MICROBIOLOGY 102 SYLLABUS

Spring Semester, 2014

This course (or an equivalent) is required by a number of majors and programs at UW-Madison. If you intend to major in Bacteriology, we have Microbiology 304 (and the corresponding lecture course, 303) for which organic chemistry is a prerequisite. Microbio. 102 does not have to be taken the same semester as Microbio. 101, but please do not sign up for 102 unless you are taking – or have taken – Microbio. 101 or an equivalent course.

Microbiology 102 has a lot of substance. It is not just a survey course that celebrates the 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" from this course to a lab technician position out in the "real world." So there are a number of basic concepts which Microbio. 102 students and aspiring microbiologists must learn and reuse throughout and possibly beyond this semester, and they are itemized below. A good understanding of them will be expected when you begin a course for which Microbio. 102 is a prerequisite – such as the Food Microbiology lab course.

It is important to note that in our course, we are only working with the **relatively small universe** of bacterial species that are "easy to grow" in the lab. They are the type of organism that (depending on the particular species) can (1) grow well in food and possibly cause spoilage, (2) grow well in us and possibly cause disease, (3) participate in various stages of simple biodegradation, and (4) "contaminate" things in general. These tend to be very easy to isolate from nature as we will find out in several of our experiments. What we learn from the organisms that we study in Microbio. 102 lab can apply to bacteria in general (even those you heard about in the news or elsewhere that can't be cultured in a lab at all) and also higher forms of life. Unlike other introductory microbiology courses, we go beyond the usual **chemotrophic** bacteria (those that respire and/or ferment to obtain energy) and also study **phototrophic** bacteria (those that get energy from light). We are filling in "the big picture" as you will see as the course progresses – not memorizing a bunch of trivia that we can forget about after each quiz.

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 stuff but also how to come up with logical ways of accomplishing things. We tend not to indulge in the memorization of lots of trivia – i.e., things that can fill up tables in reference books.

Getting your two-credits worth: Keep up with the in-lab and virtual experiments right along. As for attendance, **we will assume you have dropped the course if you miss two labs in a row** without explanation. During a regular semester, the course only meets once a week (for two hours) for the in-lab experiments. (This frequency is doubled in the summer session.) Before we had to convert to the partially-virtual system, the lab met the usual four hours a week for the two credits. So, you should plan on spending a good amount of time **(1)** reviewing things, **(2)** looking ahead to the next lab period (according to the schedule) and **(3)** working through the virtual experiments. **We will be explaining more about what is expected for the virtual experiments in the coming weeks**.

Our lab presentations (opening lecture with good stuff on the whiteboard), the on-line lecture notes, and the updates on the homepage of our website (address below) should help to amplify the schedule and clarify the subject matter. Hopefully, the experiments we do and their results should make sense – including what they mean in light of the "big picture." **We should know if we are not fulfilling the list of items itemized on the second page of this syllabus.**

Keeping a notebook is necessary. You will need to take good notes of the lab lectures including the material presented on the blackboard. Occasionally you will find there is no space in the manual to record certain observations, and you will want to make note of certain material which may need your attention before the next lab. A loose-leaf notebook in which your notes can be arranged chronologically or according to experiment number is recommended. Such a notebook can also be handy for keeping all of your handouts.

If you find you have questions about the material as you come to lab, you and the class can benefit greatly if you bring up these questions during the opening lab lecture. Before lab, you may find one or more of the instructors busy getting things ready for the lab section, and they are often unavailable until the period begins. This is a fairly easy-going lab and also has been quite safe as long as you remember your "aseptic technique"! Make sure your insurance situation is in order. We do not have a blanket insurance policy for students taking lab courses, but the lab instructor can be held fully accountable for failing to warn of potential hazards.

REQUIRED PURCHASES FOR THE COURSE

The **laboratory manual** will be sold by the Microbiology Club during the first and second week of classes this semester and will cost **$10.00** which is a considerable savings compared to what you may pay for a manual from a big publishing company. So that you have an advance copy of the first week's material, we have it reproduced on-line on the **course website** whose **address** is as follows:

`http://www.jlindquist.com/microbiology102/index.html`

Also required are **microscope slides** and a **glass marking pen**. A package of 20 slides with the marking pen will be sold by the Microbiology Club during the first week of classes for **$5.00**.

Please obtain a **3-ring binder** to keep the manual and the handouts organized and handy. This is also useful for lab lecture notes and observations that may not fit in the manual.

LIST OF TOPICS COVERED IN MICROBIOLOGY 102

Topics covered in the virtual exercises are marked with an asterisk (*).

- 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 plating methods for isolation.
- **Quantitative Microbiology I:** The plate count method.
- Microbial count of a food product – "total" and gram-negative.
- Introduction to nutritional requirements and bacteriological media.
- Requirements of certain bacteria for growth factors.*
- Alteration of phenotypic 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. (partly*)
- 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 with reference to base sequencing and phylogenetic trees.
- Detection and isolation of mutants* and recombinants.
- Quantitation of bacteriophages.
- 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 nitrogen-fixing*, antibiotic-producing and endospore-forming bacteria from soil.
- Isolation of purple non-sulfur photosynthetic bacteria from water samples.
- **Basic Catabolism III:** Anoxygenic phototrophy with a comparison to oxygenic phototrophy.
- Writing a formal lab report.
- Examination of lactic acid bacteria including those involved in yogurt and sauerkraut.*
- A brief look at *Staphylococcus, Streptococcus* and *Neisseria* including their isolation and the tests for hemolysis, coagulase and oxidase.*
- Isolation and identification of enteric bacteria. (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.
- The importance of coliforms and their enrichment, detection, isolation and identification.
- Koch's Postulates as they relate to soft rot of potatoes.*

POINT VALUES AND GRADING SCALE

Exp. 3A unknown (gram stain)	5	Problem Set no. 1	10
Exp. 7 unknown (general)	10	Problem Set no. 2	10
Exp. 14A unknown (enteric/mixed)	10	Quiz no. 1	60
Exp. 17A nature isolate checklist	10	Quiz no. 2	60
Growth curves and calculations	10	Exp. 11 formal report	60
Water analysis	5	Final, cumulative exam	100
Total Points=**350**. Our standard grading scale: **A** (93-100%), **AB** (88-92%), **B** (83-87%), **BC** (78-82%), **C** (70-77%), **D** (60-69%), **F** (<60%).			