



# **Biochemistry of Signal Transduction in Myocardium**

**edited by**

**Jos M. J. Lamers & Pieter D. Verdouw**

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# Biochemistry Of Signal Transduction In Myocardium

**Khalil Ahmed, E. Chambaz, Olaf-Georg  
Issinger**



## **Biochemistry Of Signal Transduction In Myocardium:**

**Biochemistry of Signal Transduction in Myocardium** Jos M.J. Lamers, Pieter D. Verdouw, 2012-12-06 The chapters in this volume are the Proceedings of the Satellite Symposium of the XVIth World Congress of the International Society for Heart Research on Signal Transduction in Normal and Diseased Myocardium which was held in Rotterdam at the Faculty of Medicine Health Sciences of the Erasmus University June 30 and July 1 1995 Diverse and distinct auto para and endocrine stimuli arriving at the surface of endothelium smooth muscle cells cardiomyocytes and fibroblasts within the myocardium engage cell type specific receptors which lead to transmission of signals across the cell plasma membrane and result in the production and activation of second messengers The most common mechanism by which these second messengers function is via direct or indirect activation of specific protein kinases The current challenge for scientists is to identify the specific substrates e g metabolic enzymes  $Ca^{2+}$  regulating proteins transcription and mitotic factors for the many protein kinases to elucidate the biological significance of the cell type specific expression heterogeneity of signalling proteins e g membrane receptors isoenzymes of protein kinase C G proteins and to unravel the cross talk interaction between the signalling systems e g phospholipase C with adenylate cyclase and phospholipase C with phospholipase D The multiplicity of receptor types G proteins effector proteins second messengers and protein kinases their substrate proteins and the cross talk interactions in the myocardium raises fundamental questions about the mechanisms that ensure the precision and timing of the myocardial responses to hormonal and pharmacological stimuli This book provides an up to date source of information for all scientists and clinicians interested in the mechanisms by which external signals are transmitted to the interior and regulation of a variety of physiological pathological and pharmacological responses

**Biochemical Regulation of Myocardium** Roland Vetter, Ernst-Georg Krause, 2012-12-06 This special issue of Molecular and Cellular Biochemistry contains original research papers as well as invited reviews dedicated on the occasion of the 40th anniversary of the inauguration of the Heart Research Group in Berlin Buch that today forms a part there of the Max Delbrück Center for Molecular Medicine to Professor Albert Wollenberger founder of the Heart Research Group and for 21 years its head The papers in this issue are written by researchers working in the field of cardiovascular research who together with Albert Wollenberger share the belief that an integrative application of advances in molecular and cellular biology will lead to new concepts for treatment and prevention of cardiovascular diseases We hope that this special will serve as a good source of information in this regard We wish to thank all of the contributors for their help and cooperation We also wish to thank Mrs Verona Kuhle for her secretarial help We are grateful to Dr Naranjan S Dhalla Editor in Chief of Molecular and Cellular Biochemistry for his interest and encouragement and for agreeing to publish this issue in honor of Albert Wollenberger

ROLAND VETTER and ERNST GEORG KRAUSE Max Delbrück Center for Molecular Medicine Robert Rossle StraBe 10 13122 Berlin Buch Germany PART I CARDIAC DEVELOPMENT AND REGULATION Molecular and Cellular Biochemistry 163 164 5 11 1996 1996 Kluwer

