

Microbiology Lecture Course Syllabus & Objectives

BIOL 207 • Fall 2011 • Muskegon Community College • Life Science Department



Instructor: *Scott T. Kendall*

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Office Hours: 9:35-10:35 PM Tuesday
6:25-7:25 PM Thursday
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Course Description: **BIOL 207 Microbiology Lecture (3 credit course, 3 contact hours/week, 15 week semester).** This is an introductory microbiology lecture course with an emphasis on the biology of human disease. It is designed primarily for students in allied health programs. The areas of concentration include the general characteristics of micro-organisms, the human diseases they cause, the body's resistance through the immune system, and control of microorganisms. In addition, emerging diseases and bioterrorism are also covered.

Prerequisite: **BIOL 105** (Anatomy and Physiology I) with a C or better or other college level biology course (C or better) with instructor permission. A college level chemistry course and BIOL 106 (Anatomy and Physiology II) are recommended prior to taking this course.

Co-requisites: **BIOL 207A** (Microbiology Lab). NOTE that Microbiology lecture and lab are separate courses.

Schedule/Sections: **BIOL-207LEC-W04** 5:00-6:25 pm Room 248 Tuesday and Thursday
W03 6:35-9:35 pm Lab Room 247 Tuesday

Material:

1. Talaro, Kathleen P., Chess, B., **Foundations in Microbiology**, 8th Ed. (ISBN: 978-0-07-337529-8; MHID: 0-07-337529-2).
2. Registration with McGraw-Hill Connect Web Site:
http://connect.mcgraw-hill.com/class/s_kendall_winter_2012
3. ParScore sheets (form no. F=3652-PAR-L) – 8 forms
4. Other: colored pencils, note paper, pencils...
5. Optional: D. Howell, **BIOL 207 Lecture Supplement**, current semester (MCC Bookstore only).

Technology Requirements*:

1. Computer with speakers and high speed internet access,
2. Computer operating system– Windows or Macintosh OS,
3. Web browser– Internet Explorer 8 or FireFox (FireFox is preferred),
3. Microsoft Word or compatible software,
4. Microsoft PowerPoint or PowerPoint Viewer (free viewer – www.microsoft.com/downloads,
5. QuickTime Player (free version)- <http://www.apple.com/quicktime/download/>,
6. Flash Player- <http://get.adobe.com/flashplayer/>,
7. Printer

***Students taking this course will need a back-up technology plan so that all deadlines can be met. You must have access to another computer with internet access in the event of a computer/technology failure.**

NEED HELP with a technology problem? 1-866-718-5170 (toll free, 24 hour student support).

**Student
Responsibilities:**

You are responsible for all course material/assignments on the day they are due. Technology failures cannot be used as an excuse and unexcused work will result in a grade of zero.

- **Assignments, Exams, Quizzes...** are due on the date/time designated by the instructor. In addition to the completeness of the assignment, points will be deducted for grammatical and spelling errors. **Late assignments** will receive an automatic grade drop of 20%/day, of the total points possible for up to two days. After the second day, late work is no longer accepted and a grade of zero will be assigned. **Missed exams or quizzes** require a call to the instructor on the test day or earlier with a valid excuse (*i.e., illness, funeral...*). Only one exam or quiz (not both) may be made-up per semester when an excused absence is granted by the instructor (alternate formatting for the assessment may be used). The rescheduled exam or quiz must be taken within 24 hours of the original date (to be determined by the instructor).
- **Four Unexcused Absences result in withdrawal from the course, following MCC's guidelines.** This is defined by **two weeks of missed on-campus lectures.** **Withdrawing is the responsibility of the student.** Failure to follow these guidelines will result in a grade of "E" for your final course grade. Carefully read through MCC's withdrawal guidelines located in the college catalog (www.muskegoncc.edu/pages/307.asp).
- **Cell phones** must be turned off and stored while you are in lecture, taking assessments, and/or attending a class review session on campus.
- **Testing Procedures:** Module exams must be taken in class (only one may be taken within 24 hours of the original date with instructor permission). Other assessments will be either online or given in class. **A photo identification card is required for exams.** Other material needed: ParScore sheet and pencil (no other material will be allowed). Dates are indicated on the schedule page of this syllabus.
- **All email communication** originating from MCC, including from your instructor, to a student will be via their MCC email account. **Check your email frequently** (minimum of twice weekly). **Delete old emails** from your in-box, deleted file folder, and junk mail. If this is not done your mailbox may become full and no longer accept new mail. I will respond to emails Monday-Thursday (9:00-5:00 PM) unless otherwise announced. Friday email response time will vary.
- **Academic Integrity/Behavior must be maintained:** Mutual respect and civility are expected at all times with any type of communication. Please review the following **netiquette link:** www.albion.com/netiquette/corerules.html. In the event of academic dishonesty (consists of cheating and plagiarism as defined in the student handbook/planner) students will be dealt with on an individual basis and may result in dismissal from BIOL 207 with a grade of E (see additional information later in this syllabus).

