

Syllabus

Introductory Plant Genomics PLNT7612

(Fall 2023)



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COURSE DETAILS

Course Title & Number:	Plant Genomics PLNT7162
Number of Credit Hours:	3
Class Times & Days of Week:	2:30 am-4 pm, Mondays and Wednesdays
Location for class	
Pre-Requisites:	N/A

Instructor Contact Information

Instructor(s) Name:	Dr. Harmeet Singh Chawla
Preferred Form of Address:	Harmeet
Office Location:	Agric Bldg Rm 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 and virtual meetings can be set up where applicable

Course Description

U of M Course Calendar Description

This course builds upon the foundation laid in the undergraduate course PLNT 4310 (Introduction to Plant Genomics) and delves deeper into the most recent advancements in genomics. The curriculum covers a wide range of topics, including DNA sequencing, molecular marker detection, genome sequencing, gene expression analysis, gene mapping, and functional analysis.

General Course Description

Plant genomics is an exciting and rapidly evolving field within the realm of biological sciences, closely intertwined with established disciplines like physiology, genetics, biochemistry, biology, pathology, and plant breeding. This burgeoning scientific arena has witnessed the emergence of groundbreaking

technologies, including high-throughput molecular marker detection, DNA sequencing, and comprehensive RNA and protein analysis.

At its core, plant genomics delves into the intricate world of whole genome structures, functions, and evolutionary processes in various plant species. It doesn't stop there; it extends its focus to individual genes, exploring their interactions and intricate networks. Within this dynamic landscape, functional genomics takes center stage, serving as the keystone for deciphering the mysteries of reproduction, adaptation, and the evolution of all living organisms.

What truly sets plant genomics apart is its role as a pioneer in cutting-edge technologies, significantly impacting multiple facets of plant science. Its applications span a myriad of related fields, including plant physiology, genetics, pathology, and plant breeding. By continuously pushing the boundaries of plant science, plant genomics offers a gateway to the latest advancements in the field.

For students aiming to stay at the forefront of contemporary agricultural technologies, plant genomics provides a unique opportunity to grasp, apply, and extend these innovations in various agricultural domains. It's a window into the future of agriculture, where science meets progress.

Course Goals

Aspiring students preparing for careers in biological sciences, especially those with a keen interest in plant genomics and related research areas, should consider enrolling in this course. Through a combination of lectures, presentations, and discussions, the course offers a comprehensive learning experience. It covers topics such as cutting-edge technologies in molecular marker development and applications, the latest advancements in genome science including sequencing and evolutionary aspects, essential tools for gene functional analysis, insights into gene functions in plant development, reproduction, and metabolic pathways, as well as an exploration of genome editing techniques like CRISPR-Cas9 and their practical uses. The course also emphasizes the significance of gene cloning and identification. Additionally, students will gain valuable hands-on training in the analysis of large genomics datasets, equipping them to excel in the dynamic field of plant genomics and related biological sciences.

Course Learning Objectives

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

1. **Hands-on Genomics Dataset Analysis:** Develop practical skills in analyzing and interpreting large genomics datasets, preparing students for real-world applications in the field.
2. **Comprehend Cutting-Edge Technologies:** Gain a deep understanding of the latest technologies in molecular marker development, detection, and their real-world applications.
3. **Stay Current in Genome Science:** Keep up-to-date with the most recent advances in genome science, particularly in genome sequencing, genome features, and evolutionary aspects.
4. **Understand Genome Editing:** Grasp the mechanisms underlying novel genome editing techniques, such as CRISPR-Cas9, and design gene editing experiments.
5. **Prepare for a Career in Biological Sciences:** Equip students with the knowledge and skills necessary to excel in the dynamic and rapidly evolving field of plant genomics and related biological sciences.

These learning objectives will guide students through a comprehensive exploration of plant genomics and related research topics while providing them with practical skills and knowledge for their future careers in biological sciences.