Academic Publishers      *Biochemical Mechanisms in Heart Function* Ernst-Georg Krause, Roland Vetter, 2012-12-06 This special issue of Molecular and Cellular Biochemistry good source of information in this regard contains original research papers as well as invited reviews We wish to thank all of the contributors for their help and dedicated on the occasion of the 40th anniversary of the in cooperation We also wish to thank Mrs Verona Kuhle for auguration of the Heart Research Group in Beriin Buch that her secretarial help We are grateful to Dr Naranjan S Dhalla today forms a part there of the Max Delbrück Center for Molecular Editor in Chief of Molecular and Cellular Biochemistry for his Molecular Medicine to Professor Albert Wollenberger founder interest and encouragement and for agreeing to publish this of the Heart Research Group and for 21 years its head issue in honor of Albert Wollenberger The papers in this issue are written by researchers working in the field of cardiovascular research who together with ERNST GEORG KRAUSE and ROLAND VETTER Albert Wollenberger share the belief that an integrative approach at Max Delbrück Center for Molecular Medicine publication of advances in molecular and cellular biology will lead to new concepts for treatment and prevention of cardiovascular diseases We hope that this special will serve as a German ALBERT WOLLENBERGER Professor Ph D Harvard Dr Sc Med Berlin The dedication is accorded to Prof      **Biochemistry of Hypertrophy and Heart Failure** Lorrie A. Kirshenbaum, Ian M.C. Dixon, Pawan K. Singal, 2012-12-06 The focus of this special issue of Molecular and Cellular Biochemistry is underlying mechanisms that regulate cardiac growth The new information provided in this special issue can be utilized to design new treatment modalities that will reduce the incidence of cardiac failure which will improve quality of life in patients with chronic heart disease      *Signal Transduction in the Cardiovascular System in Health and Disease* Ashok K. Srivastava, Madhu B. Anand-Srivastava, 2008-09-20 Signal Transduction in Cardiovascular System Health and Disease highlights the major contributions of different signaling systems in modulating normal cardiovascular functions and how a perturbation in these signaling events leads to abnormal cell functions and cardiovascular disorders This title is volume 3 in the new Springer series Advances in Biochemistry in Health and Disease      Biochemistry of Diabetes and Atherosclerosis James S.C. Gilchrist, Paramjit Tappia, Thomas Netticadan, 2012-12-06 Diabetes is an autoimmune inflammatory disease affecting many different organ systems and exhibiting both primary and secondary defects Because diabetes affects a wide range of cellular systems a multidisciplinary effort has been mounted over the past several decades using a wide range of investigative techniques and methodologies in order to identify molecular mechanisms responsible for cellular dysfunction Because primary defects at various levels of sub cellular signaling intracellular calcium handling protein expression and energy regulation are often a primary consequence of diabetes This volume is a compilation of new multidisciplinary research that will broaden our current understanding of diabetes and cardiovascular disease as well as provide the basis for the development of novel therapeutic interventions      **Cardiac Cell Biology** Elissavet Kardami, Larry Hryshko, Nasrin Meseali, 2013-06-29 Cardiac cell biology has come of age Recognition of activated or modified signaling molecules by specific

antibodies new selective inhibitors and fluorescent fusion tags are but a few of the tools used to dissect signaling pathways and cross talk mechanisms that may eventually allow rational drug design Understanding the regulation of cardiac hypertrophy in all its complexity remains a fundamental goal of cardiac research Since the advancement of adenovirally mediated gene transfer transfection efficiency is no longer a limiting factor in the study of cardiomyocytes A limiting factor in considering cell transplantation as a strategy to repair the damaged heart is cell availability at the right time Cardiac gap junctions intercellular communication channels that allow electrical and metabolic coupling and play an important role in arrhythmogenesis are now understood to be exquisite sensors of cardiac change The reports in this volume include elegant studies that made use of cutting edge technological advances and many specialized reagents to address these issues

*Cardiac Metabolism in Health and Disease* Salah Abdel-aleem, James E. Lowe, 2012-12-06 This special issue of Molecular and Cellular Biochemistry contains original research papers as well as invited reviews focused in the field of cardiac metabolism and its regulation under normal and disease conditions These papers cover many areas under intensive and rapid development such as the regulation of fatty acid oxidation in the heart the role of cardiac glycogen during ischemia the role of CPT I isoenzymes the pathophysiology of diabetic cardiomyopathy cardiac protection through regulation of energy production the role of fatty acid binding protein under normal and pathological conditions and several other important topics in this area of research We hope that this special issue of Molecular and Cellular Biochemistry provides an up to date source of information for scientists and clinicians interested in the mechanism by which cardiac metabolism is regulated in health and disease and the mechanistic relationship between disturbances in cardiac metabolism and the genesis of cardiovascular diseases Molecular Mechanisms of Metal Toxicity and Carcinogenesis Xianglin Shi, Vince Castranova, Val

