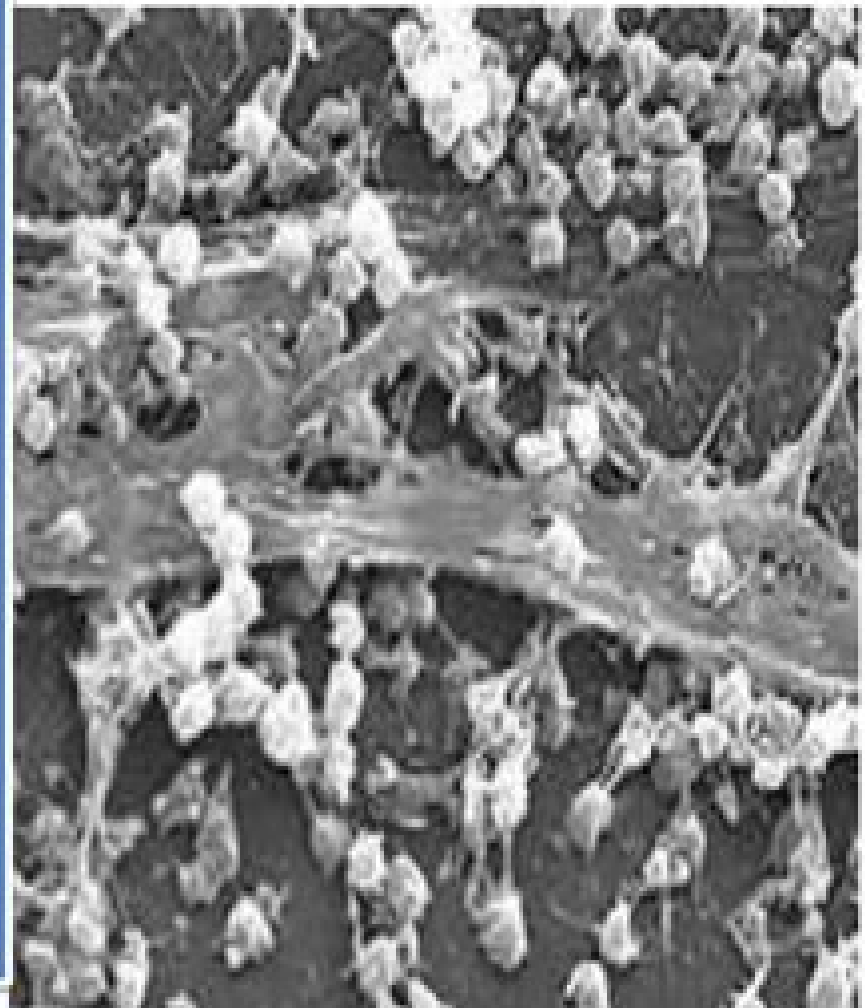


# WHAT ARE BIOFILMS

- **Biofilms** are colonies of living micro-organisms (e.g., bacteria, fungi, algae, and/or protozoa) **growing on any surface** (e.g. metals, plastics, tissue, soil particles, teeth, and so forth)
- **Biofilms** are surface-attached communities of bacteria, encased in an extracellular matrix of secreted proteins, carbohydrates, and/or DNA, that assume phenotypes distinct from those of planktonic cells



# Structure And Function Of Biofilms

**L V Evans**



## Structure And Function Of Biofilms:

*Structure and Function of Biofilms* William G. Characklis, P. A. Wilderer, 1989 Structure and Function of Biofilms W G Characklis P A Wilderer Editors Biofilms the accumulation of microorganisms at surfaces e g a rock a heat exchanger tube an oil droplet a tooth or a medical implant play an important role in nature and have recently received increasing attention in science as well as in technology This volume contains a summary of the current state of knowledge concerning the behavior of microorganisms in a biofilm and their physical chemical and biological interactions with each other and with the environment at both the biofilm substratum and the biofilm bulk liquid interfaces New techniques to investigate biofilms and to predict the performance of biofilm systems are presented and future research needs are identified An excellent source of information for microbiologists medical scientists and engineers is provided

