Economic Perspectives on Marine-Derived Products

Marco Colazingari*
Mediterranean Academy of Diplomatic Studies, University of Malta, Malta

INTRODUCTION

This article presents an analysis of marine natural product derivatives and assesses the growing importance and potential of biogenetic resources from the sea. The main features of marine organism biochemistry are described and the status of marine biotechnology discussed. The new science called marine biomimetics and cutting-edge pharmaceutical marine research are reported, stressing their recent advances and their future market potential.

About forty years ago the oceans started to attract the interest of pharmaceutical companies and research institutions. As a result, thousands of marine metabolites have been isolated, many of which are structurally novel and unprecedented within the terrestrial biosphere. Some marine organisms contain natural toxic chemicals that might be effective against some human diseases. Several marine-derived products other than drugs are already on the market. The past two decades have seen a blossoming of applications of marine-derived products in cosmetics, nutraceuticals, industrial process, and agriculture, with a potential multi-million dollar market value. The pharmaceutical market alone had a value of US$330 billion in

* This article is an adaptation and also includes excerpts from the publication M. Colazingari, Marine Natural Resources and Technological Development: An Economic Analysis of the Wealth from the Oceans (New York: Routledge, 2007).

1999, while the cosmetic market is worth more than US$200 billion per year.\(^3\)

Materials of marine origin have been used as food and in agricultural and commercial applications for years. The first marine natural product to be used for commercial applications was Tyrian purple. This well-known dye dates back to the 13th century B.C., when the Phoenicians extracted this product from the hypobranchial glands of the marine mollusc *Murex brandaris*. Tyrian purple was one of the most expensive commodities in the ancient world due to its low concentration in the marine animals from which it was extracted. The collection and extraction of approximately 12,000 mollusks was required to produce just 1.4 g of pure dye. Tyrian purple was also the first marine metabolite whose structure was correctly deduced and proven in 1909.\(^4\) Recently, a constituent from Tyrian purple (6-bromoindirubin-3-oxime) has been discovered to inhibit glycogen synthase-3 in vertebrate cells and to stabilize and allow differentiation of human embryos and stem cells.\(^5\)

However, it was only in the 17th century that scientists began to isolate, purify and define natural substances used since ancient times and, apart from sporadic early works at the beginning of the 20th century, little research was performed on the chemistry of marine creatures until the 1960s. This can mainly be attributed to the difficulties associated with the collection and identification of the marine organisms.

New metabolites have been isolated from each taxonomically distinct group. However, the distribution of novel compounds amongst each group has been unequal, with some groups possessing more interesting compounds than others. As a result, by 1999 more than 5,000 chemical compounds were derived from marine organisms.\(^6\) According to Salomon et al., more than 15,000 natural marine products have been discovered by 2003 from microbes, algae, and invertebrates, and this number continues to grow.\(^7\) The three main groups of marine organisms from which products derive are seaweed, crustaceous shells, and microalgae.


5. See FMP, n. 3 above.


7. C.E. Salomon, N.A. Magarvey and D.H. Sherman, “Merging the Potential of Microbial Genetics with Biological and Chemical Diversity: An Even Brighter Future