The University of Calgary
Bachelor of Health Sciences
Cumming School of Medicine

Academic Year 2025-2026

MDSC 501
Principles and Mechanisms of Pharmacology

Instructors:
Course Coordinators and Instructors
Dr. Donna Slater dmslater@ucalgary.ca
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Guest lecturers
Dr. Ejaife Agbani ejaife.agbani@ucalary.ca
Dr. Andrew Braun abraun@ualgary.ca
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Office Hours/Policy on Answering Student Emails
Please book appointments by email. Email communications with instructors or TAs are welcome.
Please note that all course communications must occur through your @ucalgary email, and we will respond to emails sent via student's @ucalgary emails within 48 business hours (excluding weekends and statutory holidays).

Teaching Assistant:
Darasimi Kola-Ilesanmi darasimi.kolailesanm@ucalgary.ca

Time:
Fall 2025 September 3rd to December 3rd
Classes are Monday and Wednesday 5:00 – 6.15pm

Prerequisite/Co-Requisite:
Admission to the BHSc Honours program; Biochemistry 341 or 393; and Zoology 463 or Medical Science 404.

Course Description:
Basic principles of pharmacology and mechanisms with a focus on pharmacodynamics, pharmacokinetics, pharmacogenomics, and mechanisms of action and signal transduction pathways for major drug classes. Clinical applications of these pharmacological principles will be explored and may include consideration of sex, genetics, age, adverse drug reactions and disease states.

Overarching Theme
The course is designed to introduce the basic principles of 'Pharmacodynamics and Pharmacokinetics' (what the drug does to the body and what the body does to the drug), and the 'targets and mechanisms of drug action'. In addition, students will explore the pharmacological manipulation of these in the context of clinical treatment. The class will be lecture and inquiry and discussion-based, with select drug examples to build on basic concepts taught.
Global Objectives

- To introduce basic concepts of pharmacology, including how drugs act along with factors that may affect their absorption, distribution, metabolism, and elimination within the body.
- To develop a working knowledge of key pharmacology terms and concepts
- To facilitate the ability to integrate information provided and apply to the principles and mechanisms of pharmacology in the context of select disease and or pathologies.
- To be able to critically evaluate evidence and appreciate some reasons why drugs do not always have the desired effect.

Course Learning Outcomes (CLO)

By the end of this course, students will be able to:

1. Define the main pharmacodynamics terms (e.g., drug, ligand, receptor, antagonist, agonist, partial agonists, receptor reserve, affinity, efficacy). Describe the main targets for drug action (e.g., receptors, enzymes, ion channels) and outline the translation into biological responses: i.e., signal transduction mechanisms, gene transcription.
2. Explain the principles of pharmacokinetics (ADME) and describe why an understanding of each is important for clinical pharmacology.
3. Explain why select patients (e.g., elderly, children, pregnancy, disease state) may respond differently to drugs and the role genetics may play in drug metabolism.
4. Describe the basic pathophysiology of select diseases or health problems (e.g., asthma, COPD, hypertension, preterm labour, pain, drug abuse), the main classes of drug treatments / mechanism of action, and place these into context of the above principles.
5. Investigate a drug in clinical use, describe the main treatment of the drug, adverse outcomes, contraindications, and possible drug interactions, critically assess the literature, and using pharmacological principles above hypothesize why these might be occurring.
6. Facilitate classroom learning, by presenting scientific / clinical findings and addressing questions to a broad audience.

Transferable Skill Development (TSD):

Many of the skills and abilities that you are developing in your coursework are transferable to the workforce, graduate and professional studies and other facets of life. Employers seek applicants with transferable skills because they can be an asset in the workplace, regardless of industry or sector. Transferable skills are core skills for your success in building your future career.

