Contemporary Topics in Biology
Computational Genomics

BIOL 4005-002 & 5005-002

Fall 2025 ● Tu & Th 2:00pm-3:20pm ● Lang 219

Credit hours: 3 SCH, face-to-face format.

Instructor: Dr. Fanju Meng

Contact Information: **Email**: Fanju.Meng@unt.edu
Office: Life Science Complex, B118

Please use the Inbox tool in CANVAS for all course-related correspondence. I will do my best to respond within a day, but I will likely not respond to emails on weekends.

Office Hours: Every Tuesday 10:00 am-12:00 pm (subject to change and changes will be announced on CANVAS). Office hours will be in-person (LSC B118, an appointment is not needed). Students wishing to discuss sensitive issues and concerns should make an appointment for an individual meeting.

Course Description: This course focuses on the fundamental principles and contemporary problems in epigenetics and functional genomics. We provide a further dive into genetics, genomics and computational biology. A broad range of topics will be covered, including transcriptional regulation, genome structure and function, epigenome profiling, single cell genomics, epigenetic reprogramming during embryogenesis, stress response and under disease conditions such as cancers.

Another key component of this course is hands-on experience with data analyses. We will go over multiple genomic assays and bioinformatics methods and tools for data analysis. The course also prepares students for data visualization using R and Linux based open-source software.

Course Objectives:

Upon successful completion of this course, you should be able to:

1. Understand the principles of gene expression regulation
2. Learn the concepts of DNA structure, chromatin and epigenetics
3. Know the basics of Linux commands and R programming

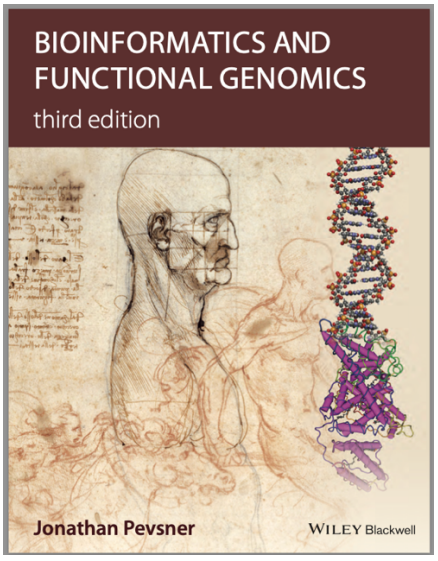
4. Learn different types of genomic assays
5. Know the pipeline and common tools for genomic analyses
6. Learn how computational genomics inform our understanding of embryogenesis, environmental stress response and diseases such as cancers
7. Utilize publicly available data and tools for your own research

Course Prerequisite:

Biology Foundation Courses (If an undergraduate student has not completed these courses but still wishes to attend the class, consent from the instructor is required).

Prior basic background knowledge in genetics and molecular biology is highly recommended. Prior experience in computer programming is not required (this course is designed to teach you coding skills for independent data analysis).

Textbook (Recommended): Bioinformatics and Functional Genomics (3rd edition, Author: Jonathan Prevsner, 2015, Wiley Blackwell)



Other Course Requirements: This course requires students to have access to a laptop computer to do hands-on analysis during class and a laptop/desktop to do homework and take-home exam. Students will be instructed to download and install R software to run multiple specific analysis package.

Attendance Policy: Attendance is expected for all class meetings but is not part of your overall course grade. I STRONGLY recommend you attend ALL lectures and hands-on sections! Generally, students who do not attend them do poorly. Students who attend all lectures/sections and actively participate in class discussions will receive extra points towards their final grades.

Syllabus Change Policy: The schedule, policies, procedures, and assignments in this course are subject to change in the event of extenuating circumstances, by mutual agreement, and/or to ensure better student learning.

This is a tentative schedule for this semester. The instructor reserves the right to change the schedule as needed. Changes will be presented in class or posted on CANVAS.

Weeks	**Date**	**Lectures/Topics**	**Hands-on analyses with laptop**	**Homework**
Week 1	Aug 19/21	Introduction to Genomics	Overview of Linux/ Server	HW 1
Week 2	Aug 26/28	Gene Regulation and Chromatin	Overview of awk/sed	HW 2
Week 3	Sept 2/4	NGS and RNA-Seq I	RNA-seq pipeline I – STAR, Samtools	
Week 4	Sept 9/11	NGS and RNA-Seq II	RNA-seq pipeline II - FeatureCounts	HW 3
Week 5	Sept 16/18	DNA Methylation and Chromatin Accessibility	Overview of R programming I	
Week 6	Sept 23/25	Histone Modifications and Variants	Overview of R programming II	HW 4
Week 7	Sept 30/ Oct 2	Epigenome Profiling – ChIP-Seq, CUT&Tag, CUT&RUN	R - DESeq2/ Data visualization	HW 5
Week 8	Oct 7/9	High-order Chromatin Organization/Project discussion	Epigenetic analysis pipeline	
Week 9	Oct 14/16	Functional Genomics Databases/Project Discussion	R- DiffBind	HW 6
Week 10	Oct 21/23	Single Cell Genomics	R - Seurat	
Week 11	Oct 28/30	Epigenetic & Embryogenesis	Paper discussion	Take-home Exam
Week 12	Nov 4/6	Epigenetics & Environmental Stress	Paper discussion	
Week 13	Nov 11/13	Epigenetics & Cancers	Paper discussion	
Week 14	Nov 18/20	Project Q&A	Work on Project	
Week 15	Thanksgiving Break	No class	No class	

Week 16	Dec 2/4	Project wrap-up & Project presentation	Project presentation	

Gradings: 6 Homework, 1 Take-home Exam, and Final project presentation (Project written report is only required for graduate students).

