

Phylogenetics– Fall 2025

BIOL 4300 Section 001 – 4 Credits

Utah Valley University

Meeting Information:

MWF 11:00am-11:50am

SB 268

Instructor Information

Dr. Carl E Hjelman (he/him)

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Dr. Heath Ogden (he/him)

Office: SB 243a Research Lab: SB 151 & 161

Phone: (801) 863-6909

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Office hours:

Dr. Hjelman: Tuesdays 11:30am-12:30pm, Wednesdays 1:30-2:30pm, or by appointment

Dr. Ogden: Wednesdays 2:00-3:00pm, or by appointment

Course Prerequisites:

BIOL 3500 Genetics

Resources:

Text:

Two texts are listed as “required” for this course. These are useful tools and we will suggest readings from them, but they are not required for success.

- The Phylogenetic Handbook, 2nd Edition. ISBN: 9780511819049
- Phylogenetic Comparative Methods in R. ISBN: 9780691219035

Course website:

Canvas. Additional helpful resources are also available on <https://cehjelman.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. You will also need to make a functioning GitHub repository

Computation:

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

Course Information:

Description

This course delves into the principles and methodologies of phylogenetics, equipping students with the necessary skills to explore evolutionary relationships among organisms and genes. Emphasizing the importance of "tree-thinking," students will learn to interpret and construct phylogenetic trees, gaining insights into their implications for evolutionary biology and specific disciplines for their major. Key topics will include sequence alignment techniques, parsimony, maximum likelihood, and Bayesian tree reconstruction methods, and concepts of nodal support and trait evolution. Through hands-on projects, students will design reproducible workflows for phylogenetic inference and compile novel molecular datasets from reputable online databases. The course culminates in the application of phylogenetic reconstruction methodologies on datasets created by students. Participants will also develop skills in professional communication by synthesizing their analysis and results into formats suitable for scientific presentation, including posters, oral presentations, and manuscripts. By the end of this course, students will possess a comprehensive understanding of phylogenetic analysis and the ability to contribute meaningfully to the field of evolutionary biology and beyond through rigorous scientific inquiry and effective communication.

Course Learning Outcomes

Upon completion of this course, students will be able to:

1. Demonstrate tree-thinking and its relation to phylogenetic trees.
2. Understand the basic principles of phylogenetic methods, such as: sequence alignment; parsimony, likelihood and Bayesian tree reconstruction; nodal support; trait evolution; among others.
3. Design a reproducible pipeline for phylogenetic inference.
4. Compile a novel molecular dataset from appropriate online databases.
5. Execute phylogenetic reconstruction methodologies on the generated dataset.
6. Synthesize a professional communication (poster, oral, manuscript, etc.) of the analysis, results, and interpretation of the phylogenetic project.

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:

We 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.

Disclaimer – Artificial Intelligence and use of tools like ChatGPT

Artificial intelligence (AI) is becoming an ever-prevalent tool in society and it is important to understand how this tool works. It is important to recognize this as a “tool” and not a “crutch”. AI is prone to “hallucinating” and giving incorrect or false results; it also does not allow me to gauge your understanding of material. I encourage use of all resources for your work but ask that you make it your own and that you do not ask AI to complete your assignments for you. If you utilize AI, be sure to indicate it in your response that you used AI and indicate how you corrected the response and made it your own (Include all prompts and conversations). If I feel you are not adequately responding or that you are relying on AI too much, I reserve the right to remove points on responses, up to zero credit.

Assessment:

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

<u>Area</u>	<u>% of grade</u>
Activities/Assignments	60%
Final Project	40%
Total	100

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

<u>Cutoff</u>	<u>Grade</u>	<u>Cutoff</u>	<u>Grade</u>
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

Assignments/Activities (60%)

Throughout the semester, we will be doing many weekly activities to develop your skills in phylogenetics. While there is not an “attendance” portion, there will be various “pop-up” activities which will contribute to this portion of your grade. These pop-up activities can only occur during class time and cannot be made-up. A tentative list of assignments is below:

Activity	Points
Tree thinking	10
Tree Reconstruction	10
Alignment	10
Retrieving Data activity	10
Model Testing Activity	10
Maximum Likelihood Activity	10
BEAST Activity	10
Phylogenetic Signal Activity	10
Paper Discussions	40
Various pop-up activities	???

Final Project (40%)

One of the objectives of this course is that you will be able to generate a repeatable pipeline for phylogenetic analysis. In order to do this, you will be generating a novel dataset, aligning your data, and generating multiple phylogenies and analyses. This project is completed as a group and is scaffolded, with various deadlines throughout the semester. You will submit most portions of this project on a shared group GitHub Repository, but some portions will be turned in on Canvas. Please see the separate “Final Project” document for more information on this project.

Late work:

It is expected that you will turn in assignments on time. If you do not communicate any issues/delays with the professors (before or when they are occurring), we reserve the right for late penalties or zeroes.

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. Hjelman 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. See above statement about use of AI. If AI is used without modification, I consider this cheating.

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.