The work that you will do in MDSC 501 will help you build the following transferable skills (TS):

1. **Collaboration**: Work respectfully with others from different backgrounds, cultures, and countries.
2. **Verbal Communication**: Learn and share information by presenting, listening, and interacting with others.
3. **Critical Thinking**: Actively and skillfully conceptualize, apply, analyze, synthesize, and/or evaluate information (data, facts, observable phenomena, and research findings) to make a reasoned judgement or draw a reasonable conclusion.
4. **Information Literacy**: Find, understand, and use information presented through words, symbols, and images
5. **Problem solving**: Identify an issue, find and implement a solution, and assess whether the situation has improved.
6. **Written Communication**: Share ideas and information by using words, images, and symbols.

Learning Resources

There is no assigned textbook for this course. Any readings / links to readings will be posted on D2L Access to library resources will be required.

Recommended Textbooks/Readings
Supplemental Reading: Rang and Dale's Pharmacology
7th edition. By HP Rang, MM Dale, JM Ritter, RJ Flower & G Henderson
8th edition. By HP Rang, JM Ritter, RJ Flower & G Henderson
9th edition. By JM Ritter, RJ Flower, G Henderson, Loke YK, MacEwan D & HP Rang.
Any of the above are recommended to supplement lectures. Copies are kept in the library.

Learning Technology Requirements
Brightspace (by D2L) is located on the University of Calgary server and will be used extensively for communication with students. **It is the student's responsibility to ensure that they receive all posted communications and documents and that they receive emails sent by instructors or fellow students through D2L.** Only your @ucalgary.ca email address may be linked to D2L. Please ensure that you are regularly checking your @ucalgary.ca account.

A laptop, desktop, tablet or mobile device is required for D2L access. If you need help accessing or using D2L, please visit the Desire2Learn resource page for students: http://elearn.ucalgary.ca/d2l-student/.

Evaluation
The University policy on grading and related matters is described in Section F of the 2025-2026 Calendar. In determining the overall grade in the course, the following weights will be used:

Assessment *	Weight (% of Grade)	Due Date and Time	Alignment with CLOs and TS
Assignment #1 (Basic Principles) Open book worksheet short response Qs	25%	Oct 3rd 11.59pm on D2L	1-3 *(3-4)*
Assignment #2 (Targets for Drug Action and Special topics) Open book worksheet short response Qs	25%	Nov 21st 11.59pm on D2L	4 *(3-5)*
DRAFT of Drug Evaluation Report	5%	Oct 24th 11.59pm on D2L	
Drug Evaluation Report Brief written report on selected drug	20%	Dec 5th 11.59pm on D2L	1-5 (3-6)
10 mins Presentation Drug pitch (group 2-3 students)	15%	Slides loaded to D2L 24 hours before presentation date (Nov 24, 26, Dec 1, 3)	1-6 *(1-5)*
Participation – attend presentations, participate in discussion /ask Qs	10%	Participate in student presentations (Nov 24, 26, Dec 1, 3) & case scenarios	6 *(2)*

*Descriptions, rubrics and marking guidelines for each component will be provided on D2L.
There is no Registrar-scheduled final exam for this course.
Students who do not complete any of the following: Assignment #1, #2, the draft Drug Report OR the final written Drug report will be considered as not passing the course, this will be reflected on the students' official transcript as a grade of 'F'.
A student's final grade for the course is the sum of the separate assignments. It is not necessary to pass each assignment separately in order to pass the course.

A Note regarding Writing Assignments:
Writing skills are important to academic study in all disciplines. In keeping with the University of Calgary's emphasis on the importance of academic writing in student assignments (Section E.2 of 2025-26 Calendar), writing is emphasized, and the grading thereof in determining a student's mark in this course. The Bachelor of Health Sciences values excellence in writing. Competence in writing entails skills in crafting logical, clear, coherent, non-redundant sentences, paragraphs and broader arguments, as well as skills with the mechanics of writing (grammar, spelling, punctuation). Sources used to complete each assessment must be properly documented, unless otherwise noted by the instructor. The University of Calgary offers instructional services through the Students' Success Centre's Writing Support Services (http://www.ucalgary.ca/writingsupport/) for students seeking feedback on assignments or seeking to improve their general writing skills. Students are **strongly encouraged** to take advantage of these programs.

