

Department of Biology
UNIVERSITY OF MASSACHUSETTS DARTMOUTH
285 Old Westport Road
N. Dartmouth, MA 02747

BIO 251-8101: MEDICAL MICROBIOLOGY
Summer 2019: 6/11 – 7/11
MWF: 9 AM – 12 PM

**N.B. THIS IS A TENTATIVE SYLLABUS AND SUBJECT TO CHANGE PRIOR TO
6/11/19**

Instructor: Dr. Alan J. Ventetuolo

Office: SENG -330 A

Phone: 508-999-9162

Email: aventetuolo@umassd.edu

Office Hours: After class or by appointment

Course Description: Fundamentals of microbiology are presented to prepare students enrolled in, or preparing for nursing programs. This course may also be applicable for those students with an interest in allied health programs. Topics include basic microbiology, control of microorganisms, host resistance and pathogenic microorganisms.

Prerequisites: CHM 101, 102; open only to students enrolled in the College of Nursing, except by special permission of the instructor.

3 credits

Required Text:

- Custom Edition of Cowan, Microbiology Fundamentals: A Clinical Approach, Third Edition + Connect, McGraw-Hill
ISBN: 9781307218305
- Connect registration link available via *myCourses*

Option #1

You may purchase the above text packaged with the Connect software at the UMD Bookstore. Connect access is mandatory.

Option #2

Students can purchase the Connect package directly through McGraw Hill for a discounted price which includes access to the eBook. Students have the opportunity to upgrade and get a loose-leaf copy of the text sent directly to them for an additional \$25 (price subject to change). Please contact McGraw Hill directly should you have any questions.

Tentative Outline of Course Topics, Required Readings and Examination Dates:

Module I

Chapter 1: Introduction to Microbes and Their Building Blocks

Chapter 2: Tools of the Laboratory: Methods for the Culturing and Microscopic Analysis of Microorganisms

Chapter 3: Bacteria and Archaea

- **Exam I: Chapters 1, 2 and 3 – Week 2 (TBA)***

Module II

Chapter 4: Eukaryotic Cells and Microorganisms

Chapter 5: Viral Structure and Life Cycles

Chapter 6: Microbial Nutrition and Growth

- **Exam II: Chapters 4, 5 and 6 – Week 3 (TBA)***

Module III

Module III

Chapter 8: Microbial Genetics and Genetic Engineering

(Omit Sections 8.3 and 8.6)

Chapter 10: Antimicrobial Treatment

Chapter 11: Interactions between Microbes and Humans

Chapter 19: Infectious Diseases Affecting the Respiratory Systems

Chapter 20: Infectious Diseases Affecting the Gastrointestinal Tract

(Omit Section 20.4)

- **Exam III : Chapters 8, 10, 11, 19, 20 – Thursday, July 11th , 2019**

**These serve as approximate markers only and therefore are subject to change*

In addition to the above exams, “Connect” homework quizzes will be posted for each Module chapter, worth a total of (100) points. This total score will count as 25% of your lecture average. The assignments must be completed by the posted due dates. Late submittals will not be accepted. You will have a maximum of (2) attempts for each quiz; the average of which will be your final score.

Lecture outline notes, as well as online quizzes and ancillary material are available via the Student Resource Website. Chapter readings should be completed *prior* to lecture.

Examinations:

- Scheduling of exams cannot and will not be based on the personal schedule of students.
- No exam, including the final, will be administered prior to its scheduled date.
- The above exams carry equal numerical weight.
- The average of the (3) lecture exams and your Connect homework score will be worth 100% of your lecture average.

Exams I and II will consist of approximately (60) items and Exam III, (100) items. Exam content will consist of objectively formatted questions such as multiple choice and true/false items, although matching (including diagrams) may be included at my discretion. Any diagrams on the exams will have been shown or referenced at some point during lecture and will also be contained in your chapter reading. **You are required to bring (2) sharpened No. 2 pencils to class when exams are scheduled.** Exams remain the property of the instructor and will be collected at the conclusion of the exam.

There is an optional short answer extra-credit section associated with exams I, II and III, worth a total of (15) additional points. To obtain extra-credit, students must follow the very specific instructions on this section of the exam and must correctly spell and legibly write or print all answers.

In addition, optional LearnSmart assignments will be posted for each chapter worth an additional (10) points to be added to your final exam score. All LearnSmart modules must be fully completed prior to the associated Module exam to be eligible for this extra-credit option. Absolutely no additional extra credit will be offered in the course.

Exam grades will be posted to your personal grade book on *myCourses*. Exams will be kept in my office for student review for two weeks following the examination date, after which they will be shredded. Should you wish to review your examination, it must be done during my scheduled office hours, or by appointment. Note taking, copying exam content or taking photos of any portion of my examinations or answer-keys are prohibited.

