BACTERIOLOGY 102 – General Microbiology Laboratory

Offered each semester and summer session – total of 28-30 two-hour labs.
Course website: **http://www.splammo.net/bact102/home102.html**

This course is required by a number of majors including Medical Technology, Nutrition, Dietetics, the Physician's Assistant Program and Nursing. If you intend to **major** in Bacteriology, we have Bacteriology 304 (and the corresponding lecture course, 303) for which organic chemistry is a prerequisite. Bact. 102 does not have to be taken the same semester as Bact. 101, but please do not sign up for 102 unless you are taking – or have taken – Bact. 101 or an equivalent course.

Bacteriology 102 has a lot of substance; this is not an introductory course that just celebrates shapes and colors of the bacterial world. We try to amplify and add to the material given in the lecture course. Likewise, the lecture course serves as a supplement to this course. From time to time, students have been known to "graduate" to a lab technician position out in the "real world." So, there are a number of basic concepts which Bact. 102 students and aspiring microbiologists must learn and re-use throughout and possibly beyond this semester. If Bact. 102 is a prerequisite for a higher-level microbiology course – such as our food microbiology lab (Bact./Food Science 324, offered in the fall semester) – then a good handle on what you have learned in Bact. 102 will be expected of you on the first day of that course.

A list of topics is given on the next page. Included in Bacteriology 102 are considerations of the following:

- The concept of a single-cell, procaryotic organism: How its structure and activities are all manifested in and about that one microscopic cell. Give it some nutrients which it can utilize for biosynthesis and energy, and it will duplicate itself repeatedly with the increasing population showing its presence to the naked eye as a colony on a petri dish or a cloudy appearance in a liquid medium. We learn about different types of bacteria, the various kinds of media we can use to "grow" them, how they obtain energy, what they might be doing out in their natural habitats, how some are pathogenic, and how some can be used to produce certain food products for human consumption. No matter how "diverse" these microorganisms are, certain basic life processes will be seen to follow the same plan. We also touch on genetics – how a chance mutation can give an individual organism an advantage in a difficult environment and also how a cell can change one or more of its characteristics by incorporating DNA from another cell. Much of what we can learn from these single-celled organisms can be applicable to higher forms of life.
- The use of microscopes: We have two kinds – one of which is especially good for observing the shapes and activities of living organisms. Remembering a few basic things each time a microscope is used will bring out the best images quickly and consistently.
- Bacterial quantitation: How to estimate the density of microorganisms in food, water, soil, and other samples. We have formulas that help, but the basics should be simple enough that formulas are not required.
- Aseptic technique: How not to contaminate yourself or the environment with the culture you are studying, and – often more importantly – how not to contaminate your culture with organisms from yourself or the environment! We will be treating our bacterial cultures as potential pathogens even though most are relatively benign. We should also get an appreciation of how "bad aseptic technique" can delay diagnosis of a disease and even encourage pathogens further.
- Proper use of terminology does matter! Hopefully you will become comfortable with this field of science, and how you come across discussing bacteriology out in the real world says much for the field and yourself.

There are really not that many basic principles to understand. However, they work together and build over the course of the semester. You can wind up not only knowing lots of material but also how to come up with logical ways of accomplishing things. We do not indulge in the memorization of trivia – i.e., things that can fill up tables in reference books. From time to time we may throw out a "thought question" to test your understanding of basic microbiology, and no mass memorization of minutiae will help in those situations.

LIST OF TOPICS COVERED IN BACTERIOLOGY 102

- Culturing environmental samples (air-exposure plates and simple swabbing).
- Gaining proficiency with the microscope.
- Simple and differential staining methods including gram, capsule, acid-fast and endospore stains.
- Basic pure culture procedures including transfer techniques and streak plates.
- **Quantitative Microbiology I:** The plate count method.
- Microbial count of hamburger – "total" and gram-negative.
- Introduction to nutritional requirements and bacteriological media.
- Requirements of certain bacteria for growth factors.
- Alteration of bacterial characteristics due to changes in the environment.
- **Basic Catabolism I:** Aerobic respiration and fermentation and their role in the test for "oxygen relationship" as per the Bergey's Manual definitions; correlation of oxygen relationship designations with related physiological processes in bacteria.
- A study of the bacterial growth curve with determination of the growth rate of an *E. coli* culture.
- Microscopic and cultural methods for the determination of bacterial motility.
- **Basic Catabolism II:** Anaerobic respiration as demonstrated by the test for nitrate reduction.
- **Characterization, Differentiation and Identification of Bacteria:** Comparative morphology and physiology of selected species and an introduction to base sequencing and phylogenetic trees.
- Detection and isolation of mutants and recombinants.
- Quantitation of bacteriophages and use of bacteriophages to assist bacterial identification.
- Determination of susceptibility of bacteria to various antibiotics.
- **Principles of enrichment and isolation of bacteria** from natural sources.
- Consideration of microbial cycling of elements – particularly N, C, S and O.
- Isolation of antibiotic-producing, endospore-forming and nitrogen-fixing bacteria from soil.
- Isolation of anoxygenic photosynthetic bacteria from water samples.
- **Basic Catabolism III:** Anoxygenic phototrophy with a comparison to oxygenic phototrophy.
- How to write a formal lab report and present a poster.
- Examination of lactic acid bacteria including those involved in yogurt and sauerkraut production.
- Brief study of *Staphylococcus, Streptococcus* and *Neisseria* including their isolation and the tests for hemolysis, coagulase and oxidase.
- Isolation and identification of enteric bacteria including the use of serology in the identification of *Salmonella*. (Clinical procedures are emphasized along with the use of correct and current taxonomic terminology.)
- Basic principles concerning pH-based differential media and the formulation of such media to distinguish certain physiological types of bacteria.
- **Quantitative Microbiology II:** The Most Probable Number (MPN) method.
- Bacteriological examination of water: Quantitation of "total" bacteria; enrichment, detection, isolation and identification of coliforms.

POINT VALUES AND GRADING SCALE

Gram stain unknown	5	Quiz no. 1	40
Motility unknown	5	Quiz no. 2	40
Mixed culture unknown	10	Quiz no. 3 (take-home)	40
Enteric unknown	5	Formal report or poster participation	50
Dichotomous key for last unknown	10	Growth curves and calculations	10
Last mixed culture unknown	15	Water analysis results	5
Problem set no. 1 (take-home)	10	Miscellaneous points	5
Problem set no. 2 (take-home)	10	Final, cumulative exam	100
TOTAL POINTS	**360**		

USE THIS GRADING SCALE AS A GUIDE. The final letter grade will not be based on a stricter scale.	93-100%	**A**	At any time during the semester, you can easily calculate your current percentage by dividing your accumulated points by the number of points taken by that time (and then multiplying by 100%).
	88-92%	**AB**	
	83-87%	**B**	
	78-82%	**BC**	
	70-77%	**C**	
	60-69%	**D**	
	<60%	**F**	