

IB 173 – Mammalogy

Lectures: TuTh 10:00 - 11:00 am, 3095 Valley Life Sciences Bldg. (VLSB)

Labs: TuTh 2:00 – 5:00 pm, 3095 VLSB

Class website: bcourses.berkeley.edu (IB 173)

General Course Content

This is a course on the biology of mammals of the world. It will combine experience from laboratories, lectures, and field work. The laboratory portion of the course will rely on the collections of the UC Berkeley Museum of Vertebrate Zoology. One major goal is to have students become familiar with the evolutionary diversification of mammals of the world and also with the ecology and evolution of the local mammalian fauna. Students will therefore be expected to learn the defining characteristics of mammalian Orders and Families worldwide, selected North American genera, and many California species. We will take a phylogenetic perspective and emphasize a functional understanding of the characters that define lineages. You will not simply memorize characters (although there will be considerable memorization), but learn their evolutionary and functional significance. At the end of the course you should be able to identify any mammalian specimen to Order and Family, and you should be able to describe aspects of its ecology, such as its food habits from an examination of its teeth and jaw structure, or its locomotory mode (and thus habitat) from an examination of its skeleton. By studying a single adaptive radiation in depth, you will hopefully come to appreciate more fully the details of the evolutionary process. The lecture portion of the course will cover a wide range of subjects in the ecology and evolution of mammals. Students will be expected to read from texts and from the primary literature. There will be three required weekend field trips in California. Field work is a critical part of the class: we will have the opportunity to observe, handle, and study wild mammals first-hand. These trips are intended to introduce students to the field identification of mammals and techniques used to study their population biology.

Lecture Schedule - Fall 2014

1.	Aug.	28	Introduction (ch 1-2)
2.	Sept.	2	Mammalian origins (ch 4)
3.		4	Mammalian origins
4.		9	Dentition (ch 4)
5.		11	Dentition
6.		16	Locomotion (ch 6)
7.		18	The mammalian radiation
8.		23	Taxonomy and systematics (ch 3)
9.		25	Taxonomy and systematics
10.		30	Feeding mechanisms and digestive systems (ch 7)
11.	Oct.	2	Physiological ecology (ch 8-9)
12.		7	Physiological ecology
13.		9	Reproduction (ch 10)
14.		14	Reproduction
15.		16	Mid Term Exam
16.		21	Behavior and social systems (ch 21-23)
17.		23	Behavior and social systems
18.		28	Population ecology (ch 24-25)
19.		30	Population ecology
20.	Nov.	4	Community ecology (ch 26)
21.		6	Community ecology
22.		11	No class - Veterans Day
23.		13	Population genetics and geographic variation
24.		18	Speciation
25.		20	Zoogeography (ch 5)
26.		25	Zoogeography
27.		27	No class - Thanksgiving
28.	Dec.	2	Mid-term exam

Before each lecture, you are expected to read and study the appropriate chapters in Feldhamer (given above).

Laboratory Schedule - Fall 2014

Aug.	28	Cranial anatomy
Sept.	2	Cranial and post cranial anatomy
	4	Cranial and post cranial anatomical diversity
	9	Data collection, field notes, zoonoses, California mammals
	11	Teeth
	16	Teeth
	18	Locomotor adaptations
	23	Horns, antlers, integument, pelage, age determination
	25	Prototheria and Metatheria (part) (ch 11)
	30	Metatheria continued
Oct.	2	Tenrecoidea, Macroscelidea, Tubulidentata, Hyracoidea, Proboscidea, Sirenia (ch 12, 19)
	7	Cingulata, Pilosa, Scandentia, Dermoptera (ch 12, 15)
	9	Chiroptera (ch 13)
	14	Chiroptera
	16	Review
	21	Lab Mid Term Exam
	23	Primates (ch 14)
	28	Rodentia (ch 18)
	30	Rodentia
Nov.	4	Rodentia
	6	Rodentia, Lagomorpha
	11	No class - Veterans Day
	13	Erinaceomorpha, Soricomorpha, Pholidota, Carnivora (part) (ch 12, 15, 16)
	18	Carnivora (part) (ch 16)
	20	Perissodactyla, Artiodactyla (ch 20)
	25	Cetacea (ch 17)
	27	No class - Thanksgiving
Dec.	2	Review
	4	Lab Final Exam

Before each lab, you are expected to read and study the appropriate chapters in the lab manual, "Lawlor's Handbook to the Orders and Families of Living Mammals" (available on the course website), and the corresponding taxonomic chapters in Feldhamer (given above).

