Biogenic Amines and Polyamines: Similar Biochemistry for Different Physiological Missions and Biomedical Applications

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ABSTRACT: Biogenic amines are organic polycations derived from aromatic or cationic amino acids. All of them have one or more positive charges and a hydrophobic skeleton. Nature has evolved these molecules to play different physiological roles in mammals, but maintains similar patterns for their metabolic and intracellular handling. As deduced from this review, many questions still remain to be solved around their biochemistry and molecular biology, blocking our aims to control the relevant pathologies in which they are involved (cancer and immunological, neurological, and gastrointestinal diseases). Advances in this knowledge are dispersed among groups working on different biomedical areas. In these pages, we put together the most relevant information to remark how fruitful it can be to learn from Nature and to take advantage of the biochemical similarities (key protein structures and their regulation data on metabolic interplays and binding properties) to generate new hypothesis and develop different biomedical strategies based on biochemistry and molecular biology of these compounds.

KEY WORDS: arginine/ornithine-derived amines, histamine, neurotransmitter amines, decarboxylases, amino oxidases, amine transport systems.

I. INTRODUCTION

Biogenic amines are natural products related to intercellular communication and, as such, present in specific cell types, globally called amine-handling cells. The most relevant ones in mammalian physiology are serotonin, histamine, dopamine, and noradrenaline. On the other hand, arginine/ornithine-derived polyamines, although they might also be considered biogenic amines, are not only involved in biosignaling and are present not only in amine-handling cells. They are ubiquitous in localization (in fact, they are present in almost every kind of cell) and have pleiotropic effects, with a recognized major role as essential compounds in maintaining macromolecular synthesis and cell proliferation rates (Cohen, 1998). Figure 1 shows the main biogenic amines and arginine/ornithine-derived polyamines. The relationship between these amine compounds and human pathologies

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Polyamines In Biomedical Research

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Polyamines in Biomedical Research Joseph M. Gaugas,1980 **Biomedical Index to PHS-supported Research: pt. A. Subject access A-H** ,1992 *Polyamine Protocols* David M. L. Morgan,2008-02-02 A unique collection of hands on enzyme assay techniques to study polyamines and their function The techniques range from assay methods for enzymes of polyamine biosynthesis and catabolism to measurements of polyamines polyamine transport and polyamine effects on cell growth The methods are presented by leading researchers who have perfected them to a high art and include clear step by step instructions with numerous hints and tips to ensure readily reproducible results Biochemical and Biological Markers of Neoplastic Transformation Prakash Chandra,2013-11-11 This volume is arecord of the proceedings of a NATO Advanced Study institute on Biochemical and Bio logical Markers of Neoplastic Transformation held September 28 October 8 1981 at Corfu Greece As early as 1860 Rudolf Virchow provided the first genetic concept of cancer by postulating Omnia ceZZuZa e ceZZuZa ejusdem generis a modification of the then exisiting cell theory Omnis ceZZuZa e ceZZuZa Thus the idea that all cells originate from the parent cell was extended to the idea that all cancer cells come from the paren t cancer cello But how the first cancer cell arose or in other words how anormal cell changed to a cancer cell is even after 120 years a mystery Experimental studies of the past have convinced us that a number of factors contribute to the neoplastic transformation of anormal cell but our knowledge on the mechanisms involved in this process is still in an embryonic state In the last few years however this field has witnessed a most remarkable advancement cata lyzed by the development of modern technology in the al lied fields of immunology the production of mono clonal antibodies molecular biology and sequencing v PREFACE and cloning of ONC genes Presently it is becoming more and more evident to the wishful mind of those engaged in this research that we are approaching a turning point Thus an assessment of the present situa tion will be most desirable at this time

The Physiology of Polyamines, Volume I Uriel Bachrach,Yair M. Heimer,2021-05-30 The area of polyamines is presented in this useful two volume publication Basic information describing the role of polyamines in the processes of growth and differentiation is given Also included are data on the regulation of polyamine biosynthesis and metabolism and their interactions with nucleic acids Several chapters are devoted to the role of polyamines in various aspects of plant biology with a special emphasis on their participation in the response of plants to extreme environments Special attention is given to the use of inhibitors of polyamine biosynthesis as potential antitumor and antiproliferative agents Additionally progress in the molecular biology and genetic engineering of genes coding for polyamine biosynthetic enzymes is described Cancer researchers biologists geneticists biochemists physiologists and clinicians will find this volume indispensable Polyamines Tomonobu Kusano,Hideyuki Suzuki,2015-01-07 This book covers key topics in polyamine research from a range of organisms including plants mammals and prokaryotes such as bacteria and archaea The book provides an introduction to general concepts in the field of polyamine research as well as more detailed information With the availability of genome sequence

