EEB1456 – Phylogenetic Comparative Methods
Course Instructor: D. Luke Mahler

Time & Location: Wednesdays, 9am – 12pm on Zoom; March 3 – April 7, 2021

Background: A central goal in ecology and evolution is to understand how past ecological and evolutionary processes have shaped large-scale biodiversity patterns. A key challenge is thus to make inferences about evolutionary process using information about evolutionary patterns. The phylogenetic comparative method provides an analytical framework for doing so, merging temporal information about sequences of evolutionary descent (i.e., phylogenies) with models of the evolutionary process to explain observed patterns of species and trait diversity. The goal of this course will be to review, understand, and apply key principles in phylogenetic comparative biology. Students will review key literature for several various types of phylogenetic comparative analysis, with the goal of understanding the basic models that underlie these approaches, and the scope, utility, and limitations of recently developed methods. Students will gain experience applying these methods by completing a course project.

Layout of the Course: We will meet weekly to discuss one or more readings relevant to the week's topic. Each week, one student will be responsible for selecting that week's readings, and will give a ~30-minute presentation in which they introduce the basic concepts and approaches underlying that week's comparative method. I can provide guidance on specific presentation content and structure, suggest starter readings, etc. If students wish, presentations can be done in pairs, although in that case everyone will likely go twice. We can discuss that option during the pre-course meeting. Then, for ~90 minutes, the presenting student will lead the class in discussion of the week's readings. If students are interested, this period can additionally include hands-on activities (e.g., brief R tutorials during which we practice using methods). The final 60 minutes is intended for students to work together on their projects in break-out groups. I will be available to discuss project work during this time.

Individually or in pairs, students will complete a project in which they use phylogenetic comparative methods to conduct an original data analysis and write up the results in the format of a short scientific manuscript. *Students are strongly encouraged to conduct analyses that directly relate to their thesis research.* Think of this as an opportunity to conduct a first-draft set of analyses for a thesis chapter. Students will submit an outline of this project during Week 2, and a final draft on the last day of class.

Schedule:

Week	Date	Topic	Required Reading
0	TBD	**Pre-course meeting** Review goals, syllabus, and course structure, sign people up for each topic.	No

1	March 3	**Continuous traits**	TBD
2	March 10	**Discrete traits** Project outline due	TBD
3	March 17	**Phylogenetic correction**	TBD
4	March 24	**Diversification**	TBD
5	March 31	**Community phylogenetics**	TBD
6	April 7	**Geographic range evolution** Final project due	TBD

Note, the order of topics is tentative. Some topics may also be replaced depending on student interest.

Marking scheme

Participation	30%
Presentation and discussion lead	20%
Project outline	10%
Final project	40%