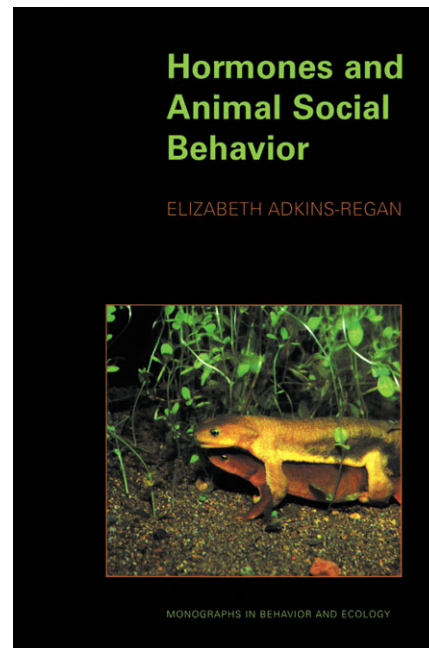


## INTEGRATIVE ENDOCRINOLOGY



### Hormones and Animal Social Behavior

Elizabeth Adkins-Regan

Princeton University Press  
416pp. ISBN 0-691-09247-8  
\$45

All animals display some form of social behavior, ranging from more simple dyadic interactions such as attracting a mate or chasing off a competitor to the elaborate and complex social behaviors displayed by group-living animals. Hormones are important regulators of social behavior, and research in behavioral endocrinology has made crucial progress in our understanding of the hormonal mechanisms that affect the timing, quality and quantity of social behavior. Social behavior is under strong natural and sexual selection and research in behavioral ecology has uncovered many of the evolutionary processes that shape social behavior. Researchers coming from the traditionally fairly separate fields of endocrinology and evolution have realized that an integration of both mechanistic and functional processes is essential for a comprehensive understanding of social behavior. Elizabeth Adkins-Regan's book '*Hormones and Animal Social Behavior*' is set right at the interface between endocrinology and evolution. Adkins-Regan thoroughly interweaves hormonal mechanisms and evolutionary theory, resulting in an unusually conceptual and

stimulating book whose goal is to further facilitate integrative research.

The book is aimed at the advanced reader and is geared for graduate students and researchers with some basic understanding of endocrinology. Adkins-Regan takes the reader on a fascinating journey through the world of hormones at different organismal levels, from endocrine processes at the cellular level to the hormonal control of affiliative and aggressive behavior at the organismal level. Her list of major topics includes hormone action during sexual differentiation, hormones and life histories, and, the evolution of the endocrine control of social behavior. Adkins-Regan's writing is informal and clear and her enthusiasm for the field is palpable. She provides a balanced overview of studies from all vertebrate taxa, along with the occasional invertebrate example. Adkins-Regan identifies numerous black holes in our knowledge of both the proximate and ultimate processes underlying the endocrine control of animal social behavior. Moreover, in most cases she proceeds to propose new hypotheses and to suggest research projects to fill in these gaps in our knowledge. In essence, this book provides a master plan for research in behavioral endocrinology for years to come!

The book is divided into seven chapters. It begins at the cellular level and provides an overview of the production and actions of steroid and protein hormones. Already here, the ecological and evolutionary angle of later chapters is anticipated by a comparative perspective. In this chapter, Adkins-Regan devotes an entire section to the potential 'costs' of hormones, a concept that is crucial for understanding life-history trade-offs and evolutionary processes.

Chapter two highlights organismal effects of hormones and reviews the endocrine regulation of social behavior such as courtship, mating, aggression, and parental behavior. Here, Adkins-Regan emphasizes that detailed knowledge of the nature of the relationship between a hormone and a behavioral trait (for example a linear relationship or a step-function) is critical for elucidating evolutionary processes. In this chapter she also discusses daily and seasonal rhythms and the hormonal control of signaling and signal reception.

Endocrine processes occurring in individuals embedded in social environments are discussed in chapter three. Results from studies in behavioral ecology are integrated with those from endocrinology to examine the hormonal regulation of dominance, territoriality and

mating systems. Adkins-Regan goes beyond other summaries of this topic by reviewing endocrine processes in traditionally less-studied social relationships such as parent–offspring conflict and cooperative breeding.

Hormones not only regulate behavior during adult life, but also have permanent effects on behavioral traits during ontogeny. In chapter four, Adkins-Regan discusses such ‘organizational’ effects of hormones during early development, in particular as they relate to sexual differentiation. Her integrative thinking really comes in to play when she connects genetic and endocrine mechanisms of sex determination. She also provides an extensive and up-to-date discussion of the hormonal and non-hormonal control mechanisms of gender-specific behavior.

After chapter four, the book takes a decidedly evolutionary turn and discusses questions in life-history theory and evolution. In chapter five Adkins-Regan outlines how field studies in behavioral endocrinology have shed light on the heritability, fitness values and response to

selection of hormonally mediated social behavior. She dissects evolutionary variation at different levels in the endocrine cascade, including hormone synthesis, metabolism and receptor function, and provides several intriguing examples of evolutionary change in hormone–behavior relationships. In an interesting twist, she integrates behavioral endocrinology with the emerging field of evolution and development, to provide a new perspective on changes in endocrine processes and how they can affect adult behavioral phenotypes during development.

The various stages of life such as birth or hatching, metamorphosis, juvenile dispersal and aging and their hormonal underpinnings are the topic of chapter six. Adkins-Regan reviews examples of the hormonal regulation of the transition between life-cycle stages and how hormones affect their overall expression. In the second part of this chapter, she assesses the role of hormones in life-history trade-offs, emphasizing our general lack of knowledge on this topic.

In the final chapter, Adkins-Regan examines hormones and behavioral traits

from a phylogenetic perspective. She reviews phylogenetic variation at different levels of endocrine function, in an attempt to distinguish processes that are conserved from those that are more evolutionarily labile. This chapter nicely integrates topics raised in previous chapters and begins to tell the story of the evolution of the hormonal control of animal social behavior. Of course, this is just the beginning of such a story as we still have much to learn about the evolutionary processes shaping hormone–behavior connections.

In summary, this is an incredibly stimulating book touching on all aspects of social behavior and hormones. The text is so saturated with new ideas that the reader will come away highly enthused and ready to tackle some of the questions Adkins-Regan poses from a uniquely integrative perspective.

10.1242/jeb.02230

**Michaela Hau**  
Princeton University  
hau@princeton.edu

Published by The Company of Biologists 2006