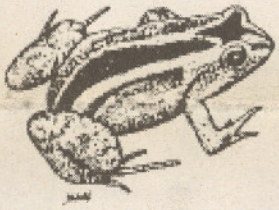


NEW Fall 2000 Courses

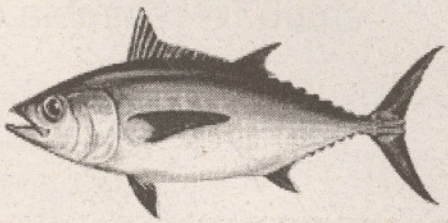
(Graduate level, open to Undergrads)

1.) Herpetology ENVB 4210

Instructors:	Dr. Zoltan Takacs/Dr. Ben Evans
Location:	Schermerhorn Extension Rm 1016
Day/Time:	Tuesdays 1:30-3:30pm
Call #:	57850

2.) Fish Biodiversity ENVB 4660

Instructor:	Dr. Melanie Stiassny
Location:	Schermerhorn Extension Rm 1016
Day/Time:	Thursdays 1:30-3:30pm
Call #:	81651



For more information, please e-mail kkh8@columbia.edu or call 854-8180.

CERC – Center for Environmental Research and Conservation

Course Website

HERPETOLOGY

The Biology of Amphibians & Reptiles

Evolution, biogeography, behavior,
ecology, physiology, field techniques,
& conservation

Columbia University

Center for Environmental Research & Conservation and
Department of Earth & Environmental Sciences

Environmental Biology ENVB-W4210 section 001
Fall 2000, Call Number 57850
graduate/undergraduate

Download Herpetology course syllabus

Instructors:

Dr. Zoltan Takacs
(general herpetology and reptiles)
Center for Environmental Research & Conservation

Dr. Ben Evans
(amphibians and conservation biology)
Center for Environmental Research & Conservation

Columbia Earth Institute
Columbia University
E-mail: zt2@columbia.edu
Tel: (212) 854 0051

Columbia University
E-mail: ben@cerc.columbia.edu
Tel: (212) 854 8068

Course Announcements & Updates

- Office hours for consultation:
  Julian Favovich (TA): Tuesdays 11:30-13:30
  Zoltan Takacs and Ben Evans: Wednesdays 10:00-12:00
- Guidelines for the NSF Proposal exam
- Additional reference for the September 19 class (Biogeography/ Ben) is:
  Morrone JL and Crisci, JV (1995) Historical biogeography: introduction to methods. Ann.Rev.Ecol.Syst. 26:373-401.

- Additional references for the October 3 class (Ecology/Ben) are:
  Pough; Chapter 13, 14
  Prohl, H and Hodl, W. (1999) Parental investment, potential reproductive rates, and mating system in the strawberry dart-poison frog, Dendrobates pumilio. Behav. Ecol. and Sociobiol. 46:215-220, and
  Hoffman, EA and Blouin, MS (2000) A review of colour and pattern polymorphisms in anurans. Biol. J. Linn.Soc. 70:633-665.

Location: Schermerhorn Extention 10th floor, Room 1016
location on CU campus map
(One lecture at the American Museum of Natural History Department of Herpetology directions)

Time: **Fall 2000, Tuesdays 1:30-3:30 PM**

Class starts: Tuesday, September 5, 2000

Open to:	Columbia College, Engineering and Applied Science, General Studies, Continuing Education and Special Programs, Graduate School of Arts and Science, School of the Arts, Barnard, Engineering and Applied Science: Graduate. Students from other New York Metro area schools contact to instructors for special arrangements.
Course website:	http://cerc.columbia.edu/herpetology
Syllabus:	Download Herpetology course syllabus
Non-CU Students:	Contact your Office of the Registar for registering this course and/or Ms. Karen K. Hwang, CERC Student Affairs Coordinator, *Tel:* (212) 854 8180, *E-mail:* kkh8@columbia.edu.

