

ANAT 565: Diseases of Membrane Trafficking

Lecture Outline & Course Information

2024

McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see <http://www.mcgill.ca/students/srr/honest>)

Language of Submission: “In accord with McGill University’s Charter of Students’ Rights, students in this course have the right to submit in English or in French any written work that is to be graded. This does not apply to courses in which acquiring proficiency in a language is one of the objectives.” (Approved by Senate on 21 January 2009)

ANAT565: Diseases of Membrane Trafficking.

Department of Anatomy and Cell Biology

Course Coordinator: Dr. John F. Presley

3 credits

Prerequisites: ANAT365.

Fridays 2:35 pm-5:25 pm, ARTS 230

Instructors: J. F. Presley (coordinator)

A. Pshezhetsky, N. Lamarche-Vane, S. Lefrancois, T. Nilsson

TA: Farah Ali (farah.ali2@mail.mcgill.ca)

Content:

This course will examine how research into diseases has played a key role in unraveling the intricate molecular mechanisms controlling membrane trafficking in mammalian cells.

Topics:

Endosomal maturation and lysosomal targeting.

Molecular basis of lysosomal storage disorders.

Regulation of protein trafficking by post-translational modifications (ubiquitination, prenylation and palmitoylation).

Rho GTPase and cytoskeletal binding protein mediated trafficking associated with neurological diseases and cancer.

Intracellular storage of lipids and disease.

Methods:

One or two lectures per week

Readings: These will generally include references for one review article and several primary articles for each topic covered in class. Among the primary articles are those that will be presented in class by the students.

Evaluation:

5% for Participation

25% In-class quizzes based on lectures and review articles

25% oral presentation of a primary research article

15% Grant proposal 1, hypothesis assigned.

30% Grant proposal 2, based on primary research article of the oral presentation.

The hypothesis (unanswered) for the first grant proposal will be assigned. For the second assignment you should propose a previously untested or unanswered hypothesis related to the topic of your paper presentation.

Lecturer Coordinates:

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Evaluation Details

1) Participation (5%)

Marks will be given for participation in the oral presentation questioning time. Each student is expected to ask one question for each of the 5 topics and will be awarded 0.5% for each valid, scientifically posed question. There is an average of 4-5 presentations per topic, so for a class size of 25 the presenter should be expecting to get about 5 student questions.

The remainder of the class participation (2.5 %) will be given for participating in the peer review of the first and second grants. You will be expected to submit your own grant for peer review, and to provide feedback on the grants of two or three other students. **The peer review sessions will be organized by the TA.**

2) Quiz (25%)

There will be 5 quizzes in total (see syllabus for dates) and each quiz will be worth 5% of the final grade. The quiz format will normally be short answer and will take place in class. One hour will be allocated to each quiz. Quizzes will be related to the material covered in one lecture and the associated review articles. When quizzes are missed for a valid reason such as illness, the grade will be replaced with the average of the other quizzes. Note that absences for foreseeable reasons (e.g., medical school interviews, varsity sports) must be approved in advance.

3) Oral Presentations (25%)

One primary research paper will be assigned per student, list available on *My Course* site (TBA). Presentations will be in the form of a 15 minute power-point presentation followed by 5 minutes for discussion and questions. Typically, a 15 minute presentation will consist of 15 slides or less. The main results of the paper should be explained using the figures from the paper. One method used to obtain the results should be discussed. A short introduction and conclusion about the paper should also be prepared. The students should explain the rationale, methods, results and conclusion for the figure(s) they present. SEND A COPY to the professor marking your presentation and to john.presley@mcgill.ca.

