

Faculty of Science Course Syllabus (Section A) (revised April 2022)
Department of Biochemistry and Molecular Biology
Advanced Cardiovascular Biochemistry - BIOC 5309
Fall Term 2022

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

We acknowledge the histories, contributions, and legacies of the African Nova Scotian people and communities who have been here for over 400 years.

Instructor(s): Dr. Thomas Pulinilkunnil & Dr. Petra Kienesberger

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Lectures: Tuesday and Thursdays (11.35 am -12.55 pm)

Laboratories: N/A

Tutorials: N/A

Course delivery: In-person - Halifax: CRC-C216; Saint John: DMNB Room 221 (Teams link:

[Click here to join the meeting](#)); lectures will not be recorded.

Course Description

Advanced Cardiovascular Biochemistry is a specialized area for students pursuing graduate and postgraduate program in cardiovascular sciences. The course material for BIOC 5309 is presented in two 90 min sessions per week and is a 3-credit course. There will be 25 sessions.

Course Prerequisites

The students must have gained fundamental knowledge of biochemistry, cell and molecular biology in the prerequisite classes. A basic knowledge on cardiovascular physiology will be desirable.

Course Exclusion

N/A

Learning Objectives

1. Understand cardiac anatomy and myocyte structure, and describe the biochemical basis of myocyte action potential, calcium handling, contractility and vasoactive signaling.
2. Illustrate biochemistry of substrate utilization and nutrient signaling in the heart. Understand the established principles of glucose, fatty acid and amino acid metabolism. Decipher the molecular underpinnings of mitochondrial metabolism, TCA cycle signaling and mitochondrial function.
3. Apply the knowledge of cardiac metabolism and signaling to understand the biochemistry of metabolic disorders in obesity, diabetes, coronary artery disease, hypertrophy, ischemia reperfusion injury and heart failure.
4. Describe the molecular basis for emerging heart failure drugs.
5. Organize an effective literature search and apply it to formulate a mini review and conceive an idea for a potential grant application.

Course Materials

Those with limited knowledge of cellular biochemistry are urged to review appropriate sections of an introductory biochemistry textbook such as Biochemistry (9th Edition). Harper, 31st Edition or Principles of Biochemistry (8th Edition) Lehninger. This course will be beyond the scope of these texts and will involve material from original manuscripts and review articles. Textbooks recommended for this course are
Molecular Mechanisms of Cardiac Hypertrophy and Failure- Edited by Richard Walsh
Cardiac Energy Metabolism in Health and Disease- Edited by Lopaschuk & Dhalla; 2014
Heart Physiology and Pathology by Eugene Braunwald; 18th Edition
Heart Failure-Bench to Bedside Jose Marin Garcia
Biochemistry of Cardiovascular Dysfunction in Obesity- Edited by Tappia, Bhullar & Dhalla; 2020

For online/blended course delivery:

N/A

Course Assessment

| Assessment | Weight (% of final grade) | Date |
|------------------------------|---------------------------|---|
| Mini Review | 15% | November 15, 2022 |
| Grant Proposal –Write Up | 35% | November 30, 2022 |
| Grant Proposal –Presentation | 15% | December 1 & 6, 2022 |
| Literature discussion | 35% | September 15, October 04 & 20, November 15& 29 |

Literature discussion and participation (35%): Students will work together to discuss research paper related to prior lecture topics. There will be five such sessions. Papers will be assigned by the course coordinator and sent to the class the week before the discussion. Students will present specific sections of a given manuscript for e.g., introduction, methods, results, discussion as assigned by the course coordinator in a PowerPoint format. Expectation is 2-4 slides per student. Examples of what the presentation entails are;

- Summarize the background information, rationale, current knowledge and knowledge gaps.
- State the goals and hypotheses of the study.
- Describe the methodological approaches and experimental design to address the goals and hypotheses.
- Describe figures within the result section with details on readouts, graph/plot details, and statistical analyses.
- Highlight the contribution of this study, knowledge advancement and its impact on the field.
- strength and weakness of the study, appropriateness of the methodology and study design and feedback on how the study could have been improved.

