

CHEM 4304-5109

Winter 2025

Instructor:

Professor Jeff Smith

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Lectures:

Thursdays, 8:35am - 11:25am

Please check Carleton Central for the room location

Textbook:

Students are not required to purchase textbooks or other learning materials for this course. Electronic PDF files will be distributed as needed.

Course website:

Brightspace will be used. Please visit Brightspace (<https://carleton.ca/brightspace/>) for course announcements, lecture notes and assignments.

Office hours:

Email is the best way to get a hold of me to make an appointment.

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CHEM 4304 / CHEM 5109 [0.5 credit]

Advanced Applications In Mass Spectrometry

Detailed breakdown of the physical, electrical and chemical operation of mass spectrometers. Applications in MS ranging from the analysis of small molecules to large biological macromolecules. Descriptions of the use of mass spectrometry in industry as well as commercial opportunities in the field.

Prerequisite(s): CHEM 2103 or BIOC 2300, and one of CHEM 2302 or CHEM 2303

Evaluation:

- a) Assignment dealing with lecture material (30%)
 - b) A large review of an application in MS
 - Oral presentation (20%)
 - CHEM 4304 – 20 mins long, ~5 mins for questions
 - CHEM 5109 – 30 mins long, ~5 mins for questions
 - Review article (50%)
 - CHEM 4304 – 12-15 pages in length
 - CHEM 5109 – 17-20 pages in length
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Grading:

The final grade for CHEM 4304-5109 will be based on the following:

Assignment	30%
Oral Presentation**	20%
Review article	50%
Total:	100%

** - 5% of this mark will come from peer evaluation

Academic Accommodations and Regulations

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes are outlined on the Academic Accommodations website (<https://students.carleton.ca/course-outline/>).

Statement on Chat GPT/Generative AI usage

Our understanding of the uses of AI and its relationship to student work and academic integrity continue to evolve. However, one of my goals for this course is to help students develop foundational skills in writing and critical thinking by practicing substantive content creation without the support of AI. As such, the use of AI in CHEM 4304/5109 is not allowed. Students who are suspected of using AI (Chat GPT/Generative AI) will have their work forwarded to the Office of the Dean of Science for an investigation into academic misconduct.

Statement on Academic Integrity

Students are expected to uphold the values of academic integrity, which include fairness, honesty, trust, and responsibility. Examples of actions that compromise these values include but are not limited to plagiarism, accessing unauthorized sites for assignments or tests, unauthorized collaboration on assignments or exams, and using artificial intelligence tools such as ChatGPT when your assessment instructions say it is not permitted.

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in [Carleton University's Academic Integrity Policy](#). A list of standard sanctions in the Faculty of Science can be found [here](#).

Additional details about this process can be found on [the Faculty of Science Academic Integrity website](#). Students are expected to familiarize themselves with and abide by [Carleton University's Academic Integrity Policy](#).

Student Rights & Responsibilities

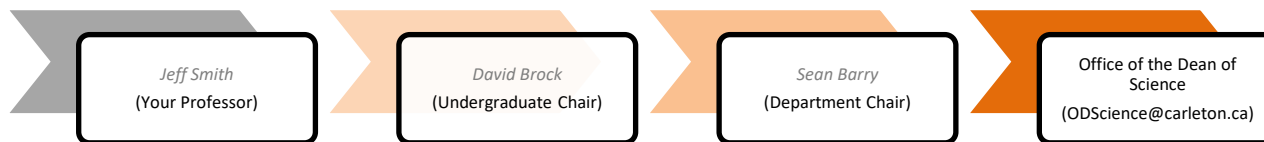
Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the [7 Rights and Responsibilities Policy](#) for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.

Mental Health and Wellness:

As a student you may experience a range of mental health challenges that significantly impact your academic success and overall well-being. If you need help, please speak to someone. There are numerous resources available both on- and off-campus to support you. For more information, please consult <https://wellness.carleton.ca/>.

Student Concerns

If a concern arises regarding this course, **your first point of contact is me**: Email me or visit my office and I will do my best to address your concern. If I am unable to address your concern, the next points of contact are (in this order):



Note: You can also bring your concerns to [Ombuds services](#).

