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DNA Replication Control in Microbial Cell Factories

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DNA Replication Control in Microbial Cell Factories Monika Glinkowska, Lidia Boss, Grzegorz Wegrzyn, 2014-09-23 This work describes the current knowledge of biochemical mechanisms regulating initiation of DNA replication in *Escherichia coli* which focuses on the control of activity of the DnaA protein Examples of direct linkages between DNA replication and other cellular processes are provided In addition similarities of the mechanisms of regulation of DNA replication operating in prokaryotic and eukaryotic cells are identified and implications for understanding more complex processes like carcinogenesis are suggested Studies of recent years provided evidence that regulation of DNA replication in bacteria is more complex than previously anticipated Multiple layers of control seem to ensure coordination of this process with the increase of cellular mass and the division cycle Metabolic processes and membrane composition may serve as points where integration of genome replication with growth conditions occurs It is also likely that coupling of DNA synthesis with cellular metabolism may involve interactions of replication proteins with other macromolecular complexes responsible for various cellular processes Thus the exact set of factors participating in triggering the replication initiation may differ depending on growth conditions Therefore understanding the regulation of DNA duplication requires placing this process in the context of the current knowledge on bacterial metabolism as well as cellular and chromosomal structure Moreover in both *Escherichia coli* and eukaryotic cells replication initiator proteins were shown to play other roles in addition to driving the assembly of replication complexes which constitutes another yet not sufficiently understood layer of coordinating DNA replication with the cell cycle *DNA Replication: The Regulatory Mechanisms* Patrick Hughes, Ellen Fanning, Masamichi

Kohiyama, 2012-12-06 DNA replication is a key event in the cell cycle Although our knowledge is far from complete and many elusive regulatory mechanisms still remain beyond our grasp many enzymes and a multiplicity of biochemical mechanisms involved have been discovered Recent findings in *E. coli* have confirmed and yet surpassed the original hypothesis of F Jacob In yeast and higher eucaryotes the apparent redundancy in putative origins and initiators has made an estimation of the importance of each identified element difficult to access In spite of well established methodologies which are also described in the book the origin identification in mammalian chromosomes is still a controversial subject On the other hand considerable advances have been made in our understanding of virus DNA replication and this continues to deepen and broaden our understanding of the controls of cellular DNA replication *DNA Replication and the Cell Cycle* Ellen Fanning, Rolf Knippers, Ernst-L. Winnacker, 2012-12-06 Provided here is an easily accessible introduction to the mechanisms of DNA replication regulation and the biochemistry of cell cycle control An overview of this rapidly developing field is presented to orient the reader followed by a series of contributions by leading researchers summarizing recent results on selected topics such as protein phosphorylation tumor suppressor genes and signal transduction in prokaryotic and eucaryotic systems The reader will gain an overview of our current understanding of DNA replication and the cell cycle and a selection

of useful recent references for further reading Mechanism and Regulation of DNA Replication Alan Kolber, 2012-12-06 1

Chromosome Replication in Prokaryotes Enzymatic Aspects of Chromosome Replication in E coli Escherichia coli DNA Polymerase II and III Initiation of DNA Synthesis In vitro Replication of DNA The Role of ATP in Chromosome Replication Studied in Tolerant Escherichia coli Membrane Protein Components and DNA Synthesis in Escherichia coli A Possible Common Role for DNA Polymerase I and Exonuclease V in Escherichia coli The Joining of DNA Duplexes at Their Base Paired Ends The Attachment of the Bacterial Chromosome to the Cell Membrane DNA Replication in Bacteriophage and *DNA Replication Origins in Microbial Genomes* Feng Gao, 2016-03-11

