Health Science 3V03 – Experimental Research and Design
Course Syllabus, Fall 2017

Instructor: Dr. Daniel Yang (yang@mcmaster.ca) ext. 22455
Teaching assistant: Alyssa Vito (alyssavito87@gmail.com)
Office Hours: Available upon request
Course Times: Th 8:30 - 10:20 am; 12:30 pm - 2:20 pm
Course Location: ETB_119 // MDCL_1116

Course Description:
The focus of this course is to prepare students for conducting experimental research, proper scientific writing and presenting scientific data and concepts. This includes sessions on establishing an experimental framework, designing experiments within a system, using the correct set of controls, and building theoretical models. Additionally, attention will be placed on the fundamental approach to how science is done, exploring questions such as “Should all research be hypothesis driven?” and “Is a question/answer approach more appropriate?”

This course runs for thirteen weeks with one one-hour lecture class and one two-hour tutorial class each week. The course begins with student-driven lectures, analysis of primary research, and application of the week’s concepts to specific research projects. Group proposal presentations will be conducted during the final weeks. These presentations will showcase each group’s efforts to propose, develop and properly structure a research project.

Prerequisites:
Registration in Level III of B.H.Sc. (Honours) – Biomedical Sciences Specialization or permission of the instructor

Required Course Materials:
Experimental Design for Biologists, David J. Glass, Cold Spring Harbor Laboratory Press; 2nd Ed.

Intended Learning Outcomes:
At the end of the course, students should be able to:
1. Compare and contrast the use of question-driven vs. hypothesis-driven approaches to research
2. Identify the inductive space for a research question which will inform the direction of the research to be taken.
3. Construct a theoretical model based on the inductive space and current research that helps predict the results of future experiments.
4. Differentiate between and determine experimental controls that will demonstrate significance, sufficiency, and necessity of the changes to the experimental system.
5. Design a research project and develop a research plan
6. Evaluate the research plan of their peers and provide critical feedback about their research design.
7. Apply the concepts learned in class to their own current research.
Course Format:
The class portion of the course will consist of student-driven lectures, during which students will present material from the assigned chapters of the textbook. Although students will only be presenting a selection of chapters from the text, it is their responsibility to know the material from the entire book and therefore strongly recommended that they read along throughout the semester. During our tutorial presentations, one group will lead a discussion regarding a primary research article of their choice and the elements within it relating to the lecture of the previous week. The second half of the tutorial will be devoted to applying the elements of actual (or theoretical) research projects or research areas of their interest. It is expected that students have all readings and tutorial work completed prior to class.

Assessment of Learning:
There are four areas which learning will be assessed:
1. Content: Using the student-driven lectures, the ability of the student to convey the necessary content will be assessed. Verbal feedback will be given at the end of the lecture and a final grade will be assigned after the completion of all lectures. Peer evaluation will be also used to determine how well this content is delivered.
2. Understanding: During student-driven discussions about primary research papers, the ability of the student to identify course content within the paper will be assessed. Students will be evaluated on their ability to demonstrate not only their understanding of the material, but the understanding of the material by their peers.
3. Application: During weekly research explorations, the ability of the student to apply the course content will be assessed. “Explorations” will not be evaluated for content, but feedback can be given if requested.
4. Synthesis: The ability of the students to integrate all the elements of course will be assessed through a presentation and final report of a research proposal. Peer evaluation of the presentation will provide feedback for the final paper.

Components and Evaluation (Weight of Final Grade)
1. Student-driven Lectures (10%)
2. Student-driven Discussions (10%)
3. Research Explorations (15%)
4. Class Participation and Peer Evaluation (20%)
5. Group Presentation of Proposed Research Program (20%)
6. Final Written Report of Proposed Research Program (25%)

Assignment Descriptions:
Student-Driven Lectures (10%)
Each group will have up to 45 minutes (including questions) to present the assigned chapters relating to various aspects of experimental research and design. The lecture will be marked based on the following criteria (number of marks as indicated in brackets):
· CONTENT (4): description and background of relevant material
· ANALYSIS (3): level of depth of analysis, using examples
· CLARITY AND CREATIVITY (2):
· OVERALL STRUCTURE (1): organization and logical flow

Peer evaluations of these lectures are to be emailed to Alyssa in-class, or no later than 5pm the day of lecture and must be submitted by all students who are not presenting.
Student-driven Tutorial Discussions (10%)
Each group will choose a primary research paper (not a review) that exemplifies the concepts taught during the previous class. The group will have up to 45 minutes to lead a discussion about the paper and class content using open-ended questions. The discussion will be marked according to the following criteria:
· ANALYSIS (5): level of depth of analysis and engagement from the class
· CONTENT (2): description and background of relevant material
· CLARITY and COMMUNICATION (2):
· OVERALL STRUCTURE (1): organization and logical flow

Papers selected for tutorial presentations should be emailed to the class (or uploaded to avenue, or to Alyssa and she can distribute) at least 24h prior to presenting.

