

BIO K235: Microbiology, Fall 2014
Three Rivers Community College, Norwich, CT
Instructor: Sarah B. Selke, Ph.D.
Office Hours (C214): Mondays 1 – 3pm, Fridays 10 – 11 am
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Required Text:

Prescott's Microbiology, 9th edition, Willey, Sherwood, and Woolverton, McGraw Hill

Required Lab Materials:

disposable gloves (non-latex), full length lab coat with long sleeves and cuffs (ex. Landau – style number 3178), coat hanger, safety goggles

Course Prerequisites:

BIO 121 and CHE 111 or CHE 121, all courses passed with a “C” grade or better; or permission of the instructor. BIO 122 is recommended.

Course Description:

This course covers a comprehensive study of microorganisms. Topics covered will include the basic characteristics, morphology, physiology, growth, reproduction, and genetics of bacteria, as well as a brief taxonomical survey of the following microbial life forms Archaea, Eubacteria (including cyanobacteria, mycoplasmas, rickettsia and chlamydia), Fungi, Protists and Viruses. Emphasis will be on species that affect humans.

Laboratory activities will include various techniques of staining, culturing, and isolating bacteria. The morphology and metabolic processes of select microbial groups will be studied. Students will learn to apply various modern biological techniques that are used for controlling the growth of microbes, and to identify unknowns.

This course is four credits, and meets for three hours of lecture and three hours of lab each week.

This course is a web-enhanced course, which means that some required activities are conducted online in our Blackboard Learn course shell. Blackboard can be accessed through <http://my.commnet.edu/>. There are two course shells associated with this class, one for lab and one for lecture. **All online course information is in the lecture shell.**

General Course Objectives:

To aid the student in developing an understanding of life processes of microorganisms

To aid the student in developing an understanding of the effect, both positive and adverse, that microorganisms have on our daily lives

To provide a useful body of knowledge for students studying all areas of biology, environmental science, food science, nutrition, nursing, dental hygiene & medical technology

A complete listing of covered concepts is attached.

Attendance Policy:

Attendance at all class sessions is required. If a class is missed due to circumstances beyond your control, please be sure to notify your instructor and make the necessary arrangements **with a classmate** for obtaining the notes. **You will be responsible** for the material.

Lab exercises or lab work that uses live bacteria cannot be made up for any reason.

Electronic devices (cell phones, pagers etc.) will be put in “Silent Mode” or turned off while class is in session.

Grading Overview:

Your grade is based on a 1000-point scale.

Assignments = 100 points
In-class quizzes = 125 points
Unit tests = 375 points
Lab Practicals = 200 points
Final Exam = 200

No individual extra assignments will be given.

- **Tests & Final**

There are three unit tests worth 125 points for a total of 375 points. **A #2 pencil is required for each exam.** This item will not be supplied in class.

The final exam is worth 200 points. **The final exam is cumulative.** The final exam is scheduled for Wednesday, December 17th during your normal lab time. The final exam must be taken to pass this course

3 units tests = 375 points (125 points each)
1 final @ 200 points = 200 points
Total = 575 points

- **Lab Practicals (200 points)**

There are two lab practicals. Each lab practical will consist of a written section and hands-on section in the lab. Further information about the lab practicals will be given in lab.

2 lab practicals x 100 points each = 200 points

- **Assignments (100 points)**

There are four assignments, worth 25 points each. The Pre-Test is the first assignment. The remaining three assignments will be assigned over the course of the semester.

- **In-class quizzes (125 points)**

There will be a minimum of six quizzes worth 25 points each. Only the highest five quiz grades will be counted in your final grade.

How to calculate your grade:

To determine your grade, I suggest creating 2 columns of scores. The first is the number of points each assignment is worth; the second is the points you earned on that assignment. To determine your grade, add up each column and divide **your points** by the **total points**.

A partial example:

Points assignment is worth	Points I earned
25 (quiz)	20
125 (test)	110
Total = 150	Total = 130

$$130/150 = 0.87 = 87\% = B$$

Make-ups:

Make-up exams will be granted on an individual basis only following a conference with the instructor. **All make-up tests must be completed within a week of the original exam date.** Please be aware that the format of any makeup exam is at the discretion of the instructor. The format could be the same, oral, essay or other, depending on the circumstances. It will not be the same exam taken by the rest of the students in the class.

Due to scheduling issues, it is unlikely that a missed lab can be made up. **There will be no make-ups for the Lab Practicals.**

Final Grade:

93.5-100.0 = A	77.5-79.4 = C+
89.5-93.4 = A-	73.5-77.4 = C
87.5-89.4 = B+	69.5-73.4 = C-
83.5-87.4 = B	63.5-69.4 = D+
79.5-83.4 = B-	59.5-63.4 = D
	00.0-59.4 = F

College Withdrawal Policy:

The last day to withdraw is **December 8th**. Students who do not withdraw but stop attending class **will receive** a grade of "F" for the final grade. **Verbal withdrawals cannot be accepted.**

Accommodations for Disabilities:

If you need assistance or modification of class procedure owing to any type of disability, please let me know so that arrangements for accommodation can be made. In order to receive accommodations, you must register with Chris Scarborough, learning specialist at 860-823-2985 or a counselor in the Student Services Development Center.

