

MICB 449 – Research Problem (6 credits Laboratory Projects)

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UBC provides appropriate accommodation for students with disabilities and for religious and cultural observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available here (<https://senate.ubc.ca/policies-resources-support-student-success>)

Course Description: A laboratory (6 credits) project. Requires permission of the Undergraduate Program Advisor. The results are presented in a written report to be reviewed by oral examination. Projects are with faculty members from the Department of Microbiology & Immunology.

MICB 449 is the graduating research thesis required as part of the Microbiology & Immunology Honour specializations.

Students make arrangements to work in a research lab under the mentorship of a Microbiology and Immunology research faculty member or an associate member of the Department. Students are encouraged to reach out to potential faculty mentors approximately 3 months before the start of term. A list of the Microbiology and Immunology Research Faculty can be found at <https://www.microbiology.ubc.ca/faculty-staff/faculty>.

The intent of Directed Studies is to provide formal research experience in a research environment and develop skills for doing scientific research in that field. To develop these skills the student should have regular meetings with the faculty supervisor and/or the project supervisor.

The major learning outcomes of the course are:

- Student researchers should be able to apply critical thinking skills to a research problem by:
 - Formulating research questions as the project proceeded.
 - Understanding the design of experiments to answer research questions.
 - Integrating observations and explanations to understand the results and relate the results to each research question.
 - Link experimental results to experimental questions to draw accurate conclusions, recognize the limitations of the results and recognize future significant directions of the research
- Student researchers should be able to effectively communicate their research in oral and written form.

To complete the course the students must:

- Contact eligible faculty members and discuss the possibilities of working in the lab of that faculty member. When there is a mutual agreement between the faculty member and the student then the student reports that agreement to the program coordinator and registers for the course.
- Submit a written outline of the proposed research project to the supervisor and the course

coordinator.

- Submit a written progress report to the supervisor and the course coordinator.
- Finish lab work and submit a research article that analyses the project and the results to the supervisor and the course coordinator.
- Defend the project and the report in a formal oral exam attended by the faculty supervisor and another faculty member.

Winter Session Schedule for MICB 449

1. The course involves lab work over both terms, a written project proposal, a progress report, a written report, an oral presentation of the work and an oral exam. You will be expected to spend at least 12 hours per week for 26 weeks (approximately 320 hours).
2. By the second Friday in September you should arrange to work in a lab supervised by a member of the Faculty of Microbiology and leave a message for the Undergraduate Program Advisor which names the supervisor that you will work under.

Summer Session Schedule for MICB 449

The summer course requires eight weeks of laboratory research work. You will be expected to spend 40 hours per week (approximately 320 hours). Students can also work sixteen weeks in the laboratory (20 hours per week).

The course grade will consider:

- The demonstrated critical understanding of the project and the results.
- The effort to get results.
- The intellectual contribution of the student toward the development of the project.
- The quality of the written report and analysis.

A description of the requirements for the project proposal, progress report, thesis and oral exam can be found on the Direct Studies Canvas site.

Covid Safety:

It is important that all of us feel as comfortable as possible engaging in research activities while sharing an indoor space. Non-medical masks that cover our noses and mouths are a primary tool to make it harder for Covid-19 to find a new host. Please wear a non-medical mask during your lab meetings and when you are working in the lab, for your own protection, and the safety and comfort of everyone else in the lab.

If you have not yet had a chance to get vaccinated against Covid-19, vaccines are available to you at no cost. Information about where you can get a vaccine will be posted at the top of the MICB 202 Canvas page. The higher the rate of vaccination in our community overall, the lower the chance of spreading this virus. You are an important part of the UBC community. Please arrange to get vaccinated if you have not already done so.

If you're sick, it's important that you stay home – no matter what you think you may be sick with (e.g., cold, flu, other). If you think you might have Covid symptoms and/or have tested positive for Covid and/or are required to quarantine: You can do a self-assessment for Covid symptoms here: <https://bc.thrive.health/covid19/en>

Do not come to campus if you are sick, have Covid symptoms, have recently tested positive for Covid, or are required to quarantine. This precaution will help reduce risk and keep everyone safer.

Outline for MICB 449 Projects

The project may concern any mutually agreeable topic in the area of microbiology, immunology and virology. Either the student or the faculty supervisor can propose the topic but it should fall within the interests of the supervisor.

The thesis should use documented archival information available in library articles, interviews, web sites or public archives to analyze, compare or test a specific research hypothesis rather than simply describe a process or review a subject area.

The student and the supervisor should meet weekly or biweekly for the first two months to discuss progress on the topic, decide about changes to the topic and consider changes to the approach to the topic as more information is collected. During the third month, the thesis should be written and presented in a final processed form. The supervisor's role at these meetings is to provide advice about your thoughts, observations and problems rather than lead the development of the thesis.

