

# Advanced Imaging Approaches to Reveal Molecular Mechanisms Governing Neuroendocrine Secretion

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## Keywords

Super-resolution · Atomic force microscopy · Transmission electron microscopy · Total internal reflection fluorescence microscopy · Neuroendocrine cells · Regulated secretion · Neuroendocrinology · Cell biology

## Abstract

Identification of the molecular mechanisms governing neuroendocrine secretion and resulting intercellular communication is one of the great challenges of cell biology to better understand organism physiology and neurosecretion disruption-related pathologies such as hypertension, neurodegenerative, or metabolic diseases. To visualize molecule distribution and dynamics at the nanoscale, many imaging approaches have been developed and are still emerging. In this review, we provide an overview of the pioneering studies using transmission electron microscopy, atomic force microscopy, total internal reflection microscopy, and super-resolution microscopy in neuroendocrine cells to visualize molecular mechanisms driving neurosecretion processes, including exocytosis and associated fusion pores, endocytosis and associated recycling vesicles, and protein-protein or

protein-lipid interactions. Furthermore, the potential and the challenges of these different advanced imaging approaches for application in the study of neuroendocrine cell biology are discussed, aiming to guide researchers to select the best approach for their specific purpose around the crucial but not yet fully understood neurosecretion process.

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## Introduction

Neuroendocrine secretion involves a succession of intracellular compartments, i.e., endoplasmic reticulum, Golgi apparatus and secretory granules, structures, and molecules [1], whose distribution and dynamics analysis require efficient resolutive imaging techniques. In neuroendocrine cells, secretory granules ensure the release of neurohormones/neuropeptides and neurotransmitters upon stimulation. These vesicular organelles, with a diameter ranging between 60 and 300 nm in their mature state depending on the neuroendocrine cell type [2], are generated by budding from the *trans*-Golgi membrane and convey their content to the cell periphery through a

# Streb Neuroendocrine And Molecular Approaches

**Rolf C. Gaillard**



## **Streb Neuroendocrine And Molecular Approaches:**

**Neuroendocrine Molecular Biology** G. Fink, A. J. Harmar, Kenneth W. McKerns, 2013-03-09 The 13th Annual Meeting of the Foundation was held in Edinburgh during September 1985 The subject was neuroendocrine molecular biology which brought together leading scientists in the fields of molecular genetics neuroendocrinology and developmental neuro biology The conference was most stimulating and as the Proceedings show novel data presented was of the highest quality The topics presented were grouped under the headings Molecular Biology of the Nervous System IIRH New Perspectives Neuropeptides Oxytocin and Vasopressin Transcriptional and Post Translational Regulation of Neuropeptide Synthesis Neuroendocrine Mechanisms at the Cellular Level Receptors Cellular and Molecular Biology and Clinical Applications The

**The Spectrum of Neuroendocrine Neoplasia** Sylvia L. Asa, Stefano La Rosa, Ozgur Mete, 2020-10-19 Neuroendocrine neoplasms comprise a large family of proliferative lesions that involve almost every part of the body Our understanding of their cells of origin as well as the pathology pathophysiology and genetics of these neoplasms has made tremendous advances in the last few decades While they are often discussed as separate entities in textbooks of gastroenteropancreatic pathology and pulmonary pathology their scope is much broader The book conveys the similarities and differences of these fascinating tumors that may be found from the hypothalamus and pituitary to the rectum and in soft tissue as well as in many organs Written by experts in the field the authors emphasize their structural functional predictive and prognostic features and attempt to provide the clinical context that allows improved diagnosis and therapy while building on the genetics that clarifies patterns of inheritance and predisposition to tumor development through precursor lesions The Spectrum of Neuroendocrine Neoplasia provides a broad overview of neuroendocrine neoplasms using a practical approach to diagnosis histological classification and therapy and presents the most important and significant developments of the technologies used to diagnose classify and treat them

**Annual Meeting of the European Society for Paediatric Endocrinology (ESPE)** ... European Society for Paediatric Endocrinology. Meeting, 1996

