Genomics– Fall 2023

BIOL 4400 Section 001 – 3 Credits
Utah Valley University

Instructor Information

Dr. Carl E Hjelmen (he/him)
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Office hours:

Monday 1-2pm and Thursday 4-5pm or by appointment

Course Prerequisites:

BIOL 3500 Genetics

Resources:

Text:

No required text. Supp. Text (up to you): Introduction to Genomics 3rd Ed., AM Lesk
Required readings will be posted in PDF format on Canvas.

Course website:

Canvas. Additional helpful resources are also available on https://cehjelmen.github.io
You can access these sites from any computer linked to the internet.

Access to Canvas will be critical as assignments, grades, updates, and other announcements will be posted there.

Computation:

While much of this class will rely on paying attention to lecture and participation in discussion and activities, some work requires use of a computer with internet access. I highly suggest that you bring your own laptop to class. **Please let me know if this is not possible.**

Course Information:

Description

Introduces genomics as a science and its relationship to bioinformatics. Provides fundamental knowledge and skills to carry out analysis of genes and genomes. Covers computational approaches for interpreting genomic data, including a broad range of applications of genomics to the broader field of biology.

Course Objectives:

1. Summarize the subtopics: sequencing methods and strategies, bioinformatics and sequence comparison, sequence alignment and phylogenetic reconstruction, comparative genomics, organization and structure of genomes, genome annotation, transcriptomics and proteomics
2. Interpret constructed evolutionary trees derived from molecular data.
3. Carry out genomic analyses such as annotation, transcriptomics, functional genomics, metagenomics, and genetic variation and SNPs.
4. Employ critical thinking skills in discussions about genomics.

Course Expectations:

Student Responsibilities

Everyone (students and instructor) should treat others with mutual respect and patience. I encourage students to work together to solve problems, unless otherwise explicitly stated. I recognize students come from their own unique background and have had their own unique experiences. If you need any special accommodations or assistance, please do not hesitate to contact me with questions.

How to do well in this course:

How well you do will be directly related to the effort you put into it. Below are suggestions:

1. Regular attendance - You will benefit from class discussion and activities. Furthermore, the class needs your participation to establish a group dynamic that provides encouragement and support.
2. Be prepared - Please do assigned readings and assignments on time. If you are interested, I can always provide additional reading materials.
3. Listening and Speaking - We will practice being generous and respectful listeners. Know that the class will benefit from what you have to contribute. Please, no side conversations.
4. Additional Information - Keep up with the work--it's not intended to be difficult, but you can't stir up your thinking without a commitment to taking the class seriously. You will be required to do additional informal assessments and exercises. Many of these exercises will be in-class work; if you have sustained absences, you will have difficulty passing the course.
5. Making your needs known - Please let me know what your needs are throughout the term. I am happy to work with you to improve your experience in this course when possible.
6. Writing – Assignments must be typed unless otherwise specified. Well-written English and good spelling are expected; I will deduct points for excessive spelling and/or grammar errors on any assignment.
7. Distractions – Unless told otherwise, put away all electronic devices during class.
8. Success may take time outside of class - Mastery isn't immediate. Part of success is spending as much time studying that is necessary for you. This amount will vary from student to student. If you need tips or help, please contact me.

Course Procedures:
I have provided a preliminary schedule that we will follow, it includes the sequence of topics, reading materials, assignments, etc., however, keep in mind that this schedule is subject to change. You are responsible for all announcements made in class or online, and adjustments to schedule (even if you are not there). If you miss a class or come late after announcements have been made, you are responsible to find out from another student what announcements were made and what material was covered.

Lecture Notes:
Lecture notes or a power point presentation will typically be posted before lecture when possible. These notes will not cover everything said in lecture, but they should prove a useful addition to your notes for understanding and reviewing the concepts.

Professor Responsibilities

It will be my goal in this course to be prepared, organized, and provide a safe, productive environment to learn. Students can be expected to be treated fairly, and with respect. Additionally, all assignments will be graded and returned in a timely manner.

I will be available outside of class time to help any students who ask for it during student hours. If for any reason you cannot meet with me during the pre-determined times, you are welcome to contact me to discuss arranging an additional meeting time. You are always welcome to come by my office, but unless it is arranged in advance, I cannot guarantee I will be available.

The best method to reach me is through e-mail, however, please be patient and recognize that you may not always receive an immediate response. I will do my best to respond in a timely manner within reasonable hours, but e-mails sent late at night will not be responded to until the next day.

