

496/896 Introduction to large sequencing data set generation and analysis for beginners
Spring 2024
Independent study – 3 credits

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Phone: 405-985-4042 only between 9:30am to 5pm weekdays (text and calls).

Office hours: to be arranged.

Zoom meetings or in person meetings upon request.

Online lectures to watch before the class (about 1h30/week)

No textbooks are required.

Undergraduate and graduate level introductory course.

Class: In-person 1h45 per week.

What you will learn

You will learn how to design a project involving transcriptomic, epigenomic and proteomic data. How –omics data are generated and how to interpret them. This course is designed to provide you the foundational knowledge regarding large biological sequencing data sets understanding, with a focus on plants and insects.

Learning outcomes

After this course, you will be able to:

- Understand how plant and insect genomes are annotated.
- Identify the appropriate -omic platform to generate for your data.
- Be familiar with online datasets repository.
- Know how to use online software for -omics data analysis.
- Use R to analyze –omics data set and generate graphics to present your results.

Prerequisites

Prerequisites: Introductory Genetics, Introductory Algebra, 12 hours biological sciences and/or agricultural sciences.

Course Required Materials

Slides will be posted on Canvas.

Course Grading Policy

Exam	Content	Points
First exam	On knowledge related to the first section. (Mix of multiple-choice and essay questions).	100
Second exam	On knowledge related to the second section. (Mix of multiple-choice and essay questions).	100
Article presentation	Presentation of an article related to the topic of the class. Two articles to present during the semester.	100 (50 each)
Quiz - assignments	One quiz/assignment per week – timed, 12 total.	600
	Participation, attendance, punctuality	100
	Total	1000 points

Grading:

≥ 95: A+	70-74.9: B-
90-94.9: A	65-69.9: C+
85-89.9: A-	60-64.9: C
80-84.9: B+	55-59.9: C-
75-79.9: B	≤ 54.9: D

Course organization and topics covered:

1. -omics Project Design (weeks 1-4)

- a. Objectif #1: Genome organization and regulation
 - i. Overview transcription
 - ii. Overview epigenome
 - iii. Overview translation and post-translational modifications
- b. Objectif #2: Identify a platform to generate -omics data
 - i. Bulk analysis or single-cell analysis
 - ii. Short reads sequencing / Long reads sequencing
 - iii. Protein sequencing
- c. Objectif #3: Access online data bases for preexisting data
 - i. Mine online database for gene sequence and function
 1. NCBI, Phytozome, Flybase, TAIR, EBI, Ensembl and other online resouces
 - ii. Mine online databases for existing -omics data
 1. SRA, gene expression omnibus

2. -omics data generation, mining and analysis (week 5-10)

- a. Objectif #1: Learn -omics data analysis pathway:
 - i. Overview of plant and insect genome annotation process
 - ii. Transcriptomic

1. RNA sequencing approach
 2. RNA sequencing data analysis
 - iii. Epigenetic
 1. Small RNA sequencing and bisulfite sequencing approaches
 2. Small RNA sequencing and bisulfite sequencing analysis
 - iv. Proteomic (Guest lecture)
 1. Protein sequencing approach
 2. Protein sequencing analysis
 - b. Objectif #2: Identify and use software to perform -omics data analysis
 - i. Gene annotation: utilization of online software (e.g. Blast2GO, Augustus)
 - ii. Use R for beginners, introduction to coding and data handling
 - iii. Use R for for –omics data analysis (e.g. mapping, differential gene expression, hierarchical clustering)
 - iv. Promoter sequence analysis
3. **Illustrate and interpret -omics data (weeks 11-13)**
- a. Know how to represent output data:
 - i. Use R for graphics/plots
 - b. Articulate output data to answer your research question
 - i. Data presentation for publication
 - ii. Data presentation for oral and poster presentations
4. **Final exam (week 14)**

Course policies:

Class cancellation: If in-person classes are canceled, you will be notified of the instructional continuity plan for this class through a Canvas email or announcement.

