BEHAVIORAL ENDOCRINOLOGY
(Graduate Seminar)

Course Description and Objectives: Hormones alter the development and expression of animal behavior, while behavior in turn changes the effects of hormones. This course will examine the ultimate causation of behaviors as well as the mechanistic basis of those behaviors from a hormonal perspective. We will take an evolutionary approach by emphasizing the selective pressures that act on animals and the hormonal and behavioral responses to these pressures. The course will combine lectures and discussions of primary literature.

Course Structure: Each class meeting is 33% lecture by instructor and 67% discussion led by discussion leaders (but involving all students). Each student will be responsible for leading in a group of 2-3 students two papers throughout the course term. Each discussion leader will post one discussion question based on the reading on a course website/discussion forum at least two days prior to the class meeting. All other students are expected to respond to each forum discussion with 2-3 sentence responses at least 12 hours prior to the class meeting.

Course Schedule (TENTATIVE)
Readings will be posted on the website: http://behavioralendocrinology.wp.txstate.edu/

Meeting 1: Behavioral Endocrinology & Behavioral Ecology Introduction

Introduction to the rapidly growing field of behavioral endocrinology and behavioral ecology. Discussion of the major endocrine glands, as well as the major hormones produced by vertebrate animals. Hormone regulation and the mechanisms of hormonal action are also described. **Learning objectives**: Students will be able to: define behavioral endocrinology and understand the historical roots of the field; define hormones and behavior and describe the general ways by which hormones and behavior interact; explain the various scientific techniques used to establish relationships among hormones, brain, and behavior; identify the major endocrine glands and their hormones; describe negative and positive feedback effects of hormonal regulation; understand that the evolution of hormones reflects more of an evolution in uses rather than structures.

- Background reading: (Nelson & Kriegsfeld, 2017) CH 1 & 2 & Sinervo CH 1 (PDF handout)
- Discussion reading: None this week

Meeting 2: Sex Differences in Behavior: Sex Determination and Differentiation

We will describe the relationship between hormones and sex differences in brain and behavior. **Learning objectives**: Students will be able to: explain the difference between sex determination and sexual differentiation, as well as the difference between gender and sex; describe how hormones both organize sex differences in the brain and later in life activate these sexually dimorphic circuits to yield behaviors.

- Background reading: (Nelson & Kriegsfeld, 2017) CH 3
- Discussion reading: (Adkins-Regan, Banerjee, Correa, & Schweitzer, 2013)

Meeting 3: Male Reproductive Behavior

We will describe the interactions between hormones and male reproductive behaviors. **Learning objectives**: Students will be able to: summarize the proximal bases of sexual behavior in male animals; describe mating behaviors in male animals; explain some of the brain mechanisms involved in sex; discuss individual and age-related variations in male reproductive behavior.

- Background reading: (Nelson & Kriegsfeld, 2017) CH 5
- Discussion reading: (Nugent, Stiver, Alonzo, & Hofmann, 2016)

Meeting 4: Female Reproductive Behavior

We will discuss the neural and hormonal mechanisms underlying the control of female sexual motivation and behavior. A brief historical overview provides the context to understand why investigations into female sexuality have a shorter past than those of males. **Learning objectives**: Students will be able to: compare female mating behavior across well-studied species; distinguish between proceptivity and receptivity and describe the neural substrates that underlie them; describe the neural, hormonal, and ovarian mechanisms responsible for the ovulatory cycle; describe the neural and hormonal circuitry underlying the control of female sexual motivation and behavior.

- Background reading: (Nelson & Kriegsfeld, 2017) CH 6
- Discussion reading: (Lynch & Wilczynski, 2006)

Meeting 5: Sexual Selection & Conflict

We will discuss reasons why in many species, females are choosier in mate selection than are males, and why there is a fundamental asymmetry in sexual reproduction. We will also discuss factors that lead to conflict between the sexes, and the implications of this conflict. **Learning objectives**: Students will be able to: describe the three reasons why females are often the choosier sex, discuss the implications for higher levels of sexual receptivity in males than in females, understand different models of the evolution of female preferences on male traits.

