

## **Environments, Ecosystems and Evolution: Evidence from the Turkana Basin**

An introduction to the ways scientists use the fossil and archaeological records to learn about past changes in Earth's climates, environments, and animal communities, and how humanity's ancestors responded to those changes physiologically and technologically. Interdisciplinary lectures will show evidence from the Turkana Basin's paleoenvironmental, fossil and archaeological records of the dynamic interactions between the climate, environment, local food webs, and ancient human populations. This background will prepare students for training in paleoanthropological and archaeological field methods.

A few short excursions and one multi-night field trip are planned as part of this module. Trips to nearby fossil-bearing locations and the habitats discussed in the course will expose students to the geological and paleoenvironmental context of important discoveries of the Turkana Basin. Lab and field exercises will acquaint students with key methods of paleoecological and paleoenvironmental reconstruction. Students should be prepared to spend time outdoors for this module and have adequate packs for carrying notebooks, water and other supplies. Lab exercises will showcase analytical methods that reveal prehistoric organisms' diet or locomotion, and give examples of physiological changes that coincided with major shifts in prehistoric climate and environment.

Instructor: Dr. Jason E. Lewis [jason.lewis@stonybrook.edu](mailto:jason.lewis@stonybrook.edu)  
Office & Phone: Soc. Behav. Sci. N-513A 631-632-5808  
Will be generally available to students for office hours during the module.

Teaching Assistants: There will be at least one graduate student TA available at the facility for the duration of the program.

Class Meetings: Monday - Saturday, 8:00 am - 12:00 pm, and 2:30 - 5:30 pm

Note: for Contact Hour calculation 'Lab' is considered as requiring outside preparation time and given a 2/1 ratio, while 'Field' is considered as not requiring outside preparation time and given a 3/1 ratio.

Week	Day	Lecture	Seminar	Recitation	Lab	Field	Other	Total
1	0					6		6
1	1	3				3		6
1	2	3				3		6
1	3	3				3		6
1	4							0
1	5	3			3			6
1	6	6						6
2	8	6						6

2	9	3			3			6
2	10	6						6
2	11	3			3			6
2	12		3					3
2	13						3 exm	3
Total Hours		36	3		9	15	N/A	60
Contact Hours		36	3		5	5		49

**Text:** There is no assigned textbook for this course; assigned readings will be given digitally to the students at the beginning of the course. The readings will be useful for clarifying concepts discussed in class and for supplying additional examples from those presented in lecture. Students will find that reading the material before attending lecture will make the lecture easier to follow. Other documents, review sheets, class announcements, etc, will be downloadable from the class Blackboard site (<https://blackboard.stonybrook.edu>).

## COURSE LEARNING OBJECTIVES

The objectives of this course are to teach you to:

- Understand the application of the scientific method (i.e., how to construct and test a hypothesis).
- Be able to summarize and describe simple quantitative and qualitative observations and react to such observations critically
- Understand the theory of evolution at both the molecular and organismal levels.
- Understand the biology, ecology and behavior of a number of extinct and living primate species, especially humans.
- Begin to develop skills needed to be a critical consumer and ultimately user of the primary scientific literature (e.g., access and use Web of Science, critical consumption of online information).
- Be able to discuss critical events and ongoing issues in human evolution.

This course satisfies the following requirements of the **DEC**:

### Category E- Natural Sciences

This course satisfies the following requirements of the **SBC**:

#### Study the Natural World (SNW):

1. Understand the methods scientists use to explore natural phenomena including observation, hypothesis development, measurement and data collection, experimentation, and evaluation of evidence.
2. Understand the natural world and the major principles and concepts that form the basis of knowledge in the natural sciences.
3. Assess scientific information and understand the application of scientific data, concepts, and models in the natural sciences.
4. Make informed decisions on contemporary issues involving scientific information.

**-In this class, via field practicals and lab experiments (see details below), students will have hands-on practice with the methods scientists use to explore natural phenomena, will gain**

**direct understanding of the natural world and the major principles and concepts that form the basis of knowledge in the natural sciences, learn how to Assess scientific information and understand the application of scientific data, concepts, and models, such that at the end of the module they will be able to make informed decisions on contemporary issues involving scientific information.**

and

**Engage Global Issues (GLO):**

1. Demonstrate knowledge and understanding of the interconnectedness of the world, past and present.
  2. Demonstrate knowledge and understanding of a society or culture outside of the United States.
- This course physically takes place in a nation, region, and culture that is significantly different from the United States and Europe in almost all respects. It examines the interconnectedness between geography, geological history, climate and environment, and the organismal evolution of plant and animal communities and the origins and cultural development of our own species.**

**PREREQUISITES**

This course is part of a 3-course themed cluster (field school) and there are no prerequisites except permission from the instructor and/or study abroad office. Lectures will cover the basic concepts that are required to understand the material. A science background is not necessary for the successful completion of the course.