Any student that copies an exam in whole, or in part, by hand or other means, or removes an exam from the classroom, will be charged with academic dishonesty and will be reported to the Academic Dean.

Quizzes:

Connect homework assignments will be assigned in lieu of in-class quizzes.

Teaching Procedures

The course will be taught primarily via Power point presentation. In addition short video segments/animations may be incorporated when appropriate. Selected case studies may be utilized to facilitate critical thinking skills.

PowerPoint chapter outlines, and ancillary material will be accessed can be accessed via myCourses. *PowerPoint outlines do not negate the need for you to take notes and be attentive in class nor do they represent or contain all the information you will be held accountable for.* All content in PowerPoint slides posted on myCourses are subject to change without notice. Slides not contained in these files may be part of my lecture presentation, and therefore will require you to take appropriate notes. Students will be held responsible for the information contained in the required chapter and lab manual exercise readings as well as all information presented in lecture and pre-lab. ***All information presented in lecture/pre-lab refers to information imparted verbally, on the blackboard, on handouts, and via video/Power Point presentations.***

Cell Phone Policy

The use of cell phones or blue tooth devices in any manner is strictly prohibited in my classroom and lab at all times. *Please be sure your cell phones are in the "off" mode at all times when class or lab is in session.* Anyone answering a cell phone during an examination or found reading/replying to text messages during an examination will receive a grade of zero for the exam and will be reported to the Dean of Students.

Computerized, Electronic and/or Audiovisual Devices:

The use of personal digital recorders are allowed during my lectures, however you must keep them at your desk. **Digital video-recording is not allowed in my lecture or lab.** Laptop computers are allowed in lecture, but you are required to use them for lecture purposes only. Uses of laptops, cell phones, electronic organizers and/or translation devices are strictly prohibited during lecture or laboratory examinations.

Attendance Policy

Only students officially registered for this course may attend classes. You are considered “officially registered” for this course if your name/ID appears on the official UMD roster.

Attendance in lecture is required and expected. Regular attendance will be taken for the first several weeks of the course for purposes of enrollment verification and thereafter will be taken sporadically to provide attendance data to appropriate University offices and Deans, when requested.

Habitual tardiness or leaving the lecture room before the end of class is disruptive to your fellow students and myself, and as such, will not be tolerated. Please use restrooms either before or after lecture.

Absence from class does not at any time, under any condition or circumstance either excuse or release a student from the satisfactory completion of any course obligation/assignment and/or the consequences of any announcements made by the instructor, nor does it absolve the absentee from the responsibility to make-up and/or remain current with any and all subject matter missed during the time of absence.

Grading Policy

A single letter grade is given to indicate your mastery of the subject matter addressed in BIO 251. Your grade earned in BIO 261 (Medical Microbiology Lab) will not have any bearing on your grade average in lecture.

All grades are final and non-negotiable and are electronically submitted to the Registrar within 72 hours of the completion of the course. *Please note that grades are not issued on the basis of perceived effort, what you want or need to gain entry or remain in an academic program or maintain a GPA of your choice; they are issued on the basis of competency and what you have legitimately earned.*

You may check your final grades and even print out an unofficial copy of your semester transcript by accessing COIN. Per Biology Department policy, I cannot mail, email or phone grades to students, nor post them.

The scaled grading format for this course is as follows:

| | |
|----|------------|
| A | >91.6% |
| A- | 88.6-91.5% |
| B+ | 84.6-88.5% |
| B | 80.6-84.5% |

| | |
|----|------------|
| B- | 76.6-80.5% |
| C+ | 72.6-76.5% |
| C | 68.6-72.5% |
| C- | 64.6-68.5% |
| D | 57.6-64.5% |
| F | <57.5 |

The above format is very generous; *there will be no further scaling up of grades.* e.g., if you have earned a 68.5% average, you will receive a (C-) and not a (C).

Please note that only letter grades are issued by the Biology Department

Make-Up Policy

Make-up examinations will be administered only in the event of significant personal illness/injury or death of an immediate family member. Appropriate documentation (e.g., medical note from physician) will be absolutely required before I consider issuing a make-up examination. The examination, if allowed, will be of a different format than the one originally administered. The following excuses are NOT accepted as reasons for missing a scheduled exam: works schedules, personal vacations, birthdays, visiting sick grandparents, deaths of extended family members or friends, loss of notes or textbooks.

Any exam not taken will result in a grade of zero. No examinations will be administered prior to the date and time it is officially scheduled. Lecture examinations will be conducted during regularly scheduled class time. ***All students are required to take the final exam.***

Course Cancellation Procedure:

Class cancellations can be accessed via the UMD website. If class is cancelled for whatever reason on the day an exam is scheduled, the exam will be given the next regularly scheduled class day.