Introduction: Should give the background information, rationale and/or hypothesis of the study.
Grading: 5/25

Materials and Methods: Should describe in detail one of the methods used. **Grading: 5/25.**

Results: Should summarize the searched question(s) and outcome(s) of the experiment(s) for the figure(s) presented. **Grading: 10/25.**

Discussion: Should state the meaning and significance of the results, including the conclusion of the figure that you present and the overall conclusion of the paper. Students should also be able to **answer questions** regarding any aspect of the paper **INCLUDING** methods and figures that are not presented during the 15 minutes. **Grading: 5/25.**

4) Grant Proposals

Grant proposals are due on **February 23th** (first grant proposal) and **April 12** (for the second grant proposal). Please provide electronic copies by e-mail to john.presley@mcgill.ca for the first grant proposal, and to the responsible professor (with copy to john.presley@mcgill.ca) for the second grant proposal. Late assignments will be penalized by 10% every day that they are late. Assignments will not be accepted past 3 days after they are due.

Peer Review of Proposals

Note that for full participation credit the first grant proposal **MUST** be complete by **February 9** and submitted to farah.ali2@mail.mcgill.ca who will distribute it to other students for peer review if you wish to receive full participation marks. After you have read the other proposals and received feedback from the other students, you will likely find that you can improve the proposal with further changes. The final version of the first proposal must be submitted to john.presley@mcgill.ca by **February 23**.

Similarly, the second proposal **MUST** be complete by **March 28** and submitted to farah.ali2@mail.mcgill.ca to be eligible for peer review and participation mark. The final version of the second proposal must be submitted to the responsible professor by email by **April 12**.

Structure of Proposals

The grant proposals consist of 5-page double-spaced text (12 point font, 1" margin) with extra pages for references (20 references maximum), and with the abstract and title on a separate page (250 word maximum; does not count against the 5 pages). A penalty will occur if the proposal is longer than this (-10%). Three to four self-generated figures i.e., not reproduced from a publication can be included as part of the assignment to illustrate the points under discussion. These figures are not included in the five pages of text and should be attached at the end and not embedded in the text. The text should be grammatically correct and easy to read, organized in the format of a scientific proposal, including Summary (abstract), Introduction (Background and Significance), Hypothesis and Rational, Experimental Design and Methods (including justification and validity of using a given method to address a specific hypothesis), Anticipated Results, Discussion (i.e., significance of results), Future Directions of Research, References and Figures.

First grant proposal (15%),
Second grant proposal (30%)

Abstract (1 or 2)

The abstract is present and summarizes the introduction, hypothesis, methods, expected results and future directions.

Introduction/ Literature Review (3 or 6)

The introduction is present and well written with appropriate and correct background, including the significance of the field (both in terms of research and medically).

Hypothesis (0 or 3)

The hypothesis will be assigned for the first grant proposal. The hypothesis for the second proposal is based on a follow-up of the paper you will present orally in class. It should be clearly stated, reasonable, and previously unanswered.

Methods (3 or 5)

The experimental design will prove the hypothesis and experiments are possible and logical.

Expected Results (4 or 6)

Results are present and well written; some expected and alternative results should be stated. The expected results should be logical, that is consistent with the hypothesis.

Discussion and Future Directions (4 or 8)

This section is present and well written. You should state the significance of the findings and propose future experiments, specifically answering questions that arise from the results. Points will be deducted for errors such as scientific error or error that affects the understanding of the proposal.

LEARNING OUTCOMES

1. Acquire knowledge of molecular and cellular biological techniques.
2. Compare, relate and analyze the different mechanisms leading to membrane trafficking associated disorders. Also develop a comprehensive understanding of the processes of membrane trafficking in the mammalian cell.
3. Read, understand, interpret, critically analyze, and present a primary research article relating to membrane trafficking and related diseases.
 - 3a. Identify a hypothesis and assess its validity in the context of the current literature in the field.
 - 3b. Identify and evaluate the molecular and cellular methods used to test the hypothesis.
 - 3c. Evaluate the data and their significance.
 - 3d. Formulate and develop a new hypothesis based on the new data.
4. Write a scientific proposal.
 - 4a. Identify, access, and read the relevant primary literature on membrane trafficking diseases.
 - 4b. Formulate an unanswered hypothesis based on the current knowledge in the field.
 - 4c. Design two or three experiments to test this hypothesis and rationalize the use of the methodology.
 - 4d. Predict and interpret the possible results of the experiments.
 - 4e. Formulate a new hypothesis based on the predicted results and identify and justify an appropriate method(s) to test this new hypothesis.

