Center for
Climate Change Research

From the sea: A marine substance can inhibit COVID-19 pathogen

Scientists confirmed the strong antiviral effect. A new study reveals the marine substance can inhibit the growth of viruses as well as the entry of viruses into cells. Aplysina aerophoba, a marine sponge species that naturally produces these antiviral substances.

The crystals of the aeroplysinin substance with a strong anti-viral effect. Photo: Herman Ehrlich

Live horn sponge - Aplysina aerophoba, under the sea. Photo: Herman Ehrlich

This research was conducted with a research group lead by Prof. Dr. Hermann Ehrlich (TU Freiberg, Germany) who is also a Research Partner and Advisor of the Center for Climate Change Research (CCCR), Toronto, Canada. “It is a time-demanding result. The challenge currently facing scientists is to find effective sources for resolving the COVID-19 issue. Because of huge resources of promising marine organisms and their very effective bioactive substances, their functional properties could be the best solution to resolving this COVID-19 crisis”, says Dr. Azizur Rahman, a Marine Biologist and CEO of the Center for Climate Change Research (CCCR), Toronto, Canada. “With the partnership of Prof. Ehrlich and his group, we would continue to complete this exciting research in our Research Center and the findings will be ready to implementation soon in Canada and Germany and rest of the world”, he says.

How it works

Responsible for the antiviral, antibacterial, and antiparasitic effect is the so-called bromotyrosines, which the Aplysina sponge always produces when its tissue has been damaged and it subsequently wants to defend itself against various pathogens. The natural chemical defence strategy developed by the sponge species during the course of evolution: the breakdown of the connections between the tissue cells leads to a rapid chemical reaction at the injured site. The product of the reaction, the amino acid derivative bromotyrosine, destroys invading foreign bodies, but also viruses and bacteria immediately. In this way, the active ingredient inhibits protein synthesis and thus the proliferation of RNA viruses - including the **coronavirus SARS-CoV-2** - and also **prevents viruses from entering the tissue cells**. The Freiberg scientists were able to demonstrate this mechanism of action in pre-clinical studies using tumor cells as an example. In cooperation with Prof. Stefan Bornstein from the University Hospital Dresden, they did not find any cytotoxic effects on the cells.

"We have succeeded in isolating these bioactive substances in a pure crystalline form, in such quantities (i.e. considerably more than 10 grams) that they are available for immediate clinical investigations against the COVID-19 pathogen," explains Prof. Dr. Ehrlich from the Biomineralogy and Extreme Biomimetics research group at the TU Bergakademie Freiberg. "In the current situation we are of course open to cooperation with the relevant authorities and institutions," said Ehrlich. Also, see Press release in Germany https://tu-freiberg.de/en/presse/virus-inhibitors-from-the-sea

Prof. Herman Ehrlich is analyzing the anti-viral crystal from the substances of *A. aerophoba*.

Extracting valuable substance in an environmentally friendly way

In recent years, researchers have been able to extract up to 100% of the valuable bromotyrosine from the sponge thanks to a new method. "We use microwave radiation to isolate and extract the bromine tyrosine from the cells and skeletal fibers of the cultured sponges," explains the head of the Biomineralogy Laboratory at the Institute for Electronic and Sensor Materials. In cooperation with the Saxon start-up company BromMarin GmbH, Prof. Ehrlich and his team are continuing their research into the ecological method, which involves the cutting off of only part of the sponge under water, thereby completely preserving its regenerative capacity. This approach opens the key way in marine phamacology of verongiid sponges as renewable source of bromotyrosines. The Freiberg researchers recently published their results in the journal "Materials Science and Engineering" under the title: Marine biomaterials: Biomimetic and pharmacological potential of cultivated Aplysina aerophoba marine demosponge: https://www.sciencedirect.com/science/article/abs/pii/S0928493119331996

Our advantages

Freiberg research group developed methods for cultivation of verongiid sponges based on their ability to regenerate tissues very quickly, as well as rapid extraction of bromotyrosines (5-15 minutes), and production of up to **10 g of individual substances** (i.e. aeroplysinin, isofistularin), which have been recognized as inhibitors of RNA-viruses (read more in OPEN ACCESS papers: *Mar. Drugs* **2016**, *14*(1), 1; **https://doi.org/10.3390/md14010001**; Gomez-Archila L.G. et al. (2014) Bromotyrosine derivatives from marine sponges inhibit the HIV-1 replication in vitro. Vitae 21:114-125.)

Such amounts can be used for pre-clinical and clinical trials immediately

Since the scientists have succeeded in extracting larger amounts of the substance, it could now even be used in clinical trials against the COVID-19 pathogen. Thus, the corresponding institutions can ask us about bromotyrosines for anti-COVID tests.

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