, Critical thinking and clinical applications questions at the end of chapters* before the next class. **You will be tested primarily upon your knowledge gained in this class, and your level of comprehension and ability to apply the major concepts (*So, do NOT just memorize facts and details*!!).** *Diligence will be your key to success in this class. I want you ALL to do well and have FUN learning about the fascinating, "invisible" world of microbiology!!*
   - *** See also tutorials and practice quizzes at ***www.microbiologyplace.com*** ***and various links on our course homepage***!!***

2. ** **EXAMS**: You will be given **3 Midterm Examinations**, and a **Cumulative Final Exam**. Midterm exams will cover the lecture material indicated on the course schedule. Exams will be 50-60% multiple-choice questions, and 40-50% short answer/short essay questions.

   For every exam, bring **a pencil** (#2/HB lead), **a blank RED scantron answer sheet (100 questions/side, answers "a-e")**, your **STUDENT I.D. CARD**, and a well-rested and ready mind!

- **There will be NO MAKE-UP or RESCHEDULING of Exams (except in case of verifiable emergency), so check your schedule NOW and PLAN appropriately!!**
  - *If you have or foresee any problems, contact Dr. Staples IMMEDIATELY!!!*

3. **Attendance Policy: There will be information covered in class that will NOT be in the Text or online Slides, and there will be assignments/quizzes and information on schedule changes that are only available if you are in class. My policy is to drop students after missing more than *six* class hours (four lectures and/or four lab periods) without a *documented* excuse.**

- ** ***Attendance at ALL LAB sessions is absolutely REQUIRED*** **– missing more than two lab sessions without a *documented* excuse will very negatively affect your course grade.**
- ***If you can no longer attend the course, it is YOUR RESPONSIBILITY to contact the professor and to WITHDRAW from the course. Failure to do so will result in an "F" grade on your Academic Record.***
- You must satisfactorily ***pass BOTH the Lecture and Lab (at least 60% in each)*** to pass this course with a C or better!!!

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4. **Academic Integrity** (Nathan Staples & Doug Hirzel, Department of Biological Sciences, Cañada College) Academic dishonesty consists of copying from someone else, copying from the Internet, using crib notes on exams, or handing in written reports that do not represent your own work. Any student turning in an assignment overly similar to that of another student or another author, or found committing academic dishonesty of any other type, will receive a failing grade for the assignment, and a report of the incident will be filed with the appropriate college authorities and will appear on the student's academic record. If the infraction is serious enough, or if subsequent infractions occur, the student will also be dismissed from the class with a failing grade. For more information, see Cañada College's Academic Integrity Policy, available on the college website.

- ***Cheating in any form will NOT be tolerated, and disciplinary action will be severely enforced by College Administration!!***
- ***Do NOT PLAGIARIZE!! Especially on reports. ANY information that is not ENTIRELY from your own mind or a part of general public knowledge MUST be FULLY CITED with Author, Date, Title, Publication, Volume and Page #s!!***
- **Have fun** learning, and **take pride** in what you can accomplish in this class!!!

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C. GRADING & SUCCESS in General Microbiology:

Information from my **lecture,** the **lab,** and from the **textbook** will be on the Exams. Lectures are taken mostly from information in the textbook, although I cover some material NOT covered in the textbook. To excel in this class you will have *to READ all assigned chapters BEFORE each class!!*, attend all lectures, participate in **all labs**, and answer for yourself all Review and Self-Quiz questions. Read every part of each chapter, and take serious time to study the Figures in each chapter – these usually illustrate the most important concepts in the chapter!! *DRAW! DRAW! DRAW!!- out every major process or concept we discuss!!* Don't just read about it!

Download my ***Study Guides*** from the course website ("Additional Materials") and work on the terms and study questions EVERY DAY! I lead ***REVIEW SESSIONS*** on **Wednesdays** during the week before each Exam. Come ***prepared*** If you want additional help, come to my office hours, or see one of the very qualified Tutors in the **Learning Center** or **MESA Center**.

