

## Cedar Crest College

### Biology 127- Fundamentals of Microbiology

#### Summer Session 2008

#### Instructor Information:

- Instructor: Dr. Eileen Epsaro
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#### General Course Information:

- **Course Title:** Bio-127- Fundamentals of Microbiology                      4 credits
- **Course Description:**
  - o The general characteristics of bacteria, protozoa, yeasts, molds and viruses will be used to understand the role of microorganisms in human health and disease. The interactions between the host and microorganisms will be emphasized as well as physical and chemical methods of control.
- **Textbooks:**
  - o Lecture: Tortora, G.; Funke, B.; Case C.; Microbiology: An Introduction, 9<sup>th</sup> Ed., Benjamin Cummings, 2007.
  - o Laboratory: Epsaro, Eileen; BIO-127 Lab Manual , 2008
- **Format:**
  - o Lecture: 10 hours per week
  - o Laboratory: 6 hours per week
- **Attendance:**
  - o **Attendance is mandatory.** In the event of a personal or family emergency, you must contact the Dean of Student Affairs (Joan Laffey : 610 437-4471, x3371 or [jmlaffey@cedarcrest.edu](mailto:jmlaffey@cedarcrest.edu)) to obtain appropriate documentation for an excused absence. These offices will contact me. You should also contact me to discuss when you will make up the work that was missed.
  - o You **MUST** come prepared for lectures (PowerPoint notes can be downloaded from the course e-college site) and labs. (It is imperative to read through the lab manual for each lab prior to coming into the lab).

## Lecture Syllabus

| <u>Date</u>  | <u>Lecture Topic</u>  | <u>Text:</u> (Chapter;Pgs)   |    |
|--|---|--|----|
| <b>May</b>   | 19 M Introduction/History of Microbiology                       | 1  |    |
|  | 19 M Properties of Biological Molecules/Enzymes                 | p. 39-49; 116-22   |    |
|  | 20 Tu Prokaryotic Cell Structure/Function; Morphology           | 4  |    |
|  | 21 W Prokaryotic Microorganisms: Bacterial Growth and Nutrition | 6  |    |
|  | 22 Th Unusual Prokaryotic Cells                                 | p. 316,333,336-7   |    |
|  | 22 Th Eukaryotic Cell Structure/Function                        | 4  |    |
|  | 27 Tu Eukaryotic Microorganisms: Algae and Protozoa             | 12   |    |
|  | 27 Tu Eukaryotic Microorganisms: Fungi                          | 12   |    |
|  | 28 W Viruses: Structure and Replication                         | 13   |    |
|  | 28 W Viruses: Bacteriophages; Viruses and Cancer; HIV           | p. 399, 410-11   |    |
|  | 29 Th Control of Microorganisms: Physical Methods               | 7  |    |
|  | 29 Th Control of Microorganisms: Chemical Methods               | 7  |    |
|  | <b>June</b>   | 2 M <b><u>EXAM 1: Chapters 1, 4, 6, 12, 13, all pages listed</u></b> |    |
|  |   | 3 Tu Control of Microorganisms: Antimicrobial Agents                 | 20 |
| 4 W Infection and Bacterial Invasiveness                                     |   | 14, 15   |    |
| 5 Th The Immune System: Non-Specific Host Resistance                         |   | 16   |    |
| 9 M The Immune System: Antigens and Antibodies                               |   | 17   |    |
| 10 Tu The Immune System: Cellular Immunity                                   |   | 17   |    |
| 10 Tu The Immune System: Role of Antibodies in Immunity                      |   | p. 520-21  |    |
| 10 Tu The Immune System: Antisera and Vaccines                               |   | p. 528-33  |    |
| 11 W Normal Flora  |   | p. 712-14, 746-47, 786-88, 614-15                                    |    |
| 11 W Pathogens that Enter the Body via the Respiratory Tract                 |   | 24, 22   |    |
| 12 Th <b><u>EXAM 2: Chapters 7, 14, 15, 16, 17, 20, all pages listed</u></b> |   |  |    |
| 16 M Pathogens that Enter the Body via the Respiratory Tract                 |   | 24, 22   |    |
| 17 Tu Pathogens that Enter the Body via the Respiratory Tract                |   | 24, 22   |    |
| 18 W Pathogens that Enter the Body via the Digestive Tract                   |   | 25, 22   |    |
| 19 Th Pathogens that Enter the Body via the Digestive Tract                  |   | 25, 22   |    |
| 23 M Pathogens that Enter the Body via the Digestive Tract                   |   | 25, 22   |    |
| 24 Tu Pathogens that Enter the Body via the Genitourinary Tract              |   | 26   |    |
| 25 W Pathogens that Enter the Body via the Skin                              |   | 21, 22   |    |
| 26 Th <b><u>EXAM 3: Chapters 22, 24, 25, 26, all pages listed</u></b>        |   |  |    |
| 30 M Zoonoses  |   | 23   |    |