Instructional continuity policy: Instructional continuity plans may include any of the following: continue working on your own, read course materials, work on an assigned project, or conduct class meetings via web conferencing or another mode at the same time as the regularly scheduled class. If the need arises to conduct class online, meetings will be recorded and made available to accommodate those who are not able to attend in real-time (also see attendance policy).

Late Work: All assignments are due at the end of each class on the date indicated. Grades on late assignments will reflect a 10% deduction per day late unless prior arrangements have been made with the instructor. After one week, the assignment will be considered as not completed and will result in a ZERO.

Regrading Policy: If you think that an error was made on your exam or lab report, you may return it for re-grading within one week of the return of the exam/quiz. No exceptions. You must clip to the graded item a typed explanation of what you think the error is. Late regrade requests and requests that are not typed will not be regarded. The exams and letters will be stored in the course folder as material for evaluation. If, during regarding, the instructor finds incorrect answers that were missing during the first grading, the points will be subtracted from the grade.

Makeup examination policy: In case of documented illness, family emergency, or other documented important circumstance preventing you from taking an exam or graded assignment, a take-home assignment will be arranged. Without a valid excuse, the assigned grade for the assignment will be ZERO.

Grades of Incomplete:

According to UNL policy, an incomplete is given only in the event of acute illness, military service, hardship, or death in the immediate family (i.e., parents, children, spouses, or siblings).

Students are eligible only if a substantial proportion of the coursework has been completed. For this course, at least 50% of the class discussions and coursework must have been completed with a minimum overall grade of C to be considered for the incomplete option.

Additional Information:

PLEDGE OF INSTRUCTIONAL STANDARDS

Entomology instructors will provide our students a complete syllabus meeting all UNL standards, our classes will be based on current science and will follow published schedules and descriptions, and our instructors will be timely in returning grades and in responding to our students.

ADA STATEMENT

Students with disabilities are encouraged to contact the Services for Students with Disabilities (SSD) office for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY (updated 8/20/07)

ACADEMIC HONESTY

Students are expected to adhere to guidelines concerning academic dishonesty as specified in Entomology's Academic Integrity Policy (<http://entomology.unl.edu/dishonesty.shtml>). As a student at UNL, you enjoy rights and protections under the student code of conduct (<http://stuafs.unl.edu/dos/code>) and are obligated to conduct yourself in compliance with the code. Academic dishonesty can involve cheating; fabrication or falsification of information; plagiarism; or misrepresenting illness, injury, accident, etc., to avoid and/or delay an examination/quiz or the timely submission of academic work and assignments. Disciplinary action imposed may range from a warning (written or oral) to assigning the student a final course grade of F for the semester. The instructor may choose to assign zero or partial credit for a specific assignment, quiz, examination or written report in which academic dishonesty was involved.

If a student wishes to appeal a claim of academic dishonesty, the following process must be followed. First, the student must submit a written appeal to the instructor of the course and state their reason(s) for appealing. If this student appeal cannot be resolved with the course instructor, then the student must immediately submit their appeal statement within seven days to the Department's Curriculum Committee for their recommendation. If a satisfactory solution to this appeal is still not reached with the Department Curriculum Committee, the student's written appeal will then be forwarded to the Department Head. If a satisfactory solution is still not achieved at the Department Head level, the student may then submit their written appeal statement to the College of Agricultural Sciences and Natural Resources (CASNR) Dean's Office. The appeal process for the College of Agricultural Sciences and Natural Resources will then be followed as outlined by the College.

Students are encouraged to contact the instructor for clarification of these guidelines if they have questions or concerns

COUNSELING AND PSYCHOLOGICAL SERVICES.

UNL offers a variety of options to students to aid them in dealing with stress and adversity. [Counseling and Psychological & Services](#) (CAPS) is a multidisciplinary team of psychologists and counselors that works collaboratively with Nebraska students to help them explore their feelings and thoughts and learn helpful ways to improve their mental, psychological and emotional well-being when issues arise. CAPS can be reached by calling 402-472-7450. [Big Red Resilience & Well-Being](#) provides one-on-one well-being coaching to any student who wants to enhance their well-being. Trained well-being coaches help students create and be grateful for positive experiences, practice resilience and self-compassion, and find support as they need it. BRRWB can be reached by calling 402-472-8770.

