NJIT BIOLOGY

Course Syllabus

SPRING 2020

BIOLOGY 345 - 002: COMPARATIVE PHYSIOLOGY

INSTRUCTOR:	Dr. Daphne Soares,	**EMAIL:**	soares@njit.edu
OFFICE:	428G CKB	**OFFICE HOURS:**	Tues.: 11:30-12:30 pm or by appointment
COURSE SCHEDULE:	T & R: 10:00am-11:20am [CKB 313]	**COURSE WEBSITE:**	https://canvas.njit.edu/

COURSE DESCRIPTION:

Comparative physiology is the study of function across levels of organization, from subcellular through organismal, in order to reveal physiological homologies and patterns of physiological adaptation to various environments. Physiology combines information about physical and chemical processes with organismal structure in order to understand how organisms evolved their functional characteristics and how they stay alive in the face of constantly changing internal and external environments. The principal objective of this course is to provide students with the state of the art of our current understanding of animal function in whole organisms, their organ systems, organs, and component tissues. This course will focus more on patterns of adaptation than on the classical phylogenic approach of revealing homologies in taxa. Emphasis will be on function as it relates to the survival of the organism and its adaptation to its environment. Traditional undergraduate physiology courses tend to be biased toward physiological principles illustrated in terrestrial mammalian vertebrates. This course will broaden this approach and illustrate these same physiological principles through an examination of a wide variety of animal phyla. Thus, the common themes of physiological adaptation of both vertebrate and invertebrate animals to their environment will be stressed, and the unique aspects of each will be discussed where appropriate.

PREREQUISITES: R120:340 or BIOL 340 Mammalian Physiology OR R120:141 Anatomy and Physiology

COURSE MATERIALS: We will be using assigned primary literature weekly as well as recommended textbook for reference: Environmental Physiology of Animals, 2nd edition. Willmer, Stone and Johnson. 2005. Blackwell Publishing.

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

COMPONENT	POINTS
Student Survey 1st day of class (4%)	10 points
Quizzes (12) 10 points each (48%)	120 points
Leading a discussion (8%)	20 points
Participation (4%)	10 points
Exam 1 (12%)	30 points
Exam 2 (12%)	30 points
Final Exam (12%)	30 points
TOTAL	**250 points**

LETTER GRADE	SCALE
A	90-100%
B+	85 – 89%
B	80 – 85%
C+	75 – 80%
C	70 – 74%
D	60 – 69%
F	0-59%

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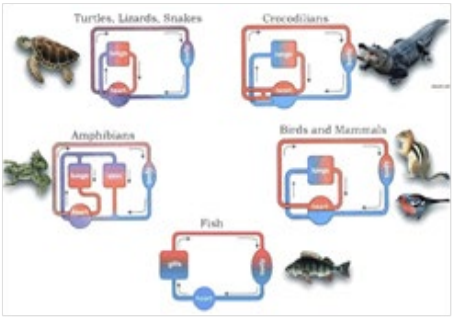
PRESENTATIONS: In this course, we will be discussing primary literature. ALL students have to read 2 papers a week but one/two student will be the discussion leader. If you have never presented a paper in a journal club or class, or are uncomfortable doing it, you should meet with me ahead of time and I'll help you prepare.

CODE OF ACADEMIC INTEGRITY: Each student in this course is expected to follow the Code of Academic Integrity. The Code is explained on Academic Integrity Code.

SCHEDULE AND COURSE OUTLINE: Please note that this is the proposed schedule. We may make changes to the schedule when needed; you will be notified of any changes. Readings and assignments will be posted to the course website.



Learning Outcomes: Students should be able to:

- Characterize 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.
- Identify and describe structural differences of major physiological systems that characterize different taxonomic groups of animals.
- Relate physiological processes, from the biochemical to the system level, to the function of the entire organism in its environment.
- Make use of the current research literature on animal physiology to develop research questions and methodologies to address these questions.

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DATE	LECTURE TOPIC	READINGS	OTHER
1/21	Intro		Student survey
1/23	1 Metabolic rate and size, scaling, physiological time		
1/28	Quiz 1 and Discussion	Stanger EZ 2008. The biology of organ size determination. Diabetes, Obesity and Metabolism, 10 Suppl. 4, 16–22 Stern DL and DJ Emlen 1999 The developmental basis for allometry in insects. Development 126, 1091-1101	Soares
1/30	2 Breathing in water		**Jan 31: Last day to add/drop**
2/4	Quiz 2 and Discussion	Seymour RS, Loveridge JP 1994. Embryonic and larval respiration in the arboreal foam nests of the African frog Chiromantis xerampelina. Journal of Experimental Biology. Dec 1;197(1):31-46. Wood CM, Pelster B, Giacomin M, Sadauskas-Henrique H, Almeida-Val VM, Val AL. The transition from water breathing to air breathing is associated with a shift in ion uptake from gills to gut: a study of two closely related erythrinid teleosts, Hoplerythrinus unitaeniatus and Hoplias malabaricus. Journal of Comparative Physiology B. 2016 May 1;186(4):431-45.	
2/6	3 Breathing in air 1		
2/11	Quiz 3 and Discussion	Nelson JA. 2014 Breaking wind to survive: fishes that breathe air with their gut. Journal of fish biology. Mar 1;84(3):554-76. Scott GR 2011. Elevated performance: the unique physiology of birds that fly at high altitudes. J Exp Biol 214, 2455-2462.	
2/13	4 Thermal physiology		
2/18	Quiz 4 and Discussion	Angilletta MJ Niewiarowski PH and CA Navas 2002. The evolution of thermal physiology in ectotherms. Journal of Thermal Biology 27:249-268. Verant ML, Meteyer CU, Speakman JR, Cryan PM, Lorch JM, Blehert DS. 2014. White-nose syndrome initiates a cascade of physiologic disturbances in the hibernating bat host. BMC physiology. Dec 9;14(1):10.	**Study for Exam 1**
2/20	**Exam 1**	**Exam 1**	**Exam 1**
2/25	5 Temperature adaptation		