Links to start

Columbia University:	Columbia University Columbia University - Office of the Registar Center for Environmental Research and Conservation (CERC) Department of Earth & Environmental Sciences
Publications:	Uncover NCBI PubMed NCBI Databases Columbia University Science Library eJournals Columbia University Electornic Journals Amphibia - Zoological Record Reptilia - Zoological Record Zoo Book Sales Bibliography of crocodilian biology Herplit NHBS Amazon

Collections:
AMNH Herpetology
CAS Herpetology
UC Berkeley MVZ Herpetology
FMNH Herpetology
Harvard MCZ Herpetology
Univ Michigan Mus Zoology, Herpetology
Kansas Univ NHM Herpetology
OMNH Herpetology
Florida MNH Herpetology
NHM London, Zoology

Societies:
Society for the Study of Amphibians and Reptiles (SSAR)
The Herpetologists' League (HL)
American Society of Icthyologists and Herpetologists (ASIH)
2000 Joint Annual Meetings of ASIH, AES, NIA, HL, CAH, and SSAR

Database Resources:
AMNH Search the Amphibian Species of the World Database
EMBL Reptile Database
Herpetology (Biosciences) (extensive link collection in herpetology)
Australian Herpetological Directory
Association of Reptilian and Amphibian Veterinarians
ASIH/HL/SSAR Guidelines for Use of Live Amphibians and Reptiles
Crocodile Specialist Group
HerpMed
Caribherp Database
Herp Index (extensive link collection in herpetology)
Kingsnake.com (captive resources and forums)

Other resources:
Amphibian embryology tutorial
How to preserve reptiles and amphibians for study, UMMZ
Herp labs
Careers in herpetology, ASIH

General biology:	NSF
	NIH
	U.S.Fish & Wildlife
Search engines:	Altavista
	Yahoo
	ODP

Course title:	**Herpetology**
Instructors:	Dr. Zoltan Takacs and Dr. Ben Evans
Term:	Fall, 2000
Time:	Tuesdays 1330-1530
Location:	Schermerhorn Extension 10th floor (CERC), Room 1015 One lecture at the American Museum of Natural History
Credits:	3
Course level:	4000 (Graduate, open for undergraduates)
Course website:	http://cerc.columbia.edu/herpetology

Instructors' contact

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Teaching Assistant's contact

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Tel: (212) 769 5856

Rationale

This course will provide students with a foundation of knowledge on the science of amphibians and reptiles. Students will gain the ability to critically review published research and independently design, conduct, and interpret their own research on amphibians and reptiles. Concepts taught in this course also will have broad applicability to other areas of natural science including systematics, developmental biology, neurobiology, ecology, and endocrinology.

Course description

The course will be divided into three parts. A first portion will explore amphibian and reptilian evolution, diversification, global biogeography, microhabitats, and evolutionary and behavioral ecology. A second portion will explore physiological adaptations of amphibians and reptiles including biomechanics, temperature and water regulation, energetics, endocrinology, neurobiology, communication systems, reproduction and life history, predator/prey interactions, and biomedical aspects of poisons and venoms. A final portion will focus on conservation management, environmental policy, and monitoring of amphibians and reptiles populations.

Course format, requirements, and readings

Herpetology class meets once a week for a two-hour lecture; there will be 13 lectures during the semester. Each lecture is focused on an area of herpetology; relevant background reading text and articles are indicated in the course schedule. Research articles will emphasize concepts for each lecture and introduce class to experimental approaches in herpetological research. Students will prepare for the class by completing reading assignments prior to each lecture.

Students should have at least one class of introductory biology.

Background readings are assigned from Pough FH et al (1998) *Herpetology*. Prentis Hall, Upper Saddle River, NJ.

Supplementary readings can be found in Zug GR (1993) *Herpetology, an introductory biology of amphibians and reptiles*. Academic Press, San Diego, CA. and Duellman WE, and Trueb L (1994) *Biology of Amphibians*. The Johns Hopkins University Press, Baltimore, MD.

Course website

The website http://www.cerc.columbia.edu/herpetology will contain a course syllabus and additional information related to the course such as links to herpetological resources (university and museum collections, databases, literature, societies and meetings) that can be utilized for preparation for lectures and exams.

