ANTH 4903 & ANTH 5153: Seminar in Anthropology
Problems in Primate Paleobiology

CLASS TIMES
Monday/ Wednesday, 3:05-4:20pm, Old Main 118

CONTACT INFORMATION
Dr. Claire Terhune
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Old Main 339
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Office Hours: Monday 1:30-3:00 pm or by appointment

COURSE DESCRIPTION
This course is focused on reviewing and discussing major issues in primate paleobiology and paleoanthropology, and more generally in biological anthropology. This course is divided into modules with 2-3 class periods devoted to a single topic. Typically the first of these classes will be devoted to basic introductory information, and subsequent classes for that topic will be focused on discussion of previous research in that area. Topics include mastication, locomotion, sensory systems, size and scaling, advanced quantitative techniques, phylogenetics, paleoecology, and genetics.

COURSE REQUIREMENTS
Performance in the course will be assessed via exams, participation, and a major research paper (and its components).

Deliverable	Undergraduate	Graduate
Participation	30%	20%
CITI Training	5%	5%
Paper	45% broken down into:	45% broken down into:
Topic/Bibliography	7.5%	2.5%
Outline and Abstract	7.5%	2.5%
Materials and Methods	--	5%
Results	--	5%
Final Paper Draft	20%	20%
Presentation	10%	10%
Discussion Leader	--	10%
Final Exam	20%	20%
Total	***100%***	***100%***

Participation
Although some lecture content will be delivered by Dr. Terhune, much of our time in class will be spent discussing research articles. As a result, preparation and participation is absolutely critical and therefore a large percentage of your final grade (30% for undergraduates and 20% for graduate students) will be based on how much you interact in class during our discussions.

CITI Training
All students are required to register for and complete the Responsible Conduct of Research (RCR) offered through the University of Arkansas's Office of Research Compliance and the Collaborative Institutional Training Initiative (CITI). Instructions for signing up and completing this training will be posted to Blackboard, and a completed certificate must be turned in by September 14, 2015. Completion of this training makes up 5% of your course grade.

Discussion Leader
Graduate students will be expected to lead the class discussion during one class meeting of their choice. This will count for a total of 10% of their final grade, 5% of which will be based on a discussion outline that will be turned in at the beginning of that day's class.

Research Paper
All students will be expected to complete a research paper that makes up the majority of their grade in the course (45%). Graduate students will be expected to generate and test a research question with data they collect themselves and/or that is culled from the literature. Undergraduates will not be required to analyze data as part of this paper, though they may do so if they wish. Portions of this paper (i.e., topic, outline, abstract, etc.) are due at various times throughout the semester. Each of these deliverables will be evaluated by Dr. Terhune and comments will be provided so that they may be incorporated in the final product. Final papers should be no longer than 15 pages of double-spaced text, not including references, figures, or tables. Ideally, the topic should be tailored to the student's research interests. During the final two weeks of class, students will present their data in a 10-15 minute powerpoint presentation to the entire class.

Late Assignments
Assignments are due on the date assigned in the syllabus. Late assignments will only be accepted for a five days after the original due date, and for each day an assignment is delayed 5% points will be deducted from the assignment's grade.

Exams
There will be a single cumulative, written final exam at the end of the semester worth 20% of the final grade. No make-ups for this exam will be given.

Grading Scale
A: 90 – 100%
B: 80 – 89.99%
C: 70 – 79.99%
D: 60 – 69.99%
F: Below 60%

ACADEMIC HONESTY
From the provost: "As a core part of its mission, the University of Arkansas provides students with the opportunity to further their educational goals through programs of study and research in an environment that promotes freedom of inquiry and academic responsibility. Accomplishing this mission is only possible when intellectual honesty and individual integrity prevail."

"Each University of Arkansas student is required to be familiar with and abide by the University's 'Academic Integrity Policy,' which may be found at http://provost.uark.edu. Students with questions about how these policies apply to a particular course or assignment should immediately contact the instructor."

