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Biofilm Formation in Bacteria

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Editorial

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Editorial

Biofilms are past (they symbolize the oldest fossils that have been explored on the planet and they form complex, heterologous structures. Besides some contain channels that permit the spread of nutrients and oxygen throughout the biofilm, facilitating growth [1]. While biofilm formation is often described as the spontaneous mode of microbial growth, it is clear that we still have a lot to study about this inimitable microbial sessile life style. Much of the microbiological research during the last century has focused on the search of the planktonic lifestyle of microorganisms [2]. In other words, biofilm; It is a colony community formed by microorganisms, usually against environmental stress conditions. Microbial biofilms form easily on permanent medical devices and cause diseases that are difficult to control in the absence of an effective treatment method [3].

A biofilm is a collection of microbial cells that are associated with a surface and can include non-cellular materials that are contained in a matrix of polysaccharide substances and incorporated into biofilms from the surrounding environment from which the biofilm is formed. The environment composition, temperature, presence of antimicrobial agents, other organisms, inoculum quantity, hydrodynamic forces, and substrate properties influence the development of the biofilm system. Biofilms are found in nearly all aquatic ecosystems that can support microbial growth, such as industrial or potable water system pipes [4].

Today, biofilm (living layer); It is defined as the extracellular polymeric structure consisting of protein, polysaccharide and DNA produced by the microorganism. While microorganisms are free in nature, only one species, while it exists as planktonic forms, it appears in the form of a complex, "polymicrobial biofilm" when attached to biotic and abiotic surfaces [5].

The biofilm is a gathering of bacteria of one or a few species. They are adherent to the surface and covered with homologous extracellular materials that are composed mostly of carbohydrates. This type of growth protects the attached bacteria from the host's immune system also increases the resistance of bacteria to many antibiotics. The biofilm is interested in many chronic infections, including endocardial and urinary tract infections and the ductus arteriosus as well as for pneumonia [6].

Bacterial biofilms are a mode of concerted living that confers emergent properties to the inhabitants of these communities. A self- manufactured extracellular matrix that encapsulates the cells and eases their cohesion to surfaces, among other functions, is a hallmark of biofilm formation. The biofilm investigate field is quick moving due to the biological affinity of these multicellular consortia to an system of advantageous and harmful influence in natural systems and human applications [7]. Micro-organisms forming biofilm are less precision to antibiotics and are immensely resistant to the host immune system than their individual form. Resistance to the immune system is owing to frequent changes in surface antigens by alteration in gene expression. In advance, resistant bacteria were collective only in intensive care units, but nowadays such bacteria are isolated from hospitals, and, other healthcare services. Biofilm formed on medical implants cause a number of microbial infections, and roundly $3790 million amount globally per year is spent on treating and diagnosing biofilm-concerned catheter-associated urinary tract infections [8].

The growth of biofilm is a stepwise and dynamic process. The first step of biofilm formation by Gram-negative bacteria is attachment to a surface. This is primaly linked on bacterial surface organelles, like flagella and type IV pili, which subsequently results in irreversible attachment, biofilm maturation into a 3-dimensional structure, and the dispersal of single cells from the biofilm [9].

Survival and pathogenic microbial adhesions on surfaces of materials followed by the creation of bio-films with robust resistance to antibiotics compose the forefront of disease transmissions. Conventional strategies responding to this challenge are rather limited owing to the biofouling influence of microorganisms or the irreversible consumption of antimicrobial agents embedded into the substances [10].

The ability of strains to form biofilms affects their rised persistence and survival. Until 40 % of human and livestock diseases are biofilm-interested and have huge medical and economic effects. The cells within a biofilm conduct differently to their planktonic state, in respect of their gene regulation. Most naturally occurring biofilms are polymicrobial in nature wherein anti-microbial resistance of one bacterial strain may allow of the survival of others in the biofilm. The formation and structure of a biofilm is affected by numerous factors, including bacterial species such as *Salmonella*, *Vibrio*, *E.coli* etc., available surface area nutrients and other environmental conditions [11].