Grading

Grading will be based on a term paper (50%) and a final exam (50%). The term paper will be a research proposal based on actual NSF guidelines. The proposed research will test a significant hypothesis in herpetology, and should be 5-10 pages in length. The final exam will be take-home and will test comprehension and application of concepts presented in the course.

Course schedule

Date:	Sept 5, 2000
Title:	**Introduction to herpetology**
Lecturer:	Zoltan Takacs and Ben Evans
Summary:	Introduction to the course curriculum and herpetology, scientific resources in herpetology, evolution of tetrapods, tetrapod sister taxa, phylogeny of amphibians, reptiles, relationships to birds and mammals; introduction to diversity of amphibians and reptiles, field and laboratory research techniques, live animal and tissue collection, reptiles and amphibians as model organisms/systems in biomedical ecological and evolutionary studies.
Text:	Pough et al Chapters 1, 2
Articles:	Milner, A. R. (1993) The Paleozoic relatives of Lissamphibians. Herpetological Monographs 7:8-27. Hedges, S. B. and Maxon, L. R. (1993) A molecular perspective on Lissamphibian phylogeny. Herpetological Monographs 7: 27-42. Losos JB, Warheit KI, Schoener TW (1997) Adaptive differentiation following experimental island colonization in Anolis lizards. Nature 387, 70. Menez, A. (1998) Functional architectures of animal toxins: a clue to drug design? Toxicon 36, 1557-1572. Secor SM, Diamond J (1998). A vertebrate model of extreme physiological regulation. Nature 395, 659-662.
Date:	Sept 12, 2000 *(location: AMNH)*
Title:	**Evolution and systematics of amphibians and reptiles**
Lecturer:	Ben Evans and Zoltan Takacs
Summary	Current concepts in amphibian and reptile evolution will be explored to the family level using museum specimen. Characters that define taxa will be illustrated, areas of disagreement will be discussed.
Text:	Pough et al Chapters 3, 4
Articles:	Feller AE Hedges SB (1998) Molecular evidence for the early history of living

amphibians. Mol Phyl Evol 9, 509-516.

Ford LS and Cannatella DC (1993) The major clades of frogs. Herp Mono 7, 94-117.

Hedges SB Poling LL (1999) A molecular phylogeny of reptiles. Science 283, 998-1001.

Heise PJ Maxson LR Dowling HG Hedges SB (1995) Higher-level snake phylogeny inferred from mitochondrial DNA sequences of 12S rRNA and 16S rRNA genes. Mol Biol Evol 12, 259-265.

Zardoya R, Meyer A (1998) Complete mitochondrial genome suggests diapsid affinities of turtles. Proc Natl Acad Sci USA 95, 14226-14231.

Date: Sept 19, 2000
Title: **Biogeography of amphibians**
Lecturer: Ben Evans
Summary: Concepts and methodology of terrestrial biogeography and review paleogeology of earth through time. Having built a framework for faunal evolution, specifics of evolution of amphibians will be discussed including differentiation from fishes, branching off of reptiles, and global diversification.
Text: Pough et al Chapters 2, 3
Articles: Manusson NE (1997) Biogeography of frogs: history as the magic bullet. J Biogeog 24, 251-252.

Phillips CA (1994) Geographic distribution of the mitochondrial DNA variants and the historical biogeography of the spotted salamander, Ambystoma maculatum. Evolution 48, 597-607.

Date: Sept 26, 2000
Title: **Biogeography of reptiles**
Lecturer: Zoltan Takacs
Summary: Temporal framework for radiation of extant reptiles, past and present patterns of distribution, effects of climate and vegetation, habitat utilization, microhabitats, composition of extant reptile faunas. Latitudinal and altitude gradients, distribution and species richness on islands, species-area relationships.
Text: Pough et al Chapters 2, 4
Articles: Bowen BW Clark AM Abreu-Grobois FA Chaves A Reichart HA Ferl RJ (1998) Global phylogeography of the ridley sea turtles (Lepidochelys spp.) as inferred from mitochondrial DNA sequences. Genetica 101, 179-89.

Caccone A Gibbs JP Ketmaier V Suatoni E Powell JR (1999) Origin and evolutionary relationships of giant Galapagos tortoises. Proc Natl Acad Sci USA 96, 13223-13228.