**Student
Assessment:**

Muskegon Community College is fully accredited by the Higher Learning Commission located in Chicago. The College is currently seeking reaccreditation by completing a two-year process called a self-study. Accreditation helps ensure students that they are receiving a quality education and can transfer to other colleges and universities with ease and confidence. MCC is committed to an essential part of the reaccreditation process: assessing student learning. You may be asked to participate in assessing student academic achievement this semester by doing such things as:

- Evaluate your class and your instructor by completing a Student Opinion Survey, usually given toward the end of the semester.
- In some classes, you will find that one hour of class time may be devoted to completing a test of your general knowledge. Your performance on this test will not affect your grade in this course or your status in the College.
- You may also be asked to be part of a group of students who will be interviewed or surveyed about their views of the College's strengths and weaknesses.

If you have any comments you would like to make about the quality of education at MCC, please email the College's assessment coordinator at this address:

studentscount@muskegoncc.edu

Lecture Format: Methods of instruction include, but are not limited to- lectures, textbook assignments, class discussion/presentations, case history analyses, projects/assignments, and self study units (external links for review offered online).

Assessment	Points Possible	Assessment Site
Assignments (connect, quizzes, case studies, presentation, ...).	~341 points	Connect, Blackboard, classroom, and other.
Five Lecture Examinations	500 points	Classroom
Total	~841 points	

Evaluation: You are evaluated on the basis of your performance on assessments. The following Life Science Department percent grading scale will be used for all MCC Life Science/biology courses:

100 - 92.0	A	79.9 – 78.0	C+	61.9 – 60.0	D-
91.9 - 90.0	A-	77.9 – 72.0	C	59.9 and ↓	E
89.9 - 88.0	B+	71.9 – 70.0	C-		
87.9 - 82.0	B	69.9 – 68.0	D+		
81.9 - 80.0	B-	67.9 – 62.0	D		

Total lecture points earned ÷ total lecture points possible × 100 = lecture percentage.

Grading Rubric: Available under Course Information on Blackboard.

Posting of Grades: All quiz scores should be posted within a seven day period following the assessment. Exam scores should be posted within a seven day period following the assessment. Other assessment scores will be addressed individually.

Review/Study Guidelines:

Complete all **assignments on time and review repeatedly.**

- 1) Study on a regular basis:
 - a. **Review class notes** as soon as possible after assigned. A minimum of 2-3 hours review time for each 1 hour of class work is recommended. This lecture **course requires approximately three hours of contact time per week and an additional 6-9 hours of review per week.**
 - b. **Rewrite class notes.** Use diagrams/concept maps to help you focus on key points.
 - c. **Form study groups** early on and meet weekly (meetings may take place online; contact your instructor).
 - d. **Contact your instructor** weekly if needed to clarify content. This may be accomplished by telephone, on-campus visits, or through instant messaging (IM).
 - e. **Study a key concept** and test your depth of knowledge. The following process requires you to organize the information, synthesize answers by writing out answers in a detailed, sequential format (excellent for preparing for essay questions).
 - i. Study one key concept from class material repeatedly in a variety of ways (textbook assignment, instructor material, lecture notes, worksheets, mind maps...).
 - ii. Take a blank sheet of paper and write down everything you know from memory.
 - iii. Compare your answer against course notes, text, worksheets...correct errors and repeat process until successful.
- 2) Attend all **review sessions** (time to be announced). Material will also be available online.

Statement on

Student Behavior:

Muskegon Community College is a community of scholars whose members include administrators, faculty, staff, and students. Mutual respect and civility are expected in the classroom or other college academic settings, as well as, in any communication.

- MCC has the duty of providing students with privileges, opportunities, and protections that best promote learning;
- Students have the right to a non-threatening learning environment;
- Students have the responsibility to refrain from infringing on the right of others to learn or the right of teachers to teach; and
- Any student whose behavior disrupts learning may be subject to disciplinary action as outlined in the Muskegon Community College *Student Handbook/Planner*.

Academic Integrity Policy:

Muskegon Community College expects that all faculty and students will adhere to high standards of personal and academic honesty. This means that all academic work will be done by the student to whom it is assigned without unauthorized aid of any kind. Faculty members, for their part, will exercise care in the planning and supervision of academic work so that honest effort will be positively encouraged.

Academic dishonesty consists of, but is not limited to:

- **Cheating.** Cheating is defined as using or attempting to use, giving or attempting to give, and obtaining or attempting to obtain, materials or information, including computer material pertaining to a quiz, examination, or other work that a student is expected to do alone.
- **Plagiarism.** Plagiarism is defined as the use of another's words or ideas without acknowledgement.
- Penalties for violation of these standards of conduct may result in sanctions of up to and including suspension or expulsion from MCC.

Statement on Dispute Resolution Process:

Should a student not agree with a faculty member's decision or actions as they may relate to this policy, the following steps shall be followed:

1. A student suspected of academic dishonesty shall be notified in writing within two school days of the time the violation is discovered. Copies of the written notification shall also be filed with the department chair and Vice President of Student Services.
2. The student should try to reach resolution of the matter through direct discussion with the involved faculty member within three (3) school days of the written notification.
3. If the matter is not resolved in Step 2, the student shall bring the matter to the attention of the department chairperson of the involved faculty member.
4. If the matter is not resolved at the department chairperson level, the student shall bring the matter to the attention of the Vice President for Academic Affairs who shall render a decision within five school days of the receipt of the dispute information.
5. If a satisfactory solution is not reached at the Step 4 level, the student may file a written request with the Vice President of Student Services for a hearing before the disciplinary board. This meeting shall be held not more than 20 days following the written request. A student may request a hearing before the disciplinary board. The disciplinary and judicial procedures are outlined in the Muskegon Community College *Student Handbook/Planner*.