Grading Scheme:

Letter Grade	Description	Percentage
A+	Outstanding performance	96-100
A	Excellent performance	90-95.99
A-	Approaching excellent performance	85-89
B+	Exceeding good performance	80-84
B	Good performance	75-79
B-	Approaching good performance	70-74
C+	Exceeding satisfactory performance	65-69
C	Satisfactory performance	60-64
C-	Approaching satisfactory performance	57-59
D+	Marginal pass	54-56
D	Minimal pass	50-53
F	Does not meet course requirements	0-49

Missed Components of Term Work:
Late assignments, and drug reports will lose 5% per day late past the deadline for all assignments. In this case, assignments will **NOT** be accepted more than 72 hours after the posted deadline and students failing to submit any assignment within this time frame will receive a mark of zero.

As per University Calendar Section G.2.3 **students who are absent from an in-class assessment will receive a mark of zero on the missed component.** Students who are absent are responsible for contacting their instructor to discuss the impact of their missed assessment. Alternative opportunities for completing missed assessments or shifting of the assessment weight **may** be possible but are not guaranteed. Students who are identified as falsifying information related to missed assessments will be subject to investigation for academic misconduct.

Extensions will NOT be granted on any assignment or quizzes in MDSC 501. The only exceptions to this are those in keeping with the University Calendar (debilitating illness, religious conviction, or severe domestic affliction) that are received in writing and with supporting documentation. Traffic jams and late or full buses are common events in Calgary and are NOT acceptable reasons for late arrivals to class, meetings and examinations. Please note that while absences are permitted for religious reasons, students are responsible for providing advance notice and adhering to other guidelines on this matter, as outlined in the University Calendar
https://calendar.ucalgary.ca/pages/02ffccb6b1a541db880fe4223d122b5e

Course Evaluations and Student Feedback
Student feedback will be sought at the end of the course through the new UCalgary Course Experience Survey and a qualitative student evaluation. Students are welcome to discuss the process and content of the course at any time with the instructor. Students may also address any concerns they may have with Dr. Fabiola Aparicio-Ting, Associate Dean (Undergraduate Health and Science Education) in the Cumming School of Medicine (feaparic@ucalgary.ca).

Attendance
Regular attendance is advised in order to succeed in *MDSC 501*. Students are expected to take notes during class and should not rely solely on material supplied by the instructors. Instructors may or may not post lectures notes to D2L, at their individual discretion. In-class discussion and all content presented in class, including concepts and examples, can constitute substantial learning and can be considered for assessment.

Attendance is recommended as 10% of the final grade is based upon participation in class discussions during case scenarios and the student presentations.

Conduct During Lectures
The classroom should be respected as a safe place to share ideas without judgement - a community in which we can all learn from one another. Students are expected to frame their comments and questions to lecturers in respectful and appropriate language, always maintaining sensitivity towards the topic. Students, employees, and academic staff are also expected to demonstrate behaviour in class that promotes and maintains a positive and productive learning environment.

As members of the University community, students, employees and academic staff are expected to demonstrate conduct that is consistent with the University of Calgary Calendar, the Code of Conduct and Non-Academic Misconduct policy and procedures, which can be found at https://ucalgary.ca/student-services/student-conduct/policy

Use of Internet and Electronic Communication Devices in Class
The Bachelor of Health Sciences program aims to create a supportive and respectful learning environment for all students. The use of laptop and mobile devices is acceptable when used in a manner appropriate to the course and classroom activities. However, research studies have found that inappropriate/off-topic use of electronic devices in the classroom negatively affects the learning of others during class time.