DIVERSITY AND INCLUSION.

The University of Nebraska-Lincoln does not discriminate on the basis of race, ethnicity, color, national origin, sex (including pregnancy), religion, age, disability, sexual orientation, gender identity, genetic information, veteran status, marital status, and/or political affiliation.

FACE COVERINGS STATEMENT. (we are online so not applicable but need to include)

As of July 17, 2020 and until further notice, all University of Nebraska–Lincoln (UNL) faculty, staff, students, and visitors (including contractors, service providers, and others) are required to use a facial covering at all times when indoors except under specific conditions outlined in the COVID 19 face covering policy found at: <https://covid19.unl.edu/face-covering-policy>. This statement is meant to clarify classroom policies for face coverings:

To protect the health and well-being of the University and wider community, UNL has implemented a policy requiring all people, including students, faculty, and staff, to wear a face covering that covers the mouth and nose while on campus. The classroom is a community, and as a community, we seek to maintain the health and safety of all members by wearing face coverings when in the classroom. Failure to comply with this policy is interpreted as a disruption of the classroom and may be a violation of UNL's Student Code of Conduct.

Individuals who have health or medical reasons for not wearing face coverings should work with the Office of Services for Students with Disabilities (for students) or the Office of Faculty/Staff Disability Services (for faculty and staff) to establish accommodations to address the health concern. Students who prefer not to wear a face covering should work with their advisor to arrange a fully online course schedule that does not require their presence on campus.

Students in the classroom:

1. If a student is not properly wearing a face covering, the instructor will remind the student of the policy and ask them to comply with it.
2. If the student will not comply with the face covering policy, the instructor will ask the student to leave the classroom, and the student may only return when they are properly wearing a face covering.
3. If the student refuses to properly wear a face covering or leave the classroom, the instructor will dismiss the class and will report the student to Student Conduct & Community Standards for misconduct, where the student will be subject to disciplinary action.

Instructors in the classroom:

- 1. If an instructor is not properly wearing a face covering, students will remind the instructor of the policy and ask them to comply with it.*
- 2. If an instructor will not properly wear a face covering, students may leave the classroom and should report the misconduct to the department chair or via the TIPS system for disciplinary action through faculty governance processes.*

**Courses that have been granted an exception to the Face Covering Policy for pedagogical reasons are excluded. Exceptions to the Face Covering Policy are only granted after an approved health safety plan is developed.*

INFORMATION FOR EMERGENCY RESPONSES:

Fire Alarm (or other evacuation)
In the event of a fire alarm: Gather belongings (Purse, keys, cellphone, N-Card, etc.) and use the nearest exit to leave the building. Do not use the elevators. After exiting notify emergency personnel of the location of persons unable to exit the building. Do not return to building unless told to do so by emergency personnel.

Tornado Warning: *When sirens sound, move to the lowest interior area of building or designated shelter. Stay away from windows and stay near an inside wall when possible.*

Active Shooter: *Evacuate: if there is a safe escape path, leave belongings behind, keep hands visible and follow police officer instructions.* ***Hide out:*** *If evacuation is impossible secure yourself in your space by turning out lights, closing blinds and barricading doors if possible.* ***Take action:*** *As a last resort, and only when your life is in imminent danger, attempt to disrupt and/or incapacitate the active shooter.*

UNL Alert: *Notifications about serious incidents on campus are sent via text message, email, unl.edu website, and social media. For more information go to: <http://unlalert.unl.edu>.* ***Additional***
Emergency Procedures can be found here:

http://emergency.unl.edu/doc/Emergency_Procedures_Quicklist.pdf

INCLEMENT WEATHER POLICY

Online courses will continue as scheduled, but if you are having problems with internet access because of inclement weather, please let me know when you can.

<https://bf.unl.edu/policies/inclement-weather>