The typical timetable for developing the project involves:

- a. choose a supervisor and a specific topic. Provide the name of the supervisor and the topic to the undergraduate advisor in Microbiology and Immunology to retain your registration in the course.
- b. by the third week of term, completion of all relevant training for working in the lab (second week if doing a summer session).
- c. laboratory research is conducted between late September and mid-March (May – August if doing a summer session).
- d. reading journal articles and review papers that are relevant to the research project throughout the project.
- e. participation in the weekly meetings of the mentor's research group.
- f. by the end of March, the draft of the thesis is due (at least 2 weeks before the end of the project for summer session).
- g. by the beginning of the first week of April, submit a final copy of the thesis to the supervisor (1 week before the end of the project for summer session).
- h. after receiving the report, the supervisor will arrange to have the thesis read by a knowledgeable examiner then set an oral exam.
- i. the oral exam consists of a short formal presentation (15 minutes, seminar-style) by the student followed by a question period where the chosen examiner and the supervisor can ask questions about the oral presentation, the written thesis and the general related background knowledge. The oral presentation should be scheduled to allow a few days for the examiner to read the written report and for the student to prepare any necessary slides for explaining the project details. The oral presentation should cover the essential ideas, relevant background, major observations and conclusions from the research project.

The reports should be written as a research article or a review using the style prescribed by the American Society for Microbiology. The final paper should normally be 15 to 20 pages of text, including the references. There should be a minimum of 20 relevant, original references cited. All

citations or figure legends should follow the style of the Journal of Bacteriology or the Journal of Immunology. The report should include:

- a. a brief summary at the beginning, an introduction
- b. a section with relevant data, explanations and discussion
- c. a section with the major conclusions
- d. a section indicating future research directions.
- e. a section of citations that must include some papers published within the last year, unless nothing that recent is available in that particular subject field.

The report will be graded for:

- a. completeness (has all the relevant information been discussed)
- b. clarity (is the report clear and concise)
- c. grammar and spelling
- d. understanding of the reported results and demonstration of explicit connections between those reported results and the purpose of the study.

The oral exam counts 25% of the final grade. The course grade will be penalized by 5% for each missed deadline or progress report.

The grade submitted by the faculty supervisor to the Senior Undergraduate Program Advisor will be a cumulative grade determined by your effort in the research, your understanding of the work and relevant background, the quality of your reports, and your performance in the oral exam. A first class mark greater than 80% should represent a first-class achievement in the work, the reports and the oral exam.

A copy of the report must be submitted to the Senior Undergraduate Advisor before the grade is submitted for the course.

Grading Rubric for Research Problem/Directed Studies

The **grade between 95 - to - 100%** represents outstanding work. To fall in this range the student and the work must demonstrate all of the following features. The student did not need to complete the entire original proposal but should have made some progress.

- The **student could work relatively independently**. The student demonstrated that they knew the limitations of the study, the place that the work fits in the field, the significance of the project and the next steps in the project.
- The student consistently participated in the development of the project by researching background outside the original references provided by you. Throughout the project the student contributed significant insight into the results and technical problems rather than passively expecting you or their immediate lab supervisor to interpret their results, provide explanations and solve their problems. If there was no dialogue concerning the meaning of the results during the meetings of the supervisor and the student then the student was probably not an active participant in the ongoing development of the project.
- The student put in at least 15 hours of active work per week on the project in an attempt to get results and complete the proposal. The student was technically competent. The student kept adequate records and did not need to keep returning to get instructions repeated. The work areas were

organized and safe.

- The first copy of the final report was organized so that it had a professional appearance and excellent flow. There were no significant spelling or grammatical errors, all the important observations and controls were included and the irrelevant observations were omitted. Critical thought and accurate consistent analysis were evident. The discussion clearly referred to the observations and clearly related the observations to the field of study by citing relevant references. The conclusion was an accurate statement that was based on the observed experimental results. The conclusion addressed the experimental purpose.
- The style was appropriate for an ASM journal submission and the content placed in the title, abstract, methods, results, discussion and reference sections were appropriate.

The **grade between 85 - to - 94%** represents very good work. To fall in this range the student and the work has the following features. The student did not need to complete the entire original proposal but should have made some progress.