In the rare instance that I am not in the classroom at the start time of class, please wait in the classroom for 20 minutes before assuming that class is cancelled.

Course Withdrawal

There is no penalty for withdrawal, other than a (W) on your transcript, as long as it is done by the last date for student-generated withdrawal. A (W) will not affect your GPA (grade point average) but may affect your SPI (student progress index) which may have consequences on your financial eligibility or academic standing. Verbal withdrawals

cannot be accepted. If you choose to withdraw, please fill out the necessary withdrawal form by the appropriate deadline. *Students who do not officially withdraw from the course, but instead simply stop attending class will receive a letter grade for the course.*

Incomplete Grades

The grade of “I” (Incomplete) can only be given by an instructor when a student, who is doing otherwise acceptable work, is unable to complete a course (e.g., final exam or term paper) because of illness or other exceptional conditions beyond the student’s control. The student has one calendar year from the date the mark of “I” is recorded to complete the course. Refer to the current *Catalog* for further details.

A **Request for Grade of Incomplete** form must be completed by the student and filed with the instructor at the time an “incomplete” grade is requested *no later* than 48 hours after the final examination or last class.

Academic Difficulty

Students experiencing academic difficulty should see me as quickly as possible for assistance. Most students procrastinate and wait too long to get the help they need – don’t let it happen to you!

Please read the section in your text entitled *Learning Skills: Using Your Brain Effectively* for extremely helpful information on improving your study skills, understanding what you have read and recall ability.

UMass Dartmouth offers students free tutoring in a variety of disciplines under the umbrella of the Academic Resource Center. The centers include the Writing and Reading Center, the Math and Business Center, the Science and Engineering Center, and Disabled Student Services.

Writing and Reading Center: x8710 in Group I-220

Math and Business Center: x8716 in Group I-010

Science and Engineering Center: x8718 in Group II – 271B

If you find that you don’t have enough time to study Med. Micro., you have to make a choice – find the time *or* continue getting poor grades.

Strive for excellence.....nothing less, for you have an obligation to your future patients and yourself!

Academic Negligence

I maintain a zero-tolerance policy towards academic negligence in any form. Academic negligence is demonstrated by failure to do assigned work, excessive absences, academic dishonesty, or distracting or disruptive classroom behavior. Any faculty member may, at any time, recommend in writing to the Dean of Academic Affairs that a student guilty of academic negligence be dropped from a course with a grade of (W) or (F).

As stated in the *Academic Ethical Standards* section of the *UMD Student Handbook*, academic dishonesty may result in expulsion from the University.

A responsible, courteous and mature attitude is expected and required of all students at all times while in my classroom. Students are required to abide by the Code of Conduct as stated in the college catalog. *Any attempt to create an intimidating, hostile or offensive situation or subject a person to unwanted and unsolicited attention will not be permitted.*

Please note that “distracting or disruptive behavior” includes the use of cell phones, including texting, talking at inappropriate times in class and playing computer laptop games.

ADA Compliance

The Center for Access & Success was established in 1979 to coordinate institutional efforts to comply with the mandates expressed in Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990.

Center for Access & Success
Office Phone: 508.999.8711
Fax: 508.910.6691
Location: Pine Dale Hall, Room 7136
E-mail access_success@umassd.edu

In accordance with University policy, if you have a learning or physical disability and require accommodations to obtain equal access in this course, please meet with me at the beginning of the semester and provide the appropriate paperwork from The Center for Access and Success.

Academic Calendar

It is your responsibility to be current with the official UE academic calendar and follow it: <http://www.umassd.edu/extension/studentresources/academiccalendar/>

Of particular importance, is the last date for withdrawal without academic penalty, the date for your final examination, and the schedule changes occurring because of observed holidays.

Requirements for Completion of the Course

- Each student enrolled in the course must read, understand and at all times be thoroughly familiar with the contents of the lecture.
- All reading assignments listed in the syllabus are mandatory
- Each student is obliged to be, and remain current with all assigned readings.
- Students must take, and achieve, at least a minimum passing average on all examinations.
- Students are bound by the details and provisions and rules/regulations of the official UMD catalog.
- Students are bound to the official UMD academic calendar.
- Students must be free of academic negligence.
- Students must be officially registered in the course by the Registrar.

Academic Regulations and Procedures

UMass Dartmouth Student Academic Integrity Policy*

I Academic Integrity

All UMass Dartmouth students are expected to maintain high standards of academic integrity and scholarly practice. The University does not tolerate academic dishonesty of any variety, whether as a result of a failure to understand required academic and scholarly procedure or as an act of intentional dishonesty.