It is expected that all students will have read the assigned research papers before the literature discussion. The grade for participation is based on attendance and presentation at the literature discussion. If a student is unable to attend, they must inform the Course coordinator beforehand to avoid being penalised. The grade will be determined at the end of the semester based on the Course coordinator assessment of the above criteria.

Mini Review (15%) and Grant Presentation and Write up (50%): Review article writing and developing grant proposal directly test the ability of the student to apply the knowledge gained from cardiovascular biochemistry to the field. After discussing with each student, Course coordinators will finalize the topics for review and grant by the second week of September.

Students will be expected to write 1 mini review (2 pages, Font 12, double spaced, one separate page of figure/table allowed). Page limit do not include references. Review article submission is due on November 15, 2022. The grant

proposal topic is based on the topic of the mini review (essentially mini review will form the introduction to the grant proposal).

Students will be expected to write a three-year grant (3 pages, Font 12, double spaced, one separate page of figure/table allowed) in either CIHR or HSFC format written on a research area that is at arm's length from student's graduate thesis work. Page limit do not include references. 3-page grant must include a brief background of the problem, hypothesis, aims/goals, methodology for each aim, contingency plans, anticipated data, timeline, sex and gender considerations, future direction, impact, and knowledge translation. Grant submission is due on November 30, 2022. Students will need to make a 10 min presentation (not more than 5 slides) on their proposed grant and defend the proposal similar to that expected of a qualifying exam. Grant presentations will be held on December 01 and 06, 2022.

It is expected that students complete these assignments in a timely manner. For any non-communicated deferral, 10% marks will be for every week after the deadline. University regulations on plagiarism will be strictly adhered to in this course. Details on guidelines and policies around plagiarism are available on the following URL: (<http://www.registrar.dal.ca/calendar/ug/UREG.htm#12>).

Other course requirements

N/A

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

| | | | | |
|-------------|------------|------------|---|---------|
| A+ (90-100) | B+ (77-79) | C+ (65-69) | D | (50-54) |
| A (85-89) | B (73-76) | C (60-64) | F | (<50) |
| A- (80-84) | B- (70-72) | C- (55-59) | | |

Course Policies on Missed or Late Academic Requirements

A student who fails to appear in class or misses due dates on assignments due to exceptional circumstances must notify the course coordinator or department office within 48 h. Absence for non-medical reasons is not ordinarily acceptable unless prearranged with the professor. A missed assignment for which no satisfactory arrangement has been made will be given a mark of zero.

Students are expected to use the Student Declaration of Absence form for late or missed requirements during the term once during this course.

Missed or Late Academic Requirements due to Student Absence (policy)

https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html

Course Policies related to Academic Integrity

For literature discussions, students will work together to discuss research papers related to prior lecture topics.

