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Applications of Marine Microbial Pharmacognosy

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Introduction

The success of modern pharmaceuticals is one of the main achievements of the 20th century. Drugs such as penicillin, streptomycin, and vincristine, among others, have contributed greatly to human disease control since their emergence early in the 20th century. New drug treatments have increased the length of human life and enhanced the quality of life. Society has become increasingly dependent on the availability of safe and effective pharmaceutical products in this respect.

Compounds which have potential as pharmaceuticals are developed by marine plants, animals and microbes. It is assumed that these "secondary metabolites," chemicals that the organism does not require for basic or main metabolic processes, confer some evolutionary advantage. Since many of these plants and animals live in densely populated habitats, are non-motile and have only primitive immune systems, chemical compounds have evolved to help protect against predators, to attract or prevent other organisms from settling or growing on them, and to provide chemical signals to synchronize reproduction between organisms that release into the water their eggs and sperm.

The hydrosphere contains a wide variety of marine organisms which, in their physiology and adaptations, are assorted, giving rise to a diversification of their derived natural compounds. Not only are these natural molecules used on their own, but they also act as lead molecules for chemical or genetic manipulation. It is noteworthy that, as producers of anticancer compounds and secondary metabolites, which act against infectious diseases and inflammation, marine sources have also shown tremendous abilities.

Description

Marine microbial photo-protective metabolites

Photoprotection is a group of mechanisms that, when exposed to ultraviolet (UV) radiation, decrease the harm an organism experiences. Some organic and inorganic compounds or substances (e.g., melanin) formed by various terrestrial and aquatic sources may regulate or organize these mechanisms. Photoprotection is a major biological concern for the source of natural bioactive molecules that have been established in recent decades as having an antiphotoaging impact and, in particular, safer marine sources.

Cyanobacteria, a primitive group of Gram-negative prokaryotes, are known to have a wide variety of environments and are therefore supposed to have evolved mechanisms that lead to survival adaptations in severe climates and to withstand essential processes such as heat, cold, drought, salinity, hunger for nitrogen, photo-oxidation, anaerobiosis, and osmotic and UV stress. There are a variety of adaptation methods that aim to prevent high white light and UV radiation stress from cyanobacteria.

These adaptations range from

- Migration via phototactic, photokinetic, and photophobic responses and vertical migration into environments of reduced light exposure;
- Development of photoprotective agents such as superoxide dismutase carotenoids that neutralize the highly toxic reactive oxygen species produced by UV-B radiation.

Conclusion

The achievements to date in the discovery of novel chemicals from marine species that have shown promise as new therapies for cancer, infectious diseases and inflammation suggest that the production of drugs from marine sources needs to be more focused. Two underexplored prospects for the discovery of novel chemicals with therapeutic potential are provided by the exploration of unusual ecosystems, such as deep sea environments, and the isolation and culture of marine microorganisms. Based on the usual physiological function of their secondary metabolites, marine organisms also offer the ability to understand and establish therapies for diseases. The mechanisms of action of the metabolites are well known in certain processes, e.g., Conus toxins, and can be extended to the creation of new groups of drugs.

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