**COURSE REQUIREMENTS**

- Participation (20%) – students are expected to actively participate in the data collection in the field and in class discussion and debates.
- Lab/Practical exercises (40%) – lab or practical exercises must be completed and handed in prior to the following exercise.
- Final exam (40%) – the exam consists of multiple choice, matching, and short answer questions covering topics from the course.

**COURSE POLICES**

Classroom etiquette:

While students are in class, they are expected to give their full attention to the lecture. Reading, talking, eating, texting or browsing on cell phones, leaving or packing up to leave before the professor has dismissed the class are inappropriate classroom behaviors and disruptive to other students. Also, please make sure that your watch alarms, pagers, and cell phones do not go off during class.

Attendance and preparation of assignments:

Students are expected to attend all classes; if you expect to miss one or two classes, please email your TA, who will inform to me. Unexcused absences will lower your grade. Computer glitches (such as computers that die, hard disks that crash, flash drives that are lost, etc) will not be accepted as excuses for failure to do assignments on time, to study for exams, etc.

Policy Regarding Missed Exams:

Generally, makeup examinations are not given (and the score for the missed exam is entered as zero “0”). If you would like to be considered for a makeup examination, the following conditions

must be met: 1. You should have a legitimate excuse for having missed the original exam, e.g., illness, family emergency. 2. You must inform me within 48 hrs before or after the scheduled exam date that you cannot take the exam. If the above conditions apply, then you will be allowed to do a makeup exam.

Americans with Disabilities Act:

If you have a physical, psychiatric/emotional, medical or learning disability that may impact on your ability to carry out assigned course work, please contact the Disability Support Services office in the Educational Communications Center (ECC) Building, room 128 (632-6748). DSS will review your concerns and determine, with you, what accommodations are necessary and appropriate. All information and documentation of disability is confidential.

Academic Integrity:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at <http://www.stonybrook.edu/uaa/academicjudiciary/>

Critical Incident Management:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn.

## Syllabus

**Arrive in NBI, transfer to Mpala Reserve with Dino Martins**

**Day 0- Sunday at Mpala**

Morning: Field- Game drive

Afternoon: Field- Game drive

**Day 1- Karibuni and Introduction**

Morning: Lecture- Ecology and Evolution Overview

Afternoon: Lecture- The African Savannah, overview of ecosystems and habitats

**Day 2- Introduction to Modern Africa Savannah Ecology**

Morning: Lecture- Introduction to Modern Africa Savannah Ecology

Afternoon: Field- Game drive

**Day 3- Modern Africa Savannah Ecology cont'd**

Morning: Lecture- Plant density, patterns, reproduction

Afternoon: Field- Game drive

**Day 4- Fly to TBI-Ileret**

**Day 5- History of Life, Environmental Change, Evolution and Extinction**

Morning: Lecture- A Brief Outline of the History of Earth

Afternoon: *Lab*- A First Look at Fossils

**Day 6- Earth Before Humans: 65 to 6 Million Years Ago**

Morning: Lecture- Cenozoic Environments and Vertebrate Evolution

Afternoon: Lecture- History of Paleontology in the Turkana Basin (M. Leakey)

**Day 7- Rest Day**

**Day 8- Finding and Studying Fossils**

Morning: Field- excursion around facility

Afternoon: *Lab*- Identification and study of collected material

**Day 9- Planet of the Apes**

Morning: Lecture- Miocene Apes of the World and especially the Turkana Basin

Afternoon: Lecture- Global Cooling and Drying and Earliest Putative Hominins

**Day 10- Mosaic Environments and Mosaic Creatures**

Morning: Lecture- Gracile Australopithecines

Afternoon: Lecture- Robust Australopithecines

**Day 11- Breaking Rocks in the Hot Sun**

Morning: Lecture- Stone Tool Making & *Homo* Responses to Environmental Change

Afternoon: *Lab*- individual experimental knapping & tool use

**Day 12- Back to TBI Turkwel**

Morning: Driving back to facility

Afternoon: Reviewing for Final w/ Instructor

**Day 13- Showing What You Learned**

Morning: Final Exam

**Day 14- Class Over: Rest Day Before Next Module**

**Readings**

Readings for individual lectures will be distributed as PDFs/photocopies before or at the beginning of the module. Students are expected to have read the papers before the day that topic is covered and come prepared with questions for discussion sessions.

**Day 5-**

Benton, M.J. & Twitchett, R.J. 2003. How to kill (almost) all life: the end-Permian extinction event. *TRENDS in Ecology and Evolution* 18:358-365.

Shipman, P. 1981. *The Life History of a Fossil*. Harvard University Press, Cambridge. Chapters: 2 – Why do bones and teeth become fossils? 3 – Geological setting and sedimentary environments. – 4. Spatial distribution of fossils in sediments.

Suggested: Shubin, N. 2009. *Your inner fish: A journey into the 3.5 billion year history of the human body*. Vintage Books New York.