Vallyathan, William G. Perry, 2012-12-06 During the last two decades chemical and cellular studies have contributed enormously to our understanding of metal induced carcinogenesis and many hypotheses on the role of metals in pathophysiological processes have been investigated In addition new techniques are available to shed light on the mechanism of carcinogenesis in molecular terms This conference on Molecular Mechanisms of Metal Toxicity and Carcinogenesis in September 2000 focused on the latest research in molecular mechanisms of metal induced toxicity and carcinogenesis The conference promoted a multidisciplinary investigative approach and included presentations from international experts on state of the art information in this field **Myocardial Ischemia and Reperfusion** Michael V. Cohen, J.M. Downey, R.J. Gelpi, Jan Slezak, 2012-12-06 The articles collected in this volume largely arose from two related meetings held last spring The first was held in Buenos Aires Argentina on April 11 12 1997 and was titled Nuevos Avances en el Fenomeno de Isquemia y Reperfusion New Advances in the Phenomenon of Ischemia and Reperfusion The second meeting took place in Star Lesn located in the High Tatras Mountains of the Slovak Republic on June 27 30 1997 Both meetings were sponsored by several organizations including the International Society and Federation of Cardiology the International Society for Heart Research

and The American Heart Association      Signal Transduction and Cardiac Hypertrophy Naranjan S. Dhalla, Larry Hryshko, Elissavet Kardami, Pawan K. Singal, 2012-12-06 Cellular signaling in cardiac muscle refers to the myriad of stimuli and responses that direct and control the physiological operation of this organ Our understanding of these complex signaling cascades has increased dramatically over the past few decades with the advent of molecular tools for their dissection Moreover this information is beginning to provide tangible targets towards manipulating cardiac function in the setting of cardiovascular disease The mechanisms and factors that regulate cardiac cell growth are of particular interest as both adaptive and maladaptive responses can occur during cardiac hypertrophy Cardiac hypertrophy describes the increase in individual cardiac myocyte size that is accomplished through the series and or parallel addition of sarcomeres The ability of cardiac muscle to increase in size through hyperplasia becomes highly restricted or negligible shortly after birth Consequently the increase in heart size associated with development and growth of an individual occurs through hypertrophy In response to a chronic increase in workload cardiac muscle cells can dramatically increase in size to face their increasing contractile demands While this plasticity is clearly a beneficial response under many conditions it can be highly deleterious and inappropriate under others For example cardiac hypertrophy associated with endurance exercise clearly enhances athletic performance In contrast the hypertrophy associated with chronic hypertension stenotic or regurgitant heart valves or following a myocardial infarction often continues far beyond the period where this adaptive response is beneficial

**Muscle Physiology and Biochemistry** Shoichi Imai, Makoto Endo, Iwao Ohtsuki, 2012-12-06 The papers in this volume were contributed by close friends co workers and pupils of Professor Setsuro Ebashi They are dedicated to him to commemorate his great and pioneering contribution to the advancement of muscle physiology and biochemistry which in time exerted a great influence on the whole field of life science We believe that this issue reveals the present state of research on muscle and or calcium that was opened up by Professor Ebashi      **Vascular Biochemistry** Peter

Zahradka, Jeffrey Wagle, Grant N. Pierce, 2012-12-06 This volume explores all aspects of vascular biochemistry and includes chapters that provide an understanding of vascular function with descriptions of tissue components present in the vascular wall as well as an exploration of the hemodynamic and metabolic activities associated with this function In addition some chapters explore the vasculature under conditions which mimic various disease states The information provided in this volume will provide new insights into the mechanisms that control vascular function as well as therapies designed to treat vascular disease      **Novel Methods in Molecular and Cellular Biochemistry of Muscle** Grant N. Pierce, William C.