Academic Misconduct:

Academic dishonesty and plagiarism will not be tolerated. Plagiarism, cheating, or any form of academic dishonesty is **prohibited**. Plagiarism includes any instance of copying words or ideas from another person (ie. another student, author of a book, internet resource etc.) without properly acknowledging the source. Students guilty of academic dishonesty directly or indirectly will receive a **zero** for an exercise or exam and may receive an **F** for the course in addition to other possible disciplinary sanctions that may be imposed through the regular institutional procedures.

Blackboard Learn & your TRCC email address:

Your Blackboard Learn courses are automatically connected to your college-provided email account. For more information about this email account, visit the college home page and click the "New student email" button. This email account is the only official electronic means that the college will communicate course and non-emergency information to you. Make sure that you check it weekly at a minimum. Another option is to set up to forward your email from the college address to your preferred address. **Important class information is frequently communicated through the Blackboard Learn email function.**

myCommNet Alert:

myCommNet Alert is a system that sends text messages and emails to anyone signed up in the event of a campus emergency. Additionally, TRCC sends messages when the college is delayed or closed due to weather. All students are encouraged to sign up for myCommNet Alert. A tutorial is available on the Educational Technology and Distance Learning Students page of the web site.

http://www.trcc.comnet.edu/div_it/educationaltechnology/Tutorials/myCommNetAlert/MIR3.html

Digication:

As a student you will maintain an online learning portfolio using a college-designed template in Digication. Through this electronic tool you will have the opportunity to monitor your own growth in college-wide learning. It may even help you determine a major that is best suited to you. You will be able to keep and maintain your learning portfolio after graduation. A Three Rivers General Education Assessment Team will select and review random works to improve the college experience for all. If your work is selected and reviewed for assessment purposes, it will remain anonymous and private. Digication provides a "place" where you will connect your learning from the classroom, college, and life in general. Sometimes when you review all of the work you have done and think about it, you end up learning something different and perhaps unexpected. Please review your course outlines to determine what assignments to upload into the TRCC Digication template and please post your own choices, as well. Have fun in learning!

BIO 235 Microbiology Lecture Schedule*
Professor Sarah Selke, Fall 2014

Date	Topic	Textbook Chapters
W 8/27	Introduction to Microbiology & Review	1, 5
M 9/1	NO CLASS Labor Day	
W 9/3	Protists	25
M 9/8	*1 Fungi	26
W 9/10	Bacterial Cell Structure	3
M 9/15	*2 Bacterial Cell con't, Microbial Growth	3, 7
W 9/17	Microbial Growth	7
M 9/22	*3 Microbial Growth, Metabolism and Enzymes	7, 10, 11, 12
W 9/24	Microbial Metabolism	10, 11, 12
M 9/29	TEST 1	
W 10/1	Microbial Metabolism wrap-up Genetics	10, 11, 12 13 – 18
M 10/6	*4 Genetics	13 – 18
W 10/8	Taxonomy of Bacteria	19 – 24 26 28 – 32 40 – 43
M 10/13 (Columbus Day)	*5 Taxonomy of Bacteria con't	See above
W 10/15	Taxonomy of Bacteria con't	See above
M 10/20	*6 Taxonomy of Bacteria con't	See above
W 10/22	Viruses	6
M 10/27	TEST 2	
W 10/29	Control of Microbial Growth and Activity	8, 9
M 11/3	Control of Microbial Growth and Activity con't	8, 9
W 11/5	*7 Control of Microbes con't Nosocomial Infections	8, 9 pg 841– 843
M 11/10	Nosocomial Infections con't Host-Microbe Interactions	pg 808– 812 32, 37
W 11/12	Host-Microbe Interactions	32, 37
M 11/17	*8 Defenses Against Disease	32, 37
W 11/19	Defenses Against Disease	33, 34, 35

M 11/24	*9 Airborne Diseases	33, 34, 35
W 11/26 (day before T-day)	Airborne Diseases con't	37, 38, 39
M 12/1	Airborne Diseases con't Food and Waterborne Diseases	37, 38, 39 40, 41
W 12/3	TEST 3	
M 12/8	Food & Waterborne Diseases	see above
W 12/10	STDs, skin disorders Disease Acquired via Vectors	37, 38, 39
M 12/15	Catch-up & Review	
W 12/17	FINAL EXAM	

* This schedule is tentative. Any and all changes will be announced in class.