Course Content

| <u>Date</u> | | <u>Lecture/Session Topic</u> | <u>Instructor</u> |
|--------------------|-----|---|-------------------|
| Sep 06 2022 | 1. | Cardiac anatomy, action potential and myocyte structure & cytoskeletal architecture | TP |
| Sep 08 2022 | 2. | Cardiomyocyte contraction and calcium handling | PK |
| Sep 13 2022 | 3. | Vasoactive Signaling in the Heart | PK |
| Sep <u>15</u> 2022 | 4. | Literature discussion (relating to session 1, 2 & 3) | --- |
| Sep <u>20</u> 2022 | 5. | Cardiac glucose metabolism and insulin signaling | TP |
| Sep <u>22</u> 2022 | 6. | Cardiac lipid Metabolism | PK |
| Sep <u>27</u> 2022 | 7. | Bioactive lipid signaling in the heart | PK |
| Sep 29 2022 | 8. | Lipoprotein metabolism in the heart | PK |
| Oct 04 2022 | 9. | Literature discussion (relating to session 5, 6, 7 & 8) | |
| Oct 06 2022 | 10. | Amino acid signaling and metabolism in the heart | TP |
| Oct 11 2022 | 11. | Mitochondrial Metabolism of Substrates: Randle's Hypothesis | TP |
| Oct 13 2022 | 12. | TCA Cycle Signaling | TP |
| Oct 18 2022 | 13. | Mitochondrial quality control in the cardiomyocyte | PK |
| Oct 20 2022 | 14. | Literature discussion (relating to session 10, 11, 12 & 13) | |
| Oct 25 2022 | 15. | Pathways and Players of Protein Synthesis and Degradation within heart | TP |
| Oct 27 2022 | 16. | Signal Transduction of Physiological and Pathological Hypertrophy | PK |
| Nov 1 2022 | 17. | Coronary Artery Disease and Vascular Disease | TP |
| Nov 3 2022 | 18. | Biochemistry of metabolic cardiomyopathy | PK |
| Nov 15 2022 | 19. | Literature discussion (relating to session 15, 16, 17 & 18) | |
| | | <i>Mini Review Submission Deadline-November 15, 2022</i> | |
| Nov 17 2022 | 20. | Biochemistry of ischemia reperfusion injury | PK |
| Nov 22 2022 | 21. | Biochemical basis of heart failure | TP |
| Nov 24 2022 | 22. | Molecular mechanism of novel drugs for heart failure | TP |
| Nov 29 2022 | 23. | Literature discussion (relating to session 20, 21, & 22) | |
| | | <i>Grant Submission Deadline-November 30, 2022</i> | |
| Dec 1 2022 | 24. | Grant Proposal Presentation | |
| Dec 6 2022 | 25. | Grant Proposal Presentation | |
| Dec 13 2022 | 26. | Final Grades will be posted | |

List of papers for literature discussion sessions

1. Sep 15, 2022, 4. Literature discussion (relating to session 1, 2 & 3)
Circ Res. 2021 Oct 15;129(9):872-886. doi: 10.1161/CIRCRESAHA.121.319828.
Cardiovasc Res. 2022 doi: 10.1093/cvr/cvac077.
2. Oct 4, 2022, 9. Literature discussion (relating to session 5, 6, 7 & 8)
Am J Physiol Heart Circ Physiol 322: H1032–H1043, 2022.
Cell Metab. 2019 May 7;29(5):1119-1134.e12. doi: 10.1016/j.cmet.2019.01.005.
Cell Rep . 2020 Nov 10;33(6):108374. doi: 10.1016/j.celrep.2020.108374.
3. Oct 20, 2022, 14. Literature discussion (relating to session 10, 11, 12 & 13)
Cardiovasc Drugs Ther . 2022 Jun;36(3):383-397. doi: 10.1007/s10557-021-07267-y.
Cardiovasc Res . 2022 Jun 22;118(7):1742-1757. doi: 10.1093/cvr/cvab207
JCI Insight. 2022 Jun 30;e155475. doi: 10.1172/jci.insight.155475.
4. Nov 15, 2022, 19. Literature discussion (relating to session 15, 16, 17 & 18)
Diabetes Obes Metab . 2022 Jul 8. doi: 10.1111/dom.14814.
J Clin Invest . 2022 Mar 15;132(6):e150595. doi: 10.1172/JCI150595.
Nat Metab 2020 Nov;2(11):1248-1264. doi: 10.1038/s42255-020-00288-1.
5. Nov 29, 2022, 19. Literature discussion (relating to session 20, 21 & 22)
Circulation. 2020 Mar 24;141(12):968-983. doi: 10.1161/CIRCULATIONAHA.119.042640
Circ Res. 2022 Jun 24;131(1):91-105. doi: 10.1161/CIRCRESAHA.122.321050
Cardiovasc Res. 2021 Jun 1;cvab182. doi: 10.1093/cvr/cvab182.