Useful web sites:

National Museum of Natural History, Wilson and Reeder's Mammal Species of the World:

<http://www.vertebrates.si.edu/msw/mswcfapp/msw/index.cfm>

University of Michigan Museum of Zoology, Animal Diversity Web:

<http://animaldiversity.ummz.umich.edu/> (click on "mammals")

American Society of Mammalogists Website (has links to many other useful sites)

<http://www.mammalogy.org/>

The Mammalian Species pdf web site:

<http://www.science.smith.edu/departments/Biology/VHAYSSSEN/msi/>

Centers for Disease Control (CDC) website on Hantavirus:

<http://www.cdc.gov/hantavirus/index.html>

Field Trips

This course includes three field trips. These trips form an essential component of the course and is mandatory for all students enrolled in the class.

Sagehen Creek Field Station: Depart Friday, Sept 12, 10:00 am
<http://sagehen.ucnrs.org/> Return Sunday, Sept 14, 5:00 pm

Hastings Natural History Reservation: Depart Friday, Oct 3, 10:00 am
<http://www.hastingsreserve.org/> Return Sunday, Oct 5, 5:00 pm

Point Reyes National Seashore Depart Friday, Nov. 21, 9:00 am
www.nps.gov/pore/ Return Friday, Nov. 21, 5:00 pm

An important goal of these trips is to make you familiar with the natural history of mammals in California. You will have the opportunity to observe, trap, and handle a variety of mammals. Because of the presence of hantavirus and other zoonoses in some rodent populations, you will not be required to trap or handle live animals if you do not wish to do so. However, participation as an observer is still expected. Students who wish to prepare standard museum specimens from animals collected in the field will have the opportunity to do so.

Course Policy and General Expectations

<u>Grading:</u>	Lecture Mid Term 1	100 pts
	Lecture Mid Term 2	100 pts
	Lab Mid Term	100 pts
	Lab Final	200 pts
	Participation (Field and Lab Work)	100 pts

Expectations:

1. Regular attendance in lecture and lab is expected. You will need the entire 3 hour lab period every time. Lab exams cannot be made up. The final exam for lab will cover material from the entire course.
2. There are weekly readings from the text and the lab manual. There are also weekly readings from the primary literature. Some exam questions will derive from this material.
3. Field trips. All students are expected to attend the field trips.
4. All students are expected to adhere to the UC Berkeley honor code: "As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others." (see <http://asuc.org/honorcode/index.php>).

Required Texts:

Feldhamer, G.A., L.C. Drickamer, S.H. Vessey, J.F. Merritt, and C. Krajewski, 2007. Mammalogy, Third Edition. Johns Hopkins University Press, Baltimore.
Patton, J.L. and Kelt, D.A. 2014. Lawlor's Handbook to the Orders and Families of Living Mammals. (Available on course website)

Weekly Readings Available on Course Website
Check the course website for changes!

Sept 2 - Mammalian origins

Required reading:

Hopson, J. 1973. Endothermy, small size, and the origin of mammalian reproduction. *Am. Nat.* 107: 446-452.

Additional optional readings:

Hopson, J. 1950. The origin of the mammalian middle ear. *Am Nat.* 6: 437-450.

Crompton, A.W., and P. Parker. 1978. Evolution of the mammalian masticatory apparatus. *Amer. Scientist* 66: 192-201.

Rowe, T.B. T.E. Macrini, and Z.H. Luo. 2011. Fossil evidence on the origin of the mammalian brain. *Science* 332: 955-957.

Northcutt, R.G. 2011. Evolving large and complex brains. *Science* 332: 926-927.

Sept. 9 - Mammalian origins

Required reading:

Luo, Z.-X. 2007. Transformation and diversification in early mammal evolution. *Nature*: 450: 1011-1019.

Additional optional readings:

Pond, C.M. 1977. The significance of lactation in the evolution of mammals. *Evolution* 31: 177-199.

Farmer, C. G. 2000. Understanding endothermy and other convergent features of birds and mammals. *American Naturalist* 155: 4326-334.

Kemp, T.S. 2006. The origin of mammalian endothermy: a paradigm for the evolution of complex biological structure. *Zool. J. Linn. Soc.* 147: 473-488.

