marine drugs

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Review

Blue-Print Autophagy: Potential for Cancer Treatment

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Abstract: The marine environment represents a very rich source of biologically active compounds with pharmacological applications. This is due to its chemical richness, which is claiming considerable attention from the health science communities. In this review we give a general overview on the marine natural products involved in stimulation and inhibition of autophagy (a type of programmed cell death) linked to pharmacological and pathological conditions. Autophagy represents a complex multistep cellular process, wherein a double membrane vesicle (the autophagosome) captures organelles and proteins and delivers them to the lysosome. This natural and destructive mechanism allows the cells to degrade and recycle its cellular components, such as amino acids, monosaccharides, and lipids. Autophagy is an important mechanism used by cells to clear pathogenic organism and deal with stresses. Therefore, it has also been implicated in several diseases, predominantly in cancer. In fact, pharmacological stimulation or inhibition of autophagy have been proposed as approaches to develop new therapeutic treatments of cancers. In conclusion, this blue-print autophagy (so defined because it is induced and/or inhibited by marine natural products) represents a new strategy for the future of biomedicine and of biotechnology in cancer treatment.

Keywords: autophagy; cancer; marine environment; natural products

1. Introduction to Autophagy

Over the last fifty years, research on programmed cell death has evolved very rapidly because it represents a key point in cellular housekeeping processes. In fact, aberrant cell death regulation leads to several diseases, including various autoimmune diseases, cancer, stroke, myocardial infarctations, and neurodegenerative diseases [1–4]. The programmed cell death process can be subdivided into three different categories: oncosis (also named necrosis), apoptosis, and autophagy or lysosomal cell death [5–7]. These three different types are based on the cellular signaling pathways involved in the process and on the morphology of the dying cells. Oncosis, or "accidental cell death", is characterized by cellular swelling followed by cell membrane bursting and the release of inflammatory signals [8]. It is most commonly triggered from acute cellular damage, from severe cytotoxicity, or from a failure of the ionic pumps within the plasma membrane. Apoptosis represents an evolutionary well-conserved form of cell suicide, coordinated by members of the caspase family of cysteine proteases. It is defined by characteristic morphological features, which include cell shrinkage, chromatin condensation, membrane blebbing, and internucleosomal DNA fragmentation [9,10]. Autophagy further distinguishes itself from apoptosis by inducing the degradation of organelles