### Structure and Function of Biofilms

William G. Characklis, P. A. Wilderer, 1989 Structure and Function of Biofilms W G Characklis P A Wilderer Editors Biofilms the accumulation of microorganisms at surfaces e g a rock a heat exchanger tube an oil droplet a tooth or a medical implant play an important role in nature and have recently received increasing attention in science as well as in technology This volume contains a summary of the current state of knowledge concerning the behavior of microorganisms in a biofilm and their physical chemical and biological interactions with each other and with the environment at both the biofilm substratum and the biofilm bulk liquid interfaces New techniques to investigate biofilms and to predict the performance of biofilm systems are presented and future research needs are identified An excellent source of information for microbiologists medical scientists and engineers is provided

**Biofilms** L V Evans, 2003-09-02 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 only gradually being unravelled with the development of increasingly sophisticated technology for their study Biofilms almost always have a negative impact on human affairs flocs in sewage treatment plants are a major exception and a lot of research is being carried out to gain a better understanding of them so that we will be in a better position to control them This volume with contributions by international experts from widely diverse areas of this field presents a state of the art picture of where we are at present in terms of our knowledge of biofilms the techniques being used to study them and possible strategies for controlling their growth more successfully It should provide a valuable reference source for information on biofilms and their control for many years to come

Biofilms from a Food Microbiology Perspective: Structures, Functions and Control Strategies Avelino Alvarez-Ordóñez, Romain Briandet, 2017-03-17 Materials and equipment in food processing industries are colonized by surface associated microbial communities called biofilms In these biostructures microorganisms are embedded in a complex organic matrix composed essentially of polysaccharides nucleic acids and proteins This organic shield contributes to the mechanical biofilm cohesion

and triggers tolerance to environmental stresses such as dehydration or nutrient deprivation. Notably, cells within a biofilm are more tolerant to sanitation processes and the action of antimicrobial agents than their free living or planktonic counterparts. Such properties make conventional cleaning and disinfection protocols normally not effective in eradicating these biocontaminants. Biofilms are thus a continuous source of persistent microorganisms including spoilage and pathogenic microorganisms leading to repeated contamination of processed food with important economic and safety impact. Alternatively, in some particular settings, biofilm formation by resident or technological microorganisms can be desirable due to possible enhancement of food fermentations or as a means of bioprotection against the settlement of pathogenic microorganisms. In the last decades, substantial research efforts have been devoted to unravelling mechanisms of biofilm formation, deciphering biofilm architecture and understanding microbial interactions within those ecosystems. However, biofilms present a high level of complexity and many aspects remain yet to be fully understood. A lot of attention has been also paid to the development of novel strategies for preventing or controlling biofilm formation in industrial settings. Further research needs to be focused on the identification of new biocides effective against biofilm-associated microorganisms, the development of control strategies based on the inhibition of cell-to-cell communication and the potential use of bacteriocins, bacteriocin-producing bacteria, phage and natural antimicrobials as anti-biofilm agents among others. This Research Topic aims to provide an avenue for dissemination of recent advances within the biofilms field from novel knowledge on mechanisms of biofilm formation and biofilm architecture to novel strategies for biofilm control in food industrial settings.

**Understanding Bacteria: Structure, Function and Importance in Biology** Dr. Sophia Zaidi, 2025-07-12      **Biofilm formation by staphylococci and streptococci: Structural, functional and regulatory aspects and implications for pathogenesis** Joan A. Geoghegan, Pietro Speziale, 2015-06-25

Members of the genus *Staphylococcus* and *Streptococcus* are the causative agents of many human and animal diseases. Over the past decade, the complete sequencing of many staphylococcal and streptococcal genomes has promoted a significant advance in our knowledge of these important pathogens. The pathogenicity of these bacteria is due to the expression of a large variety of virulence factors. Such determinants, which are cell wall-associated and secreted proteins, include adhesins that confer to the pathogen the ability to attach to extracellular matrix, plasma and host cell surfaces; proteins that contribute to host cell invasion and intracellular survival; and soluble factors that decrease phagocytosis and modulate the immune response. Furthermore, these Gram-positive cocci in many natural environments, heart valve, lung, oral cavity, throat and infections on implanted devices, live in matrix-encased groups known as biofilms. Biofilms are specialized bacterial communities with high-order organization analogous to that of a tissue in a multicellular organism that adhere to abiotic or biological substrata and produce an exopolymeric matrix composed of polysaccharides, proteins, DNA or a combination thereof. Bacteria within a biofilm persist in adverse conditions, show resistance to killing by antibiotics and to host immune defences, and are difficult to eradicate and treat clinically. Therefore,

