

SYLLABUS: Spring 2019 || BIT815: Deep DNA Sequencing Data Analysis,

- Monday, Wednesday, Friday 8:30 am – 10:20 am.
- Jordan Hall Room 6117, two credit hours; S/U grading.
- This course does not satisfy requirements for General Education Program credits. The prerequisite is graduate student standing or permission of the instructor.

INSTRUCTOR

Dr. Ross Whetten; email address ross_whetten@ncsu.edu; office 5231 Jordan Hall

Office hours by appointment – email works best to set up appointments. The classroom teaching assistant for Spring 2019 is Will Kohlway; email address whkohlwa@ncsu.edu.

COURSE DESCRIPTION

This course covers methods for analysis of data from high-throughput DNA sequencing, with or without a reference genome sequence, using free and open-source software tools with an emphasis on the command-line Linux computing environment.

STUDENT LEARNING OUTCOMES

This course introduces students to basic computational thinking, Linux command-line utilities, open-source software installation and use, and design and analysis of high-throughput DNA sequencing experiments. Through successful completion of this course, students will:

1. Become acquainted with the basic concepts of decomposition, abstraction, generalization, and algorithm development as applied to sequence data analysis.
2. Learn how these concepts apply to use of Linux command-line utilities and open-source bioinformatics software to manage and analyze large datasets, including example datasets from a variety of different types of high-throughput DNA sequencing experiments.
3. Gain experience in compiling, installing, updating, and using open-source software, including both specialized software for DNA sequence analysis and the general-purpose R statistical programming environment.
4. Practice and improve their abilities to use the Linux command-line environment and graphical user interfaces to manage, summarize, and analyze DNA sequencing datasets.

STUDENT EXPENSES

No textbook or other materials must be purchased; all reading assignments will be provided as handouts or links to on-line materials.

GRADING

The class is offered on the S/U (satisfactory/unsatisfactory) basis. Grading will be consistent with the NC State policy on grading, available at <http://policies.ncsu.edu/regulation/reg-02-50-03>. Grades are determined by preparation for and participation in class. Active participation will not

be possible without completing the assignments required out of class (readings from handouts, and preparation for discussions), and attending class to join in the discussions.

Your grade will be determined from the following components:

- Class attendance and preparation 30%
- Assignments 35%
- Class participation 35%
- Total 100%

You cannot earn credit for class participation if you have not adequately prepared.

Class preparation includes assigned readings, writing assignments, and project and presentation preparation. Class participation includes participating in class discussions and computing exercises.

COURSE ORGANIZATION

Subject to change; notification of changes will be provided.

Week	Dates	Topics	Biostar Handbook Sections
1	7 – 11 Jan	Introduction to Linux and the command- line interface	1, 2, 4
2	14 – 18 Jan	Sequencing instruments, experimental design, data preprocessing, and quality control	8, 9, 10
	21 Jan	Martin Luther King holiday: No class	...
3	22 – 25 Jan	Error correction and alignment	...
4	28 Jan – 1 Feb	Assembly: Transcriptomes and genomes	22
5	4 – 8 Feb	Re-sequencing, alignment, and structural variation	17, 18, 23
6	11 – 15 Feb	Discovery and genotyping of genetic variation	-
7	18 – 22 Feb	R and RStudio: Lectures and exercises through Software Carpentry website, Sections 1 - 8	
8	25 Feb – 1 Mar	R and RStudio, continued: Sections 9 - 12	
9	4 – 8 Mar	Transcriptome analysis: Differential gene expression and annotation	19, 20
	11 – 15 Mar	Spring break: No classes	
10	18 – 22 Mar	Genome analysis: ChIP-seq, DHS-seq, 3-D conformation	
11	25 – 29 Mar	Linux command-line tools: awk, sed, and bash	15
12	1 – 5 Apr	CLC Genomics Workbench: Data QC and pre-processing	
13	8 – 12 Apr	CLC Genomics Workbench: RNA-seq analysis	
14	15 – 18 Apr	CLC Genomics Workbench: Genome assembly	
	19 Apr	Spring holiday: No class	
15	22 – 26 Apr	CLC Genomics Workbench: Variant analysis	

POLICY ON INCOMPLETE GRADES AND LATE ASSIGNMENTS

Incomplete grades will not be granted except under exceptional circumstances by arrangement with the instructor. Late assignments will result in a reduction of credit given for the assignment, and therefore a lower grade.

POLICY ON ABSENCES (EXCUSED AND UNEXCUSED) AND MAKEUP WORK

The Attendance Regulations of the University's Academic Policies and Regulations is the policy on absence in this class. See the university regulations on the web at <http://policies.ncsu.edu/regulation/reg-02-20-03>.

If you will miss class due to a previously-scheduled conflict with another academic activity (professional meeting, class field trip, or similar event), you should arrange an excused absence with the instructor before missing class. Make-up work can be assigned before an excused absence.

Unexcused absences will affect the class participation component of your grade; more than two unexcused absences can result in a grade of F for the semester.

ACADEMIC INTEGRITY STATEMENT

Every student must be familiar with the university's policies on academic integrity as outlined in the Code of Student Conduct. This document is available on the web at <http://policies.ncsu.edu/policy/pol-11-35-01>. Violations of the policies on academic integrity will not be tolerated. Some class assignments will involve working in groups to discuss and debate ideas; however, any written assignments based on such group discussions should be written independently by each student on his or her own.

NC STATE POLICY ON WORKING WITH STUDENTS WITH DISABILITIES

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (REG02.20.01), available at <http://policies.ncsu.edu/regulation/reg-02-20-01>.

NC State Policies, Regulations, and Rules: Students are responsible for reviewing the NC State University Policies, Regulations, and Rules, located at <http://oucc.ncsu.edu/course-rights-and-responsibilities>, which pertain to their course rights and responsibilities.