



Biology 4289B **Biosystematics and Phylogenetics**

Winter 2022 - Mondays - 10:30 to 11:30 am
Tuesdays - 9:30 to 11:30 am
Thursdays - 9:30 to 11:30 am

Prerequisites

Biology 2581b 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 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.

Instructor Information

Dr. Vera Tai

e-mail: vtai4@uwo.ca

office: BGS 2028

office hours: e-mail to schedule as needed, either in person or via Zoom

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, monophyletic primary kingdoms, the admission of DNA fingerprints as court evidence, the global Tree of Life Project, to Hebert's Barcoding Project, the use of molecular biology and bioinformatics has literally transfigured our understanding of evolutionary history. Biology 4289b 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, and acquire the skills required to analyze DNA sequences in a phylogenetic context. The course consists of formal lectures as well as student presentations based on library research assignments and computer-based projects.

Course Schedule and Mode of Delivery

Mondays 10:30 –11:20 am, lecture

Tuesdays 9:30 – 11:20 am, lecture (sometimes lab)

Thursdays 9:30 – 11:20 am, lab / tutorial

While online: virtual, synchronous sessions - via Zoom, see links on OWL

-virtual synchronous sessions will be recorded for later viewing for up to 7 days afterwards.

If returning to in-person: classes held in SSC-3028

Course Materials

Students should check OWL (<http://owl.uwo.ca>) 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. Students are responsible for checking OWL on a regular basis.

All course material will be posted to OWL: <https://owl.uwo.ca/>

There is no textbook. Readings and other resources will be posted on OWL.

If students need assistance, they can seek support on the OWL 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

- ✓ Stable internet connection
- ✓ Computer with working microphone and/or webcam
- ✓ PowerPoint or other means to create digital voiced-over 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 live 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.

Hillis et al. (eds). 1996. *Molecular Systematics, 2nd edition*. Sinauer, Sunderland MA. An excellent, varied overview of the different approaches available in 1996. Detailed laboratory protocols are given at the end of many chapters. Excellent glossary of technical terms. Unfortunately, the field has changed a lot since that time, and the book is in the need of a major revision.

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.

Methods of Evaluation

The overall course grade will be calculated as listed below:

| Course Component | Weight | Description |
|-----------------------------|--------|---|
| Participation | 5% | Engagement in classes, labs, presentations, peer evaluation |
| Lab/tutorial Assignments | 30% | Weekly questions, data analysis |
| Case study, presentation #1 | 5% | Slides DUE Jan 24, 9 pm Live presentations Jan 25 and 27 |
| Case study, presentation #2 | 10% | Slides DUE Feb 13, 9 pm Live presentations Feb 14, 15, and 17 |
| Case study, presentation #3 | 15% | Slides DUE Mar 28th at 9 pm Live presentations Mar 29, 31, Apr 4, 5, 7 |
| Final Exam | 35% | Short and long answer, scheduled by the Registrar |

Participation

Students are expected to be actively engaged in this class, and participate. Participation will be evaluated based on keeping pace with classes, completing lab assignments on time, and peer evaluation of presentations.

Lab/tutorial Assignments

Lab/tutorials will consist of data collection or analysis, and associated short answer questions based on material covered in lab/tutorial sessions and fundamental concepts explored in the course, or related to a student's case study (see below). 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.

Case Study

Students will choose a taxon for analysis (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 various species concepts, evolutionary relationships, evolution of phenotypic/morphological traits, and examples of molecular phylogenetics applied to this taxon. The results of these explorations will be presented to the class in three stages. The first presentation (2 minutes) will introduce their taxon, classification, and characteristic traits. In the second presentation (4 minutes), the student will present a published phylogenetic analysis that includes their taxon. The third (9-10 minutes) will present their phylogenetic analyses, and consider the classification and evolution of the taxon. This case study is a mandatory component of this course, and the 2nd and 3rd presentations 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 figures and slides, response to comments and suggestions, etc.

Students are expected to attend and engage in presentation sessions, and will formally participate through peer evaluation of the 2nd and 3rd presentations. The average peer evaluation score will consist of 10 % of these presentations.

Final Exam

The final exam will consist of short- and long-answer questions, and will be scheduled by the registrar.