Claycomb, 2012-12-06 Experimental techniques are the life blood of science The better the methodology is the more reliable and accurate the results will be Ultimately this will lead to a clearer interpretation of those results and firmer conclusions from any set of experiments Experimental methodology in the area of cardiovascular biochemistry and molecular biology has advanced considerably in the last decade Because of these factors it was thought that a focused issue of Molecular and

Cellular Biochemistry dedicated to the novel latest technological advances in the field was warranted We must thank Dr Naranjan S Dhalla Editor in Chief of Molecular and Cellular Biochemistry for his willingness to publish an issue with such a focus We have attracted some of the leaders in the field of cardiovascular biology to submit articles describing some of the most novel significant techniques currently in use in their laboratories The purpose of the manuscripts was not to describe the recent experimental findings from each laboratory as is done in most conventional manuscripts Instead the purpose of the articles found within this focused volume of Molecular and Cellular Biochemistry was to describe how the technique is performed on the laboratory bench so that others less familiar with the technique may be able to use it in their own labs The subjects described in this volume can be generally subdivided into three categories molecular biology cell biology and basic biochemistry The methods cover wide areas including various DNA and RNA expression technologies transfection techniques quantification of ion flux movement measurements of lipid metabolism advances in the culture of specific cardiovascular cell populations and the use of confocal microscopy to examine cell structure and function We thank all of the authors who have contributed so much of their time and efforts and most importantly shared the secrets of these valuable techniques with the rest of the cardiovascular research community

Control of Gene Expression by Catecholamines and the Renin-Angiotensin System Heinz Rupp, Bernhard Maisch, 2012-12-06 The special issue of Molecular and Cellular Biochemistry focuses on Control of Gene Expression by Catecholamines and the Renin Angiotensin System in health and disease In recent years great progress has been made in the understanding of catecholamine and angiotensin II modulated gene expression There is also increasing evidence that catecholamine and angiotensin II induced cellular injury not solely arises from classical pathways but also from a perturbed gene expression Taking into account that catecholamines and angiotensin II are vital for a balanced gene expression of many cells the intriguing possibility arises that various disease are initiated or aggravated by such an imbalance Catecholamine and angiotensin II influences can be in excess arising from for example hypercaloric food intake or psychosocial stress During early progression of heart failure sympathetic activity and angiotensin II influences also become increased Due to beta adrenergic receptor downregulation depressed catecholamine influences are expected in the final stage of heart failure An imbalanced influence of catecholamines and angiotensin II on gene expression leads to disordered molecular structures of the cell and an impaired cell function This focused issue is organized into chapters concentrating on catecholamines angiotensin II and the interaction between catecholamines and angiotensin II Basic biochemical processes are covered in detail and the potential of these pathways for explaining chronic diseases associated with excess catecholamine and angiotensin II influences should become apparent It is hoped that this focussed issue triggers novel research into the development of drugs that are targeted at diseases characterized by an imbalanced gene expression involving catecholamines and angiotensin II

Lipid Binding Proteins within Molecular and Cellular Biochemistry D.A. Bernlohr, L. Banaszak, 2012-12-06 The breadth of modern biology is characterized by a comprehension of phenomena at many

levels of organization Such levels of understanding range from the organismal to the molecular It is when all these levels can be discussed together that a sense of true achievement begins to be felt The topical area of fatty acid transport and metabolism was the focus of the Third International Conference on Lipid Binding Proteins held at the University of Minnesota in May 1997 This volume contains a sampling of the proceedings of this meeting

