

Syllabus

Introductory Plant Genomics PLNT4310
(Winter 2026)

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COURSE DETAILS

Course Title & Number:	Introductory Plant Genomics
Number of Credit Hours:	3
Class Times & Days of Week:	11:30 am-12:20 pm, Mondays, Wednesdays and Fridays Lab 2:30 pm - 5:25 pm Tuesday
Location for class	AGRICULTURE 343
Location for Lab	AGRICULTURE 343 (starts Jan 27th)
Pre-Requisites:	N/A

Instructor Contact Information

Instructor(s) Name:	Dr. Harmeet Singh Chawla
Preferred Form of Address:	Harmeet
Office Location:	AGRICULTURE 307
Office Hours or Availability:	As requested
Office Phone No.	204-474-7192 (for urgent issue)
Email:	harmeet.chawla@umanitoba.ca Emails will be answered as time permits on week days (usually within 24 hours)
Contact:	Email is the preferred method of contact
Lab Instructor/ TA:	Gursimran Kaur (Gursimran.kaur@umanitoba.ca)

Course Description

U of M Course Calendar Description

An introduction to basic technologies in plant genomics. Topics include DNA sequencing, molecular markers, genome sequencing, gene expression analysis, gene mapping and functional analysis. A laboratory will provide hands-on experience with several genomic techniques.

General Course Description

This course provides a broad exploration of plant genomics, beginning with core genetic principles and progressing through the most recent innovations in the field. Topics include Mendelian genetics, molecular marker technologies, and both forward and reverse genetic approaches to gene discovery and characterization. Students will gain familiarity with genome sequencing techniques as well as essential concepts in genome annotation and functional genomics. The course also introduces current gene editing tools, including CRISPR-Cas9, and examines the development of genetically modified (GM) crops. Finally, students will discuss regulatory and ethical considerations, review emerging applications of plant genomics for crop improvement, and evaluate the broader impact of these advances on agriculture and society. By the end of the semester, participants will have a firm grounding in plant genomics and an appreciation for how genomic methods are transforming research, breeding programs, and beyond.

Course Goals

- **Understand Foundational Concepts**
Develop a solid understanding of the fundamental principles of genetics and genomics, including Mendelian laws, chromosomal theory, and the structure and function of DNA and chromosomes.
- **Acquire Technical Competencies**
Gain familiarity with key molecular marker technologies, gene mapping strategies (QTL and GWAS), and genome sequencing approaches enabling students to interpret and apply these tools in plant genomics research.
- **Explore Forward and Reverse Genetics**
Learn the principles and applications of forward genetics (e.g., QTL mapping, positional cloning) and reverse genetics (e.g., gene silencing, RNAi, CRISPR-Cas9), highlighting how these approaches can be used to dissect gene function and improve crop traits.
- **Analyze Genome Data**
Develop practical skills in genome analysis, including the construction and annotation of plant genomes, and understand the significance of these data in crop development and improvement.
- **Understand Applications and Implications**
Examine how genomics technologies contribute to plant breeding, genetically modified (GM) crops, and overall agricultural sustainability, while considering the regulatory, ethical, and societal implications of these advancements.
- **Promote Critical Thinking and Research Skills**
Encourage independent thinking, problem-solving, and experimental design through hands-on exercises, case studies, and discussions of contemporary research in plant genomics.
- **Prepare for Advanced Study and Careers**
Equip students with the knowledge and skills necessary for advanced coursework, research positions, and professional opportunities in plant science, biotechnology, and related fields.