**Methods in Neuroendocrinology** Louis D. Van de Kar, 1998-06-04 Going beyond step by step descriptions of how to perform techniques Methods in Neuroendocrinology examines the questions that are being asked in the field what problems need to be overcome and what the limits of interpretation are involved in each approach The experimental approaches described in this book merge endocrine and neuroscientific research and offer insight into the many disciplines involved Demonstrating what can be learned from applying different approaches to neuroendocrine research Methods in Neuroendocrinology leads the reader from elementary techniques to more complex methods for examining neuroendocrine function The research methodology outlined addresses four main questions 1 What are the cellular and molecular mechanisms responsible for the synthesis and secretion of hormones 2 How do other cells influence neuroendocrine control mechanisms 3 How do hormones feed back on their neuroendocrine regulatory neurons 4 How can we use hormones as indicators of specific changes in neuroendocrine control

sites in the brain Much more than a cookbook this is a resource for every researcher who wants to pursue new areas of inquiry in the science of neuroendocrinology *Science Citation Index* ,1993 Vols for 1964 have guides and journal lists

**Neuroendocrinology** David A. Lovejoy,2005-11-01 There has been an explosion of interest in the field of neuroendocrinology over the last twenty years with the discovery of neurohormones regulating virtually everything from growth and development to sexual and aggressive behavior This book provides a much needed introduction to neuroendocrinology from a zoological and evolutionary perspective It covers the evolution development and description of the neuroendocrine system throughout the animal kingdom Specific topics covered include The Evolution of early neuroendocrine systems in primitive animals Structural characterisation molecular biology and biochemistry of neuroendocrine agents A profiles section on unusual aspects of neuroendocrine physiology written by leaders in the field A unique section on the actions of environmental chemicals effect neuroendocrine systems in various species **Molecular**

**Neuroendocrinology** David Murphy,Harold Gainer,2015-12-24 Molecular Neuroendocrinology From Genome to Physiology provides researchers and students with a critical examination of the steps being taken to decipher genome complexity in the context of the expression regulation and physiological functions of genes in neuroendocrine systems The 19 chapters are divided into four sectors A describes and explores the genome its evolution expression and the mechanisms that contribute to protein and hence biological diversity B discusses the mechanisms that enhance peptide and protein diversity beyond what is encoded in the genome through post translational modification C considers the molecular tools that today s neuroendocrinologists can use to study the regulation and function of neuroendocrine genes within the context of the intact organism D presents a range of case studies that exemplify the state of the art application of genomic technologies in physiological and behavioural experiments that seek to better understand complex biological processes Written by a team of internationally renowned researchers Both print and enhanced e book versions are available Illustrated in full colour throughout This is the third volume in a new Series Masterclass in Neuroendocrinology a co publication between Wiley and the INF International Neuroendocrine Federation that aims to illustrate highest standards and encourage the use of the latest technologies in basic and clinical research and hopes to provide inspiration for further exploration into the exciting field of neuroendocrinology Series Editors John A Russell University of Edinburgh UK and William E Armstrong The University of Tennessee USA *Neuroendocrine Molecular Biology* G. Fink,A. J. Harmar,Kenneth W. McKerns,2014-09-01

**Neuroendocrine-immune Interactions** Rolf C. Gaillard,2002 Interactions between the immune endocrine and nervous systems seldom appear as main issues in the neurosciences and in immunology So far this was most likely due to the need to focus on the molecular and cellular bases of single neural endocrine and immune processes But hormones neurotransmitters and neuropeptides can also influence more subtle mechanisms underlying immune cell activity The contents of this volume aim at listing some aspects which show that not only the bases for neuroendocrine control of more refined mechanisms

related to the organization and functioning of the immune systems to exist but also that the immune system can actively communicate with neuroendocrine structures The evidence is divided into three categories Anatomical cellular and molecular bases for the exchange of information between immune endocrine and neural cells reciprocal effects between immune and neuroendocrine mechanisms and immune neuroendocrine regulatory circuits Immunologically triggered neuroendocrine responses can be either beneficial or deleterious for the host A systematic approach would imply the simultaneous evaluation of neuroendocrine and immune parameters and thus provide the basis for therapeutic interventions based on antagonizing or blocking undesirable effects      **Neuroendocrine Molecular Biology** G. Fink,A. J. Harmar,Kenneth W.

