Next generation cures born from the sea

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Tackling the risks of infection and other illnesses remains a challenge. Might the solution come from the sea?

The life that inhabits the world's oceans has almost infinite variety. It remains an untapped source of diversity. "The oceans can be deep or shallow, they can be more or less tidal, and they can include unique environments such as volcanic vents," says Brian McNeil ofStrathclyde University in Scotland, UK. "That means that the life that lives there has huge diversity. We have only very limited knowledge of it, and especially of the microbial life forms that are found in the ocean," he adds.

The SeaBioTech project, started in 2012, is intended to close some of these knowledge gaps by looking in the seas and oceans around the globe for life forms with novel properties. The aim is to find raw material for the world's biotechnology industry, with a particular emphasis on antibiotics and other medical compounds. "Think about marine sponges ," says McNeil, who is coordinator for the project. "They are vulnerable to predators and to attack by fungi and bacteria, but they don't seem to suffer much from their attacks. This is partly because they have an internal coating, the biofilm, which contains protective microbial species . We think that these microbes make compounds which deter fungi and bacteria."

The plan is for the project to sample organisms from a wide range of marine environments, ranging from the cold Atlantic sea off Scotland to the volcanically-active region near the Mediterranean island of Santorini. The sea there is so deep that a remotely-operated submarine will be used to gather samples. "Enzymes and microbes that can survive temperatures of over 70?C, and high levels of toxicity, could be of interest to biotechnology, perhaps for detoxifying land or water," McNeil tells youris.com.

He adds that the less romantic phase of the project, the lab work that will follow the sample-gathering, will also be the difficult part. The approach is to search for interesting gene sequences as well as for antibiotic activity. Antibiotics are an especially important target for the project, because of growing bacterial resistance to existing antibiotics. In addition, there could be compounds of interest as additives for cosmetics, or for wound healing. There could also be new vaccines for the fast-growing global fish industry. At the moment, farmed fish are plagued by sea lice and other parasites. The project could lead to fish vaccines that are less polluting than those used today.

Some experts perceive the project as an original initiative and praise its

unprecedented scale. "While we have appreciated the importance of marine organisms, genetics and biochemistry since the 1970s," says Frank Koehn, research fellow for natural products and world-wide medicinal chemistry at the pharmaceutical corporationPfizer, based in Groton, Connecticut, USA, "we now recognise more clearly that microbes and larger organisms are an untapped source of genetic diversity, and of compounds that can be important to human and animal health." He adds that there are already anticancer drugs in use that were discovered in the marine environment.

What is more, "many species of marine microorganisms, algae and invertebrates have been shown to produce interesting small molecules," says Camila Esguerra, lecturer at the laboratory for molecular biodiscovery at the University of Leuven in Belgium. She is involved in a completely separate EU-funded project in marine biodiscovery, calledPharmaSea. She points out that SeaBioTech is designed to discover how these molecules might work as pharmaceuticals. But it could be 10-15 years before the findings of this project turn into usable drugs or treatments.

Perhaps the project's biggest problem may be the public acceptability of new compounds from the sea, according to Yvonne Armitage, sector lead for biosciences at the UK government's biosciences knowledge transfer network, based at the Roslin Institute in Scotland. However, chemicals from the marine environment are already used in cosmetics, foods and nutraceuticals, so this issue should be manageable.

Finally, the political issue of intellectual property in the wild environment is another possible problem for a project of this type. Esguerra says that "an uncoordinated and complex mixture of legal domains" has jurisdiction over these resources… This includes the UN Convention on the Law of the Sea, the Convention on Biological Diversity, and a range of intellectual property rights law. In the past,

universities and companies collected and used soil and water samples without payment, and without proper contracts to control the use that was made of them.

But Koehn, who is also an unpaid member of the scientific advisory board for the project, contends that more recently, progress has been made in this area. He concludes: "Nations now regard biodiversity as part of their wealth, and there is an understanding that it has to be paid for."

More information: spider.science.strath.ac.uk/seabiotech/

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