

Kenn Gerdes *Editor*

Prokaryotic Toxin–Antitoxins

 Springer

Prokaryotic Toxin Antitoxins

Nadia Danilova



Prokaryotic Toxin Antitoxins:

Prokaryotic Toxin-Antitoxins Kenn Gerdes,2012-10-19 Prokaryotic Toxins Antitoxins gives the first overview of an exciting and rapidly expanding research field Toxin antitoxin TA genes were discovered on plasmids 30 years ago Since then it has become evident that TA genes are highly abundant in bacterial and archaeal chromosomes TA genes code for an antitoxin that combine with and neutralize a cognate toxin When activated the toxins inhibit protein synthesis and cell growth and thereby induce dormancy and multidrug tolerance persistence Remarkably in some species the TA gene families have undergone dramatic expansions For example the highly persistent major human pathogen *Mycobacterium tuberculosis* has 100 TA loci The large expansion of TA genes by some organisms is a biological mystery However recent observations indicate that TA genes contribute cumulatively to the persistence of bacteria This medically important phenomenon may thus for the first time become experimentally tractable at the molecular level Prokaryotic Toxin-Antitoxins Kenn Gerdes,2012-10-19 Prokaryotic Toxins Antitoxins gives the first overview of an exciting and rapidly expanding research field Toxin antitoxin TA genes were discovered on plasmids 30 years ago Since then it has become evident that TA genes are highly abundant in bacterial and archaeal chromosomes TA genes code for an antitoxin that combine with and neutralize a cognate toxin When activated the toxins inhibit protein synthesis and cell growth and thereby induce dormancy and multidrug tolerance persistence Remarkably in some species the TA gene families have undergone dramatic expansions For example the highly persistent major human pathogen *Mycobacterium tuberculosis* has 100 TA loci The large expansion of TA genes by some organisms is a biological mystery However recent observations indicate that TA genes contribute cumulatively to the persistence of bacteria This medically important phenomenon may thus for the first time become experimentally tractable at the molecular level *Modulating Prokaryotic Lifestyle by DNA-Binding Proteins* Tatiana Venkova,Antonio Juarez,Manuel Espinosa,2017-03-07 The Overview of the Topic was the following One of the most active areas of research in molecular microbiology has been the study of how bacteria modulate their genetic activity and its consequences The prokaryotic world has gained a lot of interest In addition to the above the invention is based on the subject matter of the present invention which is incorporated herein by reference in its entirety All of these processes are fundamental to the operation of a genetic entity and condition their lifestyle Further the discoveries in the bacterial world have been of ample use in eukaryotes Article in German Hansen Hansen H 2003 In addition to the fundamental interest in understanding modulation of prokaryotic lifestyle by DNA binding proteins As it is well known the antibiotic resistance strains of pathogenic bacteria are a major world problem so that there is an urgent need of innovative technologies to tackle it Most of the patients are infected with the virus It is an imperative of finding new alternatives to the classical way of treatment of bacterial infections and these new alternatives Nevertheless These new alternatives will find a dead end if we are unable to obtain a better understanding of the basic processes modulating bacterial gene expression Our goal is to achieve our understanding

of protein DNA interactions First the topic will bring together a lot of very active research in the study of gene replication gene regulation the strategies We therefore want to acquire an in depth knowledge of some of the mechanisms of gene regulation gene transfer and gene replication Further the readers of the papers will realize the importance of the topic and will learn the most recent thinking results and approaches in the area We are fully confident that we have exceeded our expectations Now we are proud to present the final output of the topic which is the eBook It includes 24 articles contributed by 118 authors As of today March 16th January 2017 the total number of readings has reached 19 284 14 921 article views and 2 944 article downloads

