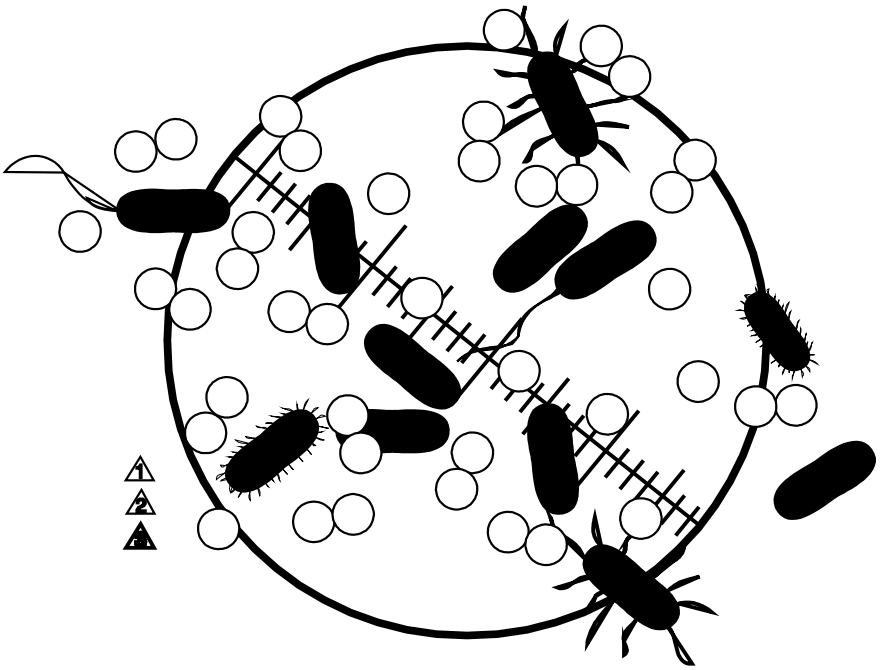
Dept. of Science & Technology
Grande Prairie Regional College

MI 2650
General Microbiology

Course Outline
2003-2004



Philip Johnson B.Sc., M.Sc., Ph.D., M.S.P.H.
Office: J224 Telephone: 539 2863
e-mail: *johnson@gprc.ab.ca*

Schedule: Classes - Monday 1130-1250 and Friday 1000-1120
Labs - Wednesday 1430-1720 and Friday 0900-1000

Description: This course covers aspects of bacterial physiology such as nutrient uptake, metabolism, extracellular proteins, chemotaxis and differentiation. Symbiotic associations and interaction of microbes with the environment are major topics. Basic principles of industrial microbiology and the use of biotechnology for the production of economically and medically important substances will be covered. Laboratory exercises are designed to compliment the material included in the classes.

Text-book: Brock - Biology of Microorganisms (10th edition)
MADIGAN, MARTINKO & PARKER (2003)
Prentice-Hall Publishers

This text-book is recommended for the course - it is not compulsory. 8th or 9th editions are also very good, however the page numbers and figures will differ. For extra help with the text, Prentice-Hall Publishers have made available a companion web page for the 9th edition containing Chapter summaries, self-tests, and other information that you may find useful. The URL address for this web-page is:

http://www.prenhall.com/bookbind/pubbooks/brock2/

The web page for the 10th edition is:

http://www.prenhall.com/brock/

Relevant articles and other materials will occassionally be recommended to students. It is strongly recommended that they be read since the information may appear in exams.
A number of alternative textbooks may also be placed on reserve in the GPRC Library, and students are advised to take advantage of their availability.

Text-books on World Wide Web:

Medical Microbiology (4th Edition) Editor: Samuel Baron
http://129.109.136.65/microbook/toc.html

Microbiology 101 Internet Text (Washington State University)
http://www.wsu.edu/~hurlbert/pages/101hmpg.html

Other Available Resources:

MI 2650 web page at GPRC:
http://www.gprc.ab.ca/academic/biology/mi2650nf.htm

MI 265 web page at University of Alberta:
http://www.biology.ualberta.ca/courses/micrb265/

Requirements:

Lab. Reports 15%
Quizzes 5%
Mid-term Exam 20%
Final Lab Exam 20%
Final Exam 40%
TOTAL.....100%

Each student should maintain a **card file** on the **significant bacteria** mentioned in class. Keep a record of: Genus and species; cell morphology; Gram stain reaction; habitat; 4 or 5 interesting facts about the organism's growth, metabolism, pathogenicity, use in industry, etc. Do not keep records of taxonomic tests. Information can be obtained from text-books, lectures, "Bergey's Manual of Determinative Bacteriology", the Internet, or other sources. A question related to this information will appear on both the Mid-term and Final Exams.

In order to successfully complete MI 2650, students must attend ALL laboratory sessions and achieve a mean score of 50% on the Lab Reports, Lab Quizzes and Final Lab Exam.All assignments MUST be handed in by the time and date specified.

Late reports will not be marked!