Statement on Special Services:

Special Services is an important part of the broad range of services offered at Muskegon Community College. Our goal is to provide effective services, materials, and resources which enable students who are members of Special Populations to be successful. Contact 231-777-0309.

Course Website

1. <https://blackboard.muskegoncc.edu/> or www.muskegoncc.edu (click on Blackboard at the top of the page).
2. Click on login → put in your username and password (given to you by the Admission's Department at MCC).
3. Click on the course (located to the right of the page).
4. Read through any announcements.
5. Get to know the layout of the site.

NEED HELP with a technology problem? 1-866-718-5170 (toll free, 24 hour student support).

AVAILABILITY OF STUDENT PAPERS:

1. Exams are typically briefly in class after the exam but can be available upon request in the Biology Office.
2. **All student papers will be available for review for up to two weeks** beyond the semester. Student papers will be destroyed following this review period.

Lecture Schedule*			
Unit	Date	Topics	Assignments
	On your own within 2 weeks of class start	The Chemistry of Biology. Use this chapter to review previously learned material. This information will be used throughout the semester.	Ch. 2 (pp 27-54)
I*	Jan 10-26	Main Themes of Microbiology; Prokaryotes vs. Eukaryotes; Microbial Growth and Nutrition. Exam I (Jan 26).	Ch. 1 (pp 1-23) Ch. 4 (pp 89-117) Ch. 5 (p 135) Ch. 7 (pp 185-213)
II*	Jan 31-Feb 21	Microbial Metabolism and Genetics. Metabolism Worksheets. Exam II (Feb 21).	Ch. 8 (pp 217-246) Ch. 9 (pp 255-285) Ch. 10 (pp 301-306)
IIIa*	Feb 23-Mar 20	Fungi, Protists, Helminths and General Information about Viruses. Case Studies. Exam III (Mar 20).	Ch. 5 (pp 135-141, 143-144, & 146-154) Ch. 22 (pp 660-682) Ch. 23 (pp 687-693, 700-701, 703-710, and 714-717) Ch. 6 (pp 158-181)
IIIb*	concurrent	Viral Diseases Self Study. Online Blackboard Quiz	Ch. 24 (pp 724-744) Ch. 25 (pp 748-752, 754-771, and 773-778)
IV*	Mar 22-Apr 10	Infection and Disease; Immunity (Innate and Specific). Exam IV (Apr 10).	Ch. 13 (pp 386-415) Ch. 14 (pp 425-448) Ch. 15 (pp 452-480) Ch. 16 (486-497 and 501-513)
Va*	concurrent	Antimicrobial Control. Online Blackboard Quiz	Ch. 12 (pp 352-381)
Vb*	Apr 12-May 1	Bacterial Diseases. Exam V (tentative date: May 1).	Ch. 18 (pp 539-565) Ch. 19 (pp 569-590) Ch. 20 (pp 599-602 & 604-623) Ch. 21 (pp 627-632, 634-638, 640-641, & 646-654)

*Other assessments will be announced in class (*e.g., connect and Blackboard Assignments, case studies, and presentations*).

The Life Science department reserves the right to modify any syllabus without advance notice.

BIOLOGY 207 LECTURE OBJECTIVES

(Textbook: K.Talaro and B. Chess, *Foundations in Microbiology*, 8th Ed.)

Below is a list of objectives for Biology 207. Students are responsible for these objectives on assessments whether or not they are covered in lecture. Answer the learning objectives for each chapter. The course syllabus contains the timeline.

The Main Themes of Microbiology (Ch.1)

1. Define the following terms:

Pathogen	Biotechnology	Domain
Bioremediation	Prokaryote	Kingdom
Genetic engineering	Eukaryote	Phylum
Microbiology	Parasite	Division
Microorganisms or microbes	Host	Class
Bacteria	Spontaneous generation (abiogenesis)	Order
Viruses	Biogenesis	Family
Fungi	Scientific method	Genus
Protozoa	Hypothesis	Species
Algae	Theory	Binomial scientific name
Macroscopic	Aseptic technique	Morphology
Immunology	Nomenclature	Eukarya
Epidemiology	Taxonomy	Eubacteria
		Archaea

- List the microbes studied in a microbiology course.
- Analyze the role microbes play in the functioning of the earth's ecosystems.
- List ways in which microbes help solve environmental, agricultural, and medical problems through the use of biotechnology, bioremediation, and genetic engineering and recombinant DNA.
- Summarize the role of infectious diseases and the human condition with regards to emerging and re-emerging diseases.
- Explain the major historical events that laid the foundations of microbiology. Compare and contrast the major contributions of: R. Hooke, A. Leeuwenhoek, J. Tyndall, L. Pasteur, R. Koch, J. Lister, C. Linnaeus (C. von Linne), E. Haeckel, R. Whittaker, C. Woese, I. Semmelweis, J. Snow; C. Gram, and F. Eilshemius.
- Differentiate spontaneous generation (abiogenesis) from biogenesis. Examine why spontaneous generation impeded the development of microbiology, and describe experiments that support and contradict this.
- Justify the statement that contributions from Leeuwenhoek, Pasteur, and Koch aided the development of microbiology as a science.
- Describe and explain the germ theory of disease and indicate why Koch's Postulates are important to this theory.
10. Explain the classification system developed by Bergey for bacteria.