## Laboratory Syllabus

| <u>Date</u>          | <u>Lab Exercise</u>   | <u>Page</u>             | <u>Lab Exercise</u>                | <u>Page</u> |
|----------------------|---|-------------------------|------------------------------------|-------------|
| <b>May 19/20</b>     | <u>Introduction to Lab:</u>                                     |                         |                                    |             |
|                      | Safety  | 3                       | Review Aseptic Technique           | 14          |
|                      | Ex. 1 Microscopy  | 4                       | Ex. 3 Smear Preparation            | 17          |
|                      | Focus in oil with prepared slides                               |                         | Ex. 4 Direct Stain                 | 19          |
|                      | Ex. 2 Wet Mount Technique                                       | 11                      | Ex. 5 Negative Stain               | 22          |
|                      | Examine Living Organisms  |                         |                                    |             |
| <b>May 21/ 22</b>    | Ex. 6 Gram Staining   | 25                      | Structural Stains                  |             |
|                      | Ex. 7 Acid-Fast Stain   | 31                      | Ex. 8 Endospore Stain              | 37          |
|                      | Examine prepared slides of<br><u>Mycobacterium tuberculosis</u> |                         | Ex. 9 Capsule Stain                | 42          |
|                      |   |                         | Examine prepared slides            |             |
|                      |   |                         | Ex. 9 Flagella Stain               | 44          |
|                      |   | Examine prepared slides |                                    |             |
| <b>May 27/28</b>     | Ex. 10 Culture Media  | 51                      | <b>QUIZ 1 (Ex. 1-9)</b>            |             |
|                      | Prepare media   |                         | Ex. 11 Microbes in the Environment | 54          |
|                      | Review Math Calculations  |                         | Ex. 12 Isolation of Bacteria       | 62          |
|                      |   |                         | Ex. 13 Transfer of Bacteria        | 73          |
|                      |   |                         | <b>Introduce 'UNKNOWN'</b>         |             |
| <b>May 29/June 2</b> | Complete Ex. 11   |                         | Ex. 14 Starch Hydrolysis Test      | 80          |
|                      | Complete Ex. 12   |                         | Ex. 15 Oxidative-Fermentative Test | 85          |
|                      | Complete Ex. 13   |                         | Ex. 16 Carbohydrate Fermentation   |             |
|                      | -Characterize your UNKNOWN                                      |                         | Tests (glucose and Lactose)        | 91          |
|                      | -Gram Stain your UNKNOWN  |                         | Ex. 17 Methyl Red Test             | 96          |
|                      |   |                         | Ex. 18 Citrate Test                | 101         |
| <b>June 3/4</b>      | Ex. 19 Lipid Hydrolysis Test                                    | 107                     | Ex. 23 Oxygen Requirements         | 127         |
|                      | Ex. 20 Catalase Test  | 113                     | Ex. 24 Anaerobic Jar Test          | 132         |
|                      | Ex. 21 Nitrate Reduction Test                                   | 117                     | Ex. 25 Gelatin Hydrolysis Test     | 139         |
|                      | Ex. 22 Oxidase Test   | 123                     | Ex. 26 Urea Test                   | 144         |
|                      |   |                         |                                    |             |
|                      |   |                         |                                    |             |