#### **Day 6-**

Blois, J.L. & Hadley, E.A. 2009. Mammalian response to Cenozoic climate change. *Annual Reviews of Earth and Planetary Science* 37:8.1-8.28.

Feakin, S.J., DeMenocal, P.B. Global and regional climate during the Cenozoic. In L. Werdelin & W. Sanders (eds.), *Cenozoic Mammals of Africa*, Chapter 4, pp 45-55. California University Press.

Heikinheimo, H., Eronen, J. T., Sennikov, A., Preston, C., Oikarinen, E., Uotila, P., Mannila, H. & Fortelius, M. 2012. Convergence in the distribution patterns of Europe's plants and mammals is due to environmental forcing. *Journal of Biogeography* 39:1633-1644.

Brown, F.B., McDougall I. 2011. Geochronology of the Turkana Depression of Northern Kenya and Southern Ethiopia. *Evolutionary Anthropology* 20:217-227

Harris, J. M., M. G. Leakey, and F. H. Brown. 2006. A brief history of research at Koobi Fora, northern Kenya. *Ethnohistory* 53:35-69.

#### **Day 8-**

Leakey, MG et al. n.d. *Field protocol for fossil prospecting, documentation, collection, and curation*. Manuscript on file at TBI.

Walker, Rikki. 1985. *Guide to the postcranial bones of East Africa*. Norwich Pubs., UK.

Ungar, P.S. 2010. *Mammal Teeth: Origin, Evolution, and Diversity*. Johns Hopkins University Press, Baltimore. Chapters:

#### **Day 9-**

Fortelius, M., L. Werdelin. P. Andrews, R. L. Bernor, A. Gentry, L. Humphrey, W. Mittmann and S. Viranta 1996. Provinciality, diversity, turnover and paleoecology in land mammal faunas of the later Miocene of western Eurasia. Pp. 414-448 in R. Bernor, V. Fahlbusch & W. Mittmann (eds.), *The Evolution of Western Eurasian Neogene Mammal Faunas*. Columbia University Press, New York.

Leakey, M.G., Grossman, A., Guitierrez, M., Fleagle, J.G. 2011. Faunal Change in the Turkana basin during the Late Oligocene and Miocene. *Evolutionary Anthropology* 20:238-253.

Leakey, MG, Feibel, CS, Bernor, RL, Harris, JM, Cerling, TE, Stewart, KM, Storrs, GW, Walker, A, Werdelin, L. & Winkler, A. 1996. Lothagam: A record of faunal change in the Late Miocene of East Africa. *Journal of Vertebrate Paleontology* 16 (3): 556-570.

Leakey, RE, Leakey, MG & Walker, AC. 1988. Morphology of *Turkanapithecus kalakolensis* from Kenya. *American Journal of Physical Anthropology* 76:277-288

Leakey, RE, Leakey, MG & AC Walker. 1988. Morphology of *Afropithecus turkanesis* from Kenya. *American Journal of Physical Anthropology* 76:289-307

Cerling et al, 2011. Woody cover and hominin environments in the past 6 million years.

Wood and Harrison 2011. The evolutionary context of the first hominins.

#### **Day 10-**

Leakey, MG, CS Feibel, I McDougall, C Ward, & A Walker. 1998. New specimens and confirmation of an early age for *Australopithecus anamensis*. *Nature* 393: 62-66.

Leakey, M & A Walker. 2003. Early hominid fossils from Africa. *Scientific American* 13:14-19.

Stern JT. 2000. Climbing to the top: A personal memoir of *Australopithecus afarensis*. *Evol Anthropol* 9(3):113-133.

Wood, B. and Constantino, P. 2007. *Paranthropus boisei*: fifty years of evidence and analysis. *Yearbook of Physical Anthropology* 50:106-132.

#### **Day 11-**

Harmand, S., Lewis, J. E., Feibel, C. S., Lepre, C. J., Boës, X., Prat, S., Quinn, R. L., Brugal, J.-P., Leakey, L., Kent, D. V., Mortlock, R. A., Wright, J. D., Lenoble, A., Brenet, M., Clement, S., Roche, H. (2015). 3.3 Million-Year-Old Stone Tools from Lomekwi 3, West Turkana, Kenya. *Nature*.

Roche, H. (2005) From simple flaking to shaping: stone-knapping evolution among early hominids. In: *Stone Knapping: the Necessary Conditions for a Uniquely Hominin Behavior* (Eds. V. Roux & B. Bril). McDonald Institute for Archaeological Research, Cambridge.

Walker, A and Leakey, R (eds.). 1993. *The Nariokotome Homo erectus skeleton*. Harvard University Press: Cambridge, Massachusetts (Several articles therein)

Spoor, F, MG Leakey, PN Gathogo, FH Brown, et al. 2007. Implications of new early Homo fossils from Ileret, east of Lake Turkana, Kenya. *Nature* 448:688-691.

Wood, BW and M Collard. 1999. The changing face of genus *Homo*. *Evolutionary Anthropology* 8:195-207.