

**Human Evolution
and evidence from the Turkana Basin**

The Turkana Basin is home to many paleoanthropological discoveries that fundamentally reshaped ideas about human evolution. Important finds from the Turkana Basin, including Nariokotome (“Turkana boy”) and KNM-WT17000 (the “Black Skull”) will be highlighted in lecture and lab activities, and their relevance to the larger picture of human evolution will be explored. In addition to highlighting the key role that Turkana Basin fossils have played in human evolutionary studies, lectures, seminars, and labs will cover the complete span of our evolutionary history from Miocene apes and the earliest putative hominins to the evolution of modern humans. Field trips to discovery locations will provide students with the opportunity to understand the geological context of important fossils of the Turkana Basin.

Instructor: Dr. Jason E. Lewis jason.lewis@stonybrook.edu
Office & Phone: Soc. Behav. Sci. S-537, 631-632-5800
Will be generally available to students for office hours during the module.

Teaching Assistants: There will be one graduate student TA and one undergraduate student TA available at the facility for the duration of the semester.

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>).

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

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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 nature of the fossil record and the geologic context of fossils.
- Understand the evidence for primate and human evolution.
- Understand the biology, ecology and behavior of a number of extinct and living primate species, especially humans.
- Understand how the biology, ecology and behavior of extinct human species is reconstructed.
- 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**:

Science, Technology, Engineering, and Mathematics (STEM+):

Learning Outcomes for “Pursue Deeper Understanding” STEM+

1. Students must use the skills expected from their Versatility courses to study and practice them in greater depth, with further study applied to the area in which they are certified.

-The structure and content of this course aims to build on the previous 3 Origins FS courses (by definition prerequisites) by practicing the skills learned in the daily labs and developing critical thinking skills in the daily seminars. Students move to a higher level of class format (daily labs, advanced fieldwork) and critical approaches (leading in-class discussions of assigned articles, final presentation, etc).

PREREQUISITES

This course is part of a 5-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

Grading:

-Lab exercises (30%) – lab exercises must be completed and handed in prior to the following lab.

-Seminar presentation (10%) – you (and possibly a partner) will be required to present for 5-10 minutes on one of the seminar readings. You and I will then lead a discussion on the paper.

-Individual/group presentation (20%) – on the final day you will present an individual/group presentation.

-Final exam (40%) – the exam consists of terms, matching questions and short answer questions covering topics of 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. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. 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. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.

Syllabus

Day 1-

Topic 1 Lecture: Introduction to course themes

Topic 2 Lecture: Anatomical terminology, human skeletal biology, and human skeletal morphology Seminar I: Reading exercise

Seminar II: Presentation exercise

Lab 1: Human and primate cranial and postcranial anatomy

Day 2-

Topic 1 Lecture: Phylogenetic reconstruction, dating, reconstructing diet

Topic 2 Lecture: Miocene apes of the Turkana Basin

Seminar I: Begun paper on Miocene ape phylogeny

Seminar II: De Queiroz (2007) Species concepts and species delimitation.

Lab 2: Miocene apes (including pre-field trip background lecture by Meave Leakey)

- *Turkanapithecus* (KNM-WT16950), *Afropithecus* (KNM-WK 16999), *Kenyapithecus* (KNM-FT 45 & 46), *Proconsul* (KNM-RU 7290)

Day 3-

Field trip to Miocene sites: Losodok (morning) and Moruorot (pm)

Day 4-

Topic 1 Lecture: Skeletal correlates of bipedalism

Topic 2 Lecture: Earliest putative hominins

Seminar I: Cerling et al (2011) Woody cover and hominin environments in the past 6 million years.

Seminar II: Wood and Harrison (2011) The evolutionary context of the first hominins.

Lab 3: Cladistics and the earliest hominins

Day 5-

Topic 1 Lecture: Australopithecines – East Africa

Topic 2 Lecture: Australopithecines – South Africa

Seminar I: Ward CV, Kimbel WH, Johanson DC (2011) Complete fourth metatarsal and arches in the foot of *Australopithecus afarensis*.

