MDSC 541/641
Advanced Genetics

Instructors:

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Office Hours/Policy on Answering Student Emails

Office hours are after class or by request. 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 24 hours M-F.

Time:

Tuesday and Thursday 9:30-10:45 (lecture). Tuesday and Thursday 11-11:25 (tutorial).

Prerequisite/Co-Requisite:

Medical Science 341 or Biology 311.

Course Description:

Principles of genetics and epigenetics and current techniques in the fields of regenerative and precision medicine will be discussed. Topics will focus on human and model organism genetics, breakthrough publications and their significance for current genetics research and applications. Students will explore significant recent discoveries and their social and ethical implications.

Overarching Theme

This course will focus on milestone events in 21st century genetics that have made the idea of precision human health a reality. Incorporating the underpinning work which first built the human reference genome and adding to it beyond the 'single person genome', we will consider the complex introgression of ancient humans and their genetic legacy in the modern human genome. A better understanding of genetic diversity will allow us to identify, assign and alter the genome in the precision medicine era. We will discuss examples in the identification of rare disease, and developments allowing genome editing. We will introduce the fundamental aspects of epigenetic reprogramming in mammalian model systems and follow how these mechanisms have laid the foundation for iPS reprogramming, a gateway technology for disease identification, drug screening, and gene-editing-based cures. Using iPSC technology, we will follow the decades of learning that led to the generation of male and female germ cells in vitro and their use in supporting innovative methods for the treatment of human infertility.

Global Objectives

• To understand modern molecular genetics including discussing the diversity of modern humans genomes, sequencing, rare disease genetics and, genome editing.
• To have a detailed understanding of epigenetic regulation of cell commitment from totipotency to pluripotency to create an organism.
• To appreciate the application of genetics in stem cell technologies to find solutions for chronic illnesses and reproductive challenges.

Course Learning Outcomes

By the end of this course, students will be able to:
- Understand current genomic technologies, fundamental to modern genetics
- Understand the construction and evolutionary composition of the human genome
- Appreciate the vital importance for the more inclusive pan-genome with impact on precision medicine
- Understand genetic underpinnings of human disease
- Have a fundamental understanding of the epigenome and its remodeling in regenerative medicine and generational impact
- Integrated comprehension of the genetic, epigenetic and reproductive implications in advanced treatment of human infertility
- Gain an appreciation of the ethical implications of the genome and its impact for individuals in health and illness
- Developing skills in group discussions of complex genetic information.
- Developing oral presentation skills.

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 541 will help you build the following transferable skills:

- **Verbal Communication**: Learn and share information by presenting, listening, and interacting with others.
- **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.
- **Information Literacy**: Find, understand, and use information presented through words, symbols, and images
- **Written Communication**: Share ideas and information by using words, images, and symbols.

Learning Resources

No textbook, all required readings will be posted on D2L.

A Note regarding readings

Required readings have been chosen carefully to inform you and enhance the lecture material. **Students are REQUIRED to complete assigned readings BEFORE each lecture.** Instructors will proceed in class on the assumption that students have read the assigned readings. Students should be aware that many of the readings they will be assigned may be of an unfamiliar nature and style. Students should plan sufficient time to allow for the possibility of several reads of the assigned material.

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/. If students do not have appropriate devices, they are encouraged to discuss this with the instructors.

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 course Learning Objectives
Regular <u>participation</u> in oral discussions	10	Sept 2- Dec 4	Developing oral skills in group discussions.
Graphical abstracts (best 2 of 3)	20	Sept 11, Nov 6, Nov 20	Graphical presentation showing an integrated understanding of genetics
Journal club- ancestral genome	20	Oct 21, 23	Developing oral skills by presenting
Genetics assignment	20	Sept 25	Computational skills in genetics
Mini-quizzes (5)	10	Sept 4, Oct 7, Oct 16, Nov 4, Nov 27	Conceptual integration based on homework.
Final	20	Exam period	Synthesis of course material in an analytical format

Descriptions and rubrics/marking guidelines of each assessment item are posted in D2L

*A passing grade on each class component is required to pass this 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:

Students will lose 20% per day late past the deadline for all assignments. In this case, assignments will **NOT** be accepted more than 24 hours after the posted deadline. Students failing to submit any assignment within this time frame will receive a mark of zero. **There will be NO exceptions to this policy.** Please contact the instructors as soon as possible if you have a challenge in meeting a deadline in the course.

As per University Calendar Section G.2.3, **students who are absent from an in-class assessment without permission from the instructor 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 541. 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 541. 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.

This course is highly interactive, and student attendance at all lectures, and participation in discussions is expected. The genetics/genomics lab can only be attended in person and oral presentations must be in person.

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.

You may use generative artificial intelligence tools and apps for learning course material, but their use **is strictly prohibited** in all course assignments unless explicitly stated otherwise by the instructor in this

course. This includes ChatGPT and other AI writing and coding assistants. Use of generative AI in this course may be considered use of an unauthorized aid, which is a form of cheating and a breach of academic integrity subject to Academic Misconduct procedures. You could be asked to provide evidence of your own work. While we appreciate that the use of AI tools is appropriate in some contexts, in this course we will be focusing on building your own critical thinking, foundational knowledge and writing skills, which could be compromised by a reliance on AI tools. **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

Media Recording
Please refer to the following statement on media recording of students: https://elearn.ucalgary.ca/wp-content/uploads/2020/05/Media-Recording-in-Learning-Environments-OSP_FINAL.pdf

Media recording for lesson capture
The instructor may use media recordings to capture the delivery of a lecture. These recordings may allow students who are ill to attend and are intended to be used for lecture capture only and will not be used for any other purpose. Although the recording device will be fixed on the Instructor, in the event that incidental student participation is recorded, the instructor will ensure that any identifiable content

(video or audio) is masked, or will seek consent to include the identifiable student content to making the content available on University approved platforms.

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.

List of important dates:
First day of classes: Tuesday, September 2nd
Term break: Nov 9th -15th, 2025 (no classes; no assignments due)
National Day for Truth and Reconciliation: Tuesday, Sept 30th (no classes; no assignments due)
Thanksgiving: Monday Oct 13th (no classes; no assignments due)
Last day of classes: Friday, Dec 5th
Registrar-scheduled final exam period: Dec 9th -19th, 2025