Preface

On any wet surface a biofilm is easily formed, whether it is on a building, a rock in a river, marine sediments, a decaying leaf, a sewage pipe, among others. The extensive appearance of the biofilm mode of life may be linked to its properties such as nutrient entrapment and physical protection of cells from the surrounding environment. Also, this mode of life is old, underlining its resistance. It is thought that aggregated layer-structured biofilms similar to ancient stromatolites have been relevant for the origin of first microbial cells on Earth. The unique and complex characteristics of biofilms include mechanisms and processes occurring at different scales addressed by different scientific branches. Atomic forces and chemical bonds are keys for attachment processes, development of the matrix, and chemical gradients. At the cell to organisms scale, life science analyzes cell-to-cell communication, diversity of microbial metabolisms and food web interactions in biofilms. Aquatic biofilms are also a significant component at the Earth sciences scale as shown for instance by their relevance in biogeochemical cycles.

From the first report of surface-associated bacterial cells, aquatic biofilm research have been exponentially developed in the last decades, covering the study of biofilms in marine and freshwater environments, including pristine but also those affected by pollution and anthropogenic disturbances, and of those developing in man-made systems such as water engineering processes. Although in each specific environment a distinct biofilm may develop, the drivers and gradients in biofilms show parallelisms. For instance, the oxygen gradient determining specific biogeochemical reactions is similar between naturally occurring fluvial biofilms and those developing on granules for water technology purposes. Other example is the knowledge gained from anthropogenic disturbances effects on biofilms, showing parallelisms to responses observed from biofilms growing in extreme environments and developing similar resistance strategies.

The aim of this book was to compile in a single volume the latest, up-to-date theory, methodology, and applications of aquatic biofilm's research. From the theory, a broad review of biofilm history, architecture, cell communication, biodiversity and biogeochemistry is included, updating both theory and methodology. Then, the study of biofilms developing in polluted systems as well as their use and relevance as ecotoxicological sensors is reviewed. Finally, application and profit of biofilms is shown in three examples on new technologies using biofilms. We believe the different points of view and approaches presented in the book, from theory to application, from ecology to engineering, are complementary and feed from each other contributing to our understanding of biofilm mode of life.

Anna M. Romaní, Helena Guasch, Marilós Balaguer