Students are responsible for being aware of the University's Internet and email use policy, which can be found at https://www.ucalgary.ca/legal-services/university-policies-procedures/acceptable-use-electronic-resources-and-information-policy

Use of Artificial Intelligence Tools
Generative Artificial Intelligence (AI), and specifically foundational models that can create writing, computer code, and /or images using minimal human prompting includes not only GPT-4 (and its siblings ChatGPT and Bing), but many writing assistants that are built on this or similar AI technologies.

Students may use artificial intelligence tools for **creating an outline for the Final Written Drug Report only,** but the **final submitted Drug Report must be original work produced by the individual student alone; students are ultimately accountable for the work they submit**. This use must be documented in an appendix for each assignment. The documentation should include what tool(s) were used, how they were used, and how the results from the AI were incorporated into the submitted work. You could also be asked to provide evidence of your own work. **Failure to cite the use of AI generated content in an assignment/assessment will be considered a breach of academic integrity and subject to Academic Misconduct procedures.** Please see this library guide for how to cite the use of AI tools: https://libguides.ucalgary.ca/c.php?g=733971&p=5302331

Students ***are not allowed*** to upload class slides, assignment instructions, or other course materials to AI tools or platforms. These are the intellectual property of the course instructor (IP); uploading these to and AI platform may breech IP rules since some of these sites may use these as training/output data.

UNIVERSITY OF CALGARY POLICIES AND SUPPORTS

Copyright
All students are required to read the University of Calgary policy on Acceptable Use of Material Protected by Copyright (https://www.ucalgary.ca/legal-services/university-policies-procedures/acceptable-use-material-protected-copyright-policy) and requirements of the Copyright Act (https://laws-lois.justice.gc.ca/eng/acts/C-42/index.html) to ensure they are aware of the consequences of unauthorized sharing of course materials (including instructor notes, electronic versions of textbooks, etc.). Students who use material protected by copyright in violation of this policy may be disciplined under the Non-Academic Misconduct Policy https://www.ucalgary.ca/legal-services/university-policies-procedures/student-non-academic-misconduct-policy

Instructor Intellectual Property
Course materials created by instructors (including course outlines, presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the instructor. These materials may **NOT** be reproduced, redistributed or copied without the explicit consent of the professor. **The posting of course materials to third party websites such as note-sharing sites without permission is prohibited**. Sharing of extracts of these course materials with other students enrolled in the course ***at the same time*** may be allowed under fair dealing.

Academic Accommodations
It is the student's responsibility to request academic accommodations according to the University policies and procedures listed below. The Student Accommodations policy is available at https://ucalgary.ca/student-services/access/prospective-students/academic-accommodations. Students needing an accommodation based on disability or medical concerns should contact Student Accessibility Services (SAS) in accordance with the Procedure for Accommodations for Students with Disabilities (https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Accommodation-for-Students-with-Disabilities-Procedure.pdf).

Students who require an accommodation in relation to their coursework based on a Protected Ground other than Disability should communicate this need in writing to Dr. Fabiola Aparicio-Ting (feaparic@ucalgary.ca), Associate Dean (Undergraduate Health and Science Education).

Academic Misconduct
The University of Calgary is committed to the highest standards of academic integrity and honesty. The University of Calgary has created rules to govern all its members regarding the creation of knowledge and the demonstration of knowledge having been learned.

Academic Misconduct refers to student behaviour that compromises proper assessment of a student's academic activities and includes (but is not limited to): cheating, fabrication, falsification, plagiarism, unauthorized assistance, failure to comply with an instructor's expectations regarding conduct required of students completing academic assessments in their courses, and failure to comply with exam regulations applied by the Registrar. **It also includes using of third party websites/services to access past/current course material, essay/assignment writing services, or real-time assistance in completing assessments, seeking answers to assessment questions and similar, whether paid, bartered or unpaid.**

For information of the Student Academic Misconduct Policy and Procedures, please visit; https://www.ucalgary.ca/legal-services/university-policies-procedures/student-academic-misconduct-policy.