SCHEDULE

1. January 5th PRESLEY: 2:35 Introduction to Course.

3:00 Introduction to Membrane Trafficking

2. January 12th PRESLEY:

2:35 Alterations of lysosomal pathways in the development of lysosomal storage disorders.

3:35 Presentation: Essential skills for manuscript interpretation and presentation. (PRESLEY; Duration: 45 min)

3. January 19th PRESLEY

2:35 **Quiz #1** on Jan 12th lecture and review articles.

3:35 Presentation: Introduction to experimental approaches and methods (PRESLEY)

4:00 Presentation: Grant proposal writing (PRESLEY)

Assignments for first grant proposal.

4. January 26th PRESLEY/ PSHEZHESKY

2:35 Lecture: Lysosomes and their diseases. (PSHEZHESKY; Duration: 1.5hs)

4:00 Four to five short oral presentations of primary research articles by students (PRESLEY)

5. February 2rd PSHEZHESKY

2:35 Four to five short oral presentations of primary research articles by students (PSHEZHESKY; Duration: 2-3hs)

6. February 9th PSHEZHESKY / LAMARCHE

2:35 **Quiz #2** on Jan 26th lecture, research, and review articles (PSHEZHESKY)

3:35 Lecture: Rho GTPases and Disease (LAMARCHE; Duration: 1:30hs)

Submit first grant for peer review to TA (farah.ali2@mail.mcgill.ca). TA will assign groups and will distribute to students in your group by Tuesday, February 13. TA will not evaluate grant except to confirm that it was complete and submitted in a timely manner.

7. February 16th LAMARCHE

2:35 Four to five short oral presentations of primary research articles by students (LAMARCHE; Duration: 2-3 hs)

4:35-5:25 Peer review session. Meet in groups to provide feedback to other students on their grants. **You will have received your assigned grants to review by Tuesday, February 13, and should have read them and filled out the evaluation sheets.**

8. February 23th NILSSON

2:35 Quiz #3 on Feb 17 lecture (LAMARCHE, 1 hr).

3:35 Lecture: Role of Lipid Metabolism in Fatty Liver Disease (NILSSON Duration: 1:30hs)

First Grant Application Due. Email to john.presley@mcgill.ca by midnight.

9. March 1st NILSSON

2:35 Four to five short oral presentations of primary research articles by students (NILSSON; Duration: 2-3 hs)

March 8th

READING WEEK, no class

10. March 15th NILSSON / LEFRANCOIS

2:35 Quiz #4 on Feb 23rd lecture, research, and review articles (NILSSON; Duration: 1.0hs)
3:35 Lecture: Regulation of protein trafficking and function by post-translational modifications (LEFRANCOIS; Duration 1.5 hrs)

11. March 22nd LEFRANCOIS

2:35 Four to five short oral presentations of primary research articles by students (LAMARCHE; Duration: 2-3hs)

Submit second grant for peer review to TA (farah.ali2@mail.mcgill.ca) by Thursday March 28. TA will assign groups and will distribute to students in your group by Tuesday, April 2. TA will not evaluate grant except to confirm that it was complete and submitted in a timely manner.

March 29th

Good Friday. No class

12. April 5th LEFRANCOIS

2:35 Quiz #5 on March 15 lecture (LEFRANCOIS) (1 hr).

3:35 Peer review session (Duration: 30 min - 1 hr). Meet in groups of 3-4 to provide feedback to other students on their grants. Small peer review groups (duration 30 min. to 1 hr) will be organized at mutually convenient times during the regular class time on March 31.

You will have received your assigned grants to review on Tuesday, April 2, and should have read them and filled out the evaluation sheets.

13. April 12th (FRIDAY)

Final version of second grant proposal due by midnight the last day of class, April 12. It should be sent to the same professor you made your presentation to, with copy to john.presley@mcgill.ca.