# Biochemistry 9545Q

# Macromolecular Informatics

# Fall 2016

# Course Outline

The course will typically meet once per week Wednesdays at 9:30-11:30. Classes start Wednesday September 14th and end October 19th. There will be an interruption in the course, and additional sessions will be scheduled to account for this interruption.

# Instructor:

Greg Gloor, [ggloor@uwo.ca](mailto:ggloor@uwo.ca), 519-661-3526 (office)

#### NOTE: This is intended to be focused largely on theoretical aspects of analysis, and practical information on how to manage and keep track of your work

# Requirements

Students will be expected to bring a functional laptop to class with the R programming environment already loaded and functional. Students should be familiar with the file system of their computer and be able to locate files associated with R on their own. Students should have a working text editor installed. For Macs this could include Textwrangler, for PCs the could include Notepad++. Students should have a copy of *"Analyzing compositional data with R"* loaded on their computer for reference. We will use many of the principles outlined in that book. In addition, I encourage students to get a copy of *"R in Action"* --- you will find this invaluable.

I expect that students will learn outside of class, by doing the readings and doing at least some of their own troubleshooting. We will not be installing much, but what we do install will help you to keep track and present your work in the future.

## Sessions

1. An introduction to high throughput sequencing and data types generated in high throughput sequencing. An introduction to R, markdown and knitr (functional note taking and reproducible data analysis)
2. A further introduction to R, data types, installing packages, simple plots, exploring multivariate data
3. An introduction to the structure of multivariate datasets. An introduction to compositional data.
4. An introduction to the error structure in high throughput sequencing. PCA and compositional biplots.
5. An introduction to Bayesian thinking in compositional data
6. Correlations in compositional data

## Assessments

1. The student will be required to submit a proper R program. Marks will be assessed based on ability to properly comment, make a functional script, conciseness and proper form. This must be submitted in the form of a .Rmd document.
2. The student will be required to make and properly interpret a compositional biplot from a dataset provided.
3. The student will be required to examine and interpret the correlation and pairwise abundance of parts of a high-throughput sequencing dataset

The course is largely theoretical. Assessments are to be worked on and handed in individually, and are equally weighted. Students will be expected to conduct independent learning to practice the concepts and tools. Here is where you will find the R in Action book or the companion website invaluable.

# Sources

This should be all you need, aside from some R packages

* R installation: <http://cran.utstat.utoronto.ca>
* Markdown: <http://daringfireball.net/projects/markdown/>
* R studio and markdown: <http://rmarkdown.rstudio.com>

# Readings:

* how does multiple testing correction work? Nat. Biotech. 2009 27:1135
* how to make more published research true. PLoS Medicine. 2014 11:e1001747
* it's the effect size stupid. <http://www.leeds.ac.uk/educol/documents/00002182.htm>
* the fickle P value generates irreproducible results. Nat. Meth. 2015. 12:179
* It's all relative: analyzing microbiome data as compositions, 2016, 26:322
* Proportionality: a valid alternative to correlation for relative data, PLoS Comp. Bio. (2015)11:e1004075

# Due dates

All assignments are due one week after they are given. All three assignments must be handed in and passed to obtain course credit.

# Statement on Academic 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/handbook/appeals/scholastic_discipline_grad.pdf> Academic Handbook, Exam, Course Outlines Page 4 Issued: 2011 02

Additionally, "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/***