understanding the mechanisms of biofilm development will allow us to effectively combat staphylococcal streptococcal biofilm based infections This Research Topic will focus on the molecular components involved in biofilm formation by staphylococci and streptococci the role they play in the development maturation and dispersal of biofilm and on the regulatory aspects of such complex processes The implication for the pathogenesis of infective diseases and potential therapeutic strategies against biofilm based infections will be also discussed The articles will highlight both the recent advances and future challenges inherent in this rapidly evolving area

Biofilms in Medicine, Industry and Environmental Biotechnology Piet Lens,V. O'Flaherty,A. P. Moran,P. Stoodley,T. Mahony,2003-04-30 Biofilms are of great practical importance for beneficial technologies such as water and wastewater treatment and bioremediation of groundwater and soil In other settings biofilms cause severe problems for example in 65% of bacterial infections currently treated by clinicians particularly those associated with prosthetics and implants accelerated corrosion in industrial systems oil souring and biofouling Until recently the structure and function of biofilms could only be inferred from gross measures of biomass and metabolic activity This limitation meant that investigators involved in biofilm research and application had only a crude understanding of the microbial ecology physical structure and chemical characteristics of biofilms Consequently opportunities for the exploitation and control of biofilms were very limited The past decade has witnessed the development of several new techniques to elucidate the structure and function of biofilms Examples include the use of molecular probes that identify different microbes in complex communities as well as their metabolic functions the use of microensors that show concentration gradients of key nutrients and chemicals the use of confocal laser scanning microscopy to describe the physical structure of biofilms and the development of a new generation of mathematical models that allow for the prediction of biofilm structure and function However much progress remains to be made in efforts to understand control and exploit biofilms This timely book will introduce its readers to the structure and function of biofilms at a fundamental level as determined during the past decade of research including Extracellular polymers as the biofilm matrix Biofilm phenotype differential gene expression interspecies signalling Biofilm ecology Biofilm monitoring Resistance of biofilms to antimicrobial agents and Biofilm abatement Biofilms in Medicine Industry and Environmental Technology offers a holistic and multi disciplinary description of the topic including biofilm formation and composition but also biofilm monitoring disinfection and control All these aspects are presented from three points of views medical industrial and environmental biotechnological in a compact easy to read format

*Global Change and River Ecosystems - Implications for Structure, Function and Ecosystem Services* R. Jan Stevenson,Sergi Sabater,2015-03-21 Rivers around the world are threatened by changes in land use climate hydrologic cycles and biodiversity Global changes in rivers include but are not restricted to water flow interruptions temperature increases loss of hydrological connectivity altered water residence times changes in nutrient loads increasing arrival of new chemicals simplification of the physical structure of the systems occurrence of invasive species and

biodiversity losses All of them affect the structure and functioning of the river ecosystem and thereby their ecosystem services Understanding the responses of river ecosystems and their services to global change is essential for protecting human well being in all corners of the planet Rivers provide critical benefits by providing food from fisheries and irrigation regulating biogeochemical balances and enriching our aesthetic and cultural experience Predicting responses of rivers to global change is challenged by the complexity of interactions among these man made drivers across a mosaic of natural hydrogeomorphic and climatic settings This book explores the broad range of determinants defining global change and their effects on river ecosystems Authors have provided thoughtful and insightful treatments of specific topics that relate to the broader theme of global change regulation of river ecosystems

**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

**Microbial Biofilms** Mahmoud Ghannoum,Matthew Parsek,Marvin Whiteley,Pranab K. Mukherjee,2020-08-11 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