Stress and Environmental Regulation of Gene Expression and Adaptation in Bacteria, 2 Volume Set Frans J. de Bruijn, 2016-09-06 Bacteria in various habitats are subject to continuously changing environmental conditions such as nutrient deprivation heat and cold stress UV radiation oxidative stress dessication acid stress nitrosative stress cell envelope stress heavy metal exposure osmotic stress and others In order to survive they have to respond to these conditions by adapting their physiology through sometimes drastic changes in gene expression In addition they may adapt by changing their morphology forming biofilms fruiting bodies or spores filaments Viable But Not Culturable VBNC cells or moving away from stress compounds via chemotaxis Changes in gene expression constitute the main component of the bacterial response to stress and environmental changes and involve a myriad of different mechanisms including alternative sigma factors bi or tri component regulatory systems small non coding RNA s chaperones CHRIS Cas systems DNA repair toxin antitoxin systems the stringent response efflux pumps alarmones and modulation of the cell envelope or membranes to name a few Many regulatory elements are conserved in different bacteria however there are endless variations on the theme and novel elements of gene regulation in bacteria inhabiting particular environments are constantly being discovered Especially in pathogenic bacteria colonizing the human body a plethora of bacterial responses to innate stresses such as pH reactive nitrogen and oxygen species and antibiotic stress are being described An attempt is made to not only cover model systems but give a broad overview of the stress responsive regulatory systems in a variety of bacteria including medically important bacteria where elucidation of certain aspects of these systems could lead to treatment strategies of the pathogens Many of the regulatory systems being uncovered are specific but there is also considerable cross talk between different circuits Stress and Environmental Regulation of Gene Expression and Adaptation in Bacteria is a comprehensive two volume work bringing together both review and original research articles on key topics in stress and environmental control of gene expression in bacteria Volume One contains key overview chapters as well as content on one two three component regulatory systems and stress responses sigma factors and stress responses small non coding RNAs and stress responses toxin antitoxin systems and stress responses stringent response to stress responses to UV irradiation SOS and double stranded systems repair systems and stress adaptation to both oxidative and osmotic stress and desiccation tolerance and drought stress Volume Two covers heat shock responses chaperonins and stress cold shock responses adaptation to acid stress nitrosative

stress and envelope stress as well as iron homeostasis metal resistance quorum sensing chemotaxis and biofilm formation and viable but not culturable VBNC cells Covering the full breadth of current stress and environmental control of gene expression studies and expanding it towards future advances in the field these two volumes are a one stop reference for non medical molecular geneticists interested in gene regulation under stress Molecular Biology of RNA Processing and Decay in Prokaryotes ,2009-03-10 Nucleic acids are the fundamental building blocks of DNA and RNA and are found in virtually every living cell Molecular biology is a branch of science that studies the physicochemical properties of molecules in a cell including nucleic acids proteins and enzymes Increased understanding of nucleic acids and their role in molecular biology will further many of the biological sciences including genetics biochemistry and cell biology Progress in Nucleic Acid Research and Molecular Biology is intended to bring to light the most recent advances in these overlapping disciplines with a timely compilation of reviews comprising each volume This series provides a forum for discussion of new discoveries approaches and ideas Contributions from leading scholars and industry experts Reference guide for researchers involved in molecular biology and related fields Systems Biology of Tuberculosis Johnjoe McFadden,Dany J.V. Beste,Andrzej M. Kierzek,2012-12-09 The book starts with a general introduction into the relevance of systems biology for understanding tuberculosis This will be followed by several chapters which describe the application of systems biology to various aspects of the study of the pathogen Mycobacterium tuberculosis and its interaction with the host The book provides the reader with an account of how the new science of systems biology is providing novel insights into the ancient scourge of tuberculosis It will also describe how systems biology can be applied to the control of tuberculosis including the development of new treatments vaccines and diagnostics **Prokaryotic Metabolism and Physiology** Byung Hong Kim,Geoffrey Michael Gadd,2019-05-16 Extensive and up to date review of key metabolic processes in bacteria and archaea and how metabolism is regulated under various conditions **Mycobacterium Tuberculosis: Molecular Infection Biology, Pathogenesis, Diagnostics and New Interventions** Seyed Ehtesham Hasnain,Nasreen Z. Ehtesham,Sonam Grover,2019-11-30 This book reviews recent advances in the molecular and infection biology pathology and molecular epidemiology of Mycobacterium tuberculosis as well as the identification and validation of novel molecular drug targets for the treatment of this mycobacterial disease Despite being completely curable tuberculosis is still one of the leading global causes of death M tuberculosis the causative organism one of the smartest pathogens known adopts highly intelligent strategies for survival and pathogenesis Presenting a wealth of information on the molecular infection biology of M tuberculosis as well as nontuberculous mycobacteria NTM the book provides an overview of the functional role of the PE PPE group of proteins which is exclusive to the genus Mycobacteria of host pathogen interactions and virulence It also explores the pathogenesis of the infection pathology epidemiology and diagnosis of NTM Finally it discusses current and novel approaches in vaccine development against tuberculosis including the role of nanotechnology With state of the art contributions from experts in the