McKerns,2012-06-14 The 13th Annual Meeting of the Foundation was held in Edinburgh during September 1985 The subject was neuroendocrine molecular biology which brought together leading scientists in the fields of molecular genetics neuroendocrinology and developmental neuro biology The conference was most stimulating and as the Proceedings show novel data presented was of the highest quality The topics presented were grouped under the headings Molecular Biology of the Nervous System IIRH New Perspectives Neuropeptides Oxytocin and Vasopressin Transcriptional and Post Translational Regulation of Neuropeptide Synthesis Neuroendocrine Mechanisms at the Cellular Level Receptors Cellular and Molecular Biology and Clinical Applications The      **Textbook of Energy Balance, Neuropeptide Hormones, and Neuroendocrine Function** Eduardo A. Nillni,2018-07-20 This textbook presents for the first time a comprehensive body of the latest knowledge in the field of neuropeptides and their action on energy balance It contains a detailed and comprehensive account of the specific hypothalamic peptides in regards to their roles in energy balance food intake control and co morbidities to better understand the patho physiology of obesity The textbook includes an examination the history of the evolution of human society from a thin to the obese phenotype and within that context how modern society habits and industrial food production did not respect the evolutionary trait resulting in changes in the energy balance set point It provides a novel conceptualization of the problem of obesity when considering the biochemistry of peptide hormones and entertaining novel ideas on multiple approaches to the problems of energy balance as well as demonstrates and explains why alterations in pro hormone processing are paramount to understand metabolic disease This text is excellent material for teaching graduate and medical school courses as well as a valuable resource for researchers in biochemistry cell and molecular biology

neuroscientists physician endocrinologists and nutritionists      **Neuroendocrine Peptide Methodology** P. Michael Conn,2012-12-02 Neuroendocrine Peptide Methodology      **Neuroendocrinology** Horst-Werner Korf,Klaus-Henning Usadel,2012-12-06 70 years after the discovery of secretory neurons internationally leading experts gathered to discuss the latest developments in neuropeptide research and endocrinology concentrating on the molecular cellular supracellular and systemic aspects A variety of neuropeptidergic systems are considered under comparative and evolutionary aspects

*Neurosecretion: Secretory Mechanisms* José R. Lemos,Govindan Dayanithi,2020-03-31 How do electrical activity and

calcium signals in neurons influence the secretion of peptide hormones This volume presents the current state of knowledge regarding the electrical calcium signaling and synaptic properties of neuroendocrine systems from both vertebrate and invertebrate systems The contributions span in vivo and in vitro studies that address state dependent plasticity relevance of firing patterns membrane properties calcium flux including dynamic imaging and homeostasis and molecular mechanisms of exocytosis including from non neuronal secretory cells The chapters focus not only on research results but also on how experiments are conducted using state of the art techniques and how the resulting data are interpreted While there are many books on the secretory properties of neurons this is the first to focus on the distinctive secretory properties of neuroendocrine neurons Accordingly it offers an important text for undergraduate and graduate neuroscience students and will also appeal to established scientists and postdoctoral fellows This is the eighth volume in the Masterclass in Neuroendocrinology series now a co publication between Springer Nature and the INF International Neuroendocrine Federation Volumes 1-7 published by Wiley

Hormonal and Neuroendocrine Regulation of Energy Balance Maria Moreno, Antonia Lanni, 2016-07-18 Alteration in adequate energy balance maintenance results in serious disturbances such as obesity and its related metabolic disorders In Mammals energy balance is homeostatically controlled through hormonal and neuroendocrine systems which cooperation is based on cross talk between central and peripheral signals The hypothalamus as well as peripheral hormones among which adipokines from adipose tissue and thyroid hormones play a crucial role in energy homeostasis Unraveling the physiological cellular and molecular mechanisms through which hormonal and neuroendocrine systems regulate energy balance has been a long standing challenge in biology and is now more necessary when considering the world wide increasing prevalence of obesity Indeed recognizing and understanding the biochemical and nutrient signaling pathways contributing to the nervous and endocrine integration of physiological mechanisms involved in the normal and or abnormal regulation of energy balance is fundamental also to the development of new effective and targeted treatments for obesity Recent studies have highlighted the role of hypothalamic pro opiomelanocortin expressing neurons in the regulation of energy homeostasis by controlling energy expenditure and food intake This is accomplished through a precise balance of production and degradation of a melanocyte stimulating hormone an anorexigenic neuropeptide which is degraded to an inactive form unable to inhibit food intake by the key enzyme prolyl carboxypeptidase PRCP thus suggesting that pharmacologic approaches targeting PRCP may provide a novel and effective option for the management of obesity and its associated metabolic disorders Indeed efforts have been made to generate potent brain penetrant PRCP inhibitors Weight loss due to negative energy balance is a goal for obese subjects not always reachable by dietary caloric restriction or increased physical activity Lipid lowering therapies have been suggested to have potential benefits however the establishment of comprehensive therapeutic strategies is still awaited Recently it has been reported that thyroid hormone TH derivatives such as 3,5 diiodothyronine and 3 iodothyronamine possess interesting biological activities opening new