- Background reading: (Davies, Krebs, & West, 2014) CH 7
- Discussion reading: (Mokkonen, Koskela, Mappes, & Mills, 2016)

Meeting 6: Parental Behavior

We will give an overview of the neuroendocrine mechanisms responsible for maternal and paternal behavior in vertebrates. We will start by considering parental investment and style based on the developmental state of offspring at birth and their growth trajectory. We will also review the hormones and neural mechanisms underlying parental care in birds and mammals. **Learning objectives**: Students will be able to: explain why paternal behavior is common in birds and relatively rare among mammals; outline the hormones and neurochemical systems responsible for parental behavior in birds and mammals; differentiate the requirements for the onset of maternal behavior in mammals from the requirements for its maintenance; elucidate some challenges to gaining insights into the mechanisms underlying human and higher primate maternal behavior.

- Background reading: (Nelson & Kriegsfeld, 2017) CH 7
- Discussion reading: (Smiley & Adkins-Regan, 2018)

Meeting 7: Social Behavior

We will describe the interactions between hormones and various types of social behavior, notably affiliation and aggressive behaviors. **Learning objectives**: Students will be able to: describe the different aspects of affiliation and aggressive behaviors; understand seasonal, sex, and individual differences in aggression; explain the roles of hormones in the regulation of social interactions.

- Background reading: (Nelson & Kriegsfeld, 2017) CH 8
- Discussion reading: (Batabyal & Thaker, 2019)

Meeting 8: Stress

We will describe the role of hormones in stress, which is the marked disruption in homeostasis caused by stressors. Stressors may be environmental, physiological, or psychosocial. Stressors are met by a stress response, which is a suite of physiological and behavioral reactions to reestablish homeostasis. **Learning objectives**: Students will be able to: understand the concept of stress; describe the endocrine contributions to the stress response; identify the adaptive features of the stress response; identify the

pathological aspects of the stress response; describe the interactions between stress and reproductive, growth, and cognitive functions.

- Background reading: (Nelson & Kriegsfeld, 2017) CH 11, (Romero, Dickens, & Cyr, 2009)
- Discussion reading: (Kim, Chavera, Gabor, & Earley, 2018)

Meeting 9: Learning and Memory

We will describe the relationship between hormones and learning and memory. There are several types of learning, and many hormones have been reported to affect various aspects of learning and memory. **Learning objectives**: Students will be able to: describe the different components of learning and memory; understand the basis for sex differences in learning and memory; describe seasonal fluctuations in learning and memory.

- Background reading: (Nelson & Kriegsfeld, 2017) CH 12
- Discussion reading: (Templeton, et al., 2012)

Meeting 10: Behavioral syndromes and hormones

We will review the evidence for variation in behavioral types and syndromes in different animal systems. We will also discuss the different approaches for identifying syndromes, and the evolutionary importance of behavioral syndromes. **Learning objectives**: Students will be able to: define behavioral syndromes; identify ways in which researchers partition variation in behavioral and physiological traits within and among individuals; and describe the physiological basis to a behavioral syndrome.

- Background reading: (Sih, Cote, Evans, Fogarty, & Pruitt, 2012)
- Discussion reading: (Fürtbauer, Pond, Heistermann, & King, 2015)

Meeting 11: Conservation Applications

We will discuss ways in which understanding of the interactions between hormones and behaviors can be applied to management and conservation of animal populations.

- Background reading: (McCormick & Romero, 2017)
- Discussion reading: (Janin, Léna, & Joly, 2011)

Meeting 12: Wrap up and Student Choice

Grading

- 200 points participation in paper discussion leads
- 100 points discussion questions posted
- 200 points participation in paper discussions in class and responses to posted discussion questions

Bibliography

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