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# Microbial Biofilms in Healthcare

## Formation, Prevention and Treatment

Edited by

Karen Vickery

Printed Edition of the Special Issue Published in *Materials*

# Microbial Biofilms Microbial Biofilms

**Gavin Lear, Gillian D. Lewis**



## **Microbial Biofilms Microbial Biofilms:**

**Microbial Biofilms** Hilary M. Lappin-Scott, J. William Costerton, 2003-09-18 Biochemistry and ecology of biofilms from industrial medical and other viewpoints *Microbial Biofilms* Dharumadurai Dhanasekaran, Nooruddin Thajuddin, 2016-07-13 In the book *Microbial Biofilms* Importance and applications eminent scientists provide an up to date review of the present and future trends on biofilm related research This book is divided with four subdivisions as biofilm fundamentals applications health aspects and their control Moreover this book also provides a comprehensive account on microbial interactions in biofilms pyocyanin and extracellular DNA in facilitating *Pseudomonas aeruginosa* biofilm formation atomic force microscopic studies of biofilms and biofilms in beverage industry The book comprises a total of 21 chapters from valued contributions from world leading experts in Australia Bulgaria Canada China Serbia Germany Italy Japan the United Kingdom the Kingdom of Saudi Arabia Republic of Korea Mexico Poland Portugal and Turkey This book may be used as a text or reference for everyone interested in biofilms and their applications It is also highly recommended for environmental microbiologists soil scientists medical microbiologists bioremediation experts and microbiologists working in biocorrosion biofouling biodegradation water microbiology quorum sensing and many other related areas Scientists in academia research laboratories and industry will also find it of interest **Microbial Biofilms** Mahmoud Ghannoum, Matthew Parsek, Marvin Whiteley, Pranab K. Mukherjee, 2015-10-01 An examination of the research and translational application to prevent and treat biofilm associated diseases In the decade since the first edition of *Microbial Biofilms* was published the interest in this field has expanded spurring breakthrough research that has advanced the treatment of biofilm associated diseases This second edition takes the reader on an exciting extensive review of bacterial and fungal biofilms ranging from basic molecular interactions to innovative therapies with particular emphasis on the division of labor in biofilms new approaches to combat the threat of microbial biofilms and how biofilms evade the host defense Chapters written by established investigators cover recent findings and contributions from investigators new to the field provide unique and fresh insights Specifically *Microbial Biofilms* provides state of the art research in the field of bacterial and fungal biofilms detailed descriptions of the in vitro and in vivo models available to evaluate microbial biofilms future areas of research and their translational and clinical applications *Microbial Biofilms* is a useful reference for researchers and clinicians It will also provide insight in the dynamic field of microbial biofilms for graduate and postgraduate students **Biofilms** L V Evans, 2000-12-21 Biofilms affect the lives of all of us growing as they do for example on our teeth as plaque on catheters and medical implants in our bodies on our boats and ships in food processing environments and in drinking and industrial water treatment systems They are highly complex biological communities whose detailed structure and functioning is *Microbial Biofilms* Gavin Lear, Gillian D. Lewis, 2012 Biofilms are the default mode of life for many bacterial species The three dimensional structure of the biofilm provides the associated microbial communities with additional protection from predation toxic substances and physical

perturbation The variety of microniches provided by the biofilm also promotes a huge diversity of microbial life and metabolic potential These complex and highly structured communities help to maintain the health of soils and waters Current applications of biofilms include the degradation of toxic substances in soil and water the commercial production of chemicals and the generation of electricity However biofilm based infections cause harm to millions of humans annually In addition biofilms can affect the quality and yield of crops and cause biofouling and microbially induced corrosion In this book leading scientists provide an up to date review of the latest scientific research on these fascinating microbial communities and predict future trends and growth areas in biofilm related research Under the expert guidance of the editors Gavin Lear and Gillian Lewis authors from around the world have contributed critical reviews on the most topical aspects of current biofilm research Subjects covered include quorum sensing and social interactions in microbial biofilms biofilms in disease plant associated biofilms biofilms in the soil applications in bioremediation biofilms in wastewater treatment corrosion and fouling aquatic biofilms microbial fuel cells and catalytic biofilms The book is essential for everyone interested in biofilms and their applications It is also highly recommended for environmental microbiologists soil scientists medical microbiologists bioremediation experts and microbiologists working in biocorrosion biofouling biodegradation water microbiology quorum sensing and many other areas