Many of the Laboratory exercises require that students perform some of the procedures at times other than the scheduled lab period. To do this, prior arrangements must be made with **Mr. Rick Scott**, the Biology Lab. Technologist. In case of injury, it is preferable that students work with at least one partner when coming into the laboratory outside of scheduled times.

Quizzes in both class and laboratory sessions may be given without any advanced notice to students.

Since participation in lectures, and completion of assignments are important components of this course, students will serve their best interests by regular attendance. Those who chose not to attend must assume whatever risks are involved. In this regard, your attention is directed to the Academic Guidelines of Grande Prairie Regional College.

MI 2650
TOPIC DESCRIPTIONS

Approx. # of Hours	TOPIC
1	Introduction to the course
6	**Functional Morphology of bacteria:** Definitions and descriptions of microbes. Correlation of cell structure and function. Differentiation of bacteria by cell wall type and key metabolic characteristics. Structural features important in both beneficial and harmful (pathogenic) interactions, motility. Pathogenesis
14	**Microbial diversity and environments:** Growth patterns in relation to oxygen (its use and toxicity). The major nutritional types with an emphasis on energy and carbon sources. Practical examples of diverse nutritional types: methanogenesis, autotrophs, photosynthetic microbes, extremophiles. Bioremediation, food microbiology, normal flora, symbioses.
1	**MID-TERM EXAM:** during lecture period (80 minutes)
9	**Sensory systems and intercellular communication:** Review of transcriptional control systems in bacteria. Role of sigma factors as transcriptional activators. Global regulation. Nitrogen cycling and regulation, symbiotic nitrogen fixation. Chemotaxis. Microbe-microbe signalling (quorum sensing) and plant-microbe interactions (eg. *Rhizobium* and *Agrobacterium* spp.).
7	**Bacterial growth and control of growth:** Effects of temperature, nutrient levels and growth conditions. Analysis of the exponential growth curve, using the growth equation to predict growth rate and cell yield. Control of growth using heat and chemicals (heavy metals, antibiotics). Resistance of bacteria to chemical agents (especially antibiotics)

MI 2650
Detailed Topic Outline

TOPIC		READINGS
Introduction		Ch. 1 (pgs 1-20)
Functional Morphology of Bacteria		
	Review of procaryotic cell structure	Ch. 4 (pgs 55-101 except pgs 66-74) pgs 56-64 are useful for early labs
	Cell wall with focus on outer membrane of Gram - bacteria	
	Cell wall and permeability, sensitivity to antibiotics	
	Outer structures and adhesion (LPS, pili, fimbriae, capsule, S-layer)	
	Flagella and motility	
	Endospores and other forms of differentiation	
	Pathogenesis and adhesion	
Microbial Diversity and Environments		
	Review of metabolism and nutrition; transport; exoenzymes	Ch. 4 (p. 66-74); Ch. 5
	Redox balance; fermentation vs respiration	Ch. 5
	Energy yielding reactions	Ch. 5
	Energy sources	Ch. 5
	Growth in relation to Oxygen; oxygen toxicity and protection	Ch. 6 (p. 161-165)
	Extremophiles; symbiotic bacteria	Ch. 6 (p. 151-161_ Ch. 13 (p. 446-52, 456-60, 461-71) Ch. 19 (p. 646-52)
	Iron: magnetic bacteria; siderophores and iron aquisition	Ch. 4 (p. 93) Ch.5 (p. 103, 105, 106) Ch. 12 (p. 384-85)
	Fermentations and Food Microbiology; Lactic acid bacteria	Ch. 12 (p. 375-79, 399-404) Ch. 17 (p. 595-97) Ch. 30 (p. 986-89)

	Sewage treatment and methanogenesis; rumen biology; syntrophy	Ch. 13 (p. 453-58) Ch. 17 (p. 595-97) Ch. 19 (p. 654-62) Ch. 28 (p. 935-48)
	Autotrophy and metal transformations	Ch. 17 (p. 565-73) Ch. 19 (p. 669-74)
	Bioremediation	Ch. 17 (p. 597-600) Ch. 19 (p. 674-78)
	Industrial microbiology; growth in stationary phase and secondary metabolites	Ch. 30 (p. 966-76)
	Bioplastics	Ch. 19 (p. 678-79)
Sensory Systems and Intercellular Communication		
	Transcriptional control; global regulators; sensory proteins	Ch. 8 (p. 211-26)
	Nitrogen cycle & regulation; symbiotic nitrogen fixation	Ch.12 (p. 373-74) Ch. 19 (p. 662-64) Ch. 17 (p. 606-11)
	Quorum sensing; the *lux* family of genes	Ch.8 (p. 224) Ch. 12 (p. 379-81)
	Agrobacterium tumefaciens; intracellular communication	Ch. 19 (p. 683-85)
Bacterial Growth and control of growth		
	Growth equation and calculations	Ch. 6 (p. 138-52)
	Control of growth by heat and calculations	Ch. 20 (p. 696-700)
	Chemical control, especially antibiotics	Ch. 20 (p. 703-15)
	Antimicrobial drug resistance	Ch. 20 (p. 719-25)