Biology 4289A
Biosystematics and Phylogenetics

Course Outline - Fall 2025

1. Course Information

See class schedule on OWL

Prerequisites

Biology 2581 and completion of 1.5 courses from Biology at the 300 level or above.

Unless you have either the requisites for this course or written special permission from your Dean's Designate (Department/Program Counsellors and Science Academic Advisors) to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Learning Outcomes

- Describing the diversity of life using evolutionary theory and biological taxonomy and classification
- Applying phylogenetics to explain the diversification and evolution of life, molecular evolution, trait evolution, and other evolutionary processes
- Understanding the theory and models used to construct phylogenetic trees
- Using software and sequence analysis tools for phylogenetic analyses
- Interpreting, communicating, and presenting phylogenetic results
- Preparing and presenting the results of an analysis to a live audience

2. Instructor Information

Dr. Vera Tai

e-mail: vtai4@uwo.ca

office hours: Thursdays 2 - 4 pm, drop-in at BGS 2068
or e-mail to schedule another time

3. Course Syllabus, Schedule, Delivery Mode

Course Description

Systematics unifies all of biology by providing a framework for understanding the diversity of species and their inter-relatedness. The integration of molecular approaches has propelled systematics to the forefront of biological research and phylogenetic analysis of DNA sequences has eliminated any remaining doubt that earthly species are related by common ancestry. From Woese's proposal that the living world consists of three primary domains, the admission of DNA fingerprints as court evidence, the global Tree of Life Project, to the Barcode of Life Project, the use of molecular biology and bioinformatics has literally transfigured our understanding of evolutionary history. Biology 4289A will introduce the fundamental principles involved in biosystematics and phylogenetics. Students will learn about the process of systematics in describing, classifying, and identifying the diversity of life, acquire the skills required to analyze DNA sequences in a phylogenetic context, and learn how phylogenetics is applied to understanding not only the evolution of life, but also disease transmission, conservation biology, other other topics. The course consists of formal lectures as well as computer-based assignments and student presentations.

Course Syllabus and Schedule

This syllabus may change to accommodate lecture progress or adjust course content over the term.

Dates	Topic(s)
September 5	No Class. Please review Course Syllabus on your own.
September 8, 9	Introduction to biosystematics and phylogenetics. Identification and classification.
September 11	**Classification and identification lab I**
September 15, 16	How to identify an organism? Interpreting how traits evolve.
September 18	**Classfication and identification lab II - in BGS 3000**

Dates	Topic(s)
September 22, 23	Interpreting trees, intro to building trees - parsimony, neighbour-joining
September 25	**Tree building lab - neighbor-joining**
September 29	Molecular evolution, molecular data
September 30	NO CLASS - Truth and Reconciliation Day
October 2	**Data collection lab - sequence databases, BLAST**
October 5	**Slides DUE for Case Study Presentation #1 Sun. Oct 5 at 9 pm**
October 6, 7, 9	**Case Study Presentation #1**, live presentations in class
October 13	NO CLASS - Thanksgiving holiday
October 14	Nucleotide evolution models, molecular phylogenetics
October 16	**Molecular phylogenetics lab - neighbour-joining**
October 20, 21	Why do trees disagree? Probabilistic tree building - maximum likelihood
October 23	**Geneological discordance lab**
October 27, 28	Diversification rates and molecular clocks
October 30	**Molecular clocks lab**
November 3-9	Reading Week - No classes
November 10, 11	Probabilistic tree building - Bayesian inference Ancestral reconstruction
November 13	**Case study help**
November 17, 18	Early evolutionary history
November 20	**Phylogeography lab**
November 24	Tree networks **Slides DUE for Case Study Presentation #2, Mon. Nov 24 at 9 pm**
November 25, 27	**Case Study Presentation #2,** live presentations in class
December 1, 2, 4	**Case Study Presentation #2,** live presentations in class
December 8	**Case Study summaries**
December 9	Wrap-up, review
December 11-22	December Exam Period, Final Exam scheduled by the registrar

Delivery Mode - all classes, tutorials, and labs are in person

4. Course Materials

All course material will be posted to OWL: https://westernu.brightspace.com/
There is no textbook. Readings and other resources will be posted on OWL.

