



# Microbial Cell Cycle

**Stephen Cooper**



## **Microbial Cell Cycle:**

The Microbial Cell Cycle Clive Arthur Edwards, 1981      **MICROBIAL CELL CYCLE** Streiblv, 1984-05-02      *The Bacterial Cell: Coupling between Growth, Nucleoid Replication, Cell Division, and Shape, Volume 2* Ariel Amir, Jaan Männik, Conrad L. Woldringh, Arieh Zaritsky, 2019-11-14

The 1st volume of our Research Topic *The Bacterial Cell Coupling between Growth Nucleoid Replication Cell Division and Shape* was published as an eBook in May 2016 see <http://journal.frontiersin.org/researchtopic/2905/the-bacterial-cell-coupling-between-growth-nucleoid-replication-cell-division-and-shape> As a sign of growing interest to the topic two workshops followed the same year *Stochasticity in the Cell Cycle* in Jerusalem Israel by the Hebrew University's Institute of Advanced Studies and EMBO's *Cell Size Regulation* in Joachimsthal Germany From the time of launching the first edition several new groups have entered the field and many established groups have made significant advances using state of the art microscopy and microfluidics Combining these approaches with the techniques pioneered by quantitative microbiologists decades ago these approaches have provided remarkable amounts of numerical data Most of these data needed yet to be put into a broader theoretical perspective Moreover the molecular mechanisms governing coordination and progression of the main bacterial cell cycle processes have remained largely unknown These outstanding fundamental questions and the growing interest to the field motivated us to launch the next volume titled *The Bacterial Cell Coupling between Growth Nucleoid Replication Cell Division and Shape Volume 2* shortly after completion of the first edition in October 2016 The issue contains 17 contributions from a diverse array of scientists whose field of study spans microbiology biochemistry genetics experimental and theoretical biophysics The specific questions addressed in the issue include What triggers initiation of chromosome replication How is cell division coordinated with replication both spatially and temporally How is cell size controlled and linked to the rate of mass growth What role plays physical organization of the chromosomes in their segregation and in regulation of cell division The publications covering these questions are divided into three topical areas 1 Cell Cycle Regulation 2 Growth and Division and 3 Nucleoid Structure and Replication New ideas and techniques put forward in these articles bring us closer to understand these fundamental cellular processes but the quest to resolve them is far from being complete Plans for the next edition are under way along with further meetings and workshops e.g. an EMBO Workshop on Bacterial cell biophysics DNA replication growth division size and shape in Ein Gedi Israel May 2020 We hope that via such interdisciplinary exchange of ideas we will come closer to answering the above mentioned complex and multifaceted questions

*The Microbial Cell Cycle* Clive Arthur Edwards, 1981-01-01      **The Microbial Cell Cycle** Olive Edwards, 1981      *The Bacterial Cell: Coupling between Growth, Nucleoid Replication, Cell Division and Shape* Ariel Zaritsky, Conrad L. Woldringh, Jaan Männik, 2016-05-02

Bacterial Physiology was inaugurated as a discipline by the seminal research of Maal e Schaechter and Kjeldgaard published in 1958 Their work clarified the relationship between cell composition and growth rate and led to unravel the temporal coupling

between chromosome replication and the subsequent cell division by Helmstetter et al a decade later Now after half a century this field has become a major research direction that attracts interest of many scientists from different disciplines The outstanding question how the most basic cellular processes mass growth chromosome replication and cell division are inter coordinated in both space and time is still unresolved at the molecular level Several particularly pertinent questions that are intensively studied follow a what is the primary signal to place the Z ring precisely between the two replicating and segregating nucleoids b Is this coupling related to the structure and position of the nucleoid itself c How does a bacterium determine and maintain its shape and dimensions Possible answers include gene expression based mechanisms self organization of protein assemblies and physical principles such as micro phase separations by excluded volume interactions diffusion ratchets and membrane stress or curvature The relationships between biochemical reactions and physical forces are yet to be conceived and discovered This e book discusses the above mentioned and related questions The book also serves as an important depository for state of the art technologies methods theoretical simulations and innovative ideas and hypotheses for future testing Integrating the information gained from various angles will likely help decipher how a relatively simple cell such as a bacterium incorporates its multitude of pathways and processes into a highly efficient self organized system The knowledge may be helpful in the ambition to artificially reconstruct a simple living system and to develop new antibacterial drugs