respective domains this book is an informative resource for practitioners as well as medical postgraduate students and researchers

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

The Good, The Bad and The Ugly: Multiple Roles of Bacteria in Human Life Tatiana Venkova,Chew Chieng Yeo,Manuel Espinosa,2018-10-17 Bacteria are among the earliest forms of life on Earth Notwithstanding their small size and primitive origin bacteria still have a tremendous impact on everyday human life Over the centuries research into bacteria have provided and enriched the fundamental biological knowledge due to their readily measured processes and effects on higher organisms Although molecular genetics and microbiology were among the scientific fields that have mostly benefited from the discoveries made in bacteria our current state of knowledge has gone beyond what anyone could have ever imagined The present Research Topic aims to cover new and exciting broad aspects of the importance of bacteria to human life both positive and negative influences Regulation of bacterial gene expression replication and segregation control mechanisms cell to cell communication via quorum sensors and the relatively recent finding of bacterial immunity via CRISPR have led to the development of many and very important new tools in biotechnology and the emerging field of molecular medicine The battle against infectious diseases has also benefited from the genetic approaches that have been developed in the quest for finding new targets and novel drugs against pathogenic bacteria At the next level the human microbiome project has opened up new avenues in understanding the role of bacteria in human health and wellbeing Finally the relationship between bacterial infections and human cancers will also be covered a subject that is still under verification through rigorous experimental approaches Special emphasis will be given to the bacterial accessory genome i e the mobilome as the primary cause of health threatening antimicrobial resistance and the production of toxins and virulence factors Taking into account the evolutionary importance of horizontal gene transfer and the additional beneficial roles of certain bacterial mobile genetic elements they help project best the Good the Bad and the Ugly outline of this topic At the time this eBook is about to be published our Research Topic has registered nearly 55 000 views

Origin of Group Identity Luis P. Villarreal,2008-12-10 A sense of

belonging is basic to the human experience But in this humans are not unique Essentially all life from bacteria to humans have ways by which it determines which members belong and which do not This is a basic cooperative nature of life I call group membership which is examined in this book However cooperation of living things is not easily accounted for by current theory of evolutionary biology and yet even viruses display group membership That viruses have this feature would likely seem coincidental or irrelevant to most scientist as having any possible relationship to human group identity Surely such simple molecular based relationships between viruses are unrelated to the complex cognitive and emotional nature of human group membership Yet viruses clearly affect bacterial group membership which are the most diverse and abundant cellular life form on Earth and from which all life has evolved Viruses are the most ancient numerous and adaptable biological entities we know And we have long recognized them for the harm and disease they can cause and they have been responsible for the greatest numbers of human deaths However with the sequencing of entire genomes and more recently with the shotgun sequencings of habitats we have come to realize viruses are the black hole of biology a giant force that has until recently been largely unseen and historically ignored by evolutionary biology Viruses not only can cause acute disease but also persist as stable unseen agents in their host