|                   |  |     |  |
|-------------------|--|-----|--|
| <b>June 5/9</b>   | <b>QUIZ 2 (Ex. 10-22)</b>  |     | <b>PRACTICAL 1</b>   |
|                   | Ex. 27 SIM Test  | 149 | ( <u>All</u> information from Ex. 1- Ex. 22)                                   |
|                   | Ex. 28 Litmus Milk Test  | 156 |  |
|                   | Ex. 29 Motility Test   | 162 |  |
| <b>June 10/11</b> | Ex. 30 Microbes in Food  | 168 | Ex. 31 Writing the Research Paper  |
|                   | <b>Introduce RESEARCH PAPER</b>  |     | Ex. 32 Skin Culture 182  |
|                   |  |     | - Inoculate a Mannitol Salt Agar plate   |
|                   |  |     | Ex. 33 Respiratory (Throat) Culture 190  |
|                   |  |     | - Inoculate a 5% Sheep Blood Agar  |
| <b>June 12/16</b> | Ex. 33 Respiratory Culture (con'd)   | 190 | Ex. 32 Skin Culture (con'd) 182  |
|                   | - Choose 3 colonies: record Hemolysis, Gram Stain, Catalase                                    |     | - Gram Stain/Catalase Test   |
|                   |  |     | - Streak Gram (+) cocci/Catalase (+) colony to 2 <sup>nd</sup> MSA plate and 1 |
|                   |  |     | Ex. 34 Mouth (Saliva) Culture 197  |
|                   |  |     | - Inoculate an MSB agar plate and a Hardy-Chrom Candida plate                  |
|                   | <b>* Take a nutrient broth and swab for Ex. 36</b>   |     |  |
|                   |  |     | <b><u>UNKNOWN REPORT DUE</u></b>   |
| <b>June 17/18</b> | <b>QUIZ 3 (Ex. 23-33, except Ex. 32)</b>   |     | Ex. 32 Skin Culture (con'd) 182  |
|                   | Ex. 32 Skin Culture (con'd)  |     | - Complete   |
|                   | - Set up additional tests: Sugar fermentation Tests and a Coagulase Test                       |     | Ex. 34 Mouth Culture (con'd) 197   |
|                   |  |     | - Complete   |
|                   | Ex. 35 Urine Culture 205   |     | Ex. 35 Urine Culture (con'd) 205   |
|                   | - Set up microscopic evaluation, 5% Sheep Bloods agar, and MacConkey agar plates               |     | - Complete   |
|                   |  |     | Ex. 36 Intestinal Culture 211  |
|                   |  |     | - Set up Bile Esculin Hydrolysis Test  |
|                   |  |     | - Set up MacConkey agar plate  |
| <b>June 19/23</b> | Ex. 36 Intestinal Culture (con'd)  | 211 | Ex. 36 Intestinal Culture (con'd) 211  |
|                   | - Complete Bile Esculin Hydrolysis Test  |     | - Set up Urea Test, Citrate test, SIM Test and an EMB agar plate               |
|                   | - MacConkey Agar plate:  |     | Ex. 37 Antimicrobial Drugs/Antibiotics 222                                     |
|                   | - Gram Stain 1 LF colony   |     | - Use your Intestinal Unknown  |
|                   | - Streak a LF/Gram (-) rod to a 2 <sup>nd</sup> MacConkey agar plate and a Nutrient Agar slant |     |  |
|                   |  |     | <b><u>RESEARCH PAPER DUE</u></b>   |

|                   |                                  |     |                                |     |
|-------------------|----------------------------------|-----|--------------------------------|-----|
| <b>June 24/25</b> | Ex. 38 Antiseptics/Disinfectants | 226 | <b>QUIZ 4 (Ex. 32, 34-40)</b>  |     |
|                   | Ex. 39 Effectiveness of Alcohol  | 230 | Ex. 41 Fungi: Molds and Yeasts | 235 |
|                   | Ex. 40 Handwashing               | 233 |                                |     |

|                   |                               |     |   |  |
|-------------------|-------------------------------|-----|---|--|
| <b>June 26/30</b> | Ex. 42 Protozoa and Helminths | 241 | <b>PRACTICAL 2</b>                      |  |
|                   | Ex. 43 White Blood Cells      | 247 | <b>(All information from Ex. 23-43)</b> |  |

- **Students are required to wear a lab coat, to be well-prepared for all classes, to work efficiently and neatly during lab sessions, to exhibit a hard-working, cooperative attitude and to observe all lab safety rules. Points will be deducted from the student's final lab grade if these requirements are not met.**

# Course Assessment

This course consists of Lecture and Laboratory. The maximum number of points to be earned in the class is 1000. A summary of lecture and laboratory grading is as follows.