Required Conditions to Pass the Course

- i) completion of the 2nd and 3rd Case Study presentations
- ii) completion of the Final Exam

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

Click [here](#) for a detailed and comprehensive set of policies and regulations concerning examinations and grading. The table below outlines the University-wide grade descriptors.

| | | |
|----|----------|---|
| A+ | 90-100 | One could scarcely expect better from a student at this level |
| A | 80-89 | Superior work which is clearly above average |
| B | 70-79 | Good work, meeting all requirements, and eminently satisfactory |
| C | 60-69 | Competent work, meeting requirements |
| D | 50-59 | Fair work, minimally acceptable |
| F | below 50 | Fail |

Accommodated Evaluations

Late Course Components

Assignments, presentations, and reports must be handed in on the appropriate due date unless a valid excuse is provided through your academic counsellor or self-reported absence (see below), and an alternate due date will be arranged with your instructor.

Missed Course Components

If you are unable to meet a course requirement due to illness or other serious circumstances, you must seek approval for the absence as soon as possible. Approval can be granted either through a self-reporting of absence or via the Dean's Office/Academic Counselling unit of your Home Faculty. Please also inform your instructor (vtai4@uwo.ca).

If you are a Science student, the Academic Counselling Office of the Faculty of Science is open for virtual appointments. Their website is https://www.uwo.ca/sci/counselling/advising_services/index.html

Information about late or missed evaluations:

- Late assessments without self-reported absences (SRA) or academic consideration will be subject to a late penalty of 10% per day.
- Late assessments with self-reported absences should be submitted within 24 hours of the end of the 48-hour period.
- Missed presentations without self-reported absences (SRA) will be subject to a late penalty of 20%.
- Any missed presentation must be re-scheduled as soon as possible. This could mean presenting outside of class time only to the instructor, and being evaluated by the instructor only.

Student Absences

Academic Consideration for Student Absences

Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

- (i) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:
 - an absence must be no more than 48 hours
 - the assessments must be worth no more than 30% of the student's final grade
 - no more than two SRAs may be submitted during the Fall/Winter term

- (ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.
- (iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered, unless otherwise instructed in the course outline.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf

and for the Student Medical Certificate (SMC), see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at <https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

Absences from Final Examinations

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

Accommodation and Accessibility

Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD) 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, <http://www.uwo.ca/its/identity/activatenonstudent.html>, 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/>

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 Student Accessibility Services (SAS) at 661-2147 if you have any questions regarding accommodations.

The policy on Accommodation for Students with Disabilities can be found here: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_disabilities.pdf

The policy on Accommodation for Religious Holidays can be found here: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

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/>.

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.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.

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

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

Course Outline

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

| Week of | Topic(s) |
|---------------|--|
| January 10 | Introduction, what is Biosystematics, what is phylogenetics? Natural and geological history, tree of life |
| | How are organisms named and classified? |
| January 17 | Species concepts, speciation, reading trees |
| | Classifying organisms lab |
| January 24 | History of phylogenetics, evolution of traits |
| | Case Study Presentation #1 , slides DUE Jan 24, 9 pm Live presentations in class, Jan 25 and 27 |
| January 31 | Phylogenetic inference, building trees |
| | Tree building lab - parsimony, neighbor-joining |
| February 7 | Molecular evolution, marker genes, phylogenomics |
| | Data collection lab - Sequence databases, BLAST |
| February 14 | Case Study Presentation #2 , slides DUE Feb 13, 9 pm Live presentations in class, Feb 14, 15, and 17 |
| February 21 | Reading Week, <u>No Classes</u> |
| February 28 | Molecular phylogenetics, genetic distance |
| | Alignment and trimming methods, interpreting trees |
| March 7 | Genetic distance, substitution models, molecular clocks |
| | Model testing |
| March 14 | Models of sequence evolution, ancestral state reconstruction |
| | Maximum likelihood, Bayesian, statistical reliability |
| March 21 | Diversification, rates of evolution Guest lecturer - Dr. Art Poon |
| | Case study help |
| March 28 | Applications of phylogenetics |
| | Case Study Presentation #3 , slides DUE March 28th, 9 pm Live presentations in class, Mar 29, 31 |
| April 4 | Live presentations continued - April 4, 5, and 7 |
| April 10 - 30 | April Exam Period, Final Exam scheduled by the registrar |