Petren K Case TJ (1998) Habitat structure determines competition intensity and invasion success in gecko lizards. Proc Natl Acad Sci USA 95, 11739-11744.

Radtkey RR Fallon SM Case TJ (1997) Character displacement in some Cnemidophorus lizards revisited: a phylogenetic analysis. Proc Natl Acad Sci USA 94, 9740-9745.

Date: Oct 3, 2000
Title: **Ecology of amphibians**
Lecturer: Ben Evans

Summary Ecology of amphibians including territoriality, feeding, cannibalism, preditor/prey interactions, r vs. k selection, ecological adaptation, amphibian community ecology, and species diversity.

Text: Pough et al Chapter 13, 14

Articles: Barthalmus GT Zielinski WJ (1988) Xenopus skin mucus induces oral dyskinesias that promote escape from snakes. Pharmacology, Biochemistry Behavior 30, 957-959.

Daly JW Myers CW (1967) Toxicity of Panamanian poison frogs (Dendrobates): some biological and chemical aspects. Science 156, 970-973.

Daly JW Myers CW Whittaker N. (1987) Further classification of skin alkaloids From neotropical poison frogs (Dendrobatidae), with a general survey of toxic/noxious substances in the amphibia. Toxicon 25, 1023-1095.

Emerson SB (1991) The ecomorphology of Bornean tree frogs (family Rhacophoridae) Zool J Linn Soc 101, 337-357.

Stearns SC (1976) Life-history tactics: a review of the ideas. Quarterly Review Biol 51, 3-47.

Date: Oct 10, 2000

Title: **Ecology of reptiles**

Lecturer: Zoltan Takacs

Summary Behavioral and evolutionary ecology of reptiles. Effects of the physical and biotic environment, foraging ecology, predation, thermal ecology, ecomorphs. Population size and density, home range, niche utilization, competition. Reptiles as model system in testing general ecological hypotheses.

Text: Pough et al Chapters 13, 14

Articles: Beck DD (1990) Ecology and behavior of the gila monster in southwestern Utah. J. Herpetol 24, 34-68.

Greene HW (1981) Coral snake mimicry: does it occur? Science 213, 1207-1212.

Madsen T Shine R (1996) Seasonal migration of predators and preys: a study of pythons and rats in tropical Australia. Ecology 77, 149-156.

Vitt LJ, Caldwell JP, Zani PA, Titus TA (1997) The role of habitat shift in the evolution of lizard morphology: evidence from tropical Tropidurus. Proc Natl Acad Sci USA 94, 3828-3832.

Wikelski M Thom C (2000) Marine iguanas shrink to survive El Nino. 403, 37.

Wikelski M Trillmich F (1997) Body size and sexual size dimorphism in marine iguanas fluctuate as a result of opposing natural and sexual selection: an island comparison. Evolution 51, 922.

Date: Oct 17, 2000

Title: **Physiology of amphibians I: Physiological regulation and Communication**

Lecturer: Ben Evans

Summary: Two major topics: physiological regulation and communication in amphibians. The first will investigate amphibian temperature and water regulation, cardiovascular system, and physiological studies of movement, energy expenditure. The second will explore different forms of amphibian communication and its function including amphibian phonotaxis, mate recognition, chemotaxis,

energy costs of communication, and sexual selection.

Text: Pough et al Chapters 11, 12

Articles: Jorgensen CB (1997) 200 years of amphibian water economy: from Robert Townson to the present. Biol Reviews Cambridge Philosophical Soc 72, 153-237.

Ryan MJ Wilczynski W (1988) Coevolution of sender and receiver: effect on local mate preference in cricket frogs. Science 240, 1786-1788.

Ryan MJ (1990) Sensory systems, sexual selection, and sensory exploitation. Oxford Surveys in Evolutionary Biol 7:157-195.

Tobias ML Viswanathan SS Kelley DB (1998). Rapping, a female receptive call, Initiates male-female duets in the South African clawed frog. Proc Natl Acad Sci USA 95, 1870-1875.

Wever EG (1975) The caecilian ear. Journal of Experimental Zoology. 191(1):63-72.

