

**MDSC 561/CMMB 561
Cancer Biology**

Course coordinator:

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Assistant Professor, Biochemistry and Molecular Biology

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Instructors:

Dr. Aaron Goodarzi, Ph.D.

Associate Professor, Biochemistry and Molecular Biology and Oncology

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Dr. Jennifer Corcoran, Ph.D.

Associate Professor, Microbiology, Immunology and Infectious Disease

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Dr. Franz Zemp, Ph.D.

Synthetic Immunology Team Lead, Alberta Cellular Therapy Immunoncology Initiative

Charbonneau Cancer Institute/Alberta Children's Hospital Research Institute

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Dr. Ebba Kurz, Ph.D.

Professor, Physiology and Pharmacology

Charbonneau Cancer Institute

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Dr. Susan Lees-Miller, Ph.D.

Professor, Biochemistry and Molecular Biology

Charbonneau Cancer Institute

leesmill@ucalgary.ca

Office Hours/Policy on Answering Student Emails

All course communications must occur through your @ucalgary email, and the instructors will attempt to respond to emails sent via student's @ucalgary emails within 48 hours (excluding weekends and statutory holidays).

Time and Location:

Tuesdays and Thursdays 3:30pm – 4:45pm

Health Sciences Centre, 1405A

Prerequisite/Co-Requisite:

Biochemistry 341 or 393; and Medical Science 341 or Biology 311; and Medical Science 351 or Biology 331; and Medical Science 408 or Cellular, Molecular and Microbial Biology 411

Course Description:

Advances in methodology and in theoretical concepts have permitted continuing breakthroughs in our understanding of the organismal, cellular and molecular biology of cancer cells, and in the development of novel strategies for cancer prevention, diagnosis and treatment. These advances will be presented in a comprehensive overview of cancer including issues of demographics and incidence, causation and detection, origins and progression and therapeutics approaches. Emphasis will be placed on the cell and molecular biology of cancer and on the interaction of the cancer cell with the host organism.

Overarching Theme

This course will explore the nature of cancer, including its global burden, the hallmarks that are common among most cancers, how cancer is caused and treated, including an exploration of emerging therapeutics.

Global Objectives

- To gain a comprehensive understanding of cancer – what it is, how it arises and how it is treated.
- To engage students in active discussion of topical issues in cancer biology
- To introduce students to the breadth and excitement of cancer research

Course Learning Outcomes

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

1. Understand the scale of cancer burden globally.
2. Describe the hallmarks of cancer and their interplay in cancer development, tumour growth and spread.
3. Understand molecular mechanisms underlying the common causes of cancer including viruses, environmental toxins, radiation and genetics.
4. Define categories of anti-cancer therapies (including chemotherapy, radiotherapy, precision, immunotherapy), their history and emerging therapeutic approaches.
5. Understand the major challenges of cancer research and treatment including cancer heterogeneity, therapy resistance and limitations of animal models.

Transferable Skill Development:

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/CMMB 561 will help you build the following transferable skills:

- **Verbal Communication:** Learn and share information by asking questions in class, listening, and interacting with others.
- **Creativity and Innovation:** Being curious, thinking imaginatively.
- **Critical Thinking:** Actively and skillfully conceptualize, apply, analyze, synthesize, and/or evaluate information (data, facts, published research findings) to make a reasoned judgement or draw a reasonable conclusion.

- **Information Literacy:** Find, understand, use and connect information presented through words, symbols, and images
- **Written Communication:** Link together and share research results, ideas and information using your own words.

Learning Resources:

Recommended Textbooks/Readings

There is no required textbook for this course.

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.

Evaluation

The University policy on grading and related matters is described in section F of the 2022-2023 Calendar.

In determining the overall grade in the course, the following weights will be used:

Assessment component	Learning outcomes/objectives assessed	Weighting
In-Class Quiz (31-Jan, classroom, closed book)	Answer questions, discuss, and synthesize ideas related to material covered in Lectures 1-4	10% of final mark
Mid-term 1 (14-Feb, classroom, closed book)	Answer questions, discuss, and synthesize ideas related to material covered in Lectures 5-9	20% of final mark
Mid-term 2 (21-Mar, classroom, closed book)	Answer questions, discuss, and synthesize ideas related to material covered in Lectures 10-16	25% of final mark
Final exam (Registrar-scheduled, classroom, closed book)	Answer questions, discuss and synthesize ideas related to material covered in Lectures 17-23	20% of final mark
Written Assignment (take home, open book)	Find, read and understand published reviews and original research material to synthesize your ideas and write in your own words about the molecular mechanisms and treatment opportunities for one type of cancer (full assignment details to be given out in class)	25% of final mark

A student's final grade for the course is the sum of the separate assignments. It is not necessary to pass each assignment separately 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 2022-23 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 in research papers must be properly documented. 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 completion of assignments: Students will lose 5% per day late past the deadline for all assignments. 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. **Students who miss a quiz/exam will receive a mark of zero unless the instructor has been previously notified.**

Extensions will NOT be granted on any assignment or quizzes in MDSC/CMMB 561. 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://www.ucalgary.ca/pubs/calendar/current/e-4.html>).

