CRISPR: Scientific breakthroughs, patent battles and societal implications

Course Coordinator: Dr. David Edgell; dedgell@uwo.ca; office hours by appointment, MBL C111

**Course Description:**

CRISPR has revolutionized genetic manipulation of complex organisms. The CRISPR system (clustered regularly interspersed palindromic repeats) is a naturally occurring genome defence system found in bacteria and archaea that protects against invasion by foreign DNA or RNA. The CRISPR system is directed to target DNA or RNA for degradation by small RNAs that are complementary to the invading DNA. CRISPR RNAs are encoded in bacterial genomes, are transcribed, processed and assembled with effector proteins to form the active CRISPR defence system. There are many CRISPR systems in nature, but by the far the most well-known system is the type II system. Seminal work by a number of scientists lead to the discovery of the biological function of CRISPR, and adapting the type II Cas9 protein to become a programmable reagent for introducing targeted double-strand breaks with high efficiency in complex genomes. CRISPR/Cas9 quickly supplanted existing genome-editing reagents of the time (ZFNs, TALENs) and has made genome editing a routine experimental protocol in virtually every model system to date. This course will explore a number of issues surrounding the discovery and applications of the CRISPR system, and touch on the current debate on patenting of CRISPR-derived technology, as well as ethical and societal implications. The format of the course will consist of an introductory lecture, followed by student presentations, a mock trial dealing surrounding the CRISPR patent (depending on student enrollment), and a short essay dealing with a CRISPR-related topic. Students will be responsible for reading primary scientific literature, patent related literature, and more general ethical issues. The course will consist of one 2-3 hour lecture per week on Wednesday at 9:30am in the Biochemistry boardroom. It may be necessary to have two lectures per week to finish the course on time.

**Evaluation**

The final mark for the course will consist of:

- Individual paper presentation: 30%
- Mock debate/trial: 25%
- Short written essay: 35%
- General participation: 20%

**Choosing a paper for presentation:**

Each student is responsible for presenting one paper in a journal club format. You can pick the paper from the list provided, or pick your own in consultation with Dr. Edgell. If so, the paper should represent a major advance in the field rather than an incremental advance (this is something you will have to justify in your presentation). For the presentation, you should focus on the big picture, and make sure you present sufficient background information for the class to understand why the paper is significant. Be sure to explain the rationale and any technical background necessary to understand the experiment and the results. Conclude with how the study advanced the field, and present any evidence of long-term impact of the paper.

**Written essay:**

Students should consider using the paper they presented as the basis of the written essay. The format for the written essay will follow a news-and-views format, maximum 2000 words, with one illustration. The essay should focus on the major advancement of the paper, described for a general
audience. Often, related papers are also included in the news-and-views article, as well as a discussion of the state of the field and how the paper will impact the field. This is not written for the specialist. It may help to read a news-and-views article from Nature, Science, or Cell.

**Patent Debate:**

Depending on enrollment in the course, the goal is for teams of students to present opposing sides of the ongoing patent dispute related to licensing of CRISPR technology. Students will need to examine each of the opposing patents, focusing on the claims of each patent. The debate will centre around how the validity, reduction to practice, and prior art supporting the claims made by each patent. There will be an introductory lecture about the patents, and how to examine the relevant material in the patents for the debate.

**Academic Accommodation:**

Students seeking academic accommodation on medical grounds for any missed tests, exams, participation components and/or assignments worth 10% or more of their final grade must apply to the Graduate Administrator, Barb Green, as soon as possible and provide documentation.

**Scholastic Offences:**

The statement: “Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf

All required papers may be subject to submission for textual similarity review to the commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

**Plagiarism:** Students must write their essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar).

As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western’s Campus Recreation Centre. Numerous cultural events are offered throughout the year. Please check out the Faculty of Music web page http://www.music.uwo.ca/, and our own McIntosh Gallery http://www.mcintoshgallery.ca/. Information regarding health- and wellness-related services available to students may be found at http://www.health.uwo.ca/

Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Campus mental health resources may be found at http://www.health.uwo.ca/mental_health/resources.html

To help you learn more about mental health, Western has developed an interactive mental health learning module, found here: http://www.health.uwo.ca/mental_health/module.html. This module is
30 minutes in length and provides participants with a basic understanding of mental health issues and of available campus and community resources. Topics include stress, anxiety, depression, suicide and eating disorders. After successful completion of the module, participants receive a certificate confirming their participation.

Helpful Resources @ Western for Graduate Students

Writing Support Centre http://www.sdc.uwo.ca/writing/  SDC’s Learning Skills Services, Rm 4100 WSS, www.sdc.uwo.ca/learning
LS counsellors are ready to help you improve your learning skills. We offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

The Student Success Centre: http://success.uwo.ca/