

Topics in Current Genetics

H. Grosjean (Ed.)

12

# **Fine-Tuning of RNA Functions by Modification and Editing**

 Springer

# Finetuning Of Rna Functions By Modificaiton And Editing

**Ken J. Ishii, Shizuo Akira**



## **Finetuning Of Rna Functions By Modificaiton And Editing:**

**Fine-Tuning of RNA Functions by Modification and Editing** Henri Grosjean, 2005-05-03 Naturally occurring RNA always contains numerous biochemically altered nucleotides. They are formed by enzymatic modification of the primary transcripts during the complex RNA maturation process designated RNA modification. A large number of enzymes catalyzing the formation of these modified nucleosides or converting one canonical base into another at the posttranscriptional level have been studied for many years but only recently have systematic and comparative studies begun. The functions of individual enzymes and of the modified edited nucleosides in RNA however have remained largely ignored. This book provides advance information on RNA modification including the associated editing machinery while offering the reader some perspective on the significance of such modifications in fine tuning the structure and functions of mature RNA molecules and hence the ability to influence the efficiency and accuracy of genetic expression. Outstanding scientists who are actively working on RNA modification editing processes have provided up to date information on these intriguing cellular processes that have been generated over the course of millions of years in all living organisms. Each review has been written and illustrated for a large audience of readers not only specialists in the field but also for advanced students or researchers who want to learn more about recent progress in RNA modification and editing. *RNA and DNA Editing* Harold C.

Smith, 2008-04-25 *RNA and DNA Editing* assembles a team of leading experts who present the latest discoveries in the field alongside the latest models and methodology. In addition the authors set forth the many open questions and suggest routes for further investigation. Overall the book serves as a practical guide for professionals in the field who need to understand the interrelationship of RNA and DNA editing with other chemical and biological processes. *RNA Modifications and*

*Epitranscriptomics* Xiao Han, Jia Meng, Giovanni Nigita, 2022-05-05 **RNA Modification**, 2007-09-13 The presence of modified nucleotides in cellular RNAs has been known for decades and over 100 distinct RNA modifications have been characterized to date. While the exact role of many of these modifications is still unclear many are highly conserved across evolution and most contribute to the overall fitness of the organism. In recent years new methods and bioinformatics approaches have been developed for the dissection of modification pathways and functions. These methods intersect a number of related fields ranging from RNA processing to comparative genomics and systems biology. In addition many of the techniques described in this volume have broad applicability particularly in regards to the isolation characterization and reconstitution of ribonucleoprotein complexes expanding the experimental repertoire available to all RNA researchers.

**DNA and RNA Modification Enzymes** Henri Grosjean, 2009-06-11 This volume is a timely and comprehensive description of the many facets of DNA and RNA modification editing processes and to some extent repair mechanisms. Each chapter offers fundamental principles as well as up to date information on recent advances in the field up to end 2008. They ended by a short conclusion and future prospect section and **The Oxford Handbook of Neuronal Protein Synthesis**

Wayne S. Sossin, 2021 The Oxford Handbook of Neuronal Protein Synthesis reviews the mechanisms of translational control used by the nervous system as well as how nervous system functions such as plasticity and homeostasis depend on accurate translational control The handbook extensively covers how dysregulation of protein synthesis can manifest itself in many distinct pathological processes including neurodevelopmental neuropsychiatric and neurodegenerative diseases

**Modified Nucleic Acids in Biology and Medicine** Stefan Jurga, Volker A. Erdmann (Deceased), Jan

Barciszewski, 2016-07-29 This volume is comprised of 18 chapters covering various aspects of DNA modification and RNA modified bases It also discusses in detail circular RNA therapeutic oligonucleotides and their different properties The chemical nature of DNA RNA protein and lipids makes these macromolecules easily modifiable but they are also susceptible to damage from both endogenous and exogenous agents Alkylation and oxidation show a potential to disrupt the cellular redox equilibrium and cause cellular damage leading to inflammation and even chronic disease Furthermore DNA damage can drive mutagenesis and the resulting DNA sequence changes can induce carcinogenesis and cancer progression Modified nucleosides can occur as a result of oxidative DNA damage and RNA turnover and are used as markers for various diseases To function properly some RNA needs to be chemically modified post transcriptionally Dysregulation of the RNA modification pattern or of the levels of the enzymes that catalyze these modifications alters RNA functionality and can result in complex phenotypes likely due to defects in protein translation While modifications are best characterized in noncoding ribonucleic acids like tRNA and rRNA coding mRNAs have also been found to contain modified nucleosides This book is a valuable resource not only for graduate students but also researchers in the fields of molecular medicine and molecular biology

