

**ANTHROPOLOGY 611: PHYLOGENETIC COMPARATIVE METHODS**  
**SPRING 2023 (CLASS 6835)**  
**TUESDAY 3:00-5:50 PM, AS 243**

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email: [agordon@albany.edu](mailto:agordon@albany.edu)      Office hours: Mondays, 2:00 to 4:00 pm, or by appointment.

**Prerequisites:** This class requires graduate standing in anthropology or permission of the instructor.

**Course Objectives:** Ecological and evolutionary patterns are often investigated through comparative analyses among different species or different ecological communities. It has been recognized for several decades that such analyses require analytical methods that explicitly take into account the non-independence of data points due to variably close evolutionary relationships among the species involved (*i.e.*, their phylogenetic relationships). These methods have also been applied to other areas of anthropology that involve vertical transmission (*e.g.*, language and culture). This course will introduce the theory and application of this set of methods, collectively known as phylogenetic comparative methods. We will discuss the development of phylogenetic comparative approaches, introduce methodologies, read applications of these methods to various types of questions, examine data collection and preparation processes, and apply these techniques to real data using the statistical programming language *R*.

**Course Website:**

Course materials such as readings, data sets for lab exercises, grades, and this syllabus will be posted on Blackboard. In addition, course announcements such as amendments to this syllabus will be posted on Blackboard.

**Required Textbook:**

Revell LJ and Harmon LJ. 2022. *Phylogenetic Comparative Methods in R*. Princeton University Press.

The textbook will form the backbone of lab exercises in the course. There will also be other required readings every week that will be made available via Blackboard.

**Statistical Software:**

We will be using the statistical programming language *R* in this course. Prior to the second class meeting, all students must download and install *R* from the CRAN website (<http://cran.r-project.org/>) onto a computer that they will have regular access to. In addition, Windows users should download and install a text editor for *R* code that color-codes functions and highlights matching brackets (such a text editor is built-in for Mac users). I use the freely-available program Notepad++ (<https://notepad-plus-plus.org/>), but there are many programs available. *R Studio* ([www.rstudio.com/](http://www.rstudio.com/)) is also a popular option that combines text editing and a GUI for *R*.

**Students with Disabilities:**

If you require a disability-related academic accommodation for this class, please register with Disability Access and Inclusion Student Services (DAISS) as soon as possible and ask them to communicate with me regarding any reasonable accommodation for the course or instructions about physical access. Please be aware that DAISS will communicate directly with me regarding any modifications to the course absence policy for a specific student, and in the absence of such communication DAISS has instructed faculty to follow the stated absence policy in the course syllabus. For more information about “reasonable accommodation”, please see DAISS’s Reasonable Accommodation Policy: <http://www.albany.edu/disability/docs/RAP.pdf>

## COURSE STRUCTURE

This course uses the A-E grade system. Your final grade is determined based on the following components:

<b>leading discussion:</b>	<b>20%</b>	<b>final presentation:</b>	<b>20%</b>
<b>research project:</b>	<b>30%</b>	<b>class participation:</b>	<b>30%</b>

**Leading discussion of readings (20%):** Starting on the fourth week of class, discussion each week will be led by one student. By the Monday of the week before you lead discussion, you will have already met with me to discuss points that should be highlighted in your discussion. ALL students will carefully read all of the assigned readings, while that week's discussion leader will be responsible for guiding the class discussion. Depending on the level of class participation, I may require discussion leaders to write and circulate a set of discussion questions the week before they lead class.

Starting on the eleventh week of class, each student will choose the topic and readings for one class meeting. The topic should be a methodological topic related to the overall theme of the course but ideally will also align with your own interests. By March 7<sup>th</sup> you will have met with me to discuss and topic and the types of articles to include as readings. By two weeks before you lead discussion on your topic, you will have met with me to finalize the reading list and discuss points that should be highlighted in their presentation and discussion.

**Research project (30%):** I expect all students to complete an independent research project (*i.e.*, not a literature review) during the course of the semester. Projects should be related to the topics discussed in this class in some way and apply some of these methods, although ideally they will also be relevant to your M.A. project, dissertation research, *etc.* Projects may be based on a data set previously collected by you, collected by you over the course of the semester, mined from the literature, obtained from another faculty member, or drawn from data sets previously collected by myself. I expect each of you to meet with me during my office hours before March 7<sup>th</sup> to discuss your project topic.

Projects should be written in scientific journal format, with an abstract, introduction, materials and methods, results, and discussion. The project should be contextualized in terms of the relevant literature. Papers will be graded on content, style, and grammar. Papers are due on May 2<sup>nd</sup> at the beginning of class.