Seminar II: Kivell et al (2011) *Australopithecus sediba* hand demonstrates mosaic evolution of locomotor and manipulative abilities.

Lab 4: Australopithecines

Day 6-

Field trip to Pliocene sites: South Turkwell and the Napudet Hills

Day 7- Rest Day

Day 8-

Topic 1 Lecture: Robust australopithecines – East Africa

Topic 2 Lecture: Robust australopithecines – South Africa

Seminar I: Ungar PS, Sponheimer M (2011) The diets of early hominins.

Seminar II: Lockwood et al (2007) Extended male growth in a fossil hominin species.

Lab 5: Robust australopithecines

Day 9-

Topic 1 Lecture: Early *Homo* and *Homo erectus* – East Africa

Topic 2 Lecture: *Homo erectus* outside of Africa

Seminar I: Braun et al (2010) Early hominin diet included diverse terrestrial and aquatic animals 1.95 Ma in East Turkana, Kenya.

Seminar II: Lordkipanidze et al (2007) Postcranial evidence from early *Homo* from Dmanisi, Georgia.

Lab 6: Early *Homo* and *Homo erectus*

Day 10-

Field trip to Pleistocene sites: Lobolo

Day 11-

Topic 1 Lecture: Middle Pleistocene hominins

Topic 2 Lecture: Neanderthals – skeletal morphology and behaviour

Seminar I: Zilhão et al (2010) Symbolic use of marine shells and mineral pigments by Iberian Neandertals.

Seminar II: TBA – African MP article

Lab 7: Middle Pleistocene *Homo*

Day 12-

Topic 1 Lecture: Modern human origins – skeletal morphology and genetics

Topic 2 Lecture: Modern human origins - behaviour

Seminar I: Aiello LC (2010) Five years of *Homo floresiensis*.

Seminar II: TBA – article on evolutionary significance of skin pigmentation

Lab 8: Neanderthals and earliest modern humans

Day 13-

Exam

Topic presentations I

Topic presentations II

Day 14- Class Over: Rest Day Before Next Module

Supplementary Readings (in addition to assigned seminar readings):

Note: Many of these readings are listed in order to guide you to further reading for particular topics. Those that will be particularly important for you to read during the course are marked.

Day 1 – Introduction and the human skeleton

Harris, J.M., Leakey, M.G. and Brown, F. 2006. A brief History at Koobi Fora, Northern Kenya. *Ethnohistory* 53:34-69

White, T. and Folkens, P. (2005) *Anatomical Terminology*. In *The Human Bone Manual*, pp. 67-74. New York: Academic Press.

Day 2 – Miocene apes

Leakey, MG, Ungar PS & Walker, A. 1995. A new genus of large primate from the Late Oligocene of Lothidok, Turkana District, Kenya. *Journal of Human Evolution* 28:519-531

Leakey, RE & MG Leakey. 1986. A new Miocene hominoid from Kenya. *Nature* 324, 143-146

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

Day 3 – Fieldtrip to Miocene ape sites

None

Day 4 – Earliest putative hominins

Brunet M, Guy F, Pilbeam D, et al. (2002) A new hominid from the Upper Miocene of Chad, central Africa. *Nature* 418:145-151. Electronic journal and also in HESB.

Zollikofer, C.P.E., Ponce de Leon, M.S., Lieberman, D.E., Guy, F., Pilbeam, D., Likius, A., Mackaye, H.T., Vignaud, P., Brunet, M. (2005). Virtual cranial reconstruction of *Sahelanthropus tchadensis*. *Nature* 434: 755-759. Electronic journal.

Senut B, Pickford M, Gommery D, Mein P, Cheboi K, Coppens Y (2001) First hominid from the Miocene (Lukeino Formation, Kenya). *Comptes rendus de l'Académie des sciences, Serie IIA* 332:137-144. Electronic journal and also in HESB.

