

Department of Biology Course Outline

SC/BIOL 4020 3.0, Genomics
Fall, 2020

Course Description

The study of genome structure, function and evolution, with emphasis on the primary literature. Topics include: gene duplication, evolution of noncoding DNA, population genomics, horizontal gene transfer, transposable element evolution and base composition. Three lecture hours. One term. Three credits.

Prerequisites (strictly enforced)

SC/BIOL 2060 3.00 or SC/MATH 2560 3.00 or SC/MATH 2565 3.00 or HH/PSYC 2020 6.00 or HH/PSYC 2021 3.00 (or equivalent); SC/BIOL 3130 3.00

Course Instructor(s) and Contact Information

Alexander Klenov
Farquharson Life Sciences Room A304
alexkle@yorku.ca

Online office hours will be scheduled upon request by email.

Schedule/Course Format

Synchronous Zoom Lectures, Recorded & Posted on Moodle
Tuesdays and Thursday 11:30AM – 1:00PM

Technology Requirements

Internet connection, webcam, microphone

Evaluation

**Dates and delivery format will be posted on course Moodle.
Tests will be administered through Moodle Quiz.**

Test 1 – Covers Module 1 – 15%
Assignment 1 – Genome Assembly/Annotation/Exploration – 15%
Test 2 – Covers Module 2 – 20%
Assignment 2 – RNA-Seq Differential Expression Analysis – 15%
Test 3 – Covers Module 3 – 20%
Assignment 3 – Constructing a phylogenetic tree of SARS-Cov 2 – 15%

Important Dates

Classes start: Sept 9th
Reading Week: Oct 10 to Oct 16th
Drop Date: Nov 6th
Course Withdrawal Period: Nov 7th to Dec 8th
Classes End: Dec 8th
Exam Period: Dec 9th to 23rd

Resources

Resources available online, on Moodle and through York Library Portal

Learning Outcomes

Upon successful completion of this course, students should be able to:

- 1) Describe the structure of a genome and its composition at the chromosome, epigenome and DNA level
- 2) Describe how genome sequencing and annotation allows the study of gene function and interaction
- 3) Compare elements of genomes within and between species to infer disease, positive traits and evolutionary relatedness
- 4) Describe how genomics has impacted aspects of life science in medicine, agriculture and industry
- 5) Perform basic bioinformatics tasks such as small genome assembly, RNA-seq differential expression and phylogenetic analysis

Course Content

Introductory Module

- 1) Brief History
- 2) Types of genomes
- 3) Structural vs Functional vs Comparative Genomics
- 4) What questions can we answer with Genomics?

Module 1 – Structural Genomics

- 1) Chromosome structure/number and gene mapping
- 2) Epigenetics
- 3) Genome sequencing technologies
- 4) Assembly of genomes
- 5) Annotation of genomic DNA
- 6) Genetic markers and mutations

Assignment 1

- Assemble, annotate and explore a small bacteria genome with Galaxy bioinformatics software

Module 2 – Functional Genomics

- 1) Sequence alignment
- 2) Annotating protein function with BLAST
- 3) Methods of determining protein function and interactions
- 4) Proteomic analysis
- 5) Transcriptome analysis of gene expression

Assignment 2

- Analyze RNA-Seq data to identify differentially expressed genes in nematode infested Arabidopsis

Module 3 – Comparative Genomics

- 1) Homologs/paralogs/orthologs
- 2) Genome wide association studies
- 3) Genome evolution
- 4) Phylogenetic analysis

Assignment 3

- Retrieve viral sequences and construct phylogenetic trees to determine evolution of SARS-COV 2

Other Information

Check course Moodle **daily** for updates to course materials

Course Policies

Make every effort to attend tests

Missed tests will be rescheduled as oral examinations

Late penalties for assignments will be 10% per day

University Policies

Academic Honesty and Integrity

York students are required to maintain the highest standards of academic honesty and they are subject to the Senate Policy on Academic Honesty (<http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/>). The Policy affirms the responsibility of faculty members to foster acceptable standards of academic conduct and of the student to abide by such standards.

There is also an academic integrity website with comprehensive information about academic honesty and how to find resources at York to help improve students' research and writing skills, and cope with University life. Students are expected to review the materials on the Academic Integrity website at - <http://www.yorku.ca/academicintegrity/>

Important A note from the Faculty of Science Committee on Examinations and Academic Standards: Numerous students in Faculty of Science courses have been charged with academic misconduct when materials they uploaded to third party repository sites (e.g. Course Hero, One Class, etc.) were taken and used by unknown students in later offerings of the course. The Faculty's Committee on Examinations and Academic Standards (CEAS) found in these cases that the burden of proof in a charge of aiding and abetting had been met, since the uploading students had been found in all cases to be wilfully blind to the reasonable likelihood of supporting plagiarism in this manner. Accordingly, to avoid this risk, students are urged not to upload their work to these sites. Whenever a student submits work obtained through Course Hero or One Class, the submitting student will be

charged with plagiarism and the uploading student will be charged with aiding and abetting.

Note also that exams, tests, and other assignments are the copyrighted works of the professor assigning them, whether copyright is overtly claimed or not (i.e. whether the © is used or not). Scanning these documents constitutes copying, which is a breach of Canadian copyright law, and the breach is aggravated when scans are shared or uploaded to third party repository sites.

Access/Disability

York University is committed to principles of respect, inclusion and equality of all persons with disabilities across campus. The University provides services for students with disabilities (including physical, medical, learning and psychiatric disabilities) needing accommodation related to teaching and evaluation methods/materials. These services are made available to students in all Faculties and programs at York University.

Students in need of these services are asked to register with disability services as early as possible to ensure that appropriate academic accommodation can be provided with advance notice. You are encouraged to schedule a time early in the term to meet with each professor to discuss your accommodation needs. Please note that registering with disabilities services and discussing your needs with your professors is necessary to avoid any impediment to receiving the necessary academic accommodations to meet your needs.

Additional information is available at the following websites:

Counselling & Disability Services - <http://cds.info.yorku.ca/>

Counselling & Disability Services at Glendon - <https://www.glendon.yorku.ca/counselling/>

York Accessibility Hub - <http://accessibilityhub.info.yorku.ca/>

Religious Observance Accommodation

York University is committed to respecting the religious beliefs and practices of all members of the community, and making accommodations for observances of special significance to adherents. Should any of the dates specified in this syllabus for an in-class test or examination pose such a conflict for you, contact the Course Director within the first three weeks of class. Similarly, should an assignment to be completed in a lab, practicum placement, workshop, etc., scheduled later in the term pose such a conflict, contact the Course director immediately. Please note that to arrange an alternative date or time for an examination scheduled in the formal examination periods (December and April/May), students must complete and submit an [Examination Accommodation Form](#) at least 3 weeks before the exam period begins. The form can be obtained from Student Client Services, Student Services Centre or online at <https://secure.students.yorku.ca/pdf/religious-accommodation-agreement-final-examinations.pdf>

Student Conduct in Academic Situations

Students and instructors are expected to maintain a professional relationship characterized by courtesy and mutual respect. Moreover, it is the responsibility of the instructor to maintain an appropriate academic atmosphere in the classroom and other academic settings, and the responsibility of the student to cooperate in that endeavour. Further, the instructor is the best person to decide, in the first instance, whether such an atmosphere is present in the class. The policy and procedures governing disruptive and/or harassing behaviour by students in academic situations is available at - <http://secretariat-policies.info.yorku.ca/policies/disruptive-andor-harassing-behaviour-in-academic-situations-senate-policy/>