Withers PC Hillman SS (1988) A steady-state model of maximal oxygen and carbon dioxide transport in anuran amphibians. J Applied Physiol 64(2):860-8.

Wood SC Weber RE Maloiy GM Johansen K (1975) Oxygen uptake and blood respiratory properties of the caecilian Boulengerula taitanus. Respiration Physiol 24, 355-363.

Date: Oct 24, 2000

Title: **Physiology of amphibians II: Reproduction and mating systems**

Lecturer: Ben Evans

Summary: Topics to be covered include sex determination, development, metamorphosis, direct development, and the evolutionary basis for different life history strategies.

Text: Pough et al Chapter 7

Articles: Grafe TU Linsenmair KE (1989) Protogynous sex change in the reed frog Hyperolius viridiflavus. Copeia 4, 1024-1029.

Hayes TB (1998) Sex determination and primary sex differentiation in amphibians: Genetic and developmental mechanisms. J Experimental Zool 281, 373-399.

Kelley DB (1996) Sexual diferentiation in Xenopus laevis. In Biology of Xenopus (Kobel and Tinsley, Eds.) Clarendon Press, Oxford.

Date: Oct 31, 2000

Title: **Physiology of amphibians III: Neurobiology and endocrinology**

Lecturer: Ben Evans

Summary: Lecture will discuss aspects of the neuroendocrinological system of amphibians and contrast these mechanisms with those of other vertebrates. Case studies of Pipa, Xenopus, and Hyperolius will be employed.

Articles: Hayes TB Menendez KP (1999) The effect of sex steroids on primary and Secondary sex differentiation in the sexually dichromatic reedfrog (Hyperolius argus: Hyperolidae) from the Arabuko Sokoke Forest of Kenya. General & Comparative Endocrinology. 115, 188-99.

Robertson JC Kelley DB (1996) Thyroid hormone controls the onset of androgen sensitivity in the developing laryna of Xenopus laevis. Dev. Biol. 176, 108-123.

Schmidt A Wake DB Wake MH (1996) Motor nuclei of nerves innervating the tongue and hypoglossal musculature in a caecilian (amphibia:gymnophiona), as revealed by HRP transport. Journal of Comparative Neurology. 370, 342-349.

Wake MH (1993) Evolutionary diversification of cranial and spinal nerves and their targets in the gymnophione amphibians. Acta Anatomica. 148, 160-168.

Date: Nov 7, 2000 No lecture: University holiday.

Date: Nov 14, 2000
Title: **Physiology of reptiles I: functional morphology, temparature and water regulation, energetics**
Lecturer: Zoltan Takacs
Summary: Functional morphology of the reptilian body, amniote egg, evolutionary aspect and biomechanics of terrestrial and aquatic locomation, evolution and diversity of feedig apparatus, digestive system. Respiration, blood, circulation, temperature/water effect and regulation, salt glands, energetics.
Text: Pough et al Chapters 5, 6, 8, 9
Articles: Cohn MJ Tickle C (1999) Developmental basis of limblessness and axial patterning in snakes. Nature 399, 474-479

Nagy KA Degen AA (1988) Do desert geckos conserve energy and water by being nocturnal? Physiol. Zool. 61, 495-499.

Owerkowicz T Farmer CG Hicks JW Brainerd EL (1999) Contribution of gular pumping to lung ventilation in monitor lizards. Science 284, 1661-1663.

Pough FH (1980) The advantages of ectothermy for tetrapods. Amer. Nat 1515, 92-112.

Schwenk K (1994) Why snakes have forked tongue. Science 263, 1573-1577.

Date: Nov 21, 2000
Title: **Physiology of reptiles II: endocrinology, neurobiology and behavior**
Lecturer: Zoltan Takacs
Summary: Endocrine and neurological systems of reptiles. Sensory qualities, vibration and sound, light and vision. Feeding and diet composition, evolution and pharmacology of snake and helodermatid venom, defense and escape mechanisms. Physiological basis of orientation and navigation. Social behavior.
Text: Pough et al Chapters 9, 10, 11
Articles: Greene HW Burghardt GM (1978) Behavior and phylogeny: constriction in ancient and modern snakes. Science 200, 74-77.