The "Policy on Academic Honesty" is at http://provost.uark.edu/245.php and the penalties for offenses are outlined are at http://provost.uark.edu/246.php.

OTHER INFORMATION
- **Emergency Procedures.** Many types of emergencies can occur on campus; instructions for specific emergencies such as severe weather, active shooter, or fire can be found at emergency.uark.edu.
- **Disability Resources.** University of Arkansas Academic Policy Series 1520.10 requires that students with disabilities are provided reasonable accommodations to ensure their equal access to course content. If you have a documented disability and require accommodations, please verify your eligibility through the Center for

Educational Access (contact 479-575-3104 or visit http://cea.uark.edu for more information on registration procedures). **If you are registered with CEA and require extra time for the exam, it is your responsibility to make an appointment with CEA. Your exam will be proctored by CEA staff at their testing center.**

This syllabus is subject to change at the discretion of the professor.

CLASS SCHEDULE (Subject to Change)

Date	Topic	Deliverable
8/24/2015	Course Introduction and Expectations	
8/26/2015	The Form/Function Relationship; Fundamentals of Biomechanics	
8/31/2015	Mastication: introduction	
9/2/2015	Mastication: extant models	
9/7/2015	**Labor Day- NO CLASS**	
9/9/2015	Mastication: inferring fossil behaviors	
9/14/2015	Responsible Conduct of Research	**Complete CITI Training (Turn in Certificates)**
9/16/2015	Locomotion: introduction	
9/21/2015	NO CLASS	
9/23/2015	Locomotion: extant models	
9/28/2015	Locomotion: inferring fossil behaviors	**Paper Topic and Bibliography Due**
9/30/2015	Sensory systems: brains and cognition	
10/5/2015	Biometry Basics	
10/7/2015	Biometry Basics Continued	
10/12/2015	Size and scaling	
10/14/2015	**Society for Vertebrate Paleontology Meetings- NO CLASS**	
10/19/2015	**Fall Break- NO CLASS**	
10/21/2015	Size and scaling: data analysis	**Paper Outline and Abstract**
10/26/2015	Advanced quantitative techniques	
10/28/2015	Advanced quantitative techniques: data analysis	
11/2/2015	Phylogenetics	

Date	Topic	Deliverable
11/4/2015	Phylogenetics: data analysis	
11/9/2015	Data analysis day	
11/11/2015	Paleoecology	**Materials and Methods and Results Due**
11/16/2015	Paleoecology	
11/18/2015	Genetics: primate studies	
11/23/2015	Genetics: human evolution	
11/25/2015	**Thanksgiving Break- NO CLASS**	
11/30/2015	Anatomy of a research presentation	
12/2/2015	Research presentations	
12/7/2015	Research presentations	
12/9/2015	Class Wrap-up	**Final Paper Due**
December 16, 1-3pm: FINAL EXAM		

COURSE READINGS (Subject to Change)

In general, readings should be read in the order they are listed here and/or in chronological order. PDFs of all readings are provided on Blackboard in the "Content" section, except for those indicated below by a web address.