The Chemistry of Biology (Ch.2)

Note: Chapter two objectives have been covered in previous required courses. Use this chapter to review core concepts in chemistry before going on to other chapters. You will be tested on the material from chapter two throughout the course. If you need extra help with this, contact the instructor for additional material and help.

11. Define the following terms (Ch. 2):

Carbohydrate	Inorganic compounds	Hydrolysis reaction
Amino acid	Monosaccharide	Peptide bond
Protein	Lipid	Enzyme
Nitrogen base	Phospholipid	substrate
Covalent bond	Peptide	Nucleotides
Ionic bond	Polar	Electrolyte

Oxidation Hydrogen bond Synthesis reaction Cation anion Ion	Reactant Disaccharide Triglyceride Cholesterol Polypeptide Deoxyribonucleic acid Adenosine triphosphate	Reversible reaction Functional groups Polysaccharide Fatty acid Disulfide bond Oxidation-reduction Dehydration synthesis Monomer
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12. Atomic Structure: name the subatomic particles of an atom and describe their charge and location in the atom; draw and explain the atomic structure for carbon (include electrons, protons, neutrons, nucleus or core, and shells), hydrogen, oxygen, and nitrogen.
13. Atomic Bonding: explain what occurs in covalent bonding; know how many bonds carbon, hydrogen, oxygen, and nitrogen need in the formation of molecules and compounds; explain what occurs in hydrogen bonding: relate this to water and the structure of DNA.
14. List examples of chemical reactions.
15. Be able to recognize and name these functional groups: methyl, hydroxyl, carboxyl, amino, phosphate, and sulfhydryl.

Tools of the Laboratory (Ch.3)

16. Define the following terms:

Culture Inoculated Pure culture Mixed culture Contaminated culture Streak plate Colonies Subculture Semisolid media Agar General-purpose medium Fastidious Enriched medium Selective medium	Differential medium Reducing medium Fermentation medium Optical microscopy Compound microscope Total magnification Resolution Numerical aperture Bright-field microscopy Dark-field microscopy Phase-contrast microscopy Fluorescence microscopy	Transmission electron microscope Scanning electron microscope Wet or hanging drop mounts Stained smear Heat-fixed Basic dye Negative staining Simple stain Differential stain Gram stain Acid-fast stain Endospore (spore) stain Capsule stain Flagella stain
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17. Compare and contrast different types of media with regards to: physical state, chemical composition, and functional type.
18. Evaluate and list examples of the following types of media:
 - a. General media.
 - b. Selective and Differential media.
 - c. Miscellaneous media.
19. Explain the principles of light microscopy.
20. List useful applications for the following types of light microscopy:
 - a. Brightfield.
 - b. Darkfield.
 - c. Fluorescent.
 - d. Phase-contrast.
21. Explain the principles of both electron and scanning microscopy.
22. List and explain units of measurement used in microbiology.
23. Describe and understand the principles of the following staining techniques:
 - a. Simple.
 - b. Differential (compound).

- c. Positive (basic dyes).
- d. Negative (acidic dyes).
- e. Gram.
- f. Acid-fast.
- g. Flagella.
- h. Endospore (spore).

A Survey of Prokaryotic Cells and Microorganisms (Ch.4)

24. Define the following terms:

Flagella	Selectively permeable membrane	Morphology
Axial filaments	Cytoplasmic membrane	Bacillus (pl: bacilli)
Fimbriae	Chromatin	Coccus (pl: cocci)
Pili	Ribosome	Vibrio (pl: vibrios)
Monotrichous	Endospores	Spirillum (pl: spirilla)
Lophotrichous	Sporangium	Spirochete (pl: spirochetes)
Amphitrichous	cortex coat	Pleomorphism
Peritrichous	prospore	Diplococcus (pl: diplococcus)
Chemotaxis	Dipicolinic acid	Staphylococcus (pl: staphylococci)
Conjugation	Vegetative cycle	Streptococcus (pl: streptococci)
Cell envelope	Germination	Tetrad (pl: tetrads)
Glycocalyx	Sporulation	sarcina (pl: sarcinae)
Encapsulated	Spore (free spore)	Aerobic
Endotoxin		Anaerobic
plasmids		Facultative
Inclusion bodies		
nucleoid		

- 25. Compare and contrast cellular structures of prokaryotes and eukaryotes. List examples of both types of cells.
- 26. Write correct scientific names for organisms-both genus and species written out, genus abbreviated, and species abbreviated.
- 27. Understand how Eubacteria and Archea differ.
- 28. Explain the classification system developed by Bergey for bacteria.
- 29. Compare and contrast psychrophiles, thermophiles, mesophiles, psychrotrophic or psychrotolerant organisms.
- 30. Describe and diagram the various shapes of most bacteria (bacillus, streptobacillus, coccus, diplococcus, tetrad, staphylococcus, streptococcus, spirochete, spirillum, vibrio, and filamentous).
- 31. Diagram and label a generic prokaryotic cell. Include the structures listed and a statement of function(s) for each structure:
 - a. Flagella.
 - b. Fimbriae.
 - c. Conjugation pilus (pilus).
 - d. Cell membrane.
 - e. Cell wall.
 - f. Cell envelope.
 - g. Glycocalyx (capsule and slime layer).
 - h. Nucleoid.
 - i. Chromosome.
 - j. Plasmid.
 - k. Ribosome.
 - l. Cytoplasm (cytosol, actin cytoskeleton, and other suspended structures).
 - m. Inclusion bodies.
 - n. Endospore.
- 32. Diagram a flowchart identifying the general cellular organization of a prokaryotic cell with regards to: external structures, cell envelope, and internal structures.
- 33. Describe the arrangement of flagella in bacteria (monotrichous, amphitrichous, lophotrichous, and peritrichous).