Bacterial Growth and Division Stephen Cooper, 2012-12-02 How does a bacterial cell grow during the division cycle This question is answered by the codeveloper of the Cooper Helmstetter model of DNA replication In a unique analysis of the bacterial division cycle Cooper considers the major cell categories cytoplasm DNA and cell surface and presents a lucid description of bacterial growth during the division cycle The concepts of bacterial physiology from Ole Maal e s Copenhagen school are presented throughout the book and are applied to such topics as the origin of variability the pattern of DNA segregation and the principles underlying growth transitions The results of research on E coli are used to explain the division cycles of Caulobacter Bacilli Streptococci and eukaryotes Insightful reanalysis highlights significant similarities between these cells and E coli With over 25 years of experience in the study of the bacterial division cycle Cooper has synthesized his ideas and research into an exciting presentation He manages to write a comprehensive volume that will be of great interest to microbiologists cell physiologists cell and molecular biologists researchers in cell cycle studies and mathematicians and engineering scientists interested in modeling cell growth Written by one of the codiscoverers of the Cooper Helmstetter model Applies the results of research on E coli to other groups including Caulobacter Bacilli Streptococci and eukaryotes the Caulobacter reanalysis highlights significant similarities with the E coli system Presents a unified description of the bacterial division cycle with relevance to eukaryotic systems Addresses the concepts of the Copenhagen School in a new and original way

**Physiology of the Bacterial Cell** Frederick Carl Neidhardt, John L. Ingraham, Moselio Schaechter, 1990 Textbook for upper division and graduate students in the biological and biochemical sciences introduces the

properties of bacteria that have led to their success as colonizers of this planet The major theme is the analysis of the molecular devices that have led to the ability of bacteria to grow rapidly in a variety of environments to adapt quickly to changes in their surroundings to withstand starvation and exposure to toxic agents and to compete successfully with other organisms Annotation copyrighted by Book News Inc Portland OR *Bacterial Transcription Factors and the Cell Cycle* Morigen Morigen,Monika Glinkowska,Jianping Xie,2022-02-10 **The Cell Cycle** G. M. Padilla,G. L. Whitson,I. L. Cameron,2013-09-11 The Cell Cycle Gene Enzyme Interactions presents the primary regulatory mechanisms of the cell cycle This book provides theoretical and methodological discussions concerning cell cycles Organized into 17 chapters this book begins with an overview of cell evolution and thermodynamics This text then examines the regulation of initiation of chromosome replication and the coordination between this event and cell division in Escherichia coli Other chapters consider the operon model for the control of genetic expression in bacterial cells which provides an understanding of the regulatory mechanisms of gene function This book discusses as well the observations and experiments on the timing of events in the cell cycles of some bacteria and attempts to provide explanations in terms of established control systems The final chapter deals with DNA markers which serve as a convenient starting point for exploring the general principles of cell cycle markers This book is a valuable resource for cell biologists **Bacterial Transcription Factors and the Cell Cycle, 2nd edition** Morigen Morigen,Monika Glinkowska,Jianping Xie,2022-10-10 Analogous to the eukaryotic G1 S and M phase of the cell cycle the bacterial cell cycle can be classified into independent stages Slowly growing bacterial cells undergo three different stages B C and D phase respectively while the cell cycle of fast growing bacteria involves at least two independent cycles the chromosome replication and the cell division The oscillation in gene expression regulated by transcription factors and proteolysis mediated by ClpXP are closely correlated with progression of the cell cycle Indeed it has been shown that DnaA couples DNA replication initiation with the expression of the two oscillating regulators GcrA and CtrA and the DnaA GcrA CtrA regulatory cascade drives the forward progression of the Caulobacter cell cycle Furthermore it has been found that the DnaA oscillation in Escherichia coli and Caulobacter crescentus plays an important role in the cell cycle coordination RpoS in Coxiella regulates the gene expression involved in the developmental cycle the SigB and SinR transcription factors control whether cells remain in or leave a biofilm responding to metabolic conditions in Bacillus subtilis similarly BolA in most Gram negative bacteria turns off motility and turns on biofilm development as a transcription factor CtrA regulates cell division and outer membrane composition of the pathogen Brucella abortus an essential transcription factor SciP enhances robustness of Caulobacter cell cycle regulation Interestingly transcription factors mediated metabolism fluctuations are also related to progression of the cell cycle It has been shown that CggR and Cra factors are involved in the flux signaling metabolite fructose 1 6 bisphosphate IclR mediates para hydroxybenzoate catabolism in Streptomyces coelicolor CceR and AkgR regulate central carbon and energy metabolism in alphaproteobacteria and these metabolism changes affect cell growth In