**Productive Biofilms** Kai Muffler,Roland Ulber,2014-10-15 This book review series presents current trends in modern biotechnology The aim is to cover all aspects of this interdisciplinary technology where knowledge methods and expertise are required from chemistry biochemistry microbiology genetics chemical engineering and computer science Volumes are organized topically and provide a comprehensive discussion of developments in the respective field over the past 3 5 years The series also discusses new discoveries and applications Special volumes are dedicated to selected topics which focus on new biotechnological products and new processes for their synthesis and purification In general special volumes are edited by well known guest editors The series editor and publisher will however always be pleased to receive suggestions and supplementary information Manuscripts are accepted in English

**Manual of Environmental Microbiology** Cindy H. Nakatsu,Robert V. Miller,Suresh D. Pillai,2020-08-11 The single most comprehensive resource for environmental microbiology Environmental microbiology the study of the roles that microbes play in all planetary environments is one of the most important areas of scientific research The Manual of Environmental Microbiology Fourth Edition provides comprehensive coverage of this critical and growing field Thoroughly updated and revised the Manual is the definitive reference for information on microbes in air water and soil and their impact on human health and welfare Written in accessible clear prose the manual covers four broad areas general methodologies environmental public health microbiology microbial ecology and biodegradation and biotransformation This wealth of information is divided into 18 sections each containing chapters written by acknowledged topical experts from the international community Specifically this new edition of the Manual Contains completely new sections covering microbial risk assessment quality control and microbial source tracking Incorporates a summary of the latest methodologies used to study microorganisms in various environments Synthesizes the latest information on the assessment of microbial presence and microbial activity in natural and artificial environments The Manual of Environmental Microbiology is an essential reference for environmental microbiologists microbial ecologists and environmental engineers as well as those interested in human diseases water and wastewater treatment and biotechnology

Microbial Extracellular Polymeric Substances Jost Wingender,Thomas R. Neu,Hans-Curt

Flemming,2012-12-06 Microbial extracellular polymeric substances EPS are the key components for the aggregation of microorganisms in biofilms flocs and sludge They are composed of polysaccharides proteins nucleic acids lipids and other biological macromolecules EPS provide a highly hydrated gel matrix in which microbial cells can establish stable synergistic consortia Cohesion and adhesion as well as morphology structure biological function and other properties such as mechanical stability diffusion sorption and optical properties of microbial aggregates are determined by the EPS matrix Also the protection of biofilm organisms against biocides is attributed to the EPS Their matrix allows phase separation in biofiltration and is also important for the degradation of particulate material which is of great importance for the self purification processes in surface waters and for waste water treatment Biofilms in Plant and Soil Health Iqbal

Ahmad,Fohad Mabood Husain,2017-07-14 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 *Handbook of Soil Sciences* Pan Ming Huang,Yuncong Li,Malcolm E.

Sumner,2011-11-17 An evolving living organic inorganic covering soil is in dynamic equilibrium with the atmosphere above the biosphere within and the geology below It acts as an anchor for roots a purveyor of water and nutrients a residence for a vast community of microorganisms and animals a sanitizer of the environment and a source of raw materials for construction and manufacturing To develop lasting solutions to the challenges of balanced use and stewardship of the Earth we require a fundamental understanding of soil from its elastic porous three phase system to its components processes and reactions Handbook of Soil Sciences Properties and Processes Second Edition is the first of two volumes that form a comprehensive



reference on the discipline of soil science Completely revised and updated to reflect the current state of knowledge this volume covers the traditional areas of soil science soil physics soil chemistry soil mineralogy soil biology and biochemistry and pedology Contributors discuss the application of physical principles to characterize the soil system and mass and energy transport processes within the critical zone They present significant advances in soil chemistry describe how minerals are formed and transformed and provide an introduction to the soil biota They also examine geomorphology land use hydrology and subaqueous soils as well as the classification and digital mapping of soil Critical elements addressed in each section include Descriptions of concepts and theories Definitions approaches methodologies and procedures Data in tabular and figure format Extensive references This cohesive handbook provides a thorough understanding of soil science principles and practices based on a rigorous complete and up to date treatment of the subject matter compiled by leading scientists It is a resource rich in data offering professional soil scientists agronomists engineers ecologists biologists naturalists and students their first point of entry into a particular aspect of the soil sciences

