

# BIOL 331

## Analytical Genomics

Winter Term (2014-15)

### CALENDAR DESCRIPTION

This course will explore the structure of genomes and the nature and origin of gene families as well as large scale functional genomics methods for analysis of novel gene function.

PREREQUISITE BIOL 205/3.0.

### SCHEDULE

**Lectures: Monday 7:00pm-9:00pm, Wednesday 7:30pm-8:30pm. STIRLG A.**  
**Tut.: Wednesday 6:30pm-7:30pm. STIRLG A.**

<b>Instructor</b>	<b>Dr. P. Young</b>
<b>Instructor Contact</b>	<a href="mailto:youngpg@queensu.ca">youngpg@queensu.ca</a> , Phone: 533-6148, Rm. 2443 Bioscience
<b>Office Hours</b>	TBA
<b>TA:</b>	See Course Website
<b>TA Contact Information</b>	See Course Website
<b>Office Hours</b>	TBA

### Learning Objectives

Genomics is one of the most rapidly moving fields in modern science. It has an impact in all areas of biology and life science. The course has two broad areas of focus:

1. Bioinformatics

Approximately one third of the course is directed at introducing genomic databases and the software tools to compare sequence and infer evolutionary relationships. Four assignments during the term ensure that students become proficient at running various programs and interpreting the results. Web based software is used; no direct programming is involved.

2. Functional genomics

The latter two thirds of the course focuses on assigning biological function to genes discovered through sequencing programs. The approaches include computer analysis, mutational analysis, gene and protein interaction, 3-D structure. The student will have an appreciation of the strengths and limitations of such methods as well as recognition of the current limits of experimental science. This portion of the course relies heavily on the current research literature.

Lecture topics from 2013 as an example: [http://130.15.90.59/Biol331\\_14/lectures\\_14.htm](http://130.15.90.59/Biol331_14/lectures_14.htm)

**Learning Hours**

<i>Teaching method</i>		<i>Average hours per week</i>	<i>Number of weeks</i>	<i>Total hours</i>
In-class hours	Lecture	3	12	36
	Seminar			
	Laboratory			
	Tutorial	1	12	12
	Practicum			
	Group learning			
	Individual instruction			
Other	Online activity	10	4	40
	Off-campus activity			
	Private study	2	12	24
Total hours on task				112

**Course Outline**

The course will broadly follow this outline. It differs year to year based on progress in this rapidly changing field.

**Week 1**

Genomics intro

[\\$1000 dollar genome](#) read this and look at the [fig.](#)

[IonTorrent](#) on youtube

Databases

Identity, Similarity, Homology, Gaps

tutorial: [Pelagibacter](#) read for Wed tutorial discussion 6:30

**Week 2**

Assignment 1

Pattern and Profile matching

tutorial: Assignment 1

**Week 3**

continue Patterns

PsiBlast and ClustalW

Scores, E-values and Sensitivity

Conserved domains and domain architecture

**Week 4**

Continue conserved domains

Rubin et al, [Comparative genomics](#)

Tutorial: Assignment 1 help

**Week 5**

Comparative genomics.

midterm exam

No tutorial this week

**Week 6**

Environmental Genomics

Finding genes

[Personal medicine](#)

Tutorial: Assignment 2&3 worth 20%

reading week

[Good news for men](#)

**Week 7**

Hybridization and microarrays

Utility of microarray diagnoses (example, abs only) [Haferlach et al., 2010](#)

Lost similarity, similar structure [Swanson et al, 2011](#)

Making mutants

[Do all genes have a function?](#) (more info on chemical genomics [Roemer](#), not required)

Tutorial: help with Assignment 2&3

**Week 8**

SNPs

[1000 genomes project](#)

[15,000,000 SNPs](#)

[GWAS vs Cheap Sequencing](#)

**Week 9**

continue SNPs etc

Is the genome stable: [Jumping genes in the brain](#)

Tutorial: help session, Q&A

large scale GWAS

CNV (CNPs)

[Sequencing costs](#)

**Week 10**

[SNPs and risk assessment](#)

