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Review

Marine Sponges and Bacteria as Challenging Sources of Enzyme Inhibitors for Pharmacological Applications

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Abstract: Enzymes play key roles in different cellular processes, for example, in signal transduction, cell differentiation and proliferation, metabolic processes, DNA damage repair, apoptosis, and response to stress. A deregulation of enzymes has been considered one of the first causes of several diseases, including cancers. In the last several years, enzyme inhibitors, being good candidates as drugs in the pathogenic processes, have received an increasing amount of attention for their potential application in pharmacology. The marine environment is considered a challenging source of enzyme inhibitors for pharmacological applications. In this review, we report on secondary metabolites with enzyme inhibitory activity, focusing our attention on marine sponges and bacteria as promising sources. In the case of sponges, we only reported the kinase inhibitors, because this class was the most representative isolated so far from these marine organisms.

Keywords: enzyme inhibitors; sponges; bacteria

1. An Introduction to Enzyme Inhibitors in Marine Environments

An important challenge of the last several decades has been the search for active compounds from natural sources, about 50% of which have pharmacological applications [1,2].

Among natural compounds, enzyme inhibitors have been considered useful tools mainly for their biotechnological potential in pharmacology [3] and agriculture [4]. In particular, protease inhibitors represent important examples of enzyme inhibitors, able to inactivate target proteases in the presence of human diseases (as for example in high blood pressure, arthritis, muscular dystrophy, pancreatitis, thrombosis, different cancers, as well as AIDS [5,6]). In the case of carbohydrate-dependent diseases, such as diabetes, obesity and hyperlipemia, amylase inhibitors represent useful tools for controlling them [7,8]. Enzyme inhibitors have been also isolated from different terrestrial organisms, including microorganisms (mainly actinomycetes; [9]), even if they are able to produce structurally identical inhibitors [10]. Differently, in the marine organisms occurs considerably different characteristics of enzyme inhibitors in comparison with the terrestrial ones [11].