A student found responsible of academic dishonesty is subject to severe disciplinary action which may include dismissal from the University. The procedure for responding to incidents of academic dishonesty may be found in Section III of this document. You may also refer to the Student Handbook for information about the judicial process.

A high standard of academic integrity promotes the pursuit of truth and learning and respect for the intellectual accomplishments of others. These are values that are fundamental to the mission of this University. Such values are undermined by academic dishonesty.

Academic freedom is a fundamental right in any institution of higher learning. Honesty and integrity are necessary preconditions of this freedom. Academic integrity requires that all academic work be wholly the product of an identified individual or individuals. Joint efforts are legitimate only when the assistance of others is explicitly acknowledged and deemed appropriate by the instructor of the course. Ethical conduct is the obligation of every member of the University community, and breaches of academic integrity constitute serious offenses.

Maintenance of the standards of academic integrity and the successful administration of this policy depend on the mutual cooperation of faculty and students.

Faculty cooperation is essential for successful application of the procedures defined by this Academic Integrity Policy. Faculty members promote academic integrity by making clear on their syllabi their expectations concerning

homework assignments, collaborative student efforts, research papers, examinations, computer-based infractions, and the like. Efforts should be made to detect and to prevent cheating and plagiarism in all academic assignments. If faculty members have evidence of academic dishonesty, they are expected to report such evidence promptly.

Students must assume responsibility for maintaining honesty in all work submitted for credit and in any other work designated by the instructor of the course. Students are also expected to report incidents of academic dishonesty to the instructor or dean of the instructional unit.

The intent of this policy is to make clear the standards of academic integrity at UMass Dartmouth.

II Violations of Academic Integrity

The various ways in which academic integrity can be violated are discussed below. The comments and examples within each section provide explanations and illustrative material, but do not necessarily exhaust the scope of these violations.

A. Cheating

Cheating is the use of unacknowledged materials, information, or study aids in any academic exercise. The use of books, notes, calculators, phones and conversation with others is restricted or forbidden in certain academic exercises. Their use in these cases constitutes cheating. Similarly, students must not request others (including commercial term paper companies) to conduct research or prepare any work for them, nor may they submit identical work or portions thereof for credit or honors more than once without prior approval of the instructor.

B. Fabrication

Fabrication is the falsification or invention of any information or citation in an academic exercise. "Invented" information may not be used in any laboratory experiment or other academic exercise without authorization from the instructor. It is improper, for example, to analyze one sample in an experiment and covertly "invent" data based on that single experiment for several more required analyses. The student must also acknowledge reliance upon the actual source from which cited information was obtained. A writer should not, for example, reproduce a quotation from a book review or other secondary source and indicate that the quotation was obtained from the book itself.

C. Facilitating Academic Dishonesty

Students who knowingly or negligently allow their work to be used by other students or who otherwise aid others in academic dishonesty are violating academic integrity. Such students are as guilty of intellectual dishonesty as the student who receives the material even though they may not themselves benefit academically from that dishonesty.

D. Plagiarism

Plagiarism is the representation of the words or ideas of another as one's own in any academic exercise. To avoid plagiarism, every direct quotation must be identified by quotation marks or by appropriate indentation and must be properly cited in the text or in a footnote. Acknowledgment is required when material from another source stored in print, electronic or other medium is paraphrased or summarized in whole or in part in one's own words. To acknowledge a paraphrase properly, one might state: "to paraphrase Plato's comment..." and conclude with a footnote identifying the exact reference. A footnote acknowledging only a directly quoted statement does not suffice to notify the reader of any preceding or succeeding paraphrased material. Information which is common knowledge such as names of leaders of prominent nations, basic scientific laws, etc, need not be footnoted; however, all facts or

information obtained in reading or research that are not common knowledge among students in the course must be acknowledged.

In addition to materials specifically cited in the text, only materials that contribute to one's general understanding of the subject may be acknowledged in the bibliography. Plagiarism can, in some cases, be a subtle issue. Any questions about what constitutes plagiarism should be discussed with the faculty member.

E. Denying others access to information or material

It is a violation of academic integrity to deny others access to scholarly resources, or to deliberately impede the progress of another student or scholar. Examples of offenses of this type include: giving other students false or misleading information; making library material unavailable to others by stealing or defacing books or journals, or by deliberately misplacing or destroying reserve materials; or altering computer files that belong to another.

F. Proprietary/Confidential Information

Related to academic integrity is the unauthorized use without written permission of proprietary and/or confidential information in any school assignment.

G. Human and Animal Subjects

Research involving human beings requires review and approval of the Institutional Review Board (IRB) for the Protection of Human Subjects and informed written consent. Research involving the use of animals requires review and approval by the Institutional Animal Care and Use Committee (IACUC).