Research Explorations (15%)
Each student will explore and apply concepts learned during tutorials to their own research area. If students are not currently involved in a thesis project they may conceptualize a theoretical project for this presentation. The exploration will be an oral presentation during the second hour of the tutorial and students will have no longer than 20 minutes (including questions). Explorations will be marked as follow:
· ANALYSIS (5): level of depth of analysis applying class concepts
· CONTENT (5): description and background of relevant material (results, models, diagrams)
· CLARITY and COMMUNICATION (3): this item also includes ability to answer questions
· OVERALL STRUCTURE (2): organization and logical flow

Class Participation and Peer Evaluation (20%)
Participation and engagement is a large component of this course and as such it is expected that student’s will be actively engaging in thoughtful conversation and discussion at all presentations. Every peer evaluation (for lectures) that is missed/not sent to Alyssa by 5pm the day of lecture will result in a deduction of 2.5% from the class participation/peer evaluation grade. Peer evaluations should be thoughtful and come with constructive criticism (pros AND cons) of the presentation as a whole, as well as of the presentation skills of the individuals presenting. Classes in which students are not paying attention/engaged in the discussion of concepts brought forth will also result in a deduction of 2.5% from the overall grade.

Research Proposal Presentation (20%)
Each group will create a research proposal and experimental design, developed using the framework learned over the semester. The proposal should be sufficiently extensive (3 year time span). Each group will have up to 60 minutes (including questions) to present their research proposal. The presentation will be marked according to the following criteria:
· OVERALL STRUCTURE (1): organization and logical flow
· CONTENT (5): description and background of relevant material
· ANALYSIS (5): level of depth and analysis in addressing research question
· SUMMARY (2): clear and concise, including future directions
· REFERENCING (1): proper use of
· CLARITY AND DELIVERY (1)
· QUESTIONS (5): ability to defend experimental design

A copy of the presentation should be emailed to Alyssa and Dr. Yang prior to class.
Research Proposal (25%)
Each group will submit a research proposal based on their presented proposed research, which should adhere to CIHR-style guidelines (see research proposal guidelines for details). The report will be marked according to the following criteria:
· OUTLINE (2): logical selection of topic with good bones prepared in outline
· OVERALL STRUCTURE (3): organization and logical flow with proper formatting
· FIGURES AND TABLES (1): good and proper use of
· CONTENT (6): description and background of relevant material
· ANALYSIS (6): level of depth and analysis in addressing question
· SUMMARY (5): this includes clear and concise summary, including future directions
· REFERENCING (2): proper use of

This final assignment should be emailed to Alyssa no later than 11:59pm on DECEMBER 7, 2017.

Academic Integrity
You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. Academic dishonesty is to knowingly act or fail to act in a way that result or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university. It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at www.mcmaster.ca/academicintegrity. The following illustrates only two forms of academic dishonesty:
1. Plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
2. Improper collaboration in group work.

Class schedule:

<table>
<thead>
<tr>
<th>Week</th>
<th>Thursday</th>
<th>8:30-10:20</th>
<th>12:30-2:20</th>
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<tbody>
<tr>
<td>SEPT</td>
<td>7</td>
<td>No Class</td>
<td>Introduction, Presentation Sign Up</td>
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<tr>
<td></td>
<td>14</td>
<td>Group Meeting</td>
<td>Group Meeting</td>
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<td>21</td>
<td>Group Meeting</td>
<td>Group Meeting</td>
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<tr>
<td></td>
<td>28</td>
<td>Research Proposal Outline Due</td>
<td>Lecture - Group 1</td>
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<tr>
<td>OCT</td>
<td>5</td>
<td>Tutorial - Group 4; Research Exploration -</td>
<td>Lecture - Group 2</td>
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<tr>
<td></td>
<td>12</td>
<td>READING WEEK</td>
<td>READING WEEK</td>
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<td></td>
<td>19</td>
<td>Tutorial - Group 1; Research Exploration -</td>
<td>Lecture - Group 3</td>
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<td>26</td>
<td>Tutorial - Group 2; Research Exploration -</td>
<td>Lecture - Group 4</td>
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<td>NOV</td>
<td>2</td>
<td>Group Meeting</td>
<td>Tutorial - Group 3; Research Exploration -</td>
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<td>9</td>
<td>Group Meeting</td>
<td>Group Meeting</td>
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<td>16</td>
<td>Research Proposal – Group 1</td>
<td>Research Proposal – Group 2</td>
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<td></td>
<td>23</td>
<td>Research Proposal – Group 3</td>
<td>Research Proposal – Group 4</td>
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<td>Group Meeting</td>
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<tr>
<td>DEC</td>
<td>7</td>
<td>Written Proposals Due</td>
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### Reading Assignment:

<table>
<thead>
<tr>
<th>Name</th>
<th>GROUP #</th>
<th>Assigned Chapters</th>
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<tbody>
<tr>
<td>Rachel Heo</td>
<td>1</td>
<td>Ch 1-9</td>
</tr>
<tr>
<td>Mughda Khondker</td>
<td>1</td>
<td>Ch 1-9</td>
</tr>
<tr>
<td>Michael Ho-Yan Lee</td>
<td>2</td>
<td>Ch 10-18</td>
</tr>
<tr>
<td>Danny Ma</td>
<td>2</td>
<td>Ch 10-18</td>
</tr>
<tr>
<td>Rohit Malyala</td>
<td>3</td>
<td>Ch 19-26</td>
</tr>
<tr>
<td>Sunshine Quan</td>
<td>3</td>
<td>Ch 19-26</td>
</tr>
<tr>
<td>Peter Zeng</td>
<td>4</td>
<td>Ch 27-34</td>
</tr>
<tr>
<td>Justyna Zukowski</td>
<td>4</td>
<td>Ch 27-34</td>
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