Additional information is available on the Academic Integrity website at: https://ucalgary.ca/student-services/student-success/learning/academic-integrity.

Recording of Lectures
Audio or video recording of lectures (or similar) by students is prohibited except where explicit permission has been received from the instructor.

Freedom of Information and Protection of Privacy Act
Student information will be collected in accordance with typical (or usual) classroom practice. Students' assignments will be accessible only by the authorized course faculty. Private information related to the individual student is treated with the utmost regard by the faculty at the University of Calgary.

Appeals
If there is a concern with the course, academic matter or a grade, first communicate with the instructor. If these concerns cannot be resolved, students can proceed with an academic appeal, as per Section I of the University Calendar. Students must follow the official reappraisal/appeal process and may contact the Student Ombuds' Office (http://www.ucalgary.ca/student-services/ombuds) for assistance with this and with any other academic concerns, including academic and non-academic misconduct. Students should be aware that concerns about graded term work may only be initiated **within 10 business days** of first being notified of the grade.
https://calendar.ucalgary.ca/pages/e31a7115dca740ec83579e946d4a4193

Sexual and Gender-Based Violence Policy
The University recognizes that all members of the University Community should be able to learn, work, teach and live in an environment where they are free from harassment, discrimination, and violence. The University of Calgary's sexual violence policy guides us in how we respond to incidents of sexual violence, including supports available to those who have experienced or witnessed sexual violence, or those who are alleged to have committed sexual violence. It provides clear response procedures and timelines, defines complex concepts, and addresses incidents that occur off-campus in certain circumstances. Please see the policy available at https://www.ucalgary.ca/legal-services/university-policies-procedures/sexual-and-gender-based-violence-policy

Resources for Support of Student Learning, Success, Safety and Wellness

Student Success Centre	http://www.ucalgary.ca/ssc/
Student Wellness Centre	http://www.ucalgary.ca/wellnesscentre/
Student Advocacy and Wellness Hub (CSM)	
	https://cumming.ucalgary.ca/mdprogram/current-students/student-advising-wellness
Distress Centre	http://www.distresscentre.com/
Library Resources	http://library.ucalgary.ca

Wellness and Mental Health Resources
The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the excellent mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (https://www.ucalgary.ca/wellnesscentre/services/mental-health-services) and the Campus Mental Health Strategy (http://www.ucalgary.ca/mentalhealth/).

Student Ombuds' Office
The Student Ombuds' Office supports and provides a safe, neutral space for students. For more information, please visit www.ucalgary.ca/student-services/ombuds/ or email ombuds@ucalgary.ca

BHSc Student Faculty Liaison Committee (SFLC)
The BHSc SFLC, with elected representatives from all majors, serves to raise issues of interest to BHSc students to the program administration, including items pertaining to curriculum, scheduling and events. A list of current representatives can be found on the BHSc website.

Student Union (SU) Information
The SU Vice-President Academic can be reached at (403) 220-3911 or suvpaca@ucalgary.ca; the SU representatives for the Cumming School of Medicine can be reached at medrep1@su.ucalgary.ca or medrep2@su.ucalgary.ca.

Student Success Centre
The Student Success Centre provides services and programs to ensure students can make the most of their time at the University of Calgary. Our advisors, learning support staff, and writing support staff assist students in enhancing their skills and achieving their academic goals. They provide tailored learning support and advising programs, as well as one-on-one services, free of charge to all undergraduate and graduate students. For more information visit: https://www.ucalgary.ca/student-services/student-success

Emergency Evacuation/Assembly Points
As part of the University of Calgary Emergency Evacuation plan, students, faculty, and staff should locate the closest Assembly Point in case of Fire Alarm. Safety signage is posted throughout the campus showing the locations and the possible route to these locations. All students, faculty, and staff are expected to promptly make their way to the nearest Assembly Point if the Fire Alarm is activated. No one is to return into campus facilities until an all clear is given to the warden in charge of the Assembly Area. For more information, see https://www.ucalgary.ca/risk/emergency-management/drills/assembly-points-and-evacuation-maps

Safewalk
Campus security will escort individuals, day or night, anywhere on campus (including McMahon Stadium, Health Sciences Centre, Student Family Housing, the Alberta Children's Hospital and the University LRT station). Call 403-220-5333 or visit http://www.ucalgary.ca/security/safewalk. Use any campus phone, emergency phone or the yellow phone located at most parking lot pay booths. Please ensure your personal safety by taking advantage of this service.

