Marine bacteria to fight tough infections

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Aggressive infections are a growing health problem all over the world. The development of resistant bacteria is rampant and, in the United States, resistant staphylococci cause more deaths than AIDS on an annual basis. Researchers from the University of Copenhagen are studying a new form of treatment based on marine bacteria. The results have been published in *PLOS ONE*.

Staphylococci have been a big problem for hospitals all over the world since the 1940s and, for many years, the pharmaceutical industry has been able to develop new antibiotics to keep up with the emergence of the aggressive bacteria. However, from 1970 to 2000, virtually no new antibiotics have come on the market. *Staphylococci* are gaining in the race – resistance is growing, and treatment options are few. In short, doctors have been set back to the time before penicillin was mass produced.

Research performed in collaboration between the University of Copenhagen and the Technical University of Denmark (DTU) focus on a new form of treatment – so-called antivirulence therapy – based on marine bacteria producing Staphylococcus inhibiting compounds.

"The marine compounds effectively inhibit the ability of staphylococci to form toxins and camouflage proteins that prevent our immune system from reacting to an infection. At the same time, marine compounds appear to paralyse a sophisticated communication system that provides staphylococci the opportunity to undertake a coordinated attack on the organism," says Anita Nielsen, PhD. She has published new results in

PLOS ONE with Professor Hanne Ingmer from the Department for Veterinary Disease Biology at the University of Copenhagen's Faculty of Health and Medical Sciences.

In the United States, resistant staphylococci cause more deaths than AIDS on an annual basis. Antivirulence therapy protects the body's natural bacterial flora and disarms, so to speak, infectious staphylococci bacteria. In this way, the body's immune system potentially gets a chance to defend itself against infection – and, in the long term, this form of treatment can mean that patients experience fewer harmful side effects.

Potent compound from the Solomon Islands

The researchers have analysed compounds extracted from marine bacteria collected from all over the world on the Galathea 3 expedition, which took place from August 2006 until April 2007. One particular compound, Solonamid B, isolated from a marine bacterium found near the Solomon Islands, is of particular interest.

"Solonamid B inhibits the ability of staphylococci to produce various toxins that break down our blood cells. White blood cells in particular are important in this context, because they participate in the fight against invasive bacteria during an infection. When Solonamid B is added to bacteria, it reduces their toxin production so only a fifth of the white blood cells die that would otherwise succumb to the staphylococci toxins," says Professor Hanne Ingmer.

It has required demanding laboratory work to analyse the compounds that can form the basis for antivirulence therapy in the future. Purification and identification of the Solonamid B used for the cell studies were undertaken in collaboration with DTU. Researchers at DTU extracted the compounds that researchers at University of Copenhagen subsequently tested biologically. Future experiments will show whether

the antivirulence compounds also work in animals and human beings.

Provided by University of Copenhagen