Antibiotic resistance: A rising concern in marine ecosystems

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A team of scientists, speaking today at the annual meeting of the American Association for the Advancement of Science, called for new awareness of the potential for antibiotic-resistant illnesses from the marine environment, and pointed to the marine realm as a source for possible cures of those threats.

The group stated that newly completed studies of ocean beach users point to an increasing risk of staph infections, and that current treatments for seafood poisoning may be less effective due to higher than expected antibiotic resistance. The group also asserts that new research has identified sponge and coral-derived chemicals with the potential for breaking down antibiotic resistant compounds and that could lead to new personalized medical treatments.

"While the marine environment can indeed be hostile to humans, it may also provide new resources to help reduce our risks from illnesses such as those caused by water borne staph or seafood poisoning," stated Paul Sandifer, Ph.D., former member of the U.S. Commission on Ocean Policy, chief scientist of NOAA's Oceans and Human Health Initiative, and co-organizer of the symposium.

Carolyn Sotka, also with the NOAA Oceans and Human Health Initiative and lead organizer of the session, stated "It is critically important that we continue research on the complex interactions between the condition of our oceans and human health. Without doubt, this research will develop new understandings of ocean health risks and perhaps more importantly

crucial discoveries that will lead to new solutions to looming public health problems."

Coral, Sponges Point To Personalized Medicine Potential

"We've found significant new tools to fight the antibiotic resistance war," says NOAA research scientist Peter Moeller, Ph.D., in describing the identification of new compounds derived from a sea sponge and corals.

"The first hit originates with new compounds that remove the shield bacteria utilize to protect themselves from antibiotics. The second hit is the discovery of novel antibiotics derived from marine organisms such as corals, sponges and marine microbes that fight even some of the worst infectious bacterial strains. With the variety of chemicals we find in the sea and their highly specific activities, medicines in the near future can be customized to individuals' needs, rather than relying on broad spectrum antibiotics."

The research team, a collaboration between scientists at NOAA's Hollings Marine Laboratory in Charleston, S.C., the Medical University of South Carolina and researchers at North Carolina State University in Raleigh, N.C., noticed a sponge that seemed to thrive despite being located in the midst of a dying coral reef. After extraction, testing showed that one of the isolated chemicals, algeliferin, breaks down a biofilm barrier that bacteria use to protect themselves from threats including antibiotics. The same chemical can also disrupt or inhibit formation of biofilm on a variety of bacteria previously resistant to antibiotics which could lead to both palliative and curative response treatment depending on the problem being addressed.

"This could lead to a new class of helper drugs and result in a rebirth for antibiotics no longer thought effective," notes Moeller. "Its potential application to prevent biofilm build-up in stents, intravenous lines and other medical uses is incredible."

The compound is currently being tested for a variety of medical uses and has gone through a second round of sophisticated toxicity screening and thus far shows no toxic effects.

Staph: A Beach Going Concern

Research, funded by multiple agencies and conducted by the University of Miami's Rosenstiel School of Marine and Atmospheric Sciences and the Leonard M. Miller School of Medicine, found that swimmers using public ocean beaches increase their risk for exposure to staph organisms, and they may increase their risk for potential staph infections once they enter the water.

"Our study found that if you swim in subtropical marine waters, you have a significant chance , approximately 37 percent, of being exposed to staph — either yours or possibly that from someone else in the water with you," said Dr. Lisa Plano, a pediatrician and microbiologist with the Miller School of Medicine. Plano collaborated in the first large epidemiologic survey of beach users in recreational marine waters without a sewage source of pollution. "This exposure might lead to colonization or infection by water-borne bacteria which are shed from every person who enters the water. People who have open wounds or are immune-compromised are at greatest risk of infection."

The Miami research team does not advise avoiding beaches, but recommends that beach-goers take precautions to reduce risk by showering thoroughly before entering the water and after getting out. They also point out that while antibiotic resistant staph, commonly

known as MRSA, has been increasingly found in diverse environments, including the marine environment, less than three percent of staph isolated from beach waters in their study was of the potentially virulent MRSA variety. More research is needed to understand how long staph (including MRSA) can live in coastal waters, and human uptake and infection rates associated with beach exposures.

Antibiotic Resistance in Seafood-borne Pathogens Increasing

Researchers at the Bigelow Laboratory for Ocean Science in West Boothbay Harbor, Maine, report that the frequency of antibiotic resistance in vibrio bacteria was significantly higher than expected. These findings suggest that the current treatment of vibirio infections should be re-examined, since these microbes are the leading cause of seafood-borne illness and death in the United States. The severity of these infections makes antibiotic resistance in vibrios a critical public health concern.

Naturally-occurring resistance to antibiotics among Vibrios may undermine the effectiveness of antibiotic treatment, but as yet this has not been extensively studied. Furthermore, antibiotics and other toxicants discharged into the waste stream by humans may increase the frequency of antibiotic-resistant Vibrio strains in contaminated coastal environments.

"We found resistance to all major classes of antibiotics routinely used to treat Vibrio infections, including aminoglycosides, tetracyclines, and cephalosporins," stated Bigelow's Ramunas Stepanauskas, Ph.D. "In contrast, we found that Vibrios were highly susceptible to carbapenems and new-generation fluoroquinolones, such as Imipenem and Ciprofloxacin. This information may be used to design better strategies

to treat Vibrio infections."

Source: NOAA Headquarters