34. Explain modes of locomotion in bacteria (flagella, axial filaments, and gliding).
35. List prokaryotic structures involved in attachment and mating.
36. Describe the formation of a biofilm.
37. Diagram and explain how the cell walls of gram positive and gram negative bacteria differ.
38. Produce a table showing the steps of the Gram stain process. Include the appearance of bacterial cells (Gram positive and Gram negative) for each step and explain the chemical reactions in the cell wall.
39. Name a cell-wall-deficient bacterium.
40. Diagram, label, and explain bacterial endospore formation (sporulation). Diagram and label a freed spore.
41. Explain germination of a bacterial spore.
42. Compare and contrast the three cellular domains (bacteria, archaea, and eukarya).

A Survey of Eukaryotic Cells and Microorganisms (Ch. 5)

43. Define the following terms:

Pseudopods	Mold spores	Pseudopodia
Fungi	Asexual spores	Undulating membrane
Yeast	Sexual spores	Trophozoite
Pseudohyphae	Fruiting body	Encystment
Molds	Bud or blastospore	Sporozoite
Hyphae	Sporangiospores	
Dimorphic	Sporangium	Vector
Saprobe	Conidia	Helminths
Mycoses	Conidiospore	Flatworms
Mycelium	Conidiophore	Roundworms
Septa	Sporangiospore	Nematodes
chitin	Sporangiophore	Cestodes
	Arthrospore	Trematodes

44. Review eukaryotic organelles and their functions (covered in prerequisite course).
45. Explain the general structures, growth requirements, and means of reproduction of the fungi (yeasts, and molds).
46. Identify the roles of fungi in nature and industry.
47. List two etiologic agents of fungal infections in humans.
48. Explain the general structures, growth requirements, and means of reproduction of the protozoa.
49. List two etiologic agents of protozoan infections in humans.
50. Explain the general structures, growth requirements, and means of reproduction of the helminths.
51. List two etiologic agents of helminthic infections in humans.

An Introduction to the Viruses (Ch. 6)

52. Define the following terms:

Virus	Virion	Exocytosis
Capsid	Lytic cycle	Cytopathic effects
Nucleocapsid	Latent	Oncogenic
Envelope	Lysis	Prions
Naked nucleocapsid	Lysogeny	Interferon
Capsomer	Prophage	Vaccine
Helical capsid	Host range	Retrovirus
Icosahedron	Tropism	Reverse transcriptase
Spike or peplomer	Endocytosis	Viroids
Complex viruses	Uncoated	
Bacteriophage	Budding	

53. Outline the history of viruses; know the contributions of Jenner, Pasteur, Iwanowsky, Beijerinck, and Stanley.
54. Diagram, label and explain the structural components of a virus, both naked and enveloped.
55. Describe the three types of viral symmetry.

56. Explain viral classification; know the characteristics used for viral classification.
57. Compare and contrast the characteristics of viruses and bacteria.
58. Describe and explain the life cycle of an animal virus.
59. Describe different types of cytopathic effect (CPE); be able to name two types of inclusion bodies.
60. List two prominent CPEs associated with specific viruses.
61. Explain lysogeny.
62. Compare and contrast viral replication in DNA versus RNA viruses.
63. Discuss inhibition, control, and diagnosis of viral diseases.
64. List two techniques used to cultivate and identify animal viruses in the laboratory.
65. List two medically important diseases caused by viruses. List two noncellular infections agents involved in disease?
66. Give examples of viruses thought to be carcinogenic (oncogenic).
67. Understand the role of interferon and inhibition of viruses.
68. Describe the properties of prions, viroids and nanobes.

Elements of Microbial Nutrition, Ecology, and Growth (Ch. 7)

69. Define the following terms:

Inorganic nutrient	Passive transport	Aerobe
Organic nutrient	Active transport Diffusion	Anaerobe
Heterotroph	Osmosis	Microaerophile
Autotroph	Isotonic	Aerotolerant Capnophiles
Phototroph	Hypotonic	Acidophiles
Chemotroph	Hypertonic	Alkaliphiles
Photoautotroph	Facilitated diffusion	Halophiles
Chemoautotrophs	Group translocation	Barophiles
Chemoheterotrophs	Endocytosis	Symbiosis
Saprobies	Phagocytosis	Mutualism
Parasites	Pinocytosis	Commensalism
Obligate	Psychrophile	Parasitism
Facultative	Mesophile	Normal microbial flora
Opportunistic	Thermophile	Binary fission
Pathogens		Generation or doubling time

70. List the roles of the following nutrient sources:

- Carbon
- Nitrogen
- Oxygen
- Hydrogen
- Other

71. Explain the nutritional categories of microbes by energy and carbon source.

- Autotroph
 - Photoautotroph
 - Chemoautotroph
- Heterotroph
 - Photoheterotroph
 - Chemoheterotroph
 - Saprobe
 - parasite