White, T. D., B. Asfaw, et al. (2009). "Ardipithecus ramidus and the Paleobiology of Early Hominids." *Science* 326 (5949): 64-86. Electronic Journal.

Haile-Selassie Y, Suwa G, White TD. 2004. Late Miocene teeth from Middle Awash, Ethiopia, and early hominid dental evolution. *Science* 303:1503-1505. Electronic journal.

Richmond BG, Jungers WL (2008) *Orrorin tugenensis* femoral morphology and the evolution of hominin bipedalism. *Science* 319:1662-1664.

Day 5 – Australopithecines in East and South Africa

East Africa

Leakey, MG, CS Feibel, I McDougall, and A Walker. 1995. New four-million-year-old hominid species from Kanapoi and Allia Bay, Kenya. *Nature* 376:565-566.

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.

Ruff, CB. 1991. Climate and body shape in human evolution. *Journal of Human Evolution*. 21:81-105
Lovejoy, C.O. 1988. The Evolution of Human Walking. *Scientific American*

Brown, B, FH Brown, & A Walker. 2001. The new hominids from the Lake Turkana Basin, Kenya. *Journal of Human Evolution* 41:29-44. (*A. afarensis*)

Leakey, MG, F Spoor, FH Brown, PN Gathogo, C Kiarie, LN Leakey, & I McDougall. 2001. New hominin genus from eastern Africa shows diverse middle Pliocene lineages. *Nature* 410:433-440.

Spoor, F., Leakey, M.G., Leakey, L.N. (2010) Hominin diversity in the Middle Pliocene of eastern Africa: the maxilla of KNM-WT 40000. *Philosophical Transactions of the Royal Society B: Biological Sciences* 365: 3377-3388.

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

Alemseged Z, Spoor F, Kimbel WH, Bobe R, Geraads D, Reed D, Wynn JG. 2006. A juvenile early hominin skeleton from Dikika, Ethiopia. *Nature* 443:296-301.

South Africa

Pickering et al (2011) *Australopithecus sediba* at 1.977 Ma and implications for the origins of the genus *Homo*. *Science* 333:1421-1423

Kibii JM et al (2011) A partial pelvis of *Australopithecus sediba*. *Science* 333:1407-1411.

Day 6 – Field trip to Pliocene sites

None

Day 7 – Rest Day

None

Day 8 – Robust *Australopithecines*

Leakey, REF & A Walker. 1988. New *Australopithecus boisei* specimens from east and west Turkana, Kenya. *American Journal of Physical Anthropology* 76: 1-24.

Walker, AC, REF Leakey, JM Harris & FH Brown. 1986. 2.5-Myr *Australopithecus boisei* from west of Lake Turkana, Kenya. *Nature* 322:517-522.

Leakey REF. 1970. Fauna and artifacts from a new Plio-Pleistocene locality near Lake Rudolf in Kenya. *Nature* 226:223-224.

Leakey REF, JM Mungai, & AC Walker. 1971. New *australopithecines* from East Rudolf, Kenya. *American Journal of Physical Anthropology* 35:175-186.

Constantino, P. and Wood, B. 2007. The evolution of *Zinjanthropus boisei*. *Evolutionary Anthropology* 16(2): 49-62

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

Lockwood et al (2007) Extended male growth in a fossil hominin species. *Science* 318, 1443-1446.

Day 9 – Early *Homo* and *Homo erectus*

Leakey et al (2012) New fossils from Koobi Fora in northern Kenya confirm taxonomic diversity in early *Homo*. *Nature* 488:201-204.

Discovery of *Homo habilis*

Leakey, LS, PV Tobias & JR Napier. 1964. A new species of the genus *Homo* from Olduvai Gorge. *Nature* 202:7-9.