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.

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. The classes delivered online will be recorded and available in UM Learn. These recordings can be streamed but not downloaded or distributed due to copyright. 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:

http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html.

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

CLASS SCHEDULE AND COURSE EVALUATION

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 to Omics**
- II. Understanding genotyping**
 - Molecular markers
 - SNP marker and detection
- III. Introduction to bioinformatics**
 - Introduction to Linux
 - Basics of High performance compute clusters
 - Cloud computing
 - Understanding the commonly used bioinformatics platforms
- IV. Genetic mapping**

- Understanding the basics
 - Hands on genetic map construction
 - QTL mapping
- V. Genome sequencing**
- First generation sequencing
 - Second generation sequencing
 - Third generation sequencing
 - Single cell RNA sequencing
 - Hands on
- VI. Genome assembly**
- Genome assembly strategies
 - Genome annotation
 - Genome browsers
- VII. Gene expression**
- Quantitative polymerase chain reaction
 - Plant transcription
 - Expression profiling
 - RNA sequencing
 - Long read RNA sequencing
- VIII. Gene editing**
- Introduction, concepts and uses
 - Plant transformation
 - Genetically modified (GM) crops
 - Genome editing tools
 - CRISPR-cas9 technology
- IX. From QTL to genes**
- Integration of various genomic datasets
 - Identification of candidate genes
- X. Grant writing**

Course Evaluation Methods

Activities	Due date	Value of final grade
Assignment 1: Student presentation	Early-October	20%
Assignment 2: Genetic map construction and QTL mapping	Early-November	20%
Assignment 3: Designing a genomics study	End-November	20%
Assignment 4: Presentation of the genomics study from assignment 3	Mid-December	20%
Class participation and discussion	Throughout	20%

Grading

Indicate your grading scale. A sample is given below that you can adjust to your course expectations.

Letter Grade	Percentage out of 100	Grade Point Range	Final Grade Point
A+	95-100	4.25-4.5	4.5
A	80-94	3.75-4.24	4.0
B+	75-79	3.25-3.74	3.5
B	72-74	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 April 25, 2022. Refer to the [Registrar's Office](#) web page for more information.

I am willing to discuss with individual students their progress and attempt to provide strategies for improvement prior the withdrawal date.

Important dates

Sept 9	First day of classes
Sept 19	Voluntary Withdrawal (VW)
Oct 2	National Day for Truth and Reconciliation
Oct 9	Thanksgiving Day
Nov 13 th to 17 th	Fall break
Nov 21	Voluntary Withdrawal (VW) deadline
Dec 11	last day of class
Dec 12 th to 22 nd	Final exam period

Assignment Extension and Late Submission Policy

Assignments will be provided with instruction and due date, i.e. generally provides two weeks. 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: <http://bit.ly/WcEbA1> or name: <http://bit.ly/1tJ0bB4>. 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. For a listing of all libraries, please consult the following: <http://bit.ly/1sXe6RA>. 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:*

<http://umanitoba.ca/student/counselling/index.html>

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 <http://umanitoba.ca/student/case-manager/index.html>

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

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 <https://umanitoba.ca/student/health-wellness/welcome-about.html>

britt.harvey@umanitoba.ca

Live Well @ UofM

For comprehensive information about the full range of health and wellness resources available on campus, visit the Live Well @ UofM site:

<http://umanitoba.ca/student/livewell/index.html>

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

http://umanitoba.ca/admin/governance/governing_documents/community/230.html

Student Discipline

http://umanitoba.ca/admin/governance/governing_documents/students/student_discipline.html and,

Violent or Threatening Behaviour

http://umanitoba.ca/admin/governance/governing_documents/community/669.html

- 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:
http://umanitoba.ca/admin/governance/governing_documents/community/230.html
More information and resources can be found by reviewing the Sexual Assault site <http://umanitoba.ca/student/sexual-assault/>
- 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

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