Lohmann K Lohmann C (1996) Orientation and open-sea navigation in sea turtles. J Exp Biol 199, 73-81.

Okelo O (1986) Neuroendocrine control of physiological color change in Chameleo gracilis. Gen Comp Endocrinol 64, 305-311.

Schwenk K (1993) The evolution of chemoreception in squamate reptiles: a phylogenetic approach. Brain Behav Evol 41, 124-137.

Date: Nov 28, 2000
Title: **Physiology of reptiles III: reproduction and life history**
Lecturer: Zoltan Takacs

Summary: Sexual dimorphism, mate attraction and selection, reproductive cycles, modes of reproduction, gametogenesis and fertilization, development, and parental investment. Temperature dependent sex determination, parthenogenesis, defense of breeding site. Growth and longetivity, daily and seasonal activities. Hibernation and aestivation.

Text: Pough et al Chapters 7, 12

Articles: Janzen FJ (1994) Climate change and temperature-dependent sex determination in reptiles. Proc Natl Acad Sci USA 91, 7487-7490.

Janzen FJ Paukstis GL (1991) Environmental sex determination in reptiles: ecology, evolution, and experimental design. Q Rev Biol 66, 149-179.

Johnston CM Barnett M Sharpe PT (1995) The molecular biology of temperature-dependent sex determination. : Philos Trans R Soc Lond B Biol Sci 350, 297-303.

FitzSimmons NN, Limpus CJ, Norman JA, Goldizen AR, Miller JD, Moritz C (1997) Philopatry of male marine turtles inferred from mitochondrial DNA markers. Proc Natl Acad Sci USA 94, 8912-8917.

Madsen T Shine R Loman J (1992) Why do female adders copulate so frequently? Nature 355, 440.

Shine R, Bull, JJ (1979) The evolution of livebearing in lizards and snakes. American Naturalist 113, 905-923.

Western PS Harry JL Marshall Graves JA Sinclair AH (2000) Temperature-dependent sex determination in the American alligator: expression of SF1, WT1 and DAX1 during gonadogenesis. Gene 241, 223-232.

Date: Dec 5, 2000

Exam due: **Term paper (NSF proposal) due**

Exam out: **Distribution of Final exam (take home)**

Title: **Conservation**

Lecturer: Ben Evans

Summary: Conservation status of amphibians and reptiles including the hypothesized decline of amphibians, possible reasons for this decline such as UV radiation, pesticides, and habitat change, and the accuracy of this hypothesis. Use of amphibians as ecological indicators, their sensitivity to human activity, and their use as biogeographical indicators. It will also discuss methods in conservation research including trapping, specimen preservation, and genetic techniques.

Text: Pough et al Chapter 15

Articles: Blaustein AR Wake DB Sousa WP (1993) Amphibian declines: judging stability, persistence, and susceptibility of populations to local and global extinctions. Conservation Biology 8, 60-71.

Blaustein, AR and Wake, DB (1995) The puzzle of declining amphibian populations. Sci. Am. 272(4): 52-57.

Dodd CK Jr (1993) Snake conservation. In: Snakes, ecology and behavior, Siegel RA and Collins JT ed. 363-393, McGraw-Hill, New York.

Mittermeier RA Myers N, Thomsen JB (1998) Biodiversity hotspots and major tropical wilderness areas: approaches to setting conservation priorities. Conservation Biology 12(3): 516-520.

Pechmann JH Scott DE Semlitsch JP Caldwell LJ Vitt LJ and Gibbons W (1991) Declining amphibian populations: the problem of separating human impacts from natural populations. Science 253, 892-895.

Phillips K. (1990) Where have all the frogs and toads gone: an apparent decline of worldwide amphibian populations. Bioscience 40, 422-424.

Scott NJ Jr seigel RA (1992) The management of amphibian and reptile populations: species priorities and methodological and theoretical constraints. In: Wildlife 2001: Populations, McCullough DR and Barrett RH ed. 343-367, Elsevier Sci Publ, London.

Date: Dec 12, 2000
Exam due: **Final exam due**