

MOL BIOL 4BB3: Plant Metabolism and Molecular Biology

Fall 2018

Instructors:

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In lieu of scheduled office hours, I will be happy to discuss material from the course outside class-time but please email me to make an appointment first.

Lectures: Tu We Fr 12:30 am to 1:20 pm KTH B101

Course Evaluation:

Midterm Exam (Date: Friday, October 5, 2018)	15 %
Inquiry Assignment:	
- Individual component	10%
- First Draft of Written Component (group)	5 %
- Final Draft of Written Component (group)	20%
- Presentation (group)	10%
- Peer feedback	5 %
Participation on Tutorials (3)	5%
Final Exam*	30%

* Please consult the exam schedule set by the Registrar's Office

Recommended Texts:

Given the nature of the course content, there are no required textbooks. You may find textbooks used for BIOL 2DO3 and BIOL 3BO3 (eg. *Plant Physiology and Development* 6th Edition L. Taiz, E Zeiger, Møller and Murphy 2015) to be helpful references for review.

Recommended and/or Assigned Readings:

The title of any research articles will be given in listed in the Contents section of Avenue to Learn and they will be available on-line through the McMaster University Library e-journal portal.

Organization of Lectures, Assignments and Participation: (This may be subject to change depending upon class enrolment)

The class is organized as a combination of lectures, discussion and an inquiry exercise.

In brief, an important learning objective of this course is to develop skills in critically reviewing and using primary research articles and to encourage critical analysis and discussion about the contents of papers, their significance and how the research has contributed to our knowledge of a topic. As such, lecture slots will occasionally be used for a tutorial format

providing a combination of discussion sessions and group work on the inquiry assignment. These topics are related to the lectures and questions arising from group work and tutorials will appear on exams.

Unless otherwise instructed, assignments are due by 5 pm on the due date.

Inquiry Assignment:

This assignment and the “deliverables” will be discussed in greater detail during class.

Learning objectives: The project will introduce students to valuable on-line resources for plant biotechnology and especially plant genomics research. The goal will be to develop and apply knowledge gained through on-line databases, published papers, and lecture content to the selection and study of genes that show potential in improving crop stress tolerance.

Process: RNA-Seq datasets will be assigned to a group of students (depending on enrolment numbers, groups based upon four to five students may be possible). Each group will be given a dataset obtained through mining an existing RNA-Seq database. Each group must then establish criteria to evaluate the genes and divide the dataset among members of the group so that every member has a subset of genes to research and critically evaluate using the selection criteria agreed upon by the group. Each student in the group will then submit the assessment of their gene list as a one to two-page appraisal and this comprises the Independent Component of the inquiry assignment. All of the information gathered by the group will then be used by the group to advance one gene that merits further study (ie, “validation”). The next part of the assignment will be devising a research approach that will enable you to validate the role of the selected gene towards eventual crop improvement. The culmination of the effort will be a group written project proposal and a class presentation defending the selection of the gene-of-interest and a description of the validation approaches that will be used. The peer review mark will include a composite of the instructors’ evaluation and student input.

Policy and Terms related to MOL BIOL 4BB4

Midterm Exam:

The mid-term exam will be held during the **Friday, Oct 5th** lecture slot. The location of the midterm is in KTH B101. You will be given the entire lecture time to write the exam so make sure you arrive to begin promptly at 12:30 pm. Calculators and other electronic devices are not permitted (and not necessary). In the event of an absence, there will be only one make-up offered at 8:30 am on Monday, October 15th.

Participation on Group Work:

You will be required to follow through as signatories of a contractual agreement for group work expectations. Class time will be given for group discussion on the contract and a template providing an outline of the agreement will be made available in advance. Skills and experience in group work is an expectation for most jobs in the workplace as this capitalizes on complementary skills and experience that different people bring to enrich a project. But group efforts can be onerous when member(s) work on different timelines, have different priorities (on the work and life in general), and directions diverge rather than converge- all possible ways of generating conflict. Yes, these are all pretty normal facets of group work but managing them is a shared responsibility and project management is a skill that is benefits from experience. Your group contract will be the blueprint of how you will identify problems, resolve conflicts, cope with changes in your plans, and deal with challenges that may compromise the efforts of the group.

McMaster Policy on Academic Integrity:

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and 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 kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at http://www.mcmaster.ca/senate/academic/ac_integrity.htm

Three of the forms that academic dishonesty may take are:

- Plagiarism, e.g. the submission of work that is not one's own (in whole or in part) or for which other credit has been obtained.
- Improper collaboration in group work

In MOL BIOL 4BB3 you will be participating in a group enquiry project that has individual as well as group components. The group effort will be recognized by a group mark in acknowledgement that this "deliverable" represents the collective efforts of all members. The individual components (gene selection and peer review) are your own assignments and the final submission represents your ideas although group discussion and exchange of information is encouraged during

preparatory stages.

