

Podcast: Harmful Algal Blooms and Your Health

Narrator: What do you think of when you hear the ocean? Many things may come to mind – blue skies and summer days. But have you ever paused to think about some of the tiny, microscopic creatures that live there?

Algae are one example of these creatures. They are microscopic organisms that are photosynthetic, which means they get their energy from the sun. Algae play an important role in the ecosystem. But under certain conditions, some species of algae produce toxins that can harm humans and wildlife. When there are overgrowths of toxin-producing algae in bodies of water, like oceans, lakes, and rivers, they create what scientists refer to as harmful algal blooms.

Dr. Daniel Baden is an expert and distinguished professor in marine sciences at the University of North Carolina at Wilmington. He has spent many decades examining harmful algal blooms and their associated toxins.

Dr. Baden says that harmful algal blooms can occur in all coastal areas of the United States. But understanding why some blooms are more toxic than others or why they occur in certain locations is complicated and varies across algae species.

Baden: It all depends on the lifecycle of the algae. Each type of algae produces a different toxin from the next. And so each bloom will produce different toxic effects.

Narrator: He notes that another complicating factor is movement of algae, which can be affected by changing climate and water currents. These changes can drive the algae into different coastal areas.

Baden: The movement of harmful algae seems to be changing in response to global weather and climate patterns.

Baden: If the area will support the lifecycle of the algae, it will develop. Excessive development of algae numbers will result in harmful algal blooms.

Narrator: At very high concentrations, the toxins produced by these algae can be a significant concern for public health, the ecosystem, and the economy. Dr. Baden says toxins that are formed in harmful algal blooms can accumulate in fish and shellfish, which can be poisonous to humans if they eat contaminated seafood or breathe in contaminated air in coastal areas. The toxins can cause many harmful health effects, including respiratory distress, diarrhea, and amnesia.

Dr. Baden says that people should pay attention and use caution in and around coastal areas to protect themselves from the adverse effects of harmful algal blooms.

Baden: If you see something unusual in a coastal area, like a bloom or a sludgy green or brown or red algae up on the shoreline, don't get in the water.

Baden: If you're in a coastal area, and you begin to cough or sneeze and others around you are coughing and sneezing, get away from the coastal area. Get back into the parking lots or further back.

Baden: Most states that have harmful algal blooms have specific programs that test for the toxins in seafood. So it's very important in these areas not to go out and collect your own seafood to eat, but to buy from establishments that are all part of the state regulatory procedures.

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Narrator: In addition to serious public health impacts, harmful algal blooms also impact local economies that depend on tourism or commercial fishing. But there may be silver lining: although the chemicals produced by algal blooms can have harmful effects on human health at high doses, scientists have discovered that very small amounts of these chemicals can potentially be used to treat certain debilitating diseases.

Dr. Baden says that the idea that toxic materials used in very small amounts can be used to treat certain disease is not new. The idea dates back to the 1500s and the scientist Paracelsus.

Baden: All toxic materials, when used in very limited amounts, can actually result in therapeutic effects. If you can control the mechanism of a toxin by concentration, you can actually end up with therapies that might be useful.

Narrator: As the executive principal investigator of MARBIONC (Marine Biotechnology in North Carolina), Dr. Baden is working with colleagues to grow large quantities of algae in the lab. This large-scale cultivation will enable them to produce enough of the algal toxins to explore their potential therapeutic benefits and how they could be used to treat diseases.

Presently, Dr. Baden and his team are examining how toxins produced by a specific type of harmful algal bloom called Florida red tide, can be used to develop treatments for cystic fibrosis.

Baden: Within the organism that produces the Florida red tides, there is an antitoxin that was discovered, called Brevenal. It can help in overcoming the toxicity that's experienced if you're exposed to neurotoxic shellfish poisons, it also turns out with a lot of extra work, to be a treatment for cystic fibrosis.

Narrator: They are hopeful that these treatments will soon go through clinical trials.

Dr. Baden's team is also looking at other algal products as potential drug carriers, or molecules that can deliver certain drugs to diseased cells in the body more efficiently. One example of a drug carrier or transporter is called Brevesin.

Baden: Brevesin is a small molecule that transports across the membranes of cells by some active transport system, and when linked to other drugs, helps carry those drugs across cell membranes to make them more efficient in delivery to cells.

Narrator: The discovery and development of these types of therapies are crucial for the pharmaceutical industry. Increasing the efficiency of drug delivery to target cells allows much lower doses of treatments to be used. This not only helps reduce cost, but also can reduce potentially unwanted side effects of some treatments.

Finally, Dr. Baden and his colleagues are studying how algal toxins can be used to develop assays that detect toxic fish or shellfish poisons and toxic materials in water. These types of assays are especially useful for regulatory agencies, such as the Food and Drug Administration, the Centers for Disease Control and Prevention, and the National Oceanic and Atmospheric Administration. Baden's work may be able to help these agencies better protect human health from harmful algal blooms in the future.

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Thanks to today's guest, Dr. Daniel Baden, for joining us. You can learn more about harmful algal blooms and public health, as well as more about how Dr. Baden and colleagues are creating new therapies using algal toxins on our website at niehs.nih.gov/podcasts.

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