Form *study groups*!! Discuss and explain chapter concepts with a group of fellow students, or even with your family and friends!! If you can explain course material well to a "layperson", then you are doing VERY well in your studies!! Finally, NEVER HESITATE to come to my OFFICE HOURS or make an appointment!! I love to see and hear how you are doing, and any difficulties you may be having are likely shared by your fellow students. LET ME KNOW how I can help you to better learn the information, and to perform better in the class!!!

Students receiving a C- (70%) or lower on any exam must meet with me ASAP to discuss improving performance in the course.

The most stringent grade distribution in the class will be ≥ 90% = A, 89-80% = B, 79-70% = C, 69-60% = D, < 60% = F. Grading scales may be adjusted as deemed appropriate to ensure fairness and the best possible success of each student.

3 midterms x 100 pts. each	= 300 points
1 FINAL (33% Comprehensive, 50/150)	= 150 points
Biweekly Online lab Quizzes (7 x 10 pts; Drop lowest quiz)	= 60 points
2 Formal Lab Reports (Sections III & V = 50 + 60 pts)	= 110 points
Lab Final PRACTICAL	= 50 points
Pre-Lab preparation/participation	= 30 points
Lab Manual/Notebook	= 50 points
TOTAL:	**= 750 points**

A Note on Recommendation Letters:

*Many of you will need recommendation letters for transfer to Bachelor's or Graduate programs, or for professional employment. I am honored when students ask me for a letter of recommendation, but be wary that all professors are VERY busy during the course of a semester. Therefore, please give us **at least 3 WEEKS after** we have **received** all of your application information (forms, personal statements, grade summaries, GPA, resume, etc.) to complete the letter or form. If the application requires a form, please provide electronic format if possible, unless your signature is required.*

Please plan appropriately and far in advance for employment applications and academic applications, or we faculty may not be able to help you or to provide the quality of recommendation that you might deserve [After all, we evaluate your organizational skills as well !! ☺]. Oh, and be sure to send us MULTIPLE REMINDERS as the due dates approach – we don't take offense!! Thank you!

Sincerely, Dr. Staples

D. Laboratory Information:

1. General: Lab will take place in **Room 16-204** (just across from this building) on Mon. and Wed. Always follow proper chemical, sharps, and biohazard safety practices. ***Lab GOGGLES, CLOSED-toed SHOES, and a lab coat should always be worn in the laboratory.*** Lab is worth 40% of your grade (300/750 points). You are expected to come to each lab mentally prepared: having read-over the daily exercises, and TYPED on loose-leaf paper and inserted within your binder or folder a ***PRE-LAB WRITEUP (due each MONDAY, written for the WHOLE week!)*:**
   - **a)** The Goal/Purpose of the exercises for the entire week.
   - **b)** A *BRIEF* summary the procedural strategies we will use to achieve the goal of the week's experiments (only 5-10 lines or sentences; outline form is fine.)
   - ➢ A good rule of thumb for writing your pre-labs is to answer**:** ***"What are we doing? Why are we doing it? And How are we going to do it?"***

2. Also, your **Composition Lab Notebook** will be checked twice for completion of all fill-in sections, questions, detailed descriptions, and for LOTS of CAREFUL DRAWINGS of the organisms that we observe. Keep a detailed record of what you've done! ***Be sure to complete all calculations, tables, and graphs EVERY period before you leave the laboratory.*** See your lab manual for more detailed instructions.

3. ****LAB REPORTS** will be turned-in within one week of the final analysis, along with a brief discussion of the experiment, and a complete flow-chart of the deductive process towards identifying your investigated bacterial species. Specific instructions are provided in the introductory pages (preface) of the Laboratory Manual.
4. ****LAB QUIZZES** will be posted every two weeks (find the link on the class website), by the first day of class that week. Quizzes will cover information from the last two weeks of laboratory, and possibly a few questions from the current or upcoming week. The quiz *MUST be completed by **WEDNESDAY** evening* following the post. The lowest quiz score will be dropped. Quizzes may be accessed at SMCCD WebAccess: **http://smccd.mrooms.net/**.