Course Learning Objectives

On completion of this course, students should be able to:

- **Explain fundamental genetic and genomic concepts**
Articulate the basic principles of DNA structure, chromosome organization, and Mendelian inheritance, relating these to the broader study of plant genomics.
- **Differentiate among key molecular marker technologies**
Compare and contrast various molecular marker approaches (e.g., SNPs) and discuss how these tools are applied in genetic mapping and plant breeding.
- **Understand forward genetic approaches**
Understand gene mapping methods such as QTL mapping and GWAS to identify genes controlling important plant traits.
- **Assess reverse genetic methods**
Demonstrate a working knowledge of gene silencing, TILLING, VIGS, and CRISPR-based editing, explaining how each is used to investigate and modify gene function in plants.
- **Interpret and utilize genome sequencing data**
Explore different sequencing platforms, analyze resulting genome data, and practice annotating plant genomes to make informed decisions in research or breeding contexts.
- **Evaluate practical applications and societal implications**
Discuss how genomics-based strategies, including GM crops and regulatory considerations, shape modern agriculture and plant science, while navigating the ethical and societal dimensions of these technologies.

Textbook, Readings, and Course Materials

There is no selected textbook for this course. Students can follow any book related to genetics, genomics, and molecular biology. A list of reference book chapters and journal articles is available, and all references can be accessed through UM library links. Related research articles will be provided to students. Be aware of copyright laws when using readings. Note: In your presentation and term paper, proper citation format (e.g., APA, MLA, Chicago, IEEE, etc.) should be used.

Laboratories - Lab books will be supplied as a PDF in UM Learn

Using Copyrighted Material

Please respect copyright. We will use copyrighted content in this course. I have ensured that the content I use is appropriately acknowledged and is copied in accordance with copyright laws and university guidelines. Copyrighted works, including those created by me, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the *Copyright Act* applies or written permission has been confirmed. For more information, see the University's Copyright Office website at <http://umanitoba.ca/copyright/> or contact um_copyright@umanitoba.ca.

Course Technology

It is a requirement that you have all hardware, software and connection ability necessary to successfully operate UM Learn, and MS Teams. Course material, grades and communication will occur using UM Learn. We will also be using iClicker Cloud for participation and practice. Thus, you will need to setup an iClicker Cloud account. Some of the lectures from the course will be synchronous within UM Learn via Webex or MS Teams. Please respect the copyright of all material used within the course. Please see the support section with UM Learn for questions regarding the use of UM Learn, Webex and iClicker Cloud. (©[R Duncan](#). Used with permission).

During Classes and Labs - It is the general University of Manitoba policy that all technology resources are to be used in a responsible, efficient, ethical and legal manner. The student can use technology during classes and labs only for educational purposes approved by instructor and/or the University of Manitoba Student Accessibility Services. Students should not participate in personal direct electronic messaging / posting activities (e-mail, texting, video or voice chat, wikis, blogs, social networking (e.g. Facebook) online and offline “gaming” during the scheduled class/lab times. If a student is on call (emergency) the student should switch his/her cell phone and/or notifications off. (©S Kondrashov. Used with permission). The use of cell phones is completely prohibited during exams and quizzes.

Expectations: I Expect You To

I expect students to attend class, involve in class discussion. Students should be ready and active to learn. They should have the relevant background of knowledge for fully understanding the content in this course. Students are encouraged to do more reading of selected publications in plant genomics. I will treat you with respect and would appreciate the same courtesy in return. I will treat you with respect and would appreciate the same courtesy in return. See [Respectful Work and Learning Environment Policy](#).

Class Communication:

You are required to obtain and use your University of Manitoba email account for all communication between yourself and the university. All communication must comply with the [Electronic Communication with Student Policy](#).

Academic Integrity:

Plagiarism or any other form of cheating in examinations, term tests or academic work is subject to serious academic penalty. Cheating in examinations or tests may take the form of copying from another student or bringing unauthorized materials into the exam room. Exam cheating can also include exam impersonation. A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty. Students should acquaint themselves with the University's policy on plagiarism, cheating, exam impersonation and duplicate submission (see the information on website of the University of Manitoba, Online Academic Calendar, Undergraduate and Graduate).

Recording Class Lectures:

No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission from Dr. Harmeet Singh Chawla. Course materials (both paper and digital) are for the participant's private study and research.