Sept. 11 - Zoonoses (read before first field trip)

Required reading:

Kelt, D.A., M.S. Hafner, and The American Society of Mammalogists Ad Hoc Committee for Guidelines on Handling Rodents in the Field. 2010. Updated guidelines for protection of mammalogists and wildlife researchers from Hantavirus pulmonary syndrome (HPS). *J. Mammalogy* 91: 1524-1527.

Childs, J.E., J.N. Mills, and G.E. Glass. 1995. Rodent borne hemorrhagic fever viruses: a special risk for mammalogists? *J. Mamm.* 76: 664-680.

Krebs, J.W., M.L. Wilson, and J.E. Childs. 1995. Rabies - epidemiology, prevention, and future research. *J. Mamm.* 76: 681-694.

Gage, K.L., R.S. Ostfeld, and J.G. Olson. 1995. Nonviral vector-borne zoonoses associated with mammals in the United States. *J. Mamm.* 76: 695-715.

Sept. 16 - Locomotion

Required reading:

Wilson, A.M., J.C. Lowe, K. Roskilly, P.E. Hudson, K.A. Golabek, and J.W. McNutt, 2013. Locomotion dynamics of hunting in wild cheetahs. *Nature* 498: 185-189.

Additional optional readings:

Biewener, A.A. 1990. Biomechanics of mammalian terrestrial locomotion. *Science* 250: 1097-1103.

Sept 23 – The mammalian radiation

Required reading:

Springer, M.S., M.J. Stanhope, O. Madsen, and W.W. deJong. 2004. Molecules consolidate the placental mammal tree. *Trends in Ecology and Evolution* 19: 430-438.

Additional optional readings:

Meredith et al. 2011 Impacts of the Cretaceous terrestrial revolution and KPg extinction on mammal diversification. *Science* 334: 521-524.

Sept. 30 - Physiological ecology

Required reading:

Schmidt-Nielsen, K. 1979. *Desert Animals; Physiological Problems of Heat and Water*, (Chapter 11). Dover Publications, Inc. New York.

Additional optional readings:

Tracy, R. L., and G. E. Walsberg. 2002. Kangaroo rats revisited: re-evaluating a classic case of desert survival. *Oecologia* 133:449-457.

Oct. 7 - Reproduction

Required reading:

Thom, M.D., D.D.P. Johnson, and D.W. Macdonald. 2004. The evolution and maintenance of delayed implantation in the mustelidae (Mammalia: Carnivora). *Evolution* 58: 175-183.

Additional optional readings:

Ferguson, S.H., J.W. Higson, and S. Lariviere. 2006. Does seasonality explain the evolution and maintenance of delayed implantation in the family Mustelidae (Mammalia: Carnivora)? *Oikos* 114: 249-256.

Renfree, M.B., T.A. Hore, G. Shaw, J.A. Marshall Graves, and A.J. Pask. 2009. Evolution of genomic imprinting: insights from Marsupials and Monotremes. *Annual Review of Genomics and Human Genetics* 10: 241-262.

Oct 14 - No assigned readings

Oct. 21 - Behavior and social systems

Required reading:

Lim, M.M., Z. Wang, D.E. Olazabal, X. Ren, E.F. Terwilliger, and L.J. Young. 2004. Enhanced partner preference in a promiscuous species by manipulating the expression of a single gene. *Nature* 429: 754-757.

Additional optional readings:

Lukas, D., and T.H. Clutton-Brock. 2013. The evolution of social monogamy in mammals. *Science* 341: 526-530.

Jarvis, J.U.M., M.J. O'Riain, N.C. Bennett, and P.W. Sherman. 1994. Mammalian eusociality: a family affair. *Trends Ecol. Evol.* 9: 47-51.

Clutton-Brock, T.H., and P.H. Harvey. 1978. Mammals, resources and reproductive strategies. *Nature* 273: 191-195.

Oct. 28 - Population ecology

Required reading:

Krebs, C.J., S. Boutin, R. Boonstra, A.R.E. Sinclair, J.N.M. Smith, M.R.T. Dale, K. Martin, and R. Turkington. 1995. Impact of food and predation on the snowshoe hare cycle. *Science* 269: 1112-1115.

Additional optional reading:

Stenseth, N.C. 1995. Snowshoe hare populations: squeezed from below and above. *Science* 269: 1061-1062.

Nov. 4 - Community ecology

Required reading:

Valone, T.J., and J.H. Brown. 1995. Effects of competition, colonization, and extinction on rodent species diversity. *Science* 267: 880-883.

Additional optional reading:

Brown, J.H., and E.J. Heske. 1990. Control of a desert-grassland transition by a keystone rodent guild. *Science* 250: 1705-1707.