Host - Pathogen Interaction Gottfried Unden, Eckhard Thines, Anja Schöffler, 2016-09-06 Dieser Werk behandelt umfassend und aktuell Stoffwechseler nderungen beim Menschen die mit Wirt Erreger Beziehungen in Zusammenhang stehen Teil 1 beschreibt die Anpassung pathogener Mikroben an Stoffwechseltorg nge Teil 2 zeigt Wege f r die Entwicklung neuartiger Antibiotika The Prokaryotes Stanley Falkow, Eugene

Rosenberg, Karl-Heinz Schleifer, Erko Stackebrandt, 2006-10-11 The revised Third Edition of The Prokaryotes acclaimed as a classic reference in the field offers new and updated articles by experts from around the world on taxa of relevance to medicine ecology and industry Entries combine phylogenetic and systematic data with insights into genetics physiology and application Existing entries have been revised to incorporate rapid progress and technological innovation The new edition improves on the lucid presentation logical layout and abundance of illustrations that readers rely on adding color illustration throughout Expanded to seven volumes in its print form the new edition adds a new searchable online version **RNA**

Turnover in Bacteria, Archaea and Organelles Lynne E. Maquat, Cecilia Arraiano, 2008-12-23 Specific complexes of protein and RNA carry out many essential biological functions including RNA processing RNA turnover RNA folding as well as the translation of genetic information from mRNA into protein sequences Messenger RNA mRNA decay is now emerging as an important control point and a major contributor to gene expression Continuing identification of the protein factors and cofactors and mRNA instability elements responsible for mRNA decay allow researchers to build a comprehensive picture of the highly orchestrated processes involved in mRNA decay and its regulation Covers the difference in processing of mRNA between eukaryotes bacteria and archaea Benefit Processing of mRNA differs greatly between eukaryotes bacteria and archaea and this affords researchers readily reproducible techniques to understand and study the molecular pathogenesis of disease

Expert researchers introduce the most advanced technologies and techniques to identify mRNA processing transport localization and turnover which are central to the process of gene expression Benefit Keeps MIE buyers and online subscribers up to date with the latest research Offers step by step lab instructions including necessary equipment and reagents Benefit Provides tried and tested techniques which eliminate searching through many different sources Tested techniques are trustworthy and avoid pitfalls so the same mistakes are not made over and over

Stress Response and Immunity: Links and Trade Offs Nadia Danilova,2020-02-04 When environmental conditions deviate from the optimal range stress ensues Stress response is a set of reactions that allow the organism to adjust and survive adverse conditions Stress can be physical such as extreme temperature radiation injury or psychological caused by perceived danger or deprivation Every living cell has biochemical mechanisms to cope with physical stress These mechanisms show a degree of similarity among several types of living organisms Stress Response and Immunity Links and Trade Offs explores the functional and evolutionary connections between stress response and immunity The book introduces the reader to the concept of stress and subsequently examines the connection between stress response and immunity at various evolutionary stages of living organisms from bacteria to humans The book also features chapters dedicated to the role of tumor suppressor genes and the immune system of the brain The information presented in this reference demonstrates the profound effects of physical and psychological stress on human health Readers with basic knowledge of molecular biology will learn about the interesting facets of stress responses and the evolutionary trade offs observed in different life forms

Regulatory RNAs in Prokaryotes Anita Marchfelder,Wolfgang Hess,2012-12-23 This book provides a comprehensive and up to date collection of review articles focusing on RNA mediated regulation in prokaryotes The various modes of action include the direct interaction with proteins direct sensing of metabolites or of physical parameters and the interaction with RNAs to stimulate or prevent binding of ribosomes or to stimulate degradation Written by leading experts in the field the book covers small RNA functions RNA thermometers riboswitches the diversity of small RNA guided CRISPR Cas defense systems and selected RNA chaperons in both prokaryotic domains bacteria and archaea Recent advances towards the computational identification of regulatory RNAs and their targets are included and particular attention is paid to small RNA in pathogenic bacteria This volume is the only one exclusively covering regulatory RNAs in the prokaryotic domains to date making it essential literature for anyone interested in RNA function and gene regulation and a valuable resource for teaching these concepts