Student Accessibility Services:

The University of Manitoba is committed to providing an accessible academic community. [Students Accessibility Services \(SAS\)](#) offers academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

Student Accessibility Services
520 University Centre
Phone: (204) 474-7423
Email: Student_accessibility@umanitoba.ca

Expectations: You Can Expect Me To

- Arrive before class and stay after class to answer any questions you may have.
 - Explain and provide examples of the topics listed below in the class schedule.
 - Make sufficient time outside of class to meet with students and make sure course material is clear.
 - A large part of my teaching practice includes the use of questions in class. I expect students to make an effort to respond and join in on class discussions.
 - Provide an unbiased grading scheme.
 - Return all graded assignments and exams within 2 weeks of the due date.
 - Help you succeed in PLNT 4310 and your degree.
-

CLASS SCHEDULE

This schedule is subject to change at the discretion of the instructor and/or based on the learning needs of the students but such changes are subject to [Section 2.8 of ROASS](#).

Lectures topics to be covered include:

- I. **Introduction and concepts on Genomics**
 - History and development in genomics
 - DNA, chromosomes, and genome
- II. **Mendelian genetics**
 - Mendel's law
 - Mono-hybrid cross
 - Di-hybrid cross
 - Chromosomal theory of inheritance
- III. **Review on molecular markers**
 - Molecular marker technologies
 - SNP marker and detection
 - Genetic map construction
- IV. **Forward genetics**
 - Gene mapping
 - QTL mapping
 - Genome wide association studies
- V. **Gene based cloning**
 - Fine mapping

- Positional gene cloning
- VI. Review on Genome science**
 - Sequencing technologies
 - Sanger and Illumina sequencing
 - Genome library and sequencing
- VII. Genome science project**
 - Genome annotation
 - Major plant genome
- VIII. Genome sequencing**
 - Genome sequencing technologies
 - Plant genome project
- IX. Reverse genetics**
 - Concepts in functional genomics and reverse genetics
 - Enzymes, vectors
 - Mutation and gene silencing
 - RNAi Gene silencing, TILLING, VIGS
- X. Gene expression**
 - Quantitative polymerase chain reaction
 - Plant transcription
 - Expression profiling
 - RNA sequencing
- XI. Gene editing**
 - Introduction, concepts and uses
 - Plant transformation
 - Genetically modified (GM) crops
 - Genome editing tools
 - CRISPR-cas9 technology
- XII. Application of plant genomics**
 - Plant improvement using genomics tool
 - Recent research and advances in plant genomics
 - Regulatory constraints
 - Final discussion

Lab Schedule and Expectations

Refer to the instructions from the TA and the lab manual

Course Evaluation

Activities/Exam	Date	Value of final grade
In class quiz-1	February 11	20%
Assignment : Student presentation	March 9-13	20%
In class quiz-2	April 8	20%
Lab*	Refer to TA's instructions	30%
Class participation	Throughout the term	10%

*A passing grade (at least 50%) in the lab must be achieved to pass the entire course.

Grading

Letter Grade	Percentage out of 100	Grade Point Range	Final Grade Point
A+	95-100	4.25-4.5	4.5
A	86-94	3.75-4.24	4.0
B+	80-85	3.25-3.74	3.5
B	72-79	2.75-3.24	3.0
C+	65-71	2.25-2.74	2.5
C	60-64	2.0-2.24	2.0
D	50-59	Less than 2.0	1.0
F	Less than 50		0

Voluntary Withdrawal

Voluntary withdrawal deadline is March 19, 2026. Refer to the [Registrar's Office](#) web page for more information.

Important dates

Jan 6	First day of classes
Feb 16	Louis Riel Day
Feb 16-20	Winter Term break
Mar 19	Voluntary Withdrawal (VW) deadline
Apr 3	Good Friday
April 9	last day of class

Assignment Extension and Late Submission Policy

Any assignment extension should be requested. Without extension permission, late submission will result in deduced grade.

Referencing Style

Assignments should use the APA reference style as outlined in the text: American Psychological Association. (2009). Publication manual of the American Psychological Association (6th ed.). Washington, DC: Author.

