

# Microbiology Lecture Course Syllabus & Objectives

BIOL 207 • Muskegon Community College • Life Science Department



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**Course Description:** **BIOL 207 Microbiology Lecture (3 credit course, 3 contact hours/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 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 included.

**NOTE: Weekly online work is required.**

**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:** See current course schedule for Muskegon Community College (MCC).

**Material:**

1. Talaro, Kathleen P., Chess, B., **Foundations in Microbiology**, 8<sup>th</sup> Ed. (ISBN: 978-0-07-337529-8; MHID: 0-07-337529-2), also need CONNECT access if not included. Subject to change.
2. D. Howell, **BIOL 207 Lecture Supplement**, current semester's edition (MCC Bookstore).
3. ParScore sheets (form no. F=3652-PAR-L) – 8 forms (protect from bending)
4. Other: colored pencils, note paper, pencils...

**Technology Requirements\*:**

1. Computer with speakers and high speed internet access,
2. Computer operating system– Windows or Macintosh OS,
3. Web browser– FireFox or compatible with MCC's Learning Management System (LMS),
3. Microsoft Word or compatible software,
4. Microsoft PowerPoint or PowerPoint Viewer (free viewer – [www.microsoft.com/downloads](http://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 assignment due dates are met.**

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

**Student Responsibilities**

You are responsible for submitting course assignments on the due date. Read through the course policies set forth below:

- **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 work will not be accepted and a grade of zero will be given**, this includes quizzes, homework, and other assignments. **A missed exam** requires a call to the instructor on the test day or earlier with a valid excuse (*i.e., illness, funeral...*). **Only one exam** may be made-up per semester when an excused absence is granted. Missed exams must be made up within 48 hours.
- **Two Unexcused Absences result in withdrawal from the course, following MCC's guidelines.** This is defined by either one week of inactivity on MCC's LMS or two missed assessments (whichever comes first). **Withdrawing is the responsibility of the student.** Failure to follow these guidelines will result in a course grade of "E".
- **Cell phones** must be turned off during all assessments and course sessions.
- **Testing Procedures:** Assessments are given either in a classroom setting (on campus sections) or an instructor approved Testing Center (for online sections predominantly). A photo identification card and test response sheet is required at the time of the assessment.
- **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, both in the deleted file folder, and junk mail. Once a mailbox is full, it will no longer accept new mail.
- **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](http://www.albion.com/netiquette/corerules.html). In the event of academic dishonesty (consists of cheating and plagiarism as defined in the MCC 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).

**Lecture Format:**

Methods of instruction include, but are not limited to- lecture presentations, textbook assignments, class discussions, case history analyses, projects/paper assignments, and self-study units.

Assessment	Weighted %	Assessment Site
Assignments (worksheets, case studies, papers, quizzes...)	~15%	TBD
Online homework	~10%	TBD
Five Proctored Lecture Examinations	~75%	TBD

**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:** Will be made available online.

**Posting of Grades:** All quiz scores will be posted within a three day period following the assessment.  
Exam scores will be posted within a five day period following the assessment.  
Other assessment scores will be posted as announced by the instructor.

**Review/Study  
Guidelines:**

- 1) Complete all **assignments on time and review repeatedly through the unit/module.**
- 2) 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. IF THIS IS A DOUBLE-PACED COURSE YOU WILL NEED TO INCREASE THE TIME BY A FACTOR OF TWO.**
  - 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.
- 3) 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*.
- Please review the following **Netiquette link:** [www.albion.com/netiquette/corerules.html](http://www.albion.com/netiquette/corerules.html).

**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. Contact must be made during or before the first week of the course (contact your instructor also).

#### Course Website

Complete prior to the first day of class:

1. <https://blackboard.muskegoncc.edu/> or [www.muskegoncc.edu](http://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 the "welcome announcement".
5. Complete:
  - a. Course orientation material,
  - b. Initial assignment.
6. You must complete course work weekly in order to remain in this course (see student responsibilities prior to this section).