Grading for **undergraduate** students (**BIOL 4005**):

	Points	**Percentage of Final Grade**
Homework (total 6)	60	60%
Take-home Exam (1)	20	20%
Project (1)	20	20%
Attendance/Participation	3 (bonus points)	3%

Grading for **graduate** students (**BIOL 5005**):

	Points	**Percentage of Final Grade**
Homework (total 6)	60	45%
Take-home Exam (1)	20	20%
Project (1)	20	20%
Project Written Report (1)	15	15%
Attendance/Participation	3 (bonus points)	3%

Grading Scales:

A = 90 – 100
B = 80 – 89.9
C = 70 – 79.9
D = 60 – 69.9
F = 0 – 59.9

Making up Exam/Homework: It is essential that all students must participate course activities such as exams and homework during the scheduled times. The instructor may provide a make-up exam for a student who misses the exam due to conditions (a medical emergency, legal obligation such as jury duty or participation in an officially sanctioned university activity, a religious observation). However, it is student's responsibility to provide proper documentation for these excuses to the instructor ahead of time. There will be no make-up homework unless aforementioned documented excuses occur during the whole period between the homework given date and the due date for the homework. Students must discuss these conditions ahead of time with the instructor.

Prohibited Use of Generative Artificial Intelligence (GenAI): GenAI refers to software systems and platforms that create new content, such as text, images, audio or video using generative models.

In this course, I want you to engage deeply with the materials and develop your own critical thinking and coding skills. For this reason, the use of Generative AI (GenAI) tools, e.g., Claude, ChatGPT, and Gemini, is not permitted. While these tools can be helpful in some contexts, they do not align with our goal of fostering the development of your independent thinking. Using GenAI to complete any part of an assignment, exam, or project will be considered a violation of academic integrity, as it prevents the development of your own skills, and will be addressed according to the Student Academic Integrity policy.

UNT Policies

Academic Integrity Policy: All exams are to be taken independently. No student will be admitted twenty minutes after the start of an exam and no student may leave during the first thirty minutes. Students caught cheating on any exam will receive a "0" for that particular exam and will not be able to drop that grade. Additionally, the incident will be reported to the Dean of Students, who may impose further penalty. According to the UNT catalog, the term "cheating" includes, but is not limited to: a. use of any unauthorized assistance in taking quizzes, tests, or examinations; b. dependence upon the aid of sources beyond those authorized by the instructor; c. the acquisition, without permission, of tests or other academic material belonging to a faculty or staff member of the university; d. any other act designed to give a student an unfair advantage.

Statement from the ODA: The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with an accommodation letter to be delivered to me to begin a private discussion regarding your specific needs in a course. You may request accommodations at any time; however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. For additional information see the Office of Disability Accommodation website at http://www.unt.edu/oda. You may also contact them by phone at (940) 565-4323.

Please email or attend office hours at the beginning of the semester to discuss what arrangements are needed to maximize your success in this course! A modification of course attendance policy agreement must be completed no later than the second week of classes for those students who have certain accommodations.

Disruptive Behavior in an Instructional Setting:

Students are expected to engage with the instructor and other students in this class in a respectful and civil manner at all times to promote a classroom environment that is conducive to teaching and learning. Students who engage in disruptive behavior will be directed to leave the classroom. A student who is directed to leave class due to disruptive behavior is not permitted to return to class until the student meets with a representative from the Dean of Students Office. It is the student's responsibility to meet with the Dean of Students before class meets again and to provide the instructor confirmation of the meeting. A student who is directed to leave class will be assigned an unexcused absence for that class period and any other classes the student misses as a result of not meeting with the Dean of Students. The student is responsible for material missed during all absences and the instructor is not responsible for providing missed material. In addition, the student will be assigned a failing grade for assignments, quizzes, or examinations missed and will not be allowed to make up the work.

The Code of Student's Rights, Responsibilities, and Conduct (Policy 7.001) describes disruption as the obstructing or interfering with university functions or activity, including any behavior that interferes with students, faculty, or staff access to an appropriate educational environment. Examples of disruptive behavior that may result in a student being directed to leave the classroom include but are not limited to: failure to comply with reasonable directives of University officials, action or combination of actions that unreasonably interfere with, hinder, obstruct, or prevent the right of others to freely participate, threatening, assaulting, or causing harm to oneself or to another, uttering any words or performing any acts that cause physical injury, or threaten any individual, or interfere with any individual's rightful actions, and harassment. You are encouraged to read the Code of Student's Rights, Responsibilities, and Conduct for more information related to behaviors that could be considered disruptive.

Emergency Notification & Procedures: UNT uses the Eagle Alert system to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In the event of a university closure, please refer to CANVAS for contingency plans for covering course materials.

Important Dates (registering, dropping, et al.):

http://registrar.unt.edu/registration/fall-registration-guide

Other Resources:

Access to Learning Resources:

- **UNT Learning Center,** Phone: 940-369-7006

  Website URL: https://learningcenter.unt.edu/about-learning-center/index.html

- **UNT Library:**

  Phone: 940-565-2411 (1-887-872-0264)

  Website URL: https://library.unt.edu/

- **UNT Bookstore**

  Email: https://unt.bncollege.com/

CANVAS student guide: https://community.canvaslms.com/docs/DOC-10701

For additional assistance, contact Student Assistance

Phone: 940-369-7394

Email: https://lms.unt.edu/resources/index.html