Leakey, REF. 1974. Further evidence of Lower Pleistocene hominids from East Rudolf, North Kenya. *Nature* 248:653-656. (1813)

Discovery of *Homo rudolfensis*

Leakey, REF. 1973. Evidence for an advanced Plio-Pleistocene hominid from East Rudolf, Kenya. *Nature* 242:170. (1470) (Also related comment, “More questions than answers at east Rudolf” by Nature correspondent in the same issue, p. 431.)

Wood, B. 1992. Origin and evolution of the genus *Homo*. *Nature* 355:783-790.

Lieberman DE, BA Wood, & DR Pilbeam. 1996. Homoplasy and early *Homo* : an analysis of the evolutionary relationships of *H. habilis sensu stricto* and *H. rudolfensis*. *Journal of Human Evolution* 30:97-120.

Discovery of the Turkana Boy

Brown, F, J Harris, R Leakey, & A Walker. 1985. Early *Homo erectus* skeleton from west Lake Turkana, Kenya. *Nature* 316 (6031): 788-792.

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

Wood, BW. 1993. Early *Homo*: How many species? In WH Kimbel & LB Martin (eds.). *Species, Species Concepts and Primate Evolution*. Plenum Press, New York, pp. 485-522.

Wood, BW and M Collard. 1999. The changing face of genus *Homo*. *Evolutionary Anthropology* 8:195-207. Turkana boy and other important *Homo erectus* fossils from Turkana

Leakey, REF. 1976. New hominid fossils from the Koobi Fora formation in Northern Kenya. *Nature* 261:574-576.

Leakey, RE & AC Walker. 1976. *Australopithecus*, *Homo erectus* and the single species hypothesis. *Nature* 261(5561):572-4.

Leakey RE, A Walker, CV Ward, & HM Grausz. 1989 A partial skeleton of a gracile hominid from the Upper Burgi member of the Koobi Fora Formation, East Turkana, Kenya. In: *Proceedings of the 2nd International Congress of Paleoanthropology*. G. Giacobini (ed). Jaca Books, Milan. (KNM-ER 1500)

A. Walker, MR Zimmerman & REF Leakey. 1982. A possible case of hypervitaminosis A in Homo erectus. Nature 296:248-250. doi:10.1038/296248a0 (KNM-ER 1808 – the diseased one)

Spoor, F, MG Leakey, PN Gathogo, FH Brown, SC Antón, I McDougall, C Kiarie, FK Manthi, & LN Leakey. 2007. Implications of new early Homo fossils from Ileret, east of Lake Turkana, Kenya. Nature 448:688-691.

Day 10 – Fieldtrip to Pleistocene sites

None

Day 11 – Middle Pleistocene hominins and Neanderthals

McBrearty, S. & Brooks, A. (2000) The Revolution that Wasn't: a new interpretation of the origin of modern human behavior Journal of Human Evolution 39, 453–563.

Hublin J-J (2009) The origin of Neandertals. PNAS 106:16022-16027.

Meyer et al (2012) A high-coverage genome sequence from an archaic Denisovan individual. Science 338:222-226.

Bermudez de Castro and Martinon-Torres (2012) A new model for the evolution of the human Pleistocene populations of Europe. Quaternary International doi:10.1016/j.quaint.2012.02.036.

Day 12 – Modern human origins

Bräuer, G. & Leakey, R.E. (1986) The ES-11693 Cranium for Eliye Springs, West Turkana, Kenya. Journal of Human Evolution 15: 289-312.

Fleagle, J.G., Assefa, Z., Brown, F.H., Shea, J.J. (2008) Paleoanthropology of the Kibish Formation, southern Ethiopia. Introduction, Journal of Human Evolution 55: 360-365.

White, T.D., Asfaw, B., Degusta, D., Gilbert, H., Richards, G.D., Suwa, G., Howell, F.C. (2003) Pleistocene Homo sapiens from middle Awash, Ethiopia. Nature 423: 742-747.

McDougall et al (2005) Stratigraphic placement and age of modern humans from Kibish, Ethiopia. Nature 433:733-736

Day 13 – Exam and presentations

None