*New and Future Developments in Microbial Biotechnology and Bioengineering: Microbial Biofilms* Mukesh Kumar Yadav,Bhim Pratap Singh,2019-10-10 New and Future Developments in Microbial Biotechnology and Bioengineering Microbial Biofilms is divided into three sections microbial adhesion biofilms in medical settings microbial adhesion biofilms in agriculture and microbial adhesion biofilm in the environment and industry Chapters cover adhesion and biofilm formation by pathogenic microbes on tissue and on indwelling medical devices including sections on human infections microbial communication during biofilm mode of growth host defense and antimicrobial resistance and more Other sections cover the biofilms of agriculturally important and environmental friendly microbes including biofilm formation on plants in soil and in aquatic environments Finally the latest scientific research on microbial adhesion and biofilm formation in the environment and in industry is covered Provides an overview on the growth structure cell to cell interactions and control dispersal of bacterial and fungal of in vitro and in vivo biofilms Presents an overview on the microbial adhesion biofilm formation and structures of single species and multi species biofilms on human tissues medical devices agriculture environment and chemical industries Includes chapters on microbial biofilms of pathogenic microbes on human tissues and in medical indwelling devices Covers factors affecting microbial biofilm adhesion and formation

**Microbial Biofilms** Naga Raju Maddela,Aransiola Sesan Abiodun,2022-05-17 Microbial biofilms have both positive and negative effects This book considers new ways of controlling environmental microbial biofilm such as using phages nanotechnology and newly discovered microbial enzymes A team of contributors shares current relevant and original research to add weight and recognition to the book Also each chapter provides enlightening and relevant tabular information charts and illustrations The

book is therefore informative precise useful and easily digested by users      **Bacterial Biofilms** Sadik Dincer,Melis Sümengen Özdenefe,Afet Arkut,2020-10-07 This book examines biofilms in nature Organized into four parts this book addresses biofilms in wastewater treatment inhibition of biofilm formation biofilms and infection and ecology of biofilms It is designed for clinicians researchers and industry professionals in the fields of microbiology biotechnology ecology and medicine as well as graduate and postgraduate students      **Microbial Biofilms in Healthcare** Karen Vickery,2020-03-16 Biofilms are ubiquitous and their presence in industry can lead to production losses However nowhere do biofilms impact human health and welfare as much as those that are found contaminating the healthcare environment surgical instruments equipment and medical implantable devices Approximately 70% of healthcare associated infections are due to biofilm formation resulting in increased patient morbidity and mortality Biofilms formed on medical implants are recalcitrant to antibiotic treatment which leaves implant removal as the principal treatment option In this book we investigate the role of biofilms in breast and dental implant disease and cancer We include in vitro models for investigating treatment of chronic wounds and disinfectant action against *Candida* sp Also included are papers on the most recent strategies for treating biofilm infection ranging from antibiotics incorporated into bone void fillers to antimicrobial peptides and quorum sensing

**Microbial Biofilms** Chaminda Jayampath Seneviratne,2017-07-12 *Microbial Biofilms Omics Biology Antimicrobials and Clinical Implications* is a comprehensive survey of microbial biofilms and their role in human health and disease with contributions from world renowned experts in molecular microbiology proteomics genomics metabolomics and infectious diseases The book is intended to serve as a guide for students as well as a reference for researchers clinicians and industry professionals The chapters cover bacterial and fungal microbiomes and the latest omics techniques organized in a clear and up to date manner One of the highlights of this book is the comprehensive information on omics of microbial biofilms The chapters dedicated to metagenomics proteomics and metabolomics are designed to provide a simple and holistic review of the current knowledge and the applications of these techniques in the field of microbial biofilms In addition to introductory chapters on microbial biofilms and their clinical implications subsequent chapters delve into oral biofilms their composition and metagenomic diversity Thereafter mechanisms of drug resistance in microbial biofilms are reviewed as well as the proteomic and metabolomic characterization of this resistance The book includes a comprehensive discussion of persister cells and host microbial interactions on mucosal surfaces Finally the book concludes with a summary of novel therapeutic approaches for biofilms such as synbiotics and biogenics      *Microbial Biofilms* Samuel Livingston,AI,2025-02-19 Microbial biofilms complex communities of microorganisms encased in a self produced matrix of extracellular polymeric substances EPS are the central focus These biofilms exhibit sophisticated cooperation regulated by quorum sensing impacting diverse fields like medicine and environmental science Microbial Biofilms highlights how these structures ubiquitous in nature influence everything from chronic infections to industrial water systems making their understanding critical Interestingly

biofilms demonstrate increased resistance to antimicrobial agents compared to free floating cells posing significant challenges in treatment and control The book explores biofilm formation mechanisms impacts and control strategies It begins by laying down the fundamental concepts of biofilm development and progresses into the genetic and physiological adaptations within these communities Examining their roles in various environments from the human body to industrial settings the book culminates in analyzing methods for biofilm control eradication and potential applications in bioremediation By integrating knowledge across disciplines it offers a holistic view essential for students researchers and professionals seeking a complete overview of biofilm biology Biofilms in Plant and Soil Health Iqbal Ahmad,Fohad Mabood Husain,2017-07-24