5. **** 2 Hours by Arrangement per week** on average are required, and will be documented, to practice and to keep up with exercises and cultivating your organisms in the Laboratory. Open lab times are often available ***MW mornings and afternoons,*** during open lab times posted by other microbiology instructors, and ***by appointment***. ***Your experiments are ALIVE!!***
   - *If you do not tend to them every 2-3 days, they might DIE and ruin your experiment!!* There is not enough time in the semester to repeat entire experiments, so if this happens, you will lose all credit related to your experiment. Keep your microscopic "pets" happy all during the semester, and they will keep you happy!!! ☺
   - ❖ These hours by arrangement partially will also be spent visiting my office hours or tutors in the Learning Center and MESA Center, and for lecture (such as reviewing animations and interactive websites from the textbook, and as presented on lecture slides). ***These activities are REQUIRED for your course participation.***

6. **TEAMWORK and COURTESY:** In the laboratory, we always **work as teams**. If you find that you cannot attend a laboratory session for any reason, you must contact BOTH me ***AND*** your lab PARTNERS as soon as possible to ensure than your experiment does not fail by neglect. Please be responsible for your experiment and materials, and be conscientious of your lab colleagues as well !!
   - ❖ ***It is EVERY student's responsibility to CLEAN-UP after him/herself!! Also, each student must make sure that his/her ENTIRE bench and immediate area are clean and disinfected at the end of each period, chairs are pushed in, and that ALL equipment and reagents are rinsed and put back in their proper places for use by later sections.***

7. ***PUNCTUALITY: Students who arrive late to lab class will be expected to spend extra time with room cleanup at the end. Students arriving more than 10 minutes late are marked as absent for the day, but may stay so as not to fall behind in lab projects.***

BIOL 240: Fall 2009 TENTATIVE LECTURE SCHEDULE Professor: Dr. Nathan Staples

Textbook: Tortora, Funke & Case (2010). *Microbiology: An Introduction, 10th Edition.*