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

#### PEER CONTACT INFORMATION

Student Name	Telephone	Email

#### AVAILABILITY OF STUDENT PAPERS:

1. Exams/assignments are available for review for a one week period following the posted assessment grade date. Student exams are the property of MCC.
2. **All student papers will be available for review for up to two weeks** beyond the semester. Student papers will be destroyed following the stated review period.

## BIOL 207 Lecture Schedule

NOTE: A syllabus with due dates will be posted on Blackboard.

Units	Dates	Topics (specific information is listed on Blackboard)	Assignments
<b>PRE-class work</b>	<b>Prior to Class</b>	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)
<b>I*</b>	TBD – Approximately two and one-half weeks during a regular semester.	Main Themes of Microbiology; Prokaryotes vs. Eukaryotes; Microbial Growth and Nutrition. <b>Exam I (date: TBD).</b>  NOTE: Other assessments may also be required.	Ch. 1 (pp 1-23) Ch. 4 (pp 89-117) Ch. 5 (p 135) Ch. 7 (pp 185-213)
<b>II*</b>	TBD – Approximately two and one-half weeks during a regular semester.	Microbial Metabolism and Genetics. Metabolism Worksheets. Review the following material in addition to the assigned material: Ch. 2 and Ch. 8 (pp216-225). <b>Exam II (date: TBD).</b>  NOTE: Other assessments may also be required.	Ch. 8 (pp 217-246) Ch. 9 (pp 255-285) Ch. 10 (pp 301-306)
<b>IIIa*</b>	TBD – Approximately two and one-half weeks during a regular semester.	Fungi, Protists, Helminths and General Information about Viruses. Case Studies. <b>Exam III (date: TBD).</b>  NOTE: Other assessments may also be required.	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)
<b>IIIb*</b>	TBD – Approximately one week during a regular semester.	Viral Diseases. <b>Online Blackboard Quiz</b>	Ch. 24 (pp 724-744) Ch. 25 (pp 748-752, 754-771, and 773-778)
<b>IV*</b>	TBD – Approximately three weeks during a regular semester.	Infection and Disease; Immunity (Innate and Specific). <b>Exam IV (date: TBD).</b>  NOTE: Other assessments may also be required.	Ch. 13 (pp 386-415) Ch. 14 (pp 425-448) Ch. 15 (pp 452-480) Ch. 16 (486-497 and 501-513)
<b>Va*</b>	TBD – Approximately two days during a regular semester.	Antimicrobial Control. <b>Online Quiz</b> – use MCC's LMS.	Ch. 12 (pp 352-381)
<b>Vb*</b>	TBD – Approximately two weeks during a regular semester.	Bacterial Diseases. <b>Exam V (date: TBD).</b>  NOTE: Other assessments may also be required.	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 for the module (e.g., case studies, worksheets, papers, and quizzes).

\*\*Testing site will be announced by the instructor. If it is MCC's Testing Center, you will need to call (231-777-0394) to schedule an appointment for the stated exam day.