**RNA Damage and Repair** Ioly Kotta-Loizou, 2021-07-04 Ribonucleic acid RNA is a macromolecule that plays a central role in cell physiology RNA molecules act as intermediates between the deoxyribonucleic acid DNA where genetic information is stored and proteins which perform the necessary functions within the cell Traditionally the structural and functional properties of RNA are closely linked to gene expression However RNA based enzymes called ribozymes are also involved in catalysis and small RNAs regulate key cellular processes such as cell growth division differentiation aging and death RNA is a sensitive macromolecule that can be easily damaged by environmental conditions ultraviolet radiation oxidative stress and biological factors ribonucleases ribotoxins CRISPR Cas systems Therefore cells have developed mechanisms to protect and or repair RNA molecules This book presents an overview of the biology of RNA damage protection and repair in prokaryotes and eukaryotes Individual chapters cover the expression regulation enzymology and physiological role of such systems and link them to important human diseases such as cancer and degenerative diseases *Mass Spectrometry of Nucleosides and Nucleic Acids* Joseph H. Banoub, Patrick A. Limbach, 2009-12-21 Assembling the work of an international panel of researchers Mass Spectrometry of Nucleosides and Nucleic Acids summarizes and reviews the latest developments in the field and provides a window on the next generation of analysis Beginning with an overview of recent

developments the book highlights the most popular ionization methods and illustrates

**Translating Epigenetics to the Clinic** Jeffrey Laurence, 2016-12-30 Translating Epigenetics to the Clinic reviews current methodological tools and experimental approaches used by leading translational researchers seeking to use epigenetics as a clinical model. It organizes epigenetics into disease treatment areas with a major focus on oncology and with much coverage of pervasive treatment categories such as diabetes as well as the diseases of modernity including pharmacological addiction, dementia, and ageing. Pedagogically, the work concentrates on the latest knowledge, laboratory techniques, and experimental approaches used by translational research leaders in this field. The book promotes cross-disciplinary communication between the sub-specialties of medicine. In common with the rest of the books in Translational Medicine, the book remains unified in theme by emphasizing recent innovations, critical barriers to progress, and the new tools being used to overcome them. Also includes specific areas of research that require additional study to advance the field as a whole. Encompasses the latest innovations and tools being used to apply epigenetics in the lab and clinic. Features extensive pedagogical updates aiming to improve the education of translational researchers in this field. Offers a transdisciplinary approach to support cross-fertilization between different sub-specialties of medicine.

Nucleic Acids in Innate Immunity Ken J. Ishii, Shizuo Akira, 2008-05-22 Until recently, innate immunity was regarded as a relatively nonspecific system designed to engulf and destroy pathogens. However, new studies show that the innate immune system is highly developed in its ability to discriminate between self and foreign entities. Understanding this mechanism can lead to therapeutic strategies based on manipulation.

**Navigating Non-coding RNA** Joanna Sztuba-Solinska, 2023-06-17 Navigating Non-coding RNA: From Biogenesis to Therapeutic Application provides a concise overview of the field of non-coding RNA (ncRNA). Chapters cover the history of discoveries that have occurred in the area of ncRNA, specific types of ncRNA, housekeeping ncRNAs such as ribosomal RNA, transfer RNA, small nuclear RNA, and telomerase RNA, regulatory ncRNAs such as microRNA, small interfering RNA, long non-coding RNA, and Y RNA. Biogenesis, structure, function, and regulation of each of these are also explored, in addition to traditional and cutting-edge methods for the identification, functional characterization, and structural characterization of ncRNA. The book also focuses on the different types of epitranscriptomic modifications and their involvement in regulating ncRNA structure, stability, and intermolecular interactions, in addition to the role of ncRNAs in a range of diseases and potential therapeutic applications. Covers a wide range of non-coding RNAs, including ribosomal RNA, transfer RNA, telomerase RNA, microRNA, small interfering RNA, and circular RNA. Features both traditional and novel methodologies for investigating ncRNA, from microarray and conventional chemical probing to CAGE-seq and computational methods. Includes chapters on ncRNAs in a range of diseases, including cancers, neurological disorders, cardiovascular conditions, and infectious illnesses. Discusses novel therapeutic strategies for targeting ncRNAs, including CRISPR/Cas9 applications and RNAi-based strategies. Explores the molecular mechanisms and intermolecular interactions of ncRNA.