**Presentation of research project (20%):** During the last class meeting, students will present their research projects in a conference meetings-style talk, with the modification that the methods portion of the talk should be expanded relative to a normal conference talk. Each student will have thirty minutes: twenty minutes for the presentation and ten minutes for questions. You will be graded on the clarity of your verbal presentation, your ability to handle questions, and the clarity of your slides. Presentations should provide a brief introduction and contextualization, but should focus on the results and implications of the research. You are expected to use PowerPoint, and your slides should reinforce your talk without distracting the audience; *i.e.*, only one figure per slide, minimal text (just a few bullet points per slide, no paragraphs), and what text there is should be large and easily readable (*i.e.*, 20-point font or larger).

**Seminar and lab participation (30%):** Each week we will be addressing a different methodological topic and discussing applications of that set of methods to various research questions as reflected in published articles. In advance of each class, students will first read the corresponding textbook chapter and run the *R* code on their own as a self-directed lab exercise to become familiar with the methods and their implementation. Students should write down any questions they have or issues that arise so that they can be discussed in class. Students will then read the assigned articles for the week,

particularly with an eye towards how the phylogenetic comparative methods are used in the service of investigating a question of scientific interest (*i.e.*, not just applying a comparative method for the sake of applying that method). In class, we will set aside a small amount of time for discussing how methods are implemented in *R*, but the majority of time will be spent discussing the readings and the methodological concepts.

Discussion participation is essential for a successful seminar. Grading will be based upon the information volunteered and presented, considering both the content of the discussion and quality of questions asked. For each seminar, you will be asked to reflect upon the readings and to identify the most important or meaningful research (and methodological) issues that emerge from them. Do the assigned readings before coming to class and be prepared to participate. Everyone must participate in the discussions – it is NOT acceptable to let all the others do the talking and not comment or ask questions. You are not expected to be an expert in the topics of discussion. You ARE expected to ask questions and make comments during class to show me that you are making an effort to understand the material, regardless of background, interest, amount of sleep, *etc.* DO NOT rely on the discussion leader or me to do all the discussing. Everyone should think about the readings – relevance, importance, unresolved questions, confusing bits, *etc.* – and talk about these things in class.

**Attendance:** This is a graduate course; as such, I expect everyone to show up for every meeting. Furthermore, as a seminar focusing on methodology the material in each class meeting builds on the material presented in earlier classes, even more so than is the case in many other courses, so it is imperative that you attend every class. I will allow one absence without penalty. Beyond the first absence I will deduct five percentage points from the overall final grade in the course for each missed class; e.g., if a student misses three classes and would have otherwise received 95% overall in the course, they will instead receive 85% overall for the course. I will allow excused absences in the case of religious holidays (per New York State Education Law, [Section 224-A](#)), and may allow them in cases of documented illness, professional conferences, and possibly other activities, but you must talk to me about these events with as much advance notice as possible.

#### ACADEMIC INTEGRITY

Academic dishonesty of any kind will not be tolerated in this course. Academic dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating information or citations, facilitating acts of academic dishonesty by others, submitting work of another person (or AI) or work previously used without informing the instructor, or tampering with the academic work of other students. Students who are found to be academically dishonest will receive academic sanctions as outlined in the university's Graduate Regulations and Degree Requirements:

[http://www.albany.edu/graduatebulletin/requirements\\_degree.htm#penalties](http://www.albany.edu/graduatebulletin/requirements_degree.htm#penalties)

#### MAJOR DEADLINES

Tuesday, Mar. 7<sup>th</sup>: Meet with me before this date to discuss research project and topic for student-led class

Tuesday, May 2<sup>nd</sup>: Final research presentation in class, and research papers due at the beginning of class – no exceptions

## COURSE SCHEDULE

The topic and readings for each week are provided below. Starting with week 11, the readings will be determined by the student leading discussion that week in consultation with me. Please note that this schedule is subject to change.

### **Week 1 (1/24)**

Topic: Tree Thinking & Building Trees in R

Readings: Nunn C. 2011. Basic phylogenetic concepts and 'tree thinking'. In: *The Comparative Approach in Evolutionary Anthropology and Biology*. The University of Chicago Press. pp. 20-51.

Lab: Revell & Harmon, Chapter 1

### **Week 2 (1/31)**

Topic: The Comparative Method, The **Phylogenetic** Comparative Method, and Independent Contrasts

Readings: Harvey PH and Pagel MD. 1991. Why worry about phylogeny? In: *The Comparative Method in Evolutionary Biology*. Oxford University Press. pp. 35-49.