**MCC's 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*, 8<sup>th</sup> Ed.)

Below is a list of objectives for Biology 207. Students are responsible for these objectives on assessments. 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 Bioremediation Genetic engineering Microbiology Microorganisms or microbes Bacteria Viruses Fungi Protozoa Algae Macroscopic Immunology Epidemiology	Biotechnology Prokaryote Eukaryote Parasite Host Spontaneous generation (abiogenesis) Biogenesis Scientific method Hypothesis Theory Aseptic technique Nomenclature Taxonomy	Domain Kingdom Phylum Division Class Order Family Genus Species Binomial scientific name Morphology Eukarya Eubacteria Archaea
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2. List the types of microbes studied in a microbiology course.
3. Analyze the role microbes play in the functioning of the earth's ecosystems.
4. List ways in which microbes help solve environmental, agricultural, and medical problems through the use of biotechnology, bioremediation, and genetic engineering and recombinant DNA.
5. Summarize the role of infectious diseases and the human condition with regards to emerging and re-emerging diseases.
6. 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.
7. Differentiate spontaneous generation (abiogenesis) from biogenesis. Examine why spontaneous generation impeded the development of microbiology, and describe experiments that support and contradict this.
8. Justify the statement that contributions from Leeuwenhoek, Pasteur, and Koch aided the development of microbiology as a science.
9. 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 Amino acid Protein Nitrogen base Covalent bond Ionic bond Oxidation Hydrogen bond Synthesis reaction Cation	Inorganic compounds Monosaccharide Lipid Phospholipid Peptide Polar Reactant Disaccharide Triglyceride Cholesterol	Hydrolysis reaction Peptide bond Enzyme substrate Nucleotides Electrolyte Reversible reaction Functional groups Polysaccharide Fatty acid
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anion Ion	Polypeptide Deoxyribonucleic acid Adenosine triphosphate	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 (basic/cationic and negative/anionic).
  - b. Differential (compound).
  - c. Gram.
  - d. Acid-fast.
  - e. Flagella.
  - f. 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	Inclusion bodies	Spirillum (pl: spirilla)
Lophotrichous	nucleoid	Spirochete (pl: spirochetes)
Amphitrichous	Endospores	Pleomorphism
Peritrichous	Sporangium	Diplococcus (pl: diplococcus)
Chemotaxis	cortex coat	Staphylococcus (pl: staphylococci)
Conjugation	prospore	Streptococcus (pl: streptococci)
Cell envelope	Dipicolinic acid	Tetrad (pl: tetrads)
Glycocalyx	Vegetative cycle	sarcina (pl: sarcinae)
Encapsulated	Germination	Aerobic
Endotoxin	Sporulation	Anaerobic
plasmids	Spore (free spore)	Facultative

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 non-cellular infectious 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	Alkalinophiles
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, and others as instructed.

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, and other as directed.

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 end products 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).
  - Distinguish among F<sup>+</sup>, F<sup>-</sup>; and Hfr cells.
  - 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	Gene probes	Gene therapy
Biotechnology	Polymerase chain reaction	Gene mapping
Gel electrophoresis	Primers Recombinant DNA	DNA fingerprinting
Hybridize	technology	Bioethics
Ligase		
Reverse transcriptase		

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	Narrow spectrum	Interferon
Prophylaxis	Broad spectrum	Allergy
Chemotherapy	Selectively toxic	Biota
Antimicrobial	Drug resistance	Superinfection
<i>Antibiotic</i>	Beta-lactamase	Toxicity
Synthetic		Chemotherapeutic drug

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

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 (MHC)	Tolerance to self
Antigen	Immunization	Toxoid
Antigen-processing cell	Immunogen	Vaccination
Antitoxin	Immunoglobulin	Immunocompetence
Attenuated		Seroconversion

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, five different types, and general 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	Autoimmunity
Allergen	Hypersensitivity	Immunodeficiency
Atopy	Sensitization	Hyperactivity
Histamine	Systemic anaphylaxis	Leukotrienes
Wheal		Prostaglandins
Induration		Cytokines
Graft		Immunotherapy

132. Identify and distinguish between the four types of hypersensitivity. List examples of disease states.

133. When given appropriate information, indicate which type of hypersensitivity is involved.

134. List examples of hypimmunity 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and clinical concerns
  - Host defenses
154. Recognize and explain the characteristics of Family Enterobacteriaceae.
  - Habitat
  - List the most important human pathogens and explain the following:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical mycoses
    - Cutaneous, subcutaneous, systemic, toxigenic, and 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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:
    - Physiological characteristics, virulence factors, epidemiology and pathogenesis, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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, and treatment and prevention
  - Scope of clinical disease
    - Cutaneous, systemic, toxigenic, and 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, and treatment and prevention
- Scope of clinical disease
  - Cutaneous, systemic, toxigenic, and 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, and 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

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