BIO 235 Microbiology Lab Schedule* (A211)
Professor Sarah Selke, Fall 2014

Date	Topic	Textbook Chapters
W 8/27	Laboratory Safety & Procedures Lecture: Microscopes & Microscopy	2
W 9/3	Care and Use of the Microscope	
W 9/10	Microscopic Observation & Identification of Various Microbial Groups	25, 26
W 9/17	Microscopic Observation & Identification of Various Microbial Groups	25, 26
W 9/24	Isolation Techniques (**)	
W 10/1	Bacterial Transformation**	16.7, 17.5
W 10/8	LAB PRACTICAL 1 DNA Analysis preparation	
W 10/15	DNA Analysis	
W 10/22	Cultural Characteristics Simple & Gram Staining Techniques	pg 32 – 34, 59 – 60
W 10/29	Gram Staining Techniques	
W 11/5	Gram Staining Techniques	
W 11/12	Microbial Metabolic Test** Lecture	
W 11/19	Acid-fast, Capsule & Endospore Staining Techniques	
W 11/26 (day before T-day)	No Lab	
W 12/3	Microbial Sensitivity Test** Lecture	9.3
W 12/10	LAB PRACTICAL 2	
W 12/17	FINAL EXAM	

* This schedule is tentative. Any and all changes will be announced in class.

** Requires students to return to lab in 24 hours to observe the results of the experiment.

Specific Course Objectives:

After completion of this course, the student will be able to

1. develop critical thinking skills and learn to develop sound scientific conclusions by the analysis of scientific data.
2. demonstrate knowledge of the scientific method through examples.
3. understand the scope of microbiology as it relates to other fields of science.
4. list and explain the characteristics of life shared by all living organisms.
5. demonstrate an understanding of the general characteristics of various microbial life forms especially bacteria.
6. demonstrate knowledge of the characteristics used in the classification of microorganisms.
7. develop an understanding of microscopes, microscopy, and the microbial world.
8. explain in detail the differences between prokaryotic and eukaryotic cells.
9. identify the major morphological characteristic of bacteria cells.
10. name the various structures of a bacteria cell and describe their functions.
11. list and describe in detail the energy requirements, electron or hydrogen requirements, and carbon requirements for the growth and cultivation of bacteria.
12. describe in detail all of the nutrient requirements for the growth and cultivation of bacteria and discuss the different nutritional types of bacteria.
13. list and explain the physical conditions required for the growth and cultivation of bacteria.
14. understand and demonstrate the procedures for cultivating microorganisms and the problems associated with cultivation.
15. demonstrate knowledge of the various reproductive processes of bacterial cells, and explain in detail the phases of growth in bacterial cells.
16. list the different categories of culture media and describe the use of each type of media in the cultivation of bacteria.
17. describe and demonstrate several pure culture techniques.
18. give the principal properties of enzymes and summarize their chemical make-up.
19. describe how enzymes function and list factors that affect enzymatic activity.
20. name the major classes of enzymes and describe their action.

21. demonstrate knowledge of the photosynthetic process including photophosphorylation, the Calvin-Benson cycle, and the chemiosmotic theory.
22. explain the differences in the photosynthetic process in algae, cyanobacteria, and bacteria.
23. demonstrate knowledge of chemical energy and the respiratory process in bacteria, including the Embden-Meyerhof, Pentose Phosphate, and the Entner-Doudoroff pathways of glucose catabolism, the Krebs's cycle and the electron transport system.
24. demonstrate knowledge of anaerobic metabolism in bacterial cells and describe various fermentation pathways used by different species of bacteria.
25. develop an understanding of the biosynthesis of proteins in bacteria.
26. describe DNA and RNA and explain their role in bacterial genetics.
27. describe various forms of modification in the genetic make-up of bacterial cells.
28. define mutation, list the various types of mutations and describe their effects on bacterial cells.
29. demonstrate knowledge of the taxonomy of bacteria.
30. explain the characteristics and the taxonomy of fungi, algae, protozoans, and viruses.
31. define and/or explain in detail the terms of microbial control.
32. describe the processes involved in controlling the growth and activities of microorganisms by antimicrobial agents.
33. outline the action and limitations of chemical and physical agents used in the control of microbes.
34. list the major classes of chemical agents used to control microbes, give specific examples of the classes of chemicals, and describe the mode of action of specific chemical agents, as well the limitations of their use.
35. differentiate between synthetic drugs and antibiotics as chemotherapeutic agents used to treat infections. Name the biological source of specific antibiotics, the spectra of organisms that they affects, and the mode of action.
36. demonstrate knowledge of nosocomial infections and describe their sources.
37. list the most common nosocomial infections and the most frequently isolated organism(s) that cause(s) that infection
38. explain the types of patients that have the greatest risk for developing nosocomial infections and why they are at such high risk
39. describe infection control and prevention in the clinical environment.