Students are responsible for checking the course OWL site (https://westernu.brightspace.com/) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class.

If students need assistance, they can seek support on the OWL Brightspace Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Technical Requirements

- ✓ Laptop running a Mac OSX or Windows operating system
  - ✳ **Please notify Dr. Tai immediately if you do not have a laptop and need to use a university workstation for your lab assignments**
- ✓ PowerPoint or other means to create slide presentations

➡ You will also be notified of required software to install for lab sessions. These softwares will be compatible with Mac OSX and Windows operating systems. Attending lab sessions will be essential for dealing with any technical issues.

Optional texts:

Baum D & Smith S. 2013. *Tree Thinking: an Introduction to Phylogenetic Biology*. Roberts, Greenwood Village, CO. A conceptual overview of the principles of phylogenetics. A highly recommended introduction.

Nei M & Kumar S. 2000. *Molecular Evolution and Phylogenetics*. Oxford University Press. An excellent text for those who wish to explore the biological and mathematical theory and principles of phylogenetic reconstruction.

Page RDM & Holmes EC. 1998. *Molecular Evolution - A Phylogenetic Approach*. Blackwell, Oxford. Probably the most lucid text available on various methods of phylogenetic analysis. Quite up-to-date considering the date of publication.

5. Methods of Evaluation

The overall course grade will be calculated as listed below:

Course Component	Weight	Description
Lab/tutorial Assignments	30%	Weekly questions, data analysis - 8 assignments total, grade based on best 7 of 8
Case study, presentation #1	10%	Slides DUE Sunday Oct 5, 9 pm Live presentations Oct 6, 7 and 9
Case study, presentation #2	20%	Slides and data DUE Monday Nov 24, 9 pm Live presentations Nov 25, 27, Dec 1, 2, and 4
Participation and case study summaries	5%	Engagement and participation during presentations Summary assignments following presentations
Final Exam	35%	Short and long answer, scheduled by the Registrar

Lab/tutorial Assignments
Lab/tutorials will consist of data collection and analysis, and associated short answer questions based on material covered in lab/tutorial sessions, fundamental concepts explored in the course, or interpretation of results. Assignments are approximately weekly and are generally completable by the end of the tutorial sessions on Thursdays, but the deadline for submission will be the next day, Friday at 5 pm. A minimum of 4 out of 8 assignments must be completed to pass this course.

Case Study
Students will choose a taxon (e.g. Sciuridae - a family of squirrels, or strains of *Vibrio cholera*) that they will use as a case study to explore the various concepts and techniques introduced in the course and in the lab/tutorials. These may include species concepts, evolutionary relationships, evolution of phenotypic/morphological traits, or examples of molecular phylogenetics applied to this taxon. The results of these explorations will be presented to the class in two stages. The first presentation (4-5 minutes) will introduce their taxon, classification, and characteristic traits. The student will also present a classification or evolutionary question concerning their taxon, or a published phylogenetic analysis that includes their taxon. For the second presentation (7-8 minutes), the student will present their own molecular phylogenetic analysis that addresses the classification or evolution of the taxon, or any other evolutionary question. The student will also be required to submit the sequence data that they used in their analysis. This phylogenetic analysis and second case study presentation is a required component of this course, and must be completed to pass the course.

Performance evaluation by the instructor will be based on criteria such as content, effective communication of concepts, quality of the analysis, figures and slides, responses to questions or comments, etc.

Participation/Case study summaries
Students are expected to attend and engage in presentation sessions, and will formally participate through peer evaluation of the presentations. In addition, after each set of case study presentations, each student will also submit a short assignment based on the presentations.

Final Exam
The final exam will consist of short- and long-answer questions, and will be scheduled by the registrar. This is a required component of this course.

General information about missed coursework

Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs* posted on the Academic Calendar:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf,

This policy does not apply to requests for Academic Consideration submitted for **attempted or completed work**, whether online or in person.

The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult Accessible Education.

