

BIOL 7711

Introduction to Bioinformatics

Tuesdays and Thursdays 11-12:30

Move to **TuTh 1-2:30**? Everybody ok with this?

RC-1 North Tower, Room P18-6107

Anschutz Medical Campus, UC Denver

Profs: Larry Hunter (10), David Pollock (7), Katerina Kechris (3), Karin Verspoor (3),
and Deborah Goldberg (2)

Single Guest Lectures: Greg Caparaso, Michael Wall, and Robyn Knight

See compbio/uchsc.edu/ for contact information.

Office hours for all professors by appointment.

TA: Ron Schuyler, RC-1 S, Room L18-6400A

Phone: 303-803-3893 (Ron) E-mail: ron_schuyler@yahoo.com

Office hours: 10am-11am Tue/Thur

Course description

An introduction to the **theory and practice of** bioinformatics and **computational biology**. **Research Topics** include: molecular biology databases, the analysis of macromolecular sequences (search, alignment, programming libraries), hidden Markov models, genome assembly and next-generation sequencing, protein-protein interaction and networks, phylogenetics, protein structure and prediction, molecular dynamics and docking, genetic linkage and association, gene expression arrays, text mining, and proteomics. **General topics** include an overview of computational biology, how to do significant research, how to design, review and present research plans, how to write and review manuscripts, and how to present research orally (public speaking).

Goals for the course: The course will **familiarize** students with the tools and principles of contemporary bioinformatics. By the end of the course, students will have a **working knowledge** of a variety of publicly available **data** and computational **tools** important in bioinformatics, and a grasp of the **underlying principles** that is adequate for them to evaluate, use, and **develop novel techniques** as needed.

This course is central to the educational mission of the Computational Bioscience PhD program.

Generally, we dislike lecture courses, but there is so much material that you have to know in order to be a well educated researcher in bioinformatics (and to pass the preliminary exam!) that we feel we have no choice. Do know that we want you to ask questions, raise topics you'd like to know more about, and otherwise make this course more your own.

Syllabus

Each of the following topics will be covered by the following professors or guest lecturers. This list is tentative until the lecture is posted. For your convenience, lecture notes, readings and links to external web sites from previous years are available (compbio.uchsc.edu/hunter/bioi7711/). Updates and modifications will be provided before each lecture. A copy of this syllabus and Pollock lecture notes will be available at www.EvolutionaryGenomics.com/7711/. Other lecture notes will be available on one of these two sites or according to information provided by contributing professors.

NB: Some PDF versions of the lecture notes have formatting problems leading to small differences from the PPT originals -- when there is a conflict, use the PPT.

David Pollock Lectures

Welcome and introduction	Tuesday, September 1
What is computational biology research?	Thursday, September 3
*Hidden Markov models	Tuesday, September 29
Peer review of project proposals	Tuesday, October 6
*Sequence assembly and next-generation sequencing	Thursday, October 8
*Phylogenetics	Tuesday, October 20
*Genetic linkage and association	Tuesday, November 10

Larry Hunter lectures

Course Project Overview	Tuesday, September 8
*Molecular Biology Databases	Thursday, September 10
How to claim significance	Thursday, September 24
Research plans and reviews of the same	Thursday, October 1
Reporting on your research	Thursday, October 22
*Molecular mechanics, molecular dynamics, and docking	Tuesday, November 3
Presentation of project status	Thursday, November 19
Knowledge-based analysis	Tuesday, November 24
Picking a thesis project	Thursday, December 1
*Mass spectrophotometry and proteomics	Tuesday, December 8

Katerina Kechris Lectures

How to review research manuscripts	Thursday, October 29
Presentation of manuscript reviews	Thursday, November 5
*Expression array analysis	Tuesday, November 17

Karin Verspoor Lectures

*Sequence search and alignment	Tuesday, September 15
How to present research orally	Thursday, November 12
*Text mining and biological natural language processing	Thursday, December 8

Deborah Goldberg Lectures (by video)

*Multiple sequence alignment	Tuesday, September 22
*Protein-protein interaction and networks	Tuesday, October 13

Guest Lectures

PyCogent (Caparaso)

*Protein structure and prediction (Wall)

Thursday, September 17

Tuesday, October 27

All Profs should attend if possible

Presentation of revised plans (Knight)

Project presentations (Hunter)

Thursday, October 15

Thursday, December 17

Rocky09

Snowmass, Colorado December 10-12; This is a broad computational biology meeting organized by Larry Hunter, and everyone is strongly encouraged to attend. It is a great opportunity and a lot of fun and you will meet a lot of people outside the program and learn about a huge variety of computational biology research.

*Research lectures

News

For oral presentations of your projects, each student will give a 15 minute presentation (with 5 minutes for questions). Your written project papers (and code) are also due on the [to be posted online]. There will NOT be a final exam. Do note that this material makes up the bulk of what your qualifying exam will test, so it's worth studying carefully anyway.

Larry Hunter has published "The Processes of Life: An Introduction to Molecular Biology". This is a concise and accessible introduction to molecular biology, particularly useful for students with a mostly computational background.

Grading

The goal of this course is to get you familiar with the use of bioinformatics techniques in addressing real scientific problems. Students will have problem sets and a series of exercises that are intended to reflect realistic research tasks. There will be several problem sets, each of which is expected to take you four to eight hours of work. These problem sets are intended to give you hands on experience with the work of computational biology, and should be learning experiences as well as evaluation tools. Ron will be grading these, so please take your problem set-related questions to him. You will also be assigned a series of research exercises as well, culminating in the design and execution of a course project. Ron will be grading and supervising these exercises and projects as well, so please take your project-related questions to him.

The assignments will be posted on line.

Honor Code

The Graduate School requires that this honor code be included in all course syllabi.

Education at the Health Sciences Center is conducted under the honor system. All students who have entered health professional programs should have developed the qualities of honesty and integrity, and each student should apply these principles to his or her academic and subsequent professional career. All students are also expected to have achieved a level of maturity, which is reflected by appropriate conduct at all times.

Note that our educational mission statement includes even stronger goals for your professional behavior. Please feel free to raise issues related to those goals in class.