International Review of Cell and Molecular Biology Kwang W. Jeon, 2015-02-20

International Review of Cell and Molecular Biology presents comprehensive reviews and current advances in cell and molecular biology Articles address structure and control of gene expression nucleocytoplasmic interactions control of cell development and differentiation and cell transformation and growth The series has a world wide readership maintaining a high standard by publishing invited articles on important and timely topics authored by prominent cell and molecular biologists Authored by some of the foremost scientists in the field Provides comprehensive reviews and current advances Wide range of perspectives on specific subjects Valuable reference material for advanced undergraduates graduate students and professional scientists

**New Antibiotic Targets** W. Scott Champney, 2008-01-15 This book examines specific techniques which can be used to explore new drug targets and the effectiveness of new antibiotics By testing new antimicrobial agents and modified existing drugs the most vulnerable cell processes such as cell wall and membrane synthesis DNA replication RNA transcription and protein synthesis can be better exploited This in depth volume however delves even deeper by identifying additional novel cellular targets for these new therapies The book will provide laboratory investigators with the vital tools they need to test the antimicrobial potential of products and to curb the rise of so many infectious diseases

*Small RNAs:* Wolfgang Nellen, Christian Hammann, 2007-09-12 In recent years Molecular Biology has experienced an unprecedented revolution by the discovery of functional small RNAs The number of cellular processes in which non coding RNAs are involved is growing rapidly and include gene regulation on the transcriptional post transcriptional and translational level To complicate matters these processes seem to be strongly interconnected on the one hand and diverse among different organisms on the other This volume describes strategies for the discovery and validation of small RNAs and provides a snapshot of our current understanding of the different mechanisms triggered by small RNAs

*Selenium* Dolph L. Hatfield, Marla J. Berry, Vadim N. Gladyshev, 2007-01-11 The discovery of selenoproteins in 1973 was the starting point for today's flourishing selenium field 1 2 It provided evidence that selenium had biochemical functions that could account for its nutritional effects 3 4 Further it opened the selenium field to investigation by the methods of biochemistry which led to the identification of several more selenoproteins and showed that selenocysteine was the form of the element in animal selenoproteins and in most bacterial ones Although noteworthy efforts were made to uncover the mechanism of selenocysteine and selenoprotein synthesis using biochemical methods the problem yielded only when attacked with the methods of molecular biology 5 6 The bacterial mechanism was characterized first characterization of the animal mechanism is a work in progress It is interesting to note that the only genes that are devoted to selenium metabolism are those that support selenoprotein synthesis and selenocysteine catabolism Consequently it seems likely that competition for selenium between selenoprotein synthesis and the production of selenium excretory metabolites 7 controls who body selenium homeostasis The physiological functions of selenium derive from the catalytic and physical properties of selenoproteins Selenoproteins such as the glutathione peroxidases and the thioredoxin reductases have redox activities that

allow them to serve in oxidant defense The deiodinases use their redox activities to activate and inactivate thyroid hormones From these two examples it can be seen that selenoprotein functions are diverse while having in common a redox mechanism

Mitochondrial Diseases Wiley,2013-07-12 This collection of reviews and protocols provides the reader with an introduction to the current state of knowledge on how various diseases are related to mitochondrial dysfunction Mitochondria contain their own genome a small circular double stranded DNA mtDNA and alterations in mtDNA may play an important role in the multistep carcinogenesis of at least some types of human cancer In addition to mutations of mtDNA many mitochondrial syndromes are due to abnormalities in nuclear genes related to oxidative phosphorylation OXPHOS Mitochondrial tRNA MTT gene mutations are an important cause of human morbidity and are associated with a wide range of pathology from isolated organ specific diseases such as myopathy or hearing loss to multisystem disorders with encephalopathy gastrointestinal dysmotility and life threatening cardiomyopathy The relationship of the mitochondrion organelle to aging and longevity is also discussed Laboratory protocols describe methodology to characterize mtDNA heteroplasmy by parallel sequencing Each eukaryotic cell contains hundreds of mitochondria with hundreds of mitochondria genomes Mutant and wild type mtDNA may co exist as heteroplasmy and cause human disease The purpose of this protocol is to simultaneously determine mtDNA sequence and quantify the heteroplasmic level Another protocol describes procedures for obtaining tissue sections and cell material suitable for histological evaluation of OXPHOS activity and integrity and immunodetection of the complexes in tissue from patients suspected of mitochondrial disease Emphasis lies on the diagnostic potential of these techniques to differentiate mtDNA from nuclear mutations This e book a curated collection from eLS WIREs and Current Protocols offers a fantastic introduction to the field of mitochondrial diseases for students or interdisciplinary collaborators