Wk.	Date:	Chapter:	Lecture Topic (Tortora et al., 2010):
			Part I: The Basics of Microorganisms
1 Wed	W 8/19	Ch. 1	Course expectations; Introduction -- Classification; The Microbial World -- Historical Perspective
2 Mon	M 8/24	Ch. 1	The Microbial World: Human Welfare & Disease
	W 8/26	Ch. 1, 2	Human Welfare & Disease; Biological Chemistry - atoms, bonds
3	M 8/31	Ch. 2	Organic Macromolecules -- carbohydrates, lipids, proteins, nucleic acids
	W 9/2	Ch. 2, 3 (lab)	Proteins, Nucleic Acids; Microscopy: Microscopes, Microscopic methods & staining
4	M 9/7	HOLIDAY	LABOR DAY HOLIDAY
	W 9/9	Ch. 4	Cell Theory, Prokaryotic v. Eukaryotic Cells; Prokaryotic Cell Structure
5	M 9/14	Ch. 4, 5	Eukaryotic organelles; Endosymbiotic Theory; Metabolism - enzymes, Glycolysis
	W 9/16	Ch. 5	Microbial Metabolism: Glycolysis, Cellular Respiration; ***REVIEW FOR MIDTERM***
6	M 9/21	*Midterm #1*	***MT1: Ch. 1-5a (100 pts.)***
	W 9/23	Ch. 5	Fermentation, Metabolic yields; Photosynthesis, Trophisms
7	M 9/28	Ch. 6	Microbial Growth: Physical, chemical requirements; Media, Bacterial Growth
	W 9/30	Ch. 7	Control of Microbial Growth: Terminology, death, Physical Methods
8	M 10/5	Ch. 7 (20), 8	Chemical methods; Microbial Genetics: genetic material
			Part II: Microbial Molecular Genetics & Biotechnology
	W 10/7	Ch. 8	Microbial Genetics: DNA replication, gene expression; Gene Regulation: Operons
9	M 10/12	Ch. 8	Mutations, mutagens, bact. Recombination;
	W 10/14	Ch. 9	Recombinant DNA: cloning, selection. ***REVIEW FOR MIDTERM***
10	M 10/19	*Midterm #2*	***MT2: Ch. 5b-8 (100 pts.)***
			Part III: Microbial Diversity
	W 10/21	Ch. 9, (10)	Mutagenesis, PCR, expression vectors; Applications. Microbial Classification: Physical, biochemical, genetic
11	M 10/26	Ch. 11	Prokaryotic Domains: Eubacteria & Archaea
	W 10/28	Ch. 12	Eukaryotic microbes: Fungi, algae, protozoa, Helminths
12	M 11/2	Ch. 13	Viruses, Viroids & Prions; bacteriophage growth & life cycle
			Part IV: Host-Microbe Interactions
	W 11/4	Ch. 15	Microbial Pathogenicity: Entry, evasion, damage; Toxins, Eukaryotic parasites.
13	M 11/9	Ch. 16	Nonspecific Host Defenses: barriers, chemicals, phagocytes, inflammation, complement; interferons. ***REVIEW FOR MIDTERM***
	W 11/11	No Classes!	College Faculty FLEX DAY: No Classes!!
14	M 11/16	*Midterm #3*	***MT3: Ch. 9-13 (100 pts.)***
	W 11/18	Ch. 17	Specific Host Immunity: Antibody-mediated, Cell-mediated
15	M 11/23	*Ch. 17 (18, 20)*	Specific Immunity; Vaccines & Diagnostics; Antimicrobial Drugs
	W 11/25	*Ch. (19)* **21**	(Immune Disorders: Autoimmunity, Hypersensitivity); Microbial Diseases of skin, eyes
16	M 11/30	Ch. 22, 23	Microbial Diseases of the Nervous system & the Cardiovascular & lymphatic systems
	W 12/2	Ch. 24 & 25	Microbial Diseases of the Respiratory & Digestive systems
17	*M 12/7*	(Ch. 26), Ch. 27	(Microbial Diseases of Urinary & Reproductive systems); Environmental Microbiology
	W 12/9	Ch. 27, (Ch. 28)	Environmental & Applied Microbiology; ***REVIEW FOR FINAL EXAM!! (During Lab)***
	W 12/16	*FINAL EXAM*	***** Cumulative FINAL EXAM: Wednesday, Dec. 16, 11:10- 1:40 PM *****

BIOL 240: Fall 2009 TENTATIVE LABORATORY SCHEDULE Professor: **Dr. Nathan Staples**
Lab Manual: Staples, N.C. (2009). *General Microbiology Laboratory Manual.* ***August 2009 (5th Edition)***

