

# Current Research in Microbiology

## Chapter 1

### Microbial Biofilms

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#### 1. Introduction and Historical Perspective

Biofilm exhibit two types of growth mode i.e. planktonic cell and sessile aggregate. In biofilm (association of micro-organisms), cells stick to each other on a surface encased within matrix of extracellular polymeric substance produced by bacteria themselves [1]. A Dutch researcher, Antoni van Leeuwenhoek, for the first time observed ‘animalcule’ on surfaces of tooth by using a simple microscope and this was considered as the microbial biofilm discovery [2]. For marine microorganism i.e. bacterial growth and activity were substantially enhanced by the incorporation of a surface to which these microorganisms could attach is known as “bottle effect” observed by Heukelekian and Heller [3]. Zobell observed that the number of bacteria on surfaces was higher than in the surrounding medium [4]. Zo Bell introduced first about multicellular prokaryotic communities on submerged surfaces who stated the presence of adherent microbial associations in all natural environments [5,6].

The extensive physical and chemical analysis of bacterial biofilms did not begin until the late 1960s and early 1970s, when some of the investigators identified the extensiveness of bacterial biofilms. Scanning and transmission electron microscopy was used by Jones *et al.* to examine biofilms on trickling filters in a wastewater treatment plant and showed them to be composed of a variety of organisms (based on cell morphology). By using a specific polysaccharide-stain such as ruthenium red when coupled with osmium tetroxide fixative to show that the matrix material surrounding and enclosing cells in these biofilms was polysaccharide. In 1973 Characklis studied microbial slimes in industrial water systems and reported that they were not only adhering very closely but also highly resistant to disinfectants such as chlorine. Costerton *et al.* in 1978 gives a theory of biofilms based on observations of dental plaque and sessile communities in mountain streams that explain the mechanisms whereby microorganisms adhere to living and nonliving materials and the benefits arises by