72. Describe the ways bacteria transport materials into their cells.

73. Explain how the following environmental factors influence microbes:

- Temperature
 - Range
 - Optimal growth (psychrophile, mesophile, and thermophile)
- Gas
- pH

- Osmotic pressure
 - Other
74. List and explain the associations between
- Symbiotic organisms (mutualism, commensalisms, and parasitism).
 - Nonsymbiotic organisms (synergistic and antagonistic).
75. Explain how bacteria reproduce and what is meant by a bacterium's generation time.
76. List and explain the growth phases of a bacterial population (lag phase, logarithmic or log phase, stationary phase, decline or exponential death phase).

An Introduction to Microbial Metabolism: The Chemical Crossroads of Life (Ch. 8)

77. Define the following terms:

Hydrolysis	Competitive inhibition	Decarboxylation
Oxidized	Negative feedback	NAD
Reduced	Endergonic	FAD
Redox reaction	Exergonic	ATP
Labile	Phosphorylate	Fermentation
Denaturation	Dephosphorylate	Chemiosmosis
	Dehydrogenation	

78. Explain the factors that influence enzyme activity.
79. Explain the role of adenosine triphosphate (ATP) and adenosine diphosphate (ADP) in a cell.
80. Diagram and explain catabolism of glucose to pyruvic acid (*i.e.*, *glycolysis or anaerobic respiration*).
81. Diagram and explain two types of bacterial fermentation (how bacteria change pyruvic acid to different endproducts by recycling $\text{NADH} + \text{H}^+$).
82. Diagram and explain the steps in the citric acid cycle (Krebs cycle) from pyruvic acid to carbon dioxide and water.
83. Explain in detail how the electron transport system (oxidative phosphorylation and chemiosmosis) works to generate ATP.
84. Compare and contrast aerobic respiration to anaerobic respiration.
85. Determine the number of ATPs that are generated from catabolic cycles and the electron transport system when given the appropriate information.
86. Explain in general how other substances other than glucose are catabolized. Include descriptions of deamination of amino acids and beta-oxidation of fatty acids.

Microbial Genetics (Ch. 9)

87. Define the following terms:

Genome	Regulatory gene	Mutation
Okazaki fragments	Start codon	Spontaneous mutation
Transcription	Translocation	Induced mutation
Translation	Nonsense (termination) codons	Mutagen
mRNA	Triplets	carcinogen
tRNA	Operon	Ames Test
rRNA	Introns	Conjugation
RNA polymerase	Exons	Transformation
Promoter region	DNA polymerase	Transduction
	Ligase	Sex pilus (conjugation pilus)

88. List the components found in DNA, mRNA, rRNA, tRNA. Explain their role.
89. Outline and explain the process of semiconservative replication.
90. Describe and interpret the steps in the processes of transcription and translation (*i.e.*, *protein synthesis*).
91. Explain the process of producing a polypeptide to the formation of an active protein.
92. Diagram and explain control of protein synthesis in bacteria (*i.e.*, operons and negative feedback inhibition using enzymes).
93. Compare and contrast replication via a replication fork to that of rolling circle.

94. Explain how the process of mutation introduces variation into genetic material.
95. Explain spontaneous and induced mutations; list examples of each.
96. Understand and explain how we use the mutation process in bacteria as a beneficial tool via the Ames Test.
97. Diagram, label and explain the various mechanisms of DNA transfer found in bacteria: transformation, conjugation, and transduction (generalized only).
 - o Distinguish among F⁺; F⁻; and Hfr cells.
 - o Interpret the experiments of Griffith and Avery with respect to transformation.
98. Describe contributions of O. Avery, J. Watson, F. Crick, B. McClintock, M. Wilkins, and R. Franklin.

Genetic Engineering A Revolution in Molecular Biology (Ch. 10)

99. Define the following terms:

Genetic engineering Biotechnology Gel electrophoresis Hybridize Ligase Reverse transcriptase	Gene probes Polymerase chain reaction Primers Recombinant DNA technology	Gene therapy Gene mapping DNA fingerprinting Bioethics
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100. Describe the tools and techniques of genetic engineering (e.g., properties of DNA, enzymes, gel electrophoresis, gene probes, DNA sequencing, and polymerase chain reaction)..
101. List some of the uses to which genetic engineering has been put in the fields of medicine, industry, law enforcement, and agriculture.
102. Describe contributions of J. Venter.

Physical and Chemical Agents for Microbial Control (Ch. 11) – covered in the laboratory course.

Drugs, Microbes, Host— The Elements of Chemotherapy (Ch. 12)

103. Define the following terms:

Parenterally Prophylaxis Chemotherapy Antimicrobial <i>Antibiotic</i> Synthetic	Narrow spectrum Broad spectrum Selectively toxic Drug resistance Beta-lactamase	Interferon Allergy Biota Superinfection Toxicity Chemotherapeutic drug
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104. Summarize the history of antimicrobial therapy (chemotherapy). Know the contribution of Ehrlich, Fleming, Chain, and Florey.
105. List the three sources of antimicrobials.
106. Explain the mechanism of action of each antimicrobial discussed in class.
107. Indicate the groups of organisms against which each of the antimicrobials is most effective.
108. Identify the toxic side effects of the antimicrobials discussed in class.
109. Describe the tube dilution and agar diffusion tests, which are used to test the sensitivity of organisms. Explain the terms sensitive versus resistant with reference to antibiotics and bacteria.
110. Discuss the means organisms use to develop resistance to antimicrobials, contrast genetic versus nongenetic resistance.
111. Explain the proper use of antimicrobials and indicate measures to slow down or halt microbial resistance.

