NJIT BIOLOGY

Course Syllabus

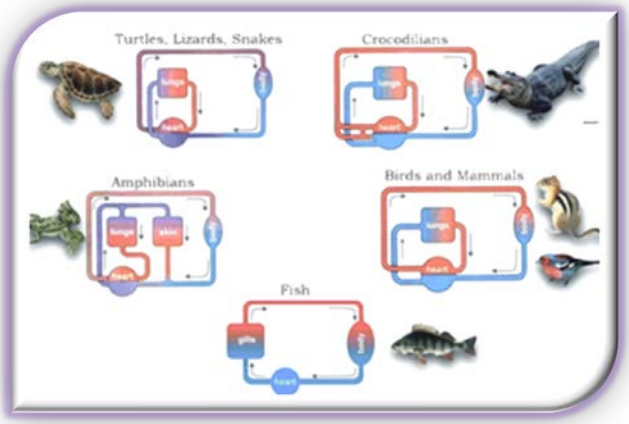
SPRING 2015

BIOLOGY 612-102: COMPARATIVE ANIMAL PHYSIOLOGY

INSTRUCTOR:	Dr. Daphne Soares	**EMAIL:**	soares@njit.edu
OFFICE:	Central King Bldg.	**OFFICE HOURS:**	M: 5:00pm–6:00pm
COURSE SCHEDULE:	M: 6:00pm–9:05pm	**COURSE LOCATION:**	CKB 317

PURPOSE:

We will use a comparative approach to examine the physiology of animals including major physiological systems. Topics to be covered include metabolic, temperature, osmotic and ionic regulation; respiration and circulatory transport, digestive, muscle, nervous, and locomotor systems; endocrine regulation and biological rhythms. We will further examine how physiological systems are integrated and thus allow animals to respond, physiologically, in different environments. This course will explore how animals, from invertebrates to vertebrates, function from the cellular to the organism level. The study of the structure and function of the various organs provides insight into how animals survive extreme environments and how they respond to changes in their environment. The comparative approach shows that the underlying physiological principles that govern life are common to all animals and yet animals have evolved unique and sometimes startling physiological solutions to problems posed by their particular environments.



MATERIALS:

We will be using assigned primary literature weekly as well as recommended textbook for reference: Environmental Physiology of Animals, 2nd Edition © 2004 By Willmer, Stone and Johnson. Wiley-Blackwell; ISBN: 978-1405107242.

CODE OF ACADEMIC INTEGRITY: Each student in this course is expected to follow the Code of Academic Integrity. The Code is explained on: http://www.njit.edu/education/pdf/academic-integrity-code.pdf.

GRADING POLICY: Grades will be based participation, presentation and writing assignments.

COMPONENT	POINTS
Participation	25pts
Presentation	25pts
Essay Mid-Term	25pts
Essay Final	15pts
TOTAL	**320pts**

GRADING SCALE	
A	88-100
B+	81-87
B	74-80
C+	67-73
C	60-66
F	0-59

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WRITING ASSIGNMENTS:

Writing is the currency of science. We will have two essays scheduled for the semester (right before spring break and after the last class). Essays are based on the previous topics discussed in class. Your task is to pick one article from the primary literature and summarize it in one page. Make sure you identify the hypothesis. I will give feedback to all assignments as needed.

PRESENTATIONS:

In this course we will be discussing primary literature. ALL students have to read the paper but one student will present it. If you have never presented a paper in a journal club or class, or are uncomfortable doing it, you should meet with me ahead of time and I'll help you prepare.

LEARNING OUTCOMES: This is a "curiosity-based" graduate-level course that seeks to expand student's knowledge in fields of their own interest. The educational goals of this course are to improve students' ability to find, understand, integrate, and present primary scientific data, hypotheses, and methodologies.

1.) Understand important physiological challenges animals face, how those challenges vary in relation to the animals' environment, and the processes by which animals deal with these challenges.

2.) Identify and describe structural differences of major physiological systems that characterize different taxonomic groups of animals.

3.) Relate physiological processes, from the biochemical to the system level, to the function of the entire organism in its environment.

4.) Develop an understanding of current research topics in animal physiology using the primary literature and to develop research questions and methodology to address these questions.

