Abstractions

LAST AUTHOR

In studying the molecular mode of action of naturally occurring compounds such as toxins, the first step is to determine their chemical structure. Unfortunately, such compounds are often in short supply. On page 573, chemist Erick Carreira and his students at ETH Zurich in Switzerland report their synthesis of a complex chlorosulpholipid that has been linked to seafood poisoning and is produced by microalgae isolated from contaminated mussels (*Mytilus galloprovincialis*). Carreira tells *Nature* that synthesizing this odd lipid required reliable methods and strategies to be established to assemble its structure.

Why did you choose this toxin?

My group is interested in natural products that have both challenging structures and intriguing biology and chemistry. When I saw these odd-looking structures a few years ago, they instantly caught my interest. Long-chain hydrocarbon lipids are usually relatively unadorned, but these were loaded with chlorides arranged in complex patterns. Little is known about their native biological role and their association with seafood poisoning. I had to work hard to convince students to work on them though, because anticancer agents and neurotoxins are the typical 'hot targets' today.

Was the synthesis more difficult than you expected?

Yes. We knew it would be challenging because the methods for preparing polychlorinated entities were not well-defined. As a result, we encountered some dead ends early on. The most difficult part was figuring out how to position so many chlorides next to each other.

Did overcoming that hurdle create new frontiers for your work?

Absolutely. We initiated a research programme with the aim of better understanding chlorination reactions and the conformational consequences of polychlorinated arrays in hydrocarbons. Now we are trying to establish the structure of other chlorosulpholipids. It will be fun as a chemist to contribute to the narrative of how nature assembles these types of molecule. There is easily enough material for a long-term research programme.

What lessons did you learn during this project?

The project renewed our appreciation that every natural product has an interesting story to tell, and it emphasizes the need to look beyond the accepted criteria by which molecules are judged to be enticing or interesting. ■

MAKING THE PAPER

Marcel Kuypers

Ocean bacteria can detoxify waters poisoned by algal blooms.

Too much of a good thing — nutrients — can spur the growth of algal blooms in coastal waters, leading to low-oxygen conditions and the production of poisonous hydrogen sulphide. This can have drastic consequences. On the coast of Namibia, for example, residents are well acquainted with 'lobster walks', whereby the crustaceans literally march up onto the shore to escape the poisonous chemical.

In Namibia the blooms are a natural phenomenon, but researchers such as Marcel Kuypers, a biogeochemist at the Max Planck Institute for Marine Microbiology in Bremen, Germany, believe that similar sulphidic events elsewhere are triggered as a result of human activity. The New York-based Wildlife Conservation Society lists algal blooms as one of the 'deadly dozen wildlife diseases' likely to spread as Earth warms. But, it seems, nature may be able to soften the blow: Kuypers and his group have discovered an opportunistic bacteria that cleanses the toxic brew that the Namibian algal blooms produce.

Kuypers first travelled to Namibia in spring 2003 to study the loss of nitrogen from coastal ecosystems, in collaboration with the Namibia Ministry of Fisheries and Marine Resources. But that wasn't the only reason for the trip. "The sulphidic events were definitely on our agenda," he says. "We had prepared to look for them, but we didn't hit on any hydrogen sulphide in the water column." He returned in January 2004, timing the research cruise to improve their chances of observing a sulphidic event.

On the ship, Kuypers and his team received daily satellite images to look for areas of discolouration; these are created when hydrogen sulphide reacts with oxygen to form elemental sulphur in surface waters. "We were looking at these images and we didn't see anything; there was no discolouration whatsoever," he says.

"But we were measuring hydrogen sulphides in the water column."

Because the depth at which they found the sulphides was 40 metres below the level at which any oxygen was present, it was clear that no chemical oxidation was occurring. But why? The researchers reasoned that biological processes must be involved, and incubated samples to look for microbes. On page 581, they describe finding large populations of γ- and ε-proteobacteria, which are known as chemolithotrophs because they live on inorganic matter. These bacteria, which had previously been found only near deep-sea hydrothermal vents, were consuming hydrogen sulphide in the bottom waters, preventing it from reaching the surface, where many fish and mammals live. This shielded the poisonous waters from human detection, so sulphidic events may be much more widespread than was thought.

On the plus side, the activity of chemolithotrophic bacteria protects animals in surface waters from hydrogen sulphide's toxic effects. But residents of the lower reaches, such as small fish hiding from predatory fish and birds, are still at risk. As sulphide poisons the lower layer, these fish are either killed directly or are preyed upon when they flee to the surface. "The areas where we found the sulphidic waters were teeming with life," says Kuypers, who saw schools of whales and dolphins, and "massive amounts" of birds, which were presumably feeding on upwardly migrating small fish. If sulphidic events increase in frequency, he says, "The frequent occurrence of these events may actually decimate the fish populations off Namibia." ■

FROM THE BLOGOSPHERE

Last week's inauguration of US President Barack Obama had several Nature bloggers asking what his 'change' motto would mean for science. Notably, writing on The Niche, *Nature Reports Stem Cells* editor Monya Baker summarizes policy recommendations from three groups that support lifting the federal ban on embryonic-stem-cell research (http://tinyurl.com/8dhblz).

The Coalition for the Advancement of Medical Research, the Center for American Progress and the Center for Genetics and Society have all issued reports outlining how best to fund the research and provide ethical and regulatory oversight.

Nature Medicine senior editor Charlotte Schubert, writing on Spoonful of Medicine, reports the mood on the streets of Washington DC a day before the inauguration and provides a playful rundown of the new administration's top science appointments and nominees (http://tinyurl.com/8eq9q5). Among the picks are Steven Chu, "a scientist to head the Department of Energy? Wow!" and Jane Lubchenco, "a bona fide fish-hugger", invited to lead the National Oceanic and Atmospheric Administration. ■

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