[SNPs and business](#)

Delta BLAST

siRNA miRNA

tutorial: no tutorial

**Week 11**

continue siRNA miRNA

Structure and Assignment 4

Protein Interaction

**Synthetic lethality**

How many protein complexes in a cell?

tutorial: help with Assignment 4

**Week 12****Large genomes**

tutorial: Q&A if requested

Chimps and humans

[Human evolutionary constraint using 29 mammals](#) markup paper, [supp files](#)

**Gorilla genome**

Extra topics that may be inserted. These vary year to year based on literature

[Encode](#) - 30 papers of new analysis, [Nature Sept 2012](#)

Single cell sequencing Nature Nov 1 2012

[Unique to the human lineage](#), O'Bleness et al 2013 Genetic and Genomic changes on the human lineage

Synthetic biology: Craig Venter - synthetic life [Ted Talk](#)

[first synthetic eukaryotic chromosome](#)

[Is it the proteins or the transcription regulation?](#)

[Fantom5](#) 2014

**Textbooks/Readings**

General comments regarding the course and recommended text (for bioinformatics part) are found here.

[http://130.15.90.59/Biol331\\_14/General%20Information.htm](http://130.15.90.59/Biol331_14/General%20Information.htm)

Much of the course is taught from the research literature.

**Grading Scheme**

Component	Weight (%)	Date
midterm	20	February
final	40	April
4 web based reports	40	Throughout term

**Grading Method**

All components of this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to Queen's Official Grade Conversion Scale.

When letter grades are employed, the following scale will be employed for purposes of calculating your course average:

***Arts & Science Letter Grade Input Scheme***

Assignment mark	Numerical value for calculation of final mark
A+	93
A	89

A-	82
B+	78
B	75
B-	72
C+	68
C	65
C-	62
D+	58
D	55
D-	52
F48 (F+)	48
F24 (F)	24
F0 (0)	0

Your course average will then be converted to a final letter grade according to Queen's Official Grade Conversion Scale:

***Queen's Official Grade Conversion Scale***

<b>Grade</b>	<b>Numerical Course Average (Range)</b>
A+	90-100
A	85-89
A-	80-84
B+	77-79
B	73-76
B-	70-72
C+	67-69
C	63-66
C-	60-62
D+	57-59
D	53-56
D-	50-52
F	49 and below

**Academic Integrity and Queen's Code of Conduct**

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments and conduct conform to the principles of academic integrity. Information is available in the Arts and Science Calendar (see Academic Regulation 1 - <http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations>, on the Arts and Science website (see <http://www.queensu.ca/artsci/academics/undergraduate/academic-integrity>), and at Biology's website (<http://www.queensu.ca/biology/undergrad/integrity.html>) and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulations on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

### **Accommodation Policy, Exam Conflicts, and Other Conflicts**

Students who feel they need accommodations for disabilities or extenuating circumstances, or have a conflict between exams or other commitments should consult the Biology Department's website for details about how to proceed (<http://www.queensu.ca/biology/undergrad/integrity.html>). In general, the earlier a course coordinator is apprised of an extenuating circumstance, the more likely an accommodation can be made. Students are encouraged to be proactive in anticipating difficulties, when it is possible to do so.

Students may apply to write a make-up or deferred exam if they have an exam conflict as defined in the Academic Regulations of the Faculty (See Arts and Science Calendar Regulation 8 - <http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations>). In this case, the student should report to the Exams Office first to verify that there is a genuine exam conflict. Biology professors will not consider your situation to be a conflict unless it meets the criteria set out by the Faculty of Arts and Sciences.

Students may request a make-up or deferred exam if they have an exam conflict with off-campus travel associated with a field course (e.g BIOL-307/3.0 or 407/3.0) that is held during the fall or winter terms.

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### **Accommodation of Disabilities**

*Queen's University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability and think you may need accommodations, you are strongly encouraged to contact the Disability Services Office (DSO) and register as early as possible. For more information, including important deadlines, please visit the DSO website at: <http://www.queensu.ca/hcds/ds/>*