COURSE SCHEDULE:

WEEK	LECTURE TOPICS	READINGS & ASSIGNMENTS
Jan. 26	**Introduction:** Course overview, administrative issues, and themes in physiology, animal form and function. How to make a presentation.	
Feb. 2	**Marine Life:** ▪ Ionic and osmotic adaptation ▪ Thermal adaptation	DeVries A. (1982) Biological antifreeze agents in coldwater fishes. Comparative Biochemistry and Physiology Part A: Physiology Volume 73, Issue 4, 1982, Pages 627–640
Feb. 9	**Marine Life:** ▪ Respiratory adaptation ▪ Reproductive and life-cycle adaptation	Marshall D and Morgan S (2011) Ecological and Evolutionary Consequences of Linked Life-History Stages in the Sea. Current Biology 21(18) R718-R725.
Feb. 16	**Marine Life:** ▪ Depth problems, buoyancy and locomotion ▪ Sensory issues: marine signaling	Sato K, Aoki K, Watanabe YY and Miller PJO (2012). Neutral buoyancy is optimal to minimize the cost of transport in horizontally swimming seals. Scientific reports 3, article number 2205

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COURSE SCHEDULE (CONT.):

WEEK	LECTURE TOPICS	READINGS & ASSIGNMENTS
Feb. 23	**Marine Life:** ▪ Feeding and being fed on ▪ Secondary invasion of the seas: marine vertebrates	Taylor M (2000) Functional significance of bone ballastin in the evolution of buoyancy control strategies by aquatic tetrapods. Historical Biology: An International Journal of Paleobiology 14 (1-2), 15-31
Mar. 2	**Fresh Water:** ▪ Ionic and osmotic adaptation ▪ Thermal adaptation ▪ Respiratory adaptation	Bridges CR (1988) Respiratory Adaptations in Intertidal Fish; Integrative and Comparative Biology 28 (1)79-96.
Mar. 9	**Fresh Water:** ▪ Reproductive and life-cycle adaptation ▪ Mechanical, locomotory, and sensory systems	Ram JL, Fong PP and Garton DW (1996) Physiological Aspects of Zebra Mussel Reproduction: Maturation, Spawning, and Fertilization; Amer. Zool. 36 (3): 326-338
»	**SPRING BREAK – MARCH 16-20, 2015**	***Writing Assignment 1 DUE***
Mar. 23	**Special Aquatic Habitats:** ▪ Transient water bodies ▪ Extreme transience	McLachlan A, Ladle R (2001) Life in the puddle: behavioural and life-cycle adaptations in the Diptera of tropical rain pools. Biol Rev Camb Philos Soc. 2001 Aug; 76(3):377-88.
Mar. 30	**Special Aquatic Habitats:** ▪ Osmotically peculiar habitats ▪ Thermally extreme water	E. 2012 Adaptation of teleosts to very high salinity. Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology; 163 (1) 1–6
Apr. 6	**Terrestrial Life:** ▪ Ionic and osmotic adaptation ▪ Thermal adaptation	Schmitz H (1994) Thermal characterization of butterfly wings—1. Absorption in relation to different color, surface structure and basking type Journal of thermal biology 19(6) 403-412
Apr. 13	**Terrestrial Life:** ▪ Respiratory adaptation ▪ Reproductive and life-cycle adaptation	Jew CJ, Wegner NC, Yanagitsuru Y, Tresguerres M and Graham JB (2013) Atmospheric Oxygen Levels Affect Mudskipper Terrestrial Performance: Implications for Early Tetrapods. Integrative Comp Biol doi: 10.1093/icb/ict034
Apr. 20	**Terrestrial Life:** ▪ Mechanical, locomotory, and sensory systems	Full RJ, Zuccarello DA and Tullis A (1990) Effect of variation in form on the cost of terrestrial locomotion. J Exp Biol 150, 233-246.
Apr. 27	**Extreme Terrestrial Habitats:** ▪ Hot and dry habitats: deserts ▪ Very cold habitats	Tekei Y, Bartolo RC, Fujihara H, Ueta Y and Donald JA (2012) Water deprivation induces appetite and alters metabolic strategy in Notomys alexis: unique mechanisms for water production in the desert. *Proc. R. Soc. B* 7 July 2012 vol. 279 no. 1738 2599-2608
May 4	**Extreme Terrestrial Habitats:** ▪ High-altitude habitats ▪ Aerial habitats ***Second Paper DUE***	Scott GR (2011) Elevated performance: the unique physiology of birds that fly at high altitudes. J Exp Biol 214, 2455-2462.
FINALS	**FINAL EXAM WEEK: MAY 8-14, 2015**	