



MBG*4110 Epigenetics

Fall 2021

Section(s): C01

Department of Molecular and Cellular Biology

Credit Weight: 0.50

Version 3.00 - September 15, 2021

1 Course Details

1.1 Calendar Description

This course presents classical non-Mendelian phenomena, including analysis of chromosome breakage, transposition, imprinting and paramutation. Modern advances in gene regulation via epigenetic phenomena will be a central theme, focusing on chromatin remodeling, gene silencing and RNA interference as they pertain to organism development, with an emphasis on plants.

Pre-Requisites: MBG*3040

1.2 Course Description

This course is providing in-depth knowledge chromatin structure, histone modifications and DNA methylation as they relate to gene silencing, position effects, gene imprinting, mobile genetic elements and their suppression. as well as more complex aspects of contemporary chromatin biology and epigenetics such as transgenerational inheritance of experience, epigenetic basis of cancer and disease and neurobiology. We will study the structure and transmission of chromatin and how these processes relate to development, disease, immune evasion by parasites and others.

Prerequisites: MCB*2050, MCB*3040

1.3 Timetable

Course schedule Lectures: TTH 8:30-9:50 *Face-to-Face, room SSC2315*

Office hours: TTH 10:30-12:00 VIRTUAL in ZOOM (Krassimir Yankulov's Personal Meeting Room)

<https://zoom.us/j/2440888785?pwd=djBHMmVYUUUvSzF6MVdOQnJLSDMxUT09>

Meeting ID: 244 088 8785
 Passcode: 7KSNew

Upon request, face-to-face meetings in Yankulov office (SSC3245) will be held.

If the COVID-19 situation changes, ALTERNATIVE COURSE DELIVERY IS POSSIBLE. Lectures will be presented online in real time via ZOOM, with synchronous in-class discussion and question periods. PowerPoint presentations will be posted online and used for instructions. Student presentations will be via ZOOM.

1.4 Final Exam

There is no final exam for this course.

2 Instructional Support

2.1 Instructional Support Team

Instructor:	Dr. K Yankulov
Email:	yankulov@uoguelph.ca
Telephone:	+1-519-824-4120 x 56466
Office:	SSC 3245
Office Hours:	TTH 10:30-12:00, virtual via ZOOM: https://zoom.us/j/2440888785?pwd=djBHMmVYUUUvSzF6MVdOQnJLSDM
	Meeting ID: 244 088 8785 Passcode: 7KSNew

Face-to-face meetings will be held upon request in Yankulov office (SSC3245).

2.2 Means of Communication

- Please send an e-mail if you need academic consideration or for other urgent matters
- Please ask for clarifications on assignments in class, use the "Raise your hand" button
- If you need to discuss course material please join the meetings during the virtual office hours. If these hours are not feasible, please schedule another time slot via e-mail.

We will use e-mails for out of class messaging. We will use the assigned class time for clarifications and questions. Virtual office hours via ZOOM and can be attended by more than one person.

3 Learning Resources

There is no textbook for this course. Basic information can be found in *Principles of Genetics (Snustad and Simmons)*, or in the McMillan textbooks assigned for the MCB1090, MBG2040 and MCB2050 courses. From time to time I will refer to materials in the **Lodish et al.** textbook for reference.

Assigned papers and review articles from recent scientific literature are essential components of this course. **These original papers will be Face-to-Face presented in class, with the expectations that all students engage in the discussions and in the analysis of these papers.**

3.1 Course Content

The direct instructional methods of this course are lectures and student presentations. The assignments include an oral presentation on an original research publication plus a written report, a presentation handout and the design of questions on the same publication. These assignments will develop your communication and problem-solving skills. Peer evaluation and peer discussions are also included.

4 Learning Outcomes

Learning goals and rationale

The central theme of this course is the increasing importance of epigenetics; i.e. heritable information that is carried by chromatin structure and not by the sequence of DNA itself. We will focus on the processes that confer the maintenance and modifications of chromatin through multiple cell divisions. We will learn how global gene expression programs are epigenetically maintained in differentiated cells and tissues and how the epigenome “senses” the environment and passes information to progeny. Such epigenetic processes play key roles in development, cell adaptation and disease progression. We will emphasise recent experiments that reveal an emerging paradigm for the transmission of epigenetic information and for the control of gene expression. The molecular mechanisms of complex genetic traits such as transposition, position-effect variegation, imprinting and RNA-mediated gene repression will be examined. Recent discoveries in epigenetic control of development, environmental responses and behaviour will be investigated through presentations of original research papers.

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Master their knowledge on structure and function of chromatin.
2. Master their knowledge on mechanisms of non-Mendelian inheritance.
3. Master their knowledge on mechanisms of DNA replication, chromatin duplication

- and inheritance of epigenetic state.
4. Master their knowledge on eukaryotic gene expression during cell differentiation and adaptation.
 5. Master their knowledge on the role of RNA in epigenetic processes.
 6. Master their knowledge on horizontal gene transfer and mobile DNA elements.
 7. Master their knowledge on analysis of primary literature.
 8. Master their knowledge on presentation skills.
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5 Teaching and Learning Activities

5.1 Course Schedule

COURSE SCHEDULE WILL BE UPDATED DURING THE FIRST WEEK OF CLASSES DEPENDING ON COURSE ENROLLMENT.

Sept. 09: Course Introduction and administration. Review of Mendelian genetics, Genetic paradigms. Adaptation and “Lamarckian” inheritance. Epigenetics and physiology, psychology, development, pathology.

Sept. 14 - Sept. 21 Lecture Panel 1: (3 classes) Chromatin, Histones, Histone Code, Most important histone modifications and their function. Histone Modifying enzymes. Non-Histone Proteins. DNA methylation. Nucleosome remodeling factors. Gene activity and gene silencing.

Sept. 23- Sept. 30 Lecture Panel 2: (3 classes) Transmission of chromatin and the maintenance of chromatin structures. Changes in chromatin structure and Position-Effect Variegation. Immune evasion by parasites.

Oct. 05 Presentations 1 and 2, peer discussion and evaluation

Oct. 07 Presentations 3 and 4, peer discussion and evaluation

Oct. 12 No classes, Thanksgiving break

Oct. 14 Quiz #1 on Lecture panels 1 and 2, presentations 1-4.

- **The quiz will be held in class. It will start at 8:30 a.m. and will last 30 min. You need to arrive in the classroom at least 5 min before the quiz. After the quiz we will continue with lecture material.**

Oct. 14 – Oct. 21 Lecture Panel 3: (2.5 classes) Non-coding RNA, heterochromatin and gene silencing. Long non-coding RNAs, RNA regulatory circuits in development.

Oct. 26 - Oct. 28 **Lecture Panel 4:** (2 classes) Mobile Genetic Elements, Mechanisms of mobility, Suppression of transposon mobility by heterochromatin, PIWI, MIWI proteins, Mobile genetic elements and regulation of gene expression.

Nov. 02 **Presentations 5 and 6**, peer discussion and evaluation

Nov. 04 **Presentations 7 and 8**, peer discussion and evaluation

Nov. 9 **Quiz #2 on Lecture panels 3 and 4, presentations 5-8.**

- **The quiz will be held in class. It will start at 8:30 a.m. and will last 30 min. You need to arrive in the classroom at least 5 min before the quiz. After the quiz we will continue with lecture material.**

Nov. 9- Nov. 16 **Lecture Panel 5:** (2.5 classes) X-chromosome inactivation. Gene imprinting and development, obesity. Insulated chromatin domains. Long range chromatin interactions. Chromatin and neurons.

Nov. 18 – Nov. 23 **Lecture Panel 6:** (2 classes) Complex genetic traits. Trans-generational epigenetic inheritance. Epigenetics and Neurobiology.

Nov. 25 **Presentations 9 and 10**, peer discussion and evaluation

Nov. 30 **Presentations 11 and 12**, peer discussion and evaluation

Dec. 02 **Quiz #3 on Lecture panel 5 and 6 and presentations 9-12.**

- **The quiz will be held in class. It will start at 8:30 a.m. and will last 30 min. You need to arrive in the classroom at least 5 min before the quiz. After the quiz we will continue with lecture material.**

5.2 Important Dates

Sept. 09	First class
Dec. 02	Last class
Oct. 12	No classes

6 Assessments

6.1 Marking Schemes & Distributions

Three quizzes will be conducted during the semester. Each quiz will consist of questions from the presentations of original research papers and questions from the lecture material.

Quizzes #1 and #2 will have a weight of 24% each.

Quiz #3 will have a weight of 22 %.

Learning outcomes 1,2,3,4,5,6.

THE QUIZZES WILL CONTAIN SHORT ANSWER QUESTIONS AND MULTIPLE CHOICE QUESTIONS ON THE LECTURE MATERIAL. UP TO 4 MULTIPLE CHOICE QUESTIONS GENERATED BY THE PRESENTERS OF THE ORIGINAL RESEARCH PAPERS WILL ALSO BE INCLUDED.

Analysis and presentation of an original research paper

Presentation Performance - individual mark 8%

Slide/handout quality - group mark 6%

Written Report-individual mark 10%

Proposed MC questions-individual mark 6%

Learning outcomes 7, 8..

6.2 Assessment Details

Analysis of an original research paper - Presentation (8%)

Learning Outcome: 7, 8

Presentation: Groups of three will present a seminar on an original research paper that illustrates important concepts and emerging ideas in the field of epigenetics. These presentations are 20 minutes long plus 5 minutes of question period. The material presented by student groups will appear in the quizzes. Attendance is expected and strongly encouraged.

The list of papers, the schedule for the presentations and instruction on the preparation of the presentations will be posted in *Courselink/Course Information* on Sept. 09/2021.

- NB: Papers from the list will be assigned to groups that are formed by the instructor. If you have **a very good reason to NOT to present** on a certain date or if you prefer **certain presentation partners and a specific paper** please advise by e-mail by noon on Sept. 11/2021.
- The presentation schedule will be finalized by 4 p.m. on Sept. 11/2021.

Analysis of an original research paper - Written Assignments (22%)

Learning Outcome: 7, 8

Written Assignments: You will use the templates posted on *COURSELINK* for both the report and the handout. Instructions for these assignments are given in the forms.

- **Handout:** The whole group will prepare a handout (two pages) for the class.
- **“News-and-Views” report on the research paper:** Each student will submit a 1000-word report that outlines the central topic, key findings and significance of the research paper.

Questions for the quizzes: Each student will submit **four multiple choice questions with five answers** on key messages from the presented paper. The answers to these MC questions should to be found in the Handout and slides. You can not exchange these questions with your group members and by no means with the class. Some of these questions will be included in the in-class quizzes.

Submission timeline and penalties: The PowerPoint presentation and the Handout will be submitted to the *DROPBOX in CourseLink* **by noon before the day of presentation**. The “News-and-Views” report and the proposed questions for the quizzes will be submitted **by 4 p.m. on the day of your presentations**. Timely submission is essential. A penalty of 1 MARK per hour is firmly in effect.

Peer discussions and bonus marks (3%)

For each presentation I will assign a group of 6 students, who could read the handout and the presented paper ahead of time and engage in a discussion with the presenters. Each insightful question, comment and/or suggestions will be awarded 0.25, 0.5 or 1.0 bonus marks.

Additional bonus marks will be awarded for questions and comments on the lecture material.

Maximum bonus mark for the semester is 3 marks.

These bonus marks will be added to the grade from the quizzes and the assignments.

6.3 Submission timeline and penalties

The PowerPoint presentation and the Handout will be submitted to the *DROPBOX in CourseLink* **by noon before the day of presentation**. The “News-and-Views” report and the proposed questions for the quizzes will be submitted **by 4 p.m. on the day of your presentations**. Timely submission is essential. A penalty of 1 MARK per hour is firmly in effect.

6.4 Grading and academic considerations

- If you miss one quiz, you will get an opportunity to write an alternative quiz on the same lecture material and presentations. The alternative quizzes will be held at a date of your preference, but not after Dec. 04/2021
- You will receive incomplete (INC) if you do not write any of the quizzes.
- You will receive incomplete (INC) if you do not participate in a presentation.
- Only under exceptional circumstances you can reschedule your presentation for the final week of classes or receive an alternative assignment. You will need academic consideration to do so.

7 Department of Molecular and Cellular Biology

Statements

7.1 Academic Advisors

If you are concerned about any aspect of your academic program:

- Make an appointment with a program counsellor in your degree program. [B.Sc. Academic Advising](#) or [Program Counsellors](#)

7.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist. <http://www.learningcommons.uoguelph.ca/>
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: <http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help> and <http://www.lib.uoguelph.ca/get-assistance/studying/math-stats-help>

7.3 Wellness

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance. <https://www.uoguelph.ca/counselling/>
- Student Health Services is located on campus and is available to provide medical attention. <https://www.uoguelph.ca/studenthealthservices/clinic>
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations. <http://www.selfregulationskills.ca/>

7.4 Personal information

Personal information is collected under the authority of the University of Guelph Act (1964),

and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) <http://www.e-laws.gov.on.ca/index.html>. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes.

For more information regarding the Collection, Use and Disclosure of Personal Information policies please see the Undergraduate Calendar.
(<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml>)

7.5 Course Offering Information Disclaimer

Please note that course delivery format (face-to-face vs online) is subject to change up to the first-class day depending on requirements placed on the University and its employees by public health bodies, and local, provincial and federal governments. Any changes to course format prior to the first class will be posted on WebAdvisor/Student Planning as they become available.

8 University Statements

8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration
<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
<https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website

<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website

<https://www.ridgetownc.com/services/accessibilityservices.cfm>

8.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community—faculty, staff, and students—to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not

relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

8.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

8.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

8.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

8.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- <https://news.uoguelph.ca/return-to-campus/how-u-of-g-is-preparing-for-your-safe-return/>
- <https://news.uoguelph.ca/return-to-campus/spaces/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.