Nov. 11 - Population genetics and geographic variation

Required reading:

Daly, J.C., and J.L. Patton. 1990. Dispersal, gene flow, and allelic diversity between local populations of *Thomomys bottae* pocket gophers in the coastal ranges of California. *Evolution* 44: 1283-1294.

Additional optional reading:

Anderson, T.M., B.M. vonHoldt, S.I. Candillee, M. Musiani, C. Greco, D.R. Stahler, D.W. Smith, B. Padhukasahasram, E. Randi, J.A. Leonard, C.D. Bustamante, E.A. Ostrander, H. Tang, R.K. Wayne, and G.S. Barsh. 2009. Molecular and evolutionary history of melanism in North American gray wolves. *Science* 323: 1339-1343.

Nachman, M.W., Hoekstra, H.E., and S.L. D'Agostino, 2003. The genetic basis of adaptive melanism in pocket mice. *Proc. Nat. Acad. Sci. USA* 100: 5268-5273.

Nov. 18 – Speciation and Zoogeography

Required reading:

Patton, J.L., and M.F. Smith. 1992. MtDNA phylogeny of andean mice: a test of diversification across ecological gradients. *Evolution* 46: 174-183.

Additional optional reading:

Marshall, L.G. 1988. Land mammals and the great American interchange. *American Scientist* 76: 380-388.

Brown, J.H. 1971. Mammals on mountaintops: nonequilibrium insular biogeography. *American Naturalist* 105: 467-478.

Nov 25 - Zoogeography

Required reading:

Moritz, C., J.L. Patton, C.J. Conroy, J.L. Parra, G.C. White, and S.R. Beissinger, 2008. Impact of a century of climate change on small-mammal communities in Yosemite National Park, USA. *Science* 322: 261-264.

Journals Specifically Oriented to Mammals

Acta Theriologica	Polish journal
Australian Mammalogy	Publication of the Australian mammal society
Bat Research News	Informal newsletter on bat biology
Bat Conservation Newsletter	Publication of Bat Conservation International
Folia Primatologia	Swiss journal, primate biology
Journal of Mammalogy	Publication of the American Society of Mammalogists
Journal of Mammalogical Society of Japan	Japanese journal
Mammalia	French journal
Mammal Review	Publication of the British Mammal Society
Theriologia	Russian journal
Zeitschrift fur Säugetierkunde	German journal

Major mammalian literature reviews (other than BioAbstracts or Zoo Record):

Wildlife Review (published by the US Fish and Wildlife Service)

Recent Literature in Mammalogy (produced by the American Society of Mammalogists)

Additional General References

- Anderson, S., and J.K. Jones, Jr. (eds.) 1984. Orders and Families of Recent mammals of the world. John Wiley & Sons.
- Eisenberg, J.F. 1981. The mammalian radiations. An analysis of trends in evolution, adaptation, and behavior. The Chicago University Press.
- Elbroch, M.E., 2006. Animal skulls: A guide to North American species. Stackpole Books.
- Glass, B.P. 1972. A key to the skulls of North American mammals. 2nd Edition. Oklahoma State University.
- Hall, E.R. 1981. The mammals of North America, vol. 1 and 2. John Wiley & Sons.
- Jameson, E.W. Jr, and H.J. Peeters, 2004. Mammals of California. University of California Press.
- Kielan-Jaworowska, Z, R.L. Cifelli, and Z.X. Luo, 2004. Mammals from the age of dinosaurs. Columbia University Press, New York.
- Macdonald, D. (ed.) 2009. The encyclopedia of mammals. 2nd revised edition. Oxford University Press.
- Nowak, R.M. 1999. Walker's Mammals of the World. 6th edition. Johns Hopkins Univ Press.
- Rose, K.D. and J.D. Archibald, eds. 2005. The rise of placental mammals. Johns Hopkins University Press.
- Simpson, G.G. 1945. The principles of classification and a classification of mammals. Bulletin of the American Museum of Natural History, 85: 1-350.
- Ungar, P.S. 2010. Mammal teeth: origin, evolution, and diversity. Johns Hopkins University Press, Baltimore.
- Vaughn, T.A., J.M. Ryan, and N.J. Czaplewski. 2010. Mammalogy, 5th Edition. Jones & Bartlett Publishers.
- Wilson, D.E. and D.M. Reeder (eds). 2005. Mammal species of the world. 3rd ed. Johns Hopkins University Press, Baltimore.