data from a broad range of organisms the evolution of the genes involved in polyamine metabolism is discussed The mode of action of polyamines has been shown to be dependent on cation channels and this mechanism is described in the book The origin of polyamine transporters from bacteria yeasts and plants is described The various effects of polyamines on growth and survival are also documented The book details the mechanisms of polyamine homeostasis and the role of polyamine molecules as precursors of secondary metabolites such as plant alkaloids and toxins derived from spiders and wasps The role of polyamines in longevity and disease is discussed A link between polyamine contents and cancer progression is reported as is the use of polyamine metabolites as diagnostic markers in the initial stages of cancer Moreover a novel approach that utilizes the polyamine pathway of a parasite as a drug target in African sleeping sickness is described Therefore this book is a valuable resource both as a textbook for undergraduate and graduate students and also as a reference book for front line polyamine researchers *Assessment of Tumour Response* B.W. Hancock,2012-12-06 The assessment of tumour response after treatment is one of the most important challenges in Oncology and the picture is so often complicated by the effects of therapy itself Clinical assessment is still by far the most important method of assessment at our disposal but there is increasing dependence on investigations of all types as indices of response This depen dence may be misplaced if inappropriate investigations are pursued and we have tried to emphasise in this book the importance of selectivity Some indices of assessment e g tumour markers organ imaging have a vital role to play others e g histopathology genetics are assuming greater impor tance as tumour behaviour becomes better understood One subject Immu nology is still in its infancy as regards tumour follow up but shows much promise so that a full account of tumour immunology and trends in immu notherapy has been included I am grateful to Dr Brian Ross for his help with the chapter on Organ Imaging to the Department of Medical Illustration for their ever ready co operation with illustrations and photographs and to Miss Shirley Francis for doing much of the typing B W HANCOCK List of Contributors HANCOCK B W MD DCH MRCP Senior Lecturer in Medicine Hon orary Consultant Physician Royal Hallamshire Weston Park Hospitals Sheffield U K NEAL F E KSG MBChB FRCR DMRT Consultant Radiotherapist Oncologist Weston Park Hospital Sheffield u K POTTER AM **Selected Topics from Neurochemistry** Neville N. Osborne,2013-10-22 This book contains up dated versions of articles which proved very popular when first published in Neurochemistry International The articles draw attention to developments in a specific field perhaps unfamiliar to the reader collating observations from a wide area which seem to point in a new direction giving the author s personal view on a controversial topic or directing soundly based criticism at some widely held dogma or widely used technique in the neurosciences **Research Awards Index** ,1989 *Polyamines* Anthony E. Pegg,Robert A. Casero, Jr.,2016-08-23 Recently important new findings in the polyamine field and a variety of new experimental systems have revolutionized the study of these ubiquitous cellular components essential for normal growth and development In Polyamines Methods and Protocols leading researchers contribute an extensive collection of up to date laboratory techniques for the

further pursuit of polyamine study The volume delves into vital subjects such as neoplasia studies with animal models and human patients therapeutic roles for polyamine inhibitors and analogs polyamine metabolism and oxidative damage polyamines as regulators of critical ion channels as well as polyamine transport systems and polyamine responsive genes Written in the highly successful Methods in Molecular BiologyTM series format chapters include introductions to their respective topics lists of the necessary materials and reagents step by step readily reproducible laboratory protocols and expert notes on troubleshooting and avoiding known pitfalls Comprehensive and cutting edge Polyamines Methods and Protocols provides a key resource for all scientists pursuing the study of this dynamic and significant aspect of cellular biology **Pharmacology of the Skin I** ,2012-12-06 The recent interest in the pharmacology of the skin and the treatment of its diseases has come about for two reasons The first is a realisation that many aspects of pharmacology can be studied as easily in human skin where they may be more relevant to human physiology and diseases as in animal models Examples of this are the action of various vasoactive agents and the isolation of mediators of inflammation after UV irradiation and antigen induced dermatitis The second reason is the fortuitous realisation that a pharmacological approach to the treatment of skin disease need not always await the full elucidation of etiology and mechanism For example whilst the argument continued unresolved as to whether the pilo sebaceous infection which constitutes acne was due to a blocked duct or to a simple increase in sebum production 13 cis retinoic acid was found quite by chance totally to ablate the disease again whilst cyclosporin fresh from its triumphs in organ transplantation has been found able to suppress the rash of psoriasis it has resuscitated the debate on etiology We are therefore entering a new era in which the pharmacology and clinical pharmacology of skin are being studied as a fascinating new way of exploring questions of human physiology and pharmacology as well as an important step in the development and study of new drugs use of which will improve disease control and at the same time help to define pathological mechanisms **Chemical and Cellular Architecture** Abel Lajtha,2013-04-18 After the completion of the first edition of this series this editor thought that a new edition would not be warranted in less than IS perhaps 20 years but it seems that we live in a time in which rapid changes are the norm and findings in a field such as neurochemistry develop exponentially The task of a future editor attempting to get a comprehensive neurochemical handbook for the year 2000 would be even less enviable but by then information processing may be very different The approach the design and the areas covered by each volume and each chapter are necessarily arbitrary and it is likely that other editors or authors would have approached the coverage or the organization in a different manner It is hoped however that readers will find the series helpful for beginning or for continuing work There may be some overlap among the various chapters but insisting on single coverage of an area would at times have restricted treatment to only one point of view and might have truncated and hurt the logical flow of some of the chapters Neoplastic Transformation in Human Cell Culture Johng S. Rhim,Anatoly Dritschilo,2012-12-06 The role of carcinogenic agents in the