*Development in Waste Water Treatment Research and Processes* Maulin P. Shah, 2024-10-26 Applied Technologies for Clean Up of Environmental Contaminants covers the features of remediation and biocontrol technology a multidisciplinary field combining environmental and industrial microbiology with biotechnology to improve environmental management Studying the advanced microbial processes involved in geomicrobiology aeromicrobiology microbial loop and nutrient availability as well as microbial energetics in the contaminated environment with an emphasis on innovative methodologies the book provides readers with a better understanding of basic microbiology allowing them to comprehend the mechanism and behavior of various biochemical processes that are used in bioremediation and biocontrol technologies Including coverage of key subjects such as management of waste energy generation restoration processes water treatment processes co metabolism and nutrient recycling as well as emerging advances in environmental microbial biotechnology green nanotechnology metagenomic and proteomic strategies DNA microarray and biosensor based technologies this book provides potential implications for environmental management Includes microbially driven sequestration of environmental contaminants such as xenobiotics heavy metals petroleum based pollutants and other micropollutants Overviews recent discoveries in geomicrobiology aeromicrobiology biocontrol complex plant microbe relationship and microbial process energetics Reviews promising ecologically benign technologies such as waste valorization biomining the use of biosolids and microbial metabolites

Understanding Microbial Biofilms Surajit Das, Neelam Amit Kungwani, 2022-10-27 Selected for Doody's Core Titles 2024 in Microbiology Understanding Microbial Biofilms Fundamentals to Applications focuses on the microbial biofilms of different environments The book provides a comprehensive overview of the fundamental aspects of microbial biofilms their existence in nature their significance and the different clinical and environmental problems associated with them The book covers both the fundamentals and applications of microbial biofilms with chapters on the introduction to the microbial community and its

architecture physiology mechanisms and imaging of biofilms in nature and fungal algal and bacillus biofilm control In addition the book highlights the molecular and biochemical aspects of bacterial biofilms providing a compilation of chapters on the bacterial community and communication from different environments Finally the book covers recent advancements in various aspects of microbial biofilms including the chapters on their biotechnological applications All the chapters are written by experts who have been working on different aspects of microbial biofilms Illustrates fundamental aspects surrounding microbial biofilms along with recent advancements Provides an overview on the principal aspects of biofilms i e formation regulation distribution control and application Updates on the progress on biofilm regulation through omics Serves as a classical manual for all researchers academicians and students who would want complete insights on biofilms in a single resource Covers all recent advancements and amendments on microbial biofilms

**Trends in Biotechnology Research**

Edwin C. Hearn, 2006 Biotechnology is a collection of technologies that capitalise on the attributes of cells and biological molecules Biotechnology will help improve the ability to customise therapies based on individual genomics prevent diagnose and treat all types of diseases rather than rely on rescue therapy and provide breakthroughs in agricultural production and food safety This book offers new research in this growing field

*Research on Nitrification and Related Processes, Part B*, 2011-06-15 The global nitrogen cycle is the one most impacted by mankind The past decade has changed our view on many aspects of the microbial biogeochemical cycles including the global nitrogen cycle which is mainly due to tremendous advances in methods techniques and approaches Many novel processes and the molecular inventory and organisms that facilitate them have been discovered only within the last 5 to 10 years and the process is in progress Research on Nitrification and Related Processes Part B provides state of the art updates on methods and protocols dealing with the detection isolation and characterization of macromolecules and their hosting organisms that facilitate nitrification and related processes in the nitrogen cycle as well as the challenges of doing so in very diverse environments Provides state of the art update on methods and protocols Deals with the detection isolation and characterization of macromolecules and their hosting organisms Deals with the challenges of very diverse environments

*Fundamentals of Biofilm Research* Zbigniew Lewandowski, Haluk Beyenal, 2007-05-17 The history of natural sciences demonstrates that major advances in the understanding of natural processes follow the development of relevant tools The progress of biofilm research is no different While individual areas have mushroomed in recent years difficulties in reproducing results communicating new findings and reconciling differences in

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