Assistance for Students

Writing and Learning Support: <https://carleton.ca/csas/support/>

Peer Assisted Study Sessions (PASS): <https://carleton.ca/csas/pass/>

Math Tutorial Centre: <https://carleton.ca/math/math-tutorial-centre/>

Science Student Success Centre: <https://sssc.carleton.ca/>

Academic Accommodation for Students with Religious Obligations:

Carleton University accommodates students who, due to religious obligation, must miss an examination, test, assignment deadline, laboratory, or other compulsory event. The University has a Senate-approved policy on religious accommodation that forms part of its Human Rights Policy, available at:

www.carleton.ca/equity. Students requesting academic accommodation on the basis of religious observance should make a formal, written request to their instructors for alternate dates and/or means of satisfying academic requirements. Such requests should be made during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist, but no later than two weeks before the compulsory academic event. Accommodation is to be worked out directly and on an individual basis between the student and the instructor(s) involved. Instructors will make accommodations in a way that avoids academic disadvantage to the student. Students or instructors who have questions or want to confirm accommodation eligibility of a religious event or practice may refer to the Equity Services website for a list of holy days and Carleton's Academic Accommodation policies, or may contact an Equity Services Advisor in the Equity Services Department for assistance. Students unable to reach a satisfactory arrangement with their instructor(s) should contact the Director of Equity Services. Instructors who have questions or wish to verify the nature of the religious event or practice involved should also contact this officer. For more details visit the Equity Services website

http://www.carleton.ca/equity/accommodation/student_guide.htm

<http://interfaith-calendar.org/>

Academic Accommodation for Pregnant Students:

Pregnant students requiring academic accommodations are encouraged to contact an Equity Advisor in Equity Services to complete a letter of accommodation. The student must then make an appointment to discuss her needs with the instructor at least two weeks prior to the first academic event in which it is anticipated the accommodation will be required. For more details visit the Equity Services website

http://www.carleton.ca/equity/accommodation/student_guide.htm.

Plagiarism:

Plagiarism is presenting, whether intentional or not, the ideas, expression of ideas or work of others as one's own. Plagiarism includes reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source. Examples of sources from which the ideas, expressions of ideas or works of others may be drawn from include but are not limited to: books, articles, papers, literary compositions and phrases, performance compositions, chemical compounds, art works, laboratory reports, research results, calculations and the results of calculations, diagrams, constructions, computer reports, computer code/software, and material on the Internet.

Examples of plagiarism include, but are not limited to:

- submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, paraphrased material, algorithms, formulae, scientific or mathematical concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another's data or research findings;
- submitting a computer program developed in whole or in part by someone else, with or without modifications, as one's own;
- failing to acknowledge sources through the use of proper citations when using another's works and/or failing to use quotation marks.

For more information, see: <http://science.carleton.ca/students/academic-integrity/>

Academic Integrity: Consequences of Academic Misconduct

In the Faculty of Science, sanctions for misconduct under the Academic Integrity Policy of Carleton University will normally be applied as follows:

- A first offence will result in a grade of zero on the work(s) associated with the misconduct, and a deduction of up to three (3) grade points from the final course grade (e.g. a grade of B could be reduced to a C).
- Any subsequent offences will result in increasingly severe sanctions ranging from:
 - A final grade of F in the course.
 - Suspension from studies for up to three (3) semesters.
 - Expulsion of enrollment from the University.

Note: These sanctions are provided here as guidelines only; more severe sanctions may be applied as appropriate (e.g., in the case of cheating on an examination).

CHEM 4304-5109 Learning Outcomes:

1. Gain an appreciation of what mass spectrometry is and how it works
2. Learn about the different technologies that comprise the field of mass spectrometry
3. Gain an appreciation of how technological advances have opened up new avenues for mass spectrometry-based analyses
4. Get a glimpse into the corporate side of mass spectrometry
5. Gain an appreciation for the roles of mass spectrometry in CROs
6. Learn about the breadth of analyses that benefit from the use of mass spectrometry through student led presentations