UNIVERSITY SUPPORT OFFICES & POLICIES

A list of academic supports available to Students, such as the Academic Learning Centre, Libraries, and other supports as may be appropriate:

Writing and Learning Support

The Academic Learning Centre (ALC) offers services that may be helpful to you throughout your

academic program. Through the ALC, you can meet with a learning specialist to discuss concerns such as time management, learning strategies, and test-taking strategies. The ALC also offers peer supported study groups called Supplemental Instruction (SI) for certain courses that students have typically found difficult. In these study groups, students have opportunities to ask questions, compare notes, discuss content, solve practice problems, and develop new study strategies in a group-learning format.

You can also meet one-to-one with a writing tutor who can give you feedback at any stage of the writing process, whether you are just beginning to work on a written assignment or already have a draft. If you are interested in meeting with a writing tutor, reserve your appointment two to three days in advance of the time you would like to meet. Also, plan to meet with a writing tutor a few days before your paper is due so that you have time to work with the tutor's feedback.

These Academic Learning Centre services are free for U of M students. For more information, please visit the Academic Learning Centre website at: <http://umanitoba.ca/student/academiclearning/>

You can also contact the Academic Learning Centre by calling 204-480-1481 or by visiting 205 Tier Building.

University of Manitoba Libraries (UML)

As the primary contact for all research needs, your liaison librarian can play a vital role when completing academic papers and assignments. Liaisons can answer questions about managing citations, or locating appropriate resources, and will address any other concerns you may have, regarding the research process. Liaisons can be contacted by email or phone, and are also available to meet with you in-person. A complete list of liaison librarians can be found by [subject](#) or [name](#). In addition, general library assistance is provided in person at 19 University Libraries, located on both the Fort Garry and Bannatyne campuses, as well as in many Winnipeg hospitals. When working remotely, students can also receive help online, via the Ask-a-Librarian chat found on the Libraries' homepage: www.umanitoba.ca/libraries.

Section (b): Mental health support

For 24/7 mental health support, contact the Mobile Crisis Service at 204-940-1781.

Student Counselling Centre

Contact SCC if you are concerned about any aspect of your mental health, including anxiety, stress, or depression, or for help with relationships or other life concerns. SCC offers crisis services as well as individual, couple, and group counselling. [Student Counselling Centre](#)
474 University Centre or S207 Medical Services
(204) 474-8592

Student Support Case Management

Contact the Student Support Case Management team if you are concerned about yourself or another student and don't know where to turn. SSCM helps connect students with on and off campus resources, provides safety planning, and offers other supports, including consultation, educational workshops, and referral to the STATIS threat assessment team.

[Student Support Intake Assistant](#)

520 University Centre
(204) 474-7423

University Health Service

Contact UHS for any medical concerns, including mental health problems. UHS offers a full range of medical services to students, including psychiatric consultation.

[University Health Service](#)

104 University Centre, Fort Garry Campus
(204) 474-8411 (Business hours or after hours/urgent calls)

Health and Wellness

Contact our Health and Wellness Educator if you are interested in [peer support from Healthy U](#) or information on a broad range of health topics, including physical and mental health concerns, alcohol and substance use harms, and sexual assault.

Health and Wellness Educator

Section (c): Copyright

All students are required to respect copyright as per Canada's *Copyright Act*. Staff and students play a key role in the University's copyright compliance as we balance user rights for educational purposes with the rights of content creators from around the world. The Copyright Office provides copyright resources and support for all members of the University of Manitoba community. Visit <http://umanitoba.ca/copyright> for more information.

Section (d) : University and Unit policies, procedures, and supplemental information available on-line:

Your rights and responsibilities

As a student of the University of Manitoba you have rights and responsibilities. It is important for you to know what you can expect from the University as a student and to understand what the University expects from you. Become familiar with the policies and procedures of the University and the regulations that are specific to your faculty, college or school.