deveolopment of human cancers is now being defined using a variety of human cells as experi mental model systems A workshop on neoplastic transformation in human cell systems in vitro mechanisms of carcinogenesis was held at the Georgetown University Medical Center Washington DC on April 25 26 1991 The aims of the workshop were to present the state of the art in the transformation of human cells in culture as well as to provide insight into the molecular and cellular changes involved in the conver sion of normal cells to a neoplastic state of growth The following topics were closely related to the theme of the workshops 1 Derivation of in vitro model systems epithelial fibroblastic and hematopoietic 2 Factors modulating cellular transformation 3 Usefulness of defined in vitro model systems for viral chemical and radiation carcinogenesis 4 Multistep nature of human cell carcinogenesis 5 Role of activated and suppressor oncogenes in neoplastic trans formation The workshop was organized by J S Rhim and A Dritschilo cochairmen G Jay J little M McCormick R Tennant and R R Weischelbaum There were 32 speakers 30 poster presentations and about 190 participants **Structure and Functions of Amine Oxidases** Bruno Mondovi,2018-01-10 A good portion of this book has been devoted to the copper dependent enzymes these being the more numerous The chapter dealing with serum amine oxidases also focuses attention on their catalytic mechanism as these enzymes have been studied in greater depth As the presentation of topics whose experimental basis is rapidly developing is likely to stimulate the reader s interest many bibliographic references have been included Readers could find this book poor as far as many topics are dealt with in a relatively little space but we believe it essential to trace the background of our present knowledge in the field of amine oxidases stressing the future outlook of research on these enzymes for they are becoming more and more important in general and medical biochemistry

Inhibition of Polyamine Metabolism Peter McCann,2012-12-02 Inhibition of Polyamine Metabolism Biological Significance and Basis for New Therapies provides an overview of the field concerning polyamine biosynthesis inhibitors The book is comprised of chapters which describe the compounds which are in use the rationale for the design of such inhibitors their synthesis and action their biological effects on mammalian cells and tissues plants and microorganisms including protozoal parasites and a review of the clinical experience with these inhibitors The major beneficial effect which the wide availability of these inhibitors has had on the field of polyamine research in general is likewise demonstrated Biochemists pharmacologist and cellular physiologists will find this text very useful **Research Grants Index** National Institutes of Health (U.S.). Division of Research Grants,1975 *Advances in Cancer Research* ,1982-08-11 Advances in Cancer Research

Research Grants ,1987 Mechanisms of Organ Dysfunction in Critical Illness Timothy W. Evans,Mitchell P. Fink,2002-01-21 The pathophysiology of sepsis can be regarded as a series of steps beginning with the invasion of normally sterile tissue by microbes and the elaboration of various pro inflammatory mediators The final common pathway is often the development of the multiple organ dysfunction syndrome MODS Whereas a great deal has been learned during the past quarter century about the inflammatory processes associated with sepsis and other related conditions such as ischemia

reperfusion injury our understanding is far less developed with respect to the pathophysiological events that lead to organ dysfunction under these conditions Nevertheless efforts by both clinical and laboratory scientists are leading to new knowledge in this area The chapters in this volume provide a state of the art overview of many aspects of the pathophysiology of organ dysfunction in critical illness **The Prostate as an Endocrine Gland** Richard J. Ablin,Wells E. Farnsworth,1989-11-30 This unique publication illustrates that the prostate elaborates an array of local hormones or autocoids and how these influence prostatic growth function and oncogenesis It describes how familiarity with these participants and how they effect the character and direction of prostatic function may suggest diagnostic markers of malfunction and new sites and modes of therapeutic intervention The catholic scope and authorship of the work seeks to integrate the views of those urologists reproductive physiologists and endocrinologists who presently work with the prostate It attempts to show all other biologists the full range of the gland s activities and participating molecules Included are oncogenes mitogens polyamines prostaglandins growth factors antigens and the familiar steroid peptide and protein hormones This volume is unique in its point of view and in the new concepts it presents Addressed are actions of spermine binding protein and osteoblastic mitogens consequences of inhibin thyrotropin releasing hormone balance and urokinase effects Covered also are androgen modulation of vasoactive intestinal polypeptides evidence of a prostatolymphoreticular system secretion of dihydrotestosterone and a model of the inter dependence of prostatic epithelium and stroma This unique new volume is of great value to those in urology internal medicine physiology endocrinology and pharmacology

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