perspectives in thyroid physiology and TH derivatives therapeutic usage Moreover several studies focusing on the interaction between thyroid hormone TH the autonomic nervous system and the liver revealed an important role for the hypothalamus in the differential effects of TH on autonomic outflow to peripheral organs controlling energy balance This Research Topic aims to give a comprehensive and integrate view of the factors involved in the endocrine and neuroendocrine signaling in energy balance regulation to highlight their involvement into physiological processes and regulatory systems as well as their perturbation during pathological processes **Neuroendocrine Correlates of Stress** Kenneth W. McKerns,2012-12-06

The beautiful town of Cavtat near Dubrovnik Yugoslavia was the site of the twelfth meeting of the International Foundation for Biochemical Endocrinology It was sponsored by the Serbian Academy for Sciences and Arts and by the Foundation The Croatia Hotel in Cavtat was a splendid place for a meeting The presentation of the subject matter relating to Neuroendocrine Correlates of Stress was interesting and informative The topics included many forms of stress their mediators and responses They included releasing factors neurotransmitters in the hypothalamus role of noradrenaline in the reaction of the hypothalamo pituitary adrenocortical axis to stress immunological stress thermal stress immobilization stress peptides in shock stress induced prolactin stress and acupuncture stress and behavior spinal cord transection and stress electroconvulsive stress neuroendocrine cells and stress protein kinase as a signal transducer the effects of constant light and darkness on the pineal sleep stress and ovarian function and finally hormonal response to exercise Subsequently the papers presented were rewritten for inclusion in this monograph The Chairmen for the sessions at Cavtat were K McKerns and Stefan Manolov V Chong Li and L Rakic S Feldman and R Milin M Lee and V Liposits The next meeting of the Foundation will be held in Edinburgh near the end of September 1985 The topic will be Neuroendocrine Molecular Biology with Professor George Fink as Honorary Chairman of the local organizing committee Stress Karel Pacak,2004-01-01

**Neuroendocrine Regulation of Behavior** Lique M. Coolen,David R. Grattan,2020-01-02 This special volume provides twelve contributions that discuss different aspects of social and endocrine behaviors with an emphasis on the neural regulation of these behaviors In addition several review chapters address the neural plasticity that results from exposure to hormones or the experiences with the behavior Finally each of the contributions emphasizes future directions and incorporation of newly developed neuroscience techniques and approaches **Stress: Neuroendocrinology and**

**Neurobiology** George Fink,2016-12-15 Stress Neuroendocrinology and Neurobiology Handbook of Stress Series Volume 2 focuses on neuroendocrinology the discipline that deals with the way that the brain controls hormonal secretion and in turn the way that hormones control the brain There have been significant advances in our understanding of neuroendocrine molecular and epigenetic mechanisms especially in the way in which stress induced hormonal and neurochemical changes affect brain plasticity neuronal connectivity and synaptic function The book features the topic of epigenetics and how it enables stress and other external factors to affect genetic transmission and expression without changes in DNA sequence

Integrated closely with new behavioral findings and relevance to human disorders the concepts and data in this volume offer the reader cutting edge information on the neuroendocrinology of stress Volume 2 is of prime interest to neuroscientists clinicians researchers academics and graduate students in neuroendocrinology neuroscience biomedicine endocrinology psychology psychiatry and in some areas of the social sciences including stress and its management in the workplace Includes chapters that offer impressive scope with topics addressing the neuroendocrinology and endocrinology of stress Presents articles carefully selected by eminent stress researchers and prepared by contributors that represent outstanding scholarship in the field Richly illustrated with explanatory figures and tables      **Molecular Neuroendocrinology** David Murphy, Harold Gainer, 2016 Discusses the mechanisms that enhance peptide and protein diversity beyond what is encoded in the genome through post translational modification



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