40. demonstrate knowledge of the normal flora in various anatomical areas of the human body and describe host-microbe interactions.
41. discuss in detail Koch's postulates in relationship to diseases.
42. list the portals of entry of microbes into the human body and explain in detail how microbes breach the portals.
43. list and discuss the invasive methods of bacteria and other microbes.
44. explain how microbes produce diseases.
45. list and explain the stages of infection and illness.
46. list and describe in detail the methods of non-specific resistance to diseases and infections (innate immunity).
47. describe the major features of acquired or adaptive immunity.
48. explain in detail the role of T-lymphocytes and B-lymphocytes in acquired immunity.
49. list the major classes of immunoglobulins (antibodies) and describe their role in immunity.
50. list the different types of humoral antibodies and explain their function.
51. describe the major events that occur during the primary and secondary immune responses.
52. describe the different types of immunity (i.e. naturally acquired passive immunity, naturally acquired active immunity, artificially acquired active immunity, artificially acquired passive immunity).
53. demonstrate knowledge of diseases caused by microorganisms (bacteria, fungi, viruses, and protozoans) by portal of entry, and how these infectious agents damage the body.
54. discuss how infectious diseases of the human body are treated and/or prevented.
55. develop an understanding of the importance of soil, water, food, medical, and industrial microbiology.

Specific Laboratory Objectives:

After completion of this laboratory component of this course, the student will be able to

1. list and describe the proper use of all safety equipment and devices used in this microbiology lab, as well as follow all safety precautions while working in the microbiology laboratory.
2. list and describe the use of various types of microscopes as they relate to the study of microbiology.

3. name all of the parts of a bright field compound light microscope and describe the function of each part.
4. demonstrate proper technique for using the microscope in a microbiology laboratory.
5. demonstrate the ability to use the microscope as a vital instrument for gathering data by direct observation.
6. describe and identify various microbial life forms by studying the unique morphological differences via direct observation using a microscope.
7. demonstrate the ability to perform and correctly interpret the results of the following laboratory procedures: isolation techniques, transformation of *E. coli*, DNA restriction analysis, microbial metabolic tests, and microbial sensitivity tests.
8. name the major classes of staining procedures, give examples of specific stains within each class, and describe the purpose of each specific staining procedure.
9. demonstrate the ability to carry out various staining procedures and correctly interpret the results
10. demonstrate the ability to use learned laboratory skills and critical thinking skills to identify unknown bacterial samples.

Topic Outline

UNIT 1

- I) Introduction
 - A) Critical thinking and the scientific method
 - B) Characteristics of life
 - C) Prokaryotic and Eukaryotic cells
 - D) Groups of microorganisms
 - 1. Monera (Procaryotae)
 - a) Archaea
 - b) Eubacteria
 - 1) Cyanobacteria (blue-green algae)
 - 2. Protistae
 - a) Algae
 - b) Protozoans
 - c) Slime molds
 - 3. Fungi
 - 4. Acellular (non-cellular) organisms (viruses)

- II) Characteristics and Classification of Microorganisms
 - A) Characteristics
 - 1. Morphological
 - 2. Chemical composition of the cell wall
 - 3. Cultural
 - 4. Metabolic
 - 5. Genetic
 - 6. Antigenic
 - 7. Ecological
 - 8. Pathological
 - B) Classification
 - 1. Species, Genus, Family, Order, Class, Phylum, Kingdom
 - 2. Scientific nomenclature – Binomial system of nomenclature

- III) Bacterial Morphology
 - A) Shape
 - 1. Spherical (Round) - coccus, cocci
 - a) Arrangements
 - 1) Diplo-
 - 2) Strepto-
 - 3) Staphylo-
 - 4) Tetra-
 - 5) Sarcina
 - 2. Cylindrical (Rod-like) - bacillus, bacilli
 - a) Arrangements
 - 1) By growth characteristics – Diplo- / Strepto-
 - 2) By morphology – Palisade
 - 3. Spiral - spirillum, spirilla

- B) Size
- C) The Anatomy of Bacteria Cells
 - 1. Bacterial Integuments
 - a) Capsules
 - b) Cell wall
 - 1) Protoplasts
 - 2) Spheroplasts
 - 2. Cell membrane (protoplasmic or cytoplasmic membrane)
 - 3. Bacterial Appendages
 - a) Flagella
 - 1) Monotrichous
 - 2) Amphitrichous
 - 3) Lophotrichous
 - 4) Peritrichous
 - 5) Periplasmic
 - b) Pili – Fimbriae / Sex pili
 - 4. Bacteria cytoplasm
 - 5. Bacterial cellular organelles
 - a) Mesosomes
 - b) Ribosomes
 - c) Inclusion bodies
 - d) Vacoules
 - e) Bacterial nucleus
 - f) Endospores

