Microorganisms are an integral part of all natural ecosystems, and as such are ubiquitous in nature. They often live adhered to or in association with surfaces of either organic or inorganic nature, and all surfaces will almost inevitably be colonized by microorganisms. This often results in the formation of highly complex sessile communities, referred to as biofilms. Such microbial communities are often highly dynamic and heterogeneous in nature. Microbial biofilms are of great importance in a wide range of natural processes and industrial settings, from the commensal flora of the gastrointestinal tract to the microbial flocs in waste water treatment facilities. Microbial biofilms may however also cause a wide range of industrial and medical problems, and have been implicated in a wide range of persistent infectious diseases, including implant-associated microbial infections. Bacterial adhesion is the first committing step in biofilm formation, and has therefore been intensely scrutinized. Much however, still remains elusive. Bacterial adhesion is a highly complex process, which is influenced by a variety of factors. In this thesis, a range of physico-chemical, molecular and environmental parameters, which influence the transition from a planktonic lifestyle to a sessile lifestyle, have been studied. Protein conditioning film formation was found to influence bacterial adhesion and subsequent biofilm formation considerably, and an aqueous extract of fish muscle tissue was shown to significantly reduce or delay bacterial biofilm formation of a range of urinary tract infectious E.coli and Klebsiella isolates. Several other proteinaceous coatings were also found to display anti-adhesive properties, possibly providing a measure for controlling the colonization of implant materials. Several other parameters controlling bacterial adhesion were also studied. Subinhibitory concentrations of certain antimicrobial compounds and several surfactants were found to significantly affect bacterial adhesion and biofilm formation, most likely by affecting the production of biofilm extracellular polymeric matrix components. These substances may both mediate and stabilize the bacterial biofilm. Finally, several adhesive structures were examined, and a novel physiological biofilm phenotype in E.coli biofilms was characterized, namely cell chain formation. The autotransporter protein, antigen 43, was implicated in this structural biofilm phenotype, at least in some bacterial strains. Understanding the fundamental requirements of bacterial adhesion and biofilm formation may aid in the development of effective preventive measures.