Biofilms are predominant mode of life for microbes under natural conditions The three dimensional structure of the biofilm provides enhanced protection from physical chemical and biological stress conditions to associated microbial communities These complex and highly structured microbial communities play a vital role in maintaining the health of plants soils and waters Biofilm associated with plants may be pathogenic or beneficial based on the nature of their interactions Pathogenic or undesirable biofilm requires control in many situations including soil plants food and water Written by leading experts from around the world Biofilms in Plant and Soil Health provides an up to date review on various aspects of microbial biofilms and suggests future and emerging trends in biofilms in plant and soil health Issues are addressed in four sub areas I The fundamentals and significance of biofilm in plant and soil health and the concept of mono and mixed biofilms by PGPR and fungal biofilms II Biochemical and molecular mechanisms in biofilm studies in plant associated bacteria and techniques in studying biofilms and their characterization gene expression and enhanced antimicrobial resistance in biofilms as well as biotic and biotic factors affecting biofilm in vitro III The ecological significance of soil associated biofilms and stress management and bioremediation of contaminated soils and degraded ecosystems IV Pathogenic biofilm associated with plant and food and its control measures This book is recommended for students and researchers working in agricultural and environmental microbiology biotechnology soil sciences soil and plant health and plant protection Researchers working in the area of quorum sensing biofilm applications and understanding microbiome of soil and plants will also find it useful Biofilm Highlights Hans-Curt Flemming,Jost Wingender,Ulrich Szewzyk,2011-08-02

Living in biofilms is the common way of life of microorganisms transiently immobilized in their matrix of extracellular polymeric substances EPS interacting in many ways and using the matrix as an external digestion and protection system This is how they have organized their life in the environment in the medical context and in technical systems and has helped make them the oldest most successful and ubiquitous form of life In this book hot spots in current biofilm research are presented in critical and sometimes provocative chapters This serves a twofold purpose to provide an overview and to inspire further discussions Above all the book seeks to stimulate lateral thinking **Microbial Biofilm Dynamics** Ashutosh Kumar Shukla,Douglas Roberto Monteiro,2025-08-01 This book explores the dynamics of microbial biofilms examining their role in

both oral and systemic diseases emphasizing developmental models and presenting various characterization and detection methodologies Divided into three sections the introductory section covers fundamental concepts including microbial biofilm understanding the critical role of the extracellular matrix antimicrobial resistance mechanisms and the relevance of biofilms to the dental and medical fields It also explores the development of novel antimicrobial therapeutic strategies for biofilm control including diverse approaches like light nanoparticle peptide phage and phytochemical based strategies along with surface modification techniques The second section navigates the diverse spectrum of biofilm complexity introducing laboratory models such as microtiter plate formation dynamic formation active attachment and in situ and in vivo formation models thus providing a comprehensive understanding of experimental setups The third section focuses on crucial analytical methods for biofilm studies covering techniques for quantifying total biomass cultivable cells and metabolism It further describes technical approaches to biofilm matrix analysis Omics techniques flow cytometry analysis imaging techniques and the electrochemical detection of biofilms An overview of machine learning approaches in biofilm research is also covered This book is tailored for researchers scientists and students of microbiology Key Features Provides an in depth exploration of microbial biofilms covering their dynamics associations with oral and systemic diseases and emphasizing developmental models Covers the role of the extracellular matrix antimicrobial resistance mechanisms and the development of novel antimicrobial therapeutic strategies Explores a diverse spectrum of biofilm complexity through various laboratory models Focuses on crucial analytical methods covering techniques for quantifying total biomass cultivable cells and metabolic activity Describes techniques for biofilm matrix analysis Omics techniques flow cytometry analysis imaging techniques electrochemical detection and the application of machine learning in biofilm research

#### **Biofilms in Human Diseases:**

**Treatment and Control** Sunil Kumar, Niharika Chandra, Leena Singh, Muhammad Zaffar Hashmi, Ajit Varma, 2019-11-19 This book highlights treatment strategies for bacterial biofilms in connection with a variety of human diseases In particular it reviews bacterial biofilm formation and its mechanism Topics covered include biofilms in human health the role of biofilms in mediating human diseases and methods for testing bacterial biofilms Further sections concentrate on biofilm mediated diseases in different parts of the human gastrointestinal tract while therapeutic strategies for biofilm control and natural agents that disrupt bacterial biofilms are also covered Readers will also find the latest advances in probiotics and biofilms as well as the use of probiotics to counteract biofilm associated infections Biofilms and antimicrobial resistance are discussed Subsequent chapters address the management of inflammatory bowel disease via probiotics biofilms as well as the role of probiotics bacteria in the treatment of human diseases associated with bacterial biofilms The book is chiefly intended for clinicians scientists in the fields of medical microbiology applied microbiology biochemistry and biotechnology