III Academic Integrity Infractions and Consequences

Any violation of academic honesty is a serious offense and is therefore subject to an appropriate penalty. Faculty may address instances of student academic dishonesty in their classes under their authority to evaluate and assign grades, even if the consequences exceed those written below. They may also refer the incident for further action, utilizing university procedures that can document repeat offenders and adjust consequences accordingly. Those who refer instances of academic dishonesty for further action can do so through Student Judicial process, initiating action by completing an Academic Integrity Policy Report Form found at:

<http://www.umassd.edu/studentaffairs/judicialaffairs/forms/academicintegrityform.pdf>.

Violations at UMass Dartmouth are classified into three levels according to the nature of the infraction. For each level of violation a corresponding set of sanctions is recommended. Faculty, Deans, staff in Judicial Affairs, or others involved in adjudicating incidents are not bound by these illustrations, which are intended as general guidelines for the academic community. Since adherence to a code of conduct can be seen as a function of socialization into the group whose norms are reflected in such a code, culpability may be assessed differentially for those with more and less experience as members of the academic community; thus, violations of academic integrity by graduate students will presumably be penalized more severely than violations by first semester first year students. Examples are cited below for each level of violation. These examples, too, are illustrations and should not be considered all-inclusive.

Example of Level One Infraction

Infraction:

Plagiarism: The student represents the work of another as his/her own in a limited academic exercise, or in a limited or minor portion (1-2 instances) of a larger exercise, and the faculty member believes this is not an accidental act by the student.

Cheating: Working with another student on a laboratory or other homework assignment when such work is prohibited.

Consequences:

- Letter to student in lieu of hearing*

And

the faculty member's choice of the following consequences:

- redo the work to be graded without prejudice
- redo the work with a lowered grade for the work
- failing grade for the work

*student may request a hearing

Example of Level Two Infraction

Infraction:

Plagiarism: The student represents the work of another as his/her own in any academic exercise for a major portion (consistently throughout the assignment, > 50%); a Level 1 violation by a student who already has committed one or more Level 1 infractions.

Cheating: Copying on exams; using prohibited materials such as calculators or notes during exams; and/or collaborating before an exam to develop methods of exchanging information during an exam.

Consequences:

- Letter to student in lieu of hearing*

And

the faculty member's choice of the following additional consequences:

- redo the work while still receiving a failing grade for the work
- failing grade for course

*student may request a hearing

Example of Level Three Infraction

Infraction:

Plagiarism: The student represents the work of another in its entirety (whether purchased or obtained by other means) as his/her own in any academic work; a Level 2 violation by a student who already has committed one or more Level 2 infractions.

Cheating: Infractions of academic honesty in ways similar to criminal activity such as forging a grade form, stealing an examination from a professor or from a university office, or buying an examination.

Consequences:

- Referral for a Judicial Hearing , with recommendation for a minimum of a one semester suspension up to and including dismissal from the university.

Appropriate Evidence

Faculty who apply penalties for academic dishonesty, or refer the matter to Student Judicial Affairs, should maintain copies of documents or other evidence that led to the charge of academic dishonesty and have this material available for inspection if required in an appeal. Examples: material printed from the internet (or derived from other sources) that is substantially the same as work submitted by the student or written work in which the voice, usage, diction, and/or sentence structure are significantly different from the rest of the student's work (especially an observed writing sample). Records should also be kept of contacts with the student regarding the matter.

Process of Adjudication

1. Level 1 and Level 2 offenses may be handled between the student and the faculty member, utilizing the Academic Integrity Policy Report Form. The student has the option to avoid a Judicial Hearing in favor of accepting the letter sent by the Coordinator for Student Judicial Affairs.
2. Level 3 offenses will include the submission of the Academic Integrity Policy Report Form and will also require a judicial hearing since the recommendation for being found responsible of a level 3 offense is a minimum of a 1 semester suspension from the University.
3. Actions at any Level may be appealed. Information about the appeal procedures may be found at:
<http://www.umassd.edu/studenthandbook/studentjud/section11.cfm>

IV Additional Consequences of Violating the Academic Integrity Policy

Students committing acts of academic dishonesty not only face university discipline and possible criminal action but run a serious risk of harming their future educational and employment opportunities. Prospective employers and other educational institutions frequently use recommendation forms that ask for judgment and comment on an individual's moral or ethical behavior. In all cases in which a grade of "F" is assigned for disciplinary reasons, the "F" will remain on the student's transcript, even if the course is retaken and a passing grade is achieved.

* This policy is substantively derived from the "Policy on Academic Integrity for Undergraduate and Graduate Students" of Rutgers University, available online through the Teaching Excellence Center of Rutgers University (<http://teachx.rutgers.edu>).