Nunn CL and Barton RA. 2001. Comparative methods for studying primate adaptation and allometry. *Evolutionary Anthropology*. 10: 81-98.

Felsenstein J. 1985. Phylogenies and the comparative method. *American Naturalist*. 125: 1-15.

Lab: Revell & Harmon, Chapter 2

### **Week 3 (2/7)**

Topic: Phylogenetic Generalized Least Squares

Readings: Manly BFJ and Navarro Alberto JA. 2017. Matrix algebra. In: *Multivariate Statistical Methods: A Primer*. CRC Press. pp. 29-39.

Symonds MRE and Blomberg SP. 2014. A primer on phylogenetic generalized least squares. In: LZ Garamszegi, ed., *Modern Phylogenetic Comparative Methods and Their Application in Evolutionary Biology*. Springer. pp. 105-130.

Gordon AD, Johnson SE, Louis EE Jr. 2013. Females are the ecological sex: Sex-specific body mass ecogeography in wild sifaka populations (*Propithecus* spp.). *American Journal of Physical Anthropology*. 151: 77-87.

Lab: Revell & Harmon, Chapter 3

### **Week 4 (2/14)**

Topic: Continuous Trait Evolution and Phylogenetic Signal

Readings: Kamilar JM and Cooper N. 2013. Phylogenetic signal in primate behaviour, ecology and life history. *Philosophical Transactions of the Royal Society B*. 368: 20120341.

Cooper N and Purvis A. 2010. Body size evolution in mammals: complexity in tempo and mode. *American Naturalist*. 175: 727-738.

Lukas D, Towner M, Borgerhoff Mulder M. 2021. The potential to infer the historical pattern of cultural macroevolution. *Philosophical Transactions of the Royal Society B*. 376: 202000572.

Lab: Revell & Harmon, Chapter 4

### **Week 5 (2/21)**

Topic: Multi-rate, Multi-Regime, and Multivariate Models for Continuous Traits

Readings: Almécija S, Smaers JB, Jungers WL. 2015. The evolution of human and ape hand proportions. *Nature Communications*. 6: 7717.

Prang TC, Ramirez K, Grabowski M, Williams SA. 2021. *Ardipithecus* hand provides evidence that humans and chimpanzees evolved from an ancestor with suspensory adaptations. *Science Advances*. 7: eabf2474.

Smaers JB, Turner AH, Gómez-Robles A, Sherwood CC. 2018. A cerebellar substrate for cognition evolved multiple times independently in mammals. *eLife* 7:e35696.

Lab: Revell & Harmon, Chapter 5

### **Week 6 (2/28)**

Topic: Discrete Trait Evolution

Readings: Kappeler PM and Pozzi L. 2019. Evolutionary transitions toward pair living in nonhuman primates as stepping stones toward more complex societies. *Science Advances*. 5:eaay1276.

Hübler N. 2022 Phylogenetic signal and rate of evolutionary change in language structures. *Royal Society Open Science*. 9: 211252.

Fortunato L and Jordan F. 2010. Your place or mine? A phylogenetic comparative analysis of marital residence in Indo-European and Austronesian societies. *Philosophical Transactions of the Royal Society B*. 365: 3913-3922.

Lab: Revell & Harmon, Chapter 6

### **Week 7 (3/7)**

Topic: Correlated Binary Traits and Discrete/Continuous Threshold Models

Readings: Brocklehurst N and Benevento GL. 2020. Dental characters used in phylogenetic analyses of mammals show higher rates of evolution, but not reduced independence. *PeerJ*. 8:e8744.

DeCasien AR, Thompson NA, Williams SA, Shattuck MR. 2018. Encephalization and longevity evolved in a correlated fashion in Euarchontoglires but not in other mammals. *Evolution*. 72: 2617–2631.

Hrnčíř V, Duda P, Šaffa G, Květina P, Zrzavý J. 2020. Identifying post-marital residence patterns in prehistory: A phylogenetic comparative analysis of dwelling size. *PLoS ONE*. 15:e0229363.

Lab: Revell & Harmon, Chapter 7

### **Week 8 (3/14)**

NO CLASS (SPRING BREAK)

### **Week 9 (3/21)**

Topic: Reconstructing Ancestral States

Readings: Fernandez AA and Morris MR. 2007. Sexual selection and trichromatic color vision in primates: statistical support for the preexisting-bias hypothesis. *American Naturalist*. 170: 10-20.

Montgomery SH, Capellini I, Barton RA, Mundy NI. 2010. Reconstructing the ups and downs of primate brain evolution: implications for adaptive hypotheses and *Homo floresiensis*. *BMC Biology*. 8: 9.