line with the argument AspC mediated aspartate metabolism coordinates the E coli cell cycle However the molecular mechanisms of maintaining the proper cell cycle progression through coordination of transcription factors mediated gene transcription oscillation cellular metabolism with the cell cycle are not yet well established This Research Topic is intended to cover the spectrum of cell cycle regulatory mechanisms in particular the coordination of transcription factor mediated gene transcription oscillations and the cellular metabolisms associated with the cell cycle We welcome all types of articles including Original Research Review and Mini Review The subject areas of interest include but are not limited to 1 Cell cycle coordination through gene expression and expression oscillation mediated by transcription factors 2 Regulation of the cell cycle by proteolysis oscillation 3 Coordination of the cell cycle with metabolism fluctuation 4 DNA methylation fluctuation and the cell cycle 5 Novel transcription factors and gene expression patterns associated with the cell cycle

*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

*Molecules in Time and Space* Miguel Vicente,Javier Tamames,Alfonso Valencia,Jesús Mingorance,2004-07-02 During the last decade a wealth of new data has arisen from the use of new fluorescent labelling techniques and the sequencing of whole microbial genomes One important conclusion from these data is that bacterial cells are much more structured than previously thought The wall and the outer membrane contain topological domains some proteins localize or move in specific patterns inside the cells and some genes appear clustered in the chromosome and form conserved evolutionary units Many of these structures are related to the cell cycle and to the process of cell morphogenesis

two processes that are themselves related to each other From these observations the *dcw* gene cluster appears as a phylogenetic trait that is mainly conserved in bacilli Molecules in Time and Space reviews the data on the formation of subcellular patterns or structures in bacteria presents observations and hypotheses on the establishment and the maintenance of cell shape and on the organization of genetic information in the chromosome Bacterial Cell Division as Part of the Cell Cycle in C. Cres Kenneth Peleman,2011 Cell division in *Caulobacter crescentus* is a very interesting research This bacterium divides in two different progeny cells both entering a different stage in the cell cycle One called the swarmer cell and is replication incompetent the other named the stalked cell enters the S phase of the cell cycle Cytokinesis of *C. crescentus* could be reflected to multicellular life because of its special division In this research we have tried to create a fusion protein of the first protein FtsZ that is recruited to the division plane *Bacterial Growth and Division* Stephen Cooper,1991-02-26 How does a bacterial cell grow during the division cycle This question is answered by the codeveloper of the Cooper Helmstetter model of DNA replication In a unique analysis of the bacterial division cycle Cooper considers the major cell categories cytoplasm DNA and cell surface and presents a lucid description of bacterial growth during the division cycle The concepts of bacterial physiology from Ole Maal e s Copenhagen school are presented throughout the book and are applied to such topics as the origin of variability the pattern of DNA segregation and the principles underlying growth transitions The results of research on *E. coli* are used to explain the division cycles of *Caulobacter* Bacilli Streptococci and eukaryotes Insightful reanalysis highlights significant similarities between these cells and *E. coli* With over 25 years of experience in the study of the bacterial division cycle Cooper has synthesized his ideas and research into an exciting presentation He manages to write a comprehensive volume that will be of great interest to microbiologists cell physiologists cell and molecular biologists researchers in cell cycle studies and mathematicians and engineering scientists interested in modeling cell growth Written by one of the codiscoverers of the Cooper Helmstetter model Applies the results of research on *E. coli* to other groups including *Caulobacter* Bacilli Streptococci and eukaryotes the *Caulobacter* reanalysis highlights significant similarities with the *E. coli* system Presents a unified description of the bacterial division cycle with relevance to eukaryotic systems Addresses the concepts of the Copenhagen School in a new and original way *The Cell Division Cycle* David Lloyd,Robert K. Poole,Steven W. Edwards,1982 **Symposium on Macromolecular Aspects of the Cell Cycle, Given at Research Conference for Biology and Medicine of the Atomic Energy Commission, Held at Gatlinburg, Tennessee, April 8-11, 1963** ,1963 Microbial Cell-cell Interactions Martin Dworkin,1991 I would recommend it to anyone interested in communication between cells Cell Biology Microbial Development Richard Losick,Lucy Shapiro,1984 **Molecular Biology of Microbial Differentiation** James A. Hoch,Peter Setlow,1985

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