- **Course Introduction and Expectations**
  - Course syllabus
  - Review the following websites
    - http://studysites.sagepub.com/bjohnsonstudy/howtoarticle.htm
    - https://www.insidehighered.com/advice/instant_mentor/essay_on_teaching_students_to_read_journal_articles
    - http://violentmetaphors.com/2013/08/25/how-to-read-and-understand-a-scientific-paper-2/
- **Form/ Function and Introduction to Biomechanics**
  - Bock WJ, von Wahlert G. 1965. Adaptation and the form-function complex. Evolution 19:269-299.
  - Wainwright, Peter. 1994. Functional Morphology as a Tool in Ecological Research. In Ecological Morphology (Eds) Peter C. Wainwright and Steven M. Reilly. The University of Chicago Press, Chicago, pp.42-59.
  - Levangie PK, Norkin CC. 2001. Joint Structure and Function: A Comprehensive Analysis. Philadelpha: F.A. Davis Company. Chapter 1 pgs 1-18 and 28-35
  - Burr DB, Allen MR. 2014. Basic and Applied Bone Biology. Chapter 6 pgs 115-119.
  - Rudyard Kipling's Just So Stories: http://www.gutenberg.org/files/2781/2781-h/2781-h.htm (pick any two)
- **Mastication**
  - Introduction
    - Hylander WL. 2006. Functional anatomy and biomechanics of the masticatory apparatus. In: Laskin JL, Green CS, Hylander WL, editors. Temporomandibular Disorders: an Evidenced Aproach to Diagnosis and Treatment. New York: Quintessence Publishing Co.
    - Hylander WL. 1979. Functional significance of primate mandibular form. J Morphol 160:223-240
    - Hylander WL. 1985. Mandibular function and biomechanical stress and scaling. Am Zool 25:315-330.
    - Ross CF, Iriarte-Diaz J, Nunn CL. 2012. Innovative approaches to the relationship between diet and mandibular morphology in primates. In J Primatol 33:632-660.
  - Extant Models
    - Hylander WL, and Bays R. 1979. An *in vivo* strain-gauge analysis of the squamosal-dentary joint reaction force during mastication and incisal biting in *Macaca mulatta* and *Macaca fascicularis*. Arch Oral Biol 24:689-697.
    - Vinyard CJ, Wall CE, Williams SH, Hylander WL. 2003. Comparative functional analysis of skull morphology of tree-gouging primates. Am J Phys Anthropol 120:153-170.
    - Ross CF, Baden AL, Georgi J, Herrel A, Metzger KA, Reed DA, Schaerlaeken V, Wolff MS. 2010. Chewing variation in lepidosaurs and primates. J Exp Biol 213:572-584.
    - Taylor AB, Vinyard CJ. 2013. The relationships among jaw-muscle fiber architecture, jaw morphology, and feeding behavior in extant apes and modern humans. Am J Phys Anthropol 151:120-134.
  - Inferring Fossil Behaviors
    - Demes B, Creel N. 1988. Bite force, diet, and cranial morphology of fossil hominids. J Hum Evol 17:657-670.
    - Spencer MA, Demes B. 1993. Biomechanical analysis of masticatory system configuration in neandertals and inuits. Am J Phys Anthropol 91:1-20.

        - Strait et al. 2009. The feeding biomechanics and dietary ecology of *Australopithecus africanus*. Proc Nat Acad Sci 106:2124-2129.