- **Lecture:**
  - **Exams:**
    - The student will take 3 major lecture exams. The first 2 exams will each be worth 125 points. The third exam will be worth 150 points. The total number of points that can be earned in lecture is 400.
- **Laboratory:**
  - **Quizzes:**
    - Four quizzes will be given in lab. Each quiz will be worth 25 points, for a total of 100 points toward the lab grade.
  - **Practical exams:**
    - Two practical exams will be given to assess the student's ability to properly interpret bacteriological tests. Each practical will be worth 75 points, for a total of 150 points toward the lab grade.
  - **Unknown Report:**
    - Each student will submit a report on a particular bacteria that they have identified. This is called an 'Unknown Report'. It will include all of the laboratory tests performed, the results of these tests and a discussion which analyzes the suitability of their identification. The instructor will assess the student's laboratory techniques while this work is being performed. This Unknown Report is worth a total of 50 points toward the lab grade.
  - **Research Project and Paper:**
    - Each student will design and perform an experiment analyzing the bacterial count in a food sample. The design and technique used to complete this experimentation, as well as the research paper which is handed in, will be worth a total of 50 points toward the lab grade.
  - **Body Site Cultures:**
    - Each student will do a skin culture, throat culture, mouth culture, urine culture and an intestinal culture. Each of these reports will be worth a total of 10 points, for a total of 50 points.
- **Final Exam:**
  - A comprehensive final exam will be given on all lecture and lab material. This exam is worth a total of 200 points toward the final grade.

## Summary of Grading and Student's Record of Grades

### LAB

|                                    | <u>Total Points</u> | <u>Student's Score</u> |
|------------------------------------|---------------------|------------------------|
| Quiz 1                             | 25                  | _____                  |
| Quiz 2                             | 25                  | _____                  |
| Quiz 3                             | 25                  | _____                  |
| Quiz 4                             | 25                  | _____                  |
| Practical 1                        | 75                  | _____                  |
| Practical 2                        | 75                  | _____                  |
| Unknown Report                     | 50                  | _____                  |
| Research Report                    | 50                  | _____                  |
| Skin Culture Report                | 10                  | _____                  |
| Throat Culture Report              | 10                  | _____                  |
| Mouth Culture Report               | 10                  | _____                  |
| Urine Culture Report               | 10                  | _____                  |
| Intestinal Culture Report          | 10                  | _____                  |
| <b><u>Total Points for Lab</u></b> | <b>400</b>          | _____                  |

### LECTURE

|  | <u>Total Points</u> | <u>Student's Score</u> |
|--|---------------------|------------------------|
| Exam 1                                 | 125                 | _____                  |
| Exam 2                                 | 125                 | _____                  |
| Exam 3                                 | 150                 | _____                  |
| <b><u>Total Points for Lecture</u></b> | <b>400</b>          | _____                  |

### FINAL EXAM

|   | <u>Total Points</u> | <u>Student's Score</u> |
|---|---------------------|------------------------|
| Lecture                                       | 150                 | _____                  |
| Lab   | 50                  | _____                  |
| <b><u>Total Points for the Final Exam</u></b> | <b>200</b>          | _____                  |

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**Total number of points for the course** 1000  
**Student' total points for the course (total lab+total lecture+final exam)** \_\_\_\_\_

**\*(Student's Total Points/1000) = Final Grade for the Course**

## Course Regulations

### 1. Attendance is mandatory

- For each **lecture** missed, **2 points** will be deducted from the final lecture grade.
- For each **lab** missed, **2 points** will be deducted from the final lab grade.
- A **doctor's excuse** or an **official excuse from the dean's office** will be permitted so as not to have any points deducted from lecture or lab.
- If the student must miss a lecture or a lab, it is the responsibility of the student to make up all work that was missed.

### 2. Testing

- If a student **misses a quiz or an exam** in lecture or lab, **an excuse from the dean's office** is required, and the exam or quiz must be made up **within 24 hours** or a "0" will be given for the grade.
- **No** books, notebooks or papers will be permitted on desks or lab tables during quizzes or exams.
- **Cheating** will result in a failure of the course.
- The **Honor Philosophy** should be followed in all work, quizzes, and practical exams. See student code book.

### 3. Lab Preparation

- The student **must come prepared for lab** and **must read all lab material for the lab** prior to coming to class.

### 4. Classroom Etiquette

- Students are expected to arrive promptly for each class session. Late arrivals or early departures will not be tolerated.
- Students are expected to be respectful in class. Unnecessary talking will not be permitted.
- Students are required to have a cooperative attitude and a willingness to learn.

**\*I will deduct up to 10% from the students' final grade if these requirements are not met.**

### 5. Safety procedures will be strictly enforced in the lab.

- Students are expected to **clean their table top** with disinfectant and to **wash their hands** before and after class.
- A **lab coat** must be worn in lab.
- **No** eating or drinking or smoking will be permitted in the lab.
- **Long hair must be tied up** in order to avoid injury from the Bunsen burners and cultures.
- Place all old cultures, plates, etc., in designated areas to be **autoclaved**.