Microbe-Human Interactions: Infection and Disease (Ch. 13)

112. Define the following terms:

Sign	Mixed infection	Endemic
Symptom	Primary infection	Epidemic
Infection	Secondary infection	Pandemic
Disease	Acute	Asymptomatic
Infectious disease	Chronic	Carrier
Pathogen	Sequelae	Vector
Pathogenicity	Morbidity	Zoonosis
Resident biota	Mortality	Communicable
True pathogens	Septicemia	Fomite
Virulence	Bacteremia	Droplet nuclei
Opportunistic pathogens	Viremia	Nosocomial
Exogenous	Subclinical	Asepsis
Endogenous	Asymptomatic	Etiologic agent
Toxemia	Prevalence	Necrosis
Intoxication	Direct transmission	Granuloma
Systemic	Indirect transmission	Abscess
Portal		

113. Describe the biota (indigenous flora) found in various parts of the body.
114. Understand the means used by organisms to establish disease: dose level, portal of entry, and virulence factors.
115. Understand how each enzymatic virulence factor promotes disease establishment.
116. Compare and contrast exotoxins and endotoxins.
117. Identify and explain the classic stages of infection and disease.

Host Defenses: Overview and Nonspecific Defenses (Ch. 14)

118. Define the following terms:

Innate immunity	Humoral immunity	Inflammation
Desquamate	Cell-mediated immunity	Pyrogen
Reticuloendothelial	Cytokine	Pyogenic
Antibodies	Vasoactive mediators	Antipyretic
Diapedesis	Edema	Complement
Chemotaxis	Phagocytosis	
Chemokine	Phagosome	
Opsonin	Pus	
Opsonization		

119. List and explain the blood components and describe the function of each.
120. Describe the lymphatic systems role in immunity.
121. Describe the different types of nonspecific immunity: racial/species, mechanical/chemical barriers, phagocytosis, inflammation, fever, complement activation, and NK cells.
122. Explain the process of nonspecific resistance (immunity) in the body.
123. List the properties of antigens; know what a hapten is.
124. Describe the importance of macrophages and cytokines (lymphokines) in specific immunity.

Adaptive, Specific Immunity and Immunization (Ch. 15)

125. Define the following terms:

Agglutination	CD receptor	Plasma cells
Allergen	Epitope	Primary response
Alloantigen	Hapten	Anamnestic (secondary) response
Anamnestic response	Major histocompatibility complex	Tolerance to self

Antigen Antigen-processing cell Antitoxin Attenuated	(MHC) Immunization Immunogen Immunoglobulin	Toxoid Vaccination Immunocompetence Seroconversion
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126. For each type of specific immunity – cell mediated immunity (CMI) and humoral (antibody mediated immunity) discuss:
- The components of the system
 - How each is formed
 - Mechanism of the system
 - The antigens each recognizes
 - How each destroy antigens
 - What occurs in the primary and secondary (anamnestic) immune responses.
127. Know the following about antibodies:
- Their structure
 - The five different types
 - Their characteristics
128. Describe an overview of the complement system is and how it assists antibodies.
129. Explain passive and acquired immunity.
130. List and explain the different types of vaccines.

Disorders in Immunity (Ch. 16)

131. Define the following terms:

Allergy Allergen Atopy Histamine Wheal Induration Graft	Allergen Hypersensitivity Sensitization Systemic anaphylaxis	Autoimmunity Immunodeficiency Hyperactivity Leukotrienes Prostaglandins Cytokines Immunotherapy
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132. Identify and distinguish between the four types of hypersensitivity. List examples of disease states for each.
133. When given appropriate information, indicate which type of hypersensitivity is involved.
134. List examples of hyp immunity and autoimmunity.
135. Explain the importance of transplant immunology.
136. Understand methods and drugs used to enhance graft acceptance.
137. Indicate the donor in each: autograft, isograft, allograft, and xenograft.
138. Understand the various forms of Immune disorders.
139. Understand the involvement of mast cells and basophils in anaphylaxis.
140. Explain the relationship between the development of AIDS and the decline of cell-mediated immunity. In addition, explain why antibody-mediated immunity may also be altered.
141. Discuss, in general, transplant rejection.

Diagnosing Infections (Ch. 17) – most of this will be addressed in the laboratory course.

142. Describe the principle of the following serology tests: agglutination, precipitation, enzyme-linked immunosorbent assay (ELISA), monoclonal antibodies, hybridoma, gene probe, and polymerase chain reaction (PCR). Describe agglutination and precipitation reactions. Explain how a titer is determined.
143. Briefly explain protein electrophoresis and monoclonal antibody production.
144. Other serology test will be discussed and used in the laboratory.