- **Responsible Conduct of Research**
    - IACUC Guidebook: http://grants.nih.gov/grants/olaw/guidebook.pdf (pages 1-25)
    - Belmont Report: http://www.hhs.gov/ohrp/humansubjects/guidance/belmont.html (read entire document)
- **Locomotion**
    - Introduction
        - Whitehead PF. 1993. Aspects of the anthropoid wrist and hand. Postcranial Adaptation in Nonhuman Primates. Northern Illinois University Press, Deklab IL, pp. 96-120.
        - Anemone RL. 1993. The functional anatomy of the hip and thigh in primates. In: Gebo DL (ed). Postcranial Adaptation in Nonhuman Primates. Northern Illinois University Press, Deklab IL, pp. 150-174.
        - Gebo DL. 1993. Functional morphology of the foot in primates. In: Gebo DL (ed). Postcranial Adaptation in Nonhuman Primates. Northern Illinois University Press, Deklab IL, pp. 175-196.
        - Hunt K, Cant JGH, Gebo DL, Rose MD, Walker SE, Youlatos D. 1996. Standardized descriptions of primate locomotor and postural modes. Primates 37:363-387.
    - Extant Models
        - Larson SG. 1998. Parallel evolution in the hominoid trunk and forelimb. Evol Anthropol 6:87-99.
        - Schmitt D, Lemelin P. 2002. Origins of Primate Locomotion: Gait mechanics of the woolly opossum. Am J Phys Anthropol 118:231-238.
        - Schmitt D. 2003. Insights into the evolution of human bipedalism from experimental studies of humans and other primates. J Exp Biol 206: 1437-1448.
        - Orr CM. 2006. Knuckle-walking anteater: a convergence test of adaptation for purported knuckle-walking features of African Hominidae. Am J Phys Anthropol 128: 639-658.
    - Inferring Fossil Behaviors
        - Richmond BG, Begun DR, Strait DS. 2001. The origin of human bipedalism: the knuckle-walking hypothesis revisited. Yearbook of Physical Anthropology 44: 70-105.
        - Anemone RL, Covert HH. 2000. New skeletal remains of *Omomys* (Primates, Omomyidae): functional morphology of the hindlimb and locomotor behavior of a Middle Eocene primate. J Hum Evol 38:607-633.
        - Pickford M, Senut B, Gommery D, Treil J. 2002. Bipedalism in *Orrorin tugenensis* revealed by its femora. Comp Rendus Paleo 1: 191-203.
- **Sensory Systems**
    - Ankel-Simons F. Primate Anatomy, An Introduction. Chapter 9, pgs 391-483. (for a general review)
    - Aiello LC, Wheeler P. 1995. The expensive-tissue hypothesis: the brain and the digestive system in human and primate evolution. Curr Anthropol 36:199-221.
    - Dunbar RIM, Shultz S. 2007. Understanding primate brain evolution. Phil Trans Roy Soc B 362:649-658.
- **Size and Scaling**
    - Jungers WL, Falsetti, Wall CE. 1995. Shape, relative size, and size-adjustments in morphometrics. Yrbk Phys Anthropol 38:137-161.
    - Vinyard CJ. 2008. Putting shape to work: making functional interpretations of masticatory apparatus shapes in primates. In: Vinyard CJ, Ravosa MJ, Wall CE, editors. Primate craniofacial function and biology. New York: Springer Science. P 357-386.
    - Smith RJ. 2009. Use and misuse of the reduced major axis for line-fitting. Am J Phys Anthropol 140:476-486.

- Lewton KL. 2015. Allometric scaling and locomotor function in the primate pelvis. Am J Phys Anthropol 156:511-530.

- **Advanced Quantitative Techniques**
  - Adams DC, Rohlf FJ, Slice DE. 2013. A field comes of age: geometric morphometrics in the 21st century. Hystrix Ital J Mammal 24:7-14.
  - Cooke SB, Terhune CE. 2015. Form, function, and geometric morphometrics. Anat Rec 298:5-28. Main text (not appendix)
  - Baab KL, McNulty KP. 2009. Size, shape, and asymmetry in fossil hominins: the status of the LB1 cranium based on 3D morphometric analyses. J Hum Evol 57:608-622.
  - Green DJ, Serrins JD, Seitelman B, Martiny AR, Gunz P. 2015. Geometric morphometrics of hominoid infraspinous fossa shape. Anat Rec 298:180-194.
- **Phylogenetics**
  - Nunn CL, Barton RA. 2001. Comparative methods for studying primate adaptation and allometry. Evol Anthropol 10:81-98.
  - Freckleton RP, Harvey PH, Pagel M. 2002. Phylogenetic analysis and comparative data: a test and review of evidence. Am Nat 160:712-726.
  - Arnold C, Matthews LJ, Nunn L. 2010. The 10kTrees Website: a new online resource for primate phylogeny. Evol Anthropol 19:114-118.
  - Klingenberg CP, Gidaszewski NA. 2010. Testing and quantifying phylogenetic signals and homoplasy in morphometric data. Syst Biol 59:245-261.
  - Motani R, Schmitz L. 2011. Phylogenetic versus functional signals in the evolution of form-function relationships in terrestrial vision. Evolution 65:2245-2257.
- **Paleoecology**
  - Ecomorphology and Community Analysis
    - Van Valkenburgh, B. 1994. Ecomorphological Analysis of Fossil Vertebrates and their Paleocommunities, pp. 140 – 166. In Wainwright and Rielly, eds, Ecological Morphology. Chicago: University of Chicago Press.
    - Plummer, Thomas W., Laura C. Bishop, and Fritz Hertel. 2008. Habitat preference of extant African bovids based on astragalus morphology: operationalizing ecomorphology for paleoenvironmental reconstructions. J Arch Sci 35: 3016-3027.
    - Fleagle JG, Reed KE. 1996. Comparing primate communities: a multivariate approach. J Hum Evol 30:489-510.
    - Reed KE, Bidner LR. 2004. Primate communities: past, present, and possible future. Yrbk Phys Anthropol 47:2-39.
  - Mesowear, microwear, and stable isotopes
    - Ambrose, Stanley H. and Michael J. DeNiro. 1989. Climate and Habitat Reconstruction Using Stable Carbon and Nitrogen Isotope Ratios of Prehistoric Herbivore Teeth from Kenya. *Quaternary Research* 31: 407-422.
    - Fortelius, Mikael and Nikos Solounias. 2000. Functional Characterization of Ungulate Molars Using the Abrasion-Attrition Wear Gradient: A New Method for Reconstructing Paleodiets. *American Museum Novitates* Number 3301.
    - Scott, Robert S., Peter S. Ungar, Torbjorn S. Bergstrom, Christopher A. Brown, Frederick E. Grine, Mark Teaford, and Alan Walker. 2005. Dental microwear texture analysis shows within-species diet variability in fossil hominins. *Nature* 435: 693- 695.