- Whenever a **spill** occurs, notify the instructor so that proper disinfection procedures can be followed.
- It is the responsibility of **everyone** to see that all materials are put away at the end of each lab session and the work bench stools are pushed under the lab table.

**\*Proper laboratory technique, being prepared for class and observations of the lab safety rules are required. Points will be deducted if these requirements are not met.**

## **Course Objectives**

At the completion of this course the student should be able to:

1. Describe the general characteristics of bacteria, protozoa, yeasts, molds and viruses.
2. Understand the roles that microorganisms have in the scheme of life, and that they are ubiquitous.
3. Explain the role that microorganisms have in maintaining human health and causing disease.
4. Understand the importance of food preservation and proper food handling in the prevention of food-borne diseases.
5. Describe the chemical and physical methods that are used to control microorganisms.
6. Describe the mechanism of action of some antibiotics/chemotherapeutic agents.
7. Explain the function of the immune system.
8. Describe the non-specific and specific immune response.
9. Explain the role of antisera and vaccines.
10. List some of the normal flora organisms.
11. Discuss the pathogens that enter the body by various portals.
12. Cultivate bacteria and understand their nutritional and physical requirements.
13. Perform various staining techniques.
14. Perform laboratory techniques aseptically.
15. Perform bacterial dilutions and plate counts.
16. Recognize bacterial types, protozoans, and fungi microscopically.
17. Prepare bacteriological media.
18. Isolate and identify a normal flora organism from the skin, GI tract, and the throat.

## **Course Outcomes**

1. The student will learn the principles of Microbiology that are necessary for careers in nursing and nutrition.
2. Students will demonstrate critical thinking and reasoning skills when they isolate and identify unknown bacteria from the skin and gastrointestinal tracts.
3. Students will be able to function in a clinical setting that requires aseptic techniques. This will allow them to protect themselves and their patients from infectious agents.
4. Students should be able to prevent microbial food contamination in a food preparation setting.

## **Policies/Procedures**

**The following have been taken from the Student Custom Book**

### **Honor Philosophy**

The Cedar Crest College Honor Philosophy states that students should uphold community standards for academic and social behavior in order to preserve a learning environment dedicated to personal and academic excellence. Upholding community standards is a matter of personal integrity and honor. Individuals who accept the honor of membership in the Cedar Crest College community of scholars pledge to accept responsibility for their actions in all academic and social situations and for the effect their actions may have on other members of the College community.

### **Academic Integrity**

Academic integrity and ethics remain steadfast, withstanding technological change. Cedar Crest College academic standards therefore apply to all academic work, including, but not limited to, handwritten or computer-generated documents, video or audio recordings, and telecommunications.

As a student at Cedar Crest College, each student shall:

- Only submit work which is his/her own
- Adhere to the rules of acknowledging outside sources, as defined by the instructor, never plagiarizing or misrepresenting intellectual property.
- Neither seek nor receive aid from another student, converse with one another when inappropriate, nor use material not authorized by the instructor.

- Follow the instructions of the professor in any academic situation or environment, including taking exams, laboratory procedures, the preparation of papers, properly and respectfully using College facilities and resources, including library and computing resources to ensure that these resources may be shared by all members of the College community.
- Abide by the Cedar Crest College Computer Use Policy.
- If a student perceives a violation of the Academic Standards, he/she will go to the instructor.
- If you are unable to resolve the problem with the instructor, you should go to the chair of the department. If you need further assistance after consultation with the instructor and the chair, you should see the Provost.

### **Classroom Protocol**

Appropriate classroom behavior is defined and guided by complete protection for the rights of all students and faculty to a courteous, respectful classroom environment. That environment is free from distractions such as late arrivals, early departures, inappropriate conversations and any other behaviors that might disrupt instruction and/or compromise students' access to the Cedar Crest College education.

Students are expected to have prompt and regular classroom attendance in accordance with the policy stated on the syllabus.

### **Learning Disabilities/Statement of College Policy**

Students with documented disabilities who may need academic accommodations should discuss these needs with their professors during the first 2 weeks of class. Students with disabilities who wish to request accommodations should contact the Advising Center.

I fully support the Cedar Crest College Honor Code and Classroom Protocol Code.

Plagiarism will result in an "F" for the assignment and will be reported to the Vice President for Academic Affairs and the Dean of Faculty.