**Microbial Biofilms in Bioremediation and Wastewater Treatment** Y.V. Nancharaiah, Vayalam P. Venugopalan, 2019-10-18 Biofilms represent the natural living style of microbial communities and play a pivotal role in biogeochemical cycles and natural

attenuation Biofilms can be engineered for biodegradation and biotransformation of organic and inorganic contaminants for both in situ bioremediation and ex situ treatment in bioreactors This book focuses on microbial biofilms and their potential technological applications for sustainable development It covers recent advances in biofilm technologies for contaminant remediation coupled to recovery of resources and serves as a complete reference on the science and technology behind biofilm mediated bioremediation and wastewater treatment

**Medical Biofilms** Jana Jass,Susanne Surman,James Walker,2003-04-02 Biofilms are formed by microorganisms growing on surfaces and comprise a series of microcolonies interspersed with spaces through which fluids and other microorganisms move In medicine the primary problems are biofilms associated with implants infections are increasingly difficult to treat with traditional antibiotics and removal of the implant often becomes essential frequently leading to higher morbidity and mortality This will be the first book dedicated to medical biofilms It will cover much recent information on the problems of biofilms how to detect them and how to control their presence

**Microbial Biofilms** Gianfranco Donelli,2016-08-23 The discovery that most of the chronic infections in humans including the oral lung vaginal and foreign body associated infections are biofilm based has prompted the need to design new and properly focused preventive and therapeutic strategies for these diseases Microbial Biofilms Methods and Protocols provides a detailed description of the currently available methods and protocols to investigate bacterial and fungal biofilms exhaustively illustrated and critically annotated in 25 chapters written by authors well known for their experience in the respective fields The book has joined together microbiologists and specialists in infectious diseases hygiene and public health involved in exploring different aspects of microbial biofilms as well as in designing new methods and or developing innovative laboratory protocols Written in the successful Methods in Molecular Biology series format chapters include introductions to their respective topics lists of the necessary materials and reagents step by step readily reproducible protocols and notes on troubleshooting and avoiding known pitfalls Authoritative and easily accessible Microbial Biofilms Methods and Protocols presents readers with the most established and validated experimental procedures to investigate microbial biofilms

**Aquatic Ecosystems and Microbial Biofilms** Siddhardha Busi,Ram Prasad,2024-10-01 Aquatic Ecosystems and Microbial Biofilms Significance Dynamics Prevention and Control provides a systematic introduction and review of state of the art information on microbial biofilms in aquatic ecosystems and their control The book is designed and developed to understand the microbial biofilms in aquatic ecosystems their role and the control strategies The contents of the book are well discussed to get state of art knowledge on various topics such as the role of biofilms in marine ecosystems microbial biofilms and drinking water systems biofilms in biofouling and biocorrosion beneficial aspects of biofilms such as biogeochemical cycling wastewater treatment and in biodeterioration of organic materials This book also provides comprehensive knowledge and in depth scientific information on the role of biofilms and their contribution to antibiotic resistance and also advanced technologies to understand biofilms such as metagenomics The book offers comprehensive



coverage of the most essential topics including Microbial biofilms in aquatic ecosystems New horizons to understand the role of biofilms in biofouling and corrosion and their control measures Beneficial role of aquatic biofilms such as in biogeochemical cycling wastewater treatment and biodeterioration of organic materials Various strategies to collaborate interdisciplinary schemes worldwide to design and develop new methods for cleaner drinking water and information on advanced techniques such as metagenomics to understand the diversity and functional role of aquatic biofilms This book serves as a reference book for scientific investigators who would like to study biofilms in aquatic ecosystems as well as researchers developing methodology in this field to study biofilm formation in aquatic ecosystems their advantages and disadvantages and control strategies

**Community Structure and Co-operation in Biofilms** Society for General Microbiology. Symposium, David G. Allison, Society for General Microbiology, 2000-10-23 The study of biofilm considers the close association of micro organisms with each other at interfaces and is relevant to a variety of disciplines including medicine dentistry bioremediation biofouling water technology engineering and food science Although the habitats studied differ widely some common elements exist such as method of attachment coadhesion and regulation of biofilm phenotype and architecture This book aims to distil the common principles of biofilm physiology and growth for all interested disciplines

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### **Microbial Biofilms Microbial Biofilms Introduction**

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