**Selected Topics in Bioinformatics and Computational Biology: Applications of NGS data processing software in genomics**

**BCB660 Fall 2014**

**Time & Location:** Tu, Th 9:30a – 10:50p (Credits: 3); 1340 MBB  
**Instructors:**Andrew Severin (206 Science I; Tel.: 294-1320);

**Email:** severin@iastate.edu   
**Wiki**http://gif.biotech.iastate.edu/Classes/doku.php?id=home:bcb660wiki2014:start   
**Office Hours:**After class as needed.   
**Grades:**will be determined as described below.  
**Computing Resources:**You will have access to the hpc-class Cluster from the High Performance Computing Facility at ISU. hpc-class is a computing cluster with multiple 16 core/64 GB RAM compute-nodes.

**Course Description**  
The course will be a hands-on, working group style course covering data processing and analysis of "Next Generation Sequence" data. Students will learn the basics of working with high performance computers, installing software, and analyzing sample data. The course will be centered around three core principles:  understanding assumptions and limitations of the biological question, of the data from the sequencing technology, and of the software used to analyze the data.  The course will cover data preprocessing, genome assembly, transcriptome assembly, RNA-Seq analysis, SNP calling and other select topics depending on time. At each step, participants will work together to generate/improve installation and How-to documentation, which will be maintained on the course Wiki page. There will be opportunity to analyze original data as well as provided sample data.

**Prerequisites**  
This interdisciplinary course is primarily directed at advanced graduate students in bioinformatics and computational biology. Students must have a working knowledge of basic Linux (installation of software without root access, editing of configuration files, commands to manipulate text files, etc) and are expected to be familiar with the data types and formats as well as biological motivation of genomic research. At the start of the class, we will run through a tutorial on basic commands that you will need to know, but please address any special needs or special accommodations with the instructor at the beginning of the semester or as soon as you become aware of your needs.

**Academic Dishonesty**

The class will follow Iowa State University’s policy on academic dishonesty. Anyone suspected of academic dishonesty will be reported to the Dean of Students Office. <http://www.dso.iastate.edu/ja/academic/misconduct.html>

**Assignments**  
Each week, students will be given the opportunity to analyze a sample dataset. We will provide class time to work on the analysis and interact with instructors and other students, but students are expected to complete the analyses outside of class. Students will be given flexibility on choosing different programs and parameters for their analysis—thus, in many cases, there will be no “right answer” to assignments. Rather, the assignments are meant to be an exploration of available analysis options. Students will then provide documentation for their analysis results via course associated Wiki pages, and students will also be asked to give informal updates on their results to the entire class on an ad hoc basis. We hope to facilitate discussion of each topic, and keep lectures to a minimum.

**Grading**  
Grades will be based on class participation and Wiki documentation. Assignments will be assessed based on effort, not necessarily on results. We are looking for good documentation (e.g. list relevant code and references to literature), explanation of what was done and why, as well as visual and or descriptive reports of what was learned from each assignment. Students are expected to complete a “Final Project” and give a short final presentation on one part of their class work at the end of the course; this can involve students’ own data, a novel dataset, or one of the class sample datasets.

**Final Projects**

Each student will develop a NGS analysis project that incorporates several elements of what we have covered in this class. This project can use original data, publicly available data, or any of the data that we have used previously in the class. The project should be more in-depth than a typical homework assignment (e.g. simply running an assembly is not enough), and should involve several steps (e.g. pre-processing, assembly, and mapping) as well as include information on quality and evaluation of the results (e.g. alignments to known/related genomes, comparisons to similar published projects, etc).

Students should provide a detailed documentation of the data used, steps involved, results, and interpretation of their projects on the wiki page and plan to present this during the class period.

**Class Themes**

**Theme 1: Introduction**

**Theme 2: Alignment**

**Theme 3: Transcriptome Assembly**

**Theme 4: Genome Assembly**

**Theme 5: RNA-Seq analysis**

**Theme 6: Pathway analysis**

**Theme 7: SNP data analysis**

**Final Projects**

**Disability Accommodation**

Iowa State University complies with the Americans with Disabilities Act and Sect 504 of the Rehabilitation Act. If you have a disability and anticipate needing accommodations in this course, please contact (instructor name) to set up a meeting within the first two weeks of the semester or as soon as you become aware of your need. Before meeting with (instructor name), you will need to obtain a SAAR form with recommendations for accommodations from the Disability Resources Office, located in Room 1076 on the main floor of the Student Services Building. Their telephone number is 515-294-7220 or email disabilityresources@iastate.edu . Retroactive requests for accommodations will not be honored.

**Harassment and Discrimination**

Iowa State University strives to maintain our campus as a place of work and study for faculty, staff, and students that is free of all forms of prohibited discrimination and harassment based upon race, ethnicity, sex (including sexual assault), pregnancy, color, religion, national origin, physical or mental disability, age, marital status, sexual orientation, gender identity, genetic information, or status as a U.S. veteran. Any student who has concerns about such behavior should contact his/her instructor, Student Assistance at 515-294-1020 or email dso-sas@iastate.edu, or the Office of Equal Opportunity and Compliance at 515-294-7612.

**Religious Accommodation**

If an academic or work requirement conflicts with your religious practices and/or observances, you may request reasonable accommodations. Your request must be in writing, and your instructor or supervisor will review the request. You or your instructor may also seek assistance from the Dean of Students Office or the Office of Equal Opportunity and Compliance.

**Contact Information**

If you are experiencing, or have experienced, a problem with any of the above issues, email [academicissues@iastate.edu](mailto:academicissues@iastate.edu).