- Copying or using unauthorized aids in tests and examinations.

McMaster Policy on course elements:

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

For absences from classes lasting up to 3 days:

If you are absent from the university for a minor medical reason, lasting fewer than 3 days, you may report your absence, once per term, without documentation, using the McMaster Student Absence Form. Absences for a longer duration or for other reasons must be reported to the Associate Dean of Science Office, with documentation, and relief from term work may not necessarily be granted. When using the MSAF, report your absence to the Instructor (weretil@mcmaster.ca) and then follow up immediately (normally within 2 working days) by email with Dr. Weretilnyk to learn what relief may be granted for the work you have missed, and relevant details such as revised deadlines, or time and location of a make-up exam. Please note that the MSAF may not be used for term work worth 25% or more, nor can it be used for the final examination. Please note above the policy for a make-up time on a missed mid-term for this class.

NOTE: This course has a compulsory inquiry component and tutorial discussions. As with all group work, the quality of your participation has an impact on the outcome. It will not be possible to arrange special sessions if the class-scheduled opportunities are missed.

Online Conduct:

As a student enrolled in this course you have been granted permission to access an online learning management system, Avenue to Learn.

Avenue to Learn course pages are considered an extension of the classroom and usage is provided as a privilege subject to the same code of conduct expected in a lecture hall (see relevant section of the student code of conduct below). This privilege allows participation in course discussion forums and access to supplementary course materials. Please be advised that all areas of Avenue to Learn, including discussion forums, are owned and operated by McMaster University. Any content or communications deemed inappropriate by the course instructor (or designated individual) may be removed at his/her discretion. Per the University Technology Services Code of Conduct, all members of the McMaster community are obligated to use computing resources in ways that are responsible, ethical and professional. Avenue to Learn Terms of Use are available at <http://avenue.mcmaster.ca>.

In this course we will be using email and in the past group members for the inquiry assignment have communicated with each other using various social media platforms including Facebook. Students

should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

Student Code of Conduct - Appendix D

Major Offences include, but are not limited to: (h) engaging in disruptive behaviour. Disruptive behaviour is behaviour in class or out of class which involves substantial disorder and/or disrupts the operation of the University (j) engaging in verbal or non-verbal behaviour or communication toward an individual or group which is considered to be intimidating, harassing and/or discriminatory.

Academic Accommodation of Students with Disabilities

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca. For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

Academic Accommodation for Religious, Indigenous or Spiritual Observances (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students requiring a RISO accommodation should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact Dr. Weretilnyk (weretil@mcmaster.ca) as soon as possible to make alternative arrangements for assignments and midterm dates.

Lecture topics below provide a tentative outline of the material to be covered. It is my intention to use some lectures to introduce a paper for a follow-up tutorial. Papers for discussion will be available a week in advance of the tutorial. Dates in bold are key dates to track.

MOL BIOLOGY 4BB3 Lectures: Tentative Outline

Proposed Schedule	Topic	Comments
Sept 4, 5	Introduction: Are plants green animals?	
Sept 7, 11	Plant genome organization	
Sept 12,14, 18	Genomics: Next Generation Sequencing <ul style="list-style-type: none"> • Sample preparation • Platforms 	Start Inquiry Project Sept 14: Discuss Inquiry Assignment deliverables and Group Contract
Sept 19	Workshop: Use of plant research databases	Cover research resources for work on plants. Bring your computer to class and use McMaster wireless.
Sept 21	Plant Respiration: Glycolysis and by-pass mechanisms.	
Sept 25, 26	Mitochondrial Respiration	
Sept 28	Farncombe Metagenomics Facility	Tour: Please be prompt. Meet in Health Sciences (TBA)
Oct 2	Class time to work on Inquiry Assignment	Class opportunity for group meetings. In-class support available.
Oct 3	Review for Midterm	
Oct 5	Midterm Exam	Midterm Exam to cover material up to end of respiration section.
Oct 9, 10,12	No classes	Midterm Recess
Oct 16	Photosynthesis: Light reactions	Focus on mechanisms regulating energy distribution from light reactions and flow of carbon.
Oct 17	Photosynthesis: CO ₂ fixation I	Individual component of Inquiry Due.
Oct 19	Photosynthesis: CO ₂ fixation II	Feedback on individual component returned.
Oct 23	Group Work on Inquiry Assignment	Class opportunity for group meetings. In-class support available.
Oct 24	Carbohydrates	
Oct 26	Tutorial-1	Review of paper.

