Hormones and Reproduction in Fishes, Amphibians, and Reptiles

Hormones and Reproduction in Fishes, Amphibians, and Reptiles

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We dedicate this volume to our teachers and mentors, Professor Howard A. Bern and Professor Aubrey Gorbman, and to all those to whom we have taught the excitement of comparative endocrinology that Professors Bern and Gorbman instilled in us.

PREFACE

Comparative endocrinology is one of the most rapidly developing subdisciplines within the field of endocrinology, and it is having a significant impact on research at the molecular, cellular, organismal and environmental levels. Much of the current ferment in endocrinology is in reproductive endocrinology. The purpose of this volume on hormones and reproduction in fishes, amphibians and reptiles is to summarize our present understandings and to identify important research problems to be addressed in the area of comparative reproductive endocrinology. It was inspired by the gathering at Copper Mountain, Colorado, of eminent endocrine scientists from around the world on the occasion of the Tenth International Symposium on Comparative Endocrinology in July, 1985. While preparing for that meeting, we decided that a special volume on reproductive endocrinology was needed to summarize what is known and to stimulate research in particular directions.

Why do we emphasize fishes, amphibians and reptiles? First, knowledge about the reproductive endocrinology of these ectothermic vertebrates can provide a clearer picture of the evolution of reproductive hormones and their effects on target organs. This comparative approach can lead to new theories about the evolution of reproductive control mechanisms.

Second, studies concerning the reproductive endocrinology of "lower" vertebrates can result in development of "model systems" for application to studies of birds and mammals. Indeed, information about the patterns of reproductive control in ectothermic vertebrates can tell us which are evolutionarily stable and which are labile. This historical perspective then can lead to predictions about reproductive control mechanisms in birds and mammals which have separate evolutionary origins from ectothermic reptiles. Even without enough information to form an evolutionary history, specific discoveries from, for example, a frog or lizard species can be tested in mammals. Contributions from such approaches are being made at all levels. Professor Howard A. Bern (1984) summarized this for us:

> . . . in recent years, has come the recognition that comparative endocrinology can break new ground: can discover new phenomena

and offer new concepts, which are then applicable to an understanding of endocrine physiology generally--in mammals and in humans.

Third, some ectothermic vertebrates are important food sources. This is especially true for fishes but also for some amphibians and reptiles. And, with the present state of human population growth, these ectothermic vertebrates will become more important economically in the future. In this regard, reproductive endocrinology has, and will continue to have, important benefits related to the propagation of certain food species (e.g., salmon, bullfrogs, green sea turtles).

Fourth, several ectothermic vertebrate species are endangered and could become extinct. Besides protection and habitat management, it will become necessary to house breeding stocks of endangered species as captive populations, and the utilization of hormonal manipulations may be a valuable tool for propagating these species for eventual release into nature. For example, synthetic gonadotropin-releasing hormone is now being used to induce ovulation in captive, endangered anuran amphibians.

Lastly, the reproductive biology of a species plays a vital role in its natural history and life cycle. Therefore, knowledge about the reproductive endocrinology of any species can fill an important gap in our understanding of its particular adaptations. Such knowledge will be essential for future management of natural habitats and for perpetuation of natural populations.

The topics chosen for this work include development and differentiation, gonadal cycles, oocyte maturation, vitellogenesis, ovulation, corpus luteum function, male gonaducts and sex accessory glands, steroid receptors and binding proteins, behavior, evolution of viviparity, aging of the neuroendocrine-reproductive axis, and the roles of gonadotropin-releasing hormones, gonadotropins, prolactin, thyroid hormones, steroid hormones, stress hormones, the pineal complex and environmental factors. The contributors are some of the current leaders in comparative endocrinology of ectothermic vertebrates, and they represent six countries evenly distributed among the three continents: Asia, Europe and North America.

It is the editors' hope and intention that this volume will not only serve as an introduction to specific topics in comparative reproductive endocrinology but also will stimulate new research in the field. We have attempted to coordinate the chapters contributed by the various authors through the use of cross-references. Furthermore, we have adhered as much as possible to a uniform terminology as well as a standard format for each chapter, beginning with mammalian (and where pertinent, avian) knowledge followed by discussions of fishes, amphibians and reptiles.

We wish to thank all of the contributors for their hard work, tolerance and patience. Frank Moore kindly supplied us with the cover photograph. Finally, special thanks go to Ann Underwood for typing the camera-ready copy and to Plenum Publishing Corporation for their support.

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CONTENTS

CHAPTER 1

HORMONES AND SEXUAL DIFFERENTIATION

Elizabeth Adkins-Regan

CHAPTER 2

GONADOTROPIN-RELEASING HORMONES IN FISHES

Nancy Sherwood

CHAPTER 3

ROLE OF GONADOTROPIN-RELEASING HORMONE IN REGULATION OF GONADOTROPIN SECRETION FROM AMPHIBIAN AND REPTILIAN PITUITARIES

Paul Licht and David Porter

CHAPTER 4

PROLACTIN AND REPRODUCTION

Valdo Mazzi and Camillo Vellano

CHAPTER 6

ENDOCRINOLOGY OF VITELLOGENESIS

Shuk-mei Ho

CHAPTER 7

ENDOCRINE CONTROL OF OOCYTE MATURATION

Yoshitaka Nagahama

CHAPTER 8

OVULATION: INSIGHTS ABOUT THE MECHANISMS BASED ON A COMPARATIVE APPROACH

Richard E. Jones

CHAPTER 9

FUNCTIONAL MORPHOLOGY AND REGULATION OF THE CORPUS LUTEUM

Françoise Xavier

CHAPTER 10

TESTICULAR FUNCTION

Brian Lofts

CHAPTER 11

REGULATION OF MALE GONADUCTS AND SEX ACCESSORY STRUCTURES

David O. Norris

CHAPTER 12

SEX STEROID RECEPTORS AND NON-RECEPTOR BINDING PROTEINS

Ian P. Callard and Gloria V. Callard

CHAPTER 13

SEASONAL REPRODUCTION; PATTERNS AND CONTROL

J. M. Whittier and David Crews

CHAPTER 14

THYROID HORMONES AND REPRODUCTION

John F. Leatherland

CHAPTER 15

PINEAL INVOLVEMENT IN SEASONALITY OF REPRODUCTION

William A. Gern, Jeanne M. Nervina, and Shelley S. Greenhouse

CHAPTER 16

STRESS AND REPRODUCTION: RECIPROCAL RELATIONSHIPS

Neil Greenberg and John Wingfield

CHAPTER 17

REGULATION OF REPRODUCTIVE BEHAVIORS

Frank L. Moore

CHAPTER 19

AGING OF THE NEUROENDOCRINE SYSTEM

Martin P. Schreibman, Henrietta Margolis-Nunno,
and Leslie Halpern-Sebold