

# MICB 421 Experimental Microbiology

## A. Course Overview

Traditional lab courses tend to present students with experimental recipes and supplies, then ask students to follow the recipe, look at the results and write a report. This approach allows each student to have the same learning experience but it limits the range of available experiments. In addition, even though instructors expect students to understand the intended work before attempting an experiment, the traditional lab approach also allows some students to get through the experiment by simply following the directions rather than understanding the purpose of the work.

In the first part of this course we use a traditional approach but expect students to participate in the production of the supplies and materials. In the latter part of the course we provide teams of students with some experiments and the experimental observations based on those experiments. These experiments were original projects done by preceding students in the MICB 421 and MICB 447 classes. We expect each team to design new experiments and protocols to test their explanations of the observations in one of the supplied experiments rather than just following the supplied recipe. In some cases the explanations might require a simple modification of the supplied recipes, in other cases the teams might need to invent an entirely new experimental protocol. In either case, once the experiment has been acceptably designed, the team will be expected to prepare the supplies, set up equipment, carry out the experiment, analyze the results and prepare a formal journal style report that describes their experimental purpose, the methods, the results and the conclusions. The course instructors will review this report. The report will then be returned to the group to correct any significant problems in style, logic or fact before it is published to the electronic "Journal of Experimental Microbiology and Immunology" where the rest of the students in the class can access the report. In subsequent years the new students in the class will be able to design their own experiments by using the original experiments and observations or the experiments and observations made by the successive classes. Teams may repeat a previous experiment to ensure that the results were correct but will still be expected to produce and test an original experiment based on the resulting observations and explanations. The experiments will have some constraints imposed by time, equipment and costs

## B. Aims and Objectives

The MICB 421 lab projects course potentially covers a wide range of topics and techniques because the project for each team is unique. The specific student learning objectives of the laboratory are:

- To make students aware of some common laboratory procedures and concepts that were not covered in the other lab courses.
- To develop student ability to adapt their knowledge and background to develop protocols to experimentally solve scientific problems.
- To further student understanding of some of the constraints of an experimental protocol or testable question as well as recognition of the common elements in research protocols.
- To further student ability to quantitatively analyze data and formulate logical and testable mechanistic models that account for the observations.
- To further student ability to prepare and present written scientific reports.

- To further student ability to organize and complete technical projects with finite resources and time.
- To further student ability to work in scientific teams.

### **C. Learning outcomes**

- Be able to define a scientific research problem.
- Be able to examine a research problem and suggest reasonable experimental explanations and solutions
- Be able to locate information and background for designing an experimental protocol.
- Be able to plan and prepare basic supplies to carry out an experiment.
- Be able to critically evaluate experimental results.
- Be able to maintain scientific records and communicate results
- Be able to write a formal journal article to a specified style.
- Be able to explain and apply the theory of basic widely used molecular techniques.
- Understand the team dynamics needed to work cooperatively on a research team.

### **D. Outline**

The course consists of three projects, three formal project reports, an optional mid-term exam and a compulsory final exam. The first project is done on week one. It examines the uptake of radioactive tracer molecules. The second project looks at the influence of purification processes on observable enzyme kinetics. It starts on week one and finishes on week three. The third project is the individual team project. It starts on week two. Over the next three weeks the team narrows the topic chosen from a previous JEMI article (see the “undergraduate program” folder at [www.microbiology.ubc.ca](http://www.microbiology.ubc.ca)), develops a testable hypothesis and sets out protocols. Over the rest of the term the team prepares supplies, carries out the experiments and writes up the report. After the first week of class the lab is open 9 – 5 each week day.

### **E. Specific Course Resources**

Most of the course material is described in the lab manual. The source experiments, resources, equipment operation, inventories and assignments for the course are located at the MICB 421 webCT site. To access the website go to <https://www.webct.ubc.ca/webct/login/login.html> then sign into the site by using your Netinfo ID and your Netinfo password. There will also be printed copies of the source experiments, equipment operation, strain inventories and chemical inventories in binders near the computer in room 104 Wesbrook. Some of the files in the website can be downloaded and searched.