- The student demonstrated that they knew the limitations of the study, the place that the work fits in the field, the significance of the project and the next steps in the project.
- The student consistently participated in the development of the project by researching background outside the original references provided by you. Throughout the project the student has been contributing significant insight into the results and technical problems rather than passively expecting you or their immediate lab supervisor to interpret their results, provide explanations and solve their problems. During meetings between the student and the supervisor there was significant dialogue concerning the results.
- The student put in at least 15 hours of active work per week on the project in an attempt to get results and complete the proposal. The student was technically competent. The student kept adequate records and did not need to keep returning to get instructions repeated. The work areas were organized and safe.
- The first copy of the final report was organized so that it had reasonable flow. There might have been a **few significant spelling or grammatical errors, but the important observations and controls were included** and the irrelevant observations were omitted. **Some critical thought and analysis is evident and there were adequate references to relate the observations and conclusions to the field. The conclusion was an accurate statement that was based on the observed experimental results.** The conclusion addressed the experimental purpose.
- The style was appropriate for an ASM journal submission and the content placed in the title, abstract, methods, results, discussion and reference sections were appropriate.

The **grade between 80 - to - 84%** represents good work. To fall in this range the student and the work has the following features. The student did not need to complete the entire original proposal but should have made some progress.

- The student demonstrated that they knew the limitations of the study, the place that the work fits in the field, the significance of the project and the next steps in the project.
- The student interpreted the observations and contributed some insight into the results and technical problems **but tended to rely on you or their immediate lab supervisor to provide explanations and solve their problems. There was some dialogue but the dialogue was limited.**
- The student put in at least 15 hours of active work per week on the project in an attempt to get results and complete the proposal. The student was technically competent. The student kept adequate

records and did not need to keep returning to get instructions repeated. The work areas were organized and safe.

- The first copy of the final report was organized so that it had reasonable flow. **There might have been a few significant spelling or grammatical errors. Most of the important observations and controls were included but the coverage was uneven so that one or two important observations might have been deemphasized or some irrelevant observations might have been included. Some critical thought and analysis were present and there were adequate references to relate the observations and conclusions to the field.**
- The style was appropriate for an ASM journal submission and the content placed in the title, abstract, methods, results, discussion and reference sections were appropriate.

The **grade between 76 - to - 79%** represents reasonable work. To fall in this range the student and the work has the following features. The student did not need to complete the entire original proposal but should have made some progress.

- The student demonstrated that they knew the limitations of the study, the place that the work fits in the field, the significance of the project and the next steps in the project.
- The student interpreted the observations and contributed some insight into the results and technical problems **but tended to rely on you or their immediate lab supervisor to provide explanations and solve their problems. There might have some dialogue but it was limited.**
- The student put in at least 15 hours of active work per week on the project in an attempt to get results and complete the proposal. The student was technically competent. The student kept adequate records and did not need to keep returning to get instructions repeated. The work areas were organized and safe.
- The first copy of the final report **was a bit difficult to follow because the presentation did not flow logically or some key points were not very clear. There might have been a few significant spelling or grammatical errors.** Most of the important observations and controls were included but **the coverage was uneven so that one or two important observations were missing or several irrelevant observations were included. The critical thought and analysis were limited but there was some integration of the observations and adequate referencing was used in an attempt to relate the observations to the field of research.**
- The style was **mostly** appropriate for an ASM journal submission but the content placed in the title, abstract, methods, results, discussion and reference sections **were not consistently appropriate.**

The **grade between 72 - to - 75%** represents adequate work. To fall in this range the student has done the work but had two or more of the following limitations. The student did not need to complete the entire original proposal but should have made some progress.

- The student interpreted the observations and contributed some insight into the results and technical problems but **tended to rely on you or their immediate lab supervisor or other students to provide explanations and solve their problems.**
- The student put in at least 15 hours of active work per week on the project in an attempt to get results and complete the proposal. The work was technically competent and the student kept records and did not need to keep returning to get instructions repeated. The work area was organized and safe.
- The first copy of the final report **was sloppy and poorly organized so it did not flow. Some key observations were missed.**
- **Critical thought and analysis were present but was very limited so the work tended to be descriptive**

rather than analytical. Documented relationships between the field and the research were limited to one or two novel references. The analysis was difficult to follow because the arguments were not consistently related to the observations or contradictory observations were not recognized or the conclusion was inappropriate for the evidence.

- The style was generally appropriate for an ASM journal submission but the content placed in the title, abstract, methods, results, discussion and reference sections were not consistently appropriate.

Grades below 72% represent poor work or effort.

- The student did not understand the significance of the project in relation to the field.
- **The student put in less than 15 hours per week and did not get results.**
- **The report is difficult to read because it was not focused on the research question or it had numerous grammatical problems or it missed many key observations or it was mostly just descriptions with no significant critical thought and analysis.**

Grades of 50- 55% represent marginal work or understanding.

- The student did adequate technical work, completed the report and the exam but did not understand the project or the meaning of the results.

Grades below 33% indicate that the student might have done good technical work but did not complete the report or the oral exam.