Last Updated On: 1/12/08

N.B. If you are registered for this course, you are held responsible to abide by all terms and conditions contained in this syllabus.

The rules and regulations of this syllabus are binding and non-negotiable

SUMMARY OF BASIC LEARNING OUTCOMES FOR THE COURSE

Chapter 1:

Section 1.1 Learning Outcomes

1. List the various types of microorganisms that can colonize humans.
2. Describe the role and impact of microbes on the earth.
3. Explain the theory of evolution and why it is called a theory.
4. Explain the ways that humans manipulate organisms for their own uses.
5. Summarize the relative burden of human disease caused by microbes.
6. Differentiate among bacteria, archaea, and eukaryotic microorganisms.
7. Identify a fourth type of microorganism.
8. Compare and contrast the relative sizes of the different microbes.

Section 1.2 Learning Outcomes

9. Make a time line of the development of microbiology from the 1600s to today.
10. List some recent microbiology discoveries of great impact.

Section 1.3 Learning Outcomes

11. Name the four main families of biochemicals.
12. Provide examples of cell components made from each of the families of biochemicals.
13. Differentiate among primary, secondary, tertiary, and quaternary levels of protein structure.
14. List the three components of a nucleotide.
15. Name the three nitrogen bases of DNA and RNA.
16. List the three components of ATP.
17. Recall three characteristics common to all cells.

Section 1.4 Learning Outcomes

18. Differentiate among the terms *nomenclature*, *taxonomy*, and *classification*.
19. Create a mnemonic device for remembering the taxonomic categories.
20. Correctly write the binomial name for a microorganism.
21. Draw a diagram of the three major domains.
22. Explain the difference between traditional and molecular approaches to taxonomy.

Chapter 2:

Section 2.1 Learning Outcomes

1. Explain what the Five I's are and what each step entails.
2. Discuss three physical states of media and when each is used.
3. Compare and contrast selective and differential media, and give an example of each.
4. Provide brief definitions for *defined media* and *complex media*.

Section 2.2 Learning Outcomes

5. Convert among the different units of the metric system.
6. List and describe the three elements of good microscopy.

7. Differentiate between the principles of light microscopy and the principles of electron microscopy.
8. Give examples of simple, differential, and special stains.

Chapter 3:

Section 3.1 Learning Outcomes

1. List the structures all bacteria possess.
2. Identify three structures some but not all bacteria possess.
3. Describe three major shapes of bacteria.
4. Provide at least four terms to describe bacterial arrangements.

Section 3.2 Learning Outcomes

5. Describe the structure and function of four different types of bacterial appendages.
6. Explain how a flagellum works in the presence of an attractant.

Section 3.3 Learning Outcomes

7. Differentiate between the two main types of bacterial envelope structure.
8. Discuss why gram-positive cell walls are stronger than gram-negative cell walls.
9. Name a substance in the envelope structure of some bacteria that can cause severe symptoms in humans.

Section 3.4 Learning Outcomes

10. Identify five structures that may be contained in bacterial cytoplasm.
11. Detail the causes and mechanisms of sporogenesis and germination.

Section 3.5 Learning Outcomes

12. Compare and contrast the major features of archaea, bacteria, and eukaryotes.

Section 3.6 Learning Outcomes

13. Differentiate between *Bergey's Manual of Systematic Bacteriology* and *Bergey's Manual of Determinative Bacteriology*.
14. Name four divisions ending in *-cutes* and describe their characteristics.
15. Define a *species* in terms of bacteria.

Chapter 4:

Section 4.1 Learning Outcomes

1. Relate bacterial, archaeal, and eukaryotic cells to the *last common ancestor*.
2. List the types of eukaryotic microorganisms, and denote which are unicellular and which are multicellular.

Section 4.2 Learning Outcomes

3. Differentiate flagellar structures among bacteria, eukaryotes, and archaea.
4. List which eukaryotic microorganisms have a cell wall or a glycocalyx, noting the importance of each structure.
5. List similarities and differences between eukaryotic and bacterial cytoplasmic membranes.
6. Describe the main structural components of a nucleus.

7. Diagram how the nucleus, endoplasmic reticulum, and Golgi apparatus act together with vesicles during the transport process.
8. Explain the function of the mitochondrion.
9. Explain the importance of ribosomes, and differentiate between eukaryotic and bacterial types.
10. List and describe the three main fibers of the cytoskeleton.

Section 4.3 Learning Outcomes

11. List two detrimental and two beneficial activities of fungi (from the viewpoint of humans).
12. List three general features of fungal anatomy.
13. Differentiate among the terms *heterotroph*, *saprobe*, and *parasite*.
14. Explain the relationship between fungal hyphae and the production of a mycelium.
15. Describe two ways in which fungal spores arise.