IV) Bacterial Cultivation

- A) Nutritional Requirements
 - 1. Energy requirement
 - a) Phototrophs
 - b) Chemotrophs
 - 2. Source of electrons or hydrogen
 - a) Lithotrophs
 - b) Organotrophs
 - 3. Carbon requirement
 - a) Autotrophs
 - b) Heterotrophs
 - 4. Nutritional types
 - a) Photolithotrophic autotrophs (Photoautotrophs)
 - b) Photolithotrophic heterotrophs
 - c) Chemolithotrophic autotrophs (Chemoautotrophs)
 - d) Photoorganotrophic heterotrophs (Photoheterotrophs)
 - e) Chemoorganotrophic heterotrophs (Chemoheterotrophs) (Heterotrophs)
 - f) Mixotrophic bacteria
 - g) Mutant forms
 - 1) prototrophs
 - 2) auxotrophs
 - 5. Elements and Compounds
 - a) Nitrogen
 - b) Sulfur
 - c) Phosphorus

- d) Sodium
 - e) Calcium
 - f) Iron
 - g) Potassium
 - h) Magnesium
 - i) Trace elements
 - 1) Zinc, Copper, Cobalt, Manganese
 - j) Vitamins
 - k) Amino acids
 - l) Purines and Pyrimidines
 - m) Water
- B) Bacteriological Media
1. Nutrient agar and broth
 2. Enriched media
 3. Selective media
 4. Differential media
 5. Assay media
 6. Media for the enumeration of bacteria
- C) Physical Requirements
1. Temperature
 - a) Psychrophiles
 - b) Mesophiles
 - c) Thermophiles
 - 1) Eu-thermophiles
 - 2) Facultative thermophiles
 - 3) Steno- or extreme thermophiles
 2. Gaseous requirement
 - a) Aerobic
 - b) Microaerophiles
 - c) Anaerobic
 - 1) Non-stringent or Non-strict anaerobes (aero-tolerant)(oxygen tolerant)
 - 2) Facultative anaerobes
 - 3) Stringent anaerobes or Strict anaerobes
 3. Ph requirement
 - a) Acidophiles
 - b) Neutrophiles
 - c) Alkalophiles
 4. Specific Requirements - i. e. Halophilic
- D) Reproduction Methods
1. Asexual
 - a) Fission
 - b) Budding
 - c) Sporulation
 2. Sexual Conjugation
- E) Phases of Growth
1. **Quiescent** stage
 2. **Lag** phase & transitional period
 3. **Logarithmic** or **Exponential** phase (**Log** phase)
 4. **Stationary** phase
 5. **Logarithmic** phase of decline (Death phase)

F) Colony or Cultural Characteristics

1. Abundance of growth
2. Size of the colony
3. Margin
4. Elevation
5. Pigmentation (Chromogenesis)
6. Optical features
7. Odor
8. Surface texture
9. Consistency

G) Pure Culture Techniques

1. Streak-plating technique
2. Serial-dilution technique
3. Spread-plating technique
4. Pour-plating technique
5. Chemical technique
6. Single-cell isolation technique

V) Bacterial Metabolism

A) Enzymes

1. Chemical properties
2. Characteristics and physical properties
3. Enzymatic action
4. Factors affecting enzymatic activity
5. Classification of enzymes

B) Photosynthesis

1. Oxygenic microbes
 - a) Non-cyclic photophosphorylation
2. Anoxygenic microbes
 - a) Cyclic photophosphorylation
3. The Calvin-Benson Cycle

C) Cellular Respiration

1. Glycolysis
 - a) Embden-Meyerhof pathway
 - b) Pentose-Phosphate pathway
 - c) Entner-Doudoroff pathway
2. Krebs's Cycle (TCA) (Citric acid cycle)
3. Cytochrome system – Electron transport chain (Oxidation-reduction reactions)

D) Anaerobic Metabolism

1. Glycolysis
2. Fermentation
 - a) Homofermentative bacteria and the biochemical pathway
 - b) Heterofermentative bacteria and various biochemical pathways

VI) Bacterial Genetics

A) The Bacterial Chromosome

B) Genotype

C) Phenotype

D) DNA and RNA

E) Biosynthesis

1. DNA synthesis
 - a) Mutations
 - 1) types
 - 2) rates
 2. Protein synthesis
 - a) Transcription
 - b) Translation
 3. The operon theory
- F) Genetic Modifications
1. Transduction
 2. Transformation

UNIT II

- I) Bacteriological Classification and Characteristics
- A) Taxonomy
 - B) Characteristics
 1. Morphological
 2. Chemical composition of cell wall
 3. Cultural
 - a) Energy, electron, carbon requirements
 - b) Nutrient requirements
 - c) Physical requirements
 4. Metabolic
 5. Antigenic
 6. Genetic
 - a) Low G + C
 - b) High G + C
 7. Ecological
 8. Pathological
 - C) Taxonomic Scheme
 1. Kingdom
 2. Phylum – Division – ending (phyta or a)
 3. Class – ending (etes or ae or i)
 4. Order – ending (ales)
 5. Suborder – ending (ineae)
 6. Tribe – ending (eae)
 7. Family - ending (aceae)
 8. Genus
 9. Species

Criteria used to divide bacteria into four major divisions described in *First Edition of Bergey's Manual of Systemic Bacteriology* are: 1) the presence or absence of cell walls and 2) the chemical composition of the cell walls. Bacteria have been assigned to the following four phyla.