        - Cerling et al. 2015. Dietary changes of large herbivores in the Turkana Basin, Kenya from 4 to 1 Ma. Proc Nat Acad Sci. Published online before print August 3, 2015, doi:10.1073/pnas.1513075112

- **Genetics**
    - General references (not required reading, but may be helpful)
        - Relethford JH. 2012. Human Population Genetics. Chapters 1 and 9 and Glossary (available online through library: http://0-site.ebrary.com.library.uark.edu/lib/uark/reader.action?docID=10630499)
        - Tenesa A, Navarro P, Hayes B, Duffy DL, Clarke GM, Goddard ME, Visscher PM. 2007. Recent human effective population size estimated from linkage disequilibrium. Genome Research 17:520-526.
    - Primate studies
        - Perry GH, Martin RD, Verrelli BC. 2007. Signatures of functional constraint at aye-aye opsin genes: the potential of adaptive color vision in in a nocturnal primate. Mol Biol Evol 24:1963-1970.
        - Kaessmann H, Wiebe V, Paabo S. 1999. Extensive nuclear DNA sequence diversity among chimpanzees. Science 286:1159-1162.
        - Prufer et al. 2012. The bonobo genome compared with the chimpanzee and human genomes. Nature 486:527-531.
        - Enard et al. 2002. Molecular evolution of FOXP2, a gene involved in speech and language. Nature 418:869-872.
    - Human evolution
        - Krings M, Stone A, Schmitz RW, Krainitzki H, Stoneking M, Paabo S. 1997. Neandertal DNA sequences and the origin of modern humans. Cell 90:19-30.
        - Reich D, et al. 2010. Genetic history of an archaic hominin group from Denisova Cave in Siberia. Nature 468:1053-60.
        - Meyer et al. 2014. A mitochondrial genome sequence of a hominin from Sima de los Huesos. Nature 505:403-406.
        - Sankararaman S, Mallick S, Dannemann M, Prufer K, Kelso J, Paabo S, Patterson N, Reich D. 2014. The genomic landscape of Neanderthal ancestry in present-day humans. Nature 507:354-357.
        - Fu et al. 2015. An early modern human from Romania with a recent Neanderthal ancestor. Nature 524:216-219.
        - Sudmant et al. 2015. Global diversity, population stratification, and selection of human copy number variation. Science Express doi 10.1126/science.aab3761