The [Academic Calendar](http://umanitoba.ca/student/records/academiccalendar.html) <http://umanitoba.ca/student/records/academiccalendar.html> is one important source of information. View the sections *University Policies and Procedures* and *General Academic Regulations*.

While all of the information contained in these two sections is important, the following information is highlighted.

- If you have questions about your grades, talk to your instructor. There is a process for term work and final **grade appeals**. Note that you have the right to access your final examination scripts. See the Registrar's Office website for more information including appeal deadline dates and the appeal form <http://umanitoba.ca/registrar/>

- You are expected to view the General Academic Regulation section within the Academic Calendar and specifically read the **Academic Integrity** regulation. Consult the course syllabus or ask your instructor for additional information about demonstrating academic integrity in your academic work. Visit the Academic Integrity Site for tools and support <http://umanitoba.ca/academicintegrity/> View the **Student Academic Misconduct** procedure for more information.
- The University is committed to a respectful work and learning environment. You have the right to be treated with respect and you are expected to conduct yourself in an appropriate respectful manner. Policies governing behavior include the:

Respectful Work and Learning Environment

<https://umanitoba.ca/governance/governing-documents/governing-documents-university-community>

Student Discipline

<https://umanitoba.ca/governance/governing-documents-students#student-discipline> and,

Violent or Threatening Behaviour

<https://umanitoba.ca/governance/governing-documents/governing-documents-university-community#violent-or-threatening-behaviour>

- If you experience **Sexual Assault** or know a member of the University community who has, it is important to know there is a policy that provides information about the supports available to those who disclose and outlines a process for reporting. The **Sexual Assault** policy may be found at: <https://umanitoba.ca/governance/governing-documents/governing-documents-university-community>
- More information and resources can be found by reviewing the Sexual Assault site <https://umanitoba.ca/sexual-violence>
- For information about rights and responsibilities regarding **Intellectual Property** view the policy [https://umanitoba.ca/governance/sites/governance/files/2021-06/Intellectual_Property_Policy - 2013_10_01_RF.pdf](https://umanitoba.ca/governance/sites/governance/files/2021-06/Intellectual_Property_Policy_-_2013_10_01_RF.pdf)

For information on regulations that are specific to your academic program, read the section in the Academic Calendar and on the respective faculty/college/school web site <http://umanitoba.ca/faculties/>

Contact an **Academic Advisor** within our faculty/college or school for questions about your academic program and regulations <http://umanitoba.ca/academic-advisors/>

Student Advocacy

Contact Student Advocacy if you want to know more about your rights and responsibilities as a student, have questions about policies and procedures, and/or want support in dealing with academic or discipline concerns.

<http://umanitoba.ca/student/advocacy/>

520 University Centre

204 474 7423

student_advocacy@umanitoba.ca

Academic integrity and generative artificial intelligence (genAI)

- Students are encouraged to make use of technology, including generative artificial intelligence (genAI) tools to contribute to their understanding of course materials.
- Students may use artificial intelligence tools, including generative AI, in this course as learning aids or to help produce assignments. However, students are ultimately accountable for the work they submit to be assessed and assigned grades.
- Students must submit, as an appendix with their assignments, any content produced by an artificial intelligence tool, and the prompt used to generate the content.
- Any content produced by an artificial intelligence tool must be cited appropriately. Many organizations that publish standard citation formats are now providing information on citing generative AI (e.g. MLA: <https://style.mla.org/citing-generative-ai/>; APA 7: <https://apastyle.apa.org/blog/how-to-cite-chatgpt>).
- Students may choose to use generative artificial intelligence (genAI) tools as they work through the assignments in this course carefully. This use must be documented in an appendix for each assignment. The documentation should include what tool(s) was/were used, how the tool(s) was/were used, and how the result(s) from the genAI was/were incorporated into the submitted work.

Acknowledgements: This resource has been adapted from a document retrieved from the Office of the Vice-Provost, University of Toronto. <https://www.viceprovostundergrad.utoronto.ca/strategic-priorities/digital-learning/special-initiative-artificial-intelligence/>

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