Brenner's Encyclopedia of Genetics Stanley Maloy,Kelly Hughes,2013-03-03 The explosion of the field of genetics over the last decade with the new technologies that have stimulated research suggests that a new sort of reference work is needed to keep pace with such a fast moving and interdisciplinary field Brenner s Encyclopedia of Genetics Second Edition Seven Volume Set builds on the foundation of the first edition by addressing many of the key subfields of genetics that were just in their infancy when the first edition was published The currency and accessibility of this foundational content will be unrivalled making this work useful for scientists and non scientists alike Featuring relatively short entries on genetics topics written by experts in that topic Brenner s Encyclopedia of Genetics Second Edition Seven Volume Set provides an effective way to quickly learn about any aspect of genetics from Abortive Transduction to Zygotes Adding to its utility the work provides short entries that briefly define key terms and a guide to additional reading and relevant websites for further study Many of the entries include figures to explain difficult concepts Key terms in related areas such as biochemistry cell and molecular biology are also included and there are entries that describe historical figures in genetics providing insights into their careers and discoveries This 7 volume set represents a 25% expansion from the first

edition with over 1600 articles encompassing this burgeoning field Thoroughly up to date with many new topics and subfields covered that were in their infancy or not in existence at the time of the first edition Timely coverage of emergent areas such as epigenetics personalized genomic medicine pharmacogenetics and genetic enhancement technologies Interdisciplinary and global in its outlook as befits the field of genetics Brief articles written by experts in the field which not only discuss define and explain key elements of the field but also provide definition of key terms suggestions for further reading and biographical sketches of the key people in the history of genetics

*Epitranscriptomics: The Novel RNA Frontier* Giovanni Nigita, Mario Acunzo, William Chi Shing Cho, Carlo Maria Croce, 2019-01-31 Following the formulation of the central dogma of molecular biology and the later discovery of classes of non coding RNAs the primary focus of Genetics was essentially on variation of DNA aiming at elucidating biological pathways perturbed in diseases Recently extensive attention has shifted towards the study of posttranscriptional RNA modifications occurring in both protein coding as well as non coding RNAs revealing a novel and finer layer of complexity in gene regulation This in turn has led to the birth of the novel field of Epitranscriptomics The recent increase of applications of high throughput sequencing technology HTS has allowed the unprecedented opportunity to identify on a transcriptome wide scale millions of RNA modifications in human genes counting today more than 140 distinct types such as methylation e.g. m6A m1A m5C hm5C 2 OMe methylation e.g. m6A m1A m5C hm5C 2 OMe pseudourylation deamination e.g. A to I RNA editing The scope of this Research Topic was to collect both reviews and research articles addressing the wet lab approaches and bioinformatics methodologies necessary to aid in the identification of novel RNA modifications and characterization of their biological functions Among the articles embracing the aim of the Research Topic we have collected four original research and methods articles five reviews and a technology article

*Wiley Encyclopedia of Chemical Biology, Volume 1* Tadhg P. Begley, 2009 The first major reference at the interface of chemistry biology and medicine Chemical biology is a rapidly developing field that uses the principles tools and language of chemistry to answer important questions in the life sciences It has enabled researchers to gather critical information about the molecular biology of the cell and is the fundamental science of drug discovery playing a key role in the development of novel agents for the prevention diagnosis and treatment of disease Now students and researchers across the range of disciplines that use chemical biology techniques have a single resource that encapsulates what is known in the field It is an excellent place to begin any chemical biology investigation Major topics addressed in the encyclopedia include Applications of chemical biology Biomolecules within the cell Chemical views of biology Chemistry of biological processes and systems Synthetic molecules as tools for chemical biology Technologies and techniques in chemical biology Some 300 articles range from pure basic research to areas that have immediate applications in fields such as drug discovery sensor technology and catalysis Novices in the field can turn to articles that introduce them to the basics whereas experienced researchers have access to articles exploring the cutting edge of the science Each article ends with a list of references to facilitate further



investigation With contributions from leading researchers and pioneers in the field the Wiley Encyclopedia of Chemical Biology builds on Wiley s unparalleled reputation for helping students and researchers understand the crucial role of chemistry and chemical techniques in the life sciences

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