The Cocci of Medical Importance (Ch. 18)

145. List four genera that are sometimes referred to as pyogenic cocci.
146. Recognize and explain the characteristics of Staphylococci.
 - Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses
147. Recognize and explain the characteristics of Streptococci and Related Genera
 - Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses
148. Recognize and explain the characteristics of the Gram-Negative Cocci
 - Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses
149. Analyze case studies.

The Gram-Positive Bacilli of Medical Importance (Ch. 19)

150. Recognize and explain the characteristics of Gram-Positive Spore Forming Bacilli.
 - Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic

- Toxigenic
 - Clinical concerns
- Host defenses
- 151. Recognize and explain the characteristics of Gram-Positive Regular Non-Spore-Forming Bacilli (e.g., *Listeria monocytogenes*).
 - Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses
- 152. Recognize and explain the characteristics of Gram-Positive Irregular Non-Spore-Forming Bacilli (e.g., *Corynebacterium diphtheriae*, *Mycobacterium spp*, and *Nocardia spp.*).
 - Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses

The Gram-Negative Bacilli of Medical Importance (Ch. 20)

- 153. Recognize and explain the characteristics of Aerobic Gram-Negative Nonenteric Bacilli.
 - Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses
- 154. Recognize and explain the characteristics of Family Enterobacteriaceae.
 - Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous

- Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses
155. Recognize and explain the characteristics of Oxidase-Positive Pathogens in Family Pasteurellaceae.
- Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses

Miscellaneous Bacterial Agents of Disease (Ch. 21)

156. Recognize and explain the characteristics of the Spirochetes.
- Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses
157. Recognize and explain the characteristics of Curviform (vibrios) Gram-Negative Bacteria and Enteric Diseases.
- Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses
158. Recognize and explain the characteristics of Cell-Wall Deficient Bacteria.
- Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous

- Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses
159. Recognize and explain the characteristics of Bacteria in Dental Disease.
- Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses

The Fungi of Medical Importance (Ch. 22)

160. Recognize and explain the characteristics of Medically Important Fungi.
- Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical mycoses
 - Cutaneous and Subcutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses
161. Identify the role fungi play in allergies.
162. . Recognize and explain the characteristics of Mycotoxicosis.
- Habitat
 - List the most important toxins and explain the following
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Host defenses

The Parasites of Medical Importance (Ch. 23)

163. List three factors that influence parasitic disease
164. List of the percent of infectious diseases caused by parasites.
165. Recognize and explain the characteristics of Protozoan Pathogens.
- Habitat
 - List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic

- Toxigenic
 - Clinical concerns
- Host defenses
- 166. Recognize and explain the characteristics of Helminth Parasites (e.g., Nematodes and Cestodes).
- Habitat
- List the most important human pathogens and explain the following:
 - Growth and physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
- Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
- Host defenses
- 167. Name common arthropods that are biological vectors of disease.
- Identify the following
 - Habitat
 - Transmission process
 - Etiologic agents/diseases transmitted

Introduction to Viruses That Infect Humans: The DNA Viruses (Ch. 24)

- 168. Explain the following with reference to viral disease
 - Target cells
 - Scope of infection
 - Viral persistence, latency, and oncogenicity
 - Teratogenicity and congenital defects
 - Diagnosis methods
- 169. Recognize and explain the characteristics of enveloped DNA viruses.
 - Habitat
 - List the most important human pathogens and explain the following:
 - Physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses
- 170. Recognize and explain the characteristics of Nonenveloped DNA viruses.
 - Habitat
 - List the most important human pathogens and explain the following:
 - Physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses

The RNA Viruses That Infect Humans (Ch. 25)

171. Recognize and explain the characteristics of Enveloped Single-Stranded RNA Viruses.
 - Habitat
 - List the most important human pathogens and explain the following:
 - Physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses
172. Recognize and explain the characteristics of Human Immunodeficiency Virus (HIV).
 - Habitat
 - List the most important human pathogens and explain the following:
 - Physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis (including stages of disease)
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses
173. Recognize and explain the characteristics of Poliovirus or Poliomyelitis.
 - Habitat
 - List the most important human pathogens and explain the following:
 - Physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses
174. Recognize and explain the characteristics of Hepatitis A.
 - Habitat
 - List the most important human pathogens and explain the following:
 - Physiological characteristics
 - Virulence factors
 - Epidemiology and Pathogenesis
 - Treatment and Prevention
 - Scope of clinical disease
 - Cutaneous
 - Systemic
 - Toxigenic
 - Clinical concerns
 - Host defenses

175. Identify diseases associated with prions and explain the following:

- Transmission and epidemiology
- Diagnosis
- Prevention and treatment

Emerging and Reemerging Infectious Diseases (chapters vary)

176. For the following emerging and reemerging infectious diseases (not all are identified here) identify the etiologic agent, transmission, clinical manifestations, and treatment:

- Acquired immune deficiency syndrome (AIDS)
- Lyme disease
- Mad cow disease (or bovine spongiform encephalopathy-BSE)
- Severe acute respiratory syndrome (SARS)
- Cholera
- Tuberculosis
- West Nile fever
- Identify the microorganisms and/or microbial toxins that can be used as bioterrorism agents to cause the following diseases in humans:
 - Anthrax
 - Smallpox
 - Plague
 - Tularemia

177. Understand the following about bioterrorism agents identified above:

- Portal of entry (most likely)
- Initial treatment methods
- Prevention methods