Section 4.4 Learning Outcomes

16. Describe the protozoan characteristics that illustrate why protozoa are informally placed into a single group.
17. List three means of locomotion exhibited by protozoa.
18. Explain why a cyst stage may be useful to a protozoan.
19. Give an example of a disease caused by each of the four types of protozoa.

Section 4.5 Learning Outcomes

20. List the two major groups of helminths, and provide examples representing each body type
21. Summarize the stages of a typical helminth life cycle.

Chapter 5:

Section 5.1 Learning Outcomes

1. Explain what it means when viruses are described as *filterable*.
2. Identify better terms for viruses than *alive* or *dead*.

Section 5.2 Learning Outcomes

3. Discuss the size of viruses relative to other microorganisms.
4. Describe the function and structure(s) of viral capsids.
5. Distinguish between enveloped and naked viruses.
6. Explain the importance of viral surface proteins, or spikes.
7. Diagram the possible configurations that nucleic acid viruses may possess.

Section 5.3 Learning Outcomes

8. Diagram the five-step life cycle of animal viruses.
9. Define the term *cytopathic effect* and provide one example.
10. Discuss both persistent and transforming infections.
11. Provide thorough descriptions of both lysogenic and lytic bacteriophage infections.

Section 5.4 Learning Outcomes

12. List the three principal purposes of cultivating viruses.
13. Describe three ways in which viruses are cultivated.

Section 5.5 Learning Outcomes

14. Name two noncellular infectious agents besides viruses.

Section 5.6 Learning Outcomes

15. Analyze the relative importance of viruses in human infection and disease.
16. Discuss the primary reason that antiviral drugs are more difficult to design than antibacterial drugs.

Chapter 6:

Section 6.1 Learning Outcomes

1. List the essential nutrients of a bacterial cell.
2. Differentiate between macronutrients and micronutrients.
3. List and define four different terms that describe an organism's sources of carbon and energy.
4. Define *saprobe* and *parasite*, and provide microbial examples of each.
5. Compare and contrast the processes of diffusion and osmosis.
6. Identify the effects of isotonic, hypotonic, and hypertonic conditions on a cell.
7. Name two types of passive transport and one type of active transport.

Section 6.2 Learning Outcomes

8. List and define five terms used to express a microbe's optimal growth temperature.
9. Summarize three ways in which microorganisms function in the presence of differing oxygen conditions.
10. Identify three important environmental factors (other than temperature and oxygen) with which organisms must cope.
11. List and describe the five types of associations microbes can have with their hosts.
12. Discuss characteristics of biofilms that differentiate them from planktonic bacteria.

Section 6.3 Learning Outcomes

13. Summarize the steps of cell division used by most bacteria.
14. Define *doubling time*, and describe how it leads to exponential growth.
15. Compare and contrast the four phases of growth in a bacterial growth curve.
16. Identify one quantitative and one qualitative method used for analyzing bacterial growth.

3. Differentiate between constitutive and regulated enzymes.
4. Diagram four major patterns of metabolism.
5. Describe how enzymes are controlled.

Chapter 8:

Section 8.1 Learning Outcomes

1. Define the terms *genome* and *gene*.
2. Differentiate between genotype and phenotype.
3. Draw a segment of DNA, labeling all important chemical groups
4. Summarize the steps of bacterial DNA replication, and identify the within the molecule. enzymes used in this process.
5. Compare and contrast the synthesis of leading and lagging strands during DNA replication.

Section 8.2 Learning Outcomes

6. Provide an overview of the relationship among DNA, RNA, and proteins.
7. Identify important structural and functional differences between RNA and DNA.
8. Draw a picture of the process of transcription.
9. List the three types of RNA directly involved in translation.

10. Define the terms *codon* and *anticodon*, and list three start and stop codons.
11. Identify the locations of the promoter, the start codon, and the A and P sites during translation.
12. Indicate how eukaryotic transcription and translation differ from these processes in bacteria.

Section 8.4 Learning Outcomes

15. Explain the defining characteristics of a recombinant organism.
16. Describe three forms of horizontal gene transfer used in bacteria.

Section 8.5 Learning Outcomes

17. Define the *term mutation*, and discuss one positive and one negative example of it in microorganisms.
18. Differentiate among frameshift, nonsense, silent, and missense mutations.

Chapter 10:

Section 10.1 Learning Outcomes

1. State the main goal of antimicrobial treatment.
2. Identify the sources for the most commonly used antimicrobials.
3. Describe two methods for testing antimicrobial susceptibility.
4. Define *therapeutic index*, and identify whether a high or a low index is preferable.