Disclaimer - Communication and Syllabus Changes

All items in this syllabus are subject to change or modification to correct errors or accommodate extenuating circumstances. You are responsible for messages sent by me and other UVU officials to your UVU email address. If you do not regularly use this address, please forward your UVU email to the address you regularly use. Please check the email for important class announcements and updates.

Assessment:
Your final grade will be determined by the following formula (to be determined):

Assignment	% of grade
Exams	25 (12.5% each)
Discussion précis	15
Leading Discussion	15
Quizzes	10
Assignments	10

Project	25
Total	100

- The class will not be graded on a curve
- Your final grade will be calculated on a percentage basis

Cutoff	Grade	Cutoff	Grade
93%	A	73%	C
90%	A-	70%	C-
87%	B+	67%	D+
83%	B	63%	D
80%	B-	60%	D-
77%	C+	<59.5%	E

Assignments and Project Descriptions

Discussion "précis" (15%)

A précis is a short summary of a text or speech. Each week in which we have a discussion over a paper you will be required to submit a précis that accompanies the text. These are required by the beginning of class to ensure everyone reads the material. A précis includes information such as the question being asked, identification of the hypothesis, a summary of the findings, and at least one question you have about the material. Specific rubrics and descriptions can be found on Canvas.

Leading Discussion (15%)

Most weeks, we will spend Fridays discussing a paper from the primarily literature (peer reviewed work). Students must sign up to lead (or co-lead) a discussion. Students may utilize slide shows, the white board, etc., but must be prepared to lead the class in the discussion.

Quizzes (10%)

Quizzes will focus on basic concepts from the assigned readings in order to encourage discussion of concepts in a useful manner. Quizzes may or may not occur each week.

Assignments (10%)

In some of the sections, we will focus on the application of skills and utilization of tools. Handouts will accompany these activities and must be turned in on Canvas for assessment and feedback.

Exams (25%)

There will be two take home exams throughout the semester (see dates on schedule) and make up 25% of your final grade (12.5% each). These exams will be "take-home" exams and may include some basic recall of information from lectures, but will focus primarily on interpretations, critical thinking, and thoughtful discussion over open-ended questions.

Final Project (25%)

There is no way to cover all of the subfields within Genomics in a semester. In order to enrich the material we learn in lectures, students will work in groups to construct posters to present a topic within genomics we do not cover in the course. More detail will come throughout the semester related to topics and specific dates.

Late work:

I will keep the window for submitting assignments open, but they will accrue a 10% grade deduction daily.

I understand that life can be chaotic and there are many things outside of your control. **If you are unable to complete an assignment for any reason by the due date, please let me know and we can work something out**! Remember to always let Dr. Hjelmen know if you're going to be late!

Cheating and plagiarism:

I encourage students to work together to solve problems, unless otherwise explicitly stated. This does not mean copying answers. I do not tolerate cheating of any kind, including copying from another student on exams or assignments. I will impose one of several penalties for cheating that range from a warning up to assigning a failing grade for the course. Please ask me if you are not sure about what constitutes plagiarism.

UVU Policies and Resources

Policies and Success Strategies (Links to an external site.)

Accessibility Services (Links to an external site.)

- Students who need accommodations because of a disability may contact the UVU Office of Accessibility Services (OAS), located on the Orem Campus in LC 312. To schedule an appointment or to speak with a counselor, call the OAS office at 801-863-8747. Deaf/Hard of Hearing individuals, email nicole.hemmingsen@uvu.edu or text 385-208-2677.

Campus Resources (Links to an external site.)

Technology Support Services

For 24/7 technical support contact Instructure's Canvas Support Live Chat (Links to an external site.)
(385) 204-4930 (Available 24/7)

Student Care Statement

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to visit https://www.uvu.edu/studentcare/ for access to a variety of resources. You may also email care@uvu.edu for assistance.

All of us have a need to maintain mental health and benefit from the assistance of professionals to do so. UVU offers mental health services at very low cost (some are free). While there may be a wait list for individual counseling, group counseling may be available in some circumstances. Student Health Services is located in SC 221, telephone 801-863-8876 https://www.uvu.edu/studenthealth/psych/ . The following community resources are

available 24/7- the National Suicide Prevention Lifeline 1-800-273-8255 and the Safe UT Crisis Chat & Tip Line https://safeut.med.utah.edu/. You may also access the Crisis Text Line 741-741 or call 9-1-1. If an emergency is happening on campus, call campus police 801-863-5555.

Tentative Course Schedule

Here is a (tentative) schedule for topics. It is your responsibility to make up any work that you might miss if absent. All readings and assignments can be found on Canvas.