DNA replication a central event for cell proliferation is the basis of biological inheritance Complete and accurate DNA replication is integral to the maintenance of the genetic integrity of organisms In all three domains of life DNA replication begins at replication origins In bacteria replication typically initiates from a single replication origin *oriC* which contains several *DnaA* boxes and the AT rich DNA unwinding element DUE In eukaryotic genomes replication initiates from significantly more replication origins activated simultaneously at a specific time For eukaryotic organisms replication origins are best characterized in the unicellular eukaryote budding yeast *Saccharomyces cerevisiae* and the fission yeast *Schizosaccharomyces pombe* The budding yeast origins contain an essential sequence element called the ARS autonomously replicating sequence while the fission yeast origins consist of AT rich sequences Within the archaeal domain the multiple replication origins have been identified by a predict and verify approach in the hyperthermophilic archaeon *Sulfolobus* The basic structure of replication origins is conserved among archaea typically including an AT rich unwinding region flanked by several short repetitive DNA sequences known as origin recognition boxes ORBs It appears that archaea have a simplified version of the eukaryotic replication apparatus which has led to considerable interest in the archaeal machinery as a model of that in eukaryotes The research on replication origins is important not only in providing insights into the structure and function of the replication origins but also in understanding the regulatory mechanisms of the initiation step in DNA replication Therefore intensive studies have been carried out in the last two decades The pioneer work to identify bacterial *oriCs* in silico is the GC skew analysis Later a method of cumulative GC skew without sliding windows was proposed to give better resolution Meanwhile an oligomer skew method was also proposed to predict *oriC* regions in bacterial genomes As a unique representation of a DNA sequence the Z curve method has been proved to be an accurate and effective approach to predict bacterial and archaeal replication origins Budding yeast origins have been predicted by Oriscan using similarity to the characterized ones while the fission yeast origins have been identified initially from AT content calculation In comparison with the in silico analysis the experimental methods are time consuming and labor intensive but convincing and reliable To identify microbial replication origins in vivo or in vitro a number of experimental methods have been used including construction of replicative *oriC* plasmids microarray based or high throughput sequencing based marker frequency analysis two dimensional gel electrophoresis analysis and replication

initiation point mapping RIP mapping The recent genome wide approaches to identify and characterize replication origin locations have boosted the number of mapped yeast replication origins In addition the availability of increasing complete microbial genomes and emerging approaches has created challenges and opportunities for identification of their replication origins in silico as well as in vivo and in vitro The Frontiers in Microbiology Research Topic on DNA replication origins in microbial genomes is devoted to address the issues mentioned above and aims to provide a comprehensive overview of current research in this field

DNA Replication Hisao Masai,Marco Foiani,2018-01-22 This book reviews the latest trends and future directions of DNA replication research The contents reflect upon the principles that have been established through the genetic and enzymatic studies of bacterial viral and cellular replication during the past decades The book begins with a historical overview of the studies on eukaryotic DNA replication by Professor Thomas Kelly a pioneer of the field The following chapters include genome wide studies of replication origins and initiation factor binding as well as the timing of DNA replications mechanisms of initiation DNA chain elongation and termination of DNA replication the structural basis of functions of protein complexes responsible for execution of DNA replication cell cycle dependent regulation of DNA replication the nature of replication stress and cells strategy to deal with the stress and finally how all these phenomena are interconnected to genome instability and development of various diseases By reviewing the existing concepts ranging from the old principles to the newest ideas the book gives readers an opportunity to learn how the classical replication principles are now being modified and new concepts are being generated to explain how genome DNA replication is achieved with such high adaptability and plasticity With the development of new methods including cryoelectron microscopy analyses of huge protein complexes single molecular analyses of initiation and elongation of DNA replication and total reconstitution of eukaryotic DNA replication with purified factors the field is enjoying one of its most exciting moments and this highly timely book conveys that excitement to all interested readers

[DNA Replication Controls: Volume 1](#) Eishi Noguchi,2018-04-27 This book is a printed edition of the Special Issue DNA Replication Controls that was published in Genes

[DNA Replication](#) Judith L. Campbell,1995-10-11 The critically acclaimed laboratory standard for forty years Methods in Enzymology is one of the most highly respected publications in the field of biochemistry Since 1955 each volume has been eagerly awaited frequently consulted and praised by researchers and reviewers alike More than 250 volumes have been published all of them still in print and much of the material is relevant even today truly an essential publication for researchers in all fields of life sciences Key Features Includes descriptions of functional structural kinetic and genetic methods for analyzing major enzymes of DNA replication Describes strategies for studying interactions of these proteins during replication Provides comprehensive descriptions of uses of prokaryotic and eukaryotic crude in vitro replication systems and reconstitution of such systems from purified proteins Includes methods for analyzing DNA replication in vivo

Fundamental Aspects of DNA Replication Jelena Kusic-Tisma,2011-09-26 DNA replication the process of copying one double stranded DNA molecule to produce two

identical copies is at the heart of cell proliferation This book highlights new insights into the replication process in eukaryotes from the assembly of pre replication complex and features of DNA replication origins through polymerization mechanisms to propagation of epigenetic states It also covers cell cycle control of replication initiation and includes the latest on mechanisms of replication in prokaryotes The association between genome replication and transcription is also addressed We hope that readers will find this book interesting helpful and inspiring