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar's webpage:
https://registrar.uwo.ca/academics/academic_considerations/
All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

All Academic Consideration requests must include supporting documentation; however, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request **without supporting documentation** in this course. However, the following assessments are excluded from this, and therefore always require formal supporting documentation:

- Examinations scheduled during official examination periods
- Case Study Presentations

When a student *mistakenly* submits their one allowed Academic Consideration request **without supporting documentation** for the assessments listed above or those in the **Coursework with Assessment Flexibility** section below, the request cannot be recalled and reapplied. This privilege is forfeited.

Evaluation Scheme for Missed Assessments

Assignments

When a student misses an assignment and their Academic Consideration has been granted, the weight of each missed assignment will be transferred to the final exam.

Case Study Presentations

When a student misses their scheduled Case Study Presentation (either #1 or #2) and their Academic Consideration has been granted, the presentation will be re-scheduled without penalty. When Academic Consideration has not been granted, a late penalty of 30% will be applied, and the presentation will be re-scheduled.

Please note that for Presentation #2, the re-scheduled date may occur during the Study Days or December Exam Period.

When the submission of presentation slides is missed, a penalty of 10% per day will be applied unless Academic Consideration has been granted.

Final Exam

When a student misses the Final Exam and their Academic Consideration has been granted, they will be allowed to write the Special Examination (the name given by the University to a makeup Final Exam). See the Academic Calendar for details (under Special Examinations), especially for those who miss multiple final exams within one examination period.

Essential Learning Requirements

Even when Academic Considerations are granted for missed coursework, the following are deemed essential to earn a passing grade.

- a minimum of 4 completed assignments,
- completion of the Case Study phylogenetic analysis and 2nd presentation,
- completion of the final exam.

Students not meeting these requirements will receive a maximum grade of 45.

Coursework with Assessment Flexibility

By policy, instructors may deny Academic Consideration requests for the following assessments with built-in flexibility:

Flexible Completion

Assignments. This course has 8 assignments, and the 7 assignments with the highest marks are counted towards your final grade. Should extenuating circumstances arise, students do not need to request Academic Consideration for the first missed assignment. Academic consideration requests will be denied for the first missed assignment. After the first missed assignment, Academic Consideration requests may be granted.

Deadline with a No-Late-Penalty Period
Assignments. Students are expected to submit each of the 8 assignments by the deadline listed. Should extenuating circumstances arise, students do not need to request Academic Consideration and they are permitted to submit their assignment up to 48 hours past the deadline without a late penalty. Should students submit their assessment beyond 48 hours past the deadline, a late penalty of 10% per day will be applied. Academic Consideration requests may be granted only for extenuating circumstances that started before the deadline and lasted longer than the No-Late-Penalty Period (48 hours).

6. Additional Statements

Religious Accommodation
When conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing to the course instructor and/or the Academic Advising office of their Faculty of Registration. This notice should be made as early as possible but not later than two weeks prior to the writing or the examination (or one week prior to the writing of the test).

Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays:

https://www.edi.uwo.ca.

Accommodation Policies
Students with disabilities work with Accessible Education which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The Academic Accommodation for Students with Disabilities policy can be found at:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf

Academic Policies
The website for Registrarial Services is http://www.registrar.uwo.ca.

In accordance with policy, https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf, the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Electronic devices will not be permitted on tests and exams.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following web site:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

Review Biology 2290 learning outcomes. You are expected to know what plagiarism is at this stage of your programme.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Remote Proctoring, in the event of a health lock-down:
Tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service.

More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at: https://remoteproctoring.uwo.ca.

Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on add/drop courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: https://www.uwo.ca/sci/counselling/

Students who are in emotional/mental distress should refer to Mental Health@Western (https://uwo.ca/health/) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or

in the past), you will find information about support services for survivors, including emergency contacts at:

https://www.uwo.ca/health/student_support/survivor_support/get-help.html

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at:

http://academicsupport.uwo.ca/accessible_education/index.html

if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre (https://learning.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: https://www.uwo.ca/se/digital/

Additional student-run support services are offered by the USC, http://westernusc.ca/services.