Oct 30	Group Work on Inquiry Assignment	
Oct 21	N assimilation I	
Nov 2	Tutorial-2	Review of paper
Nov 6	N assimilation II	
Nov 7	Group Work on Inquiry Assignment	
Nov 9	S assimilation	Draft of group submission due.
Nov 13	Lipid metabolism I	
Nov 14	Lipid metabolism II	
Nov 16	Group Work on Inquiry Assignment	Class opportunity for group meetings. In-class support available.
Nov 20	Specialized metabolites I	Guest lecturer Dr. David Liscombe
Nov 21	Specialized metabolites II	Guest lecturer Dr. David Liscombe
Nov 23	Tutorial-3	Review of paper
Nov 27	Group Work on Inquiry Assignment	Class opportunity for group meetings. In-class support available.
Nov 28	Presentations on Inquiry Project	In-class presentations.
Nov 30	Concluding comments	
Dec 4	Last class: Review Session	Final exam covers material covered from Photosynthesis lectures on and includes content of tutorials.
Dec 5	No class	Final version of written component of project due Dec 5.

MOL BIOL 4BB3. Preparing for Tutorials: Reviewing a Paper

Reading and Reviewing a Paper (adapted from V.E. McMillan (1997) *Writing Papers in the Biological Sciences* 2nd Ed, Bedford Books, Boston)

1. **Acquire some background knowledge.** What is the historic background for the topic? What terms must you define to follow/explain the paper?
2. **Read the abstract first.** An abstract should summarize the most important points of the study. A disadvantage is that it is brief and may seem confusing. The introduction or discussion can often clarify unfamiliar terms or concepts.
3. **Determine the aim or objective of the study.** Why was the research done? (Relate this to #1, the background and the history of the subject). What were the hypotheses tested and what predictions were made? A “good” author will make his/her objectives very clear.
4. **Do not lose yourself in the ‘Methods and Materials’ section.** While it is true that techniques can be a source of misgivings regarding the outcome and interpretation of experiments, sometimes we can spend too much time reconciling details about techniques and lose sight of the relevance of the paper. Return to ‘Methods and Materials’ once you feel comfortable with the contents of the ‘Results’ and ‘Discussion’ section(s).
5. **Read the results carefully.** Look at the figures or tables and make your own notes of what is happening. Now, look at the author’s description of findings. Do not worry if your interpretation and that of the author disagree. Re-examine the data with the author’s interpretation in mind and try to reconcile any differences.
6. **The discussion section should highlight the relevance of the data, especially as it relates to satisfying questions raised by the objectives of the study.** Does the data support the author’s predictions or conclusions? If so, how? If not, why not? What does the author suggest is the significance of the contribution? Does the work raise the possibilities of future research avenues?
7. **If the paper is not very recent, have some related but more recent discoveries followed from this work?** Did the original paper you read lead to exciting, new outcomes? Was the paper well-accepted/refuted and cited by other researchers?
8. **Do not assume that a single read-through will be all you need to understand a paper.** It may take several attempts before you satisfactorily understand a paper and several more to review it fairly. Primary research articles can be detailed and difficult to follow - try not to lose yourself on detail or jargon at the expense of understanding the broader issues being covered.

MOL BIOL 4BB3 Independent Inquiry format and content:

- Clear and concise writing. This component may be done as bullet points.
- One to two pages in length excluding page for references cited.
- Line spacing: 1.5.
- Summarize findings on the genes in your subset and succinctly evaluate their promise as a gene lead for validation.
- Make and support a recommendation for the most promising gene in your subset.

MOL BIOL 4BB3 Group Inquiry Report format and content:

- Clear and concise writing.
- Five to ten page length excluding page for references cited.
- Line spacing: 1.5.
- You may include flow charts or figures and these pages are not included in the text length.
- Content guidelines given below.

Organization:

- 1) Introductory section outlining the scope of the problem: what is the challenge you are addressing regarding crop productivity? Use credible, scientific references here not a popular journal for farmers or the almanac, etc. Avoid “motherhood statements” that can’t actually be backed up by references because they are too broad (eg. *Low temperatures affect crops*. This is a statement that may hold some truth but is too vacuous to be useful or informative.). Make every sentence count. This section should also discuss/introduce the plant that was used for identifying this stress-responsive gene and whether it shows similar regulatory properties in other plants.
- 2) Give a short discussion on the gene your group selected for your focal research and explain why. You may want to identify some of the challenges you face and the nature of the research already published on the activity/structure/physiological role/regulation of the gene and/or its product.
- 3) Organize an experimental plan that outlines what you intend to do by way of empirical research. What do you need to know before you begin your experiments? How will you manipulate the gene? Which model plant do you intend to use? Outline the experiments with sufficient detail that you show that you understand the challenges lying ahead, the controls needed, equipment requirements if special, growing conditions, etc. Be specific in your details, many experiments can be done but which experiments must you do to validate your gene of interest.
- 4) Closing section to summarize the project and the contribution you believe that you will make to our understanding of plant responses to stress. That is, how will your results contribute towards what is already known in this field?
- 5) Consistent reporting of citations in the body of the work and a reference list that is also formatted consistently. I suggest following the format used for the journal, *Plant Physiology*. I want to see all authors listed in the reference section but “*et al.*” is fine for the report part.