Tentative Lecture Schedule**

<u>#</u> <u>Lecture</u>	<u>Topics</u>	<u>Reading</u>
1 Jan 9 th , 2025	<ul style="list-style-type: none">• Presentation / discussion of syllabus• Tips for success• Introductory discussion, topical overview of course• Mass spectrometric interpretation, resolution and vacuum operations• “Hard” ionization techniques	N/A N/A See Brightspace See Brightspace See Brightspace
2 Jan 16 th , 2025	<ul style="list-style-type: none">• “Soft” ionization techniques• Low resolution mass separation – quadrupole ion guides and traps	See Brightspace See Brightspace
3 Jan 23 rd , 2025	<ul style="list-style-type: none">• High resolution mass separation – sector instruments, TOF, FTICR and Orbitrap• Ion detection	See Brightspace See Brightspace
4 Jan 30 th , 2025	<ul style="list-style-type: none">• Ion fragmentation in the source (CID, ECD, EID, ETD, SID, LIFT, PSD, LID, IRMPD, BIRD)• Ion fragmentation (CID, ECD, ETD, SID, LID, IRMPD, BIRD, UVPD)	See Brightspace See Brightspace

** – Lecture and course schedule is subject to change at the discretion of Professor Smith

Tentative Lecture Schedule**

<u>#</u> <u>Lecture</u>	<u>Topics</u>	<u>Reading</u>
5 Feb 6 th , 2025	<ul style="list-style-type: none">• Putting technologies together – single quad, triple quad, ion mobility, TOF, QqTOF and TOF-TOF, QIT, LIT, Sector, FTICR and Orbitrap mass spectrometers	See Brightspace
6 Feb 13 th , 2025	<ul style="list-style-type: none">• Applications – MS-based proteomics – Part I• **determine topic for review article and presentation by now**	See Brightspace
Feb 20 th , 2025	<ul style="list-style-type: none">• READING WEEK	See Brightspace
7 Feb 27 th , 2025	<ul style="list-style-type: none">• Applications – MS-based proteomics – Part II• Applications – MS-based lipidomics	See Brightspace See Brightspace
Mar 6 th , 2025	<ul style="list-style-type: none">• Guest lecturers – Maria Garrett from Agilent Technologies	N/A
Mar 13 th , 2025	<ul style="list-style-type: none">• Field trip – Sir Fredrick Banting Building, Tunney's Pasture, Health Canada• **Assignments are due**	N/A

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Tentative Lecture Schedule**

<u>Lecture</u>	<u>Topics</u>	<u>Reading</u>
Mar 20 th , 2025	<ul style="list-style-type: none">• 8:35am – 9:05am – Grad Student #1• 9:05am – 9:25am – Undergrad Student #1• 9:25am – 9:45am – Undergrad Student #2• 9:45am – 10:15am – Grad Student #2• 10:15am – 10:35am – Undergrad Student #3• 10:35am – 10:55am – Undergrad Student #4• 10:55am – 11:15am – Undergrad Student #5	<p>Grad Undergrad Undergrad Grad Undergrad Undergrad Undergrad</p>

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Tentative Lecture Schedule**

<u>Lecture</u>	<u>Topics</u>	<u>Reading</u>
Mar 27 th , 2025	<ul style="list-style-type: none">• 8:35am – 9:05am – Grad Student #3• 9:05am – 9:25am – Undergrad Student #6• 9:25am – 9:45am – Undergrad Student #7• 9:45am – 10:15am – Grad Student #4• 10:15am – 10:35am – Undergrad Student #8• 10:35am – 10:55am – Undergrad Student #9• 10:55am – 11:15am – Undergrad Student #10	<p>Grad Undergrad Undergrad Grad Undergrad Undergrad Undergrad</p>

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Tentative Lecture Schedule**

<u>Lecture</u>	<u>Topics</u>	<u>Reading</u>
Apr 3 rd , 2025	<ul style="list-style-type: none">• 8:35am – 9:05am – Grad Student #5• 9:05am – 9:25am – Undergrad Student #11• 9:25am – 9:45am – Undergrad Student #12• 9:45am – 10:15am – Grad Student #6• 10:15am – 10:35am – Undergrad Student #13• 10:35am – 10:55am – Undergrad Student #14• 10:55am – 11:15am – Undergrad Student #15• **Review papers are due**	<p>Grad Undergrad Undergrad Grad Undergrad Undergrad Undergrad</p>