Marine Genetic resources: A Source of New Drugs
The experience of the Biotechnology sector

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Traditionally, higher plants and terrestrial microorganisms have proven to be the richest sources of natural drugs. However, we are living in a planet of oceans. The marine ecosystem covers more than 70% of the Earth's surface but represents 95% of the biosphere. The first living organisms appeared in the sea more than 3,500 million years ago and evolutionary development has equipped many marine organisms with the appropriate mechanisms to survive, developing exquisitely complex biological and chemical mechanisms for defence, attack, signalization and other still unknown purposes. These biological capabilities are clearly revealed by their ability to biosynthesize and release potent chemical weapons that are active *per se*.

Such novel chemical structures often result in new modes of action and open up the potential of new ways to treat cancer and other diseases. The current scientific, academic and biotech-pharmaceutical industries have recognized this opportunity and thousands of bioactive compounds are being discovered and some of them are being testing in clinical trials, mainly in oncology. But the conversion of a bioactive molecule into a medicine is a long and risky process. It involves astronomic investment for developing the identification and validation of new targets, drug discovery, medicinal chemistry and drug delivery, apart from ensuring the future supply, where chemical synthesis and biotechnology are the preferred sources for manufacturing. Natural collections are typically used only for drug discovery purposes.

This marine bioprospection, involving the study of extracts from invertebrates, microorganisms and recently, exploring DNA from non-cultivable organisms, involves large amount of investment and is a long and risky process with a low chance of finally reaching the market. For instance, the anticancer Yondelis (PharmaMar, Spain) isolated from a marine tunicate and manufactured using a hemi-synthetic process, took 15 years to achieve EU Commission approval to market.

The classical view of marine biotechnology has been radically changed with the advent of molecular tools. Now, the concept of biological diversity is based on an enormous universe of DNA sequences, where the majority of the life forms cannot be cultivated in the laboratory. There are more microbes in a gram of seabed than there are humans alive today. This is great news for the scientific community (and, of course, for the biotechnology sector). It opens up the possibility of analyzing all this genomic content as potential genes able to produce innovative pharmaceutical compounds and enzymes.

Today we are beginning to explore this metagenomic approach. Soon, the number of new compounds with applications in human health is expected to increase dramatically as a result of using innovative genetic technology. Gene sequencing at the site of collection and rapid, global transmission of the nucleotide sequences (A, C, T and G), will be the starting point for the synthesis of genomic products from marine genomic resources located overseas.

Future laws for the regulation of marine genomic resources have to contemplate this possibility and not only the physical transfer of marine samples as done today.