1. *Gracilicutes*. *Gram-negative bacteria with thin cell walls containing peptidoglycan.* (Includes cyanobacteria and non – oxygenic photosynthetic bacteria.)
2. *Firmicutes*. *These bacteria are usually gram-positive with thick rigid cell walls containing peptidoglycan.* (Includes filamentous bacteria.)
3. *Tenericutes*. *Bacteria without cell walls.*
4. *Mendosicutes*. *These bacteria maybe gram-positive or gram-negative and have nonpeptidoglycan-containing cells walls.* (Archaea are the only members of the phyla.)

D) Major Groups of Bacteria

1. Phototrophic Bacteria
 - a) Non-oxygenic phototrophs
 - 1) Purple non-sulfur bacteria (Rhodospirillaceae)
 - 2) Purple sulfur bacteria (Chromatiaceae)
 - 3) Green sulfur bacteria (Chlorobiaceae)
2. Gliding Bacteria
 - a) Order Myxobacterales
 - b) Order Cytophagales
3. Sheathed Bacteria
 - a) Order Chlamydobacterales
4. Budding and/or Appendaged Bacteria
 - a) Caulobacteraceae & Hyphomicrobiaceae
5. The Spirochetes
 - a) Order Spirochaetales
 - 1) Spirochaetaceae
 - 2) Leptospiraceae
6. Spiral and Curved Bacteria
 - a) Order Spirillales
 - 1) Spirillaceae
7. Gram-Negative Aerobic Rods and Cocci
 - a) Order Pseudomonadales
 - 1) Pseudomonaceae
 - b) Order Azotobacterales
 - 1) Azotobacteraceae
 - c) Order Rhizobiales
 - 1) Rhizobiaceae
 - d) Order Methylomonales
 - 1) Methylococcaceae
 - e) Order Halobacteriales
 - 1) Halobacteriaceae
8. Gram-Negative Facultative Anaerobic Rods
 - a) Order Enterobacteriales
 - 1) Enterobacteriaceae
 - b) Order Vibrionales
 - 1) Vibrionaceae
 - c) Order Pasteurelliales
 - 1) Pasteurellaceae
 - d) Other genera not assigned to any family

9. Gram-Negative Anaerobic Bacteria
 - a) Bacteroidales
 - 1) Bacteroidaceae
10. Gram-Negative Cocci and Coccobacilli
 - a) Order Neisseriales
 - 1) Neisseriaceae
11. Gram-Negative Anaerobic Cocci
 - a) Order Veillonellales
 - 1) Veillonellaceae
12. Gram-Negative Chemolithotrophic Bacteria
 - a) Order Nitrobacterales
 - 1) Nitrobacteraceae
 - b) Bacteria that metabolize sulfur
 - c) Order Siderocapsales
 - 1) Siderocapsaceae
12. Methane-Producing Bacteria
 - a) Order Methanobacteriales
 - 1) Methanobacteriaceae
13. Gram-Positive Cocci
 - a) Micrococcaceae
 - b) Deinococcaceae
14. Gram-Positive Endospore Forming Rods and Cocci
 - a) Order Bacillales
 - 1) Bacillaceae
15. Gram-Positive Asporogenous Rod-Shaped Bacteria
 - a) Order Lactobacillales
 - 1) Lactobacillaceae
16. Other Bacteria Types
 - a) Coryneforms
 - b) Arthrobacter
 - c) Nocardioforms
 - d) Order Actinomycetales
 - 1) Actinomycetaceae
 - e) Mycobacteriaceae
 - f) Actinoplanaceae
 - g) Streptomyetaceae
 - h) Mycoplasmas
17. Bacteria-Like Microbes
 - a) Rickettsias
 - 1) General Characteristics
 - 2) Classification
 - b) Chlamydia
 - 1) General Characteristics