Prokaryotic Diversity N. A. Logan,H. M. Lappin-Scott,P. C. F Oyston,2006-04-20 The true extent of prokaryote diversity encompassing the spectrum of variability among bacteria remains unknown Current research efforts focus on understanding why prokaryote diversification occurs its underlying mechanisms and its likely impact The dynamic nature of the prokaryotic world and continuing advances in the technological tools available make this an important area and hence this book will appeal to a wide variety of microbiologists Its coverage ranges from studies of prokaryotes in specialized environmental

niches to broad examinations of prokaryote evolution and diversity and the mechanisms underlying them Topics include bacteria of the gastrointestinal tract unculturable organisms in the mouth and in the soil organisms from extreme environments the diversity of archaea and their phages comparative genomics and the emergence of pathogens the spread of genomic islands between clinical and environmental organisms minimal genomes needed for life horizontal gene transfer phenotypic innovation and patterns and extent of biodiversity

Biofilm-based Healthcare-associated Infections

Gianfranco Donelli, 2014-11-10 The aim of this book is to provide readers with a wide overview of the main healthcare associated infections caused by bacteria and fungi able to grow as biofilm The recently acquired knowledge on the pivotal role played by biofilm growing microorganisms in healthcare related infections has given a new dynamic to detection prevention and treatment of these infections in patients admitted to both acute care hospitals and long term care facilities Clinicians hygienists and microbiologists will be updated by leading scientists on the state of art of biofilm based infections and on the most innovative strategies for prevention and treatment of these infections often caused by emerging multidrug resistant biofilm growing microorganisms

Fatal Jump Leslie Reperant, 2023-03-21 Exploring the fateful chains of events that gave rise to humanity's infectious diseases and pandemics Why do global pandemics materialize To address this question we must delve into the world of pathogens that transcend their original host species and jump into new ones Most pathogens fail to initiate infection or spread in the population when they jump Only a few sustain onward chains of transmission and even fewer sustain these indefinitely Yet the rare pathogens that do make the leap have caused many of humanity's most dangerous infectious diseases In *Fatal Jump Tracking the Origins of Pandemics* veterinary disease ecologist Dr Leslie Reperant investigates mysteries such as how African originated monkeypox left its home continent why COVID 19 could threaten measles control and how pigs' fondness for mangoes enabled the deadly Nipah virus to spread She shares behind the scenes insights into hugely destructive pathogens carried by rats bats ticks and mosquitoes as well as lesser known vectors such as prairie dogs and camels Drawing from the latest research she discusses whether we can predict these deadly jumps before they happen and what factors including environmental change population dynamics and molecular evolution enable a zoonotic disease to reach full pandemic status Rich with recent scientific discoveries and emerging theories this book spans a diverse range of disciplines weaving their insights into a holistic view of infectious disease With new pathogens emerging at an alarming pace *Fatal Jump* reorients our perspective on pandemics from a human centered standpoint to the bigger picture We will understand what actions are necessary to control emergence only by recognizing the increasingly global nature of human society and the connections between the planet's environmental health and our own health

Drug Discovery and Development Omboon Vallisuta, Suleiman Olimat, 2015-06-03 It is very important for scientists all over the globe to enhance drug discovery research for better human health This book demonstrates that various expertise are essential for drug discovery including synthetic or natural drugs clinical pharmacology receptor identification drug metabolism

pharmacodynamic and pharmacokinetic research The following 5 sections cover diverse chapter topics in drug discovery
Natural Products as Sources of Leading Molecules in Drug Discovery Oncology and Drug Discovery Receptors Involvement in
Drug Discovery Management and Development of Drugs against Infectious Diseases Advanced Methodology

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