**Molecular and Cellular Effects of Nutrition on Disease Processes** Grant N. Pierce, Heinz Rupp, Tohru Izumi, Alain Grynberg, 2013-04-17 This volume contains the proceedings of the 2nd World Conference of the International Society for Molecular Nutrition Therapy This conference was held on August 2-4 1997 in Winnipeg Canada The goal of the conference was to advance our knowledge concerning the molecular events which link nutrition to various disease processes in the body This volume represents an important compilation of unique articles addressing the molecular and cellular basis for the nutritional and therapeutic treatment of five general disease processes

*A Molecular and Cellular View of Protein Kinase CK2* Khalil Ahmed, E. Chambaz, Olaf-Georg Issinger, 2012-09-18 It is now generally recognized that protein kinase signaling is involved in virtually every aspect of cell function including growth and proliferation The field of protein phosphorylation including the enzymes involved in this post translational modification continues to advance at a fascinating pace Since the first international meeting on this topic held in Heidelberg in 1994 several new avenues of CK2 research have emerged despite persistent deficiencies in our understanding of the regulation of its activity Among the significant new directions are studies related to the structure of the enzyme especially its crystal structure as well as an interesting aspect of CK2 function that involves its subunits as binding partners of several other proteins In addition new data have been gathered on the role of CK2 in transcription as well as in certain other cellular functions To address these various aspects of the progress of CK2 a number of key scientists from different parts of the world came together at the second international meeting on *A Molecular and Cellular View of Protein Kinase CK2* held at Villard de Lans near Grenoble on September 24-26 1997 The meeting was attended by nearly 50 participants and included 28 presentations which provide a view of the latest progress on protein kinase CK2

**Bioenergetics of the Cell: Quantitative Aspects** Valdur A. Saks, Renée Ventura-Clapier, Xavier Leverve, André Rossi, Michel Rigoulet, 2012-12-06 This volume continues the discussion of the problems of in vivo and in vitro The recently solved X ray structure of the mitochondrial creatine kinase and its molecular biology cellular bioenergetics the tradition we started in 1994 by publication of the focused issue of *Molecular and Cellular* are analyzed with respect to its molecular physiology and Biochemistry volume 133 134 and a book *Cellular Bio functional coupling to the adenine nucleotide translocase as energetics role of coupled creatine kinases* edited by V Saks well as its participation together with the adenylate kinase and R Ventura Clapier and published by Kluwer Publishers system in intracellular energy transfer The results of the Dordrecht Boston In the present volume use of quantitative studies of creatine kinase deficient transgenic mice are methods of studies of organized metabolic systems such as summarized and analyzed by using mathematical models of



mathematical modeling and Metabolic Control Analysis for the compartmentalized energy transfer thus combining two investigation of the problems of bioenergetics of the cell is powerful new methods of the research All these results described together with presentation of new experimental together with the physiological and NMR data on the cardiac results The following central problems of the cellular bio metabolic and mitochondrial responses to work load changes energetics are the focus of the discussions the mechanisms concord to the concept of metabolic networks of energy of regulation of oxidative phosphorylation in the cells in vivo transfer and feedback regulation      Oxygen/Nitrogen Radicals: Cell Injury and Disease  
Val Vallyathan,Vince Castranova,Xianglin Shi,2012-12-06 A veritable mountain of literature has been published showing the causal relationship of reactive oxygen nitrogen species in human disease conditions and there has been an explosion in the understanding of oxidative stress the protective role of antioxidants and molecular events involved in the regulation of transcription editing and translation of key events leading to disease processes Strategies need to be developed for prevention of diseases by allowing scientists and clinicians to obtain information on new and emerging advances The molecular mechanisms involved in several diseases including Alzheimer s disease atherosclerosis diabetes arthritis and Parkinson s disease as well as disorders of the eye skin cardiac and pulmonary systems are discussed in this volume along with scientific evidence supporting the value of dietary supplementation with antioxidants in the prevention of cellular damage leading to chronic disease Special in vivo techniques are also discussed at length along with the role of molecular studies in human risk assessment

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