In bacteria, many unlike mechanisms of surface attachment by cells have been described. The biofilm matrix is typically composed of a diversity of molecules, including a combination of polysaccharides, proteins, and extracellular DNA, used to take part cells together into a biofilm. In general, a combination of multiple molecules makes up the biofilm matrix, but some organisms use distinct molecules as their major biofilm matrix components. For many bacteria, biofilm formation is major for the effective colonization of their natural niches in the soil, on plants, or in the aquatic column. Biofilm formation has also been showed as an significant virulence factor for many pathogenic bacteria. It is for this reason important to understand both the mechanisms by which bacteria can form a biofilm and the ways in which that process is organized [12].

Biofilm-forming microorganisms, that *P. aeruginosa; B. megaterium, Burkholderia cenocepacia, Citrobacter werkmanii, E. coli, E. faecalis, K. pnemoniae, Listeria monocytogenes, Mycobacterium colombiense, Salmonella typhinurium, Shwanella putrefaciens, S. aureus, S. epidermidis, S. mutans and V. cholera* [13].

P. aeruginosa biofilms in medical settings are often associated with chronic infections, enhanced tolerance toward antibiotics and increased resistance toward immune responses. As a result, strategies directed at avoid or dispersing biofilms are significant [14]. *S. aureus* has the capability to form a biofilm of situated microbes. Those microbes are described by their ability to attach to a substrate or surfaces and to any available moist solid surface, including host tissue, forming a matrix using extracellular polymer materials. These microbes exhibit a special phenotype depending on the growth phase and gene term and play a critical role in providing resistance to both host immune response and antibiotics [15].

Salmonella spp. is bacteria with the capability to stick to and form a biofilm. Biofilm formed on the surface of gallstones or biomaterials favors the progress and continuation of chronic infection. Biofilm formation is caused by such factors as the type of surface to which microorganisms adhere, pH and temperature of the environment, the presence, amount and kind of nutrients, and antimicrobial substances. The biofilm structure impedes the penetration of antimicrobial compounds into its inner layers, limiting their action on the surface layer. So, cure of infections with the accession of biofilm formed by *Salmonella* spp. has limited effectiveness [16].

Staphylococcus aureus and *Staphylococcus epidermidis* are considered two of the most significant pathogens, and their biofilm constantly causes device-associated infections. According to Otto, the biofilm phenotype that these bacteria adapt during device associated infection facilitates increased resistance to antibiotics and host immune defenses. Biofilm formation by microbial pathogens enables them to live in hosts and causes chronic infections that result in stable inflammation and tissue harm. So, biofilm formation on medical materials, human tissues, and organs has an effect on human health and the economy [17].

B. subtilis biofilm formed by a unique isogenic species is a remarkably heterogeneous society, making it ideal for the working of evolution within biofilm communities. The ability of *B. subtilis* to switch from a motile to a sessile state has been used to work biofilm formation. Additionally, The undomesticated, ancestral isolate NCIB 3610 is widely studied to discover the three types of well- structured, three-dimensional biofilm that *B. subtilis* typically forms in vitro: a pellicle biofilm that develops at an air–liquid interface, a colony biofilm that improves at an air–solid interface and a ingrown surface- attached biofilm [7].

Recently, to better utilize the periphytic biofilms' capacity of biological purification and impairment, different kinds of artificial substrates have been applied to immobilise periphytons, substituting natural substrates. In addition, former studies indicated that periphytic biofilms on artificial substrates were immensely heterogeneous and dynamic, and notably unlike from those on natural substrates [18].

The biofilm investigate field is fast moving because of the biological relevance of these multicellular consortia to an array of advantageous and detrimental impacts in natural systems and human applications [7]. In conclusion, we will say that; Biofilm is an important protective shield for bacteria. It is an effective response to all stress conditions (eg high temperature, coldness, pH etc.). Almost all bacteria have the ability to form biofilms.

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