DNA Replication: The Regulatory Mechanisms Patrick Hughes, Ellen Fanning, Masamichi Kohiyama, 1992-03-20 DNA replication is a key event in the cell cycle Although our knowledge is far from complete and many elusive regulatory mechanisms still remain beyond our grasp many enzymes and a multiplicity of biochemical mechanisms involved have been discovered Recent findings in E coli have confirmed and yet surpassed the original hypothesis of F Jacob In yeast and higher eucaryotes the apparent redundancy in putative origins and initiators has made an estimation of the importance of each identified element difficult to access In spite of well established methodologies which are also described in the book the origin identification in mammalian chromosomes is still a controversial subject On the other hand considerable advances have been made in our understanding of virus DNA replication and this continues to deepen and broaden our understanding of the controls of cellular DNA replication

DNA Replication Herve Seligmann, 2011-08-01 The study of DNA advanced human knowledge in a way comparable to the major theories in physics surpassed only by discoveries such as fire or the number zero However it also created conceptual shortcuts beliefs and misunderstandings that obscure the natural phenomena hindering its better understanding The deep conviction that no human knowledge is perfect but only perfectible should function as a fair safeguard against scientific dogmatism and enable open discussion With this aim this book will offer to its readers 30 chapters on current trends in the field of DNA replication As several contributions in this book show the study of DNA will continue for a while to be a leading front of scientific activities

The Initiation of DNA Replication Dan S Ray, 1981-01-28 The Initiation of DNA Replication contains the proceedings of the 1981 ICN UCLA Symposia on Structure and DNA Protein Interactions of Replication Origins held in Salt Lake City Utah on March 8 13 1981 The papers explore the initiation of DNA replication and address relevant topics such as whether there are specific protein recognition sites within an origin how many proteins interact at an origin and whether they interact in a specific temporal sequence or whether origins can be subdivided into distinct functional domains The specific biochemical steps in DNA chain initiation and how they are catalyzed are also discussed This book is organized into six sections and comprised of 41 chapters The discussion begins by analyzing the replication origin region of the Escherichia coli chromosome and the precise location of the region carrying autonomous replicating function A genetic map of the replication and incompatibility regions of the resistance plasmids R100 and R1 is described and several gene products produced in vivo or in vitro from the replication region are considered The sections that follow focus on the DNA initiation determinants of bacteriophage M13 and of chimeric derivatives carrying foreign replication determinants

suppressor loci in E coli and enzymes and proteins involved in initiation of phage and bacterial chromosomes The final chapters examine the origins of eukaryotic replication This book will be of interest to scientists students and researchers in fields ranging from microbiology and molecular biology to biochemistry molecular genetics and physiology

DNA Replication and Related Cellular Processes Jelena Kusic-Tisma,2011-09-26 Since the discovery of the DNA structure researchers have been highly interested in the molecular basis of genome inheritance This book covers a wide range of aspects and issues related to the field of DNA replication The association between genome replication repair and recombination is also addressed as well as summaries of recent work of the replication cycles of prokaryotic and eukaryotic viruses The reader will gain an overview of our current understanding of DNA replication and related cellular processes and useful resources for further reading

The Control of Normal DNA Replication in Bacteria ,1961 **DNA Replication** Hisao Masai,Marco Foiani,2017 Cell Cycle Control of DNA Replication Gennaro D'Urso,1990 **DNA Replication and the Cell Cycle** Ellen Fanning,Rolf Knippers,Ernst-L. Winnacker,1993-01-29 Provided here is an easily accessible introduction to the mechanisms of DNA replication regulation and the biochemistry of cell cycle control An overview of this rapidly developing field is presented to orient the reader followed by a series of contributions by leading researchers summarizing recent results on selected topics such as protein phosphorylation tumor suppressor genes and signal transduction in prokaryotic and eucaryotic systems The reader will gain an overview of our current understanding of DNA replication and the cell cycle and a selection of useful recent references for further reading

DNA Replication, Recombination and Repair ,1995 Control of DNA replication; mechanisms replication licensing to once per cell cycle Benjamin John Hodgson,2002 *DNA Replication Controls* Eishi Noguchi (Ed.),2017 The conditions for DNA replication are not ideal owing to endogenous and exogenous replication stresses that lead to arrest of the replication fork Arrested forks are among the most serious threats to genomic integrity because they can break or rearrange leading to genomic instability which is a hallmark of cancers and aging related disorders This title DNA Replication Controls presents series of new reviews and original research articles providing a comprehensive guide to theoretical advancements in the field of DNA replication research in both prokaryotic and eukaryotic systems The topics include DNA polymerases and helicases replication initiation replication timing replication associated DNA repair and replication of difficult to replicate genomic regions including telomeres centromeres and highly transcribed regions This title also provides recent advancements in studies of cellular processes that are coordinated with DNA replication and how defects in the DNA replication program result in genetic disorders including cancer Written by leading experts in DNA replication regulation this book will be an important resource for a wide variety of audiences including junior graduate students and established investigators who have interests in DNA replication and genome maintenance mechanisms

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