II) Other Microbes

A) Fungi

1. General Characteristics
2. Classification

- a) Division Gymnomycota – Slime molds

- 1) Acrasiomycetes
 - 2) Myxomycetes
 - b) Division Mastigomycota
 - 1) Chytridiomycetes
 - 2) Hypochytridiomycetes
 - 3) Plasmodiophoromycetes
 - 4) Oomycetes
 - c) Division Amastigomycota
 - 1) Zygomycetes
 - 2) Ascomycetes
 - 3) Basidiomycetes
 - 4) Deuteromycetes
- B) Algae
- 1. General Characteristics
 - 2. Classification and Specific Characteristics
 - a) Oxygen Phototrophic Bacteria (Cyanobacteria or Blue-green algae (Cyanophycophyta))
 - b) Chlorophycophyta (Green algae)
 - c) Euglenophycophyta (Euglenoids)
 - d) Xanthophycophyta (Yellow-green algae)
 - e) Pyrrophycomphyta (Dinoflagellates)
 - f) Cryptophycophyta (Cryptomonads)
 - g) Bacillariophycophyta (Diatoms)
 - h) Chrysophycophyta (Golden-brown algae)
 - i) Rhodophycophyta (Red algae)
 - j) Phaeophycophyta (Brown algae)
- C) Protozoans
- 1. General Characteristics
 - 2. Classification and Specific Characteristics
 - a) Subkingdom (Protozoa) (14 Phyla)
 - 1) Phylum Apicomplexa
 - a. Sporozoa
 - 2) Phylum Sacromastigophora
 - a. Subphylum Mastigophora (Flagellata)
 - 1a. Zoomastigophora
 - 2a. Phycomastigophora
 - b. Subphylum Sarcodina
 - 3) Phylum Ciliophora (Ciliates)
 - 4) Phylum Labyrinthomorpha
 - 5) Phylum Microspora
 - 6) Phylum Ascetospora
 - 7) Phylum Myxozoa
- D) Viruses
- 1. General Characteristics
 - 2. Structure and Composition
 - a) Capsid
 - b) Nucleic Acid Core
 - c) Envelope
 - 3. Characteristics for the classification of viruses
 - a) Examples of DNA animal viruses

- b) Examples of RNA animal viruses
- 4. Methods of cultivation
- 5. Replication
- 6. Viroids & Prions

UNIT III

- I) Control of Microorganisms
 - A) The Importance of Controlling Microbial Growth and Activity
 - B) Definition of Terms of Control
 - 1. Asepsis
 - 2. Antisepsis
 - 3. Antiseptic
 - 4. Disinfectant
 - 5. Sterilization
 - 6. Sanitizer
 - 7. Microbicides (Germicides)
 - a) Bactericidal agent
 - b) Fungicidal agent
 - c) Algicidal agent
 - d) Virucidal agent
 - e) Sporicidal agent
 - 8. Microbistasis
 - a) Bacteriostasis
 - b) Fungistasis
 - 9. Preservative
 - 10. Chemotherapeutic – Antimicrobial agents
 - 11. Death
 - a) The death rate of bacteria
 - b) Environmental factors that causes the death of microorganisms
 - C) Control of Microorganisms by Antimicrobial Agents
 - 1. Cell wall damage or inhibition of cell wall synthesis
 - 2. Cell membrane damage
 - 3. Alteration of cellular proteins and/or alteration of nucleic acids
 - 4. Inhibition of enzymatic activity
 - 5. Inhibition of nucleic acid synthesis
 - 6. Inhibition of protein synthesis
 - D) Control by Physical Agents & Their mode of action (Antimicrobial properties)
 - 1. Temperature
 - 2. Desiccation
 - 3. Osmotic pressure
 - 4. Radiation
 - 5. Ultrasonic vibrations
 - 6. Electricity
 - 7. Surface tension
 - 8. Filtration
 - E) Control by Chemical Agents
 - 1. Major groups of chemical agents & Their mode of action (Antimicrobial properties)
 - a) Phenols and phenolic compounds

- b) Alcohols
- c) Halogens
- d) Heavy metals and their compounds
- e) Acridine dyes
- f) Soaps & Detergents
- g) Ammonium compounds
- h) Aldehydes
- i) Gaseous agents
- 2. Chemotherapeutic Agents
 - a) Synthetic drugs
 - 1) Some common drugs
 - 2) The mode of action of the drugs (Antimicrobial properties)
 - b) Antibiotics
 - 1) Some common antibiotics products
 - 2) Microbial derivation
 - 3) Primary spectrum
 - 4) Mode of action (Antimicrobial properties)
- F) Control of Microorganisms in a Clinical Environment
 - 1. Nosocomial infections
 - a) The most frequent types of infections
 - b) The most frequently encountered organisms
 - c) The most at risk procedures for causing nosocomial infections
 - d) Persons at the greatest risk for developing nosocomial infections
 - 2. Methods of reducing or preventing the occurrence of nosocomial infections

II)

Microorganisms and Disease

A) Normal Flora (Microbiota)

B) Transient Organisms

C) Host-Microbe Interactions

- 1. Epidemiology
 - a) Epidemic
 - b) Endemic
 - c) Pandemic
 - d) Sporadic
- 2. Koch's Postulates and Diseases
- 3. Infection, Infestation, and Parasitism
- 4. Pathogenicity and Virulence
- 5. Portals of Microbial Entry into the Human Body
 - a) Respiratory System – Airborne
 - b) Digestive System – Food and Water Borne
 - c) Uro-genital System – Direct contact
 - d) Integumentary System – Burns, Cuts, Abrasions, Wounds, Animal bites, Vectors
- 6. Invasive Methods of Bacteria and Factors that Influence Virulence
 - a) Specific proteins in the cell wall
 - b) Capsules
 - c) Pili
 - d) Enzymes
 - 1) Leukocidins
 - 2) Hemolysins
 - 3) Coagulases