2/27	Quiz 5 and Discussion	Larson DJ, Middle L, Vu H, Zhang W, Serianni AS, Duman J, Barnes BM. Wood frog adaptations to overwintering in Alaska: new limits to freezing tolerance. Journal of Experimental Biology. 2014 Jun 15;217(12):2193-200. Aubret F, Shine R. Thermal plasticity in young snakes: how will climate change affect the thermoregulatory tactics of ectotherms? Journal of Experimental Biology. 2010 Jan 15;213(2):242-8.	
3/3	6 Digestion and excretion		
3/5	Quiz 6 and Discussion	Sauer C, Clauss M, Bertelsen MF, Weisbjerg MR, Lund P. Rumen content stratification in the giraffe (Giraffa camelopardalis). Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology. 2017 Jan 31;203:69-76. Frei S, Dittmann MT, Reutlinger C, Ortmann S, Hatt JM, Kreuzer M, Clauss M. Methane emission by adult ostriches (Struthio camelus). Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology. 2015 Feb 28;180:1-5.	
3/10	7 Ionic Balance		
3/12	Quiz 7 and Discussion	Laverty G and E Skadhauge 2012. Adaptation of teleosts to very high salinity. Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology 163 (1) 1–6 Benlamlih SA, Dahlborn KR, Filali RZ, Hossaini-Hilali JA. Fluid retention after oral loading with water or saline in camels. American Journal of Physiology-Regulatory, Integrative and Comparative Physiology. 1992 May 1;262(5):R915-20.	
3/15-3/22	**SPRING BREAK: MARCH 15-22, 2020**		
3/24	8 Neural systems		
3/26	Quiz 8 and Discussion	Arizza V, Vazzana M, Schillaci D, Russo D, Giaramita FT, Parrinello N. Gender differences in the immune system activities of sea urchin Paracentrotus lividus. Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology. 2013 Mar 31;164(3):447-55. Landis SH, Sundin J, Rosenqvist G, Poirier M, Jørgensen GØ, Roth O. Female pipefish can detect the immune status of their mates. Behavioral ecology and sociobiology. 2015 Dec 1;69(12):1917-23.	
3/31	**Exam 2**	**Exam 2**	**Exam 2**
4/2	9 Muscles		
4/7	Quiz 9 and Discussion	Constable P, Hinchcliff K, Demma N, Callahan M, Dale B, Fox K, Adams L, Wack R, Kramer L. Electrocardiographic consequences of a peripatetic lifestyle in gray wolves (Canis lupus). Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology. 1998 Jul 1;120 (3):557-63.	

		Hindle AG, Otis JP, Epperson LE, Hornberger TA, Goodman CA, Carey HV, Martin SL. Prioritization of skeletal muscle growth for emergence from hibernation. Journal of Experimental Biology. 2015 Jan 15;218 (2):276-84.	
4/9	10 Endocrinology		
4/14	Quiz 10 and Discussion	Dunlap KL, Reynolds AJ, Tosini G, Kerr WW, Duffy LK. Seasonal and diurnal melatonin production in exercising sled dogs. Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology. 2007 Aug 31;147(4):863-7. Setiawan AN, Davis LS, Darby JT, Lokman PM, Young G, Blackberry MA, Cannell BL, Martin GB. Hormonal correlates of parental behavior in yellow-eyed penguins (Megadyptes antipodes). Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology. 2006 Nov 30;145(3):357-62.	
4/16	11 Sex Diversity		
4/21	Quiz 11 and Discussion	Brennan PL, Prum RO, McCracken KG, Sorenson MD, Wilson RE and TR Birkhead 2007. **Coevolution of male and female genital morphology in waterfowl.** *PLoS one*, *2*(5), p.e418. Harcourt AH, Purvis A, Liles L. Sperm competition: mating system, not breeding season, affects testes size of primates. Functional Ecology. 1995 Jun 1:468-76.	
4/23	12 Affecting others physiology		
4/28	Quiz 12 and Discussion	Kowalski K, Marciniak P, Rosiński G, Rychlik L. **Evaluation of the physiological activity of venom from the Eurasian water shrew Neomys fodiens.** Frontiers in zoology. 2017 Dec;14(1):46. Kaushik M, Knowles SC, Webster JP. **What makes a feline fatal in Toxoplasma gondii's fatal feline attraction? Infected rats choose wild cats.** American Zoologist. 2014 Jun 6;54(2):118-28.	
4/30	Review		
5/5	**Review for Final Exam*** **		**http://www5.njit.edu/registrar/exams/**
FINALS	**FINAL EXAM WEEK: MAY 8-14, 2020**		

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