Young NM, Capellini TD, Roach NT, Alemseged Z. 2015. Fossil hominin shoulders support an African ape-like last common ancestor of humans and chimpanzees. *Proceedings of the National Academy of Sciences of the United States of America*. 112: 11829-11834.

Lab: Revell & Harmon, Chapter 8

### **Week 10 (3/28)**

Topic: Biogeographic and phylogenetic community ecology

Readings: Buckner JC, Lynch Alfaro JW, Rylands AB, Alfaro ME. 2015. Biogeography of the marmosets and tamarins (Callitrichidae). *Molecular Phylogenetics and Evolution*. 82: 413-425.

Feijó A, Ge D, Wen Z, Cheng J, Xia L, Patterson BD, Yang Q. 2022. Mammalian diversification bursts and biotic turnovers are synchronous with Cenozoic geoclimatic events in Asia. *Proceedings of the National Academy of Sciences of the United States of America*. 119:e2207845119.

Rolland J, Condamine FL, Beeravolu CR, Jiguet F, Morlon H. 2015. Dispersal is a major driver of the latitudinal diversity gradient of Carnivora. *Global Ecology and Biogeography*. 24: 1059-1071.

Lab: Revell & Harmon, Chapter 12

### **Week 11 (4/4)**

Topic: Student selected topic and articles: Phylogenetic logistic regression

Readings: Ives AR, Garland Jr T. 2010. Phylogenetic logistic regression for binary dependent variables. *Systematic Biology*. 59: 9-26.

Ives AR, Garland Jr T. 2014. Phylogenetic logistic regression for binary dependent variables. In: LZ Garamszegi, ed., *Modern Phylogenetic Comparative Methods and Their Application in Evolutionary Biology*. Springer. pp. 231-261.

Strier KB, Lee PL, Ives AR. 2014. Behavioral flexibility and the evolution of primate social states. *PLoS ONE*. 9: e114099.

Lab: See files on Blackboard

### **Week 12 (4/11)**

Topic: Student selected topic and articles: Identifying and quantifying convergence

Readings: Arbuckle K, Speed MP. 2016. Analysing convergent evolution: a practical guide to methods. In: P Pontarotti, ed., *Evolutionary Biology*. Springer. pp. 23-36.

Ingram T, Mahler DL. 2013. SURFACE: detecting convergent evolution from comparative data by fitting Ornstein-Uhlenbeck models with stepwise Akaike Information Criterion. *Methods in Ecology and Evolution*. 4: 416-425.

Aguilar-Puntriano C, Avila LJ, De la Riva I, Johnson L, Morando M, Troncoso-Palacios J, Wood Jr PL, Sites Jr JW. 2018. The shadow of the past: Convergence of young and old South American desert lizards as measured by head shape traits. *Ecology and Evolution*. 8: 11399-11409.

Lab: Castiglione S, Serio C, Tamagnini D, Melchionna M, Mondanaro A, Di Febbraro M, Profico A, Piras P, Barattolo F, Raia P. 2019. A new, fast method to search for morphological convergence with shape data. *PLoS ONE*. 14: e0226949.

Also, see files on Blackboard

### **Week 13 (4/18)**

Topic: Tree building and phylogenetic comparative methods in other subfields of anthropology

Readings: Mace R, Holden CJ. 2005 A phylogenetic approach to cultural evolution. *TRENDS in Ecology and Evolution*. 20: 116-121.  
Holden CJ. 2002. Bantu language trees reflect the spread of farming across sub-Saharan Africa: a maximum-parsimony analysis. *Proceedings of the Royal Society B: Biological Sciences*. 269: 793-799.  
O'Brien MJ, Buchanan B, Eren MI. 2016. Clovis colonization of eastern North America: A phylogenetic approach. *STAR: Science & Technology of Archaeological Research*. 2: 67-89.

Lab: <https://fuzzyatelin.github.io/bioanth-stats/module-24/module-24.html>

### **Week 14 (4/25)**

Topic: Student selected topic and articles: Character-dependent diversification

Readings: FitzJohn RG. 2012. Diversitree: comparative phylogenetic analyses of diversification in R. *Methods in Ecology and Evolution*. 3: 1084-1092.  
Davis MP, Midford PE, Maddison W. 2013. Exploring power and parameter estimation of the BiSSE method for analyzing species diversification. *BMC Evolutionary Biology*. 13: 38.  
Beaulieu JM, O'Meara BC. 2016. Detecting hidden diversification shifts in models of trait-dependent speciation and extinction. *Systematic Biology*. 65: 583-601.

Lab: Revell & Harmon, Chapters 9-11

### **Week 15 (5/2)**

Topic: Final presentations