- 4) Kinases
- 5) Hyaluronidase
- 6) Collagenase
- e) Toxins
 - 1) Exotoxins
 - a) Toxoids
 - 2) Endotoxins
- 7. Invasive Methods of Other Microbes – Factors that Influence Virulence
 - a) Viruses
 - b) Fungi
 - c) Protozoans
- 8. Pattern of Diseases (Periods of the acute illness)
 - a) Incubation period
 - b) Prodromal period
 - c) Period of the acute illness
 - d) Decline and recovery period
- 9. Natural Resistance to Diseases and Infections (Innate or non-specific resistance)
 - a) Species resistance
 - b) Mechanical barriers
 - c) Enzymatic activity & Chemical action
 - d) Interferons
 - e) Inflammation
 - f) Phagocytosis
 - g) NK – cells
 - h) Fever
- 10. Specific Immunity – Acquired or Adaptive Immunity
 - a) T-lymphocyte system – Cellular mediated immunity
 - 1) T – Helper cells
 - 2) T – Cytotoxic cells
 - 3) T – Suppressor cells
 - b) B-lymphocyte system – Antibody mediated or humoral immunity
 - 1) The major classes of Immunoglobulins (antibodies) and their role in immunity
 - a. IgG
 - b. IgM
 - c. IgA
 - d. IgD
 - e. IgE
 - 2) Humoral antibodies (immunoglobulins) and their primary functions
 - a. Antitoxins
 - b. Agglutinins
 - c. Precipitins
 - d. Lysins
 - e. Complement-fixating antibodies
 - f. Opsonins
 - g. Neutralizing antibodies
 - c) Interleukins
 - d) The primary immune response
 - e) Secondary immunity
 - f) Types of immunity

- 1) Naturally acquired passive immunity
 - 2) Artificially acquired passive immunity
 - 3) Naturally acquired active immunity
 - 4) Artificially acquired active immunity
- D) Diagnostic Application of Antigen-Antibody Reactions
1. Agglutination tests
 2. Precipitin tests
 3. Complement-fixation tests
 4. Serological tests
 5. Intracutaneous diagnostic tests

DISEASES

- E) Air-Borne Infections in Humans
1. Diphtheria
 2. Streptococcal infections
 - a) Pharyngitis
 - b) Scarlet fever
 - c) Rheumatic fever
 3. Tuberculosis
 4. Streptococcal Pneumonia (Other etiological agents of Pneumonia)
 5. Mycoplasma Pneumonia
 6. Meningitis
 7. Pertussis or Whooping cough
 8. Small Pox
 9. Chicken Pox
 10. Infectious mononucleosis
 11. Measles (Rubeola)
 12. German measles (Rubella)
 13. Mumps
 14. Influenza
 15. Reye's Syndrome
 16. Guillian-Barre Syndrome
 17. Rhinitis (Common Cold)
 18. Poliomyelitis
 19. Psittacosis
 20. Legionaire's disease
 21. Pneumocystosis
 22. Systemic Mycosis
 - a) Actinomycosis
 - b) Nocardiosis
 - c) Cryptococcosis
 - d) Moniliasis
 - e) Blastomycosis
 - f) Histoplasmosis
 - g) Coccidiomycosis
 - h) Sporotrichosis
- F) Food and Water-Borne Human Infections
1. Gastroenteritis
 - a) Campylobacter

- b) Escherichia
 - c) Salmonellosis
- 2. Typhoid fever
- 3. Shigellosis – Bacillary dysentery
- 4. Cholera
- 5. Brucellosis
- 6. Botulism (Bacterial Food Poisoning)
- 7. Other forms of bacterial food poisoning
- 8. Hepatitis
- 9. Amebiasis
- 10. Toxoplasmosis
- 11. Infections of the Mouth
- G) Sexually Transmitted Diseases (STDs)
 - 1. Non-specific urethritis
 - 2. Gonorrhoea
 - 3. Syphilis
 - 4. Genital Herpes
 - 5. A. I. D. S.
 - 6. Some lesser known STDs
- H) Diseases Acquired Through Wounds and Abrasions
 - 1. Erysipelas
 - 2. Impetigo contagiosum
 - 3. Puerperal fever
 - 4. Peritonitis
 - 5. Tetanus
 - 6. Gangrene
- I) Direct Contact Diseases of the Skin
 - 1. Leprosy
 - 2. Dermatomycoses
- J) Human Infections Acquired via Vectors
 - 1. Plague
 - 2. Tularemia
 - 3. Yellow fever
 - 4. Encephalitis
 - 5. Malaria
 - 6. Rickettsial diseases
 - 7. Leishmaniasis
 - 8. Trypanosomiasis
 - 9. Lyme's disease
 - 10. Dengue fever
- K) Slow viral infections (Diseases caused by Prions)
- L) Infectious diseases of plants (Optional)
- M) Infectious diseases of animals (Optional)