Course Evaluations and Student Feedback

Student feedback will be sought at the end of the course through the Universal Student Rating of Instruction (USRI) 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. Ebba Kurz, Associate Dean (Undergraduate Health and Science Education) in the Cumming School of Medicine (kurz@ucalgary.ca).

Attendance

Students are expected to attend all lectures. Lecture slides will be posted to D2L, but lectures will not be recorded.

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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://www.ucalgary.ca/legal-services/university-policies-procedures>.

Students are expected to take notes during class and should not rely solely on material supplied by the instructors.

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/policies/files/policies/electronic-communications-policy.pdf>.

UNIVERSITY OF CALGARY POLICIES AND SUPPORTS

Copyright

All students are required to reach the University of Calgary policy on Acceptable Use of Material Protected by Copyright (<https://www.ucalgary.ca/policies/files/policies/acceptable-use-of-material-protected-by-copyright-policy.pdf>) 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/pubs/calendar/current/k.html>.

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/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities.pdf>). SAS will process the request and issue letters of accommodations to instructors. For additional information on support services and accommodations for students with disabilities, visit www.ucalgary.ca/access/.

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. Ebba Kurz (kurz@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://ucalgary.ca/policies/files/policies/student-academic-misconduct-policy.pdf>
<https://ucalgary.ca/policies/files/policies/student-academic-misconduct-procedure.pdf>

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) 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/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://www.ucalgary.ca/pubs/calendar/current/i-2.html>

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/sites/default/files/teams/1/Policies-Sexual-and-Gender-Based-Violence-Policy.pdf>.

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) (Cumming School of Medicine students only)	https://cumming.ucalgary.ca/student-advocacy-wellness-hub/home
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/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/emergencyplan/building-evacuation/assembly-points>

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.

Class Schedule

Day	Date	Lecture #	Topic	Instructor	Theme
Tues	10-Jan	1	Introduction 1	Dr. Williams	Introduction
Thu	12-Jan	2	Introduction 2	Dr. Williams	Introduction
Tues	17-Jan	3	Hallmarks 1: Growth Signaling	Dr. Williams	Hallmarks
Thu	19-Jan	4	Hallmarks 2: Genome instability	Dr. Williams	Hallmarks
Tues	24-Jan	5	Hallmarks 3: Replicative potential	Dr. Williams	Hallmarks
Thu	26-Jan	6	Hallmarks 4: Evading cell death	Dr. Williams	Hallmarks
Tues	31-Jan	QUIZ 1 (10%): Lectures 1-4 only			
Thu	02-Feb	7	Hallmarks 4: Evading cell death	Dr. Williams	Hallmarks
Tues	07-Feb	8	Hallmarks 4: Evading cell death	Dr. Williams	Hallmarks
Thu	09-Feb	9	Hallmarks 7: Immune evasion and inflammation	Dr. Zemp	Hallmarks
Tues	14-Feb	MIDTERM 1 (20%): Lectures 5-9			
Thu	16-Feb	10	Environmental exposure 1	Dr. Goodarzi	Causes
TERM BREAK FEB 19-25			TERM BREAK - NO CLASSES - FEB 19-25		
Tues	28-Feb	11	Environmental exposure 2	Dr. Goodarzi	Causes
Thu	02-Mar	12	Environmental exposure 3	Dr. Goodarzi	Causes
Tues	07-Mar	13	Environmental exposure 4	Dr. Goodarzi	Causes
Thu	09-Mar	14	Virus-induced cancers 1	Dr. Corcoran	Causes
Tues	14-Mar	15	Virus-induced cancers 2	Dr. Corcoran	Causes
Thu	16-Mar	16	Virus-induced cancers 3	Dr. Corcoran	Causes
Tues	21-Mar	MIDTERM 2 (25%) Lectures 10-16			
Thu	23-Mar	17	The immune system as a target in cancer	Dr. Zemp	Treatments
Tues	28-Mar	18	Immunotherapy 1	Dr. Zemp	Treatments
Thu	30-Mar	19	Immunotherapy 2	Dr. Zemp	Treatments
Tues	04-Apr	20	Anti-cancer therapy 1	Dr. Lees-Miller/Kurz	Treatments
Thu	06-Apr	21	Anti-cancer therapy 2	Dr. Lees-Miller/Kurz	Treatments
Tues	11-Apr	22	Anti-cancer therapy 3	Dr. Lees-Miller/Kurz	Treatments

WRITTEN PAPER 25%

FINAL EXAM (20%): Lectures 17-23 only (Registrar scheduled)