Wk.	Date:	Expt. #:	Laboratory Assignment:
1 Wed	**W 8/19**	**1**	Course introduction; Laboratory Safety; Introduction to Microscopy.
2	M 8/24	1 (2a)	Microscopy, magnification, Kohler illumination.
	W 8/26	**2a**	Wet mounts. *(Textbook, Ch. 3)*
3	**M 8/31**	2ab	Aseptic transfer and Observation of wet mounts *(Textbook, Ch. 3)*
	W 9/2	2fin, **3a**	Finish wet mounts; Observe aseptic technique. Smears & Simple stains. *****Quiz 1 DUE Online*****
4	**M 9/7**	HOLIDAY!	LABOR DAY HOLIDAY!!
	W 9/9	3b; **4a**	Gram stain and observations. *Practice: Smears, Stains, Microscopy!!* Spread-plate pond/lake water sample.
5	**M 9/14**	**3c;** 4b,	Acid-fast stain & Observe. Examine spread-plates, & Streak plate for single colonies (every student!!).
	W 9/16	4c, **5**	Restreak single colony isolations. Inoculate selective and differential media. *****Quiz 2 DUE Online*****
6	**M 9/21**	4d, 5fin, **6**	Slant isolated colonies. Score Select. and Differ. media; Inoculate BHIA *(Textbook, Ch. 7)* **[Lecture Midterm #1]**
	W 9/23	6fin, **7**	Score BHIA for oxygen phenotype. Inoculate anaerobic cultures.
7	**M 9/28**	7fin, **9ab**	Score anaerobic growth. Observe yeast morphology, Inoculate Yeast & Molds.
	W 9/30	9ab-p2, **8a**,	Score yeast fermentation. Perform dilution series and spread-plate *E. coli*. *****Quiz 3 DUE Online*****
8	**M 10/5**	8b, 9fin, **10**	Calculate CFU/ml. Observe 7d molds; Dilute and plate phage. ***[Refrigerate plaques on Thursday!!].***
	W 10/7	10fin, **11-p1**	Calculate PFU/ml phage. Inoculate mouth/throat samples – Sucrose, Snyder, Blood Agar.
9	**M 10/12**	11-p2, **12a**	Examine Snyder deep, BA & $CaCO_3$ plates - Catalase, Acid? Pasteurize Soil & cultivate organisms under enrichment conditions. **Notebook Check #1 (Ex. 1-10)**
	W 10/14	11-p3,12b, ***NB1***	Gram Stain & Wet mount oral bacteria; Observe & restreak sporulators. *****Quiz 4 DUE Online*****
10	**M 10/19**	(11-p4), 12c	(Re-examine $CaCO_3$ plates.) Streak $MnSO_4$ agar. **[Lecture Midterm #2]**
	W 10/21	12d	Spore stains; *****Collect WATER SAMPLE for Mon!*****
11	**M 10/26**	12e, 13a1	Inoculate Differential Media. *****Bring & Analyze WATER!!!*****
	W 10/28	12f, *13a2/b1*	Observe & identify *Bacillus* species. Score water for MPN, streak EMB. *******Bring household chemical for Mon.!! **Quiz 5 DUE Online*****
12	**M 11/2**	*13b2,* **15a**	Slant & EC broth; Ames Test for Mutagenesis - *****Bring Cosmetics, hair or clothing dye, cola, etc. !!*****
	W 11/4	*13b3,* 15b (17)	Score fecal coliform & Gram stain. Score Ames Test. (Preview Expt. 17)
13	**M 11/9**	**17p1 (p2)**	Inoculate Unknowns ***(MANDATORY attendance!!!);*** Inoculate NB broths with Unknown. (Preview 17-p3) *****Section III report DUE!!*** *****Quiz 6 DUE Online*****
	W 11/11	No Classes!	College Faculty FLEX DAY: No Classes!!
14	**M 11/16**	17p2/p3	Finish PR & AADC, Score media. Inoculate final tests. (Mandatory Attendance!!!!) **[Lecture Midterm #3]**
	W 11/18	17p4, **(16)**	Observe all media, test & discard Starch agar; **(Preview Expt. 16)**
15	**M 11/23**	17p5, **16a**	Test, observe, & discard SIM, Urea, MR & VP, PheDA, TSI, Citrate, KCN, & NO_3; ** **pGLO Transformation (*refrigerate Tues. PM*)**
	W 11/25	17p6, **16b**	Observe/discard Gelatin. Determine unknown; Score transformation & *ARA* operon activity. ***(MANDATORY ATTENDANCE!!!)*** *****Quiz 7 DUE Online***** **.... *Then, Happy Thanksgiving!***
16	**M 11/30**	17 Finish	Finish unknown and clean-up. Check final unknown with professor.
	W 12/2	***Practical Review***	***Discussion & REVIEW for Practical*** **(Mandatory!).**
17	***M 12/7***	***PRACTICAL***	****** FINAL PRACTICAL EXAM ******; *****NB2: Final Notebook Check (11-17)!!!***
	W 12/9	***Report DUE***	*****Section V Report DUE!! NONE accepted Late!!*** *****Review for Lecture Final*****