Assignments for MDSC BIOL 501

1. Drug Evaluation Report (25% overall)
    a. Drug selection due by September 17th
    b. Draft drug evaluation report (5%) – DUE October 24th 11.59pm
    c. Final Drug Report (20%) – DUE December 5th 11.59pm
2. Worksheet #1 (25%) – due Friday Oct 3rd
3. Worksheet #2 (25%) – due Friday Nov 21st.
4. Presentation (15%) – group 'drug pitch' presentation
    a. Drug pitch selection due by September 24th
5. Participation (10%) in case scenarios / student presentations

Lecture TOPICS

Basic Principles of Pharmacology

- Drug discovery and clinical development: Brief overview, what is pharmacology, drug discovery & clinical development, successes, failures, & the FDA.
- Introduction to IUPHAR: Brief introduction to IUPHAR and the pharmacology education project, with a brief overview of the diverse range of targets (revisited in detail in the later classes), endogenous ligands and drugs and the impact for understanding drug action.
- Pharmacodynamics I and II: Is the study of the relationship between drug concentration and its interaction with a receptor to produce a response. Brief history of receptor theory, and ligand/drug – receptor interactions as they are fundamental for drug design. Concentration response curves, potency, affinity, receptor occupancy and response, efficacy and spare receptors. Drugs as agonists (partial, inverse, biased), antagonists (competitive surmountable, competitive insurmountable), and allosterism (negative and positive allosteric modulators) will be presented and how these effect the concentration/dose response curves.
- Pharmacokinetics I and II: What happens to a drug within the body? Understanding how a drug is absorbed, distributed, metabolised and excreted (ADME) by the body is important to enable clinicians to target the therapeutic window (enhance efficacy and reduce toxicity). The effect of how CYP450 enzyme induction, inhibition and drug interactions can affect drug metabolism will be discussed.
- Personalised Medicine I: Epidemiology and inter-individual variation in drug response. Differences may occur with ethnicity, age, sex, pregnancy, breastfeeding, disease and with genetic contributions.
- Personalised Medicine II: Pharmacogenetics: overview of how pharmacogenetics is currently used in the clinic, interpretation of pharmacogenetic tests.

Targets for Drug action and Special Topics

- GPCRs: overview of key signaling pathways, discussion of select GPCRs as current therapeutic targets, examples may include treatments for asthma, cardiovascular disease, induction of labour, post partum haemorrhage etc
- Nuclear Hormone Receptors: classes, clinical examples may include the use of sex steroids for contraception, glucocorticoids to modulate inflammation, thyroid hormones etc
- Enzymes: Overview of enzymes as drug targets. Examples for discussion may include, the NSAIDs, COXIBs and for pain and inflammation, ACE inhibitors for treating high blood pressure
- Kinase linked receptors and signaling: TBD
- Ion channels and transporters: discuss the molecular basis of membrane excitability and how drugs affect these properties to elicit biological effects. The topic could be covered in 2 back-to-back lectures, or an initial introductory lecture and a subsequent Select Topics lecture focusing on anti-arrhythmic agents, anti-epileptics, etc. Clinically, ion channel targets represent the second largest drug class
- Pain management: overview of pain and analgesics, with a focus on opioids and cannabinoid analgesics in development
- CAR-T Cell Cancer Therapy: New & emerging cancer therapies
- Drugs affecting blood coagulation:
- Toxicology and drug safety: