MBG*4110 Epigenetics

Fall 2018
Section(s): C01

Department of Molecular and Cellular Biology
Credit Weight: 0.50
Version 1.00 - August 24, 2018

---

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 chromatic remodeling, gene silencing and RNA interference as they pertain to organism development, with an emphasis on plants.

Pre-Requisite(s): MBG*3040

1.2 Course Description

This course is providing in-depth knowledge of contemporary chromatin biology and epigenetics. We will describe and analyse non-Mendelian genetics phenomena such as gene silencing, position effects, gene imprinting, transposition and its suppression. We will study the structure and transmission of chromatin and how these processes relate to development, disease, cancer and behavior.

Prerequisites: MCB*2050

1.3 Timetable

Course schedule Lectures: TTH 8:30-9:50 *SSC1304*

Office hours: TTH 10:30-12:00

1.4 Final Exam

FINAL EXAM Dec.06/2018, 14:30-16:30

Exam time and location is subject to change. Please see WebAdvisor for the latest information.

---

2 Instructional Support

2.1 Instructor(s)

Dr. K Yankulov
Email: yankulov@uoguelph.ca
Telephone: +1-519-824-4120 x56466
Office: SSC 3245
Office Hours: TTH 10:30-12:00

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

- If you need to discuss course material please attend office hours. If these hours are not feasible, please schedule a time slot via e-mail.

---

3 Learning Resources

There is no textbook for this course. Basic information can be found in *Principles of Genetics (Snustad and Simmons)*, other textbooks and on-line resources. Assigned papers and review articles from recent scientific literature are essential components of this course.

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.

---

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.

---

5 Teaching and Learning Activities

5.1 Course Schedule: will be updated in the first week of classes

Sept.06

Course Introduction and administration. Review of Mendelian genetics, Genetic paradigms. Adaptation and “Lamarckian” inheritance, Brief history of Epigenetics, Epigenetics and psychology, development, parasitology, pathology.

Sept.11 - Sept.18

Lecture Panel 1: Chromatin, Histones, Histone Code, Histone Modifying enzymes. Non-Histone Proteins. DNA methylation. Gene activity and gene silencing. Nucleosome remodeling factors.

Sept.20 - Sept.28

Lecture Panel 2: Transmission of chromatin and the maintenance of chromatin structures. Changes in chromatin structure and Position-Effect Variegation. Immune evasion by parasites.

Oct.02 **Two presentations on Lecture Panel 1**

Oct.04 **Two presentations on Lecture Panel 2**

Oct. 09 No classes, Thanksgiving week

Oct.11 Quiz #1 on Lecture panels 1 and 2, presentations from Oct. 02-04

Oct.11 – Oct. 16

Lecture Panel 3: X-chromosome inactivation, Gene imprinting, Insulated chromatin domains, Long range chromatin interactions.

Oct.18 - Oct.23

Lecture Panel 4: Non-coding RNA and heterochromatin.

Oct. 25 Two presentations on Lecture Panel 3

Oct. 30 Two presentations on Lecture Panels 4

Nov. 01 Quiz #1 on Lecture panels 3 and 4, presentations from Oct. 25-Oct. 30

Nov. 01 - Nov. 06

Lecture Panel 5: Mobile Genetic Elements, Mechanisms of mobility, Suppression of transposon mobility by heterochromatin.

Nov. 08 – Nov. 15

Lecture Panel 6: Complex genetic traits. Trans-generational epigenetic inheritance. Epigenetics and Neurobiology.

Nov. 20 **Two presentations on Lecture Panels 5**

Nov. 22 **Three presentations on Lecture Panel 6**

Nov. 27 **No classes, Re-scheduled presentations**

Nov. 29 **Quiz #3 on Lecture panel 5 and 6 and presentations from Nov. 20-22**

Nov. 29 Wrap-up, Review and preparation for the exam

FINAL EXAM Dec.06/2018, 14:30-16:30

5.2 Important Dates

Sept. 06 First class

Nov. 29 Last class

Oct. 9 and Nov. 27 No classes

Nov.02	Course drop deadline
Final exam	Dec.06/2018, 14:30-16:30

---

6 Assessments

6.1 Marking Schemes & Distributions

Three quizzes will be conducted during the semester. Each quiz will consist of 4-6 marks on 4-6 MC questions from the presentations of original research papers and 6-8 marks on SA questions from the lecture material. **Total of 36 marks.** Learning outcomes 1,2,3,4,5,6.

Analysis 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%

Total of 30 marks. Learning outcomes 7, 8.

Final Exam covers all the material from lectures, excluding presentations.

Total of 34% marks. Learning outcomes 1,2,3,4,5,6,7.

6.2 Assessment Details

Analysis of an original research paper - Presentation (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. 07/2017.

- 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 Sept. 10/2017.

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

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 **three 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.

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 additional questions (worth 12 marks) to your final exam.
- You will receive incomplete (INC) if you miss two 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.
- The final exam is compulsory. You will receive incomplete (INC) if you miss this exam.

---

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.
- 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: Chemistry & Physics Help and 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.
- Student Health Services is located on campus and is available to provide medical attention.
- 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.

---

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 regulations and procedures for Academic Consideration are detailed in the Undergraduate Calendar.

8.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for Dropping Courses are available in the Undergraduate Calendar.

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.

More information: www.uoguelph.ca/sas

8.6 Academic Misconduct

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 discourages misconduct. 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.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar.

8.7 Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate 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 which apply to undergraduate, graduate and diploma programs.