Section 10.2 Learning Outcomes

5. Explain the concept of selective toxicity.
6. List the five major targets of antimicrobial agents.
7. Identify which categories of drugs are most selectively toxic and why.
8. Distinguish between broad-spectrum and narrow-spectrum antimicrobials, and explain the significance of the distinction.
9. Identify the microbes against which the various penicillins are effective.
10. Explain the mode of action of penicillinases and their importance in treatment.
11. Identify two antimicrobials that act by inhibiting protein synthesis.
12. Explain how drugs targeting folic acid synthesis work.
13. Identify one example of a fluoroquinolone.
14. Describe the mode of action of drugs that target the cytoplasmic or cell membrane.
15. Discuss how treatments of biofilm and nonbiofilm infections differ.
16. Name the four main categories of antifungal agents.
17. Explain why antiprotozoal and antihelminthic drugs are likely to be more toxic than antibacterial drugs.
18. List the three major targets of action of antiviral drugs.

Section 10.3 Learning Outcomes

19. Discuss two possible ways that microbes acquire antimicrobial resistance.
20. List five cellular or structural mechanisms that microbes use to resist antimicrobials.
21. Discuss at least two novel antimicrobial strategies that are under investigation.

Section 10.4 Learning Outcomes

22. Distinguish between drug toxicity and allergic reactions to drugs.
23. Explain what a superinfection is and how it occurs.

Chapter 11:

Section 11.1 Learning Outcomes

1. Differentiate among the terms *colonization*, *infection*, and *disease*.
2. Enumerate the sites where normal biota is found in humans.
3. Discuss how the Human Microbiome Project is changing our understanding of normal biota.

Section 11.2 Learning Outcomes

4. Differentiate between a microbe's pathogenicity and its virulence.
5. Define *opportunism*, and list examples of common opportunistic pathogens.
6. List the steps a microbe has to take to get to the point where it can cause disease.
7. List several portals of entry and exit.
8. Define *infectious dose*, and explain its role in establishing infection.
9. Describe three ways microbes cause tissue damage.
10. Compare and contrast major characteristics of endotoxin and exotoxins.
11. Provide a definition of *virulence factors*.
12. Draw a diagram of the stages of disease in a human.
13. Differentiate among the various types of reservoirs, providing examples of each.
14. List several different modes of transmission of infectious agents.
15. Define *healthcare-associated infection*, and list the three most common types.
16. List Koch's postulates, and discuss when they might not be appropriate in establishing causation.

Section 11.3 Learning Outcomes

17. Summarize the goals of epidemiology, and differentiate it from traditional medical practice.
18. Explain what is meant by a disease being "notifiable" or "reportable," and provide examples.
19. Define *incidence* and *prevalence*, and explain the difference between them.
20. Discuss the three major types of epidemics, and identify the epidemic curve associated with each.

Chapter 19:

Section 19.1 Learning Outcomes

1. Draw or describe the anatomical features of the respiratory tract.
2. List the natural defenses present in the respiratory tract.

Section 19.2 Learning Outcomes

3. List the types of normal biota presently known to occupy the respiratory tract.

Section 19.3 Learning Outcomes

4. List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for the "Highlight Disease" pharyngitis.
5. Discuss important features of the other infectious diseases of the upper respiratory tract. These are rhinitis, sinusitis, acute otitis media, and diphtheria.
6. Identify two bacteria that can cause dangerous pharyngitis cases.

Section 19.4 Learning Outcomes

7. List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for the “Highlight Disease” influenza.
8. Compare and contrast *antigenic drift* and *antigenic shift* in influenza viruses.
9. Discuss important features of the other infectious diseases of the upper and lower respiratory tracts. These are pertussis and RSV disease.

Section 19.5 Learning Outcomes

10. List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/ treatment for the “Highlight Disease” tuberculosis.
11. Discuss the problems associated with MDR-TB and XDR-TB.
12. Discuss important features of the other lower respiratory tract diseases, community-acquired and healthcare-associated pneumonia.

Chapter 20:

Section 20.1 Learning Outcomes

1. Draw or describe the anatomical features of the gastrointestinal tract.
2. List the natural defenses present in the gastrointestinal tract.

Section 20.2 Learning Outcomes

3. List the types of normal biota presently known to occupy the gastrointestinal tract.
4. Describe how our view has changed of normal biota present in the stomach.

Section 20.3 Learning Outcomes

5. List the possible causative agents, modes of transmission, virulence factors, diagnostic techniques, and prevention/treatment for the “Highlight Disease” acute diarrhea.
6. Discuss important features of the conditions food poisoning and chronic diarrhea.
7. Discuss important features of the two categories of oral conditions: dental caries and periodontal diseases.
8. Identify the most important features of mumps, gastritis, and gastric ulcers.
9. Differentiate among the main types of hepatitis, and discuss the causative agents, mode of transmission, diagnostic techniques, prevention, and treatment of each.