Week	Dates	Topics	Readings	Due
1	Aug. 23 Aug. 25	Intro. & Syllabus How to read a paper	*For Class:* Various online articles (Canvas)	***Pre-course quiz—Aug. 25***
2	Aug 28 Aug. 30 Sep. 1	How to read a paper pt. 2 Overview of Genetics and Genomics Structural Components of the Genome	*For Class:* Various online articles (See Canvas)	
3	Sep. 4 Sep. 6 Sept. 8	***LABOR DAY—NO CLASS*** Sanger Sequencing and the Human Genome Project **Discussion on HGP**	*For Class:* – Watson 1990 – Bentley 2000 *For Discussion:* – Nurk et al. 2022	***Selection of Project Subject-Sept 8*** *Precis Sep. 8*
4	Sep. 11 Sep. 13 Sep. 15	Human Genome Project Implications and Applications of HGP **Discussion on All of Us Project**	*For Class:* – Gibbs 2020 – Mao and Zhang 2022 *For Discussion:* – All of Us Intro – Ramirez et al. 2022	*Precis Sep. 15*
5	Sep. 18 Sep. 20 Sep. 22	Next Generation Sequencing Methods Third Generation Sequencing **Discussion Comparing Sequencing Method**s	*For Class:* – Shendure et al. 2017 – Heather and Chain 2016 *For Discussion*: – Hotaling et al. 2023	*Precis Sep. 22*

6	Sep. 25 Sep. 27 Sept. 29	Output from Sequencing Methods Investigate SRA, set up Galaxy Account **Discussion on Galaxy/Open tools**	*For Class:* – Galaxy 2020 *For Discussion:* – Hiltemann et al. 2023	 *Precis Sep. 29*
7	Oct. 2 Oct. 4 Oct. 6	Genome Assembly Methods Genome Assembly Methods **Discussion on Genome Assembly**	*For Class:* – Rice and Green 2019 For Discussion: – Wick and Holt 2023	**Exam 1 Due Oct. 4** *Precis Oct. 6*
8	Oct. 9 Oct. 11 Oct. 13	Genome Polishing, and Annotation Genome Annotation and BUSCO **Discussion on Assessing Genome Quality**	*For Class:* – Yandell and Ence 2012 *For Discussion*: – Marks et al 2021	***Outline and Annotated Bibliography- Oct. 13*** *Precis Oct. 13*
9	Oct. 16 Oct. 18 Oct. 20	Genome Assembly Assignment BUSCO and Annotation Hands on ***FALL BREAK—NO CLASS***	*Recommended Reading (annotation)*: – Dunn et al 2019	
10	Oct. 23 Oct. 25 Oct. 27	Sequence Alignments and Substitution Models Phylogenetics **Discussion on Phylogenomics**	*For Class:* – Kapli et al. 2020 *For Discussion:* – Kawahara et al 2023	**Hands on Activities due Oct 25** *Precis Oct. 27*
11	Oct. 30 Nov. 1 Nov. 3	Phylogenomics Hands On Phylogenomics Hands On Phylogenomics	*For Class:* – Steenwyk et al 2023	***Phylogenetics Hands on by Nov. 3*** ***Meet with Dr. Hjelmen by Nov. 3***
12	Nov. 6	**WORK ON FINAL PROJECT**		

	Nov. 8 Nov. 10	**WORK ON FINAL PROJECT** **Discussion on Introgression**	*For Discussion:* – Koller et al. 2022	*Precis Nov. 10*
13	Nov. 13 Nov. 15 Nov. 17	Comparative Genomics Interpreting Comparative Genomics Plots Poster Prep Day	*For Class* – Stephan et al. 2022	***Poster Draft Due Nov. 13*** **Peer Review for Posters Due Nov. 17**
-	Nov. 20-24	***THANKGIVING BREAK—NO CLASS***		
14	Nov. 27 Nov. 29 Dec. 1	Poster Prep Day Population Genomics **Discussion on Comparative Genomics**	*For Class* – Webster et al. 2023 *For Discussion:* – Christmas et al. 2023	**Final Posters due by Nov. 27** *Precis Nov. 17*
15	Dec. 4 Dec. 6 Dec. 8	**PRESENT POSTER FINAL** Population Genomics Cont. **Discussion on Population Genomics**	*For Discussion*: – Ragsdale et al. 2023	**Exam 2 Due Nov. 17** *Precis Dec. 1*
		Final Assignment: Due Dec 11 by 11:59pm		